# Nagarjuna College of Engineering and Technology

(An Autonomous College under VTU)

## 3.4.3 Number of research papers per teacher in the Journals notified on UGC website during the last five years (5)

## Index Sheet

| Sl. No. | Academic year | Page Numbers |
|---|---|---|
| 1 | 2020-21 | 1 to 11 |
| 2 | 2019-20 | 12 to 15 |
| 3 | 2018-19 | 16 to 18 |
| 4 | 2017-18 | 19 to 21 |
| 5 | 2016-17 | 22 to 24 |

3.4.3 Number of research papers per teacher in the Journals notified on UGC website during the last five years (5)

3.4.3.1: Number of research papers in the Journals notified on UGC website during the last five years

| Sl. No | Title of paper | Name of the author/s | Year of publication | Link to Paper |
|---|---|---|---|---|
| 1 | Experiment on Strength Properties of High Performance Concrete with the Incorporation of Activated Fly Ash | Mrs Chaitra DM | 2020-2021 | https://www.irjet.net/archives/V7/i8/IRJET-V7I8488.pdf |
| 2 | Study on performance of activated flyash and silica fume in HPC | Mrs Chaitra DM | 2020-2021 | https://www.irjet.net/archives/V7/i8/IRJET-V7I8398.pdf |
| 3 | Performance and strength Evaluation of concrete by using Alccofine and slag sand | Ms Chaya | 2020-2021 | https://www.irjet.net/archives/V7/i8/IRJET-V7I8735.pdf |
| 4 | A review om durability properties of alkali activated composites- Material science and manufacturing Technology | Dr Nagaraj V | 2020-2021 | https://iopscience.iop.org/article/10.1088/1757-899X/872/1/012126/pdf |
| 5 | Shear Strength characteristics of Geosynthetic Reinforced Rubber-Sand Mixtures | Dr. Manohar | 2020-2021 | https://www.sciencedirect.com/science/article/abs/pii/S0266114421000017 |
| 6 | Conversion of conventional building to Net Zero Energy Building | Dr. L Pinky | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 7 | Implementation of Building Information Modelling (BIM) in Construction Industry: A Review | Dr. L Pinky & Narendra | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 8 | Indoor air quality of classrooms and occupants comfort in an institutional building | Dr L Pinky Devi & Mrs Chaitra DM | Under review | Under review |
| 9 | Comparative study of green building and conventional building | Dr L Pinky Devi & Mrs Chaitra DM | Under review | Under review |

| | | | | |
|---|---|---|---|---|
| 10 | Elucidation: Scantiness of Electricity and its Effective Utilization during Peak Hours. | Dr Shantakumar B Patil | 2020-2021 | https://www.ijitee.org/wp-content/uploads/papers/v9i5/E2585039520.pdf |
| 11 | Detection on DDos attack using hybrid machine learning techniques | Ms.Bhagya M | 2020-2021 | https://www.jetir.org /view?paper=JETIR 2002296 |
| 12 | Hybrid Mobile Application Development in Appzill on MADP | Ms.Bhagya M | 2020-2021 | https://www.jetir.org /papers/JETIR2002 429.pdf |
| 13 | A Privacy Preserving Big Data Platform for Collaborative Spam Detecti on | Ms.Vidya V | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss3_March20/IJRESM_V3_I3_7 8.pdf |
| 14 | Novel DIP Method based Detection of Malaria Parasite | Ms.Vidya V | 2020-2021 | https://www.ijresm.com/articles/a- novel-dip-method-based-detection-of- malaria-parasites/ |
| 15 | Smart Agriculture Monitoring System using ML | Mr.Pramoda R | 2020-2021 | https://www.ijeat.org/wp-content/uploads/papers/v9i4/D791604 9420.pdf |
| 16 | Automated system to detect alcohol in automobiles for safety | Mr.Bhargava R | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss5_May20/IJRESM_V3_I5_25 9.pdf |
| 17 | Aquarium monitoring system | Dr. Anitha Patil | 2020-2021 | https://iceiee.org/index.php/testmagzine/article/download/2257/2018 |
| 18 | Design and Implementation of Heart Diseases Predict or Using Machin e Learning Algorithm over Live Cloud infrastr ucture | Mr.Raghavendra B | 2020-2021 | https://www.jetir.org/view? paper=JETIR2002432 |
| 19 | Smart Supervi sory Stick for Blind Using Raspbe | Mr.Pramoda K V | 2020-2021 | https://www.jetir.org/papers/JETIR20 03354.pdf |
| 20 | Anti poachi ng of trees and wildlife monito ring | Mr.Raghavendra T K | 2020-2021 | https://www.jetir.org/view? paper=JETIR2003039 |
| 21 | Chronic Kidney Disease Predictio n Based on Naïve Based Techniqu E | Ms.Priyanka | 2020-2021 | https://www.irjet.net/archives/V6/i9/I RJET-V6I9251.pdf |

| | | | | |
|---|---|---|---|---|
| 22 | Wavelet Packet Transform-Based Image Classification for Computer-Aided Glaucoma Diagnosis Using Naïve Bayes Classifier | Dr. S Mohan Kumar | 2020-2021 | https://link.springer.com/chapter/10.1007/978-981-15-5397-4_60 |
| 23 | Brain Image Classification by Deep Neural Network with Pyramid Design of Inception Module | Dr. S Mohan Kumar | 2020-2021 | https://www.annalsofrscb.ro/index.php/journal/article/view/5726/4449 |
| 24 | Automated Driving License Evaluation | Mr.Gopinath A R | 2020-2021 | https://doi.org/10.32628/IJSRST2183208 |
| 25 | Smart Pedestrian Crossing System | Mr.Gopinath A R | 2020-2021 | https://www.irjet.net/archives/V8/i7/IRJET-V8I7187.pdf |
| 26 | Light Weight Cloud Storage Auditing With De-Duplication Supporting Strong Privacy Protection | Mr.Gopinath A R | 2020-2021 | https://www.jetir.org/papers/JETIR2106545.pdf |
| 27 | Credit Card Fraud Detection Using Machine Learning | Mr.Gopinath A R | 2020-2021 | https://www.jetir.org/papers/JETIR2106367.pdf |
| 28 | Automatic number plate recognition using deep learning and open CV | Mrs.Swathi S | 2020-2021 | https://ijsrst.com/IJSRST2183211 |
| 29 | Chatbot for disease prediction and treatment recommendation | Mrs.Swathi S | 2020-2021 | https://turcomat.org/index.php/turkbilmat/article/view/4190 |
| 30 | Rtc Based Exam Paper Leakage Protection System | Mr.Sudhakara reddy M | 2020-2021 | https://ijsrst.com/paper/8121.pdf |
| 31 | Screening System For Early Detection of Diabetic Retinopathy | Mr.Sudhakara reddy M | 2020-2021 | https://ijsrst.com/paper/8121.pdf |
| 32 | High Accuracy Phishing Detection Based on Convolutional Neural Network | Mr.Sudhakara reddy M | 2020-2021 | https://ijsrst.com/paper/8121.pdf |
| 33 | Aquarium Monito ring System | Mr.Sudhakar Reddy | 2020-2021 | https://iceiee.org/index.php/testmagzine/article/download/22 57/2018 |
| 34 | Low- cost Real- time logistic s tracking | Mr.Sudhakar Reddy | 2020-2021 | https://iceiee.org/ind ex.php/testmagzine/ article/download/22 57/2018 |
| 35 | Crop Loss Predicti on using IoT | Mr. Subramanya S G | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss3_March20/IJRESM_V3_I3_37.pdf |

| | | | | |
|---|---|---|---|---|
| 36 | Ai Base D Shoo T At Sight Missi Le | Mr. Subramanya S G | 2020-2021 | https://www.jetir.org/view? paper=JETIR2003375 |
| 37 | Android Based Sign Board Detecti on with Image and Voice Alert System | Mr. Subramanya S G | 2020-2021 | https://www.jetir.org/view? paper=JETIR2004577 |
| 38 | Agriculture Agro App Development | Mr. Subramanya S G | 2020-2021 | https://www.jetir.org/view?paper=JETIR2106097 |
| 39 | Design and Analysis of IoT Based Intelligent Robot | Mr. Subramanya S G | 2020-2021 | https://ijsrst.com/IJSRST2183107 |
| 40 | Chatbots: Cross-Domain Engineering Applications | Mr. Subramanya S G | 2020-2021 | https://www.tojqi.net/index.php/journal/article/view/3296 |
| 41 | Design and Development of Automated Emission Monitoring for General Vehicle | Mr. Subramanya S G | 2020-2021 | https://www.jetir.org/papers/JETIR2106158.pdf |
| 42 | Doctor_Chatbot_-_Smart_Health_Prediction | Mrs.SEEMA J | 2020-2021 | https://doi.org/10.32628/IJSRST2183172 |
| 43 | AI_Driven_Planetary_Bot_for_Future_Vision | Mrs.SEEMA J | 2020-2021 | https://doi.org/10.32628/IJSRST2183120 |
| 44 | Farm Management System | Dr Mohan Kumar S | 2020-2021 | https://ijsrst.com/IJSRST218354 |
| 45 | Automatic Skin Cancer Detection | Dr Mohan Kumar S | 2020-2021 | https://ijsrst.com/IJSRST218355 |
| 46 | Burglar Prevention IOT Model | Dr Mohan Kumar S | 2020-2021 | https://ijsrst.com/IJSRST1218353 |
| 47 | Resource Allocation Techniques in Edge/Fog Computing | Dr Mohan Kumar S | 2020-2021 | https://ieeexplore.ieee.org/document/9392422/metrics#metrics |
| 48 | Disease Detection through Deep Learning Over Data Analytics from Healthcare Communities | Dr. Muthukumar Subramanian | 2020-2021 | http://www.journal-aquaticscience.com/article_134169_0986adb87c2b669587b74d72a7e3a0c0.pdf |
| 49 | A Conceptual Distributed Framework to Support the Role of Cloud Computing in Marketing Management | Dr. Muthukumar Subramanian | 2020-2021 | https://efflatounia.com/index.php/journal/article/view/196 |
| 50 | Machine Learning Systems in Image manipulation and Fake detection | Dr. Muthukumar Subramanian | 2020-2021 | https://turkjphysiotherrehabil.org/pub/pdf/322/32-2-347.pdf |
| 51 | Efficient Coded OFDM with high Performance for wireless Lan | Dr. Muthukumar Subramanian | 2020-2021 | https://oeconomiacopernicana.pl/sdm_downloads/03/ |

| | | | | |
|---|---|---|---|---|
| 52 | Empirical Analysis of Student Performance Using Data Mining Approaches | Dr. Muthukumar Subramanian | 2020-2021 | https://thedesignengineering.com/index.php/DE/article/view/1587 |
| 53 | Voice Assistance for Dumb People Based on Hand Gestures | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/paper/8044.pdf |
| 54 | Prediction of Cancer in situ using Machine Learning | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/IJSRST218350 |
| 55 | IOT Based Camouflage Surveillance Robot | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/IJSRST218351 |
| 56 | Password Authentication Using Gaze Based Eye Tracking | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/IJSRST218352 |
| 57 | Farm Management System | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/IJSRST218354 |
| 58 | Automatic Skin Cancer Detection | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/IJSRST218355 |
| 59 | Burglar Prevention IOT Model | Dr Jitendranath Mungara | 2020-2021 | https://ijsrst.com/IJSRST1218353 |
| 60 | A Survey of Text Steganography Methods | Mr. Vivek Sharma | 2020-2021 | https://ijsrst.com/paper/8042.pdf |
| 61 | Evaluation of Women Protection using Machine Learning | Mr. Vivek Sharma | 2020-2021 | http://dx.doi.org/10.46610/JoDMM.2021.v06i02.002 |
| 62 | Review Process on URL Phishing | Mr. Vivek Sharma | 2020-2021 | https://ijsrst.com/paper/8037.pdf |
| 63 | Trust Aware Data Aggregation mechanism for malicious node identification in WSN | Mrs.Swathi S | 2020-2021 | https://turcomat.org/index.php/turkbilmat/article/view/8905 |
| 64 | Voice Assistance for Dumb People Based on Hand Gestures | Mr. Srikanth M S | 2020-2021 | https://ijsrst.com/paper/8044.pdf |
| 65 | Prediction of Cancer in situ using Machine Learning | Mr. Srikanth M S | 2020-2021 | https://ijsrst.com/IJSRST218350 |

| | | | | |
|---|---|---|---|---|
| 66 | IOT Based Camouflage Surveillance Robot | Mr. Srikanth M S | 2020-2021 | https://ijsrst.com/IJSRST218351 |
| 67 | Password Authentication Using Gaze Based Eye Tracking | Mr. Srikanth M S | 2020-2021 | https://ijsrst.com/IJSRST218352 |
| 68 | Track and monitor platform for election commission using altered voter ID card to make compulsory voting | Mr.Vivek sharma | 2020-2021 | |
| 69 | A Real-time framework for detection of abnormal activities in videos using CFS and BoF classifiers | Mr.Basavaraj G M and Mr.Ashok Kusagur | 2020-2021 | https://penseeresearch.com/ |
| 70 | Security Issues & Solutions in Cloud Computing | Mr.Basavaraj G M and Mr.RajashekharB.Somasagar | 2020-2021 | http://matjournals.in/index.php/JTS/article/view/6148 |
| 71 | A Reversible Data Hiding Scheme in Encrypted Images for Medical Applications | Dr. Rohith S and Harish V | 2020-2021 | http://ijarsct.co.in/A776.pdf |
| 72 | Modeling and Analysis of Parallel Boost Converter | Ms.Jyothi S K, Mr.Sreenivasulu K N | 2020-2021 | https://www.ijisrt.com/modeling-and-analysis-of-parallel-boost-converter |
| 73 | FPGA Implementation of 8-Bit Vedic Multiplier for DIT-FFT Application Using Urdhva Tiryagbhyam Sutra | Mr.Rohith S, Mr.Kasetty Ram Babu and Mr.Chandrashekar M N | 2020-2021 | http://ijarsct.co.in/Paper775.pdf |
| 74 | Target Tracking System Using Passive Radar: A Survey | Dr. Nagesh K.N | 2020-2021 | https://doi.org/10.31305/rrijm.2020.v05.i12.026 |
| 75 | Circularly Polarized Dielectric Resonator Based MIMO Antenna with Pattern and Polarization Diversity for Vehicular Applications | Mr.Komal Srivastava, Dr. Ajay Kumar Dwivedi, Dr.Anand Sharma | 2020-2021 | https://doi.org/10.1002/cta.3078 |

| | | | | |
|---|---|---|---|---|
| 76 | Dual-Band Modified Rectangular Shaped Dielectric Resonator Antenna with Diversified Polarization Feature | Dr. Ajay Kumar Dwivedi, Dr.Anand Sharma, Dr.Pinku Ranjan | 2020-2021 | https://doi.org/10.1002/cta.3095 |
| 77 | Broadband Dielectric Resonator Antenna with Dual-Frequency Circularly polarized response for WLAN and WiMAX Applications | Dr. Anand Sharma, Dr. Ajay Kumar Dwivedi, Dr. Nagesh K.N, Dr. A. Gupta, Dr. D.K Tripathi | 2020-2021 | https://onlinelibrary.wiley.com/doi/10.1002/cta.3151 |
| 78 | High-Isolated WiFi-2.4 GHz/LTE MIMO Antenna for RF-Energy Harvesting Applications | Mr. A. Kumar, Dr. Nagesh K.N, Dr. H.Venkatesh Kumar, Mr. S. A Siddique, Dr. B. Mishra, Dr. Ajay Kumar Dwivedi | 2020-2021 | https://doi.org/10.1016/j.aeue.2021.153964 |
| 79 | Smart farming using IOT | Ms.Sunitha.M | 2020-2021 | https://doi.org/10.32628/IJSRST218398 |
| 80 | Sensor Node Localization and Visualization in Underwater Sensor Networks | Mr.Yashwanth N, Mr.Yogeshwary B H | 2020-2021 | https://www.ijasi.org/index.php/ijasi/article/view/18/11 |
| 81 | Live Streaming of Agriculture Market Statistics to the Remote Village Areas Using Amateur Radio | Mr.H.Venkatesh Kumar, Mr.Venkata Mohan Reddy, Mr.B. Samarasimha Reddy, | 2020-2021 | https://ijisrt.com/live-streaming-of-agriculture-market-statistics-to-the-remote-village-areas-using-amateur-radio |
| 82 | Arduino based Human Following ROBOT | Mr.Mahesh M R | 2020-2021 | http://ijaem.net/issue_certificate/828966.pdf |
| 83 | Remote Monitoring of Live EEG on 5G Networks | Mr. H.Venkatesh Kumar, Mr.Yadu Prasad | 2020-2021 | http://www.ijareeie.com/upload/2021/january/24_Remote_NC.pdf |

| | | | | |
|---|---|---|---|---|
| 84 | Department Announcement System Using Arduino | Dr. H. Venkatesh Kumar, Pavan Kalyan B S, P Sai Kumar | 2020-2021 | https://docplayer.net/210523445-Department-announcement-system-using-arduino.html |
| 85 | Tracking Of Aircrafts Using Software Defined Radio (SDR) With An Antenna | Mr.H. Venkatesh Kumar, Ms.Surabhi. G, Ms.Neha V,Mr Sandesh. Y. M, Mr.Sagar Kumar | 2020-2021 | https://www.ijsrst.com/archive.php?v=11&i=63&pyear=2021 |
| 86 | IoT based Air and sound pollution Monitoring system | Ms.Jyothi sk, Mr,Sai Roshan, Ms.Monika, Ms.Tanushree, Bharat Reddy | 2020-2021 | https://doi.org/10.22214/ijraset.2021.34688 |
| 87 | Real Time Face Mask Identification using AI-Deep Learning Neural Network | Mr.Sreenivasulu. K. N, Mr.Aishwarya. B. K,, Chandan. L, Ganesh. B,Harshitha. C | 2020-2021 | https://doi.org/10.22214/ijraset.2021.35280 |
| 88 | Voice Controlled Wheel Chair for Persons with Disability | Dr. Rohith S | 2020-2021 | doi : https://doi.org/10.32628/IJSRST2183125 |
| 89 | Phone Call Controlled Obstacle Detection Robot | Mr. Kasetty Ram Babu, Mr.Pruthvi D , Mr. Mandle Veneesha , Ms.Pramodini,Ms. Sushma H D | 2020-2021 | http://ijsrem.com/volume-05-issue-05-may-2021/ |
| 90 | Night Vision Patrolling Navigation System For Women's Safety | Dr. Rohith S | 2020-2021 | https://www.ijcrt.org/papers/IJCRT2106385.pdf |

| | | | | |
|---|---|---|---|---|
| 91 | A Review on Microstrip Patch Antenna Parameters of different Geometry and Bandwidth Enhancement Techniques | Dr. Brijesh Mishra, Dr.Ramesh Kumar Verma, Dr.Yashwanth N, Dr.Rakesh Kumar Singh | 2020-2021 | https://doi.org/10.1017/ S1759078721001148 |
| 92 | Object recognition for visually impaired using Machine Learning | Dr. Mamatha G | 2020-2021 | https://www.ijraset.com/print-certificate.php?member=28197 |
| 93 | Crowd sourcing Towards Block chain | Dr. Mamatha G | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_98.pdf |
| 94 | Object Recognition for aged people | Dr. Mamatha G | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_129.pdf |
| 95 | Introduction to Mobile Technology 6G- A Revolution | Dr. Mamatha G | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss2_February20/IJRESM_V3_I2_65.pdf |
| 96 | A study on E-learning and Cloud computing | Ms.Mounika N | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_71.pdf |
| 97 | Smart traffic Automation system | Ms.Mounika N | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_30.pdf |
| 98 | Speech to Gesture Interpreter | Ms.Ashwini S S | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_116.pdf |
| 99 | A Smart Helmet on IoT technology for safety and Accident Detection | Ms.Ashwini S S | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss4_April20/IJRESM_V3_I4_22.pdf |
| 100 | IoT based air and noise pollution monitoring systems in urban and rural ares | Mr.Mohan D N | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_111.pdf |
| 101 | Smart water usage and Leakage Monitoring | Mr.Mohan D N | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss1_January20/IJRESM_V3_I1_96.pdf |
| 102 | Iot based solar powered agribot for irrigation and farm monitoring | Mr.Ashok S Patil | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss2_February20/IJRESM_V3_I2_92.pdf |

| | | | | |
|---|---|---|---|---|
| 103 | Trustworthy keyword search over Encrypted data via Block chain | Mr.Mohan D N | 2020-2021 | http://ijrar.com/uploads/conference/ijrar_44.pdf |
| 104 | Smart Accident Zone Detection System | Mr. Ashok S Patil | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss2_February20/IJRESM_V3_I2_55.pdf |
| 105 | Augmented Reality and its working | Ms.A Sushma | 2020-2021 | https://www.ijresm.com/Vol.3_2020/Vol3_Iss2_February20/IJRESM_V3_I2_53.pdf |
| 106 | Automated Fabric Defect Detection | Ms.Mounika N | 2020-2021 | https://www.ijraset.com/print-certificate.php?member=27904 |
| 107 | Iot Based On Smart Agriculture | Ms.Mounika N | 2020-2021 | https://www.ijraset.com/fileserve.php?FID=27942 |
| 108 | "Generative Adversarial Networks based method for generating photorealistic Super Resolution images" | Dr. Sandhya G | 2020-2021 | http://icmsmt.com/ |
| 109 | "COVID-19 Diagnosis from Chest X-Ray Images Using Convolutional Neural Network and K-Fold Cross" | Dr. Syed Naimatullah Hussain ET | 2020-2021 | https://doi.org/10.3390/app112110301 |
| 110 | "Brain Tumor Classification from MRI Images Using Convolutional Neural Network". | Dr. Syed Naimatullah Hussain ET | 2020-2021 | https://ieeexplore.ieee.org/abstract/document/9573574 |
| 111 | A Study on Challenges & Prospects of Startups w.r.t Covid-19 | Mrs.Geethanjali G | 2020-2021 | VOL.7,Issue27 |
| 112 | Mechanical and Dynamich behaviour of Acetylation treated plane oven banana reinforce bio degradible composits | Mr. Amaresh Gunge | 2020-2021 | https://www.researchgate.net/publication/350854460_Mechanical_and_dynamic_mechanical_behavior_of_acetylation-treated_plain_woven_banana_reinforced_biodegradable_composites |
| 113 | Contribution of Solar Photovoltaic technology in making India leader in renewable energy | Dr. D.G.Kantharaj | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |

| | | | | |
|---|---|---|---|---|
| 114 | Optimization of biodiesel production parameters using Bauhinia variegate oil | Dr. D.G.Kantharaj | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 115 | Experimental Study On Performance of Shell and Tube Heat Exchanger Using Baffled Twisted Tapes as Tube Inserts | Mr.Vijaykumar M Patil | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 116 | Effects of additives on the performance of Diesel engine | Mr.Vijaykumar M Patil | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 117 | Optimization Of Tribological Properties Of Al6061, Boron And Graphite MMCs Using Taguchi Method | Mr. Shashikanth G S | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 118 | Experimental Investigation on Performance and Emission Characteristics of Blended fuels in Diesel Engine | Mr.Prashanth Kumar S, | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 119 | Fabrication of the solar air coller | Mr. Shashikanth G S | 2020-2021 | https://www.iosrjournals.org/iosr-jmce/pages/GET-2021-Volume1.html |
| 120 | Identification of reasons behind infant crying using acoustic signal processing and deep neural network for neonatal intensive care unit | Dr Anil Kannur | 2020-2021 | https://www.igi-global.com/article/identification-of-reasons-behind-infant-crying-using-acoustic-signal-processing-and-deep-neural-network-for-neonatal-intensive-care-unit/289576 |
| 121 | An Iot Based Smart Helmet To Prevent Road Accidents | Dr. Sandhya G | 2020-2021 | http://www.thedesignengineering.com/index.php/DE/article/view/3509 |
| 122 | Classification of Natural, Accidental and Artificial Body Marks Using Machine Learning Techniques | Dr Anil Kannur | 2020-2021 | http://www.thedesignengineering.com/index.php/DE/article/view/3509 |
| 123 | Doctor patient Assistance system using Artificial Intelligence | Mr.Muthuraju | 2020-2021 | https://ieeexplore.ieee.org/document/9532856 |
| 124 | Role of Panchayats in Rural Development | Mrs.Poornima | 2019-2020 | https://ijmdrr.com |

| | | | | |
|---|---|---|---|---|
| 125 | Paradigms of Women Empowerment through Microfinance and SHGs | Mrs.Poornima | 2019-2020 | https://testmagzine.biz/index.php/testmagzine/article/view/861/778 |
| 126 | Role of Gram Panchayats in economic development | Mrs.Poornima | 2019-2020 | https://ijbarr.com |
| 127 | Fresh, Strength and Durability Characteristics of Binary and Ternary Blended Self Compacting Concrete | Dr Venkatesh Babu DL | 2019-2020 | https://www.ijeat.org/ |
| 128 | Deep belief network based approach to recognize handwritten Kannada characters using distributed average of gradients | Dr. Srikanta Murthy K | 2019-2020 | https://www.researchgate.net/publication/323714457_Deep_belief_network_based_approach_to_recognize_handwritten_Kannada_characters_using_distributed_average_of_gradients |
| 129 | A Survey on Predictive Analysis and parallel algorithms for knowledge Extraction from data retrieved through various satellites. | Dr.Gururaj Murtugudde | 2019-2020 | https://www.irjet.net/archives/V6/i11/IRJET-V6I1193.pdf |
| 130 | New Intrusio n- Detecti on System for AODV (IDAO DV) | Mrs.Swathi S | 2019-2020 | https://www.ijert.org/a-secure-based- new-intrusion-detection-a-secure- based-new-intrusion-detection |
| 131 | Smart Helmet on IoT Techno logy for safety and accident detection | Mrs.Swathi S | 2019-2020 | https://ijisrt.com/assets/upload/submitted_files/1582794554.pdf |
| 132 | Secure Data Aggreg ation in IOT using efficien t CSDA | Mrs.Swathi S | 2019-2020 | http://ijece.iaescore.com/index.php/IJECE/article/view/16943 |
| 133 | Lidar Based Adaptive Cruise Control System | Mrs.Swathi S | 2019-2020 | https://www.jetir.org/papers/JETIR2003010.pdf |
| 134 | Perfor mance Metrics to study the effectiv eness of image segmen | Ms. Nagashre N | 2019-2020 | https://www.ijitee.org/wp-content/uploads/papers/v9i2S/B14011 292S19.pdf |

| | | | | |
|---|---|---|---|---|
| 135 | Compa rison of various machine learning methods for classification and recognition of Autism | Ms. Nagashree N | 2019-2020 | https://www.ijrar.org/papers/IJRAR19 K3713.pdf |
| 136 | Integrated Framework for secure and Energy Efficient Communication System in Heterogeneous Sensory Application | Dr. Shantakumar B. Patil | 2019-2020 | 10.11591/ijece.v9i4.pp2695-2702 |
| 137 | Smart Supervisory Stick for Blind Using Raspberry Pi | Mr.Pramoda K V | 2019-2020 | https://www.jetir.org/papers/JETIR2003354.pdf |
| 138 | Chronic Kidney Disease Prediction Based On Naive Bayes Technique | Mrs.Priyanka K | 2019-2020 | https://www.irjet.net/archives/V6/i9/IRJET-V6I9251.pdf |
| 139 | AI Based Shoot At Sight Missile | Mr.Subramanya S.G | 2019-2020 | https://www.jetir.org/papers/JETIR2003375.pdf |
| 140 | Virtual Assistant Using Artificial Intelligence And | Mr.Sudhakar Reddy M | 2019-2020 | https://www.jetir.org/papers/JETIR2003165.pdf |
| 141 | Design And Implementation Of Heart Diseases Predictor System Using Machine Learning Algorithm Over Live Cloud Infrastructure | Mr. Raghavendra B | 2019-2020 | https://www.jetir.org/view?paper=JETIR2002432 |
| 142 | 2DCrypt: Image Scaling and Cropping Without Physical Interface | Sudhakara Reddy M | 2019-2020 | https://www.ijisrt.com/assets/upload/files/IJISRT20APR055.pdf |
| 143 | Low-Cost Interactive Humanoid Robot | Mr. Gopinath A R | 2019-2020 | https://www.ijitee.org/wp-content/uploads/papers/v9i6/F3808049620.pdf |
| 144 | Secure data aggregation in IoT using Efficient-CSDA | Mrs. Swathi S | 2019-2020 | http://ijece.iaescore.com/index.php/IJECE/article/view/16943/13203 |
| 145 | GPS Based Vehicle Tracking System Via Android Device | Mr.Mahesh M R | 2019-2020 | https://www.ijisrt.com/gps-based-vehicle-tracking-system-via-android-device |
| 146 | Military Surveillance Robot | Ms.Jyothi | 2019-2020 | https://www.ijisrt.com/assets/upload/files/IJISRT20APR615_(3).pdf |
| 147 | Interactive Humanoid Robot | Mr Sreenivasulu K N | 2019-2020 | https://www.ijisrt.com/interactive-humanoid-robot |

| | | | | |
|---|---|---|---|---|
| 148 | Design and development of fault tolerance system of obc in studsat | Ms.Sreevani.N | 2019-2020 | https://www.ijisrt.com/design-and-development-of-the-fault-tolerance-software-for-the-obc-subsystem-of-studsat |
| 149 | Energy generation through footsteps | Ms.G Roopa | 2019-2020 | https://www.ijresm.com/ |
| 150 | Pursuing Robot for Assisting Senior Citizen and Physically Challenged | Mr.Sunil Kumar B S | 2019-2020 | https://ijisrt.com/assets/upload/files/IJISRT20APR650.pdf |
| 151 | Live Streaming of Agriculture Market Statistics to the Remote Village Areas Using Amateur Radio | Dr.H.Venkatesh Kumar | 2019-2020 | https://ijisrt.com/live-streaming-of-agriculture-market-statistics-to-the-remote-village-areas-using-amateur-radio |
| 152 | Weather Monitoring System Using Internet Of Things | Ms.Navya HS | 2019-2020 | http://ijrar.com/uploads/conference/ijrar_44.pdf |
| 153 | Centre Fuselage Metal Cover Weight Optimization of Combat Aircraft Using CFC | Mr. Balaji Y S | 2019-2020 | http://ijsrd.com/index.php?p=Archive&v=7&i=5 |
| 154 | Performance Enhancement of Solar Water Heater using Reflective White Sheet | Mr. ManjunathRaju G | 2019-2020 | http://www.ijsred.com/may-june-2020.html |
| 155 | Study on mechanical properties of alkali treated plain woven banana fabric reinforced biodegradable composites | Mr. Amaresh Gunge | 2019-2020 | https://www.sciencedirect.com/science/article/abs/pii/S2452213918302377 |
| 156 | Mechanical properties of chemically treated woven banana/polyvinyl alcohol composites | Mr. Amaresh Gunge | 2019-2020 | https://www.icevirtuallibrary.com/doi/abs/10.1680/jemmr.18.00028 |
| 157 | Effect of Mechanical and Tribological properties on Aluminium - Graphene reinforced composites | Mr. Vinod Kumar | 2019-2020 | https://researchjournalnmit.wordpress.com/ |
| 158 | Centre fuselage metal cover weight optimization of combat aircraft using CFC | Mr. Prabhakar C.G | 2019-2020 | http://ijsrd.com/Article.php?manuscript=IJSRDV7I50423 |

| | | | | |
|---|---|---|---|---|
| 159 | Comparative Study of Doubled Pipe Heat Exchanger and Shell and Tube Heat Exchanger | Mr Lava K R | 2019-2020 | http://ijsrd.com/Article.php?manuscript=IJSRDV7I10774 |
| 160 | Enhancement of Mechanical Properties For Conventional and Heat Treated "High Carbon Steel" | Dr N Kapilan | 2019-2020 | http://www.ijsred.com/volume3-issue3-part1.html |
| 161 | Compressive and Wear Properties Of Heat Treated "High Carbon Steel | Dr N Kapilan | 2019-2020 | http://www.ijsred.com/volume3-issue3-part1.html |
| 162 | Performance and Efficiency of Swamp Cooling System | Dr. Kantharaj D G | 2019-2020 | http://ijsrd.com/index.php?p=Archive&v=8&i=3 |
| 163 | Development and Evolution of a Low Cost radial cooling system | Mr. JullyaNaik L | 2019-2020 | http://www.ijsred.com/may-june-2020.html |
| 164 | Development and Evaluation of Thermoacoustic Refrigeration System | Mr. Vijaykumar M Patil | 2019-2020 | http://www.ijsred.com/volume3-issue3-part1.html |
| 165 | Improvement in Heat Transfer Characteristic of Nucleate Pool Boiling of Water | Mr. Prashanth Kumar S | 2019-2020 | https://www.google.com/search?q=Improvement+in+Heat+Transfer+Characteristic+of+Nucleate+Pool+Boiling+of+Water-IJSRED%2C+Volume+3%2C+Issue+3%2C+2020%2C+Page+No.144&rlz=1C1CHBF_enIN907IN907&sxsrf=ALeKk00bnE9nPwuqxjxcPLd5H6RlsguboQ%3A1621059337210&ei=CWefYPadDIb0rAHp6ZqYBQ&oq=Improvement+in+Heat+Transfer+Characteristic+of+Nucleate+Pool+Boiling+of+Water-IJSRED%2C+Volume+3%2C+Issue+3%2C+2020%2C+Page+No.144&gs_lcp=Cgdnd3Mtd2l6EANQ1OVXWJ-tWGCFtFhoAHACeACAAZIOiAG_JJIBCTUtMS4wLjIuMZgBAKABAqABAaoBB2d3cy13aXrAAQE&sclient=gws-wiz&ved=0ahUKEwi2xtDPhMvwAhUGOisKHem0BlMQ4dUDCA4&uact=5 |
| 166 | Performance study on evaporative cooling system | Mr.HareeshNaik | 2019-2020 | http://ijsrd.com/index.php?p=Archive&v=8&i=3 |

| | | | | |
|---|---|---|---|---|
| | | | | https://www.irjet.net/ |
| 167 | Studies on Flexural Strength of Concrete with Demolished Concrete as Coarse Aggregate(Partial Replacement) and Manufactured Sand as Fine Aggregate(Total Replacement) using Admixtures | Mr.DivyaSrinath | 2019-2020 | |
| 168 | Extraction of Melanoma 3D Features from Tensor Representation | Dr. Gururaj Murtugudde | 2018-2019 | https://www.sciencepubco.com/index.php/ijet/article/view/10012 |
| 169 | DSP-IR: Delay Sensitive Protocol for intelligent routing with Medium Access Control | Dr. Shantakumar B. Patil | 2018-2019 | https://www.researchgate.net/scientific-contributions/Shantakumar-B-Patil-2084460641 |
| 170 | Anomaly Detection in MANET Using Zone Based AODV Routing Protocol | Dr. Shantakumar B. Patil | 2018-2019 | https://www.springerprofessional.de/en/anomaly-detection-in-manet-using-zone-based-aodv-routing-protoco/17595830 |
| 171 | Cloud Securit y using Artifici al Intellig | Mrs.Mamata ha C M | 2018-2019 | https://acadpubl.eu/ hub/2018-118- 24/3/521.pdf |
| 172 | Adaptive Speech Spectrogram Approximation for Enhancement of Speech Signal | Mr.Manju RamraoBhosle, Mr.Nagesh K.N, Mr.Ravi Chaurasia | 2018-2019 | https://www.ijrte.org/wp-content/uploads/papers/v8i1C/A10280581C19.pdf |
| 173 | Analysis of Low Power Design Techniques for Last Level Caches Using Way Filter Technique | Dr. Nagesh K.N, Shashikiran R, Manjunatha M, A | 2018-2019 | http://ijhssi.org/papers/vol8(5)/Series-2/H0805023946.pdf |
| 174 | ALU Design and Simulation Using Folded Tree and Clock Gating. | Ms. Sunitha K, Nagesh K N, H.Venkatesh Kumar | 2018-2019 | https://www.jetir.org/ |
| 175 | Study and Design the Performance Analysis of Digital Modulation Techniques | Dr. Nagesh K.N, Vinay R, Yaseen Basha | 2018-2019 | https://www.wjert.org/home/article_abstract/670 |

| | | | | |
|---|---|---|---|---|
| 176 | Performance Analysis and Simulation of Digital Modems | Ms. Hemashree C M, H.Venkatesh Kumar | 2018-2019 | https://www.jetir.org/ |
| 177 | A Novel Compressed Encrypted and Encoded Watermark Embedding Scheme for Digital Images | Mr. Rohith S B K Sujatha | 2018-2019 | https://www.sciencepubco.com/index.php/ijet/article/view/17842 |
| 178 | Optical flow approach followed by the SVM classification model to recognize abnormal behavior of a crowd | Dr Basavaraj G M and Ashok Kusagur | 2018-2019 | https://www.sciencepubco.com/index.php/ijet/article/view/18927 |
| 179 | Anomaly Detection in MANET using Zone Based AODV Routing Protocol | Dr Premjyoti Patil, G.S. Prasanna Lakshmi, Shantakumar Patil, | 2018-2019 | https://www.springerprofessional.de/en/anomaly-detection-in-manet-using-zone-based-aodv-routing-protoco/17595830 |
| 180 | Hybrid Intrusion Detection using a Zone Based AODV Routing Protocol for MANETS | Dr Premjyoti Patil,G.S. Prasanna Lakshmi, Shantakumar Patil | 2018-2019 | https://www.researchgate.net/publication/330629113_Hybrid_intrusion_detection_using_a_zone_based_AODV_routing_protocol_for_MANETs |
| 181 | Design of Area and Power Efficient Approximate Multipliers for Image Processing | Dr. Premjyoti Patil, Mr. Sridhar T N | 2018-2019 | https://www.ijrar.org/papers/IJRAR19K1463.pdf |
| 182 | Anomaly Detection in MANET using Zone Based AODV Routing Protocol | Dr Premjyoti Patil, G.S. Prasanna Lakshmi, Shantakumar Patil, | 2018-2019 | https://www.springerprofessional.de/en/anomaly-detection-in-manet-using-zone-based-aodv-routing-protoco/17595830 |
| 183 | ALU Design and Simulation Using Folded Tree and Clock Gating. | Ms. Sunitha K, Nagesh K N, H.Venkatesh Kumar | 2018-2019 | |
| 184 | Study and Design the Performance Analysis of Digital Modulation Techniques | Dr. Nagesh K.N, Vinay R, Yaseen Basha | 2018-2019 | https://www.wjert.org/home/article_abstract/670 |

| | | | | |
|---|---|---|---|---|
| 185 | Intelligent shopping Trolly and Billing System using Raspberry Pi | Ms. Sunitha M | 2018-2019 | https://ijisrt.com/assets/upload/submitted_files/1585466793.pdf |
| 186 | Real-Time Flood Supervising and Forecasting using Simulated Neural Network | Mr Vinaya Kumar S R | 2018-2019 | https://www.ijisrt.com/assets/upload/files/IJISRT20MAR558.pdf |
| 187 | Microcontroller based Smart Crop Protection System to Detect Fire and Animals | Dr.Premjyoti Patil | 2018-2019 | https://ijisrt.com/microcontroller-based-smart-crop-protection-system-to-detect-fire-and-animals |
| 188 | Extraction of Melenama 3D features from Tensor Reprentation | Mrs. Sushmita N S | 2018-2019 | https://www.sciencepubco.com/index.php/ijet/article/view/10012 |
| 189 | Threshold Analysis Method using Threshold Based Congestion Control Protocol in Wireless Sensor Networks for Node Optimization | Dr. Mamatha G | 2018-2019 | http://www.ijtrd.com/papers/IJTRD16635.pdf |
| 190 | Study on Critical length of Fiber on Natural Areca Sheath Reinforced Polymer matrix Composites by Tensile and Flexural Testing” | Dr.S.G.Gopala Krishna | 2018-2019 | http://www.iraj.in/journal/journal_file/journal_pdf/2-289-147497007990-92.pdf |
| 191 | An experimental and numerical study on effects of exhaust gas temperature and flow rate on deposit formation in Urea-Selective Catalytic Reduction (SCR) system of modern automobiles | Dr.Kapilan N, | 2018-2019 | https://www.sciencedirect.com/science/article/abs/pii/S1359431116318853 |
| 192 | Influence of Personal Factors on the Knowledge Sharing Attitude of Individuals in Engineering Education Context” | Mr. Yogeesh H C | 2018-2019 | https://www.ijsr.net/get_abstract.php?paper_id=ART20171322 |

| | | | | |
|---|---|---|---|---|
| 193 | Study on Critical length of Fiber on Natural Areca Sheath Reinforced Polymer matrix Composites by Tensile and Flexural Testing | Mr.Chetan M R | 2018-2019 | |
| 194 | Experimental Investigation For Heat Transfer of a Double Pipe Heat Exchanger | Mr. Prabhakar C G | 2018-2019 | https://iaeme.com/MasterAdmin/Journal_uploads/IJMET/VOLUME_8_ISSUE_8/IJMET_08_08_023.pdf |
| 195 | Design and Development of Running Wheel Air Pressure Monitoring System for Vehicles | Mr. Chethankumar N | 2018-2019 | http://www.onlinejournal.in/IJIRV3I6/019.pdf |
| 196 | Optimaization of Shell and Tube Heat Exchangers by using Twisted tapes and wire wound wire Matrix as Tube Inserts | Mr. Vijaykumar M Patil | 2018-2019 | http://www.ijsrd.com/articles/IJSRDV6I21858.pdf |
| 197 | Mechanical And Tribological Properties Of Aa-7075 And Graphene Reinforced Metal Matrix Composites | Mr Vinod kumar R | 2018-2019 | https://www.ijsdr.org/papers/IJSDR180703 |
| 198 | A study on energy use for excavation and transport of soil during building construction | Dr.L Pinnky Devi | 2017-2018 | https://doi.org/10.1016/j.jclepro.2017.06.208 |
| 199 | Life cycle energy analysis of a low-cost house in India | Dr L Pinky Devi | 2017-2018 | |
| 200 | Compressive Strength of Concrete with Construction and Demolition Waste and m-SAND using Additives - | Mr.DivyaSrinath | 2017-2018 | https://www.ijrte.org/download/volume-8-issue-2s10/ |
| 201 | Automatic Car Parking System | Dr.Gururaj Murtugudde | 2017-2018 | https://acadpubl.eu/hub/2018-120-6/8/763.pdf |
| 202 | Solar Powered Smart Agricultural Practice Using Multi Purpose Agribot | Dr. Gururaj Murtugudde | 2017-2018 | https://www.jardcs.org/backissues/abstract.php?archiveid=5067 |

| | | | | |
|---|---|---|---|---|
| | | | | https://acadpubl.eu/hub/2018-118-24/3/521.pdf |
| 203 | A Cloud Security with Performance Increase and Energy Efficient using AI with DCS and PDC | Dr. Gururaj Murtugudde | 2017-2018 | |
| 204 | Extraction of Melanoma 3D Features from Tensor Representation | Dr. Gururaj Murtugudde | 2017-2018 | https://www.sciencepubco.com/index.php/ijet/article/view/10012 |
| 205 | A survey on Energy Efficient, Secure Routing Protocols for Wireless Sensor Networks | Dr. Shantakumar B Patil | 2017-2018 | http://www.ijecs.in/index.php/ijecs/article/view/2314 |
| 206 | Crowd Anomaly Detection Using Motion Based Spatio-Temporal Feature Analysis | Basavaraj G M and Ashok Kusagur, | 2017-2018 | http://ijeecs.iaescore.com/index.php/IJEECS/article/view/8484 |
| 207 | Analysis Of High Speed Wallace Tree Multiplier Using Compressors For DSP Applications | Ms.Jayalakshmi N , Mr.H. Venkatesh Kumar, Mr.Kasetty Rambabu | 2017-2018 | https://www.ijera.com/papers/Vol8_issue7/Part-3/I0807034448.pdf |
| 208 | DSP-IR: Delay Sensitive Protocol for intelligent routing with Medium Access Control | Ms.Premjyoti Patil, Mr.A.C. Yogeesh, Mr.Shantakumar Patil, Ms.H.R.Roopashree | 2017-2018 | https://www.springerprofessional.de/dsp-ir-delay-sensitive-protocol-for-intelligent-routing-with-med/15770234 |
| 209 | A STUDY ON VARIOUS OBJECT DETECTION METHODS IN SATELLITE IMAGERY | Dr. Premjyoti Patil, Mrs. Swetha Vura | 2017-2018 | https://www.researchgate.net/publication/350091249_A_STUDY_ON_VARIOUS_OBJECT_DETECTION_METHODS_IN_SATELLITE_IMAGERY |
| 210 | Crowd Anomaly Detection Using Motion Based Spatio-Temporal Feature Analysis | Mr.Basavaraj G M and Mr.Ashok Kusagur, | 2017-2018 | http://ijeecs.iaescore.com/index.php/IJEECS/article/view/8484 |
| 211 | Analysis Of High Speed Wallace Tree Multiplier Using Compressors For DSP Applications | Ms.Jayalakshmi N , Mr.H. Venkatesh Kumar, Mr.Kasetty Rambabu | 2017-2018 | https://www.ijera.com/papers/Vol8_issue7/Part-3/I0807034448.pdf |

| | | | | |
|---|---|---|---|---|
| 212 | DSP-IR: Delay Sensitive Protocol for intelligent routing with Medium Access Control | Ms.Premjyoti Patil, Mr.A.C. Yogeesh, Mr.Shantakumar Patil, Mr.H.R.Roopashree | 2017-2018 | https://www.springerprofessional.de/dsp-ir-delay-sensitive-protocol-for-intelligent-routing-with-med/15770234 |
| 213 | A STUDY ON VARIOUS OBJECT DETECTION METHODS IN SATELLITE IMAGERY | Dr. Premjyoti Patil, Mrs. Swetha Vura | 2017-2018 | https://www.researchgate.net/publication/350091249_A_STUDY_ON_VARIOUS_OBJECT_DETECTION_METHODS_IN_SATELLITE_IMAGERY |
| 214 | Array Synthesis of Circular and Planar Antenna Arrays for Pattern Nulling Using Invasive Weed Optimization Algorithm | Mr.P. Krishna Kanth Varma, Mr.Nagesh K. N.,Mr.P. V. Rama Raju and, Mr.P. B. Sai Dileep. | 2017-2018 | https://www.academia.edu/33375741/Array_Synthesis_of_Circular_and_Planar_Antenna_Arrays_for_Pattern_Nulling_Using_Invasive_Weed_Optimization_Algorithm |
| 215 | Design of Booth Multiplier using Double Gate MOSFET. | Mr.Yogeesh K.V, Mr.Venkateshkumar H | 2017-2018 | https://www.researchgate.net/publication/317609787_Design_of_Booth_Multiplier_using_Double_Gate_MOSFET |
| 216 | A Design of Sigma-Delta ADC Using OTA | Mrs.Niveditha Yadav , Mr. Yaseen Basha, Dr. Venkatesh kumar | 2017-2018 | https://www.ijera.com/papers/Vol7_issue5/Part-5/C0705051116.pdf |
| 217 | An Efficient VLSI Implementation of Double Error Correction Orthogonal Latin Square Codes | Ms.Malavika M S, Mr.Rohith S,Mr.venkatesh Kumar H | 2017-2018 | https://www.ijcaonline.org/archives/volume170/number6/malavika-2017-ijca-914856.pdf |
| 218 | Combining Optical Flow and Heat Map Feature Vectors for Crowd Behavior Recognition system | Dr Basavaraj G M and Ashok Kusagur | 2017-2018 | https://www.jardcs.org/backissues/abstract.php?archiveid=3843 |
| 219 | Functional and Assertion Based Verification of Audio Echo Effect | Dr Nagesh .K.N,SreevaniNanjuri N, YaseenBasha | 2017-2018 | https://www.ijera.com/papers/Vol8_issue7/Part-4/B0807040408.pdf |

| | | | | |
|---|---|---|---|---|
| 220 | Analysis Of High Speed Wallace Tree Multiplier Using Compressors For DSP Applications | Ms.Jayalakshmi N , Mr.H. Venkatesh Kumar, Mr.Kasetty Rambabu | 2017-2018 | https://www.ijera.com/papers/Vol8_issue7/Part-3/I0807034448.pdf |
| 221 | A STUDY ON VARIOUS OBJECT DETECTION METHODS IN SATELLITE IMAGERY | Dr. Premjyoti Patil, Mrs. Swetha Vura | 2017-2018 | https://www.researchgate.net/publication/350091249_A_STUDY_ON_VARIOUS_OBJECT_DETECTION_METHODS_IN_SATELLITE_IMAGERY |
| 222 | Combining Optical Flow and Heat Map Feature Vectors for Crowd Behavior Recognition Systems | Mr.Basavaraj G M and Mr. Ashok Kusagur | 2017-2018 | https://www.jardcs.org/backissues/abstract.php?archiveid=3843 |
| 223 | Detection of Melanoma Using Pixel Interpolation Technique | Dr.T Y Satheesha | 2017-2018 | https://www.morebooks.de/store/gb/book/detection-of-melanoma-using-pixel-interpolation-technique/isbn/978-613-8-33876-5 |
| 224 | Influence of Personal Factors on the Knowledge Sharing Attitude of Individuals in Engineering Education Context | Dr.S.G.Gopala Krishna | 2017-2018 | https://www.ijsr.net/get_abstract.php?paper_id=ART20171322 |
| 225 | Seismic Analysis of Shear Wall Buildings Incorporating Site Specific Ground Response | Dr. Chinmayi H.K. | 2017-2016 | http://koreascience.or.kr/article/JAKO201634347320567.page |
| 226 | Seismic force evaluation of RC shear wall buildings as per international codes | Dr. Chinmayi H.K. | 2017-2016 | https://www.koreascience.or.kr/article/JAKO201605041840631.page |
| 227 | GIS Based Approach for Vulnerability Assessment of the Karnataka Coast, India | Dr. Akshaya B J | 2017-2016 | https://www.researchgate.net/publication/302555211_GIS_Based_Approach_for_Vulnerability_Assessment_of_the_Karnataka_Coast_India |
| 228 | Efficient Provable Multicopy Dynamic Data Possession Method Over Cloud Servers. | Dr. Shantakumar B. Patil | 2017-2016 | http://ijaecs.iraj.in/paper_detail.php?paper_id=5567 |

| | | | | |
|---|---|---|---|---|
| 229 | 3D point cloud generation from 2D depth camera images using successive triangulation | Dr.Y. S. Kumaraswamy | 2017-2016 | https://ieeexplore.ieee.org/document/7975586 |
| 230 | ABCD Rules for Melanoma | Dr. Gururaj Murtugudde | 2017-2016 | https://www.researchgate.net/publication/322499164 |
| 231 | ABCD Rules for Melanoma | Dr. Gururaj Murtugudde | 2017-2016 | https://www.researchgate.net/publication/322499164 |
| 232 | Knowledge based MDSS using Data Mining | Dr. Shantakumar B. Patil | 2017-2016 | https://ijitee.org/wp-content/uploads/papers/v6i11/K24480761117.pdf |
| 233 | Rule construction for recommendation based on social context | Mr.Gopinath A R | 2017-2016 | www.ijrise.com |
| 234 | Segmentation and Recognition of Handwritten Kannada Text Using Relevance Feedback and Histogram of Oriented Gradients – A Novel Approach | Dr.Srikanta Murthy K | 2017-2016 | https://www.researchgate.net/publication/292946494_Segmentation_and_Recognition_of_Handwritten_Kannada_Text_Using_Relevance_Feedback_and_Histogram_of_Oriented_Gradients_-_A_Novel_Approach |
| 235 | An Overview of Image Security Techniques | Dr.Srikanta Murthy K | 2017-2016 | https://www.ijcaonline.org/archives/volume154/number6/26499-2016911834 |
| 236 | Array Synthesis of Circular and Planar Antenna Arrays for Pattern Nulling Using Invasive Weed Optimization Algorithm | Mr.P. Krishna Kanth Varma, Mr.Nagesh K. N.,Mr P. V. Rama Raju and,Mr. P. B. Sai Dileep. | 2017-2016 | https://serialsjournals.com/index.php?route=product/product&product_id=365 |
| 237 | Design of Booth Multiplier using Double Gate MOSFET. | Mr.Yogeesh K.V, Mr.Venkateshkumar H | 2017-2016 | https://www.ijcaonline.org/archives/volume167/number4/27760-2017914241 |
| 238 | A Design of Sigma-Delta ADC Using OTA | Ms.Niveditha Yadav , Mr. Yaseen Basha, Dr. Venkatesh kumar | 2017-2016 | https://www.ijera.com/papers/Vol7_issue5/Part-5/C0705051116.pdf |

| | | | | |
|---|---|---|---|---|
| 239 | An Efficient VLSI Implementation of Double Error Correction Orthogonal Latin Square Codes | Ms.Malavika M S, Mr.Rohith S,Mr.venkatesh Kumar H | 2017-2016 | https://www.ijcaonline.org/archives/volume170/number6/28074-2017914856 |
| 240 | Functional and Assertion Based Verification of Audio Echo Effect | Mr.Nagesh .K.N,Mrs.SreevaniNanjuri N, Mr.YaseenBasha | 2017-2016 | https://www.ijera.com/papers/Vol8_issue7/Part-4/B0807040408.pdf |
| 241 | Functional and Assertion Based Verification of Audio Echo Effect | Mr.Nagesh .K.N,Mr.SreevaniNanjuri N, Mr.YaseenBasha | 2017-2016 | https://www.ijera.com/papers/Vol8_issue7/Part-4/B0807040408.pdf |
| 242 | Combining Optical Flow and Heat Map Feature Vectors for Crowd Behavior Recognition Systems | Mr.Basavaraj G M and Mr.Ashok Kusagur | 2017-2016 | https://www.jardcs.org/backissues/abstract.php?archiveid=3843 |
| 243 | Crowd Anomaly Detection Using Motion Based Spatio-Temporal Feature Analysis | Mr.Basavaraj G M and Mr.Ashok Kusagur, | 2017-2016 | http://ijeecs.iaescore.com/index.php/IJEECS/article/view/8484 |
| 244 | An efficient implementation of double error correction orthogonal latin square codes | Mr.Rohith S, Mr.Venkatesh Kumar, Ms.Malavika | 2017-2016 | https://www.ijcaonline.org/archives/volume170/number6/28074-2017914856 |
| 245 | Multiple Zone Wireless Sensor Network Data Access using Parallel Processing Algorithm | Dr. Mamatha G | 2017-2016 | https://scholar.google.co.in/citations?user=zPJ-jicAAAAJ&hl=en#d=gs_md_cita-d&u=%2Fcitations%3Fview_op%3Dview_citation%26hl%3Den%26user%3DzPJ-jicAAAAJ%26citation_for_view%3DzPJ-jicAAAAJ%3AYsMSGLbcyi4C%26tzom%3D420 |
| 246 | Enabling Multi keyword Search on Secure Encrypted Data using Multi Cloud Approach | Dr. Mamatha G | 2017-2016 | http://13.232.72.61:8080/jspui/bitstream/123456789/493/1/Enabling%20Multi%20keyword%20Search%20on%20Secure%20Encrypted%20Data%20using%20Multi%20Cloud%20Approach.pdf |

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 1 (2018) pp. 53-58
© Research India Publications. http://www.ripublication.com

# Effect of Compression Ratio on the Performance of the Diesel Engine Fuelled with Alternative Fuel

**N Kapilan**[1]
[1]*Professor and Head, Department of Mechanical Engineering*
*Nagarjuna College of Engineering and Technology*
*Devanhalli, Bangalore- 562 164*

**L J Naik** [2]
[2]*Department of Mechanical Engineering*
*Asso.Professor, Nagarjuna College of Engineering and Technology*
*Devanhalli, Bangalore- 562 164*

## Abstract

The availability of fossil fuels is reducing and the usage of these fuels affects the environment and causes climate change. Hence researchers working on alternative fuels which can be used as substitute for the fossil diesel. India is facing problem in disposing waste tires and tubes. However, we can produce tire pyrolysis oil (TPO) from the waste tires and tubes by pyrolysis process which can be used as fuel in diesel engine. In this work, we have used mixture of biodiesel and TPO as fuel in the diesel engine without making any modification in the fuel injection system. We have studied the effect of compression ratio on the performance and emissions of the engine fuelled with the fuel mixture. From the engine tests, we observed that the TPO can be used as an alternative fuel to the diesel in the diesel engine and the performance of the engine may be increased with the higher compression ratio.

**Keywords:** Alternative fuel, tyre pyrolysis oil, properties, engine tests, compression ratio

## INTRODUCTION

In recent years, the world is facing two issues namely energy crisis and environmental degradation. Hence researchers working in this direction to overcome the problems associated with these issues. The biodiesel derived from non-edible oil is considered as an alternative fuel to the fossil diesel. The unscientific disposal of waste tyres and tubes degrades environment. The tyre contains synthetic rubber which causes environmental problem because it is not biodegradable.

As per a statistics India's waste tyres account for about 6-7% of the global waste tyre. In India, recycling and reusing of waste tyres is common, however it is estimated that 60% are disposed of through illegal dumping. According to a report, India is the second largest producer of reclaimed rubber and 90,000 metric tonnes of reclaimed rubber from waste tyres [1]. Also these materials take significantly much longer time as compared to biomass materials in case of photo degradation. However these materials can be disposed in controlled environment called pyrolysis. The value added by product of this pyrolysis process is a tyre pyrolysis oil which has properties similar to the fossil diesel. Figure1 shows the waste tyres.

**Figure 1 Waste Tyres**

The pyrolysis process is thermochemical decomposition of shredded tires carried out at higher temperature in a reactor vessel containing an oxygen-free atmosphere. The rubber is softened during this process and the rubber polymers break down into smaller molecules. These smaller molecules vaporize and can be condensed to get a liquid, called as tyre pyrolysis oil. The pyrolysis process is considered to give solution to waste disposal problem related to used tires [2].

Abdulkadir et al.[3] carried out pyrolysis of waste tire to produce tyre pyrolysis oil (TPO) by catalytic distillation. They reported that the characteristics of those light and heavy fuels were resembled to those of gasoline and diesel fuel [3]. Few researchers compared nitrogen sweeping pyrolysis with the vacuum pyrolysis with retorting. From their work they reported that longer vapor residence times lead to higher gas and coke yields and lower liquid yields [4].

Few researchers used the sensible heat of blast-furnace (BF) for the production of fuel oil and combustible gas from the pyrolysis of waste tire. They reported that the presence of BF slag greatly improved the production of derived-oil and increased the contents of $H_2$ and CO in pyrolysis gases [5].

Yunpu et al. reported that the microwave can be used for the pyrolysis of waste tyres. For the bio-oil production, they used microwave-assisted catalytic fast co- pyrolysis of waste and

bamboo saw dusts. They reported that the optimal bamboo sawdust to waste tire ratio is 1:1, to get maximum yield of aromatic hydrocarbons [6]. Erick Ryoiti Umeki et al. reported that the specific gravity of the is 0.93 g $cm^{-3}$ and the research octane number (RON) is similar to the RON for premium gasoline. They concluded that the blend properties highlight the complexity of the chemical interactions between the fuels [7]. M. N. Islam and M. R. Nahian reported that the distilled tire pyrolysis oil is similar to diesel fuel and able to replace diesel fuel in small engine. They observed that the brake specific fuel consumption of fuel mixture of diesel and TPO (DTPO 25) is close to the specific fuel consumption of diesel and suggested that the DTPO 25 blend can be directly utilized in diesel engine [8].

The cost of the biodiesel is higher than the diesel; however the cost of TPO is less. Hence in this work, we prepared the mixture of biodiesel and TPO and used as duel in the diesel engine to reduce the operating cost. The availability of the TPO is limited and hence it was used as partial substitute for the biodiesel. In India, honge oil has considerable potential for the biodiesel production and hence it was used as raw material for the biodiesel production. The honge biodiesel can be used as substitute for the diesel in the diesel engine [9]. Also it can be used as a pilot fuel in the dual fuel engine [10].

## MATERIALS AND METHODOLOGY

In this work, biodiesel was produced from non-edible honge oil by a two-step transesterification process. The (TPO) commercially available was used in this work. The mixture of biodiesel TPO was prepared by mixing the fuels by 80: 20 ratio (volume ratio). The properties of the biodiesel were determined by ASTM and BIS methods. The fuel mixture was used as fuel in the diesel engine

The engine tests were carried out on a single cylinder naturally aspirated diesel engine without making any modifications in the fuel injection system. Table 1 provides technical details of the engine and eddy current dynamometer was used for loading the engine. The engine exhaust emissions were measured using an AVL make gas analyser. The necessary instrumentations were used to measure the engine performance parameters such as airflow, fuel flow, temperature and load measurement. The cooling water flowrate was controlled using rotameter. Figure 2 shows the experimental setup.

**Table 1 Technical details of the engine**

| | |
|---|---|
| Engine | Single cylinder,4-Stroke, Naturally Aspirated Diesel Engine |
| Make | Kirloskar |
| Displacement | 661 CC |
| Maximum Brake Power | 3.5 kW at 1500 rpm |
| Rated Speed | 1500 rpm |
| Compression Ratio | 16.5 : 1 and 17.5 : 1 |
| Load Sensor | Load cell, type strain gauge, range 0-50 Kg |
| Dynamometer | Eddy Current Dynamometer |
| Thermocouple Sensor | Type RTD |
| Thermocouple Range | 0 – 1200 Degree C |

**Figure 2 Engine experimental setup**

## RESULTS AND DISCUSSION

The engine tests were conducted without making any modifications in the fuel injection system. Figure 3 shows the effect of fuel mixture on brake thermal efficiency at different compression ratios and at different loads. From the figure we observe that the compression ratio affects the thermal efficiency of the engine. The thermal efficiency of the engine with diesel is higher than the fuel mixture. However the higher compression ratio results in better thermal efficiency due to increase in combustion temperature which results in better vapourisation and atomization of the fuel mixture as compared to lower compression ratio.

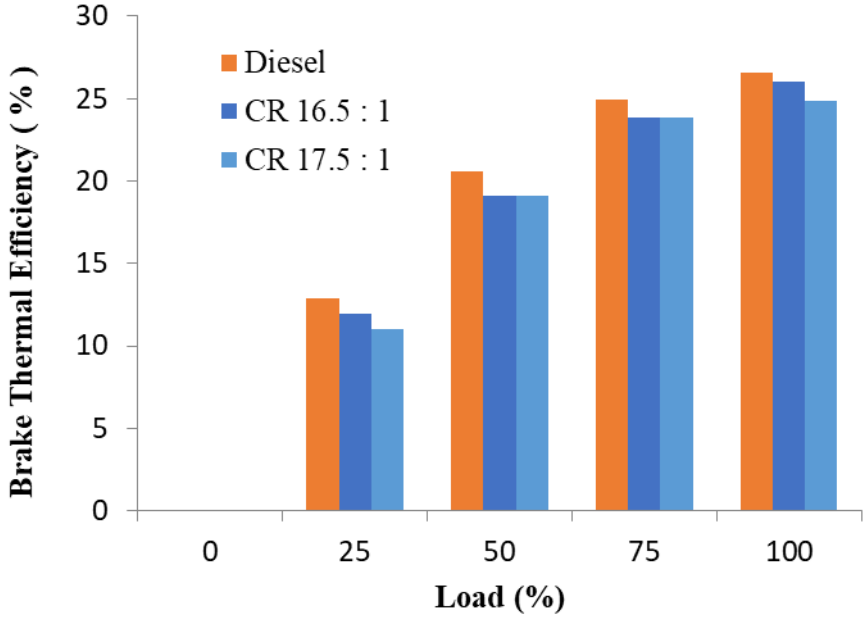



**Figure 3 Effect of Compression Ratio on Brake Thermal Efficiency**

The effect of compression ratio on the engine exhaust gas temperature (EGT) at different loads is shown in the Figure 4. From the figure, it is observed that the EGT of the fuel mixture is higher than the diesel and this is due to slow combustion of the fuel mixture which results in higher combustion temperature. The EGT of the diesel is lower than the fuel mixture. A slight variation in EGT at different compression ratio was observed.

Figure 5 shows the effect of compression ratio on the carbon monoxide (CO) emission of the engine at different loads. From the figure it is observed that the CO of the diesel is higher than the fuel mixture. The biodiesel contains oxygen in its molecular structure which results in better combustion of the fuel mixture. This reduces the formation of CO.

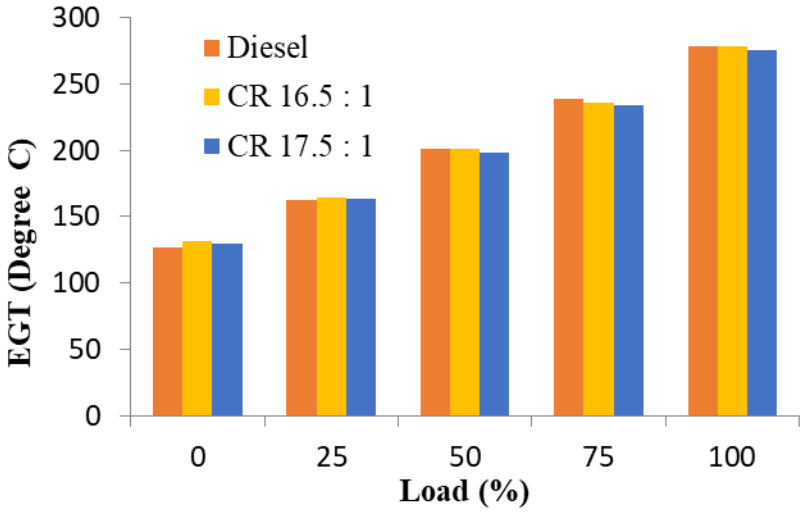



**Figure 4 Effect of Compression Ratio on EGT**

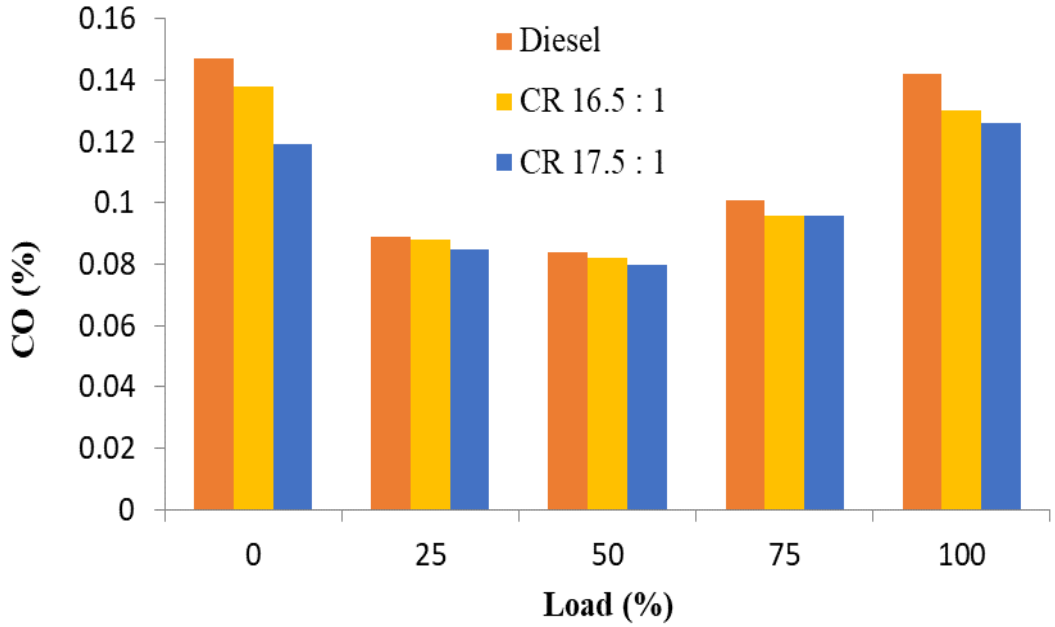



**Figure 5 Effect of Compression Ratio on CO**

The higher combustion chamber temperature causes lower CO emission due to higher combustion temperature which results in lower CO. The figure 6 shows the hydro carbon (HC) emission of the diesel engine with different fuels at different compression ratios. From the figure it is observed that diesel results in higher HC emission. The higher compression ratio of 17.5 :1 results in lower HC emission due to presence of oxygen in the molecular structure of the biodiesel.

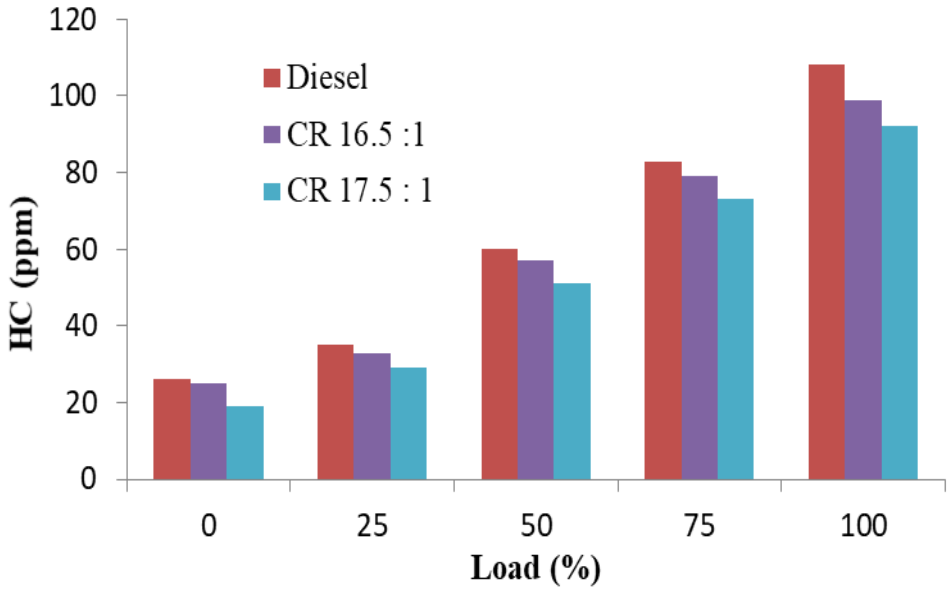



**Figure 6 Effect of Compression Ratio on HC**

The effect of compression ratio on the engine oxides of nitrogen ($NO_x$) with different fuels at different loads is shown in the Figure 7. From the figure, it is observed that the NOx of the fuel mixture is higher than the diesel and this is due to lower volatility and slightly higher viscosity of the fuel mixture. The $NO_x$ emission of the engine with the compression ratio of 17.5 : 1 is lower than the other compression ratio. The $NO_x$ emission of the diesel is lower than the fuel mixture.

Figure 8 shows the engine smoke emission with different fuels at different compression ratios and loads. From the figure it is observed that the diesel results in higher smoke emission. The compression ratio of 16.5:1 results in higher smoke emission and the compression ratio of 17.5:1 results in lower smoke emissions. The lower smoke emission is due to higher combustion chamber temperature which results in better combustion and lower smoke emission.

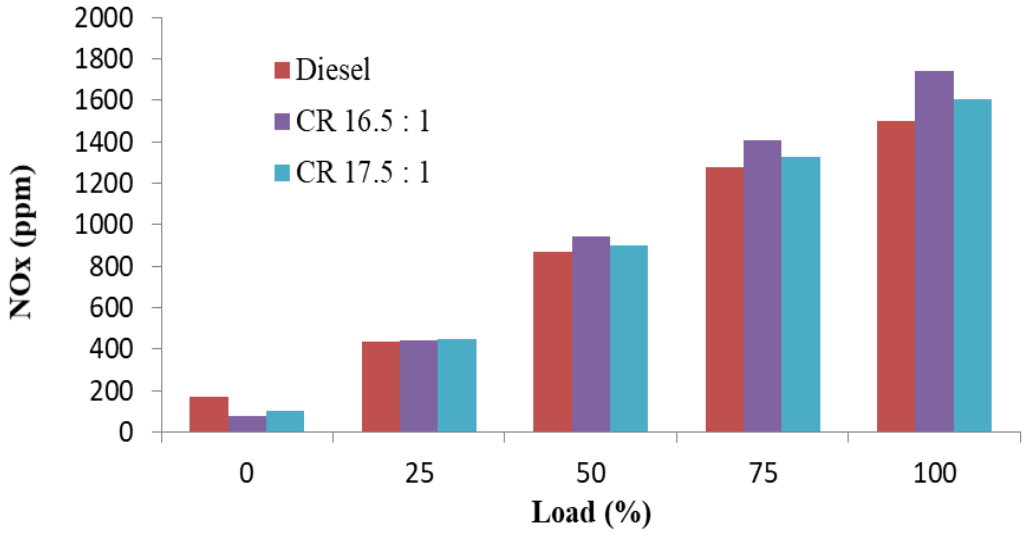



**Figure 7 Effect of Compression Ratio on $NO_x$**

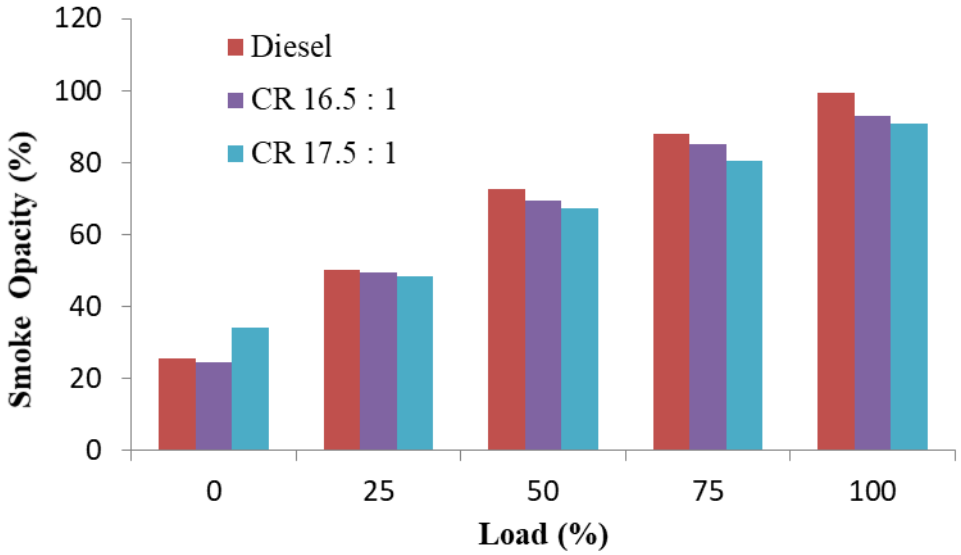



**Figure 8 Effect of Compression Ratio on Smoke Opacity**

## CONCLUSION

The availability of fossil fuels is reducing and unscientific disposal of waste tyres and tubes affects the environment. Hence in this work we successfully used a fuel mixture of biodiesel and TPO as a substitute for fossil diesel in the diesel engine and without making any modification in the fuel injection system. The engine runs without any problem with the fuel mixture and the engine thermal efficiency is close to diesel. The compression ratio affects the performance of the diesel engine fuelled with the fuel mixture. From this work, we observed that the higher compression ratio results in better brake thermal efficiency and lower engine exhaust emissions. From this work, we suggest that the fuel mixture of biodiesel and TPO can be used as fuel in the diesel engine.

## References

[1] http://www.thehindu.com/business/Turning-waste-tyre-into-%E2%80%98 green- steel%E2%80%99/ article14518524.ece (browsed on 1st November 2017)
[2] Juan Daniel Martínez, Magín Lapuerta, Reyes García-Contreras, Ramón Murillo, and Tomás García, Fuel Properties of Tire Pyrolysis Liquid and Its Blends with Diesel Fuel, Energy Fuels, 2013, 27 (6), pp 3296–3305.
[3] Abdulkadir Ayanoğlu and Recep Yumrutaş, Production of gasoline and diesel like fuels from waste tire oil by using catalytic pyrolysis, Energy, Volume 103, 15 May 2016, Pages 456-468.
[4] Ma Xiaolong, DmitryRidner, ZhangZisheng, LiXinganga. .LiHonga. SuiHonga. .GaoXina, Study on vacuum pyrolysis of oil sands by comparison with retorting and nitrogen sweeping pyrolysis, Fuel Processing Technology, Volume 163, August 2017, Pages 51-59.
[5] SiyiLuo. YuFeng, The production of fuel oil and

combustible gas by catalytic pyrolysis of waste tire using waste heat of blast-furnace slag, Energy Conversion and Management, Volume 136, 15 March 2017, Pages 27-35.

[6] YunpuWang, LeileiDai, LiangliangFan, DengleDuana, YuhuanLiua, RogerRuana. .ZhentingYua and YuezhenLiua LinJianga. , Microwave-assisted catalytic fast co-pyrolysis of bamboo sawdust and waste tire for bio-oil production, Journal of Analytical and Applied Pyrolysis, Volume 123, January 2017, Pages 224-228.

[7] Erick RyoitiUmeki, Camilla Fernandesde Oliveira, Ricardo BelchiorTorres and Ronaldo Gonçalves dosSantos, Physico-chemistry properties of fuel blends composed of diesel and tire pyrolysis oil, Fuel, Volume 185, 1 December 2016, Pages 236-242.

[8] M. N. Islam and M. R. Nahian, Improvement of Waste Tire Pyrolysis Oil and Performance Test with Diesel in CI Engine, Journal of Renewable Energy, Volume 2016 (2016), Article ID 5137247, 8 pages.

[9] K.Nantha Gopal and R.Thundil Karupparaj, Effect of pongamia biodiesel on emission and combustion characteristics of DI compression ignition engine, Ain Shams Engineering Journal, Volume 6, Issue 1, March 2015, Pages 297-305.

[10] N. Kapilan, T.P. Ashok Babu and R.P.Reddy, Improvement of Performance of Dual Fuel Engine Operated at Part Load , International Journal of Automotive and Mechanical Engineering, Volume 2, pp. 200-210, July-December 2010.

International Journal of Scientific Research and Engineering Development-– Volume 3 Issue 2, Mar-Apr 2020

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

# Improvement in Heat Transfer Characteristic of Nucleate-Pool Boiling of Water

Dhanush.P[1] , Manjunatha.N[2] , Prashanth Kumar.S[3]

[1,2]*Student, Department of Mechanical Engineering, Nagarjuna College of Engineering and Technology, Bangalore.*

[3] *Assistant Professor, Department of Mechanical Engineering, Nagarjuna College of Engineering and Technology, Bangalore.*

**Abstract:-Now-a-days, to save energy and to save environment are the great issues of the world.The enhancementof boiling heat transfer is one of the most important andadvanced research fields to meet up the partial crisis of energy. But the way of research should beenvironmentally friendly. Various inferences have been drawn based on the existing parameters like operating pressure, temperature, and types ofworking fluids are Nano fluids by different researchers for enhancement of heat transferrate. Here is an experimental study which is conducted to investigate the pool boilingheat transfer of environmentally friendly water as base fluid and nichrome wire as aheating surfaces. The goal of the Experiment was to understand the characteristics anddesign of a pool boiling heat transfer, as well as evaluate the effect of addition of wateras a base fluid, in nucleate pool boiling heat transfer coefficient. The experiments werecarried out a nichrome wire as a heating surface.The results showed that, the heat transfer coefficient increases with increasing thickness of the nichrome wire.**

**Keywords:- Power dissipated, Heat Flux, Heat Transfer Coefficient, Nichrome wire.**

## 1. Introduction

Pool boiling is the process in which the heating surface is submerged in a large body with a stagnant liquid. In a pool boiling, when a pool of liquid is heated with a heating coil (Nichrome wire) through a horizontal surface, the liquid motion of the surface is primarily due to naturalconvection and to mixing induced by bubble growth and detachment. Nucleate boiling region isa one of the most efficient heat transfer modes, which had been applied in various engineeringfields such as nuclear energy, electric power generation, electronic chips coolingand airconditioning plant. Now we conducted experiment improvement in heat transfer characteristic of nucleate pool boiling by water as a base fluid by using nichrome wire enhancing heat transfer coefficient due toincreasing the thermal conductivity wire. And further experiment as to be conducted by Nano fluid coating on the nichrome wire surface with diameter 100nm to 200nm thickness, in a base fluid such as water,oils. These Nano fluids coating way of enhancing heat transfer due toincreasing the thermal conductivity of base fluid properties.Choy [1], and Eastman etal.[2] Early studied of Nano fluids had mainly focused on thermalconductivity enhancement and the

 ©IJSRED: All Rights are Reserved 

behavior. The Influence of adding $Al_2O_3$Nano particlesdiluted binary watermixtures with different volumetric concentrations to enhance thenucleate pool boiling. The results indicated that the pool boiling heat transfer coefficientincreases by 25%.Soltani etal. [3] where, they studied increasing nucleate pool boiling heat transfercoefficients of $Al_2O_3$-water and $TiO_2$water Nano fluids at different volumetric concentrations.Their results showed that, for stainless steel and brass heating surface tubes, the presence of Nanoparticles significantly enhanced the pool boiling heat transfer coefficients, on the other hand,heat transfer coefficients deteriorated around the copper heating surface tube due to its higherthermal conductivity in comparison with the other tubes.

**Principle of Operation:-** It state that Electricallyheated nichrome wire is used as the source of heat. The heat source isimmersed in a pool of water heated to the desired temperature. The current through the resistancewire is continuously increased thus increasing the heat transferred to the water, and further study of convective, nucleate and film boilingregimes, as well as Micro bubble Emission Boiling. The current input and the voltage arerecorded by the VA meter for calculation of boiling parameters.

## 2. Objectives

The main objective of the current study are analyzed to complete the project are:

1. To study the pool boiling characteristics of water.

2. To enhance the pool boiling using nichrome wire as a heating element.

3. To study the bubble growth of pool boiling.

## 3. Materails and Methodology

## 3.1. Materails:-

Power Source, Water heater, Wire mounting arrangement, Water container, Steel shell, Heat exchanger, Submerged water pump, Temperature Controller, Data Recorder.

## 3.2. Methodology

Literature Survey

⇩

Collection of Materials

⇩

Assembling of Parts

⇩

Conduction of Experiment with Nichrome Wire as a Heating Element

⇩

Optimization

⇩

Cost Analysis

## 4. Experimental details

1. Heating element Specifications:- The equipment is standardized for the use of Nichrome (80 Nickel 20 Chromium) wire, 0.54 mmdiameter and 95-135 mm long. Thinner wires and wires of other materials may also be used.

2. A suitable length of the resistance wire is taken and it is fixed on ends of the electrode rode, The effective length of the wire between the lugs ismeasured accurately.

3. The connecting flat surfaces from both the leads and the copper shoes are polished to ensure proper electrical contact.then fixed securely to the leads by screws.

4. Nearly 4 liters of distilled water is taken in the beaker. The copper leads, the RTD and theimmersion coils are assembled.

 ©IJSRED: All Rights are Reserved 

5. The micro SD card is inserted into the VA meter in the slot provided in the front of themeter.

6. The temperature controller is set to the desired level. Voltage is increased continuouslyand slowly. The rate of increase of the voltage depends on the experimental conditions.

7. The SD card from the VA meter is removed and the data transferred to the laptop/PCthrough an SD card reader.

## 5. Results and Discussions

1) The boiling heat transfer characteristics were enhanced by using of nichrome wire as a heating filament, calculated by using formulas.
2) we ploted some graphs comparison between the platinum wire and nichrome wire results obtained nichrome wire as more resistance then the other wire and constant increased heat transfer coefficient.
3) The enhancement increases with the nichrome wire thickness as to increases, the heat transfer coefficient of water had significant increased.
4) The experimental heat transfer coefficient of water is vary the nichrome wire thickness at different applied heat flux.

## 5.1 Specimen Calculation:-

- Resistivity of the wire material, ρ = 1.206 E-06 ohm-m,
- Temperature at which resistivity was measured, $T_{Ref:}$ 26 $^0$C,
- Wire length (L): 0.132 m,
- Wire diameter (D): 0.54E-03 m,
- Water temperature: 60$^0$C.

**Tabular Column:-**

| Sl No. | Current(A) | Voitage(V) |
|---|---|---|
| 1 | 0.36 | 0.29 |
| 2 | 4.30 | 3.50 |
| 3 | 6.50 | 5.31 |
| 4 | 7.44 | 6.08 |

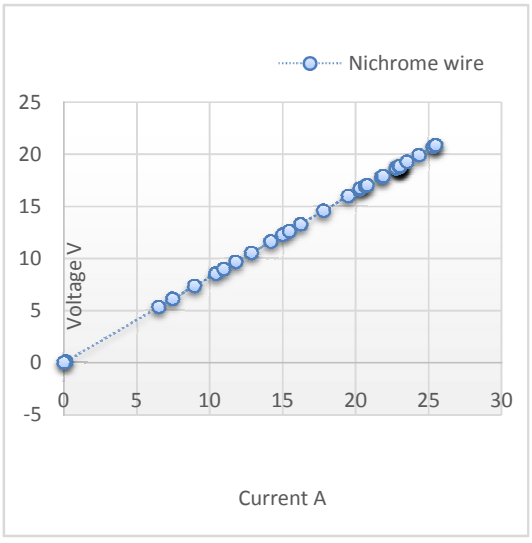
- Power dissipated $P = I^2 * R_{wire}$
  $= (2.0126)^2 * (0.7002)$
  $= 2.8336$ w

- Heat flux rate $q = P/A_s$
  $= (2.8336)/(2.2381E-04)$
  $= 12674$ w/m$^2$

- Heat transfer coefficient
  □ = q ($T_{wire} - T_{water}$)
  $=12674(76^0-60^0)$
  $= 789$ w/m$^2$K.

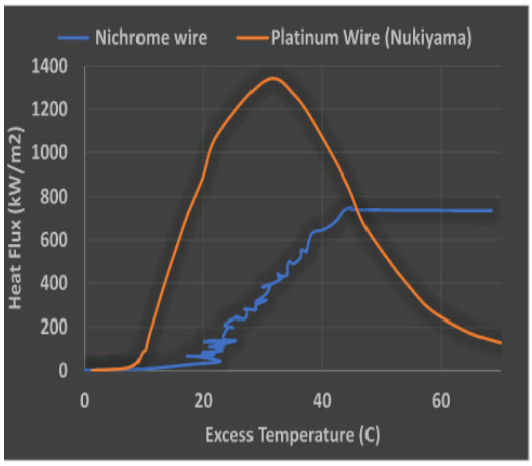
## 5.2 Graphs

1) Current v/s Voltage Graph

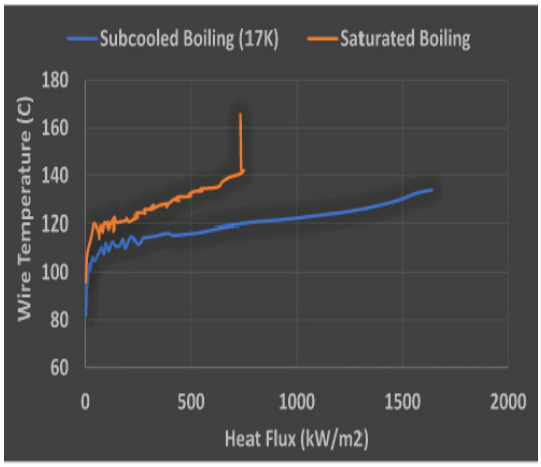



2) saturated pool boiling using nichrome wire compared with that using platinumwire

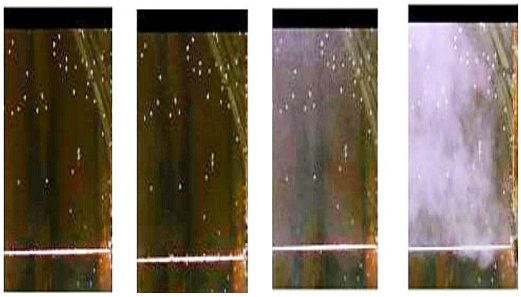
 ©IJSRED: All Rights are Reserved 




3) saturated pool boiling using nichrome wire compared with that using platinum wire




- **Bubble growth and detachment of heat transfer in pool boiling**



Natural Nucleate Transition Film

## Conclusions

We carried out the literature survey and materials required for the experimental set up. We conducted experiment heat transfer coefficient of pool boiling by using water as a base fluid.

Results obtained improvement in the pool boiling using nichrome wire on the heating element and heat transfer take place to the bubble growth and detachment on the filament on pool boiling.

In this study following conclusion can be drawn:-

i. Heat transfer coefficient should be increased depends on the heating material used and thickness of the wire.

ii. The trend of higher heat transfer coefficients and heat flux is observed in the nichrome wire as heating source.

## References

[1]. S.U.S. Choi "Enhancing Thermal Conductivity of Fluids with NanoParticles" ASME FED231, vol. 66, pp 99–103, 1995.

[2]. J.A. Eastman, S.U.S. Choi, S. Li, W. Yu, L.J. Thomson, "Anomalously Increased Effective Thermal Conductibility of Ethylene Glycol-based Nanofluids Containing Copper Nano particlesAppl. Phys. Lett. 78 718–720, 2007.

[3]. S. Soltani, S. Gh. Etemad, J. Thibault "Pool boiling heat transfer performance ofNewtonian Nanofluids" Heat and Mass Transfer, vol. 45, pp. 1555–1560,2009.

[4]. I.C. Bang, S.H. Chang, Boiling heat transfer performance and phenomena of $Al_2O_3$-water Nano-fluids from a plain surface in a pool boiling, Int. J. Heat Mass Transfer, vol. 48, pp. 2407–2419, 2005.

[5]. M.S. You, J.H. Kim, "Effect of Nanoparticles on critical heat flux of water in poolboiling",2003.

 ©IJSRED: All Rights are Reserved 

# Performance enhancement of Solar water heater using reflective white sheet

Kiran Kumar[1],G V Sai Subhash[2],C Rahul Kulkarni[3],Ananth Kumar[4,]
Manjunath Raju G[5] [1,2,3,4]
Department of Mechanical Engineering, Nagarjuna College of Engineering and Technology, Bangalore.

**Abstract: -** Nowadays, hot water is used for commercial, domestic and industrial uses. Various resources like diesel, coal, gas, petrol etc. are used for producing steam and to heat water. Solar energy is the alternative to replace the Non-renewable energy sources. The solar water heating system is the technology to trap the free available solar energy emitting from Sun. The solar energy system is designed to meet the energy demands. The size of the systems are according to solar radiation available, temperature, customer requirement, condition of geographical location and solar system arrangement, etc. Therefore, it is necessary to design the solar water heater as per above given parameters. Solar water heater proves to be an effective technology for converting solar energy from sun into thermal energy. The efficiency of solar heat conversion is around 69% when compared to solar electrical direct conversion system which has an efficiency of just 18%.So providing reflectors below evacuated tubes can improve energy harnessing. So solar water heaters hold a vital role in industrial as well as domestic Works due to its easy operation and easy maintenance. Providing reflective white sheets(GI sheets) will be increasing the efficiency and heat harnessing much better than the usual setup which is without any reflective sheet.

## 1. Introduction

The planet Earth gets an enormous amount of solar energy**.** The sun, an average star, is a fusion reactor that has been burning nearly 4 billion years. It provides sufficient energy in one minute to supply the world's energy needs for annum. In one day, it provides more energy than world population would consume in 27 years. In fact, The total amount of solar energy received by land over a 72 hour period is equal to the energy collected in all non renewable energy sources. Solar energy is a cost free**,** inexhaustible resource, yet trapping it is a very new plan. The ability to use solar power for heat was the very first invention. A famous Swiss scientist named Horace de Saussure, built the first solar collector thermally in later 1700, which was later used to water heating and cooking. The first commercial patent for a solar water heater went to Clarence Kemp from USA in the year 1891. This system was bought by two executives of California and installed in one-third of the homes of city of Pasadena by early 1900. Producing electricity from solar energy was the second invention. In the later 1839 a French physicist by the name Edmund Becquerel realized that the sun's energy may be producing a "photovoltaic effect". In the early 1880s, selenium photovoltaic (PV) cells were manufactured that can convert light into electricity with 1-2% efficiency (the efficiency of a solar cell is the percentage of current solar power from sun converted to domestic electricity for usage), but how the conversion happened was not known to them. Photovoltaic power therefore "remained a curious mystery for coming years, since it was not efficient at turning sunlight into electricity." It was not until Albert Einstein gave an explanation for the "effect of photo electricity" in the early 1900s, for which he was given Nobel Prize, that people began to know the importance the photovoltaic effect.

### Principle of solar water heater

There are numerous ways of creating a solar system. Some methods are proposed in the

literature, others are based on computer simulations. Both of them are complex processes which should begin with introductory measurements and a detailed analysis of diagrams, construction projects and the financial planning and economic analysis. It is necessary to guess the costs and uses of the tedious planned investment. The basic data which are required at the beginning stage are: the amount of solar energy (insulation), the location of the solar energy collectors (inclination) and to analyze the requirement of hot water. To determine the basic Solar energy condition in the region the parameters like solar radiation flux density W/m2, insulation kWh/m2 the energy of solar energy radiation reaching the unit area at a unit time and the numbers of sunshine hours of direct solar operation, visible operations are very needed

## 2. Objectives

The objectives of the present project work are listed below

1. To study the performance of solar water heater.

2. To study the performance of solar water heater with the help of reflective white sheet.

3. To study the performance of solar water heater throughout the day at different position of sun for multiple days.

4. To study the performance of solar water heater at diverse climate.

## 3. Materials and Methodology

### 3.1. Materials

The following materials are required to build solar water heater:

1. Infrared digital thermometer: The infrared thermometer is a device which gives temperature from a portion of the thermal radiation sometimes called black body radiation emitted by the object being measured.. By finding the amount of infrared light emitted back from the subject and subject's emissivity, the subject temperature can usually be calculated in a particular range of distance of its original temperature. Infrared thermometers are a derivatives of devices known as thermal laser thermometers.

2. Evacuating Tube collector: Evacuated tube collectors are flat devises which consist of cylindrical absorbing surfaces or tubes with internal fins installed in an evacuated tube to reduce the convection losses.

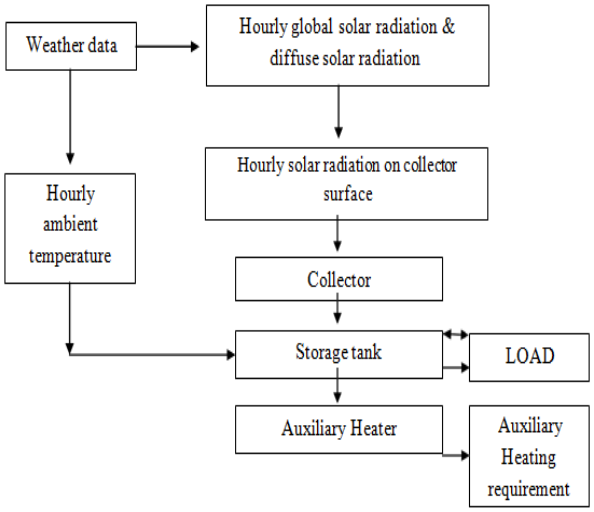
3. Tube Ring: The tube caps are majorly used to avoid any leakage of heated water from the collecting tank which is heated through the solar energy received from the sun. The tube rings may be of different dimensions.

4. Reflective white sheet: Reflective white sheet is common, such as light reflector, solar heat reflector materials, decoration, decoration of wall, signs, logo for brands, bags and so on. Aluminum bright grinded mirror sheet of coil is manufactured from intensive line of rolling, which rolled from pure quality of Aluminum, which is usually used as reflectors.

5. Frame: The frame helps in holding the evacuated tubes and withstands the weight of the system and this frame is made to place the tubes in a certain inclination angle to extract maximum energy.

6. Pyranometer :It is used for measuring solar radiance on a planar surface and it is fabricated to measure the solar radiation flux from the hemisphere above within a wavelength. range 0.3µm to 3µm.which is an essential device in measuring the intensity of the solar light coming from sun.

## 3.2 Methodology

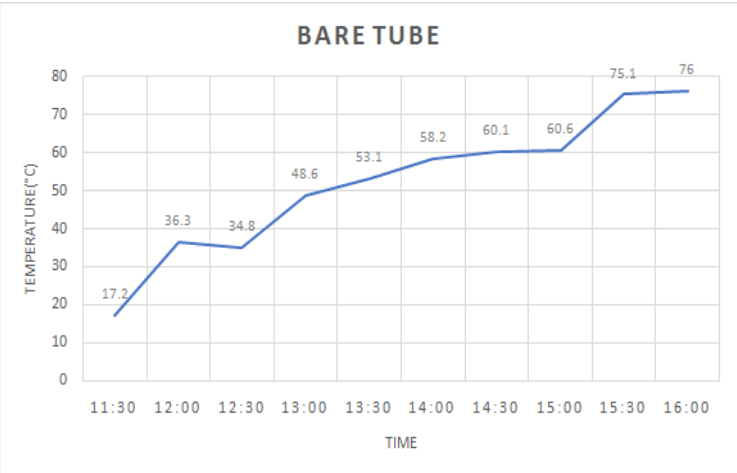



There are several methods for designing a solar water heater .we made the solar water heater with the help of a few L shaped bar for the supporting the parts of solar water heater, evacuated tubes to trap solar heat and heat the water, rubber to create a cushion for the evacuated tube as its in direct contact with iron support, Pyranometer to measure the brightness of sun for the comparison with temperature ,GI sheets to provide them as reflective white sheet which helps in heating the water much faster and finally infra red thermometer to measure the temperature of water which is getting heated up in the evacuated tube. The process of our experiment begins with measuring initial temperature of water in evacuated tubes and setting up the pyranometer setup at the same time so that the comparison can be synced later process of calculation. The setup contains evacuated tubes provided with different angle of reflective white sheets. The same process of recording the temperature is done per every one hour till the evening and the results are recorded for further research and the pyranometer readings of corresponding time is recorded and graphs are plotted accordingly. Based on the results better angle of inclination of the reflective white sheet is identified and they can be helpful in commercial installation thus reducing its cost of installation for household purposes.

placing reflective white sheets below the evacuated solar tubes at different angles and the temperature is measured with the help of Infrared digital Thermometer. The resulted temperature varies from time to time as the position of sun changes every minute in the sky. The below are the results of the conducted experiment.

Case I: Without any reflective white sheet (Bare)

| Time | Date | Water Temperature (◦c) | Tube Temperature (◦c) | | Intensity ($W/m^2$) |
|---|---|---|---|---|---|
| | | | Top | Bottom | |
| 11:30 | 07/03/2020 | 17.2 | 18.5 | 13 | 666 |
| 12:00 | 07/03/2020 | 36.3 | 27.8 | 24.8 | 684 |
| 12:30 | 07/03/2020 | 34.8 | 28.2 | 23.5 | 865 |
| 13:00 | 07/03/2020 | 48.6 | 20.1 | 21.6 | 884 |
| 13:30 | 07/03/2020 | 53.1 | 20.3 | 19.5 | 782 |
| 14:00 | 07/03/2020 | 58.2 | 17.2 | 19.5 | 263 |
| 14:30 | 07/03/2020 | 60.1 | 24.4 | 22.4 | 207 |
| 15:00 | 07/03/2020 | 60.6 | 20 | 20.2 | 120 |
| 15:30 | 07/03/2020 | 75.1 | 32 | 34.2 | 107 |
| 16:00 | 07/03/2020 | 76 | 31.4 | 32.5 | 430 |




# 4.Results and Discusssion

## 4.1.Results

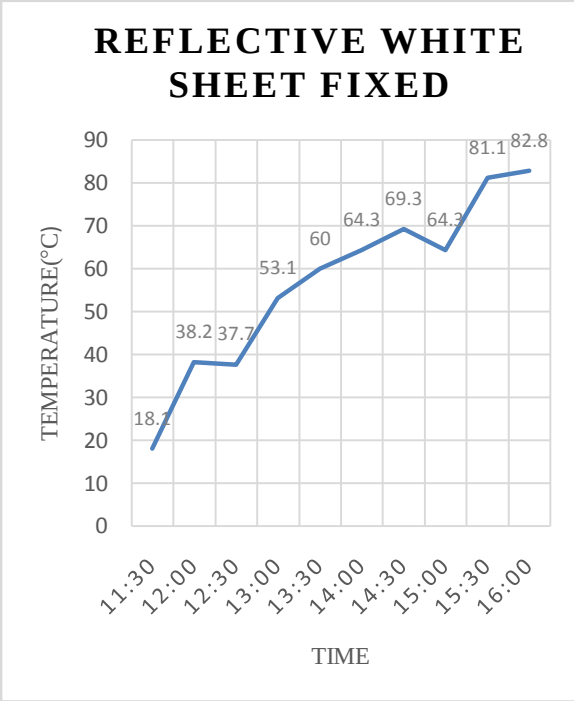
The Experiment is conducted by

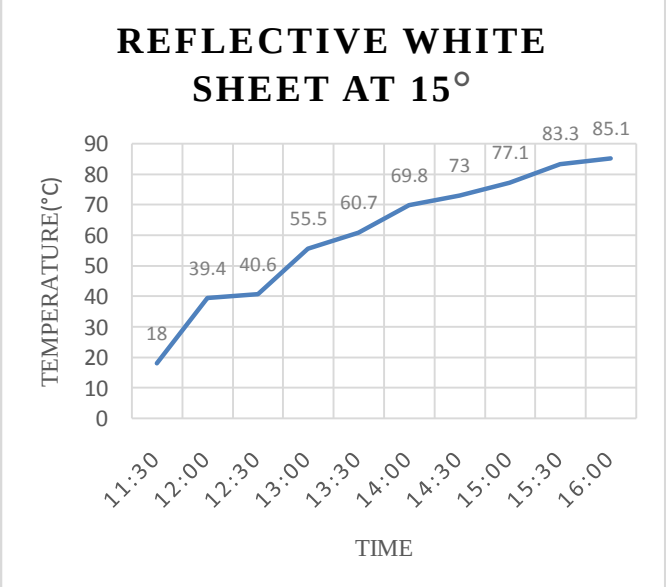
Case II: Tube with reflective white sheet (Fixed)

| Time | Date | Water Temperature (◦c) | Tube Temperature (◦c) | | Intensity ($W/m^2$) |
|---|---|---|---|---|---|
| | | | Top | Bottom | |
| 11:30 | 07/03/2020 | 18.1 | 19.3 | 13.8 | 666 |
| 12:00 | 07/03/2020 | 38.2 | 27.7 | 24.7 | 684 |
| 12:30 | 07/03/2020 | 37.7 | 28.7 | 24.0 | 865 |
| 13:00 | 07/03/2020 | 53.1 | 21.4 | 20.4 | 884 |
| 13:30 | 07/03/2020 | 60 | 18.8 | 17.1 | 782 |
| 14:00 | 07/03/2020 | 64.3 | 16.9 | 19.8 | 263 |
| 14:30 | 07/03/2020 | 69.3 | 23.4 | 23.4 | 207 |
| 15:00 | 07/03/2020 | 64.3 | 19.9 | 20.3 | 120 |
| 15:30 | 07/03/2020 | 81.1 | 30.9 | 32.1 | 107 |
| 16:00 | 07/03/2020 | 82.8 | 31 | 32.4 | 430 |

Case III: Tube with reflective white sheet ($15^0$)

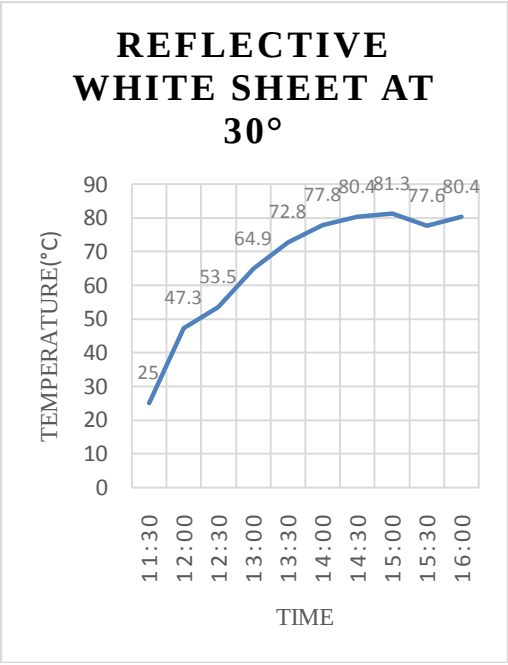
| Time | Date | Water Temperature (◦c) | Tube Temperature (◦c) | | Intensity ($W/m^2$) |
|---|---|---|---|---|---|
| | | | Top | Bottom | |
| 11:30 | 07/03/2020 | 18.0 | 21.5 | 14.9 | 666 |
| 12:00 | 07/03/2020 | 39.4 | 27.8 | 24.4 | 684 |
| 12:30 | 07/03/2020 | 40.6 | 23.5 | 26.8 | 865 |
| 13:00 | 07/03/2020 | 55.5 | 19.8 | 21.3 | 884 |
| 13:30 | 07/03/2020 | 60.7 | 21.1 | 22.4 | 782 |
| 14:00 | 07/03/2020 | 69.8 | 22.9 | 22.5 | 263 |
| 14:30 | 07/03/2020 | 73 | 28.8 | 23.5 | 207 |
| 15:00 | 07/03/2020 | 77.1 | 28 | 21.0 | 120 |
| 15:30 | 07/03/2020 | 83.3 | 36.4 | 38.5 | 107 |
| 16:00 | 07/03/2020 | 85.1 | 32.9 | 32 | 430 |



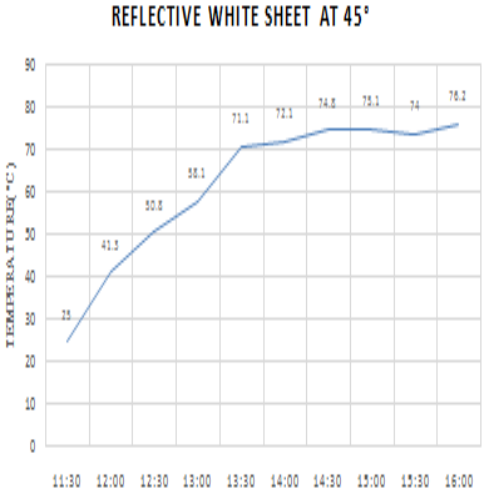
Case IV: Tube with reflective white sheet ($30^0$)

| Time | Date | Water Temperature (◦c) | Tube Temperature (◦c) | | Intensity ($W/m^2$) |
|---|---|---|---|---|---|
| | | | Top | Bottom | |
| 11:30 | 07/03/2020 | 25 | 12.5 | 19.1 | 652 |
| 12:00 | 07/03/2020 | 47.3 | 17.6 | 21 | 680 |
| 12:30 | 07/03/2020 | 53.5 | 21.3 | 18 | 847 |
| 13:00 | 07/03/2020 | 64.9 | 26.1 | 27.6 | 881 |
| 13:30 | 07/03/2020 | 72.8 | 28.1 | 29.4 | 782 |
| 14:00 | 07/03/2020 | 77.8 | 36.6 | 36.2 | 263 |
| 14:30 | 07/03/2020 | 80.4 | 46 | 40.7 | 207 |
| 15:00 | 07/03/2020 | 81.3 | 47 | 40 | 170 |
| 15:30 | 07/03/2020 | 77.6 | 28.1 | 30.2 | 107 |
| 16:00 | 07/03/2020 | 80.4 | 39.1 | 38.2 | 406 |




Case V: Tube with reflective white sheet ($45^0$)

| Time | Date | Water Temperature (◦c) | Tube Temperature (◦c) | | Intensity ($W/m^2$) |
|---|---|---|---|---|---|
| | | | Top | Bottom | |
| 11:30 | 07/03/2020 | 25 | 11.5 | 17 | 656 |
| 12:00 | 07/03/2020 | 41.3 | 19.3 | 22.3 | 689 |
| 12:30 | 07/03/2020 | 50.8 | 22 | 23.7 | 228 |
| 13:00 | 07/03/2020 | 58.1 | 21.9 | 26.6 | 981 |
| 13:30 | 07/03/2020 | 71.1 | 33.5 | 32.3 | 927 |
| 14:00 | 07/03/2020 | 72.1 | 33.7 | 34.5 | 202 |
| 14:30 | 07/03/2020 | 74.8 | 43.6 | 41.2 | 205 |
| 15:00 | 07/03/2020 | 75.1 | 42.2 | 40 | 120 |
| 15:30 | 07/03/2020 | 74 | 31.3 | 31.5 | 86 |
| 16:00 | 07/03/2020 | 76.2 | 31 | 31.9 | 467 |



### 4.2. Discussion

1. By tilting the solar setup to the north 8 degree we can extract more energy.
2. With the help of reflective white sheet we can observe more than 20-30% compare to the domestic setup.
3. The part of evacuated tube which doesn't face sunlight will be used in order to heat up the water.
4. It yields better result than the setup with no reflective sheet, which is inferred from the results recorded.
5. The evacuated tube is better utilized when the reflective white sheet is at 15 degrees when compared to 30 and 45 degrees.

## 6. Conclusion

Evacuated tube solar collectors are more efficient than flat plate collector in the application of high temperature used domestic and industrial application. Because advantage of vacuum created between tube is type of collector very common and effective in cooled climate. Since it can harvest both beam and diffuse radiations more efficient than concentric types of solar collector. Since the tube is independent in every damage only efficiency of system is decreased but the other types of collector totally system damage.

1. Heating efficiency of the solar water heater with reflective white sheet is far better than the solar water heater without reflective white sheet.
2. Water gets heated up faster and the efficiency increases when the reflective white sheet is at $45^{o}$
3. Placing reflective white sheets at certain angles may help us reduce thw number of evacuated tubes in the solar water heater as the efficiency rises by 30%.

## 7. References


1. **Soteris A. Kalogiraou:** Solar collector and application.", Progresses in Energy and Combustible energy Science 30(2005).
2. **Samara Sadrin :**Alternative solar water heater for domesticpurpose.
3. **P. Rushi Prasad:** Experimenalt Analysis of Flat Plate Collectosr and Comparison of Performance with Tracking Collectors" European Journal of Scientific Research, ISSN 1450-216X Vol.40 No.1(2010).
4. **Wattana Ratismith:** A Novel Non-Tracking Solar Collector for High Temperature Application.", proceedings of ecos 2012 - the 25th international conference on efficiency, cost, optimization, simulation and environmental impact of energy systems june 26-29, 2012, perugia,italy.
5. **KrisztinanUzuneanu:** Optimum Tilt Angle for Solar Collectors with Low ConcentrationRatio.
6. **R. Herrero**: Experimental heat transfer research in enhanced flat-plate solar collectors" World Renewable Energy Congress -2011,Sweden.
7. **ustafa AKTAS:** The Thermal Effectiveness Compression Of The Classical And Finned Solar System" IstBilimiveTeknigiDergisi, 26, 2, 29-33,2006.
8. **K. Shivakumar:** Performance analysis of elliptical heat pipes solar collectors" Indian Journals of Sciences and Technology.

ACCEPTED MANUSCRIPT

# Study on Mechanical Properties of Alkali Treated Plain Woven Banana Fabric Reinforced Biodegradable Composites

Amaresh. Gunge[1,*], Praveennath G. Koppad[1,*], Nagamadhu. M[2], Sangamesh Kivade[3], K.V. Shivananda Murthy[4]

[1]Department of Mechanical Engineering, Nagarjuna College of Engineering & Technology, Bengaluru 562164, India
[2]Department of Mechanical Engineering, Acharya Institute of Technology, Bengaluru 560107, India.
[3]Department of Mechanical Engineering, Basavakalyan Engineering College, Basavakalyan 585327, India.
[4]Department of Mechanical Engineering, Government Engineering College, Ramanagar 562159, India

## Abstract

Raising environmental concerns and pollution level has prompted for the need for biodegradable materials which have least negative effect on nature. Keeping such issues in mind, the present research work is focused on the development of banana fabric reinforced polyvinyl alcohol composites. The plain woven banana fabric is subjected to alkali treatment with different % of NaOH and its effect on mechanical properties like tensile, impact and flexural are studied and compared with that of untreated one. The mechanical and flexural tests were conducted as according to ASTM D638 and D790 standards. In addition to this dynamic mechanical analysis was carried out in the temperature range of 30°C-140°C and 10Hz frequency to study visco-elastic behaviour. The fracture analysis after tensile testing was conducted using scanning electron microscopy. Overall the mechanical properties and dynamic mechanical behavior of alkali treated composites were better than that of untreated composite.

**Keywords:** Natural fibers, Chemical treatment, Polymer matrix composites, Tensile properties, Fracture behaviour.

Email address: amargunge93@gmail.com, praveennath2007@gmail.com

International Journal of Scientific Research and Engineering Development-– Volume 3 Issue 3, May – June 2020

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

# Development and Evaluation of a Low Cost Radial Cooling System

Yashwanth.N[1],U. Raghu Ram Chowdary.[2], Jullya Naik L,[3] Vinay kumar HG, Shivaraj CR

Assistant Professor, Department of Mechanical Engineering, Nagarjuna College of Engineering and Technology, Bangalore.

[1,2]Student, Department of Mechanical Engineering, Nagarjuna College of Engineering and Technology, Bangalore.

## Abstract:-

This project is designed to outcome the traditional coolers which are not much efficient and more power consuming. The two stage radial cooling is also known as "Indirect and direct" cooler. In the first stage, incoming air passed through a heat exchanger that can cool the air without adding moisture. In second stage, air passes through the water soaked pad where the temperature dropped more and air to be pick the water which is increasing the humidity. So, two stage evaporative cooling system is a smart cooling as considered as a cost factor and power saving.

Especially since cooling systems are becoming more popular resulting in increased demand of energy. Buildings with radial ceiling cooling systems, also known as "chilled Beam" systems, incorporate pipes in the ceiling through which chilled water flows. The pipes lie close to the ceiling surfaces, and they cool the room via natural convection and radiant heat transfer the demand of ventilation appliances in the residential and commercial buildings in the topical reason is increasing very rapidly due to the population increase as well as climate change. The increasing number of high rise buildings may result in lack of natural ventilation in modern building increases need of cooling. Generally fan and air conditioner are used to obtain cooling effect. After some time the cooling effect is increased above the comfort level causing shivering. While the use of radial cooling system it maintains comfort level of humans by reducing about 5-6 degree Celsius that of atmospheric temperature and also reduces the use of energy

***Keywords:-*** Power saving, Humidity, chilled beam.

## 1. Introduction

Radiant cooling refers to any system where surrounding surface temperatures are lowered to remove sensible thermal loads from a conditioned space and its occupants, thus providing or contributing to thermal comfort. Radiant cooling uses actively cooled surfaces to absorb excess thermal energy and remove it from a space. This is the inverse of the radiant floor heating systems .In the case of radiant cooling thermal energy is flowing from the occupants, equipment, lights, and other surfaces in the room to the actively cooled surface. Active thermal slab systems, as the other radiant systems, belong to the so called Low Temperature Systems, they can heat and cool buildings with a little temperature difference between the supply fluid and indoor air. As a consequence, an increasingly use of renewable energy sources and a considerable energy saving can be realized

**Principle of Operation:-**It state that water is used as cooling medium with the help of pump water is passed through copper tubes present in the ceiling of model.

 ©IJSRED:All Rights are Reserved 

As water passes through tubes that will absorb the heat present inside the model and exits through outlet their byit reduces the temperature of confined space by 5-6 degree Celsius than that of atmospheric temperature.

## 2. OBJECTIVES

The main objective of the current study are analyzed to complete the project are

1. Study of suitable material for radial cooling model
2. Fabrication of radial cooling system
3. Analysis on performance of radial cooling system
4. Improving the performance of radial cooling system.

## 3. Materials andMethodology

## Materials:-

Concrete bed, Water pump, tank, Thermocouple, Copper tube, Power source, Thermometer.

## Methodology

Objectives

⇩

Material selection

⇩

Preparation of 3d model

⇩

Analysis of model

⇩

Conclusion

## 4. Experimental details

1. According to required dimensions model has prepared using suitable material and cooper tubes are placed in the ceiling.

2. Model is well insulated, thermocouple is fitted and connected to Digital temperature indicator.
3. Water at suitable temperature is passed through copper tubes with the help of motor and it is recirculated.
4. After some time temperature inside the model is checked with temperature gun and compared with atmospheric temperature.
5. Thermocouple readings are obtained from Digital temperature indicator.

## 5. Results and Discussion

1. Two models are prepared one is without radial cooling and other is with radial cooling.
2. These models are exposed to sunlight with proper orientation and observed changes in temperature with time.
3. Suitable temperature of water is passed as it passes through copper tubes water outlet temperature is increased 5-6 degree Celsius than water inlet temperature.
4. After certain time model inside temperature is reduced by 5-6 degree Celsius than that of atmospheric temperature.
5. Temperatures inside and outside the model are checked with temperature gun were recorded and compared.
6. Ceiling temperature of model were noted and plotted
7. Graphs plotted for different inlet temperatures as temperature v/s time.

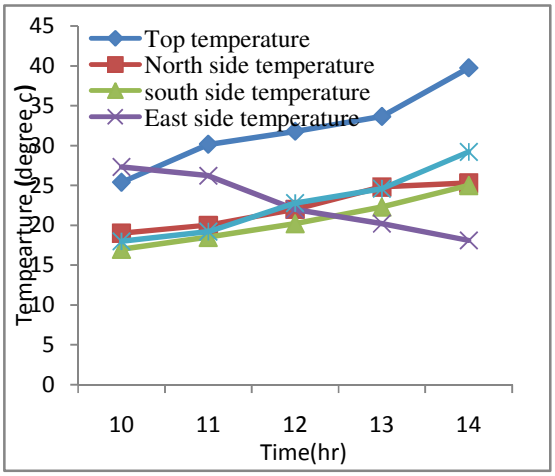



Figure:-Temperatures of system without radial cooling.

 ©IJSRED:All Rights are Reserved 

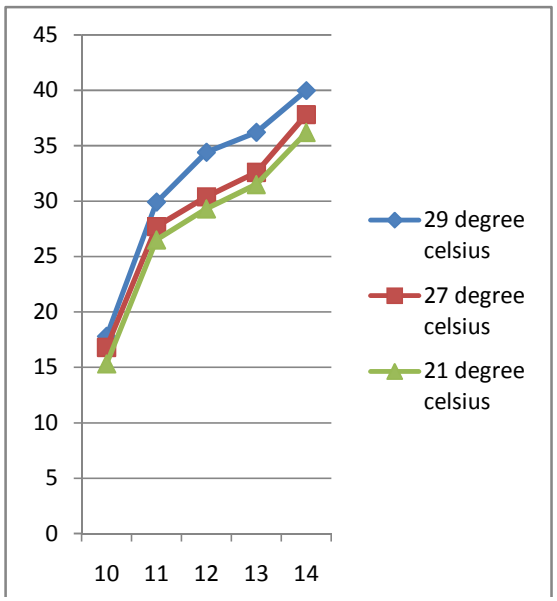



Figure:- Top ceiling temperatures comparison with various water cooling temperature.

## Conclusions

1. We have fabricated the two model one with radial and other without radial cooling.
2. After passing inlet water through copper tubes model inside temperature is reduced by 5-6 degree Celsius than atmospheric temperature
3. Different range of water inlet temperatures are passed and observed their effect on cooling.
4. Copper tubes placed at ceiling will gives more cooling effect.
5. It is experimentally proved that using radial cooling system is more economical than conventional Air conditioner.

## References

1. KIM K. K., OLESEN W. B., ASHRAE, Radiant Heating and Cooling Systems, ASHRAE (2004).
2. Choudhary A. A., Towards Energy Efficient Buildings ASSETS, ESL-HH-06-07-30
3. Mohamed T. E., Effect of a Radiant Panel Cooling System on Indoor Air Quality of a Condensed Space
4. Li Y. A. & Liu X.L., Study on Condensation Phenomenon in Floor Radiant Cooling Systems, 20 April 2007.
5. Seshadri B. et al. “Feasibility Study of Chilled Ceiling Technology in Singapore through Simulation
6. Mohamed E.T. &Abdulla N. K., Design of a Radiant Panel Cooling System for Summer Air Conditioning

 ©IJSRED:All Rights are Reserved 

# Optimization of Shell and Tube Heat Exchanger by using Twisted Tapes and Wire Wound Wire Matrix as Tube Inserts

**Vijaykumar M Patil[1] Hareesh Naik[2] Chandrashekhar Biradar[3] Prashantkumar S[4]**
[1,2,4]Assistant Professor [3]Associate Professor
[1,2,3,4]Department of Mechanical Engineering
[1,2,3,4]Nagarjuna College of Engineering and Technology, Bengaluru, India

*Abstract*— In present day it is necessary to optimize the heat transfer characteristic of heat exchangers, as heat exchangers are universal equipments which are used in day to day life, in industry, home appliances, transportations and power production units. Thermal characteristics are studied for the tube in the shell and tube heat exchanger working with water as working fluid for two different configurations of twisted tape.1)Twisted tapes and 2)Soldered wire wound inserts(wire wound wire matrix). Experiment was carried out by using these two types of inserts on the tube side. This project work deals with laminar flow in the tube side; Re varies from 200 to 600. Experiment carried out by maintaining the constant tube wall temperature with tube flow rate and shell flow constant. Twisted tapes used in this experiment have 2.2 twist ratio, and. The heat transfer and pressure drop in case of twisted tape and Soldered wire wound inserts with baffles are found to increase by 110 to 120% and 130 to 140% respectively compared to that of plain tube.

***Key words:*** Inserts, Heat Exchanger, Friction Factor, Thermal Performance, Raynolds Number, Pressure Drop

## I. INTRODUCTION

Heat exchangers are the devices, provides the flow of thermal energy between two or more fluids at different temperature. Fundamental of heat exchanger principle is to facilitate an efficient heat flow from hot fluid to cold fluid. Heat exchangers are used in different processes ranging from conversion, utilization & recovery of thermal energy in various industrial, commercial & homemade applications figure 1 shows the basic structure of shell and tube heat exchanger.

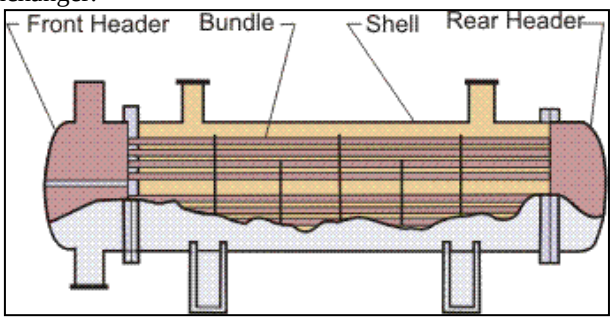



Fig. 1: Shell and Tube Heat Exchanger

Increase in heat exchanger's thermal performance which can result in fabricating more dense and economical heat exchangers. There are three methods to increase the thermal performance of heat exchangers, those are.

### *A. Active Method*

This method requires some external power input for the improvement of thermal performance of heat exchanger; examples are mechanical aids, surface vibration, fluid vibration, electrostatic fields, suction and jet impingement

### *B. Passive Method*

This method generally uses amendments to the flow in the tube of heat exchangers by fitting inserts into the tube. Such method does not need any type of external power. Due to these inserts the flow get disturbed and turbulence is created which results in increase in pressure drop, decreasing the tube wall temperature and thereby increase in heat transfer coefficient.

### *C. Compound Method*

When two or more methods incorporated simultaneously to obtain improvement in thermal performance of heat exchanger is termed as compound method. Hence obtained thermal performance of heat exchanger is greater than that produced by any one method of them when used individually.

## II. DETAILS OF TWISTED TAPES AND SOLDERED WIRE WOUND INSERTS

Initially stainless steel twisted tapes of width 12mm, thickness 3mm and length 825mm having twist ratio 2.2 are fabricated. Strip of same material of height 5.5mm, length 12mm were made, then at equal distances those strips are fixed on the hence fabricated twisted tapes as baffles at an angle of 450 with normal axis of twisted tape by the aid of gas welding using copper as the filling material. Figure -2

Soldered wire wound Tabulators are used in present experiments as second inserts, these inserts has high wire loop density on rigidly fixed central rod where t9he loops of wires soldered to central wire rod. These inserts for present work fabricated with pitch 9.5mm; pitch indicates the distance between the two conjugative wire loops. As shown in figure-3.

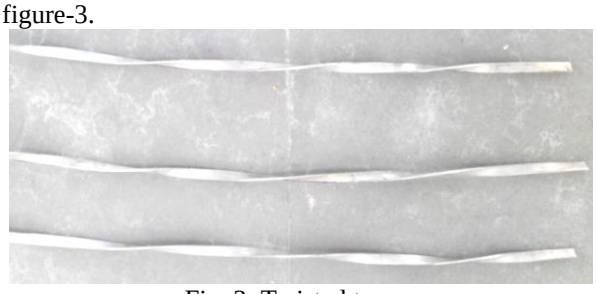


Fig. 2: Twisted tapes.

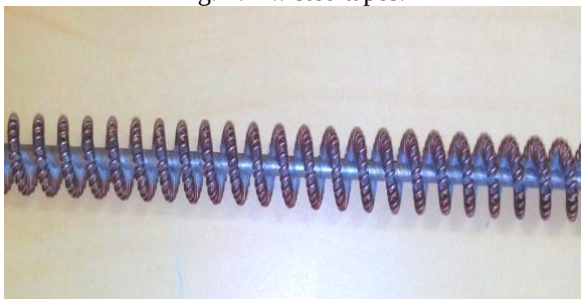


Fig. 3: Soldered wire wound inserts.

All rights reserved by www.ijsrd.com 

## III. EXPERIMENTAL SETUP

The experiment set up of 1-2 pass shell and tube heat exchanger that has been used in this experiment. Experimental shell and tube heat exchanger that used has 18 numbers of tubes of internal diameter of 16mm and length 825mm. The set up includes two digital flow meter; four thermocouples to measure the inlet and out let temperature of shell as well as tube side. LAB VIEW software is incorporated to draw the readings from the heat exchanger to the computer system. Set up further includes the hot water tank and cold water tank of same capacity of 30 litters, the external power source is used for heating the water in the hot water tank. In this experiment hot water is allowed to flow though the tubes of heat exchanger and cold water is made to flow in the shell of heat exchanger.

### *A. Experiment Procedure*

All the rotameters & thermocouples are calibrated first. The set up is cleaned and both the tanks are filled with the water, up to a certain limit. By using the external water heater which is fixed to the hot water tank the water is heated to required temperature. Both pumps are turned on by turning on the switch of motors connected to the pumps. By turning on the pump required amount of water is allowed to flow into shell (Cold Water), and also into the tube (Hot Water) by operating the control valve. Temperature of inlet water at the tube and the shell are noted given by the thermocouple. After flow gets stabilized, the temperature of out lets of shell and tube are noted. All the readings are obtained on the digital display and the readings are sent to the computer system and obtained the tabular column directly by using the LAB VIEW software. Lab view software is prepared to calculate the heat transfer coefficient and pressure drop of heat exchanger using the BELL DELAWARE method. Same procedure is followed by inserting the soldered wire wound Turbulators and twisted tapes.

## IV. RESULTS AND DISCUSSIONS

### *A. Variation in Reynolds Number*

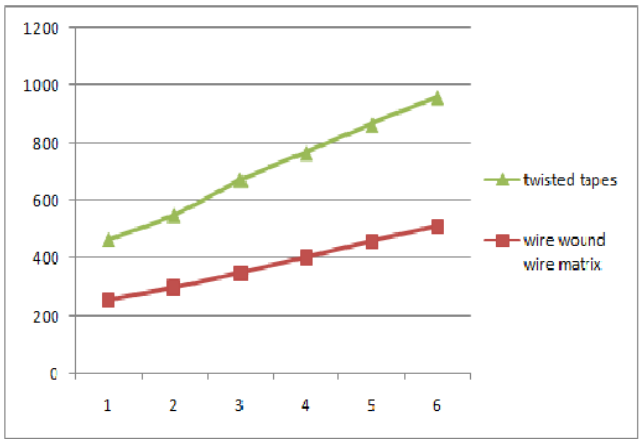



Fig. 4: variation in Reynolds number vs tube length

The above plot shows the variation of Re with respect to both the inserts. By observing above graph we can conclude that the Reynolds number for twisted is more than that of in case of wire wound wire matrix inserts. Hence turbulence nature of fluid in case of twisted tape as inserts in more that leads in increasing in the heat transfer rate.

### *B. Variation in Pressure Drop*

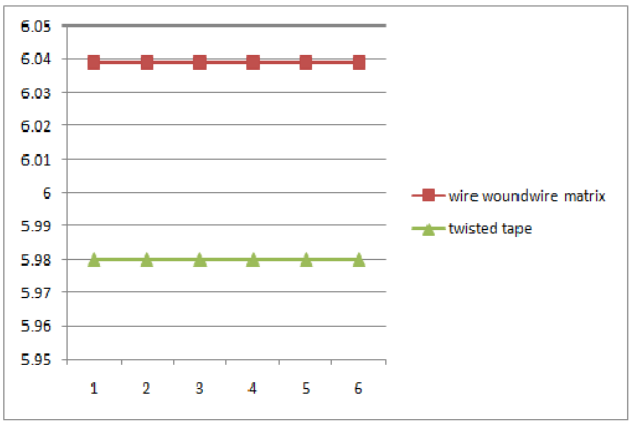



Fig. 4: Variation in pressure drop tube length

By above plot it can conclude that there is no such difference in pressure drop, but still it can be said that the pressure drop in case of wire wound wire matrix is more compared to that of incase of twisted tapes. Increase in pressure drop leads in opposition to flow in the tube, so more pressure drop needs more power to pump the water into the tube.

### *C. Variation in Friction Factor*

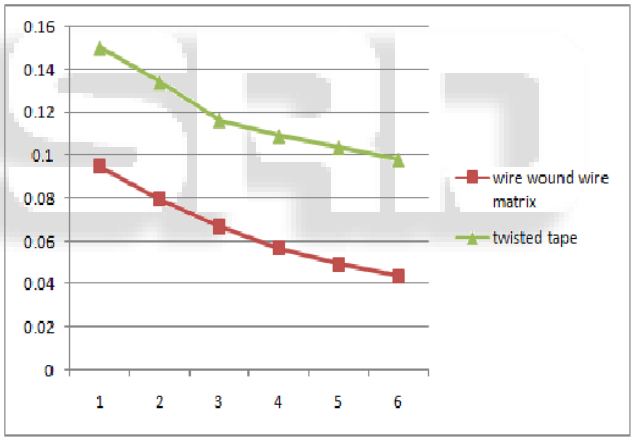



Fig. 4: Variation in friction factor vs tube length

The above graph shows the variation in friction factor, which shows that the friction factor is more in case of twisted tape used as pipe inserts and less in case of wire wound wire matrix used as pipe inserts.

## V. CONCLUSION

From the above experiment using bell deaware method and soldered wire wound turbulators and twisted tapes, it can be concluded that the Reynolds number for twisted is more than that of in case of wire wound wire matrix inserts. The pressure drop in case of wire wound wire matrix is more compared to that of incase of twisted tapes. Increase in pressure drop leads in opposition to flow in the tube, so more pressure drop needs more power to pump the water into the tube. The friction factor is more in case of twisted tape used as pipe inserts and less in case of wire wound wire matrix used as pipe inserts.

All rights reserved by *www.ijsrd.com*

REFERENCES

[1] Manglik.R.M., A.E. Bergles.A.E., Heat transfer and pressure drop correlations for twisted-tape inserts in isothermal tubes, Part I. Laminar flows, ASME Journal of Heat Transfer 115 (4) (1993),pp. 881–889.
[2] S.Selvam, PR.Thiyagarajan, S. Suresh, Experimental studies on effect of bonding the twisted tape with pins to the inner surface of the circular tube.
[3] S. Eiamsa-ard, K. Wongcharee, P. Eiamsa-ard, C. Thianpong, Heat transfer enhancement in a tube using delta-winglet twisted tape inserts, Applied Thermal Engineering 30 (2010) 310–318.
[4] M Ahmed, L Deju, M. A. R. Sarkar and S. M. Nazrul Islam, Heat transfer in turbulent flow through a circular tube with twisted tape inserts, International Conference on Mechanical Engineering 2005 (ICME2005) 28- 30 December 2005, Dhaka, Bangladesh.
[5] S.K. Saha, A. Dutta, S.K. Dhal, Friction and heat transfer characteristics of laminar swirl flow through a circular tube fitted with regularly spaced twisted: tape elements, International Journal of Heat and Mass Transfer 44 (2001) 4211–4223.
[6] M.M.K. Bhuiya, J.U. Ahamed, M.S.U. Chowdhury, M.A.R. Sarkar, B. Salam, R. Saidur, H.H. Masjuki, M.A. Kalam, Heat transfer enhancement and development of correlation for turbulent flow through a tube with triple helical tape inserts, International Communications in Heat and Mass Transfer 39 (2012) 94–101.
[7] Anil Singh Yadav, Effect of half length twisted-tape turbulators on heat transfer and pressure drop characteristics inside a double pipe u-bend heat exchanger, Jordan Journal of Mechanical and Industrial Engineering, ISSN 1995-6665. [8]. V Zimparov and P Penchev, Performance evaluation of some tube inserts as heat transfer enhancement techniques, Gabrovo Technical University4, H. Dimitar, 5300 Gabrovo, Bulgaria.
[8] Cengiz Yildiz, Yasar Bicer, and Dursun Pehlivan, Effect of twisted stripes on heat transfer and pressure drop in the heat exchangers, Energy Conversion and Management, vol. 39, March. 1998, pp. 331-336.
[9] Date, A. W., Prediction of fully-developed flow in a tube containing a twisted tape, Intl. J. of Heat and Mass Transfer, Vol. 17, pp. 845-859, 1974.
[10] Bodius Salam, Sumana Biswas and Muhammad Mostafa Kamal Bhuiya, Heat transfer enhancement in a tube using twisted tape insert, 13th Asian Congress of Fluid Mechanics 17-21 December 2010, Dhaka, Bangladesh.
[11] N. B. Dhamane, D. B. Nalawade, M. M. Dange, Experimental Study of Heat Transfer for Wavy Twisted Tape Insert of Various Pitches Placed in a Circular Tube, International Journal Of Innovative Research & Development, ISSN 2278 – 0211.
[12] Fabio T. Kanizawa , Renan S. Hernandes, Anderson A. U., de Moraes, Gherhardt Ribatski, A New Correlation For Single And Two- Phase Flow Pressure Drop In Round Tubes With Twisted-Tape Inserts, Journal of the Brazil Society Of Mechanical Science & Engineering.
[13] S. Ray, A.W. Date, Friction and heat transfer characteristics of flow through square duct with twisted tape insert, International Journal of Heat and Mass Transfer 46 (2003) 889–902.
[14] Shyy Woei Chang, Ker-Wei Yu, and Ming Hsin Lu, Heat transfers in tubes fitted with single, twin, and triple twisted tapes, Taylor & Francis Inc. ISSN: 0891-6152 print/1521-0480.
[15] Suhas V. Patil, P. V. Vijay Babu, Experimental studies on heat transfer and friction factor through isothermal square duct with twisted tape inserts, Proceeding of the International Conference on Advanced Science, Engineering and Information Technology 2011, ISBN 978-983-42366-4-9.
[16] A. V. N. Kapatkar, B. Dr. A. S. Padalkar and C. Sanjay Kasbe, Experimental investigation on heat transfer enhancement in laminar flow in circular tube equipped with different inserts, AMAE Int. J. on Manufacturing and Material Science, Vol. 01, No. 01, May 2011.
[17] S. Eiamsa-ard and P. Promvonge, Enhancement of heat transfer in a circular wavy surfaced tube with a helical-tape insert, International Energy Journal 8 (2007) 29-36.
[18] S.D.Patil, A.M. Patil, Gutam S. Kamble, Analysis of twisted tape with straight winglets to improve the thermo-hydraulic performance of tube in tube heat exchanger, International Journal of Advanced Engineering Research and Studies, E-ISSN2249–8974.
[19] Al Amin, Zunayed Mahmud, Md. Nafis Bin Islam, Md. Lutfor Rahman and Dr Mohammed Ali, Heat transfer enhancement using a rotating twisted tape insert, Proceedings of 4th Global Engineering, Science and Technology Conference, ISBN: 978-1-922069-43-6.

All rights reserved by *www.ijsrd.com* 

# EFFECT OF FIBER LENGTH ON TENSILE CHARACTERISTICS OF UNTREATED NATURAL ARECA SHEATH FRP GREEN COMPOSITES

**[1]CHETHAN M. R., [2]S. G. GOPALA KRISHNA**

Research Scholar[1], Principal and Research Supervisor[2],
Research and Development Centre, Department of of Mechanical Engineering,
Nagarjuna College of Engineering and Technology, Bengaluru-562164,
Visvesvaraya Technological University, Belagavi-590018, Karnataka, India
E-mail: [1]cmrgowdru@gmail.com,

**Abstract-** The interest and development in natural fiber materials over synthetic fiber is growing rapidly due to economical, eco friendly, renewable, Bio degradable and abduantly available. The present study aims in learning of tensile properties of untreated natural areca sheath fiber reinforced polymer matrix green composite (UNASFRPMGC). The reinforcement is natural areca fibers, which are extracted from areca sheath. The composites are prepared by using hand layup technique and are characterized with respect to mechanical properties tensile strength, tensile modulus. The results obtained for both the test were observed and compared with different fiber length to perceive the change in strength. The experimental results are validated by finite element method (FEA) through ANSYS software package.

**Keywords**- Areca Sheath Green, Composite, Fiber Length, Natural Fiber.

## I. INTRODUCTION

The use of Fiber reinforced polymer (FRP) for reinforcement of natural fibers has emerged as one of the most exciting and promising technologies in engineering structure, with a wide range of usage ranging from aircraft, boats, offshore platforms, automobiles, sports goods etc. Thus due to the wide range of application FRP composites are growing continuously at an impressive rate due to their more usage in the existing market. There has been much research conducted in the area of epoxy bonded with natural fibers. Composites obtained by using natural fibers reinforced with epoxy resin have been investigated and mechanical properties like, tensile strength, tensile modulus has been determined. The following is one sample of the research that has been carried out to develop a new class of natural fiber based polymer composites in order to explore the potential of Areca leaf sheath fibers.

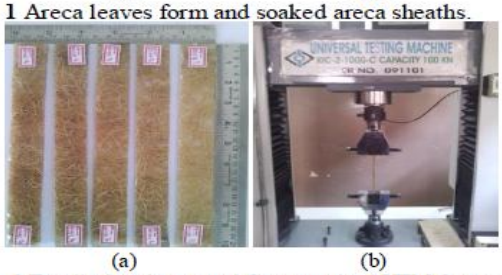
Padmaraj N H et al. [01] studied the development of bio-degradable composites using areca nut frond fibers. The tensile strength of the composite obtained was 45.29N. Chethan M. R. et al. [02] the present investigation faces this challenge and shows the influence of parameters such as fabric and lamination process. Select the bonding material such as epoxy. Finally Prepare the Natural Areca Leaf Fiber Lamina Using Polymer Matrix Composites. Noor Ahmed R. [03] FRP's have huge applications in the field of Automobile, Aerospace, Military applications, Building and Construction Industries (ceiling, paneling and partition boards) Etc. The mechanical properties of a natural fiber reinforced composite depend on parameters like fiber strength, fiber length, chemical treatment and orientation in addition. S. G. Gopala Krishna et al. [04] in this research work natural fiber reinforced polymer composites were prepared by reinforcing epoxy and vinylester resin with short areca leaf fibers. It has been found that the compressive strength of areca leaf fiber reinforced vinylester composites were more than epoxy composite.

## II. MATERIALS AND METHODS

These are fibrous materials, when introduced into polymer matrix produce a dramatic improvement in physical properties of a composite. A wide range of short fibers of various lengths and chopped fibers of are used to fabricate the composites. The Lapox 12 resin was used with various hardeners for preparing reinforced composite and laminates. Hardener is selected depending upon the processing method to be used for curing the composite.

(a) (b)

**Fig. 1** Areca leaves form and soaked areca sheaths.



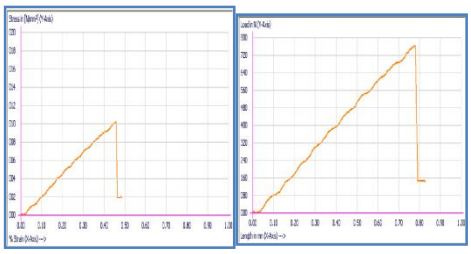

(a) (b)

**Fig. 2** Tensile Specimens and Computerized UTM for tensile setup.

The most basic type of mechanical test that is commonly performed is tensile. It is simple and inexpensive. Deformation can be measured by stretching a material in opposite direction. A complete tensile profile is obtained as it is continued to stretch until it breaks.

## III. RESULTS AND DISCUSSION

Tensile test is carried out for the specimens having ASTM D3039 Strength and modulus of fiber as well as bonding strength between fibers and matrix are the prime factors, which accounts for the tensile strength of composite materials. The ultimate point in the curve represents the complete fracture of the fiber. The values of UTS and Young's modulus for the composites are shown in Table.



(a) (b)

**Fig. 3** Tensile Stress / Strain and Load / Displacement10 mm Fiber Length for UNASFRPGC.

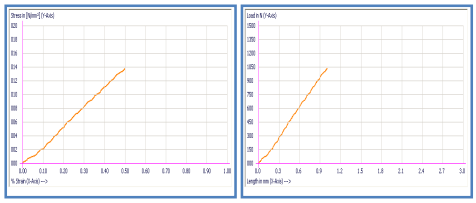


**Fig. 4** Tensile Stress / Strain and Load / Displacement10 mm Fiber Length for UNASFRPGC.

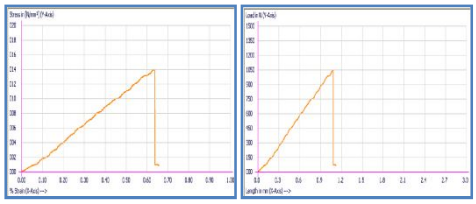


**Fig. 5** Tensile Stress / Strain and Load / Displacement10 mm Fiber Length for UNASFRPGC.

**Fig. 6** Fractured Tensile test specimens.

**Table 1.** Tensile Properties of 10mm Fiber Length UNASFRPGC.

| Specimen Number | Stress ($N/mm^2$) | Modulus of Elasticity ($N/mm^2$) |
|---|---|---|
| 1 | 09.54 | 2053.52 |
| 2 | 10.02 | 2182.82 |
| 3 | 10.60 | 2177.64 |
| 4 | 09.22 | 2847.54 |
| 5 | 10.19 | 2310.07 |

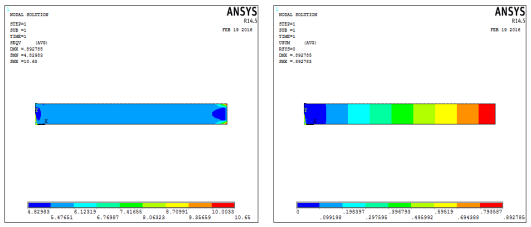
**Table 2.** Tensile Properties of 20mm Fiber Length UNASFRPGC.

| Specimen Number | Stress ($N/mm^2$) | Modulus of Elasticity ($N/mm^2$) |
|---|---|---|
| 1 | 12.06 | 1973.22 |
| 2 | 11.94 | 2069.87 |
| 3 | 13.17 | 2147.20 |
| 4 | 12.37 | 2107.43 |
| 5 | 12.05 | 1939.76 |

**Table 3.** Tensile Properties of 30mm Fiber Length UNASFRPGC.

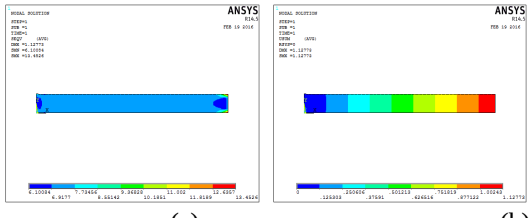
| Specimen Number | Stress ($N/mm^2$) | Modulus of Elasticity ($N/mm^2$) |
|---|---|---|
| 1 | 12.41 | 2199.96 |
| 2 | 12.23 | 2487.14 |
| 3 | 13.38 | 3045.73 |
| 4 | 13.46 | 3345.16 |
| 5 | 13.11 | 2761.99 |

This finite element analysis investigations on the fiber lengths reported in the present work give some insight into areca composite behavior. In the present analysis, the Von-Misses stresses and deformation of the areca composite at different length of fibers.



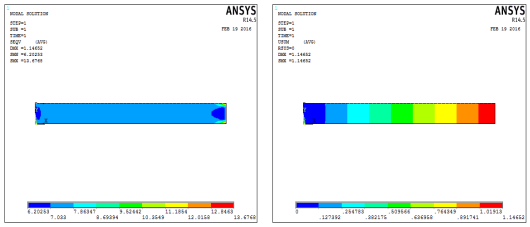
(a) (b)

**Fig. 7** Von-Mises Stress and Displacement Plot for UNASFRPGC (10 mm Fiber Length)



(a) (b)

**Fig. 8** Von-Mises Stress and Displacement Plot for UNASFRPGC (20 mm Fiber Length).



(a) (b)

**Fig. 9** Von-Mises Stress and Displacement Plot for UNASFRPGC (30 mm Fiber Length)

**Table 4.** Comparison of Tensile properties for Experimental and Ansys of UNASFRPGC.

| Fiber Length (mm) | Experimental ($N/mm^2$) | FEA (MPa) | % of Error |
|---|---|---|---|
| 10 | 10.60 | 10.76 | 1.50 |
| 20 | 13.17 | 13.45 | 2.08 |
| 30 | 13.46 | 13.67 | 1.53 |

The analysis is done for tensile specimen of same dimension used in experimental work. Considering this result, it is confirmed that experimental result is similar to the result FEA analysis. The errors may occur due to some possible measurement errors are done in experimental tests such as measurement, non-uniformity in the specimens properties (voids, variations in thickness, non-uniform surface finishing) and fiber misalignment and resin flow or bleed-out during curing that created slight differences in the modulus, density and thickness of the composite which affects the results.

## CONCLUSIONS

The natural Areca sheath has been found to be better reinforcing materials for primary and secondary structural materials. Tensile strength and modulus of 30mm fiber length areca sheath fiber reinforced polymer composite is found to be 13.67 $N/mm^2$ and 3345.16 $N/mm^2$ respectively, these values are more than 10mm & 20mm fiber length areca sheath fiber composites Longer the fiber length higher the strength is from the experimental and numerical simulation method.

## REFERENCES


1. Padmaraj N. H., M. Vijay Kini, and B. Raghuvir Pai and B. Satish Shenoy, “Development of Short Areca Fiber Reinforced Biodegradable Composite Material”, Elsevier Journal: Procedia Engineering - 64, (2013), 966-972.
2. Chethan M. R. and S. G. Gopala Krishna, “Study on Preparation of Natural Areca Leaf Fiber Reinforced Polymer Composites”, International Conference on polymeric Biomaterials, Bio-Engineering and Bio-Diagnostics held in IIT Delhi, 27th to 30th October 2014.
3. Noor Ahmed R., Chethan M. R., Suraj S. and S. G. Gopala Krishna, “A Review on Natural Fiber Reinforced Polymer Composites”, International Journal of Research and Development Organization, ISSN 3855-0154, Volume 2, Issue 6, June 2015.
4. Sunil Kumar M., S. G. Gopala Krishna, Shivakumar H. R. and K.S Rai, “Preparation and Characterization of Short Areca Leaf Fiber Reinforced Epoxy and Vinyl Ester Composites”, International Journal of Advance Research In Science And Engineering, (2015) Vol. No.4, Special Issue (01), 1635-1646.
5. G. C. Mohan Kumar, “A Study of Short Areca Fiber Reinforced PF Composites”, Proceedings of the World Congress on Engineering (WCE), ISBN: 978-988-17012-3-7, Vol. 2, pp. 1375-1380, 2008.
6. Munikenche Gowda T., Naidu A. C. B. and Rajput Chhay, “Some Mechanical Properties of Untreated Jute Fabric Reinforced Polyester Composites”, Elsevier Journal: Composite Pat A: Applied science and Manufacturing, Vol. 30, pp. 277-284, 1999.


★★★

**International Journal of Mechanical Engineering and Technology (IJMET)**
Volume 8, Issue 8, August 2017, pp. 203–210, Article ID: IJMET_08_08_023
Available online at http://iaeme.com/Home/issue/IJMET?Volume=8&Issue=8
ISSN Print: 0976-6340 and ISSN Online: 0976-6359

© **IAEME** Publication **Scopus** Indexed

# EXPERIMENTAL INVESTIGATION FOR THE HEAT TRANSFER OF A DOUBLE PIPE HEAT EXCHANGER

**Anand Babu K**
Department of Mechanical Engineering,
Nagarjuna College of Engineering and Technology, Bengaluru, India

**Naveena H S**
Department of Mechanical Engineering,
Sri Venkateshwara college of engineering, Bengaluru, India

**Nagesh R**
Department of Mechanical Engineering,
Sri Venkateshwara college of engineering, Bengaluru, India

**Prabhakar C G**
Department of Mechanical Engineering,
Nagarjuna College of Engineering and Technology, Bengaluru, India

## ABSTRACT

*A heat exchanger is a device that transfers thermal energy from a high-temperature fluid to a low-temperature fluid with both fluids moving through the device. There are three main types of heat exchangers: The first is Recuperative type in which the flowing fluids exchanging heat are on either side of a dividing wall. The second is Regenerative type in which the hot and cold fluids pass alternately through a space containing a matrix of material that provides alternately a sink and a source for heat flow. The third is Evaporative type in which a liquid is cooled evaporative and continuously in the same space as the coolant. Engineers are continually being asked to improve processes and increase effectiveness of heat exchangers. These requests may arise as a result of the need to increase process throughput, increase profitability, or accommodate capital limitations. Researches on the varieties of thermal conductive fillers and the effects of the contents of high-thermal conductive coating have been done, which shows that the thermal conductivity of coating increases with the increase of the quality fraction and the coefficient of thermal conductivity of the thermal conductive fillers of coating. In the present work the coating on the inner pipe of the double pipe heat exchanger is made by the different high thermal conductivity materials and tested for the effectiveness of the heat exchanger for various flow rates of hot fluid and cold fluid. The properties of hot fluid and cold fluids are suitably analyzed for various flow rates. The effectiveness of the*

*heat exchangers are experimentally determined at different temperature and flow rates and compared with that of the analytical calculations made using general Nusselt equations.*

**Key words:** Heat Exchanger, Coatings, Nusselt Equation.

**Cite this Article:** Anand Babu K, Naveena H S, Nagesh R and Prabhakar C G, Experimental Investigation for the Heat Transfer of a Double Pipe Heat Exchanger, *International Journal of Mechanical Engineering and Technology*, 8(8), 2017, pp. 203–210.
http://iaeme.com/Home/issue/IJMET?Volume=8&Issue=8

## 1. INTRODUCTION

Heat transfer continues to be a field of major interest to engineering and scientific researchers, as well as designers, developers, and manufacturers. Considerable effort has been devoted to research in traditional applications such as chemical processing, general manufacturing, and energy devices, including general power systems, heat exchangers, and high performance gas turbines. In addition, a significant number of papers address topics that are at the frontiers of both fundamental research and important emerging applications, such as micro channel flows, bio-heat transfer, electronics cooling, semiconductors and a number of natural phenomena ranging from upwelling currents in the oceans to heat transport in stellar atmospheres. Effective utilization of available energy becomes need of hour today. This obviously requires effective devising. When it concerns with heat energy the devices are heat exchangers. Heat exchanger may be defined as equipment which transfers the energy from a hot fluid to a cold fluid, with maximum rate and minimum investment and running cost. Heat exchangers are used in variety of applications. Some of the applications of heat exchangers are-in process industries, thermal Power plants, air-conditioning equipments, refrigerators, radiators for space.

For efficiency, heat exchangers are designed to maximize the surface area of the wall between the two fluids, while minimizing resistance to fluid flow through the exchanger.

**Figure 1** Heat Exchanger.

A heat exchanger may be defined as equipment which transfers the energy from a hot fluid to a cold fluid, with maximum rate and minimum investment and running costs. In heat exchangers the temperature of each fluid as it passes through the exchangers, and hence the temperature of the dividing wall between the fluids also changes along the length of the exchanger.

# 2. EXPERIMENTAL SETUP

The overall experimental setup of double pipe heat exchanger is as shown in below photographic figure 2 which, shell and consist of heat exchanger assembled to the heating tank provided with the heater facilities, temperature indicator with thermocouple.

**Figure 2** Overall experimental setup

The main component of this experimental setup is double pipe heat exchanger. As its name implies, this type of heat exchanger consists of a tube surrounded by an outer tube. One fluid runs through the tubes, and another fluid flows over the anulus to transfer heat between the two fluids. Here water which is flowing through the annulus gets heated and the same is made to study the increase in heat transfer with thermal coatings.

## 2.1. Design Specifications

In this section certain calculations are made to design the double pipe heat exchanger. In order to design some parameters are required like mass flow rate of both the fluids, inlet temperatures of both the fluids, velocity of the fluids and some other data are necessary to assume to carry out the calculations. In order to meet the above condition, it is necessary to assume certain conditions to calculate the heat transfer theoretically. In order to meet the above operating conditions the following design specifications are made, which majorly includes.

- Specifications of thermocouple with Digital indications.
- Heating Tank specifications.

### *2.1.1. Temperature Indicator*

- Type: Digital indication with multi point connection.
- Mounting : Panel mounting.
- No of ports : 8 ports.
- Range : -200°C to 1500°C.
- Voltage : 230 DC volt.

### *2.1.2. Thermocouple*

- Type: K (chromel{90 percent nickel and 10 percent chromium}–alumel
- (Alumel consisting of 95% nickel, 2% manganese, 2% aluminium and 1% silicon)
- Sensitivity: 41 µV/°C (Approx).
- Range: −200 °C to +1350 °C range is used for various connections.

### *2.1.3. Heating Tank Specification*

- Capacity: 200 liters
- Hating arrangement: 4 heating coils with threaded connection for leak tight each
- Having the capacity of 2 kW.
- ½ inch BSP connection at center for thermocouple connections.
- Four 1 ½ inch BSP connection at the bottom at right angles to each other for heaters connection.
- 1 inch BSP connection for Pump inlet connections.

## 2.2. 3D Modeling Using Solid Edge V20

The design and modeling of the double pipe heat exchangers are most importantly required for the fabrication and to carry out the experiments. The design drawings of the double pipe heatexchanger are modeled and drafted in solid edge V20.

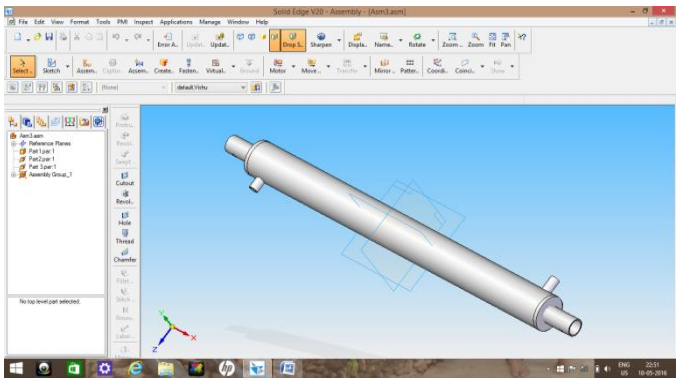


**Figure 3** 3- D Assembled model of a double pipe heat exchanger

Figure 3 shows a double pipe model by using solid edge.

### *2.2.1. Fabrication of Double Pipe Heat Exchangers*

**Figure 4** Fabrication arrangements used.

**Figure 5** welding of washers

The components used for fabricating double pipe heat exchangers such as pipes, washers and copper tube are shown in figure 4. The washer welding is done at end of pipes by using arc welding which is shown in figure 5

This session clearly describe the fabrication of a double pipe heat exchanger. The three heat exchangers are fabricated viz a double pipe heat exchanger with a simple mild steel pipe of the inner pipe of double pipe heat exchanger and the outer pipe is common to all heat exchanger, the pipe coated with copper, and the regular copper pipes are provided for the inner tubes which is of main interest if heat transfer. The fabrications are done by gas welding

and brazing based on requirement. The connections for the hot fluid and cold fluid are provided for the inner and the outer pipes. Facilities are also made for the measurements of temperature and the flow rates of hot fluid and cold fluids.

## 3. RESULTS AND DISCUSSIONS

The objective of this experiment is to evaluate the performance characteristics of a double-pipe heat exchanger under parallel arrangements having a normal steel pipe and with a copper coated pipe and also the results are examine with the pure copper pipes which will give the clear data for the importance of thermal coating.

A Heating tank supplies continuous hot water which can be regulated through control valve. Cold water supply from external source is also regulated by another control valve.

- Cold water and Hot water connections are properly set in Parallel flow type by keeping cold water valves V1 and V4 in open position and V2 and V3 in closed position.
- First water is allowed through heating tank and heating is done by using Electrical power supply.
- Hot water flow rate from outlet of heating tank is controlled by operating the valve V5.
- Cold water flow rate is controlled by operating the valve V1 generally maintained constant.
- After attaining Steady State Steady Flow conditions, flow rates of both
- Hot water and Cold water are measured by using measuring jar and stop watch.
- Inlet temperature $T_{hi}$( $T_1$) and outlet temperature $T_{ho}$($T_2$) of hot water are noted from Digital temperature indicator.
- Simultaneously Inlet temperature $T_{ci}$ ($T3_)$and outlet temperature, $T_{co}$($T4_)$of cold water are noted.
- Similar Procedure is carried out for the heat exchangers with coated copper and Pure copper.

**Table 1** Observation for exit temperatures for inner MS pipe in

| Sl No. | Time taken for collecting 400ml of Hot water, $\tau_1$ (sec) | Time taken for collecting 400ml of cold water, $\tau_2$ (sec) | Hot water inlet temperature $T_1(^0C)$ | Hot water outlet temperature $T_2(^0C)$ | Cold water inlet temperature $T_3(^0C)$ | Cold water outlet temperature $T_4(^0C)$ |
|---|---|---|---|---|---|---|
| 1 | 20 | 60 | 75 | 56 | 26 | 28 |
| 2 | 30 | 60 | 75 | 55 | 26 | 30 |
| 3 | 40 | 60 | 75 | 53 | 26 | 31 |
| 4 | 50 | 60 | 75 | 51 | 26 | 33 |
| 5 | 60 | 60 | 75 | 50 | 26 | 35 |

### 3.1. Parallel Flow

The above Tables 1 shows the observation made for the readings of exit temperature hot fluid and the cold fluid by varying the flow rate hot fluid uniformly in decreasing order by adjusting the flow control valve from 0.02 kg/sec to 0.006667kg/sec and the flow rate of cold fluid maintained at constant flow rate of 0.006667kg/sec. and the flow rate of cold fluid maintained at constant flow rate of 0.006667kg/sec as calculated results of Logarithmic mean temperature difference(LMTD), Overall Heat Transfer Co-efficient(U) ,Effectiveness (Є) for a double pipe heat exchanger of parallel flow arrangement with inner MS pipe.

**Table 2** Calculated results of LMTD, Overall Heat Transfer Co-efficient, Effectiveness for inner MS pipe in parallel flow Heat exchanger.

| Sl No. | Mass flow rate of hot fluid $m_h$(kg/s) | L.M.T.D. $^0$C | Overall Heat Transfer Co-efficient, U W / m$^2$. $^0$C | Effectiveness of the Heat Exchanger, Є |
|---|---|---|---|---|
| 1 | 0.02 | 37.52575 | 1800.389 | 0.387755 |
| 2 | 0.013333 | 35.66416 | 1329.379 | 0.408163 |
| 3 | 0.01 | 33.71722 | 1160.067 | 0.44898 |
| 4 | 0.008 | 30.95516 | 1102.758 | 0.489796 |
| 5 | 0.006667 | 28.72179 | 1031.69 | 0.510204 |

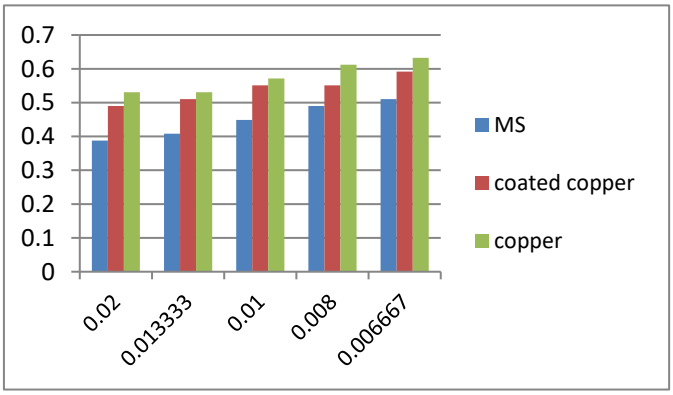



**Figure 5** Variation of Effectiveness of double pipe heat exchanger for parallel flow arrangement with inner MS, Copper coated and copper pipes

The figure 5 shows the variations and Comparison of Effectiveness for double pipe heat exchanger of parallel flow arrangement with inner MS, Copper coated, and copper pipes. The results obtained are by varying the flow rate hot fluid uniformly in decreasing order by adjusting the flow control valve from 0.02 kg/sec to 0.006667kg/sec and the flow rate of cold fluid maintained at constant flow rate of 0.006667kg/sec. The results shows that Effectiveness of the double pipe heat exchanger with the normal inner mild steel pipe is less for parallel flow as compared to the counter flow, but when compared with the coated copper pipe the effectiveness of the coated copper pipe shows the better results with increase in effectiveness and also the effectiveness is increasing with the decrease in the flow rate of hot fluid but when compared to the pure copper pipe the effectiveness is almost the nearer value.

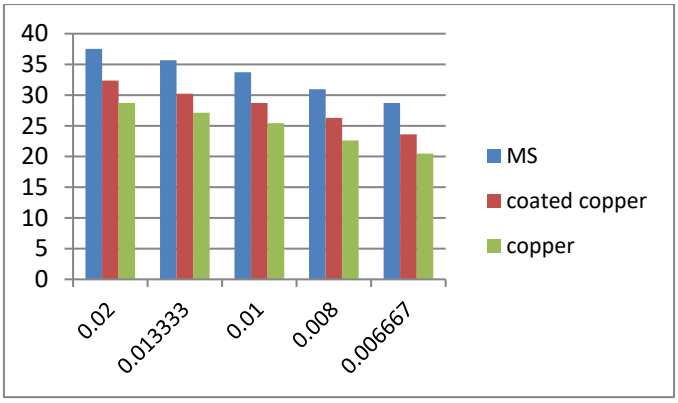



**Figure 6** Variation of LMTD for double pipe heat exchanger for parallel flow arrangement with inner MS, Copper coated and copper pipes.

The figure 6 Shows the variations and Comparison of Logarithmic mean temperature difference (LMTD) for double pipe heat exchanger of parallel flow arrangement with inner MS, Copper coated, and copper pipes. The results obtained are by varying the flow rate hot fluid uniformly in decreasing order by adjusting the flow control valve from 0.02 kg/sec to 0.006667kg/sec and the flow rate of cold fluid maintained at constant flow rate of 0.006667kg/sec.The results shows that Logarithmic mean temperature difference (LMTD) of the double pipe heat exchanger with the normal inner mild steel pipe is more when compared with the coated copper pipe the Logarithmic mean temperature difference (LMTD) of the coated copper pipe and gradually decreases with the decrease in mass flow of hot fluid. Similar results are obtained with the coated copper and pure copper tubes, the Logarithmic mean temperature difference (LMTD) gradually decreases with the decrease in mass flow of hot fluid. The coated copper tube is showing lesser LMTD with MS pipe and more with the pure copper pipe which may not be good indication but the contribution in transferring the heat from hot fluid to cold fluid may slightly affect with Logarithmic mean temperature difference (LMTD).

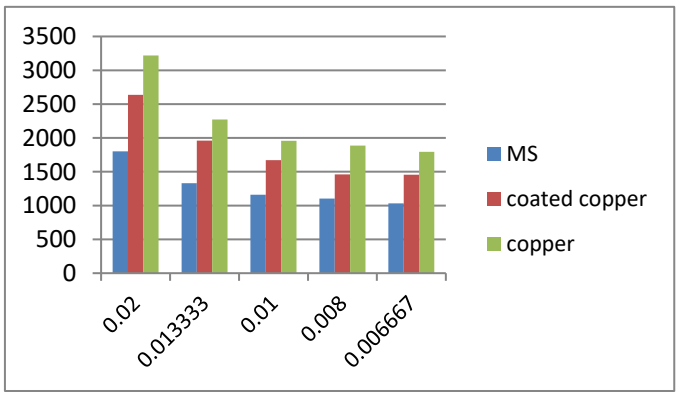



**Figure 7** Variation of Overall Heat Transfer Coefficient for double pipe heat exchanger for parallel flow arrangement with inner MS, Copper coated and copper pipes.

The figure 7 shows the variations and Comparison of Overall Heat Transfer Coefficient for double pipe heat exchanger of parallel flow arrangement with inner MS, Copper coated, and copper pipes. The results obtained are by varying the flow rate hot fluid uniformly in decreasing order by adjusting the flow control valve from 0.02 kg/sec to 0.006667kg/sec and the flow rate of cold fluid maintained at constant flow rate of 0.006667kg/sec.

## 4. CONCLUSIONS

Experiments are conducted on a double pipe heat exchangers for hot water flows inside in three cases viz. MS pipe, copper coated and pure copper pipe and cold water flows in annular space between inner pipe and outer G.I. pipe for Parallel flow. Comparisons are made drawn the following conclusions:

- The results shows that Effectiveness of the double pipe heat exchanger with the coated copper pipe shows the better results with increase in effectiveness and also the effectiveness is increasing with the decrease in the flow rate of hot fluid but when compared to the pure copper pipe the effectiveness is almost the nearer value almost same sometimes.
- From the material point of view the coated copper type of heat exchangers plays a vital role with the less material consumption for the same performance which helps in reducing the material cost required.
- It is found that the surface area exposed to the heat transfer for the coated copper and copper pipes are of same material copper on inner and outer portion of the inner tube hence almost same performance can be observed with coated pipe.

## REFERENCES

[1] 'Process Heat Transfer' by Donald Q Kern.Vol 1, 4th Edition(Pergamon)

[2] R. Surendran, P. Suresh "Insert of passive techniques in double pipe heat exchanger for heat transfer enhancement "International Journal of Mechanical and Production Engineering Research and Development. Vol. 4, Issue 2, Apr 2014, 107- 110.

[3] Webb, R. L., (1994), Principles of enhanced heat transfer. Newyork, Wiley. Xie, G.N., Wang, Q.W. and Zeng, M., (2007),"Heat transfer analysis for shell and tube heat exchangers with experimental data by artificial neural networks approach",Applied Thermo engineering, 27: 1096 – 1104

[4] Saha S. K., Dutta A. and Dhal S. K. "Friction and heat transfer characteristics of laminar swirl flow through a circular tube fitted with regularly spaced twisted-tapeelements", International Journal of Heat and Mass Transfer, Vol.44, No.22, pp.4211- 4223, 2001.

[5] Peddi Dilleswara Rao and B. Nageswara Rao. CFD Simulations and Validation Through Test Data of a Double Pipe Counter Flow Heat Exchanger. International Journal of Mechanical Engineering and Technology, 8(5), 2017, pp 818-831

[6] Kalapala Lokesh, N. Somasankar, Sk. Azharuddin, K. Uma Maheswara Rao, M. Hari Krishna, M. Siva Sankar Mani Kumar, Heat Transfer Enhancement of Double Pipe Heat Exchanger using Twisted Tape Inserts. International Journal of Mechanical Engineering and Technology, 8(5), 2017 , pp. 420-424

# Comparative Study of Doubled Pipe Heat Exchanger and Shelland Tube Heat Exchanger

**Mahadeva Gouda R[1] Gyanappa[2] Riyaz Ahmed[3] Kallayya[4] Lava K R[5]**
[1,2,3,4]UG Student [5]Assistant Professor
[1,2,3,4,5]Department of Mechanical Engineering
[1,2,3,4,5]NCET, Bengaluru, India

*Abstract*— Heat exchanger using Nano fluid is a device in which the heat transfer takes place by using Nano fluid. In this the working fluid is Nano fluid. Nano fluid is made by the suspending Nano particles in the fluid like water, ethylene glycol and oil, hydrocarbons, fluorocarbons etc. Heat transfer is the exchange of thermal energy between physical systems. The rate of heat transfer is dependent on the temperatures of the systems and the properties of the intervening medium through which the heat is transferred. The three fundamental modes of heat transfer are conduction, convection and radiation. Heat transfer, the flow of energy in the form of heat, is a process by which a system changes its internal energy, hence is vital use in applications of the First Law of Thermodynamics. The direction of heat transfer is from a region of high temperature to another region of lower temperature, and is governed by the Second Law of Thermodynamics. Heat transfer changes the internal energy of the systems from which and to which the energy is transferred.

***Nomenclature:***

| | |
|---|---|
| TDC | : top dead centre |
| BTDC | : before top dead centre |
| UBHC | : unburned hydrocarbon |
| NOX | : oxides of nitrogen |
| CO | : carbon monoxide |
| CI | : compression ignition |
| PME | : poly methyl ester |
| CFD | : computational fluid dynamics |
| SF C | : specific fuel consumption |
| CV | : calorific value |
| CR | : compression ratio |
| IP | : injection pressure |
| Bth | : brake thermal efficiency |
| BP | : brake power |

## I. INTRODUCTION

A heat exchanger is a device that allows heat from a fluid (a liquid or a gas) to pass to a second fluid (another liquid or gas) without the two fluids having to mix together or come into direct contact. The most common design has one fluid flowing through metal tubes and the other fluid flowing around the tubes. On either side of the tube, heat is transferred by Convection. Heat is transferred through the tube wall by conduction, woking of heat exchanger as shown in figure 1.1.

Nano fluids are a new class of fluids engineered by dispersing Nanometer-sized materials (Nanoparticles, Nano fibers, Nanotubes, Nanowires, Nano rods, Nano sheet, or droplets) in base fluids. In other words, Nano fluids are Nano scale colloidal Suspensions containing condensed Nano material. They are two-phase systems with one phase (solid phase) in another (liquid Phase). Nano fluids have been found to possess enhanced thermo physical properties such as thermal conductivity, thermal diffusivity, viscosity, and convective heat transfer coefficients compared to those of base fluids like oil or water.

It has demonstrated great potential applications in many fields. For a two-phase system, there are some important issues we have to face. One of the most important issues is the stability of Nano fluids, and it remains a big challenge to achieve desired stability of Nano fluids

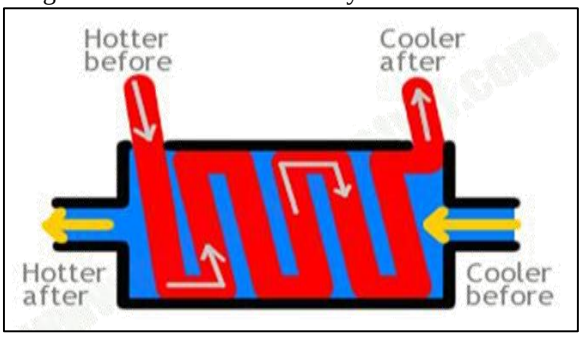



Fig. 1.1: Working of Heat Exchanger

### *A. Classification of Heat Exchangers*

#### *1) Classification of Heat Exchangers by Flow Configuration*

There are four basic flow configurations:

- Counter Flow
- Parallel flow
- Cross flow
- Hybrids such as Cross Counter flow and Multi Pass Flow

a) Counter Flow

As shown in Figure1.2 illustrates an idealized counter flow exchanger in which the two fluids flow parallel to each other but in opposite directions. This type of flow arrangement allows the largest change in temperature of both fluids and is therefore most efficient (where efficiency is the amount of actual heat transferred compared with the theoretical maximum amount of heat that can be transferred).

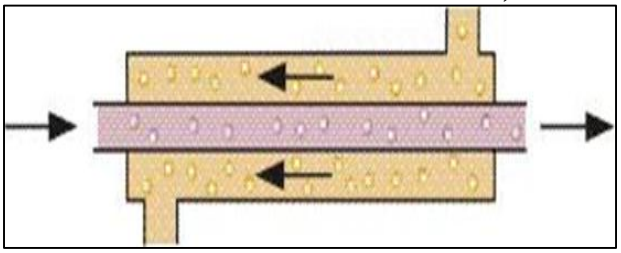


Fig. 1.2: Counter flow

b) Parallel Flow

In parallel flow heat exchangers, the streams flow parallel to each other and in the same direction as shown in Figure 1.3, this is less efficient than countercurrent flow but does provide more uniform wall temperatures.

All rights reserved by www.ijsrd.com 

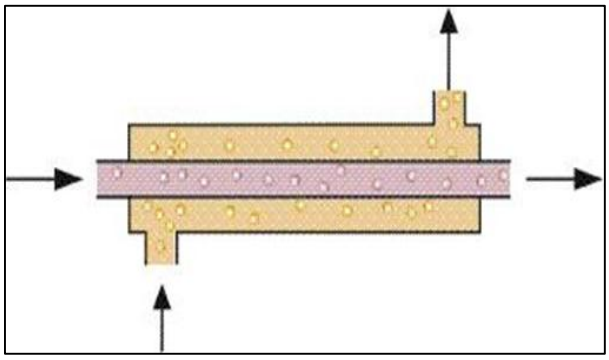


Fig. 1.3: Parallel flow

c) Cross flow

Cross flow heat exchangers are intermediate in efficiency between counter flow and parallel flow exchangers. In these units, the streams flow at right angles to each other as shown in Figure 1.4.

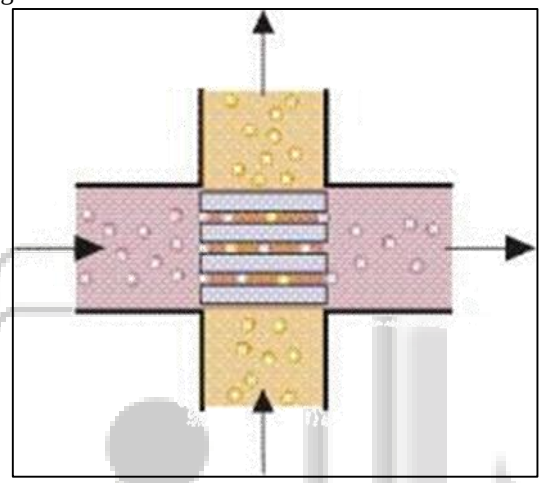


Fig. 1.4: Cross flow

d) Cross/counter flow

In industrial heat exchangers, hybrids of the above flow types are often found. Examples of these are combined cross flow/counter flow heat exchangers and multi pass flow heat exchangers. As shown in figure 1.5.

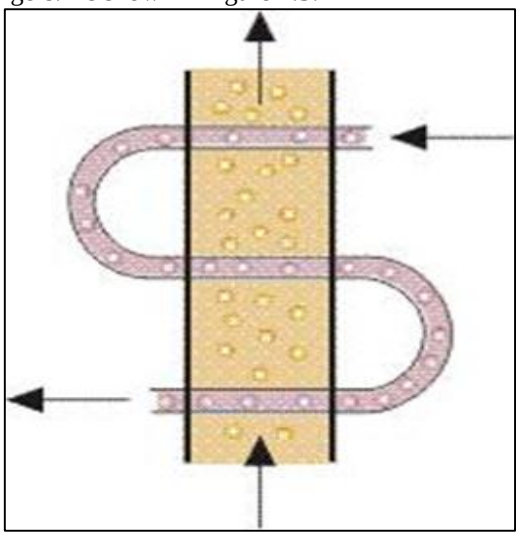


Fig. 1.5: Cross/counter flow

## II. EXPERIMENTAL SET UP

The experiments were conducted on a computerized CI engine test rig shown in Fig.1.

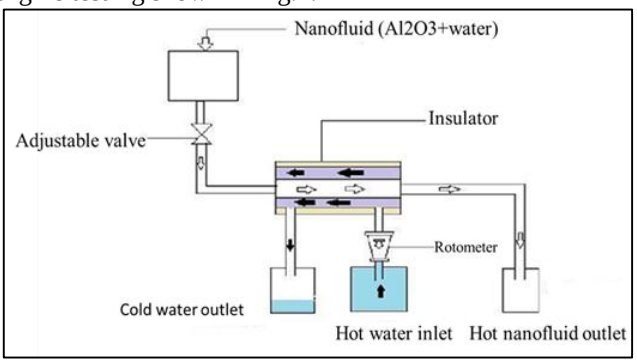



Fig. 1.6: Experimental set up

We selected the materials and required equipment. The calculations of parallel and counter flow heat exchanger are carried out for comparison. The Assemble Copper tube and Cotton Thread Insulation is done

Fig. 1.7: Shell and tube Heat exchanger

| SL NO | SPECIFICTION |
|---|---|
| 01 | Inner Pipe diameter - 12mm |
| 02 | Outer Pipe diameter - 18mm |
| 03 | Inlet temperature – 28’c |
| 04 | Hot water temperature – 70 - 80’c |
| 05 | Length of the device – 609mm |
| 06 | Flow rate – 0.5LPM to 2LPM. |
| 07 | Outer shell diameter – 130mm |

Table 1: Shell and Tube Heat Exchanger Specification

## III. EXPERIMENTAL PROCEDURE

A set of experiments were conducted for Doubled pipe Parallel and counter flow heat exchanger for both Water and Nanofluid, and experiments were conducted for Doubled pipe shell and tube heat exchanger for both Water and Nanofluid. Compare the effectiveness for both the fluids at different temperatures.

## IV. RESULTS & DISCUSSION

The results of the Heat Exchangers presented in Figs. 4-11. All comparisons have been made at different temperature of hot fluid and different flow rates.

All rights reserved by *www.ijsrd.com* 

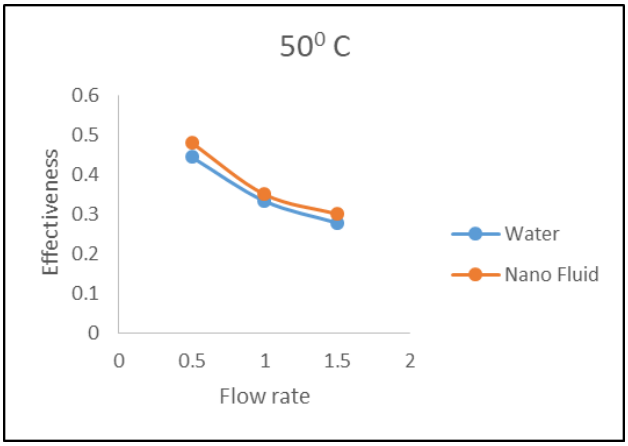



Fig. 1.8: Parallel and Shell and Tube Heat Exchanger at $50^0$ C

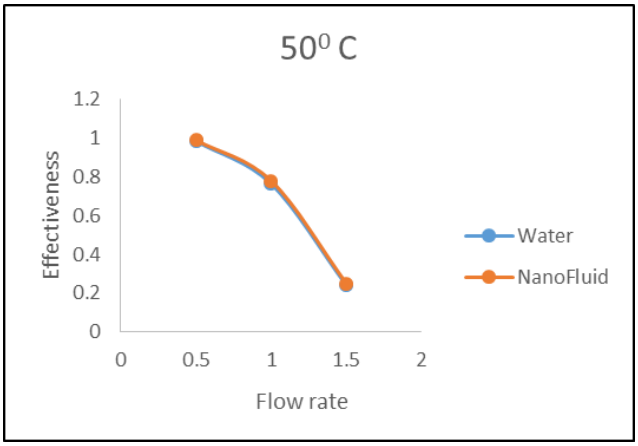



Fig. 1.11: Counter and Shell and Tube Heat Exchanger at $50^0$ C

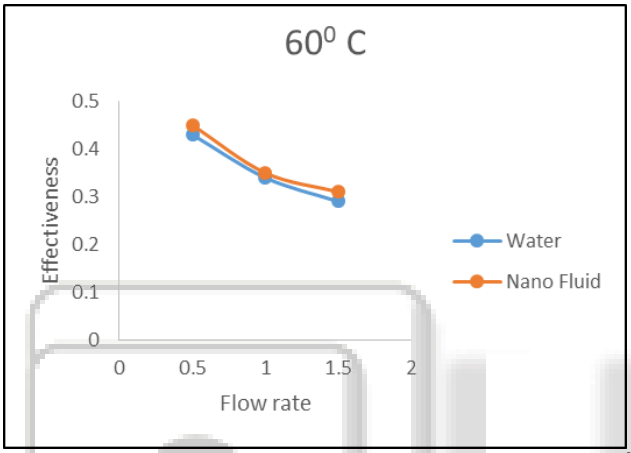



Fig. 1.9: Parallel and Shell and Tube Heat Exchanger at $60^0$ C

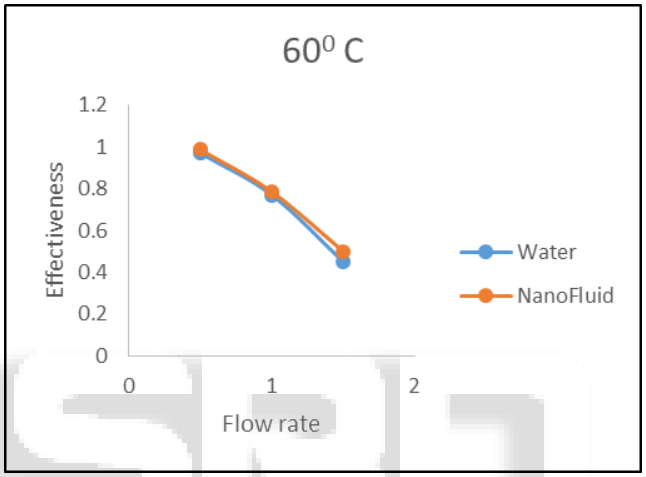



Fig. 1.13: Counter and Shell and Tube Heat Exchanger at $60^0$ C

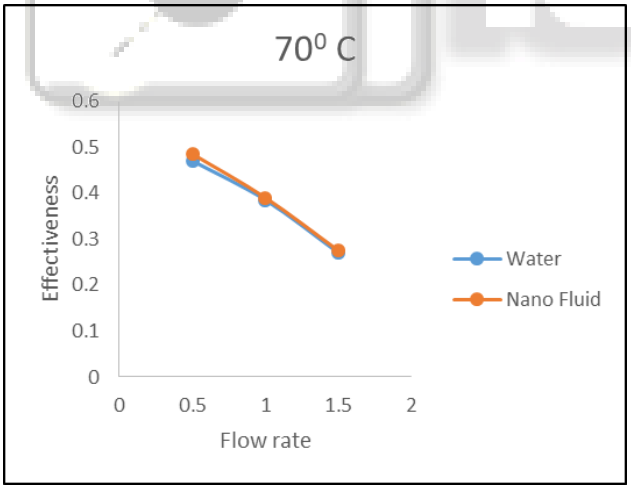



Fig. 1.10: Parallel and Shell and Tube Heat Exchanger at $70^0$ C

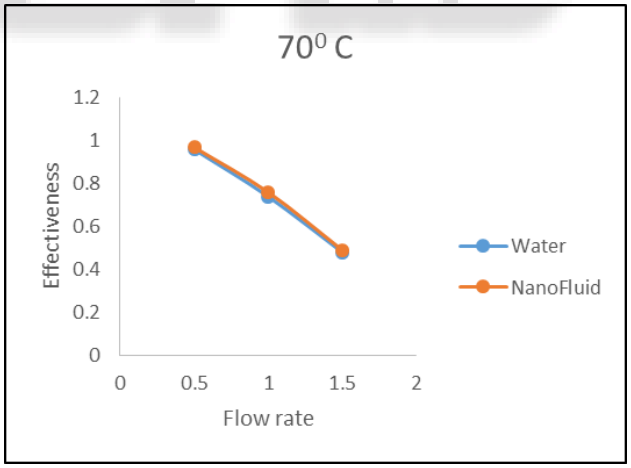



Fig. 1.14: Counter and Shell and Tube Heat Exchanger at $60^0$ C

## V. CONCLUSIONS

Heat exchangers are widely used in industries both for cooling and heating large scale industrial processes. The type and size of heat exchangers used can be tailored to suit a process depending on the type of fluid, its phase, temperature, density, viscosity, pressures, chemical composition and various other thermodynamic properties. Experiments were conducted on various types of heat exchangers to compare

All rights reserved by *www.ijsrd.com* 

their efficiencies, effectiveness and over all heat transfer coefficients

A comparison of the results obtained on the Parallel flow heat exchanger and shell and tube Heat exchanger for different flow rates and temperature of both the fluids are shown in figures from 1.8 to 1.10, it is observed that in all graphs the nanofluid effectiveness is high compared to water. This is due to more amount of heat exchange takes place in nanofluids compare to water.

In figure 1.8 and 1.9 the effectiveness of nanofluid is too high compared to water.

A comparison of the results obtained on the counter flow heat exchanger and shell and tube Heat exchanger for different flow rates and temperature of both the fluids are shown in figures from 1.11 to 1.14, it is observed that in all graphs the nanofluid effectiveness is high compared to water. This is due to more amount of heat exchange takes place in nanofluids compare to water.

## REFERENCES

[1] "Heat Transfer Enhancement of Shell and Tube Heat Exchanger" - International Journal for Research in Applied Science and Engineering Technology, Vol. 2 Issue VIII, August 2014, ISSN: 2321-9653.
[2] "Effectively Design Shell-and-Tube Heat Exchangers" - Rajiv Mukherjee, Engineers India Ltd.
[3] "Standards of the tubular exchanger manufactures Association" - 9th edition.
[4] "Copper Oxide Nanomaterials Prepared by Solution methods, Some Properties, and Potential Applications" - International Scholarly Research Notices, Volume 2014, Article ID 856592.
[5] "Optimization of Shell & Tube Heat Exchanger by Baffle Inclination & Baffle Cut" - International Journal of Innovative Research in Science, Engineering and Technology, Vol.4, Special Issue 12, September 2015.
[6] "CFD Analysis to study the effects of inclined baffles on Fluid Flow in a shell and tube Heat Exchanger" – International Journal of Research in Advent Technology, Vol.2, No.7, July 2014, E-ISSN: 2321-9637.
[7] "Experimental Analysis of Heat Transfer Enhancement in Shell and Helical Tube Heat Exchangers" Author Name- N. Jamshidi, M. Farhadi, D.D. Ganji, K. Sedighi Dept.Mechanical Engineering Univ.Babol University of Technology College Faculty of Mechanical Engineering Babol University of Technology, Shariati street, Babol, Date 9 October 2012.
[8] Bengt Sunden, high temperature heat exchanger, Division of Heat Transfer, Department of Heat and Power Engineering, Lund Institute of Technology, Lund University, P.O. Box 118, SE: - 22100, Lund,Sweden.
[9] Ahmad Fakheri, "Heat Exchanger Efficiency", J. Heat Transfer 129(9), 1268-1276 (Nov16, 2006), asme.org.
[10] Prof. S. Y. Sawant, Mr. Sagar E. More "Experimental analysis of advanced materials for Anticorrosive Heat Exchanger".
[11] Prabhat Gupta, M.D. Atrey, "Performance evaluation of counter flow heat exchangers considering the effect of heat in leak and longitudinal conduction for low-temperature applications.

All rights reserved by *www.ijsrd.com* 

# MECHANICAL AND TRIBOLOGICAL PROPERTIES OF AA-7075 AND GRAPHENE REINFORCED METAL MATRIX COMPOSITES

**[1]Darshan M, [2]Reddappa H.N, [3]A Chandrashekar, [4]Vinod Kumar R**

Department of Mechanical Engineering
Bangalore Institute of Technology
Bengaluru- 560004, Karnataka, India

***Abstract*: In this paper, the work report deals with the Investigations made on microstructure and Mechanical behaviour and Tribological properties of 4 different weight percentage of Aluminium alloy (7000 series) with Graphene nano powder composites. Aluminium matrix composite having Nano graphene is fabricated by liquid stir casting method. The microstructure of the composites was examined by Scanning Electron Microscopy and EDS. Further, mechanical behaviour of composites was studied. Tensile properties like hardness, ultimate tensile strength; yield strength and wear were evaluated as per ASTM standards. Microstructure observation revealed uniform distribution of reinforcement particles in the matrix and particulates were confirmed by EDS and SEM. The analysis gives the result that the ultimate tensile strength, yield strength and the hardness of composites increases with increases the percentage of graphene and the wear test results reveals that as the percentage of graphene increases wear rate decreases**

***Keywords*: Aluminium alloy, Nano Graphene, Ultimate Tensile Strength, Yield Strength, Hardness, Stir casting, wear rate.**

## Introduction

Metal Matrix Composites MMC's give numerous additional advantages to the designers, because of their structural rigidity, strength and dimensional strength. They are outstanding at mechanical properties and tribological characteristics. MMC's are made of a metallic matrix, ceramic matrix or metallic phase .Ceramic reinforced might be Al2o3, Sic and boron carbide. Though Metallic Reinforcements are tungsten, beryllium etc... MMC's are utilized for Space Shuttle, Airlines, Bikes, and Vehicles etc... MMC's are suitable and reasonable for cutting edge basic, and wear applications. Comparing with unreinforced aluminum composites MMCs show huge change in Physical properties & Mechanical properties the metal matrix development is robust and tough. The initial MMC's are light metal matrix composites and the common materials used are the Aluminum, Magnesium, Titanium and their alloys. Aluminum oxide, boron carbide and commonly used fibers and reinforcement. At the point when the metals are strengthened with reinforcement the Physical and Mechanical properties will enhance for example, strength, thickness, solidness, wear and hardness, and electrical properties.

## Literature Reviews

B.Saijagadesh [1] This work reveals the synthesis of Al-graphene MMC's and here 0.25%,0.5%,0.75%,1% of graphene are added to the Aluminum 2024 to form the matrix. The matrix has high quality compared to other matrix. In this the author preferred to study tensile, impact flexural and hardness test so that he concluded that the hardness is shown maximum by pure aluminium and the minimum hardness is by 0.5% graphene sample. The pure Al-2024 shows the maximum flexural stress of 52.9847mpa and also high tensile strength is shown by 0.75%.

Pulkit Garg, Pallav Gupta [2], this work reveals, effect of sintering temperature and mechanical characteristics of Al-graphene MMC's has investigated. Adding graphene as reinforcement in aluminum increases the strength of Al-matrix. Strength of composite increases with increase the wt% of graphene. This paper shows the effect of sintering temperature on density, phase, microstructure, hardness and compressive strength of graphene reinforced aluminum matrix composites containing 0.1%, 0.3% and 0.5% of graphene respectively. This is used to find XRD, SEM and Compression strength.

Muhammad Rashed, Aitao Tanga, [3]. They study the microstructure and mechanical properties before and after extrusion. The experiment reveals that Al-0.25% graphene composites shows the excellent mechanical properties compare to pure Al, 0.5% and 0.1% before extrusion the 0.25%composite shows 14% improvement in ultimate strength. The extruded matrixes showed different trends. The ultimate strength of composites of 0.25%, 0.5% graphene has lower than the monolithic matrix. So that the superior mechanical properties (failure strain) of Al-0.25% graphene attributed to 2-D type and also the corrosion rate increase as graphene % increases

Jinghang Liu, Umar Khaan, Jonatan Colman, [4]. The work deals with the study of preparation of reduced graphene oxide and graphene nano sheets reinforcement with Al-metal matrix. Here the powder synthesis are made to prepare the sample by 1 hour stirring time to get sufficient for completely clearly dispersion for 0.7%,0.15%, 0.3% Gr-Al dispersion in acetone. Here the microstructure and mechanical properties were studied.

S. Ventatesan and M. Antony Xavier [5]. This work involves the preparation of aluminium –graphene MMC's by deals with the mechanical behavior of AMMC with different wt% of 0.33%, 0.55%, and 0.77% by stir casting method. They concluded that as graphene percentage increases, tensile strength decreases except 0.33% and also the hardness of 0.77% leads to decreases compare to base metal. The SEM analysis reveals the 0.33% of graphene shows homogeneous dispersion.

D.Hari Madhava Swamy, Manjunatha L.H [6]. "Fabrication and analysis of aluminium –Graphene MMC's using powder metallurgical technique". The work deals the Al-Gr MMC's are synthesis by varying percentage of 0.1%, 3.8%. The experimental result gives that the wear of aluminium is strongly depends on the graphene composites and decreases with increases graphene percentage. The SEM analysis shows the good distribution of both Al-graphene components.

**Experimental Work**

**Materials:-**

**Aluminium 7075**

Aluminium 7075 is an aluminium alloy, with zinc as the primary alloying element. It is a strong material by strength comparable to many steels, and has good fatigue strength and average machinability. It has lower resistance to corrosion than other aluminium alloys, but has significantly better corrosion resistance than the 2000 alloys. It is relatively high cost material.

| **Element** | Aluminium | Silicon | Iron | Zinc | Copper | Manganese | Magnesium | Titanium | Others |
|---|---|---|---|---|---|---|---|---|---|
| **%by wt** | 87.1-91.4 | Max 0.40 | Max 0.50 | 5.1-6.1 | 0.18-0.28 | Max 0.30 | 2.1-2.9 | Max0.20 | Max 0.15 |

**Table 1:-Composition of Al-7075 Alloy**

**Graphene**

Graphene is an allotrope of carbon that exists as a two-dimensional planar sheet.
One way to think of graphene is as a single atomic graphite layer.
Graphene is technically a non-metal but is often referred to as a quasi-metal due to its properties being like that of a semi-conducting metal.

**Preparation of Composites**

The process of stir casting starts with placing empty crucible in the furnace. The heater temperature is then gradually increased up to 800°C. Aluminium alloy is cleaned to remove dust particles, weighed and charged in the crucible for melting. Required quantities of reinforcement powder are weighed on the weighing machine. Reinforcements are heated for 4 minutes at a temperature of 500°C. After five minutes the scum powder is added which forms a scum layer of impurity on liquid surface which to be removed. Heater temperature is then gradually increased to 800°C. At this heater temperature stirring is started and continued for five minutes. Stirring rpm is 300 RPM with the help of speed controller. Preheated reinforcements are added during five minutes of stirring. Reinforcements are poured manually with the help of conical hopper. The flow rate of reinforcements measured is 0.5 gram per second. Stirrer rpm is then gradually lowered to the zero. Then molten composite slurry is poured in the metallic mould without giving time for reinforcement to settle down at crucible bottom. Mould is preheated at 500°C temperature for ten minutes before pouring the molten slurry in the mould. This is necessary to maintain slurry in molten condition throughout the pouring. While pouring the slurry in mould the flow of the slurry is kept uniform to avoid trapping of gas, also distance between crucible and mould plays a vital role in quality of casting.

**Testing of Composites**

The microstructure study was carried out on the prepared composites using Vegas Tescan made scanning electron microscope. The test sample is 10 -12 mm in diameter cut from the castings and polished thoroughly, for etching the sample Keller's reagent was used.

The brinell test is the method to measure the specimen on a microscopic scale. The test is conducted by differencing the test force and ball size we can test the different metals. By applying a load of 250 kg and dwell time of 30 seconds the experiment is made. The indentation depth values recorded and experimental hardness was determined. The indentation test was repeated for 3 times for each composite and the average value is considered.

Tensile and Compressive specimens were machined. The tensile specimens of circular cross section with a diameter of 9 mm and gauge length of 45mm were prepared according to the ASTM E8 standard testing procedure by Universal Testing Machine

**Figure 1:- Hardness Test Specimen**

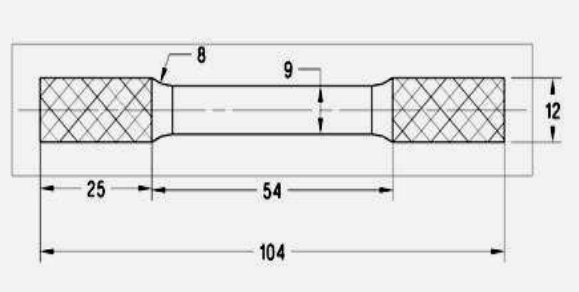



**Figure 2:- Tensile Test Specimen**

## Results and Discussion

### Microstructure Study

Microstructure study is analysed on prepared composite with SEM. The test specimens of 8mm in diameter are cut from the prepared castings and it is polished and then finally it is etched with Keller's reagent in order to get good results. The specimens were visualized at different magnifications to show the presence of reinforcement. The microstructures of all the samples of 0.25%, 0.5%, 0.75% and 1%graphene are made.

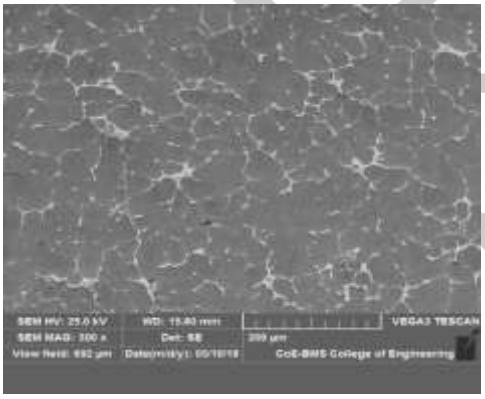


**Figure 3a:- Al+0.25% graphene**

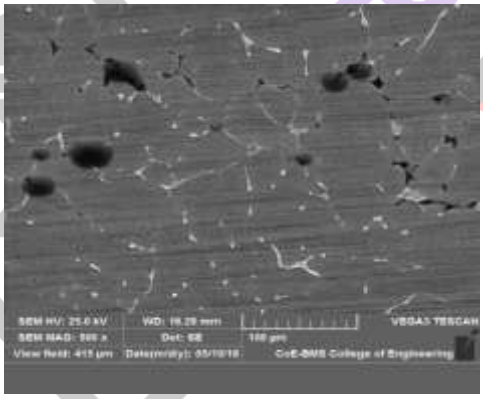


**Figure 3b:- Al+0.5% graphene**

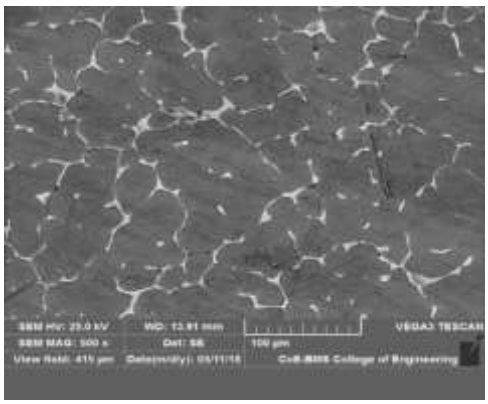


**Figure 3c:- Al+0.75% graphene**

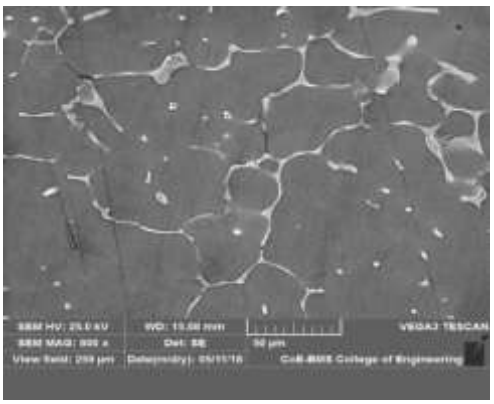


**Figure 3d:- Al+1% graphene**

Figure3.a) shows the clear picture of aluminium 7075 reinforced with 0.25% of graphene using stir casting process. The typical microstructure of aluminium 7075 shows the primary aluminium matrix in white phase and the graphene distribution in the dark gray colour and there is no voids or dislocation and porosity found from the specimen. The image reveals there is a uniform distribution of graphene in aluminium alloy.

Figure3.b) This SEM study reveals that the improper distribution of aluminium 7075 and graphene MMC's. The common casting defect like blowholes, porosity, voids are present in the composites so it will affect the mechanical properties of the composites.

Figure3.c) This picture shows that there is an excellent bonding and the good interfacial bonding between the aluminium 7075 and graphene MMC's so that it improves the tensile strength and hardness of the materials. Here the aluminium matrix is in white phase and there is no porosity or voids.

Figure3.d) the microstructure analysis shows a uniformly distribution of aluminium – graphene composites. The common defects like porosity, voids are not seen here and the graphene are in small grain size so that properties of graphene increases

**EDS EVALUATION**

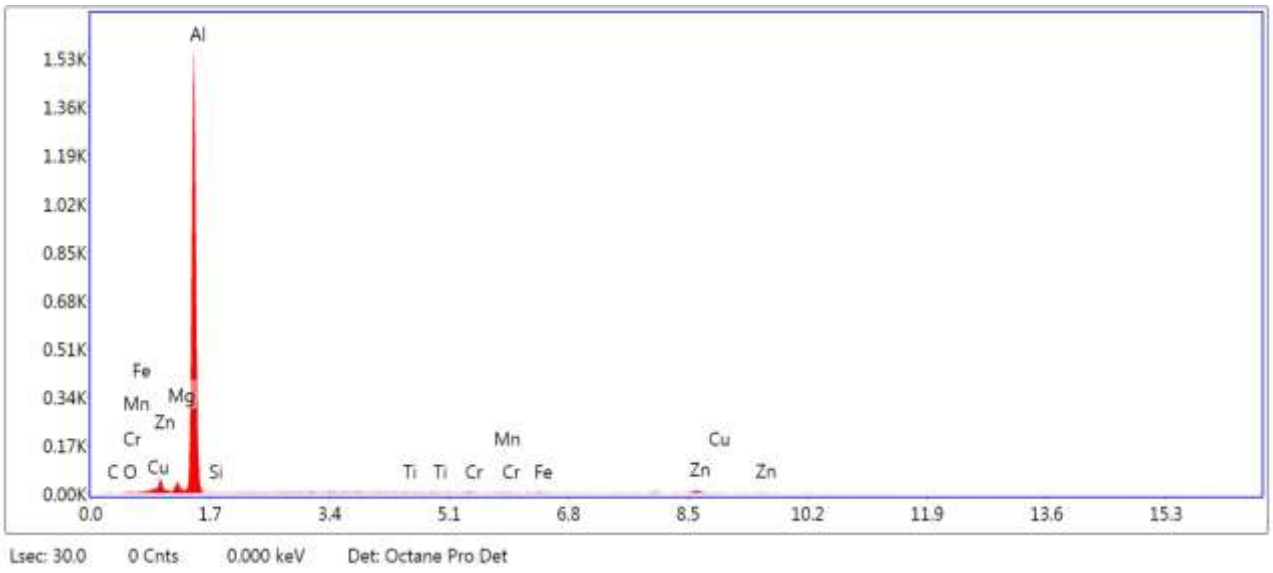



**Fig 4a:-EDS of Aluminium Alloy**

The above graph represents the aluminium alloy composites. In the figure we are able to see the maximum percentage of aluminium along with some percentage of zinc so that it confirms that the material taken for this present work is aluminium alloy 7000 series

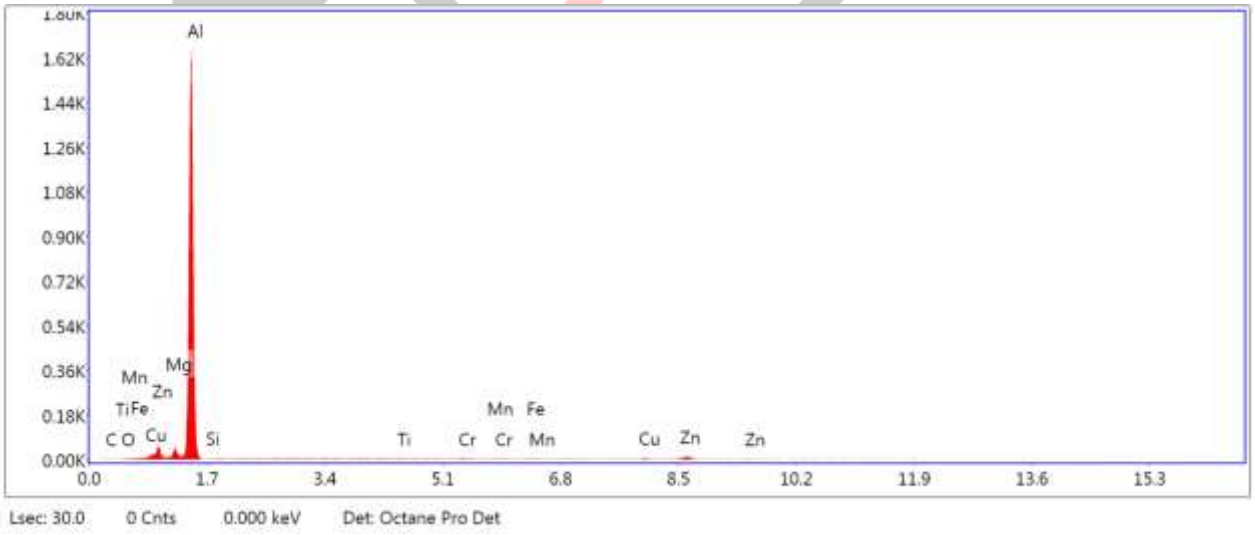



**Fig 4b:- EDS of Al-Graphene**

In the above graph, the figure there is a presence of carbon and zinc with minute percentage of mn, mg and cr which indicates that graphene is present in the form of carbon and it confirms that the reinforcement added is present in the aluminium alloy

**Ultimate Tensile Test**

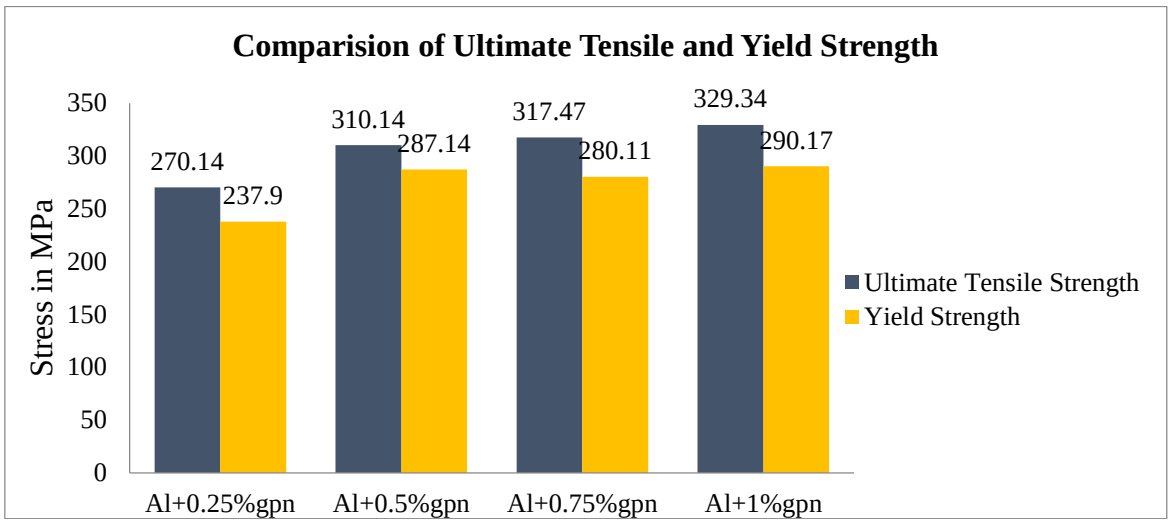



**Figure 5:- Tensile Test Result**

The variation of ultimate tensile strength with varying wt.% of graphene is shown in chart . The ultimate tensile strength and yield strength were increased with increasing graphene content. The graphene particles in the matrix alloy provide protection to the softer matrix this interaction between the dislocations and graphene results in an improved strength

**Hardness test**

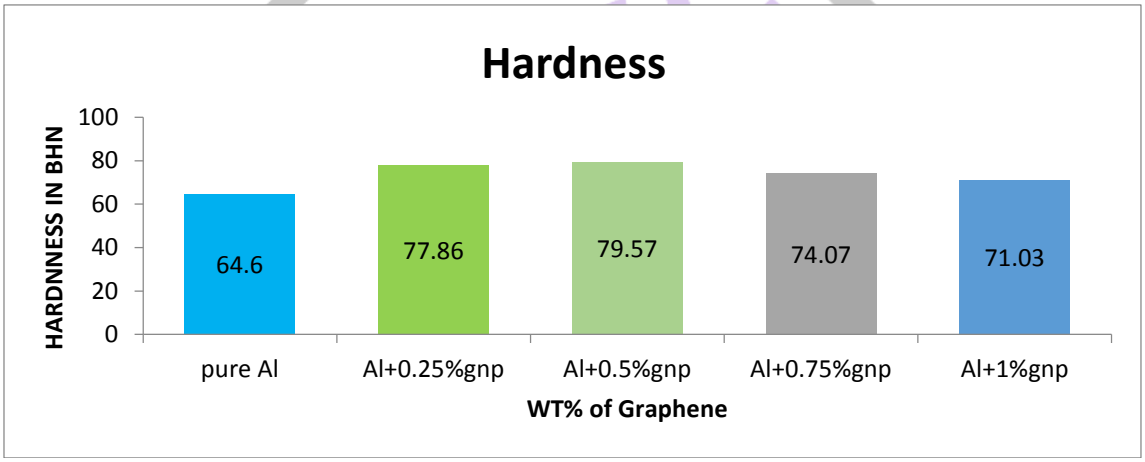



**Figure 6:- Hardness Test Result**

From the results as the graphene percentage increases the hardness is increases up to 0.5% and then hardness is decreases for 0.75% and 1% this shows the ductility property I.e., as the graphene percentage increases the material become more ductile, hence hardness decreases.

**Wear Test:-**

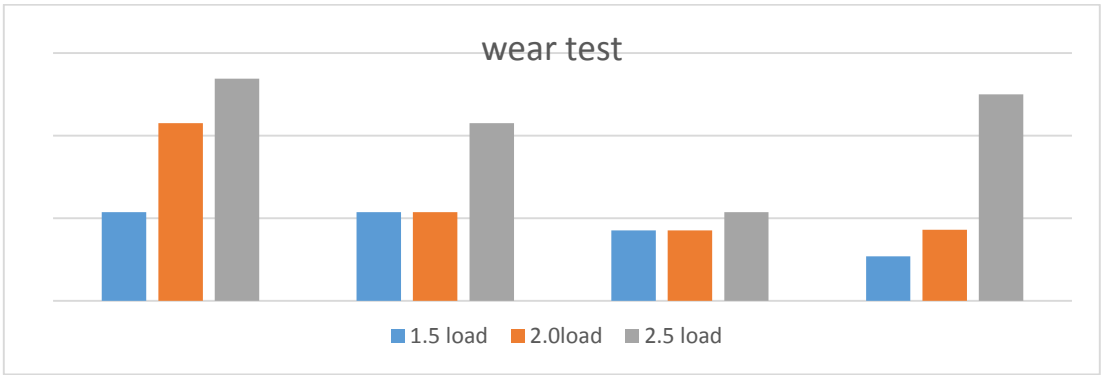



**Figure 7:- Wear Test Result**

The wear test result shows that as the percentage of graphene increases the wear resistance also increases. But in 1% of graphene the wear rate is change

**Conclusions**

The mechanical properties and tribological characteristics investigations of the aluminium alloy with graphene reinforcement materials produced by stir casting are remarked as below:

- The liquid metallurgy technique was successfully adopted in the preparation of aluminium alloy reinforced with graphene.
- The microstructure studies revealed that the uniform distribution of reinforcement (graphene) is observed and in some specimen voids and porosity is present because of improper casting
- The ultimate tensile strength and yield strength and wear resistance of the composites is increases as the wt.% of graphene increases.
- Improvement in the hardness of the aluminium metal matrix composites due to increases in graphene percentage in the composites.

**References**

[1] S Venkatesan and M. Anthony Xaviour *" mechanical behaviour of aluminium metal matrix composites reinforced with graphene particulates by stir casting method"* journal of chemical and pharmaceutical science

[2] Lee C, Wei X.D, Kysar, *"measurements of elastic properties and intrinsic properties of monolayer graphene",* science.321, 2008,385-388

[3] Pai B C, Rohatgi P K. *"production of cast aluminium graphite composites using pellet method"*, journal of material science, 13, 1979, 329-335

[4] Istif, M T Tuncel, A.S Dalkili*c "pin on disk test for aluminium graphene metal matrix composites"*

[5] Xin Gao, Hongyan Yue, Erjun Guo, Hong Zhang, Xuan Yulin, " preparation and tensile properties of homogeneous dispersed graphene reinforced aluminium matrix composites "Elsevier journal paper.

[6] D.Hari Mahadev Swamy, Dr. Manjunath L H, *"Development and characterization of aluminium graphene metal matrix composites using powder metallurgy route"* IISN.

[7] Yang-Ha-Jeong, Huynh Ngoc Tien *"Material properties of graphene/ aluminium metal matrix composites fabricated by friction stir processing"* www. Researchgate.net/ article in international journal of precision engineering and manufacturing

[8] Muhammad rashad , Fusheng Pan,Zhengwen Yu, Muhammad Asif, Han Lin , Rongjian Pan. *"Investigation on microstructure, mechanical and electrochemical properties of aluminium composites reinforced with graphene nanoplates"* www.sciencedirect.com.

[9] Morrish Kumar, Manjunatha L.H. *"Fabrication and analysis of aluminium –graphene metal matrix composites using powder metallurgy technique"*.

[10] Meysam Tabandeh Khorshid, Emad Omrani,Pradeep L,Menezes,Pradeep K.Rohat. *"Tribological performance of self-lubricating aluminium matrix nanocomposites: role of graphene nanoplates".* Elesvier journal paper.

[11] B Sai Jagadish *"Synthesis and charecterization of aluminium 2024 and graphene metal matrix composites by powder metallurgy".*SSRG international journal of mechanical engineering.

[12] Victor Volkov, Svetlana Eliseeva, Alexxander Pimenov, Alex *Shvarev "Electrochemical properties of aluminium – graphene composites anodes*". International journal of electrochemical science, www.electrochemsci.org

[13] X M Du, R Q Chen, F G *Liu "Investigation of graphene nanosheets reinforced aluminium matrix composites".*

[14]Lin C B, Chang RJ, Weng WP, A study on process and tribological behaviour of Al-Graphene composites,wear.217,1998,167-74

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

# Influence of Personal Factors on the Knowledge Sharing Attitude of Individuals in Engineering Education Context

**Yogeesha H. C[1], S.G. Gopala Krishna[2]**

[1]Associate Professor – Mechanical Engineering Department, Nagarjuna College of Engineering& Technology, Bengaluru

[2]Principal, Nagarjuna College of Engineering& Technology, Bengaluru

**Abstract:** ***This study intends to understand the influence of individual components of the personal factors on the attitude concerning the knowledge sharing intention or behaviour in the context Engineering Education in Karnataka State, India. The personal factors considered for the study are: age, gender and experiencein the field of engineering education. The data for the said study was collected from the online survey. From thestudy, it isobservedthat only two factors, i.e. the age and experience werefound to be statistically significant in influencing an individual's attitude towards knowledge sharing. It proposes that there is no deterministic individual factors that inhibit the knowledge sharing attitudes based on gender.***

**Keywords:** Knowledge Sharing, Knowledge Management, Technical Education

## 1. Introduction

Knowledge can be considered as a fluid mix of expert insight, framed experiences, circumstantial information, values and grounded intuition that provides a framework for evaluating and incorporating new experience and information [1]. Knowledge is the understanding of a specialized area of concern that has been assimilated over the years of experience [2].

Knowledge has turned into the most essential consideration in all most all organisations. An emphasis on knowledge as a strategic advantage is vital because improving the management of this asset can enhance the efficiency and effectiveness of the organization and help in meeting the future challenges. Globalisation, information technology, communications systems and the exponential growth of knowledge all contribute to an increasingly complex environment in which information is abundant and volatile. Numerous experts contend that an organization‟s capability to perform well in the information age depends on its capacity to utilize knowledge effectively. In many private sector organizations, knowledge has become a critical source of comparative advantage as companies increasingly draw on factors such as employee‟s know-how and innovative capacity to remain competitive[3].To be more productive and competitive within a given field of specialization, employees need to access the necessary knowledge in more efficient ways than others do [4]. Survival in this aggressive and competitive world is subjected to the best possible response provided by the organizations to the huge number of challenges. Managing knowledge implies adding and creating value of knowledge by leveraging the know-how, intuition, judgement and experience within and outside the organization.

Organisations are attempting to find new and systematic ways to recognize and convert individual expertise, insights, experiences and skills into organisational knowledge. The strategic management of knowledge resources is viewed as one of the important factors for sustainable competitive advantage.

## 2. Knowledge Management and Knowledge Sharing

Knowledge management can be seen as turning data (raw material) into information (finished goods) and from there into knowledge (actionable finished goods)[5]. The implication of this conversion of data into knowledge and management of the knowledge gives an individual the power to make the right decisions that are value producing to the company. The main goal of Knowledge Management is to build and effective usage of the intellectual capital. Suitable measures can be implemented by the organizations to leverage the organisational knowledge for creating business value and sustainable competitive advantage.[6]. Knowledge Management is a systematic method for maximizing the creation, sharing, and effective use of knowledge to support organizational learning, competitiveness and ultimately the performance of the organization.

Knowledge can be leveraged only when people value the building of knowledge on each other‟s ideas and sharing their own insights. Knowledge sharing is considered as the most essential part for knowledge management as it positively affects creativity, team performance, working environment, cohesion, knowledge integration and effective decision making [7][6].Knowledge sharing is the process where individuals mutually exchange their knowledge and jointly create new knowledge. Knowledge sharing can also be defined as the action of the individuals in making knowledge available to others in an organizational context [8]. Barton and Srivatsava [9] viewed knowledge sharing as sharing organizationally relevant and important information, ideas, experience, suggestions and expertise with one another.


Licensed Under Creative Commons Attribution CC BY

By sharing knowledge, individuals contribute to the creation of the knowledge base, innovativeness and ultimately competitive advantage of their organization [10]. In a survey of 260 CEOs and directors in European multinational organisations conducted by the Financial Times in 1999, 94% of respondents answered that people should share what they know with others[6]. However, knowledge sharing is often argued as an unusualand unnatural act[1]. Individuals will not share their knowledge as they think that knowledge is their power and is important and valuable to them. The biggest hurdle in managing knowledge is changing the behaviour of the individuals towards knowledge sharing and contributing to the knowledge base of the organization [11].

Sharing knowledge is not a natural process. Many a times, individuals question the reason for sharing the knowledge as they feel that knowledge is a valuable resource, and sharing it may put their jobs at risk if others use their knowledge. An individual‟s knowledge in the organization is the primary source of power, giving up or sharing that knowledge diminishes the value or uniqueness of the individual [12]. As a consequence of this, the individuals may fear a loss of superiority and ownership of the unique knowledge after sharing it. Therefore, individuals try to hoard knowledge rather than to share[1][13]. Employees accomplish the assigned work by keeping their knowledge to themselves for their own benefit, rather than sharing it with others. As per the old school of thinking, where profitability was reflected by organization‟s output, knowledge hoarding was believed to be benefitting the career advancement of the individuals. Brown and Woodland stated that individuals use knowledge both for defence and control[14]. When individuals perceive the knowledge they possess as a valuable commodity, KS becomes a process mediated by decisions about what knowledge to share, when to share, and who to share it with [15].

Knowledge management requires a shift in the behaviour of individuals where knowledge sharing, collaboration and team working are valued as well with individual achievement. The vital component to the implementation of knowledge management is the shift in the belief that knowledge sharing is power.

Knowledge is mainly derived from past experience, which leads to sound judgement and wisdom[1]. Wisdom is the knowledge that is used in making future decisions. Being able to transfer knowledge implies that experiential knowledge also gets transferred to the recipient. The benefit of experience lies in the fact that it provides a historical perspective that helps people better understand present situations. Experienced people are usually valued in a company (and are often paid more) because they possess this historical perspective from which they can view current situations – something that a typical newcomer will almost never have.

Organisations need to examine the individual‟s attitudes and habits concerning knowledge sharing. They need to monitor with whom the employees collaborate, how they get the information they need, whether and when they document their own knowledge and how they store and distribute knowledge. Hence, the aim of this research is to develop an understanding of the personal factors influencing an individual‟s attitude towards knowledge sharing behaviour in the context of technical education.

## 3. Personal Factors Influencing Knowledge Sharing

Attitude is the way an individual think or feel about something. An attitude can be as a positive or negative evaluation of the other individual, object, event, activity or an idea. It could be just about anything in the environment the individual is working. Attitudes are closely related to values, and are about how people view their world. Attitudes are born out of what we know (cognitive), feel (emotions), and do (behavior) about someone or something. They are shaped by education, environment and by the culture to which people belong. Attitudes often result in and affect the behaviour or action of the people. Attitudes can lead to intended behaviour if there are no external interventions. Values and attitudes shape many of the ways a person behaves. Values reflect a person‟s ethos about their work and their interaction with the people connected. They rarely change. Attitudes can change where people see that it is necessary [16].

The way an individual reacts to and addresses a situation is influenced by many factors such as abilities of an individual, his/her gender, age, perception, and attitude. Abilities of an individual consists of intellectual, physical and self awareness abilities. The psychological, physical and self assurance characteristics owned by an individual defines the behaviour of the persons in personal and social life.

The personal factors which influence the individual behaviour can be of two types, viz. biographical characteristics such as age, gender, religion, marital status, experience, intelligence, personality, perception, attitude, values, etc. and environmental factors such as employment level, salary/wage, available technology, physical facilities at the workplace, organizational structure, leadership and reward system.

It is suggested that the easiest way to approach the subject of knowledge management is for individuals to make themselves aware of how they deal with their own knowledge and emphasise that an atmosphere of trust is essential for the sharing of knowledge [17].

## 4. Theoretical Framework

To build a theoretical model which decides personal influences affecting knowledge sharing attitudes, it is proposed to use the Theory of Reasoned Action (TRA). The useful aspect of the Theory of Reasoned Action is that it assumes all other factors influence behaviour only indirectly, by influencing attitude [6]. Because it has this explanatory power, the Theory of Reasoned Action can be a useful model for explaining knowledge sharing behaviour in organisations.

The Theory of Reasoned Action is a widely accepted model in social psychology, used to explain virtually any human


Licensed Under Creative Commons Attribution CC BY

behaviour. According to this theory, a person‟s performance of a specific behaviour is determined by his or her behavioural intention to perform the behaviour. Next, the intention is jointly determined by the person‟s attitude and subjective norm concerning the behaviour in question. And then, a person‟s attitude toward a behaviour is determined by his or her salient beliefs about the consequences of performing the behaviour, multiplied by the evaluation of those consequences. Finally, an individual‟s subjective norm is determined by a multiplicative function of his or her normative beliefs and motivation to comply [6].

## 5. Research Hypothesis and Methodology

The objective of this research is to explore the personal factors influencing attitudes towards knowledge sharing. The purpose of this study is explanatory. This study hypotheses that “there is a relationship between personal factors and attitude of individual‟s towards knowledge sharing”. Various sub-hypothesis can be stated by substituting the generic “personal factors” with specific factors under consideration, namely: Gender, Age and Experience.

The study will adopt a quantitative online survey-based approach to test the corresponding null-hypotheses. The purpose of this study is explanatory as it seeks to establish whether attitude towards knowledge sharing is determined by such variables as gender, age, education and experience.

The questionnaire administered was developed by Bock and Kim[6][18]. The instrument measures respondents‟ attitude towards knowledge sharing. Attitude towards knowledge sharing was defined as the degree of one‟s positive feelings about sharing one‟s knowledge. Variables were measured on a five point Likert-scale ranging from1 (very rarely) through 5 (very frequently).

### Data Collection

Target population of this study was defined as faculty members working in engineering colleges affiliated to a Technological University in Karnataka state, India. There are about 30,000 faculty members working in various engineering colleges affiliated to a Technological University in Karnataka state. They are teaching both undergraduate and post graduate courses. These faculty members are working in the institution with the minimum qualification of a post graduate degree and can have doctoral degree also.

The sample size for the said study is calculated based on 95% of confidence level and the formula adopted from Yamane[19].

$$n = \frac{N}{1 + N(e^2)}$$

Where n – sample size, N – Population size and e-level of precision.

When the formula is applied to the given study with a population size of approximately 30000 and level of confidence of 0.05, we get the sample size as 395. We have chosen the random purposive sampling technique and considering the percentage of useful responses to be around 60%, we have arrived at the sample size as 628.

Faculty members from different branches and different colleges were selected randomly and the online questionnaires were sent to the selected faculty members to elicit their responses on knowledge sharing intentions.The questionnaire was prepared using Lime survey, a free open source software survey tool on the web. The link to the survey was sent to the selected target population through emails and the responses were collected using the online survey tool. The responses received were screened and useful responses were taken for the study.

## 6. Analysis of the Data

To test the identified hypothesis, the numeric variables „age‟ and „experience‟, captured in years, were converted into categorical variables. This permitted an analysis to be performed, namely using the Pearson chi-square test for the significance of association, which is more relevant to the objectives of the research.

It is found that there is significant correlation between age on the one hand and experience and education on the other. The statistical test performed for testing the stated hypothesis was the Pearson chi-square test. In addition, linear regression and ANOVA was also performed.

**Table 1:** Frequency table for "attitude towards knowledge sharing"

| *Frequency* | *Category* | *Frequency* | *%* |
|---|---|---|---|
| Attitude < 2 | Low | 70 | 11% |
| Attitude >= 2 and Attitude < 3 | Medium | 176 | 28% |
| Attitude >= 3 and Attitude < 4 | Medium – High | 254 | 40% |
| Attitude >= 4 | High | 128 | 20% |

In order to perform chi-square analysis, all continuous variables are converted into categorical data. Although this process may introduce bias, it was found that the results were not particularly sensitive to the exact cut-off values used to group data. Table 1 above shows the 4 classes which were created for the variable attitude. The labels such as low and high are arbitrary and relative to the responses obtained. The use of these labels is purely intended to facilitate the reading of the statistical results and they should not be interpreted strictly.

### Attitude vs Gender

The gender of the respondents was studies and correlatedon attitude towards knowledge sharing.

**Table 2:** Influence of Gender on Attitude towards knowledge sharing

| *Attitude* | *Male* | *Female* | *Row totals* |
|---|---|---|---|
| Low | 46 | 38 | 84 |
| Medium | 92 | 84 | 177 |
| Medium – High | 163 | 90 | 253 |
| High | 65 | 49 | 114 |
| All groups | 367 | 261 | 628 |


Licensed Under Creative Commons Attribution CC BY

The chi-square value was found to be 2.41, which has a significance of 0.41 (df=3), i.e. p-value > 0.05. This implies that there is no association between attitude and gender. The lack of association – or even any suggestion of association – is certainly an interesting finding and demonstrates clearly the danger of holding gender-based prejudices.

**Attitude and Age**

**Table 3:** Age and knowledge sharing attitude

| *Attitude* | *Age: < 30* | *Age: 30-40* | *Age: 40-50* | *Age: >50* | *Row totals* |
|---|---|---|---|---|---|
| Low | 30 | 24 | 14 | 16 | 84 |
| Medium | 33 | 71 | 24 | 49 | 177 |
| Med – High | 43 | 65 | 57 | 87 | 253 |
| High | 30 | 16 | 38 | 30 | 114 |
| All groups | 136 | 177 | 128 | 188 | 628 |

The chi-square value was 15.5, which has a significance of 0.02, i.e. p-value < 0.05. This means that there is a definite correlation between attitude and age. Therefore the null hypothesis of no association between age and an individual‟s attitude towards knowledge sharing must be rejected, and the alternate hypothesis of an association between age and attitude can be accepted.

However, if the influence of age on attitude towards knowledge sharing is tested by means of linear regression analysis, the regression test only indicates a weakly positive ($r^2$= .012) influence on attitude by the respondents‟ age with a p-value of only 0.059 i.e. not statistically significant. An ANOVA analysis reveals that some of the problems may be due to a more dispersed spread of attitudes for this group, with a heavy low-end tail, indicating that there is more probability of very young respondents having a low attitude than the other age categories. Hence, it must be concluded that there is a definite correlation between age and attitude towards knowledge sharing, but this is not of a linear nature.

**Attitude and Experience of the respondents**

**Table 4:** Experience and knowledge sharing attitude

| *Attitude* | *Less than a year* | *1 to 5 years* | *5 to 10 years* | *> 10 years* | *Total* |
|---|---|---|---|---|---|
| Low | 43 | 27 | 11 | 3 | 84 |
| Medium | 106 | 38 | 14 | 19 | 177 |
| Med – High | 114 | 76 | 16 | 46 | 253 |
| High | 63 | 38 | 3 | 11 | 114 |
| All groups | 326 | 179 | 43 | 79 | 628 |

The chi-square value was 12.3, which has a significance of 0.04, i.e. p-value > 0.05. This suggests that there is astatistical basis to assume an association between attitude and experience.

Table 5 below presents a summary of the test results for each of the personal factors which were hypothesised to have a potential influence on attitude towards knowledge sharing. It must be noted that the actual chi-square analysis tests (two-way) association rather than unidirectional influence.

**Table 5:** Summary of findings

| | *Pearson chi-square test statistic* | *P< 5% significance level* | *Association/ influence?* |
|---|---|---|---|
| Gender | 2.41 | 0.41 | No |
| Age | 15.5 | 0.03 | **Yes** |
| Experience | 12.3 | 0.24 | **Yes** |

From the Pearson chi-square test for significance of association, the significant finding were the association between attitude and age as well as attitude and experience in the field of engineering education.

## 7. Conclusion

The research focused on the personal factors gender, age and experience and on how these factors influence an individual‟s attitude towards knowledge sharing.The findings of the report suggest that the attitude towards knowledge sharing is influenced by age as well as experience in the field of engineering education.

The findings of this research must be treated with caution given the limitations of the study. The sample design of randomly selected faculty members from affiliated engineering colleges in Karnataka state may have been biased. The effect of this sampling design on the ability to generalise results to the whole engineering education sector is not clear. Also, the sample was from a large population, which therefore limits the ability to generalise to particular academic sector.

However, the lack of support for the influence on knowledge sharing attitude of personal factors such as experience or gender can be seen as a positive and hopeful indicator. It suggests that there is no deterministic individual barrier against knowledge sharing attitudes based on gender and experience.

Areas for future research could include possible theoretical explanations for why age influences knowledge sharing attitude. Additionally, it would be useful to research the organisational and technological factors that influence knowledge management implementations in an academic context. Finally, the effect of rewards or incentives on knowledge sharing, could be investigated, to determine whether they are a significant factor in academic context.It is hereby felt that a more qualitative research methodology be more appropriate to investigate in more detail what factors affect knowledge sharing attitudes of individuals in academic environment.

## References

[1] T. Davenport and L. Prusak, Working knowledge: how organizations manage what they know., Boston, Massachusetts, USA: Harvard Business School Press, 1998.
[2] E. M. Awad and H. M. Ghaziril, Knowledge Management, New Jersy: Pearson Education, 2004.
[3] T. A. Stewart, The Wealth of Knowledge: Intellectual Capital and the Twenty-first Centrury Organization, Doubleday, 2001.


Licensed Under Creative Commons Attribution CC BY

[4] A. Bourdreau and G. Couillard, "Systems integration and knowledge management," Information Systems Management, vol. 16, no. 4, pp. 24-32, 1999.
[5] J. Kanter, "Knowledge management, practically speaking," Information Systems Management, vol. 16, no. 4, pp. 7-15, 1999.
[6] G. Bock and Y. Kim, "Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing"„" Information Resources Management Journal, vol. 15, no. 2, pp. 14-21, 2002.
[7] P. Schepers and P. T. van den Berg, "Social Factors of Work Environment Creativity," Journal of Business and Psychology, vol. 21, no. 3, pp. 407-428, 2007.
[8] M. lpe, "Knowledge Sharing in Organization: A Conceptual framework," Human Resource Development Review, vol. 2, pp. 337-359, 2003.
[9] K. M. Bartol and A. Srivastava, "Encouraging knowledge sharing : The role of organizational reward systems," Journal of leadership and organizational studies, vol. 9, pp. 64-76, 2002.
[10] S. E. Jackson, C. H. Chuang, E. E. Harden and Y. Jiang, "Toward developing humna resource management systems for knolwedge-intensive team work," Research in personnel and human resource management, vol. 25, pp. 27-70, 2006.
[11] R. Ruggles, "The state of notion: Knowledge management in practice," California Management Review, vol. 40, no. 3, pp. 80-89, 1999.
[12] C. Chow, J. Deng and J.L. Ho, "The openness of knowledge sharing within organizations: A comparison study of the United States and the People"s Republic of China," Journal of Management Accounting Research, vol. 12, no. 1, pp. 65-96, 2000.
[13] A. Tiwana, The knowledge management toolkit: Practical techniques for building a knowledge management system, Upper Saddle River, New York, USA: Prentice-Hall, 2000.
[14] R. Brown and M. Woodland, "Managing knowledge wisely: A case study in organizational behaviour," Journal of Applied Management Studies, vol. 6, no. 2, pp. 175-198, 1999.
[15] K. M. Andrews and B. L. Delahaye, " Influences on knowledge processes in organizational learning: The psychological filter," Journal of Management Studies, vol. 37, no. 6, pp. 2322-2380, 2000.
[16] A. Mayo, The human value of the enterprise: Valuing people as assets: Monitoring, measuring, managing., London, UK.: Nicholas Brealey Publishing, 2001.
[17] G. Probst, S. Raub and K. Romhardt, Managing knowledge: Building blocks for success., West Sussex, UK: John Wiley & Sons, Chichester, 2000.
[18] V. Brink and J.-P. Van Belle, "An Exploration of Personal Factors Influencing Disposition towards Knowledge Sharing in a South African Context," University of Cape Town, 2003.
[19] T. Yamane, Statistics: An Introductory Analysis, 2nd Ed., New York: Harper and Row, 1967.
[20] K. Sveiby, The new organizational wealth: Managing and measuring knowledge-based assets., San Francisco, USA: Berrett-Koehler Publishers, 1997.


Licensed Under Creative Commons Attribution CC BY

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

# Influence of Personal Factors on the Knowledge Sharing Attitude of Individuals in Engineering Education Context

**Yogeesha H. C[1], S.G. Gopala Krishna[2]**

[1]Associate Professor – Mechanical Engineering Department, Nagarjuna College of Engineering& Technology, Bengaluru

[2]Principal, Nagarjuna College of Engineering& Technology, Bengaluru

**Abstract:** ***This study intends to understand the influence of individual components of the personal factors on the attitude concerning the knowledge sharing intention or behaviour in the context Engineering Education in Karnataka State, India. The personal factors considered for the study are: age, gender and experiencein the field of engineering education. The data for the said study was collected from the online survey. From thestudy, it isobservedthat only two factors, i.e. the age and experience werefound to be statistically significant in influencing an individual's attitude towards knowledge sharing. It proposes that there is no deterministic individual factors that inhibit the knowledge sharing attitudes based on gender.***

**Keywords:** Knowledge Sharing, Knowledge Management, Technical Education

## 1. Introduction

Knowledge can be considered as a fluid mix of expert insight, framed experiences, circumstantial information, values and grounded intuition that provides a framework for evaluating and incorporating new experience and information [1]. Knowledge is the understanding of a specialized area of concern that has been assimilated over the years of experience [2].

Knowledge has turned into the most essential consideration in all most all organisations. An emphasis on knowledge as a strategic advantage is vital because improving the management of this asset can enhance the efficiency and effectiveness of the organization and help in meeting the future challenges. Globalisation, information technology, communications systems and the exponential growth of knowledge all contribute to an increasingly complex environment in which information is abundant and volatile. Numerous experts contend that an organization‟s capability to perform well in the information age depends on its capacity to utilize knowledge effectively. In many private sector organizations, knowledge has become a critical source of comparative advantage as companies increasingly draw on factors such as employee‟s know-how and innovative capacity to remain competitive[3].To be more productive and competitive within a given field of specialization, employees need to access the necessary knowledge in more efficient ways than others do [4]. Survival in this aggressive and competitive world is subjected to the best possible response provided by the organizations to the huge number of challenges. Managing knowledge implies adding and creating value of knowledge by leveraging the know-how, intuition, judgement and experience within and outside the organization.

Organisations are attempting to find new and systematic ways to recognize and convert individual expertise, insights, experiences and skills into organisational knowledge. The strategic management of knowledge resources is viewed as one of the important factors for sustainable competitive advantage.

## 2. Knowledge Management and Knowledge Sharing

Knowledge management can be seen as turning data (raw material) into information (finished goods) and from there into knowledge (actionable finished goods)[5]. The implication of this conversion of data into knowledge and management of the knowledge gives an individual the power to make the right decisions that are value producing to the company. The main goal of Knowledge Management is to build and effective usage of the intellectual capital. Suitable measures can be implemented by the organizations to leverage the organisational knowledge for creating business value and sustainable competitive advantage.[6]. Knowledge Management is a systematic method for maximizing the creation, sharing, and effective use of knowledge to support organizational learning, competitiveness and ultimately the performance of the organization.

Knowledge can be leveraged only when people value the building of knowledge on each other‟s ideas and sharing their own insights. Knowledge sharing is considered as the most essential part for knowledge management as it positively affects creativity, team performance, working environment, cohesion, knowledge integration and effective decision making [7][6].Knowledge sharing is the process where individuals mutually exchange their knowledge and jointly create new knowledge. Knowledge sharing can also be defined as the action of the individuals in making knowledge available to others in an organizational context [8]. Barton and Srivatsava [9] viewed knowledge sharing as sharing organizationally relevant and important information, ideas, experience, suggestions and expertise with one another.


Licensed Under Creative Commons Attribution CC BY

By sharing knowledge, individuals contribute to the creation of the knowledge base, innovativeness and ultimately competitive advantage of their organization [10]. In a survey of 260 CEOs and directors in European multinational organisations conducted by the Financial Times in 1999, 94% of respondents answered that people should share what they know with others[6]. However, knowledge sharing is often argued as an unusualand unnatural act[1]. Individuals will not share their knowledge as they think that knowledge is their power and is important and valuable to them. The biggest hurdle in managing knowledge is changing the behaviour of the individuals towards knowledge sharing and contributing to the knowledge base of the organization [11].

Sharing knowledge is not a natural process. Many a times, individuals question the reason for sharing the knowledge as they feel that knowledge is a valuable resource, and sharing it may put their jobs at risk if others use their knowledge. An individual‟s knowledge in the organization is the primary source of power, giving up or sharing that knowledge diminishes the value or uniqueness of the individual [12]. As a consequence of this, the individuals may fear a loss of superiority and ownership of the unique knowledge after sharing it. Therefore, individuals try to hoard knowledge rather than to share[1][13]. Employees accomplish the assigned work by keeping their knowledge to themselves for their own benefit, rather than sharing it with others. As per the old school of thinking, where profitability was reflected by organization‟s output, knowledge hoarding was believed to be benefitting the career advancement of the individuals. Brown and Woodland stated that individuals use knowledge both for defence and control[14]. When individuals perceive the knowledge they possess as a valuable commodity, KS becomes a process mediated by decisions about what knowledge to share, when to share, and who to share it with [15].

Knowledge management requires a shift in the behaviour of individuals where knowledge sharing, collaboration and team working are valued as well with individual achievement. The vital component to the implementation of knowledge management is the shift in the belief that knowledge sharing is power.

Knowledge is mainly derived from past experience, which leads to sound judgement and wisdom[1]. Wisdom is the knowledge that is used in making future decisions. Being able to transfer knowledge implies that experiential knowledge also gets transferred to the recipient. The benefit of experience lies in the fact that it provides a historical perspective that helps people better understand present situations. Experienced people are usually valued in a company (and are often paid more) because they possess this historical perspective from which they can view current situations – something that a typical newcomer will almost never have.

Organisations need to examine the individual‟s attitudes and habits concerning knowledge sharing. They need to monitor with whom the employees collaborate, how they get the information they need, whether and when they document their own knowledge and how they store and distribute knowledge. Hence, the aim of this research is to develop an understanding of the personal factors influencing an individual‟s attitude towards knowledge sharing behaviour in the context of technical education.

## 3. Personal Factors Influencing Knowledge Sharing

Attitude is the way an individual think or feel about something. An attitude can be as a positive or negative evaluation of the other individual, object, event, activity or an idea. It could be just about anything in the environment the individual is working. Attitudes are closely related to values, and are about how people view their world. Attitudes are born out of what we know (cognitive), feel (emotions), and do (behavior) about someone or something. They are shaped by education, environment and by the culture to which people belong. Attitudes often result in and affect the behaviour or action of the people. Attitudes can lead to intended behaviour if there are no external interventions. Values and attitudes shape many of the ways a person behaves. Values reflect a person‟s ethos about their work and their interaction with the people connected. They rarely change. Attitudes can change where people see that it is necessary [16].

The way an individual reacts to and addresses a situation is influenced by many factors such as abilities of an individual, his/her gender, age, perception, and attitude. Abilities of an individual consists of intellectual, physical and self awareness abilities. The psychological, physical and self assurance characteristics owned by an individual defines the behaviour of the persons in personal and social life.

The personal factors which influence the individual behaviour can be of two types, viz. biographical characteristics such as age, gender, religion, marital status, experience, intelligence, personality, perception, attitude, values, etc. and environmental factors such as employment level, salary/wage, available technology, physical facilities at the workplace, organizational structure, leadership and reward system.

It is suggested that the easiest way to approach the subject of knowledge management is for individuals to make themselves aware of how they deal with their own knowledge and emphasise that an atmosphere of trust is essential for the sharing of knowledge [17].

## 4. Theoretical Framework

To build a theoretical model which decides personal influences affecting knowledge sharing attitudes, it is proposed to use the Theory of Reasoned Action (TRA). The useful aspect of the Theory of Reasoned Action is that it assumes all other factors influence behaviour only indirectly, by influencing attitude [6]. Because it has this explanatory power, the Theory of Reasoned Action can be a useful model for explaining knowledge sharing behaviour in organisations.

The Theory of Reasoned Action is a widely accepted model in social psychology, used to explain virtually any human


Licensed Under Creative Commons Attribution CC BY

behaviour. According to this theory, a person‟s performance of a specific behaviour is determined by his or her behavioural intention to perform the behaviour. Next, the intention is jointly determined by the person‟s attitude and subjective norm concerning the behaviour in question. And then, a person‟s attitude toward a behaviour is determined by his or her salient beliefs about the consequences of performing the behaviour, multiplied by the evaluation of those consequences. Finally, an individual‟s subjective norm is determined by a multiplicative function of his or her normative beliefs and motivation to comply [6].

## 5. Research Hypothesis and Methodology

The objective of this research is to explore the personal factors influencing attitudes towards knowledge sharing. The purpose of this study is explanatory. This study hypotheses that “there is a relationship between personal factors and attitude of individual‟s towards knowledge sharing”. Various sub-hypothesis can be stated by substituting the generic “personal factors” with specific factors under consideration, namely: Gender, Age and Experience.

The study will adopt a quantitative online survey-based approach to test the corresponding null-hypotheses. The purpose of this study is explanatory as it seeks to establish whether attitude towards knowledge sharing is determined by such variables as gender, age, education and experience.

The questionnaire administered was developed by Bock and Kim[6][18]. The instrument measures respondents‟ attitude towards knowledge sharing. Attitude towards knowledge sharing was defined as the degree of one‟s positive feelings about sharing one‟s knowledge. Variables were measured on a five point Likert-scale ranging from1 (very rarely) through 5 (very frequently).

### Data Collection

Target population of this study was defined as faculty members working in engineering colleges affiliated to a Technological University in Karnataka state, India. There are about 30,000 faculty members working in various engineering colleges affiliated to a Technological University in Karnataka state. They are teaching both undergraduate and post graduate courses. These faculty members are working in the institution with the minimum qualification of a post graduate degree and can have doctoral degree also.

The sample size for the said study is calculated based on 95% of confidence level and the formula adopted from Yamane[19].

$$n = \frac{N}{1 + N(e^2)}$$

Where n – sample size, N – Population size and e-level of precision.

When the formula is applied to the given study with a population size of approximately 30000 and level of confidence of 0.05, we get the sample size as 395. We have chosen the random purposive sampling technique and considering the percentage of useful responses to be around 60%, we have arrived at the sample size as 628.

Faculty members from different branches and different colleges were selected randomly and the online questionnaires were sent to the selected faculty members to elicit their responses on knowledge sharing intentions.The questionnaire was prepared using Lime survey, a free open source software survey tool on the web. The link to the survey was sent to the selected target population through emails and the responses were collected using the online survey tool. The responses received were screened and useful responses were taken for the study.

## 6. Analysis of the Data

To test the identified hypothesis, the numeric variables „age‟ and „experience‟, captured in years, were converted into categorical variables. This permitted an analysis to be performed, namely using the Pearson chi-square test for the significance of association, which is more relevant to the objectives of the research.

It is found that there is significant correlation between age on the one hand and experience and education on the other. The statistical test performed for testing the stated hypothesis was the Pearson chi-square test. In addition, linear regression and ANOVA was also performed.

**Table 1:** Frequency table for "attitude towards knowledge sharing"

| *Frequency* | *Category* | *Frequency* | *%* |
|---|---|---|---|
| Attitude < 2 | Low | 70 | 11% |
| Attitude >= 2 and Attitude < 3 | Medium | 176 | 28% |
| Attitude >= 3 and Attitude < 4 | Medium – High | 254 | 40% |
| Attitude >= 4 | High | 128 | 20% |

In order to perform chi-square analysis, all continuous variables are converted into categorical data. Although this process may introduce bias, it was found that the results were not particularly sensitive to the exact cut-off values used to group data. Table 1 above shows the 4 classes which were created for the variable attitude. The labels such as low and high are arbitrary and relative to the responses obtained. The use of these labels is purely intended to facilitate the reading of the statistical results and they should not be interpreted strictly.

### Attitude vs Gender

The gender of the respondents was studies and correlatedon attitude towards knowledge sharing.

**Table 2:** Influence of Gender on Attitude towards knowledge sharing

| *Attitude* | *Male* | *Female* | *Row totals* |
|---|---|---|---|
| Low | 46 | 38 | 84 |
| Medium | 92 | 84 | 177 |
| Medium – High | 163 | 90 | 253 |
| High | 65 | 49 | 114 |
| All groups | 367 | 261 | 628 |


Licensed Under Creative Commons Attribution CC BY

The chi-square value was found to be 2.41, which has a significance of 0.41 (df=3), i.e. p-value > 0.05. This implies that there is no association between attitude and gender. The lack of association – or even any suggestion of association – is certainly an interesting finding and demonstrates clearly the danger of holding gender-based prejudices.

**Attitude and Age**

**Table 3:** Age and knowledge sharing attitude

| *Attitude* | *Age: < 30* | *Age: 30-40* | *Age: 40-50* | *Age: >50* | *Row totals* |
|---|---|---|---|---|---|
| Low | 30 | 24 | 14 | 16 | 84 |
| Medium | 33 | 71 | 24 | 49 | 177 |
| Med – High | 43 | 65 | 57 | 87 | 253 |
| High | 30 | 16 | 38 | 30 | 114 |
| All groups | 136 | 177 | 128 | 188 | 628 |

The chi-square value was 15.5, which has a significance of 0.02, i.e. p-value < 0.05. This means that there is a definite correlation between attitude and age. Therefore the null hypothesis of no association between age and an individual‟s attitude towards knowledge sharing must be rejected, and the alternate hypothesis of an association between age and attitude can be accepted.

However, if the influence of age on attitude towards knowledge sharing is tested by means of linear regression analysis, the regression test only indicates a weakly positive ($r^2$= .012) influence on attitude by the respondents‟ age with a p-value of only 0.059 i.e. not statistically significant. An ANOVA analysis reveals that some of the problems may be due to a more dispersed spread of attitudes for this group, with a heavy low-end tail, indicating that there is more probability of very young respondents having a low attitude than the other age categories. Hence, it must be concluded that there is a definite correlation between age and attitude towards knowledge sharing, but this is not of a linear nature.

**Attitude and Experience of the respondents**

**Table 4:** Experience and knowledge sharing attitude

| *Attitude* | *Less than a year* | *1 to 5 years* | *5 to 10 years* | *> 10 years* | *Total* |
|---|---|---|---|---|---|
| Low | 43 | 27 | 11 | 3 | 84 |
| Medium | 106 | 38 | 14 | 19 | 177 |
| Med – High | 114 | 76 | 16 | 46 | 253 |
| High | 63 | 38 | 3 | 11 | 114 |
| All groups | 326 | 179 | 43 | 79 | 628 |

The chi-square value was 12.3, which has a significance of 0.04, i.e. p-value > 0.05. This suggests that there is astatistical basis to assume an association between attitude and experience.

Table 5 below presents a summary of the test results for each of the personal factors which were hypothesised to have a potential influence on attitude towards knowledge sharing. It must be noted that the actual chi-square analysis tests (two-way) association rather than unidirectional influence.

**Table 5:** Summary of findings

| | *Pearson chi-square test statistic* | *P< 5% significance level* | *Association/ influence?* |
|---|---|---|---|
| Gender | 2.41 | 0.41 | No |
| Age | 15.5 | 0.03 | **Yes** |
| Experience | 12.3 | 0.24 | **Yes** |

From the Pearson chi-square test for significance of association, the significant finding were the association between attitude and age as well as attitude and experience in the field of engineering education.

## 7. Conclusion

The research focused on the personal factors gender, age and experience and on how these factors influence an individual‟s attitude towards knowledge sharing.The findings of the report suggest that the attitude towards knowledge sharing is influenced by age as well as experience in the field of engineering education.

The findings of this research must be treated with caution given the limitations of the study. The sample design of randomly selected faculty members from affiliated engineering colleges in Karnataka state may have been biased. The effect of this sampling design on the ability to generalise results to the whole engineering education sector is not clear. Also, the sample was from a large population, which therefore limits the ability to generalise to particular academic sector.

However, the lack of support for the influence on knowledge sharing attitude of personal factors such as experience or gender can be seen as a positive and hopeful indicator. It suggests that there is no deterministic individual barrier against knowledge sharing attitudes based on gender and experience.

Areas for future research could include possible theoretical explanations for why age influences knowledge sharing attitude. Additionally, it would be useful to research the organisational and technological factors that influence knowledge management implementations in an academic context. Finally, the effect of rewards or incentives on knowledge sharing, could be investigated, to determine whether they are a significant factor in academic context.It is hereby felt that a more qualitative research methodology be more appropriate to investigate in more detail what factors affect knowledge sharing attitudes of individuals in academic environment.

## References

[1] T. Davenport and L. Prusak, Working knowledge: how organizations manage what they know., Boston, Massachusetts, USA: Harvard Business School Press, 1998.
[2] E. M. Awad and H. M. Ghaziril, Knowledge Management, New Jersy: Pearson Education, 2004.
[3] T. A. Stewart, The Wealth of Knowledge: Intellectual Capital and the Twenty-first Centrury Organization, Doubleday, 2001.


Licensed Under Creative Commons Attribution CC BY

[4] A. Bourdreau and G. Couillard, "Systems integration and knowledge management," Information Systems Management, vol. 16, no. 4, pp. 24-32, 1999.
[5] J. Kanter, "Knowledge management, practically speaking," Information Systems Management, vol. 16, no. 4, pp. 7-15, 1999.
[6] G. Bock and Y. Kim, "Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing"„" Information Resources Management Journal, vol. 15, no. 2, pp. 14-21, 2002.
[7] P. Schepers and P. T. van den Berg, "Social Factors of Work Environment Creativity," Journal of Business and Psychology, vol. 21, no. 3, pp. 407-428, 2007.
[8] M. lpe, "Knowledge Sharing in Organization: A Conceptual framework," Human Resource Development Review, vol. 2, pp. 337-359, 2003.
[9] K. M. Bartol and A. Srivastava, "Encouraging knowledge sharing : The role of organizational reward systems," Journal of leadership and organizational studies, vol. 9, pp. 64-76, 2002.
[10] S. E. Jackson, C. H. Chuang, E. E. Harden and Y. Jiang, "Toward developing humna resource management systems for knolwedge-intensive team work," Research in personnel and human resource management, vol. 25, pp. 27-70, 2006.
[11] R. Ruggles, "The state of notion: Knowledge management in practice," California Management Review, vol. 40, no. 3, pp. 80-89, 1999.
[12] C. Chow, J. Deng and J.L. Ho, "The openness of knowledge sharing within organizations: A comparison study of the United States and the People"s Republic of China," Journal of Management Accounting Research, vol. 12, no. 1, pp. 65-96, 2000.
[13] A. Tiwana, The knowledge management toolkit: Practical techniques for building a knowledge management system, Upper Saddle River, New York, USA: Prentice-Hall, 2000.
[14] R. Brown and M. Woodland, "Managing knowledge wisely: A case study in organizational behaviour," Journal of Applied Management Studies, vol. 6, no. 2, pp. 175-198, 1999.
[15] K. M. Andrews and B. L. Delahaye, " Influences on knowledge processes in organizational learning: The psychological filter," Journal of Management Studies, vol. 37, no. 6, pp. 2322-2380, 2000.
[16] A. Mayo, The human value of the enterprise: Valuing people as assets: Monitoring, measuring, managing., London, UK.: Nicholas Brealey Publishing, 2001.
[17] G. Probst, S. Raub and K. Romhardt, Managing knowledge: Building blocks for success., West Sussex, UK: John Wiley & Sons, Chichester, 2000.
[18] V. Brink and J.-P. Van Belle, "An Exploration of Personal Factors Influencing Disposition towards Knowledge Sharing in a South African Context," University of Cape Town, 2003.
[19] T. Yamane, Statistics: An Introductory Analysis, 2nd Ed., New York: Harper and Row, 1967.
[20] K. Sveiby, The new organizational wealth: Managing and measuring knowledge-based assets., San Francisco, USA: Berrett-Koehler Publishers, 1997.


Licensed Under Creative Commons Attribution CC BY

# MECHANICAL AND TRIBOLOGICAL PROPERTIES OF AA-7075 AND GRAPHENE REINFORCED METAL MATRIX COMPOSITES

**[1]Darshan M, [2]Reddappa H.N, [3]A Chandrashekar, [4]Vinod Kumar R**

Department of Mechanical Engineering
Bangalore Institute of Technology
Bengaluru- 560004, Karnataka, India

***Abstract*: In this paper, the work report deals with the Investigations made on microstructure and Mechanical behaviour and Tribological properties of 4 different weight percentage of Aluminium alloy (7000 series) with Graphene nano powder composites. Aluminium matrix composite having Nano graphene is fabricated by liquid stir casting method. The microstructure of the composites was examined by Scanning Electron Microscopy and EDS. Further, mechanical behaviour of composites was studied. Tensile properties like hardness, ultimate tensile strength; yield strength and wear were evaluated as per ASTM standards. Microstructure observation revealed uniform distribution of reinforcement particles in the matrix and particulates were confirmed by EDS and SEM. The analysis gives the result that the ultimate tensile strength, yield strength and the hardness of composites increases with increases the percentage of graphene and the wear test results reveals that as the percentage of graphene increases wear rate decreases**

***Keywords*: Aluminium alloy, Nano Graphene, Ultimate Tensile Strength, Yield Strength, Hardness, Stir casting, wear rate.**

## Introduction

Metal Matrix Composites MMC's give numerous additional advantages to the designers, because of their structural rigidity, strength and dimensional strength. They are outstanding at mechanical properties and tribological characteristics. MMC's are made of a metallic matrix, ceramic matrix or metallic phase .Ceramic reinforced might be Al2o3, Sic and boron carbide. Though Metallic Reinforcements are tungsten, beryllium etc... MMC's are utilized for Space Shuttle, Airlines, Bikes, and Vehicles etc... MMC's are suitable and reasonable for cutting edge basic, and wear applications. Comparing with unreinforced aluminum composites MMCs show huge change in Physical properties & Mechanical properties the metal matrix development is robust and tough. The initial MMC's are light metal matrix composites and the common materials used are the Aluminum, Magnesium, Titanium and their alloys. Aluminum oxide, boron carbide and commonly used fibers and reinforcement. At the point when the metals are strengthened with reinforcement the Physical and Mechanical properties will enhance for example, strength, thickness, solidness, wear and hardness, and electrical properties.

## Literature Reviews

B.Saijagadesh [1] This work reveals the synthesis of Al-graphene MMC's and here 0.25%,0.5%,0.75%,1% of graphene are added to the Aluminum 2024 to form the matrix. The matrix has high quality compared to other matrix. In this the author preferred to study tensile, impact flexural and hardness test so that he concluded that the hardness is shown maximum by pure aluminium and the minimum hardness is by 0.5% graphene sample. The pure Al-2024 shows the maximum flexural stress of 52.9847mpa and also high tensile strength is shown by 0.75%.

Pulkit Garg, Pallav Gupta [2], this work reveals, effect of sintering temperature and mechanical characteristics of Al-graphene MMC's has investigated. Adding graphene as reinforcement in aluminum increases the strength of Al-matrix. Strength of composite increases with increase the wt% of graphene. This paper shows the effect of sintering temperature on density, phase, microstructure, hardness and compressive strength of graphene reinforced aluminum matrix composites containing 0.1%, 0.3% and 0.5% of graphene respectively. This is used to find XRD, SEM and Compression strength.

Muhammad Rashed, Aitao Tanga, [3]. They study the microstructure and mechanical properties before and after extrusion. The experiment reveals that Al-0.25% graphene composites shows the excellent mechanical properties compare to pure Al, 0.5% and 0.1% before extrusion the 0.25%composite shows 14% improvement in ultimate strength. The extruded matrixes showed different trends. The ultimate strength of composites of 0.25%, 0.5% graphene has lower than the monolithic matrix. So that the superior mechanical properties (failure strain) of Al-0.25% graphene attributed to 2-D type and also the corrosion rate increase as graphene % increases

Jinghang Liu, Umar Khaan, Jonatan Colman, [4]. The work deals with the study of preparation of reduced graphene oxide and graphene nano sheets reinforcement with Al-metal matrix. Here the powder synthesis are made to prepare the sample by 1 hour stirring time to get sufficient for completely clearly dispersion for 0.7%,0.15%, 0.3% Gr-Al dispersion in acetone. Here the microstructure and mechanical properties were studied.

S. Ventatesan and M. Antony Xavier [5]. This work involves the preparation of aluminium –graphene MMC's by deals with the mechanical behavior of AMMC with different wt% of 0.33%, 0.55%, and 0.77% by stir casting method. They concluded that as graphene percentage increases, tensile strength decreases except 0.33% and also the hardness of 0.77% leads to decreases compare to base metal. The SEM analysis reveals the 0.33% of graphene shows homogeneous dispersion.

D.Hari Madhava Swamy, Manjunatha L.H [6]. "Fabrication and analysis of aluminium –Graphene MMC's using powder metallurgical technique". The work deals the Al-Gr MMC's are synthesis by varying percentage of 0.1%, 3.8%. The experimental result gives that the wear of aluminium is strongly depends on the graphene composites and decreases with increases graphene percentage. The SEM analysis shows the good distribution of both Al-graphene components.

**Experimental Work**

**Materials:-**

**Aluminium 7075**

Aluminium 7075 is an aluminium alloy, with zinc as the primary alloying element. It is a strong material by strength comparable to many steels, and has good fatigue strength and average machinability. It has lower resistance to corrosion than other aluminium alloys, but has significantly better corrosion resistance than the 2000 alloys. It is relatively high cost material.

| **Element** | Aluminium | Silicon | Iron | Zinc | Copper | Manganese | Magnesium | Titanium | Others |
|---|---|---|---|---|---|---|---|---|---|
| **%by wt** | 87.1-91.4 | Max 0.40 | Max 0.50 | 5.1-6.1 | 0.18-0.28 | Max 0.30 | 2.1-2.9 | Max0.20 | Max 0.15 |

**Table 1:-Composition of Al-7075 Alloy**

**Graphene**

Graphene is an allotrope of carbon that exists as a two-dimensional planar sheet.
One way to think of graphene is as a single atomic graphite layer.
Graphene is technically a non-metal but is often referred to as a quasi-metal due to its properties being like that of a semi-conducting metal.

**Preparation of Composites**

The process of stir casting starts with placing empty crucible in the furnace. The heater temperature is then gradually increased up to 800°C. Aluminium alloy is cleaned to remove dust particles, weighed and charged in the crucible for melting. Required quantities of reinforcement powder are weighed on the weighing machine. Reinforcements are heated for 4 minutes at a temperature of 500°C. After five minutes the scum powder is added which forms a scum layer of impurity on liquid surface which to be removed. Heater temperature is then gradually increased to 800°C. At this heater temperature stirring is started and continued for five minutes. Stirring rpm is 300 RPM with the help of speed controller. Preheated reinforcements are added during five minutes of stirring. Reinforcements are poured manually with the help of conical hopper. The flow rate of reinforcements measured is 0.5 gram per second. Stirrer rpm is then gradually lowered to the zero. Then molten composite slurry is poured in the metallic mould without giving time for reinforcement to settle down at crucible bottom. Mould is preheated at 500°C temperature for ten minutes before pouring the molten slurry in the mould. This is necessary to maintain slurry in molten condition throughout the pouring. While pouring the slurry in mould the flow of the slurry is kept uniform to avoid trapping of gas, also distance between crucible and mould plays a vital role in quality of casting.

**Testing of Composites**

The microstructure study was carried out on the prepared composites using Vegas Tescan made scanning electron microscope. The test sample is 10 -12 mm in diameter cut from the castings and polished thoroughly, for etching the sample Keller's reagent was used.

The brinell test is the method to measure the specimen on a microscopic scale. The test is conducted by differencing the test force and ball size we can test the different metals. By applying a load of 250 kg and dwell time of 30 seconds the experiment is made. The indentation depth values recorded and experimental hardness was determined. The indentation test was repeated for 3 times for each composite and the average value is considered.

Tensile and Compressive specimens were machined. The tensile specimens of circular cross section with a diameter of 9 mm and gauge length of 45mm were prepared according to the ASTM E8 standard testing procedure by Universal Testing Machine

**Figure 1:- Hardness Test Specimen**

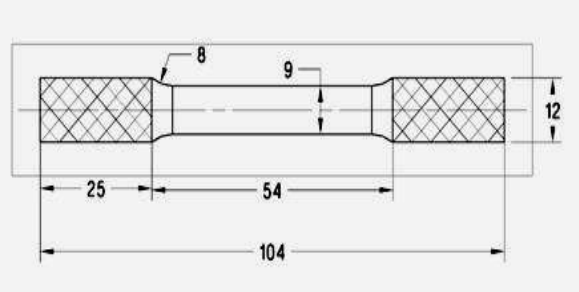



**Figure 2:- Tensile Test Specimen**

## Results and Discussion

### Microstructure Study

Microstructure study is analysed on prepared composite with SEM. The test specimens of 8mm in diameter are cut from the prepared castings and it is polished and then finally it is etched with Keller's reagent in order to get good results. The specimens were visualized at different magnifications to show the presence of reinforcement. The microstructures of all the samples of 0.25%, 0.5%, 0.75% and 1%graphene are made.

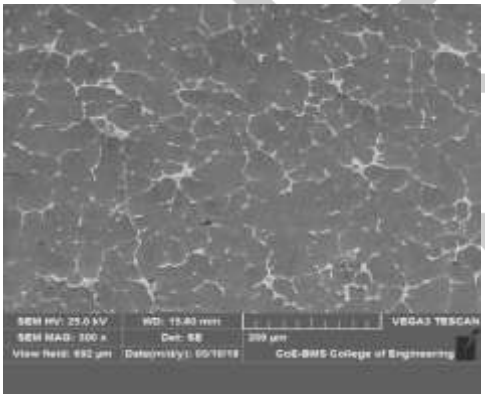


**Figure 3a:- Al+0.25% graphene**

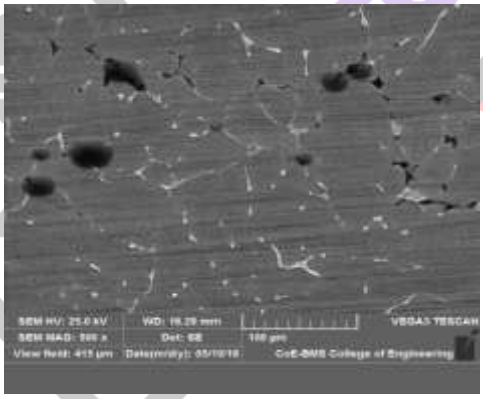


**Figure 3b:- Al+0.5% graphene**

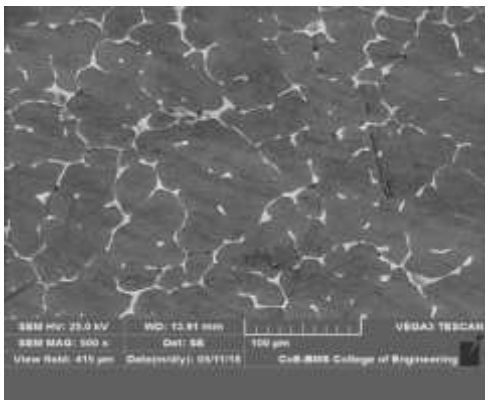


**Figure 3c:- Al+0.75% graphene**

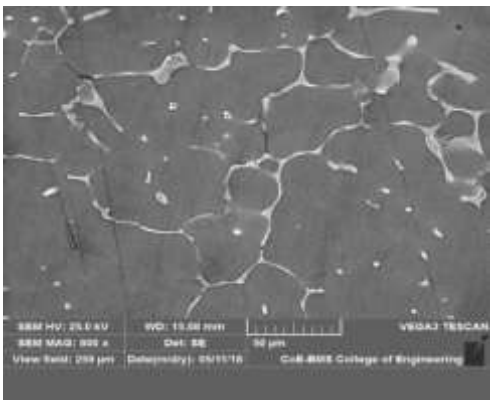


**Figure 3d:- Al+1% graphene**

Figure3.a) shows the clear picture of aluminium 7075 reinforced with 0.25% of graphene using stir casting process. The typical microstructure of aluminium 7075 shows the primary aluminium matrix in white phase and the graphene distribution in the dark gray colour and there is no voids or dislocation and porosity found from the specimen. The image reveals there is a uniform distribution of graphene in aluminium alloy.

Figure3.b) This SEM study reveals that the improper distribution of aluminium 7075 and graphene MMC's. The common casting defect like blowholes, porosity, voids are present in the composites so it will affect the mechanical properties of the composites.

Figure3.c) This picture shows that there is an excellent bonding and the good interfacial bonding between the aluminium 7075 and graphene MMC's so that it improves the tensile strength and hardness of the materials. Here the aluminium matrix is in white phase and there is no porosity or voids.

Figure3.d) the microstructure analysis shows a uniformly distribution of aluminium – graphene composites. The common defects like porosity, voids are not seen here and the graphene are in small grain size so that properties of graphene increases

**EDS EVALUATION**

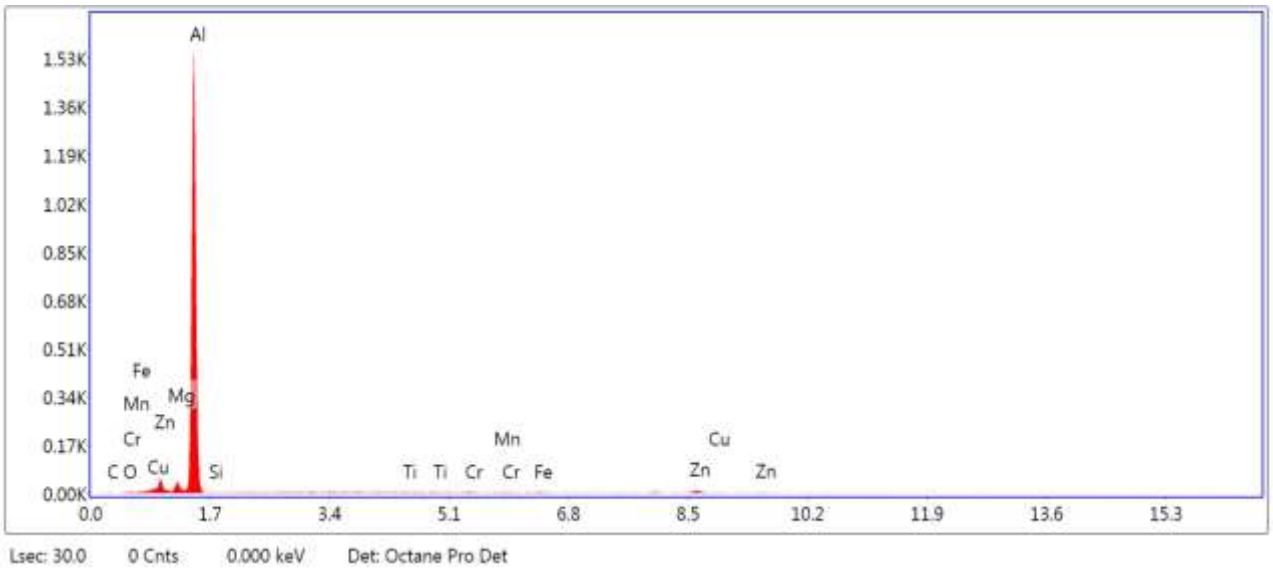



**Fig 4a:-EDS of Aluminium Alloy**

The above graph represents the aluminium alloy composites. In the figure we are able to see the maximum percentage of aluminium along with some percentage of zinc so that it confirms that the material taken for this present work is aluminium alloy 7000 series

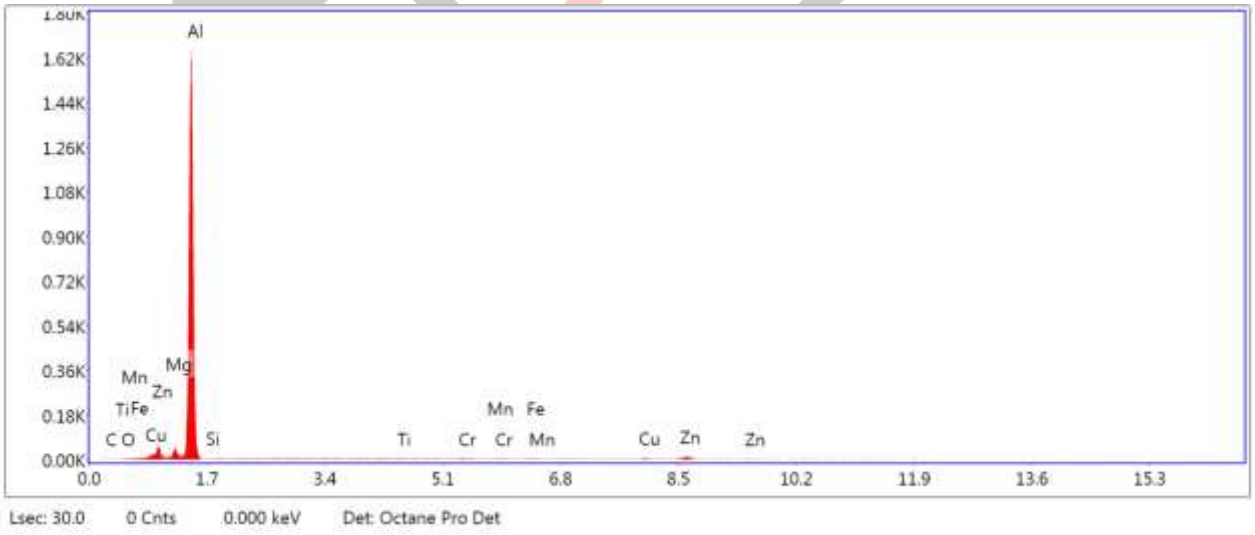



**Fig 4b:- EDS of Al-Graphene**

In the above graph, the figure there is a presence of carbon and zinc with minute percentage of mn, mg and cr which indicates that graphene is present in the form of carbon and it confirms that the reinforcement added is present in the aluminium alloy

**Ultimate Tensile Test**

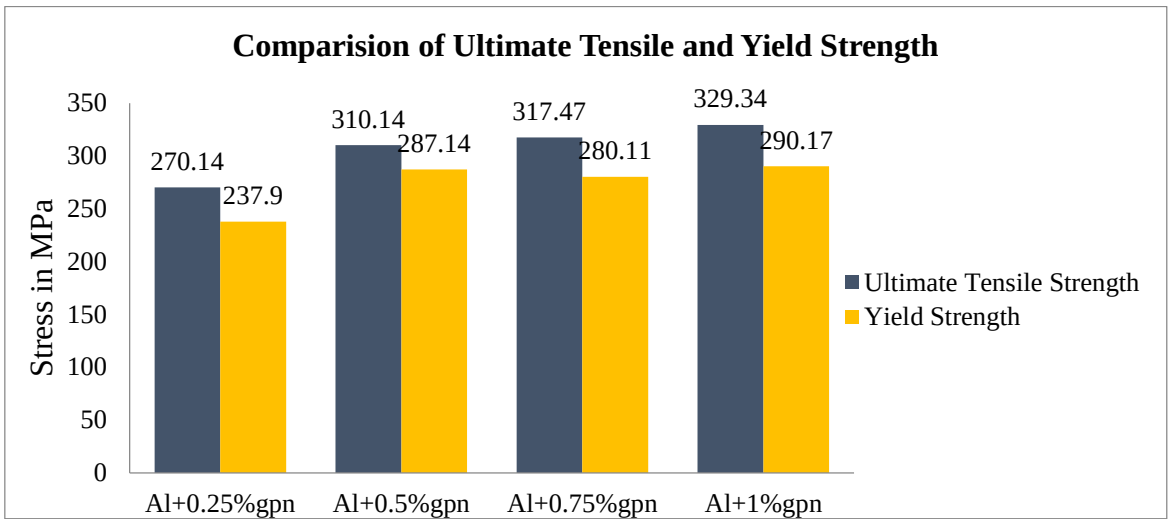



**Figure 5:- Tensile Test Result**

The variation of ultimate tensile strength with varying wt.% of graphene is shown in chart . The ultimate tensile strength and yield strength were increased with increasing graphene content. The graphene particles in the matrix alloy provide protection to the softer matrix this interaction between the dislocations and graphene results in an improved strength

**Hardness test**

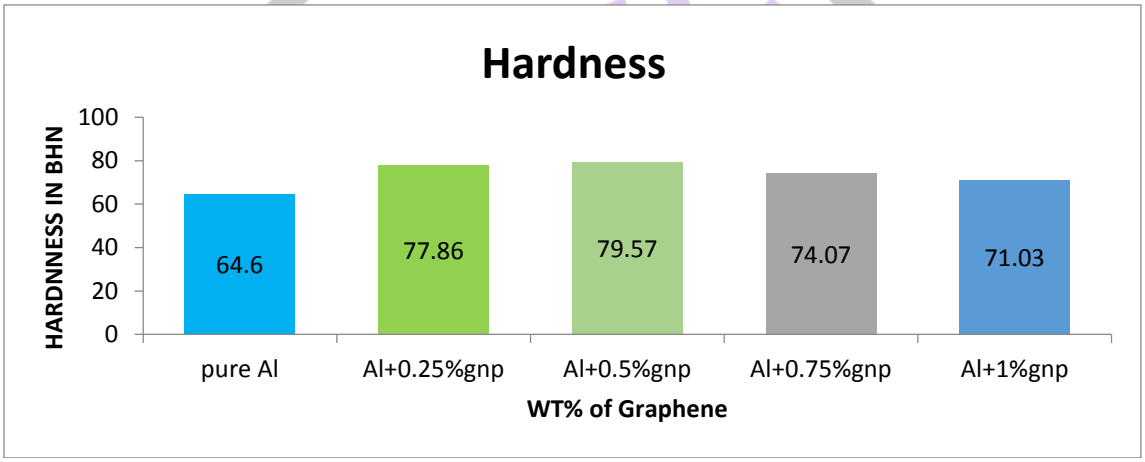



**Figure 6:- Hardness Test Result**

From the results as the graphene percentage increases the hardness is increases up to 0.5% and then hardness is decreases for 0.75% and 1% this shows the ductility property I.e., as the graphene percentage increases the material become more ductile, hence hardness decreases.

**Wear Test:-**

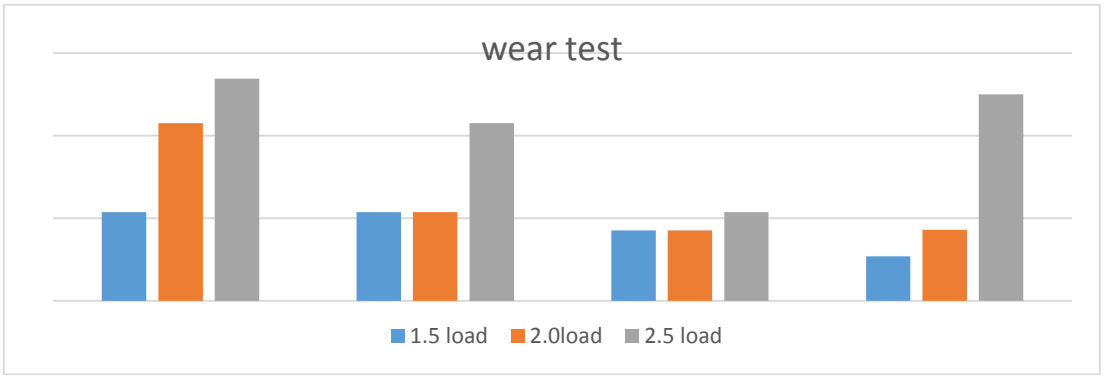



**Figure 7:- Wear Test Result**

The wear test result shows that as the percentage of graphene increases the wear resistance also increases. But in 1% of graphene the wear rate is change

**Conclusions**

The mechanical properties and tribological characteristics investigations of the aluminium alloy with graphene reinforcement materials produced by stir casting are remarked as below:

- The liquid metallurgy technique was successfully adopted in the preparation of aluminium alloy reinforced with graphene.
- The microstructure studies revealed that the uniform distribution of reinforcement (graphene) is observed and in some specimen voids and porosity is present because of improper casting
- The ultimate tensile strength and yield strength and wear resistance of the composites is increases as the wt.% of graphene increases.
- Improvement in the hardness of the aluminium metal matrix composites due to increases in graphene percentage in the composites.

**References**

[1] S Venkatesan and M. Anthony Xaviour *" mechanical behaviour of aluminium metal matrix composites reinforced with graphene particulates by stir casting method"* journal of chemical and pharmaceutical science

[2] Lee C, Wei X.D, Kysar, *"measurements of elastic properties and intrinsic properties of monolayer graphene",* science.321, 2008,385-388

[3] Pai B C, Rohatgi P K. *"production of cast aluminium graphite composites using pellet method"*, journal of material science, 13, 1979, 329-335

[4] Istif, M T Tuncel, A.S Dalkili*c "pin on disk test for aluminium graphene metal matrix composites"*

[5] Xin Gao, Hongyan Yue, Erjun Guo, Hong Zhang, Xuan Yulin, " preparation and tensile properties of homogeneous dispersed graphene reinforced aluminium matrix composites "Elsevier journal paper.

[6] D.Hari Mahadev Swamy, Dr. Manjunath L H, *"Development and characterization of aluminium graphene metal matrix composites using powder metallurgy route"* IISN.

[7] Yang-Ha-Jeong, Huynh Ngoc Tien *"Material properties of graphene/ aluminium metal matrix composites fabricated by friction stir processing"* www. Researchgate.net/ article in international journal of precision engineering and manufacturing

[8] Muhammad rashad , Fusheng Pan,Zhengwen Yu, Muhammad Asif, Han Lin , Rongjian Pan. *"Investigation on microstructure, mechanical and electrochemical properties of aluminium composites reinforced with graphene nanoplates"* www.sciencedirect.com.

[9] Morrish Kumar, Manjunatha L.H. *"Fabrication and analysis of aluminium –graphene metal matrix composites using powder metallurgy technique"*.

[10] Meysam Tabandeh Khorshid, Emad Omrani,Pradeep L,Menezes,Pradeep K.Rohat. *"Tribological performance of self-lubricating aluminium matrix nanocomposites: role of graphene nanoplates".* Elesvier journal paper.

[11] B Sai Jagadish *"Synthesis and charecterization of aluminium 2024 and graphene metal matrix composites by powder metallurgy".*SSRG international journal of mechanical engineering.

[12] Victor Volkov, Svetlana Eliseeva, Alexxander Pimenov, Alex *Shvarev "Electrochemical properties of aluminium – graphene composites anodes*". International journal of electrochemical science, www.electrochemsci.org

[13] X M Du, R Q Chen, F G *Liu "Investigation of graphene nanosheets reinforced aluminium matrix composites".*

[14]Lin C B, Chang RJ, Weng WP, A study on process and tribological behaviour of Al-Graphene composites,wear.217,1998,167-74

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

# Influence of Personal Factors on the Knowledge Sharing Attitude of Individuals in Engineering Education Context

**Yogeesha H. C[1], S.G. Gopala Krishna[2]**

[1]Associate Professor – Mechanical Engineering Department, Nagarjuna College of Engineering& Technology, Bengaluru

[2]Principal, Nagarjuna College of Engineering& Technology, Bengaluru

**Abstract:** ***This study intends to understand the influence of individual components of the personal factors on the attitude concerning the knowledge sharing intention or behaviour in the context Engineering Education in Karnataka State, India. The personal factors considered for the study are: age, gender and experiencein the field of engineering education. The data for the said study was collected from the online survey. From thestudy, it isobservedthat only two factors, i.e. the age and experience werefound to be statistically significant in influencing an individual's attitude towards knowledge sharing. It proposes that there is no deterministic individual factors that inhibit the knowledge sharing attitudes based on gender.***

**Keywords:** Knowledge Sharing, Knowledge Management, Technical Education

## 1. Introduction

Knowledge can be considered as a fluid mix of expert insight, framed experiences, circumstantial information, values and grounded intuition that provides a framework for evaluating and incorporating new experience and information [1]. Knowledge is the understanding of a specialized area of concern that has been assimilated over the years of experience [2].

Knowledge has turned into the most essential consideration in all most all organisations. An emphasis on knowledge as a strategic advantage is vital because improving the management of this asset can enhance the efficiency and effectiveness of the organization and help in meeting the future challenges. Globalisation, information technology, communications systems and the exponential growth of knowledge all contribute to an increasingly complex environment in which information is abundant and volatile. Numerous experts contend that an organization‟s capability to perform well in the information age depends on its capacity to utilize knowledge effectively. In many private sector organizations, knowledge has become a critical source of comparative advantage as companies increasingly draw on factors such as employee‟s know-how and innovative capacity to remain competitive[3].To be more productive and competitive within a given field of specialization, employees need to access the necessary knowledge in more efficient ways than others do [4]. Survival in this aggressive and competitive world is subjected to the best possible response provided by the organizations to the huge number of challenges. Managing knowledge implies adding and creating value of knowledge by leveraging the know-how, intuition, judgement and experience within and outside the organization.

Organisations are attempting to find new and systematic ways to recognize and convert individual expertise, insights, experiences and skills into organisational knowledge. The strategic management of knowledge resources is viewed as one of the important factors for sustainable competitive advantage.

## 2. Knowledge Management and Knowledge Sharing

Knowledge management can be seen as turning data (raw material) into information (finished goods) and from there into knowledge (actionable finished goods)[5]. The implication of this conversion of data into knowledge and management of the knowledge gives an individual the power to make the right decisions that are value producing to the company. The main goal of Knowledge Management is to build and effective usage of the intellectual capital. Suitable measures can be implemented by the organizations to leverage the organisational knowledge for creating business value and sustainable competitive advantage.[6]. Knowledge Management is a systematic method for maximizing the creation, sharing, and effective use of knowledge to support organizational learning, competitiveness and ultimately the performance of the organization.

Knowledge can be leveraged only when people value the building of knowledge on each other‟s ideas and sharing their own insights. Knowledge sharing is considered as the most essential part for knowledge management as it positively affects creativity, team performance, working environment, cohesion, knowledge integration and effective decision making [7][6].Knowledge sharing is the process where individuals mutually exchange their knowledge and jointly create new knowledge. Knowledge sharing can also be defined as the action of the individuals in making knowledge available to others in an organizational context [8]. Barton and Srivatsava [9] viewed knowledge sharing as sharing organizationally relevant and important information, ideas, experience, suggestions and expertise with one another.


Licensed Under Creative Commons Attribution CC BY

By sharing knowledge, individuals contribute to the creation of the knowledge base, innovativeness and ultimately competitive advantage of their organization [10]. In a survey of 260 CEOs and directors in European multinational organisations conducted by the Financial Times in 1999, 94% of respondents answered that people should share what they know with others[6]. However, knowledge sharing is often argued as an unusualand unnatural act[1]. Individuals will not share their knowledge as they think that knowledge is their power and is important and valuable to them. The biggest hurdle in managing knowledge is changing the behaviour of the individuals towards knowledge sharing and contributing to the knowledge base of the organization [11].

Sharing knowledge is not a natural process. Many a times, individuals question the reason for sharing the knowledge as they feel that knowledge is a valuable resource, and sharing it may put their jobs at risk if others use their knowledge. An individual‟s knowledge in the organization is the primary source of power, giving up or sharing that knowledge diminishes the value or uniqueness of the individual [12]. As a consequence of this, the individuals may fear a loss of superiority and ownership of the unique knowledge after sharing it. Therefore, individuals try to hoard knowledge rather than to share[1][13]. Employees accomplish the assigned work by keeping their knowledge to themselves for their own benefit, rather than sharing it with others. As per the old school of thinking, where profitability was reflected by organization‟s output, knowledge hoarding was believed to be benefitting the career advancement of the individuals. Brown and Woodland stated that individuals use knowledge both for defence and control[14]. When individuals perceive the knowledge they possess as a valuable commodity, KS becomes a process mediated by decisions about what knowledge to share, when to share, and who to share it with [15].

Knowledge management requires a shift in the behaviour of individuals where knowledge sharing, collaboration and team working are valued as well with individual achievement. The vital component to the implementation of knowledge management is the shift in the belief that knowledge sharing is power.

Knowledge is mainly derived from past experience, which leads to sound judgement and wisdom[1]. Wisdom is the knowledge that is used in making future decisions. Being able to transfer knowledge implies that experiential knowledge also gets transferred to the recipient. The benefit of experience lies in the fact that it provides a historical perspective that helps people better understand present situations. Experienced people are usually valued in a company (and are often paid more) because they possess this historical perspective from which they can view current situations – something that a typical newcomer will almost never have.

Organisations need to examine the individual‟s attitudes and habits concerning knowledge sharing. They need to monitor with whom the employees collaborate, how they get the information they need, whether and when they document their own knowledge and how they store and distribute knowledge. Hence, the aim of this research is to develop an understanding of the personal factors influencing an individual‟s attitude towards knowledge sharing behaviour in the context of technical education.

## 3. Personal Factors Influencing Knowledge Sharing

Attitude is the way an individual think or feel about something. An attitude can be as a positive or negative evaluation of the other individual, object, event, activity or an idea. It could be just about anything in the environment the individual is working. Attitudes are closely related to values, and are about how people view their world. Attitudes are born out of what we know (cognitive), feel (emotions), and do (behavior) about someone or something. They are shaped by education, environment and by the culture to which people belong. Attitudes often result in and affect the behaviour or action of the people. Attitudes can lead to intended behaviour if there are no external interventions. Values and attitudes shape many of the ways a person behaves. Values reflect a person‟s ethos about their work and their interaction with the people connected. They rarely change. Attitudes can change where people see that it is necessary [16].

The way an individual reacts to and addresses a situation is influenced by many factors such as abilities of an individual, his/her gender, age, perception, and attitude. Abilities of an individual consists of intellectual, physical and self awareness abilities. The psychological, physical and self assurance characteristics owned by an individual defines the behaviour of the persons in personal and social life.

The personal factors which influence the individual behaviour can be of two types, viz. biographical characteristics such as age, gender, religion, marital status, experience, intelligence, personality, perception, attitude, values, etc. and environmental factors such as employment level, salary/wage, available technology, physical facilities at the workplace, organizational structure, leadership and reward system.

It is suggested that the easiest way to approach the subject of knowledge management is for individuals to make themselves aware of how they deal with their own knowledge and emphasise that an atmosphere of trust is essential for the sharing of knowledge [17].

## 4. Theoretical Framework

To build a theoretical model which decides personal influences affecting knowledge sharing attitudes, it is proposed to use the Theory of Reasoned Action (TRA). The useful aspect of the Theory of Reasoned Action is that it assumes all other factors influence behaviour only indirectly, by influencing attitude [6]. Because it has this explanatory power, the Theory of Reasoned Action can be a useful model for explaining knowledge sharing behaviour in organisations.

The Theory of Reasoned Action is a widely accepted model in social psychology, used to explain virtually any human


Licensed Under Creative Commons Attribution CC BY

behaviour. According to this theory, a person‟s performance of a specific behaviour is determined by his or her behavioural intention to perform the behaviour. Next, the intention is jointly determined by the person‟s attitude and subjective norm concerning the behaviour in question. And then, a person‟s attitude toward a behaviour is determined by his or her salient beliefs about the consequences of performing the behaviour, multiplied by the evaluation of those consequences. Finally, an individual‟s subjective norm is determined by a multiplicative function of his or her normative beliefs and motivation to comply [6].

## 5. Research Hypothesis and Methodology

The objective of this research is to explore the personal factors influencing attitudes towards knowledge sharing. The purpose of this study is explanatory. This study hypotheses that “there is a relationship between personal factors and attitude of individual‟s towards knowledge sharing”. Various sub-hypothesis can be stated by substituting the generic “personal factors” with specific factors under consideration, namely: Gender, Age and Experience.

The study will adopt a quantitative online survey-based approach to test the corresponding null-hypotheses. The purpose of this study is explanatory as it seeks to establish whether attitude towards knowledge sharing is determined by such variables as gender, age, education and experience.

The questionnaire administered was developed by Bock and Kim[6][18]. The instrument measures respondents‟ attitude towards knowledge sharing. Attitude towards knowledge sharing was defined as the degree of one‟s positive feelings about sharing one‟s knowledge. Variables were measured on a five point Likert-scale ranging from1 (very rarely) through 5 (very frequently).

### Data Collection

Target population of this study was defined as faculty members working in engineering colleges affiliated to a Technological University in Karnataka state, India. There are about 30,000 faculty members working in various engineering colleges affiliated to a Technological University in Karnataka state. They are teaching both undergraduate and post graduate courses. These faculty members are working in the institution with the minimum qualification of a post graduate degree and can have doctoral degree also.

The sample size for the said study is calculated based on 95% of confidence level and the formula adopted from Yamane[19].

$$n = \frac{N}{1 + N(e^2)}$$

Where n – sample size, N – Population size and e-level of precision.

When the formula is applied to the given study with a population size of approximately 30000 and level of confidence of 0.05, we get the sample size as 395. We have chosen the random purposive sampling technique and considering the percentage of useful responses to be around 60%, we have arrived at the sample size as 628.

Faculty members from different branches and different colleges were selected randomly and the online questionnaires were sent to the selected faculty members to elicit their responses on knowledge sharing intentions.The questionnaire was prepared using Lime survey, a free open source software survey tool on the web. The link to the survey was sent to the selected target population through emails and the responses were collected using the online survey tool. The responses received were screened and useful responses were taken for the study.

## 6. Analysis of the Data

To test the identified hypothesis, the numeric variables „age‟ and „experience‟, captured in years, were converted into categorical variables. This permitted an analysis to be performed, namely using the Pearson chi-square test for the significance of association, which is more relevant to the objectives of the research.

It is found that there is significant correlation between age on the one hand and experience and education on the other. The statistical test performed for testing the stated hypothesis was the Pearson chi-square test. In addition, linear regression and ANOVA was also performed.

**Table 1:** Frequency table for "attitude towards knowledge sharing"

| *Frequency* | *Category* | *Frequency* | *%* |
|---|---|---|---|
| Attitude < 2 | Low | 70 | 11% |
| Attitude >= 2 and Attitude < 3 | Medium | 176 | 28% |
| Attitude >= 3 and Attitude < 4 | Medium – High | 254 | 40% |
| Attitude >= 4 | High | 128 | 20% |

In order to perform chi-square analysis, all continuous variables are converted into categorical data. Although this process may introduce bias, it was found that the results were not particularly sensitive to the exact cut-off values used to group data. Table 1 above shows the 4 classes which were created for the variable attitude. The labels such as low and high are arbitrary and relative to the responses obtained. The use of these labels is purely intended to facilitate the reading of the statistical results and they should not be interpreted strictly.

### Attitude vs Gender

The gender of the respondents was studies and correlatedon attitude towards knowledge sharing.

**Table 2:** Influence of Gender on Attitude towards knowledge sharing

| *Attitude* | *Male* | *Female* | *Row totals* |
|---|---|---|---|
| Low | 46 | 38 | 84 |
| Medium | 92 | 84 | 177 |
| Medium – High | 163 | 90 | 253 |
| High | 65 | 49 | 114 |
| All groups | 367 | 261 | 628 |


Licensed Under Creative Commons Attribution CC BY

The chi-square value was found to be 2.41, which has a significance of 0.41 (df=3), i.e. p-value > 0.05. This implies that there is no association between attitude and gender. The lack of association – or even any suggestion of association – is certainly an interesting finding and demonstrates clearly the danger of holding gender-based prejudices.

**Attitude and Age**

**Table 3:** Age and knowledge sharing attitude

| *Attitude* | *Age: < 30* | *Age: 30-40* | *Age: 40-50* | *Age: >50* | *Row totals* |
|---|---|---|---|---|---|
| Low | 30 | 24 | 14 | 16 | 84 |
| Medium | 33 | 71 | 24 | 49 | 177 |
| Med – High | 43 | 65 | 57 | 87 | 253 |
| High | 30 | 16 | 38 | 30 | 114 |
| All groups | 136 | 177 | 128 | 188 | 628 |

The chi-square value was 15.5, which has a significance of 0.02, i.e. p-value < 0.05. This means that there is a definite correlation between attitude and age. Therefore the null hypothesis of no association between age and an individual‟s attitude towards knowledge sharing must be rejected, and the alternate hypothesis of an association between age and attitude can be accepted.

However, if the influence of age on attitude towards knowledge sharing is tested by means of linear regression analysis, the regression test only indicates a weakly positive ($r^2$= .012) influence on attitude by the respondents‟ age with a p-value of only 0.059 i.e. not statistically significant. An ANOVA analysis reveals that some of the problems may be due to a more dispersed spread of attitudes for this group, with a heavy low-end tail, indicating that there is more probability of very young respondents having a low attitude than the other age categories. Hence, it must be concluded that there is a definite correlation between age and attitude towards knowledge sharing, but this is not of a linear nature.

**Attitude and Experience of the respondents**

**Table 4:** Experience and knowledge sharing attitude

| *Attitude* | *Less than a year* | *1 to 5 years* | *5 to 10 years* | *> 10 years* | *Total* |
|---|---|---|---|---|---|
| Low | 43 | 27 | 11 | 3 | 84 |
| Medium | 106 | 38 | 14 | 19 | 177 |
| Med – High | 114 | 76 | 16 | 46 | 253 |
| High | 63 | 38 | 3 | 11 | 114 |
| All groups | 326 | 179 | 43 | 79 | 628 |

The chi-square value was 12.3, which has a significance of 0.04, i.e. p-value > 0.05. This suggests that there is astatistical basis to assume an association between attitude and experience.

Table 5 below presents a summary of the test results for each of the personal factors which were hypothesised to have a potential influence on attitude towards knowledge sharing. It must be noted that the actual chi-square analysis tests (two-way) association rather than unidirectional influence.

**Table 5:** Summary of findings

| | *Pearson chi-square test statistic* | *P< 5% significance level* | *Association/ influence?* |
|---|---|---|---|
| Gender | 2.41 | 0.41 | No |
| Age | 15.5 | 0.03 | **Yes** |
| Experience | 12.3 | 0.24 | **Yes** |

From the Pearson chi-square test for significance of association, the significant finding were the association between attitude and age as well as attitude and experience in the field of engineering education.

## 7. Conclusion

The research focused on the personal factors gender, age and experience and on how these factors influence an individual‟s attitude towards knowledge sharing.The findings of the report suggest that the attitude towards knowledge sharing is influenced by age as well as experience in the field of engineering education.

The findings of this research must be treated with caution given the limitations of the study. The sample design of randomly selected faculty members from affiliated engineering colleges in Karnataka state may have been biased. The effect of this sampling design on the ability to generalise results to the whole engineering education sector is not clear. Also, the sample was from a large population, which therefore limits the ability to generalise to particular academic sector.

However, the lack of support for the influence on knowledge sharing attitude of personal factors such as experience or gender can be seen as a positive and hopeful indicator. It suggests that there is no deterministic individual barrier against knowledge sharing attitudes based on gender and experience.

Areas for future research could include possible theoretical explanations for why age influences knowledge sharing attitude. Additionally, it would be useful to research the organisational and technological factors that influence knowledge management implementations in an academic context. Finally, the effect of rewards or incentives on knowledge sharing, could be investigated, to determine whether they are a significant factor in academic context.It is hereby felt that a more qualitative research methodology be more appropriate to investigate in more detail what factors affect knowledge sharing attitudes of individuals in academic environment.

## References

[1] T. Davenport and L. Prusak, Working knowledge: how organizations manage what they know., Boston, Massachusetts, USA: Harvard Business School Press, 1998.
[2] E. M. Awad and H. M. Ghaziril, Knowledge Management, New Jersy: Pearson Education, 2004.
[3] T. A. Stewart, The Wealth of Knowledge: Intellectual Capital and the Twenty-first Centrury Organization, Doubleday, 2001.


Licensed Under Creative Commons Attribution CC BY

[4] A. Bourdreau and G. Couillard, "Systems integration and knowledge management," Information Systems Management, vol. 16, no. 4, pp. 24-32, 1999.
[5] J. Kanter, "Knowledge management, practically speaking," Information Systems Management, vol. 16, no. 4, pp. 7-15, 1999.
[6] G. Bock and Y. Kim, "Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing"„" Information Resources Management Journal, vol. 15, no. 2, pp. 14-21, 2002.
[7] P. Schepers and P. T. van den Berg, "Social Factors of Work Environment Creativity," Journal of Business and Psychology, vol. 21, no. 3, pp. 407-428, 2007.
[8] M. lpe, "Knowledge Sharing in Organization: A Conceptual framework," Human Resource Development Review, vol. 2, pp. 337-359, 2003.
[9] K. M. Bartol and A. Srivastava, "Encouraging knowledge sharing : The role of organizational reward systems," Journal of leadership and organizational studies, vol. 9, pp. 64-76, 2002.
[10] S. E. Jackson, C. H. Chuang, E. E. Harden and Y. Jiang, "Toward developing humna resource management systems for knolwedge-intensive team work," Research in personnel and human resource management, vol. 25, pp. 27-70, 2006.
[11] R. Ruggles, "The state of notion: Knowledge management in practice," California Management Review, vol. 40, no. 3, pp. 80-89, 1999.
[12] C. Chow, J. Deng and J.L. Ho, "The openness of knowledge sharing within organizations: A comparison study of the United States and the People"s Republic of China," Journal of Management Accounting Research, vol. 12, no. 1, pp. 65-96, 2000.
[13] A. Tiwana, The knowledge management toolkit: Practical techniques for building a knowledge management system, Upper Saddle River, New York, USA: Prentice-Hall, 2000.
[14] R. Brown and M. Woodland, "Managing knowledge wisely: A case study in organizational behaviour," Journal of Applied Management Studies, vol. 6, no. 2, pp. 175-198, 1999.
[15] K. M. Andrews and B. L. Delahaye, " Influences on knowledge processes in organizational learning: The psychological filter," Journal of Management Studies, vol. 37, no. 6, pp. 2322-2380, 2000.
[16] A. Mayo, The human value of the enterprise: Valuing people as assets: Monitoring, measuring, managing., London, UK.: Nicholas Brealey Publishing, 2001.
[17] G. Probst, S. Raub and K. Romhardt, Managing knowledge: Building blocks for success., West Sussex, UK: John Wiley & Sons, Chichester, 2000.
[18] V. Brink and J.-P. Van Belle, "An Exploration of Personal Factors Influencing Disposition towards Knowledge Sharing in a South African Context," University of Cape Town, 2003.
[19] T. Yamane, Statistics: An Introductory Analysis, 2nd Ed., New York: Harper and Row, 1967.
[20] K. Sveiby, The new organizational wealth: Managing and measuring knowledge-based assets., San Francisco, USA: Berrett-Koehler Publishers, 1997.


Licensed Under Creative Commons Attribution CC BY

**Imperial Journal of Interdisciplinary Research (IJIR)**
**Vol-3, Issue-6, 2017**
**ISSN: 2454-1362,** http://www.onlinejournal.in

# Design and Development of Running Wheel Air Pressure Monitoring System for Vehicles

Chethan Babu S[1], Kishor Kumar S[2], Kiran Kumar B V[3], Chethan kumar N[4]
Department of Mechanical Engineering, NCET, Bengaluru-562164

***Abstract*** *- Several manufacturers produce tire pressure monitoring systems (TPMS) for heavy trucks which are designed to detect low tire pressure and alert the driver. This paper reports on a series of test procedures conducted on these aftermarket TPMS to determine the suitability of these tests for use in developing performance requirements.*

*TPMS were installed one at a time on two heavy trucks. The minimum activation pressure of the TPMS was determined. After driving for a period of up to fifteen minutes, the vehicle was stopped and air was released from one tire to bring its inflation pressure to a point below the minimum activation pressure for the system. The vehicle was driven and the time needed for the system to detect the loss of pressure and alert the driver was recorded. Multiple tire deflations and failure modes were also tested*

***Keywords*** *- Tire Pressure Monitoring System, Running Wheel Air Pressure Monitoring System, Central Tire Inflation Systems (CTIS), Automatic Tire Inflation Systems (ATIS)*

## I. INTRODUCTION

**Tire Pressure Monitoring System -** A typical tire pressure monitoring (TPM) system specifically intended for automotive use. It serves as a reference to design a real-world system based on various Microchip products. A TPM system primarily monitors the internal temperature and pressure of an automobile's tire. system. For the driver the dynamics of the car seem "normal", until he is faced with an emergency or an incident occurs. Therefore important to inform the driver of any time, by means of a message displayed on the dashboard. The tire pressure monitoring system fulfils this role. A small electronic module housed in the inflation valve of each wheel permanently monitors the tire. A loss of pressure, an imbalance in pressure between the wheels, or over- or under-inflation immediately triggers an air compressor

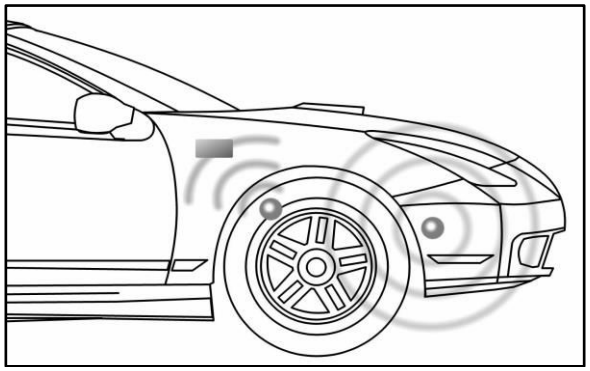


**Fig. 1 Tire pressure monitoring system**

Fig 1 is an electronic system designed to monitor the air pressure inside the pneumatic tires on various types of vehicles. TPMS report real-time tire-pressure information to the driver of the vehicle, either via a gauge, a pictogram display or a simple low-pressure warning light. TPMS can be divided into two different types — direct (TPMS) and indirect (TPMS). TPMS are provided both at an original equipment manufacturer OEM(factory) level as well as an aftermarket solution

**Description of Currently Available Tire Pressure Systems for Commercial Vehicles:**

Based on interviews with tire pressure systems suppliers, other NACFE-conducted fleet surveys, and a review of online information sources including industry standards and recommended practices

The major categories are:

1. **Tire Pressure Monitoring Systems (TPMS)**

These systems provide a direct measurement of pressure, and, in some cases, temperature. The measured pressure is compared to a preset target pressure determined by the fleet user for a given vehicle wheel position. If the tire is underinflated, maintenance staff and the driver are alerted by either a static visual display at the wheel-end, or by the transmission of sensor data to an in-cab display or to a computer system that can be accessed by the fleet. The TPMS category includes mats or plates containing an array of sensors that pick up and transmit the loading conditions of the tire footprint as the tire rolls over the surface of the mat. The mats can be embedded in pavement or placed on the floor of a garage. In addition, fleet-

wide manual tire pressure check procedures are included in this category. Most of these systems can also signal an overpressure condition. With the exception of the floor sensor mats, all systems included in this report are direct TPMS, that is, systems wherein pressure is measured directly and is not derived from other vehicle or tire parameters.

2. **Dual Tire Pressure Equalizer**

In these systems, a single sensor unit is mounted to the vehicle wheel end, monitoring the pressure in both tires of a dual-tire assembly, with a hose connection to each tire valve stem. If pressure levels between the tires do not match, either due to temperature warming of one tire position versus the other, unequal loading, or slow air seepage, the system will attempt to bring the inflation pressure of the two tires to the same level. No air is added or removed from the dual assembly by the equalizer unit. If air loss continues, the leaking tire is isolated and a static visual display indicates the progressive loss of pressure.

3. **Central Tire Inflation Systems (CTIS)**

The operation of this type of system is similar to ATIS, with the difference that the driver can select the target pressure from an in-cab display, in order to raise or lower the tire inflation level depending on the operating conditions of the vehicle. Most systems of this type are intended for off-road or military truck applications.

4. **Passive Pressure Containment Approaches**

Another category of technologies capable of preventing tire pressure loss attempt to retain air in the tire once it has been inflated. These most commonly function by reducing natural air loss through the tire casing. However, certain products in this category can mitigate the effects of small punctures. Use of an inflation medium such as nitrogen that has a lower permeation rate than oxygen, and alternative means to providing barriers to air loss through the use of sealants, are represented in this category.

## II. OBJECTIVE

The overall goal of our design project is to develop a product that will decrease tire wear while improving fuel economy. Increases performance and safety of a passenger vehicle through dynamically-adjustable tire pressures. A synthesis of commercially available tire pressure monitoring and maintenance systems and their features. An exploration of the potential benefits and challenges for fleets related to system implementation. Recommendations/guidelines for selecting and incorporating tire pressure systems into fleet operations

## III. MATERIALS AND METHODS

The following are the parts of running wheel air pressure monitoring system

### Compressor

An air compressor is a device that converts power (usually from an electric motor, a diesel engine or a gasoline engine) into kinetic energy by compressing and pressurizing air, which, on command, can be released in quick bursts. There are numerous methods of air compression

**Fig 2 Single-stage**

### Pressure Switch

A pressure switch is a form of switch that closes an electrical contact when a certain set pressure has been reached on its input. The switch may be designed to make contact either on pressure rise or on pressure fall


**Fig 3 Differential & ranging pressure switch**

### Rotary Joint

A Rotary Union transfer's media (water, steam, air, oil, Hydraulic fluid, etc.)from a stationary source (or) to rotating source. Fig:-3.7 show rotary joint. A rotary union is that allows for rotation of the united parts. It is thus a device that provides a seal between a stationary supply passage (such as pipe or tubing) and a rotating part (such as a drum, cylinder, or spindle) to permit the flow of a fluid into or out of the rotating part. Fluids typically used with rotary joints and rotating unions include various heat transfer media and fluid power media such as steam, water, thermal oil, hydraulic fluid, and coolants.

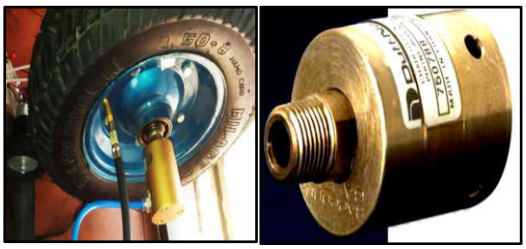


**Fig 4 Rotary joints**

A rotary union is sometimes referred to as a rotating union, rotary valve, rotary coupling, rotary joint, hydraulic coupling, pneumatic rotary union, through bore rotary union, air rotary union, electrical rotary union, vacuum rotary union

**Axial Hollow Shaft**

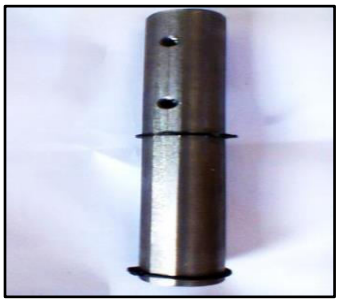


**Fig 5 Axial hollow shaft**

Axial are the shafts on which road wheels are mounted. . Fig:-3.9 shows the axial hallow shaft. The road wheels are provided with the required drive through these axial.

**Frame**

**Fig 6 Frame**

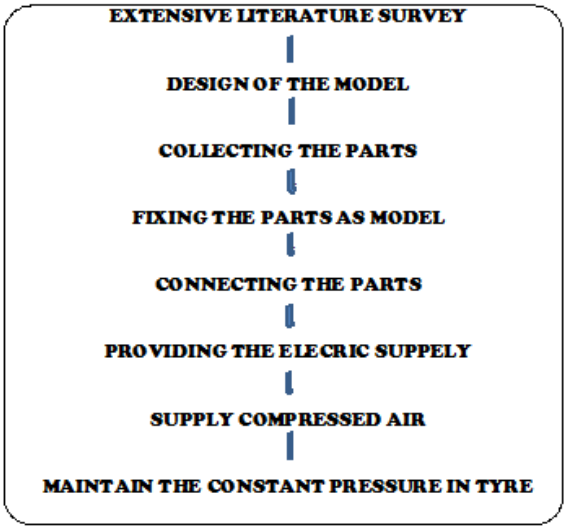



**Fig 2 Flow chart of the methodology**

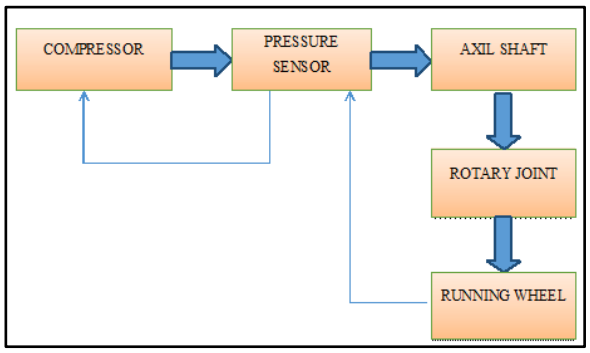



**Fig 3 Block diagram of RPMS**

## IV. RESULTS AND DISCUSSION

**Working principle of pressure switch.**

A pressure switch is a form of switch that closes an electrical contact when a certain set pressure has been reached on its input. The switch may be designed to make contact either on pressure rise or on pressure fall.

Another type of pressure switch detects mechanical force; for example, a pressure-sensitive mat is used to automatically open doors on commercial buildings.

A pressure switch for sensing fluid pressure contains a capsule, bellows, Bourdon tube, diaphragm or piston element that deforms or displaces proportionally to the applied pressure. The resulting motion is applied, either directly or through amplifying levers, to a set of switch contacts. Since pressure may be changing slowly and contacts should operate quickly, some kind of over-centre mechanism such as a miniature snap-action switch is used to ensure quick operation of the contacts. One sensitive type of pressure switch uses mercury switches mounted on a Bourdon tube; the shifting weight of the mercury provides a useful over-center characteristic.

The pressure switch may be adjustable, by moving the contacts or adjusting tension in a counterbalance spring. Industrial pressure switches may have a calibrated scale and pointer to show the set point of the switch. A pressure switch will have a differential range around its setpoint in which small changes of pressure do not change the state of the contacts. Some types allow adjustment of the differential.

The pressure-sensing element of a pressure switch may be arranged to respond to the difference of two pressures. Such switches are useful when the difference is significant, for example, to detect a clogged filter in a water supply system. The switches must be designed to respond only to the difference and not to false-operate for changes in the common mode pressure.

The contacts of the pressure switch may be rated a few tenths of an ampere to around 15 amperes, with smaller ratings found on more sensitive switches. Often a pressure switch will operate a relay or other control device, but some types can directly control small electric motors or other loads.

Since the internal parts of the switch are exposed to the process fluid, they must be chosen to balance strength and life expectancy against compatibility with process fluids. For example, rubber diaphragms are commonly used in contact with water, but would quickly degrade if used in a system containing mineral oil.

Switches designed for use in hazardous areas with flammable gas have enclosure to prevent an arc at the contacts from igniting the surrounding gas. Switch enclosures may also be required to be weather proof, corrosion resistant, or submersible.

An electronic pressure switch incorporates some variety of pressure transducer (strain gauge, capacitive element, or other) and an internal circuit to compare the measured pressure to a set pont. Such devices may provide improved repeatability, accuracy and precision over a mechanical switch.

**Working of tyre inflation system.**

The pressures switch with is couples to tyre through the 6 od tubes circuit, in the circuit the ball valve is introduced which imitates the tyre puncher or air leakage, ones the empty tyre is coupled with the air compressor, pressure switch, rotary joint & air filling knob, the whole system is ready to test. the desired pressure will be set to desired level depends on the tyre type. ones the power is enabled the air is starts filling to the tyre & it will be triggered off when the desired pressure is reached in tyre.

The running wheel will be filled with air through the rotary joint, which will have rotor & stator of having knob size 1/4$^{th}$ which is fitting with desired fittings, the rotor will be fixed to the tyre with air filling knob and stator is fixed to axial shaft.

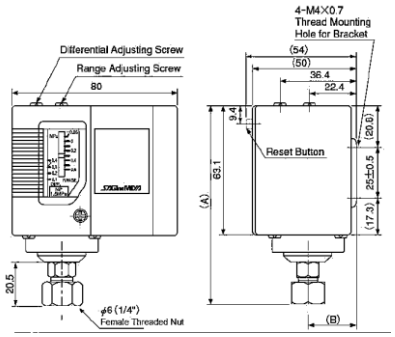
The ball valve is imitates the air leak in the system & that cause the pressure drop in the pressure switch which will be again triggers the on board air compressor the process respites.

**Steps by step procedure**

Connect the all tubes to the desired devises & please absorb the leakage of air(leakage will cause the pressure drop in system & more power consumption through the compressor, rectify with proper push in & air tight fitting with Teflon ).

1) Differential adjusting screw – this is the screw which defines & controls the how much difference in the system has to react. Example if u set pressure range adjustment to 2 bar, differential screw is set for 0 bar exactly at 2 bar system will on & stops, it will lades to frequent on and off of compressor. If we set for 0.5 bar it will on at 2bar +/- 0.5 bar.

2) Range adjusting screw – this screw is used to directly set the pressure of the system & depends on the type of vehicle & tyre.




3) Connections to terminals- from the 12 v DC battery either (+) or (-) will be always connected to compressor terminal & one will be connected to pressure switch

**Test pressure chart**

| Test pressure chart | | | | |
|---|---|---|---|---|
| Sl no | Differential adjusting screw pressure in bar | Range adjusting screw pressure in bar | Results Yes/no | Remarks |
| 1 | 0 | 1.25 | | |
| 2 | 0 | 1.5 | | |
| 3 | 0.25 | 1.25 | | |
| 4 | 0.25 | 1.5 | | |

The tyre inflation system has to react for the above test pressure chart & result will be filled in the test chart.

**Working Principle Running Wheel Air Pressure Monitoring System**

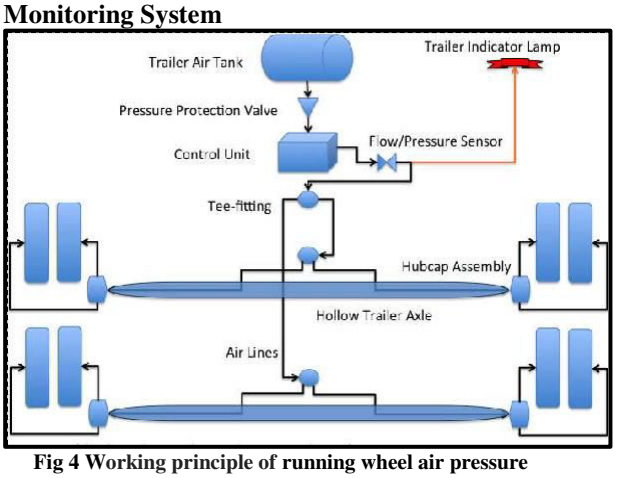



**Fig 4 Working principle of running wheel air pressure monitoring system**

Fig:-4 indicates working principle of running wheel air pressure monitoring system Individual tire pressures were transferred to the sensors using a network of rotary unions, valves, Couplings, hoses, and transducers. To allow for wheel rotation, rotary unions were installed in the air lines at each wheel to couple the air compressor & pressure monitoring sensor switch, which triggers the compressor. A tire pressure monitoring system (TPMS) is an electronic system designed to monitor the air pressure inside the pneumatic tires on various types of vehicles. TPMS report real-time tire-pressure information to the Driver of the vehicle, either via a gauge, a pictogram display, or a simple low-pressure warning light. TPMS can be divided into two different types — direct (DTPMS) and indirect (ITPMS). TPMS are provided both at an (factory) level as well as an aftermarket solution

The presence of the actuator also ensures that the system would be automatic. Also, because this system only involves small actuator-controlled valve power requirements for this process would be minimal. Nevertheless, several items have ultimately led this concept to be considered deficient. Because of the limited volume of the reservoir, several refills may be necessary over the life of the system. In addition, the presence of the reservoir would introduce extra mass in the system and a potential rotating unbalance. This rotating balance could lead to a potential hazardous condition due to vehicle instability. Maintenance effort for this system would also be high as the reservoir would have to be removed before servicing any other components in the system. Moreover, the appearance of a reservoir on such a conspicuous surface such as the wheel rim would result in unsatisfactory visual aesthetics.

The final concept documented in this section involves a high-pressure reservoir system. In this setup, a high pressure reservoir would be placed directly on each wheel rim with air passageways linking the reservoirs with the tires. Actuator-controlled valves would then maintain the tire pressures as specified by the consumer. It should be noted that the actuator-controlled valve would be nominally set to the cold tire pressure and that a pressure relief valve would be placed on each tire to reduce pressure as necessary

**Fig 5 Model of running wheel air pressure monitoring system**

**Fig 6 layout and arrangement of running wheel air pressure monitoring system**

**Factors Influencing Tire Pressure Monitoring System**

(i) The precondition for fleets to match their needs with the specific capabilities of the various tire pressure systems when making purchase decisions.

(ii) The importance of user readiness, in terms of personnel training and preparation of internal operating procedures around new tire pressure systems, to ensure successful deployment in the fleet.

(iii) The need for the functionality of tire pressure systems (alerts, warnings, data reporting) to integrate relatively seamlessly into normal, day-to-day fleet operations without requiring significant system oversight or maintenance by the fleet.

(iv) A tire pressure monitoring system or TPMS will be distinguished from an ATIS (automatic tire inflation system) and a CTIS (central tire inflation system) by the following features

(v) A TPMS monitors pressure and in some cases, temperature, for each individual tire. TPMS can identify underinflated tires by using a device that senses pressure and temperature and in most cases, transmits the data and displays it to the operator.

A TPMS monitors each tire based on a pre-set target pressure, and issues alerts based on the difference between the target pressure and the actual measured pressure in the tire

**Advantages of Running Wheel Air PMS**

When selecting a tire pressure monitoring system ("TPMS"), and assuming that a tire pressure

monitoring system has all the necessary capabilities (temperature, over and under inflation alarming and slow leak detection), then the following advantages can be realized

1. Overall tire life can be substantially extended by monitoring tire pressure in real time. (A 20% under-inflated tire reduces tread life by approximately 25 %.)
2. Properly inflated tires predictably increase overall fuel economy.
3. Tires that are under-inflated by 20% lose approximately 30% of the life of the casing. A TPMS system significantly extends the life of the casing so that a tire can be safely rethreaded up to five (5) times to a useful life of over 1 million miles.
4. Increases overall safety of the vehicle by detecting overheated, under-inflated, over-inflated and slow-leaking tires.
5. Helps to prevent late deliveries from unforeseen tire mishaps.
6. Reduces overall liability exposure for property damage and workers compensation and insurance cost increases from tire blow-outs and tire separation.
7. Provides the means to help compare various manufacturers' overall tire performance (tread wear, rethreads, etc.) as it relates to tire expense by brand.
8. Aids in tire benchmarking by collecting, comparing and statistically analysing tire data. Such things as tire temperature versus tire pressure levels over time, by vehicle type, vehicle weight and tire position can be documented, leading to improved performance against predetermined benchmarks.
9. Increased traction
10. Longer tire life.
11. Reduced fuel consumption.
12. Protection against soil compaction.
13. Increased driving stability.
14. Enhanced productivity for field work.
15. Improved pulling performance.

## V. CONCLUSIONS

The dynamically-self-inflating tire system would be capable of succeeding as a new product in the automotive supplier industry. It specifically addresses the needs of the consumers by maintaining appropriate tire pressure conditions for:

(i) Reduced tire wear
(ii) Increased fuel economy
(iii) Increased overall vehicle safety

Because such a product does not currently exist for the majority of passenger vehicles, the market conditions would be favourable for the introduction of a self-inflating tire system. Through extensive engineering analysis, it has also been determined that the self-inflating tire system would actually function as desired. In particular, the product would be capable of:

• Providing sufficient airflow to the tire with minimal leakage

• Withstanding the static and dynamic loading exerted on the rotary joints Note that likewise, this system would not produce any negative dynamic effects (such as CV joint failure due to resonance) on surrounding systems. Most significantly, the self-inflating tire system would be a successful product because of its economic benefits to investors. Specifically, the final product would:

• Sell at about $900/unit, with total first year profit and sales of nearly $2.1 million and 58,000 units, respectively

• Experience 12% annual market growth each year for the first five years of the product, bringing total sales up to 370,000 units

• Break-even on the capital investment in just under three years for further development of this product, we recommend increasing the capability of the system

## SCOPE FOR FUTURE WORK

From this survey administered a 27 question to potential users for this dynamically self-inflating tire system to gain an understanding of their knowledge regarding the topic as well as to observe their preferences for certain aspects that we can incorporate with our system. Below is a list of the main points discovered.

From our results:

1. Only 4.3% of those surveyed check their tire pressures on a weekly basis.
2. Only 5.3% of survey participants check their tire pressures for fuel economy.
3. Most participants check their tire pressures for safety reasons instead of tire wear.
4. Those that do not check their tire pressures either do not care or do not know the correct pressures.
5. Roughly half of those surveyed have had their tires replaced in the 3-4 year timeframe.
6. Almost half of those surveyed never check their tire tread depth.
7. Those that do check their tread depths mostly check it for safety concerns.
8. Those that never check their tread depths either do not know the correct depth or do not care.
9. 70% of those surveyed drive on the highway a moderate amount (50% of all driving done on highways)
10. 48% of survey participants drive over the legal speed limit.
11. 52% of those surveyed drive compact cars and the rest sports cars, trucks/suns, and mid-size cars.
12. 66% care about vehicle appearance.
13. 86% of survey participants listen to music/radio at a moderate to loud volume level.

14. Almost half of those surveyed get their vehicle service every 6 months and are mostly willing to wait either 1 hour or 1 day depending on the type of service required.
15. 70% of survey participants would look to purchase a middle grade vehicle
16. With regards to system override, people are most interested in being able to control the pressures in each tire.
17. Of all options presented to them, people mostly want a light to show them that the system is turned on as well as a numeric display of the pressures in each tire.
18. 52% of those surveyed expect to see a return on investment for this device in 1 year.

Thus, these survey results were used to narrow down the scope of our project and help to define key targets. The following is a list of conclusion and changes to our design scope based on our survey

## ACKNOWLEDGMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible, whose consistent guidance and encouragement crowned our efforts with success. I consider myself proud to be part of **Nitte Nagarjuna College of Engineering & Technology,** the institution which stood by throughout my endeavour career. I would like to express our gratitude to our beloved principal **Dr. S. G Gopala Krishna,** NCET for providing us congenial environment and surrounding to work in. It has been my great fortune to have **Dr. N. KAPILAN**, Professor & H.O.D Dept of ME (PG), NMIT Bangalore. In fact he has been the source of inspiration for me in and outside the classroom for the successful completion of my project. I would like to express my deepest gratitude to my guides **Mr. Chethan Kumar N,** Asst Professor, Dept of ME, NCET, Bangalore, for his valuable guidance and encouragement. I would like to thank my **Parents, brother** & **sister** for their co-operation and guidance through all aspects of my life.

## REFERENCES

[1] The North American Council for Freight Efficiency (NACFE www.nacfe.org) is a non-profit organization dedicated to doubling the freight efficiency of North American goods movement
[2] The Federal Motor Carrier Safety Administration(FMCSA) and National Highway Traffic Safety Administration (NHTSA) evaluations of dual tire pressure equalizers
[3] In 2003, the Federal Motor Carrier Safety Administration reported the results of a widespread data collection effort to document actual tire pressures on trucks during their normal operations (FMCSA, 2003).
[4] NACFE operates as a non-profit with the objective of providing independent and unbiased research to support the transformation of the transportation industry.
[5] Grygier, P., Garrott, W.R., Mazzae, E.N., Mac Isaac, Jr., J.D., Hoover, R.L., Elsasser, D., and Ranney, T.A. 2001. An Evaluation of Existing Tire Pressure Monitoring Systems, U.S. Dept. of Transportation, DOT HS 809 297
[6] FMVSS No. 138. 2006. U.S. Dept. of Transportation, National Highway Traffic Safety Administration, FMVSS No. 138, Tire Pressure Monitoring Systems, 49 CFR, Ch. V.
[7] Brady, S., Nicosia, B., Kreeb, R., and Fisher, P. 2007. Tire Pressure Monitoring and Maintenance Systems Performance Report, U.S. Dept. of Transportation, FMCSA-PSV-07-001.
[8] Benedict, Robert Leon, The Goodyear Tire & Rubber Company, Akron, OH, "Self-Inflating Tire", U.S.Patent Number 8,113,254, February 14, 2012.
[9] Bridgestone Firestone, North American Tire LLC, "Real Answers, Tires& Truck Fuel Economy", 2008.CODA Development, 2008, www.selfinflatingtire.com.
[10] Doran Tire Pressure Monitoring System, 360 HD and 360 SL sales brochures, Doran Manufacturing LLC,2013.Doran Tire Pressure Monitoring System, 360 HD and 360 SL User Manual #3673, Revision 1, Doran Manufacturing LLC, 2007.
[11] Evans, Larry, John Harris, Ed Terrill, and James D. Mac Isaac, Jr, "The Effects of Varying the Levels of Nitrogen in the Inflation Gas of Tires on Laboratory Test Performance", National Highway Traffic Safety Administration, Report No. DOT HS 811 094, March 2009.

# Impact of Natural Additives on the Performance of a Bio-diesel Fuelled Diesel Engine

**Mamatha G C[1] Dr N Kapilan[2]**
[1,2]Department of Mechanical Engineering
[1,2]Nagarjuna College of Engineering and Technology Bengaluru, India

*Abstract*— The biodiesel is a renewable alternative to the fossil diesel as the properties of the bio-diesel is like to the fossil diesel. However, the bio-diesel have lower volatility and has lower oxidation stability. Hence, in this work we have chosen the Black seedoil, clove oil + Pg and turmeric oil as a natural additive for the honge biodiesel. Anti-oxidative properties and stability of ethanolic extracts of Black seed oil, clove oil + Pg and turmeric oil is studied. Along with that constituent's black seed,turmeric oil and clove oil+ accounting a 90% of essential oil content which preferred as additive to the biodiesel. Also, we calculated the effect of these additives on the fuel properties of the bio-diesel and its impact on compression ignition thermal efficiency and exhaust emissions. The additive concentration ratio of binary anti-oxidants is the key factor to get best synergy for greatest stabilization. In an engine, temperature has reaction completeness is the most critical fuel quality parameter as well as engines' durability and reliability. By adding natural additives to the biodiesel, as the amount of concentration increases it led to reduction in hazardous emissions through engine exhaust like NOx, CO2, HC's, CO decreases. But the O2 content increases in a engine exhaust. All these emissions are as compared with conventional diesel which gives the best results for lowering the environmental pollution.As the proper qualities of biodiesel blends met by adding these naturally available additives, these biodiesel blends can be used in most modern engines.

***Keywords:*** Biodiesel, Black Seedoil, Clove Oil, Turmeric, Additives

## I. INTRODUCTION

From day to day, in modern society, unconventional energy sources are constantly expanding due to the growing demand for the use of petroleum products as follows petrol, kerosene diesel and white gasoline. India imports over 70% of oil based goods from different nations. That is the reason you have to locate an elective fuel. Biodiesel is viewed as a satisfactory option in contrast to diesel. Nonetheless, it has less oxidation security. In this manner, we discovered added substances for reasonable powers that can be included with bio-diesel. Bio-diesel, a substitute for fuel acquired from an collection of fats, oils and fats, is important to ranchers for a few reasons: it be able to offer an extra promote to vegetable oils & creature fats, be able to enable ranchers develop fuel it requirements for farming hardware, and can diminish the country's reliance on import oil, since the fuel crude material can develop in the nation. It is a sustainable power source that can be help limit ozone depleting substances out flowing and reduces agriculture's carbon impressions. It is contributes least to an Earth-wide temperature boost in light of the fact that can carbon in fuel has been expelled on from the a air by the plants crude material.

## II. MATERIALS AND METHODOLOGY

- Alternative fuels: Honge biodiesel
- Natural additives: Black Seed oil, Turmeric oil, Clove oil + Propyl Gallate
- Mixing ratio: 500, 1000 and 1500 ppm with the biodiesel
- Determination of fuel properties: As per ASTM Procedures
- Engine test setup: Diesel engine experimental setup
- Engine Exhaust Emission Analyzer: AVL Exhaust Gas Analyzer
- Engine Exhaust smoke Analyzer: Smoke meter test setup.

Biodiesel manufacturing is the method of manufacturing biofuels, biodiesel, through chemical reactions of at transesterification and an esterification. includes vegetable or animal fat and oils that react with short chain alcohols (generally methanol or ethanol). The alcohols used want to be of low molecular weight, with ethanol being the maximum used due to the low rate. however, it is viable to acquire higher conversions in biodiesel using methanol. although the transesterification response which may be catalyzed through using the use of acids or bases, the most commonly used approach of producing is catalyzed transesterification. This path has decrease reaction times and catalyst expenses than those presented via manner of acid catalysis. however, alkaline catalysis it has a first-rate drawback of fairly sensitivity, which is observed in both water and loose fatty acids gift within the oils. a primary constituent of glyceroides tri the use of anhydrous alcohol within the presence of a base chain together with a sodium hydroxide as catalyst produces the monoalkyl fatty acid ester (reputation), this is known as biodiesel and glycerin as a derivative, as shown in figure.

### *A. Oil Extraction:*

The honge seeds are overwhelmed in a screwdriver to extract the oil. The crude oil turned into then filtered and used for biodiesel production. The productions of a bio-diesel from waste vegetable oils offers a 3-sided, financial, nature and waste management solution.

The time period "used vegetable oil" (WVO) refers to vegetable oil that has been utilized in meals manufacturing and is not usable for its intended use. India's biodiesel processing capacity is predicted at six hundred,000 lots regular with 12 months. Used cooking oil (WCO) is a residue of a ramification of assets, which includes consuming places, Commercial Corporation or domestic elements, which no longer handiest harm human fitness, but also cause environmental troubles. But, OMA can be used as a uncooked cloth for biodiesel production. On this manner, the producing of biodiesel from OMA to partly update petroleum diesel is an opportunity way of protective the environment and electricity protection. The american Society for testing and

All rights reserved by www.ijsrd.com 

materials (ASTM) defines biodiesel gas as monoalkyl esters of prolonged chain fatty acids in derived from a renewable lipid uncooked cloth, along with vegetable oil or animal fat. Determine 4.2.2 shows the steps worried in getting prepared the Honge oil.

The types of biodiesel can be a classified according to their origin and the production process, as follows:

1. Esterificated oils 2. Non-esterificated oils
3. Waste vegetable oils

Honge Tree

Honge Seeds

Biodiesel

*B. Steps Involved in Biodiesel Production:*

*1) Pre-treatment for high ffa oils*

The oils are glycerol esters of fatty acids, glycerine molecules and oily acids. these triglycerides a oxidized to unfastened acids (FFA) in the course of storage. these free oily acids form soap throughout the transesterification process. If the FFA exceeds three%, biodiesel restoration is appreciably reduced. consequently, an acid remedy is administered at some stage in which the FFA are transformed to biodiesel with the aid of acidification of the acid. Vegetable oils that have a low content material of loose fatty acids (less than 3%) can be converted to biodiesel through direct transesterification. The acidification of the acid changed into done the usage of focused sulfuric acid as catalyst and FFA40:1.The volume of H2SO4 (ml) asked changed into decided through (FFA weight * zero.05) / H2SO4 density) the burden of FFA in a liter changed into determined primarily based at the acid variety. The methanol-H2SO4 mixture was introduced slowly and allowed to react for 1 hour. After the reaction turned into completed, the aggregate was stored for an hour, forming a skinny layer wealthy in better acid. The top level became discarded and the lower level become analyzed to decide the FFA content material.

The decrease layer changed into then subjected to a transesterification manner. The required amount of catalyst became decided through titration as shown in figure.

Biodiesel and glycerin layer

*C. Titration Testing:*

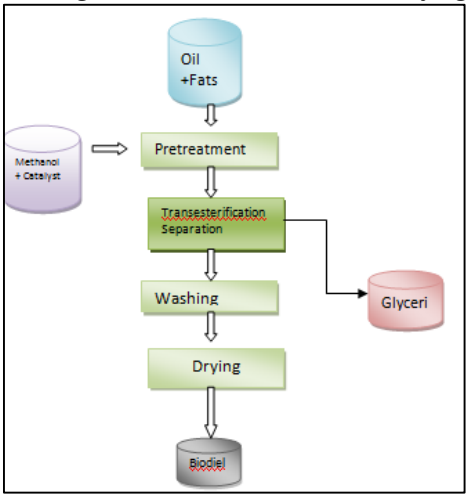
The amount of NaOH required to neutralize the FFA gift in the oil was determined with the aid of titration checking out the usage of known awareness NaOH solution. generally, the oil without FFA requires three.5gNaOH for transesterification. more quantity of NaOH need to be brought to neutralize FFA which consequently shaped into cleaning soap.

The total amount of catalyst (NaOH) required for the reaction was calculated by using the formula

Amount of NaOH required Amount of NaOH required
Transesterification of + for neutralization of FFA
Triglyceroids (3.5 g ) (titration)

The biodiesel was then dried by heating at 110'C till the humidity content be removed wholly. It was frozen and clean, then subjected for further analysis. Figure: shows the biodiesel washing with water and drying of Biodiesel using heating

Washing of biodiesel with water and Drying.




All rights reserved by *www.ijsrd.com* 

## III. ADDITIVES

### *A. Black Seed Oil:*

The Black Seed oil has good antioxidant properties and hence it will be used as additive in this work. It contains thymoquinone, which is an anti-inflammatory compound, antioxidant and hence it has better antioxidant activity. Figure 4.3.1 shows the Black seed oil.


Black seed oil

### *B. Turmeric oil:*

The Turmeric oil has good antioxidant properties and hence it will be used as additives in this work. The data indicated the presence of twenty-five compounds in turmeric oil. Aromatic in turmerone, a-zingiberene, ß-(Z)- farnesene, aromatic curcumene, turmerone and the Curlone are the major compounds as in turmeric oil. Figure 4.3.2 shows the Turmeric oil.


Turmericoil

### *C. Clove oil +Pyrogallol:*

Clove oil is a mixture of different compounds, with the three main active ingredients being eugenol, eugenyl acetate and caryophyllene. Figure 4.3.3 shows the Clove oil. It has essential oil content about 87%, which can be used as a natural additive.


Clove oil

### *D. Sample Preparation:*

Honge Bio-Diesel with Black Seed Oil

## IV. EMISSION TEST

An emission screening cycle, it is a protocol and it accommodate in an emission general to permit new release and parallel measurement of exhaust emissions for one-of-a-kind vehicles. Vehicle is operated while cycles specify the specific situations below which the engine sooner or later of the emission check. There are numerous methods to test series issued by means of the usage of diverse national and international governments and operating organizations. Particular parameters in a test cycle, it includes a variety of pace, load and working temperature. Theoretically those are particular as to mainly and nearly represents the variety of situations underneath which ther engine may be operated in actual use. Due to the fact it's far unrealistic to check an engine or vehicle below each practicable aggregate of pace, load, and temperature, this could no longer literally be the case. Car and engine producers may capitalize the restricted range of take a look at new release situations within the cycle via the usage of programming their engine management systems to control emissions to regulated ranges on the suitable test factors contained in the cycle, but generate a splendid deal more pollution under situations completed in real operation but now not represented in the check technology. The ones consequences in real emissions higher than the requirements are imagined to allow, reduces the necessities and public health as shows in figure4.9.

### *A. ASTM Procedure:*

heat up time: 7min.
Operating- temperature: 5 to 45OC
Relative- Humidity :< 95 percentage
Interface: RS232C, pickup, oil- temperature probe.

Fig. 4.9: AVL Gas Analyzer

### *B. Smokemeter Test*

Smoke capacity units degree the optical homes of diesel smoke, introducing a slanted method to quantify diesel

All rights reserved by *www.ijsrd.com* 

particulate discharges. There are organizations of units: darkness meters, which assess smoke in fumes gases, and smoke assortment meters, which optically check the sediment assembled in paper channels. Connections were progressed to evaluate PM mass outflows essentially dependent on obscurity estimate. Second-generation opacity meters based totally absolutely actually at the diffusion of laser mild are masses extra sensitive and appear promising for utility to extra moderen engines with an lousy lot lower particle emissions. Diesel Exhaust Smoke meters, additionally known as opacity meters, discover and measure the quantity of moderate blocked in a pattern of smoke emitted through diesel engines from automobiles, cars, ships, buses, motorcycles, locomotives and massive stacks from commercial operations. The smoke meter readout shows the smoke density giving a diploma of the performance of combustion. This makes the smoke meter an terrific diagnostic device to make certain proper protection of diesel engines for stepped forward fuel financial system and protection of the surroundings.

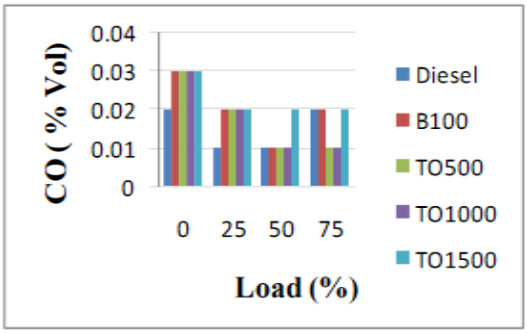
Partial drift non-stop gasoline sampling blended with a heated and temperature-controlled smoke chamber compensates for adjustments in strain and check situations to provide you the most accurate readings possible.

All cutting-edge Diesel Exhaust Smoke Meters need to diploma diesel emissions (darkish smoke) in Opacity (N) and/or Smoke Density (ok) in line with SAEJ1667.

There become quite some misconception approximately the Diesel Exhaust monitoring and size in recent times all constant with the sector's requirement to lessen CO2 emissions. This is why the government introduced a by way of manner of-regulation-model for adoption via the one of a kind municipalities in SA as an smooth manual as indicates indicates in figure

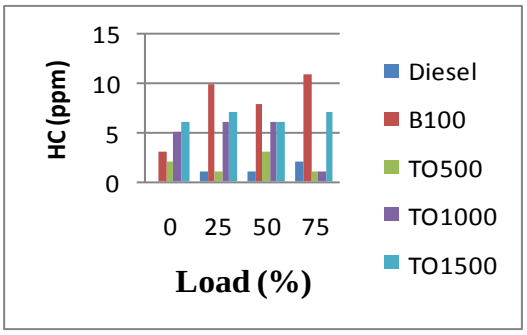
## V. RESULTS AND DISCUSSIONS

### A. *Load V/s CO*



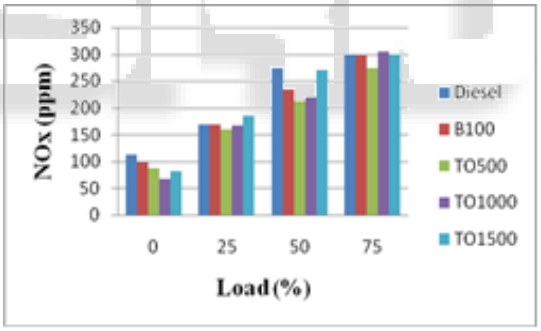

CO emission at distinct engine loads and with exceptional fuels and additives. From the figure, it's miles found that the version in CO emission is low at low loads. However, the version is full-size at higher hundreds because of consumption of huge amount of fuel. The diesel gasoline consequences in better CO emission in comparison to biodiesel. The biodiesel is brought with components because of in decreasing CO emission.

### B. *Load V/s Hydrocarbons*



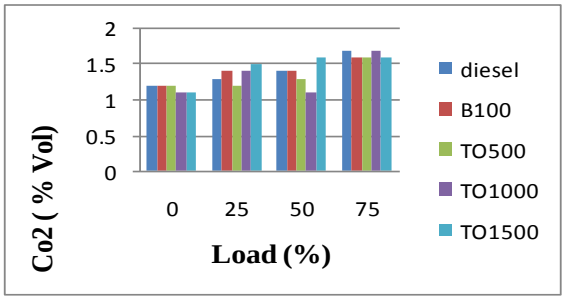

Variation of HC's emission at different engine loads and with different fuels and additives. From the figure, it is observed that the variation in HC's emission is low at low loads. However, the variation is significant at higher loads due to consumption of large amount of fuel. The diesel fuel results in higher HC'semission as compared to biodiesel. The biodiesel is added with additives due to in lower HC's emission.

### C. *Load V/s NOx*




NOx emission at different engine loads and with different fuels and additives. From the figure, it is observed that the variation in NOx emission is low at low loads. However, the variation is significant at higher loads due to consumption of large amount of fuel. The diesel fuel results in higher NOX emission as compared to biodiesel. The biodiesel is added with additives due to in lower NOX emission

### D. *Load V/s CO2*




All rights reserved by *www.ijsrd.com* 

CO2 emission at different engine loads and with different fuels and additives. From the figure, it is observed that the variation in CO2 emission is low at low loads. However, the variation is significant at higher loads due to consumption of large amount of fuel. The diesel fuel results in higher O2 emission as compared to biodiesel. The biodiesel is added with additives due to in lower O2 emission.

## VI. CONCLUSIONS

The biodiesel is a renewable alternative to the fossil diesel as the properties of the bio-diesel is like to the fossil diesel. However, the bio-diesel have lower volatility and has lower oxidation stability. Hence, in this work we have chosen the Black seedoil, clove oil + Pg and turmeric oil as a natural additive for the honge biodiesel. Anti-oxidative properties and stability of ethanolic extracts of Black seed oil, clove oil + Pg and turmeric oil is studied. Along with that constituent's black seed, turmeric oil and clove oil+ accounting a 90% of essential oil content which preferred as additive to the biodiesel. Also, we calculated the effect of these additives on the fuel properties of the bio-diesel and its impact on compression ignition thermal efficiency and exhaust emissions. The additive concentration ratio of binary anti-oxidants is the key factor to get best synergy for greatest stabilization. In an engine, temperature has reaction completeness is the most critical fuel quality parameter as well as engines' durability and reliability. By adding natural additives to the biodiesel, as the amount of concentration increases it led to reduction in hazardous emissions through engine exhaust like NOx, CO2, HC's, CO decreases. But the O2 content increases in an engine exhaust. All these emissions are as compared with conventional diesel which gives the best results for lowering the environmental pollution. As the proper qualities of biodiesel blends met by adding these naturally available additives, these biodiesel blends can be used in most modern engines.

## REFERENCES

[1] Venkataramanan Madhavan, Harish Venu, Effect of di-ethyl and Alluminium oxide Nano particle additives asbiodiesel - diesel-ethanol blends. Performance, combustion and emission characteristics, Journal of Mechanical Science and Technology,31, 409-420,2017.
[2] Prabu. A, Nano-particles a additive in bio-diesel on the operational characteristics of a diesel engine, Ain Shams Engineering Journal, 9,2343-2349,2018.
[3] A.Veeresh Babu, P.Ravi Kumar,M. Vijay Kumar, The impacts on combustion, performance and emissions of diodiesel by using additives in direct injection diesel engine, Alexandria engg. Journal,57 ,509-516,2018.
[4] Ibrahimlawan, Weimingzhou, Zaharaddeennasirugarba, Mingxinzhzng, Zhanhuiyuan, Lihuichen, Critical Insights Into The Effects Of Bi0-Based Additives On Biodiesels Properties, Renewable And Sustainable Energy Reviewas,102,83-95,2019.
[5] M.Mohamed Musthafa, Development of performance and emission characteristics on coated diesel engine fuelled by biodiesel with cetane number enhancing additive,energy,134,234-239,2017.
[6] N.Vedaraman, K.Vinukumar, A.Azhagurajan, S.C.Vettivel, A.Haiter Lenin, Biodiesel with nano additives from coconut shell for decreasing emissions in diesel engines,fuel,222,180-184,2018.
[7] A.Tamilarasu, K.Nanthagopal, B.Ashok,Aravind Mohan ,AjithJohny, comparative analysis on the effect of zinc oxide and ethanox as additives with biodiesel in CI engine energy.140,352-364,2017.
[8] NatesanKapilan, Chandra B.Sekar, production and evaluation of storage stability of honge biodiesel, International Journal of Engineering, 9,267-269,2011.
[9] L.Lin et al. Opportunities and challenges for biodiesel fuel ,88,1021-23,2011
[10] P.K. Joshi, S.S. Raju, P. Shinoj, Sustainable Development of Biodiesels: Prospects and Challenges, Economic and Political Weekly,52,55-61,2009
[11] A.Teklewold and Getinet, An ogronomic and seed quality evaluation of niger germplasm grown in Ethiopia plant breed,114,375-76,1995.

All rights reserved by *www.ijsrd.com* 

# Centre Fuselage Metal Cover Weight Optimization of Combat Aircraft using CFC

**Kasi Vishwanath MH[1] Balaji Y S[2] Prabhakar C G[3]**
[1]Student [2,3]Assistant Professor
[1,2,3]Department of Mechanical Engineering
[1,2,3]Nagarjuna College of Engineering and Technology, Bengaluru, India

*Abstract*— The hydraulic, electrical, avionics and ECS systems are to regular monitoring and maintain is very much required, where the doors and covers also included in an war aircrafts. The covers of such aircrafts are fastener by TRIDAIR attachments, depends upon the load acting on such covers can be used to determine the number of fasteners required under different parameters(weather). The work deals with design and analysis of aircraft fuselage by using carbon fiber composite (CFC) under bending loads and given boundary conditions, CATIA V5is used as modeling tool to model cover and MSC PATRAN and NASTRAN is used for analysis. To validate the results obtained from the NASTRAN, the theoretical calculations are done, CFC covers are better withstanding capacity compared with metallic and the weight on cover is reduced nearly 50% as compared to metallic cover.

***Keywords:*** CFC, Finite Element Methods, and Isotropic Plates

## I. INTRODUCTION

Conflict aircraft, or "fighter planes", are classified into multi-role fighters, bombers, attackers, and electronic warfare support. Mutation which, includes fighter-bombers, like the MiG-23 ground-attack aircraft also Soviet Ilyushin Il-2 Shturmovik. Also like the long-range maritime patrol aircraft, Hawker Siddeley Nimrod and S-3 Viking equipped to attack with anti-ship missiles also anti-submarine weapons.

Composite material has a long history of usage. There beginning is unknown, but all recorded history contains references to some form of composite materials. Which is a combination of more materials on macroscopic scale to a useful material? The properties of composite usually reveal the best grade of their constituent and usually some qualities are neither constituent possesses. Composite materials can be molded efficiently to meet the requirements like strength, stiffness and other specification in all assorted directions.

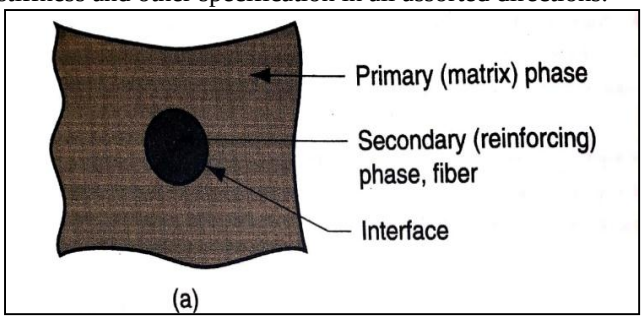



Fig. 1: composite material parts

Composite materials usage in the Aircraft Industry have overcome complications that have been encountered the usage of materials individually. Constituent materials retain their properties in composites which either dissolve or otherwise combine completely into each other. The materials can be of 'hybrid' material with modified structures.

The development of high-temperature, light-weight resistant composite materials that allow next generation of high-performance, economical aircraft designs to occur. Usage of such materials with improved efficiency and reduce the costs of aircraft. Composite materials can be formed into various forms and the fibers to be wounded tight to increase strength. The composites can be layered, with fiber each layers fuming in various directions. That allows for design models with distinctive properties

Fuel utilization depends on certain parameters, including: aircraft dry weight, payload weight, and grade of fuel, takeoff speed, climatic changes, and other things. The weight of an aircraft materials made by composites is reduced by approximately 20%, in the case of the 787 Dream liners. A simple calculation of overall fuel savings with 20% weight reduction done below for the Airbus A340-300 aircraft.

The review of available literature on topics such as aerodynamics, modeling tools and analysis tools available that are relevant to this project. This chapter has been classified to various sections. The various forces on the airplane n flight, the axes of the airplane, modeling tool, UNIGRAPHICS, finite element methods and analysis package MSC/NASTRAN and PATRAN.

## II. METHODOLOGY

Finite element analyses are conducted for the stress concentration analyses of rectangular plate. The Finite plates have dimensions 330 mm (x-direction), 290mm (y-direction), and 5 mm (z-direction) as shown in Fig.2. Exploded view of CFC assembly of 17 layers as shown in Fig.3. Material properties and load cases for CFC and Aluminum shown in table 1.

To clearly observe the affect under load, MSC/NASTRAN, a general purpose finite element program, is used for the analysis.

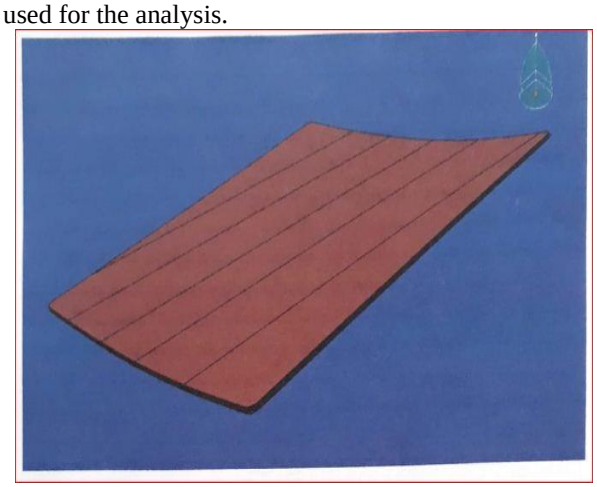


Fig. 2: Model of Finite Plate using CATIA.

All rights reserved by www.ijsrd.com 

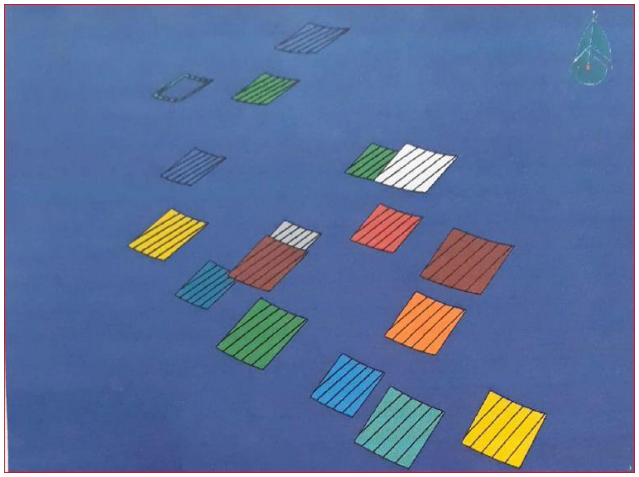


Fig. 3: Exploded view of CFC assembly

| Material | CFC | Aluminum |
|---|---|---|
| Young's modulus | 65 GPa | 75 GPa |
| Poisson's ratio | 0.235 | 0.3 |
| Density & /or Areal weight | 250 g/m$^2$ | 2780 Kg/m$^3$ |
| Surface pressure distribution | Normal to surface | Normal to surface |
| Pressure on the cover | 50 Kpa | pa |

Table 1: material properties and load cases

For analysis the material is considered to isotropic ductile material, for some combinations of supports conditions and loading conditions the data is not readily available. Hence the free edge condition with doublers resting on a member is assumed to have a value, little lesser than that of a simply supported member without doublers with free edge.

Initial buckling of an isotropic flat plate whether it is compression or in-plane bending or shear is described by the following governing equation:

$$\sigma_{CR} = \frac{k\pi^2 E}{12(1-\nu^2)}\left(\frac{t}{b}\right)^2$$

a- Panel dimension b - Panel dimension t - panel thickness $\sigma_{cr}$ - Critical stress k - Buckling coefficient η - Plasticity correction factor.

## III. Finite Element Model

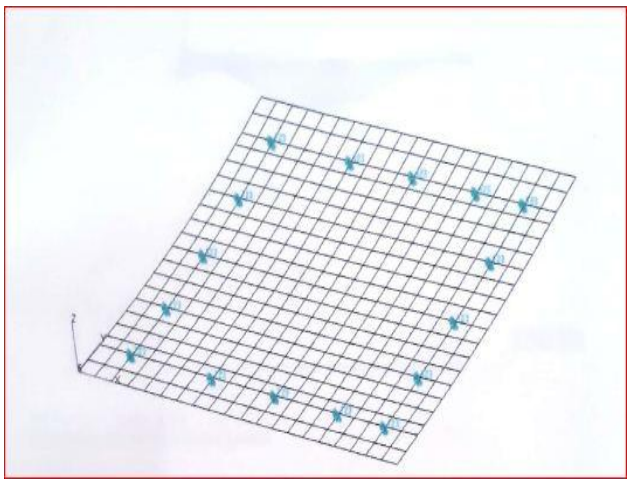


Fig. 4: Boundary conditions

The Figure 4 shows the component, in which rigidly fixed all degrees of freedom in a rectangular manner with equal edge distance. The pressure acting on the cover plate or modeled cover is normal to the surface as shown in figure 5.

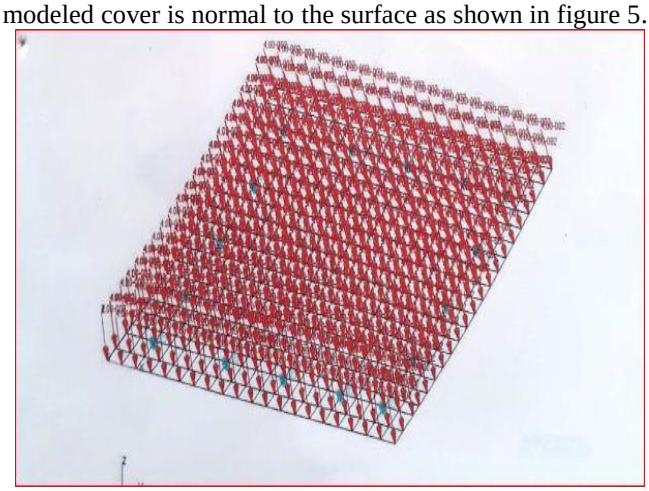


Fig. 5: Pressure acting normal to the surface

## IV. Results and Discussion

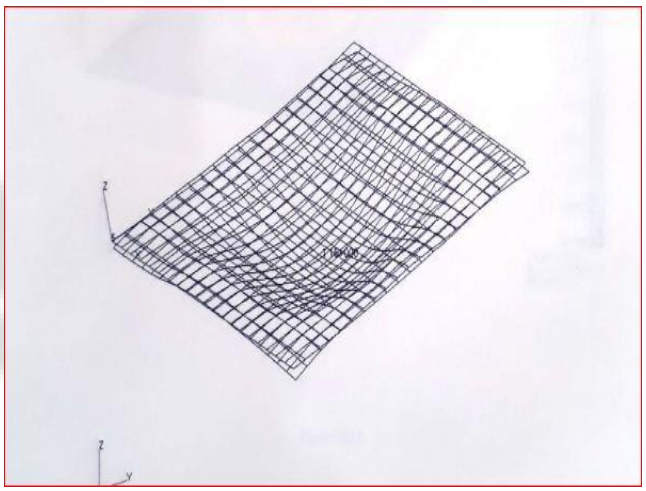


Fig. 6: displacement due to pressure force

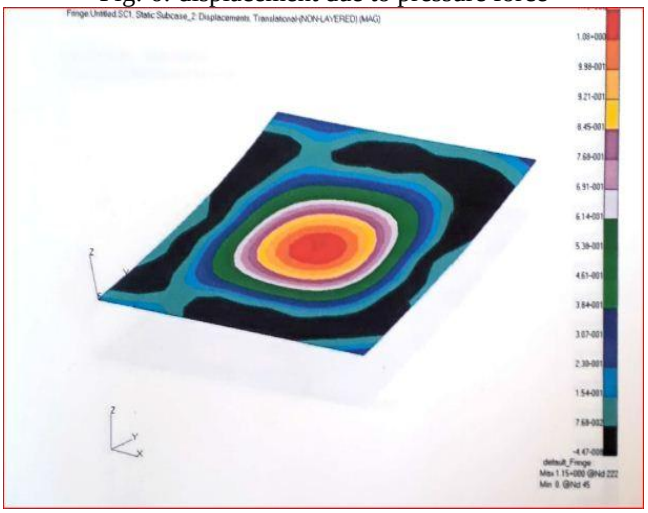


Fig. 7: Displacements

All rights reserved by *www.ijsrd.com* 

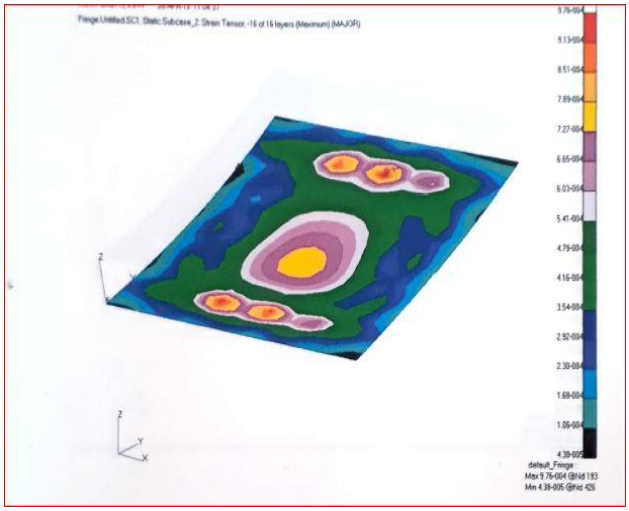


Fig. 8: maximum principle strain

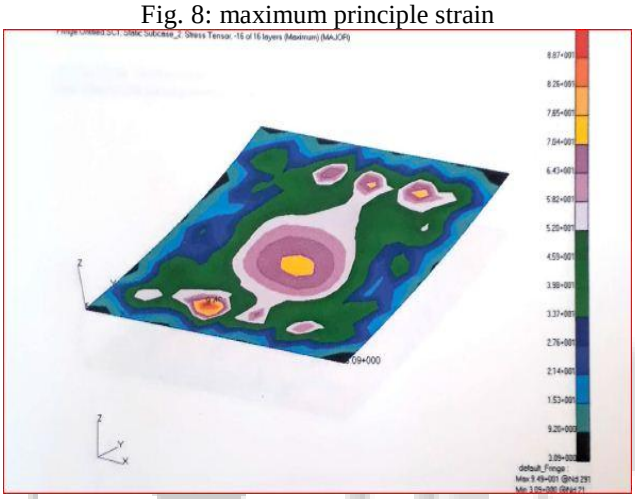


Fig. 9: maximum principle stress

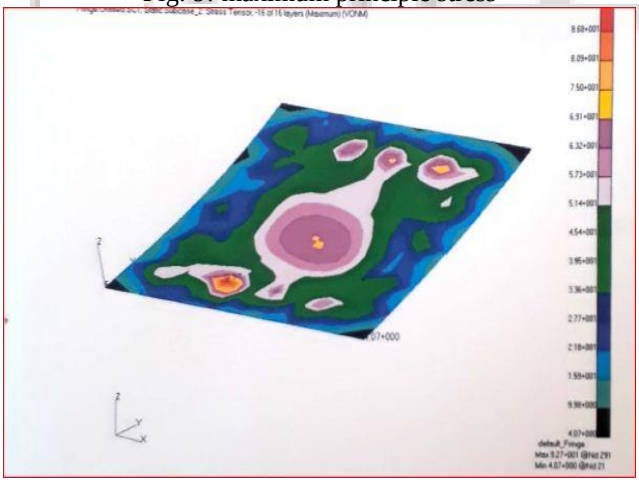


Fig. 10: von mises stress

Percentage of weight reduction
Composite cover weight calculation
Area = a * b
Area = 0.390 * 0.290 = 0.0957 m2
Copper weight = areal weight * area
= 0.0957 * 0.120 = 0.01196 kg
Glass cloth weight = 0.0957 * 0.230 = 0.022011 kg
CFC weight = 16 * 0.0957 * 0.240 = 0.3674 kg
Total weight of composite cover is sum of CFC weight, Copper cover weight and Glass cloth weight = 0.4015 kg
Metal cover weight calculations:
Weight of metal cover = area * thickness * density + stiffener weight
= 0.0957 * 2.7 E-3 * 2780 + 0.059 = 0.7773 kg
Therefore % weight reduction = (0.7773 – 0.4015) / 0.7773
= 0.483 i.e. 48% weight reduction.

## V. CONCLUSIONS

Weight reduction is the greatest parameter of composite material usage and its key factors in decisions regarding its selection. Other benefits includes is high corrosion resistance and resistance to damage from fatigue. These will play major role in minimizing the operating costs of the aircraft, further enhancing its efficiency.

Composites are used as a replacement material for aircraft structures, replacing aluminum alloy that has been used for last decades. Introduction of composites materials in advanced aircrafts has once again proves that more reliable than conventional materials. However, composites are expensive to fabricate.

- Airframe composites have the advantages of:
- high specific strength and stiffness
- tailored directional properties
- non-corroding in salt environments
- excellent fatigue resistance
- dimensional stability
- Reduced number of parts required (compared to metal components)

However, these composites are susceptible to:

- impact damage
- moisture pick-up
- lightning strikes
- extremes of temperature

## VI. FUTURE SCOPE

Self-repairing composites are composites that are able to repair cracks on the aircrafts as they happen. By designing a network of glass rods filled with resin, it is possible to stop the crack from propagating and repair the aerodynamics characteristic of the aircraft when crack happen in flight.

However, there are limitations in self-repairing like the supply of the resin in the webbing. A system with vascular network should be used to resupply the resin so that self-repairing composites serve their purpose from time to time.

## REFERENCES

[1] Athreya Nagesh, Ola Rashwan and Ma'moun Abu-Ayyad "Optimization of the Composite Airplane Fuselage for an Optimum Structural Integrity" Volume 1: Advances in Aerospace Technology Pittsburgh, Pennsylvania, USA, November 9–15, 2018.
[2] Adrien Boulle, Martine Dubé "Parametric study of an elliptical fuselage made of a sandwich composite structure" Mechanics Research Communications 69 (2015) 129–135.
[3] Ohapkin, S. Serokhvostov "optimization of spar mass and fuselage location to decrease loss of airplane lift force" ISSN 1648-7788. AVIATION, vol XI, no 3, 2007.
[4] D. Liu,H. Lohse-Busch,V. Toropov,C. Hühne &U. Armani "Detailed design of a lattice composite fuselage

All rights reserved by *www.ijsrd.com* 

structure by a mixed optimization method' taylor and francis online Pages 1707-1720 | Received 29 Apr 2015, Accepted 21 Nov 2015, Published online: 29 Dec 2015

[5] chongxin Yuan Otto Bergsma "Optimization of Sandwich Composites Fuselages Under Flight Loads" Applied Composite Materials February 2012, Volume 19, Issue 1, pp 47–64

[6] Y Prem Chand, K Krishna Veni. Weight and Strength Optimization of Airplane Fuselage Structure for different Materials, International Journal of Mechanical Engineering Research and Technology, Vol. 1, No. 2, November 2015.

[7] Edwin L. Fasanella and Karen E. Jackson, Yvonne T. Jones, Gary Frings and Tong Vu. Crash Simulation of a Boeing 737 Fuselage Section Vertical Drop Test

[8] Marampalli Shilpa, M. Venkateshwar Reddy, Dr. A. Siva Kumar. Design and Analysis of Fuselage Structure using Solidworks and Ansys, International Journal of Engineering Sciences and Research Technology, 3(9): September, 2014.

[9] Khairi Yusuf, Nukman Y., S. Z. Dawal, Devi Chandra, N. Sofia. Conceptual Design of Fuselage Structure of Very Jet Aircraft, Latest Trends on Theoretical and Applied Mechancis, Fluid Mechancis and Heat & Mass Transfer.

[10] Han – Gi Son, Deepak Kumar, Yong-Bin Park, Jin-Hwe Kweon and Jin-Ho Choi. Structural Design and Analysis of Composite Aircraft Fuselage Used to Developo AFP Technology, Aerospace and Informatics Engineering, Japan, February21-23, 2013.

[11] B. Karthick, S. Balaji, P. Maniiarasan. Structural Analysis of Fuselage with Lattice Structure, International Journal of Engineering Research & Technology, Vol. 2 Issue 6, June – 2013.

All rights reserved by *www.ijsrd.com* 

# Centre Fuselage Metal Cover Weight Optimization of Combat Aircraft using CFC

**Kasi Vishwanath MH[1] Balaji Y S[2] Prabhakar C G[3]**
[1]Student [2,3]Assistant Professor
[1,2,3]Department of Mechanical Engineering
[1,2,3]Nagarjuna College of Engineering and Technology, Bengaluru, India

*Abstract*— The hydraulic, electrical, avionics and ECS systems are to regular monitoring and maintain is very much required, where the doors and covers also included in an war aircrafts. The covers of such aircrafts are fastener by TRIDAIR attachments, depends upon the load acting on such covers can be used to determine the number of fasteners required under different parameters(weather). The work deals with design and analysis of aircraft fuselage by using carbon fiber composite (CFC) under bending loads and given boundary conditions, CATIA V5is used as modeling tool to model cover and MSC PATRAN and NASTRAN is used for analysis. To validate the results obtained from the NASTRAN, the theoretical calculations are done, CFC covers are better withstanding capacity compared with metallic and the weight on cover is reduced nearly 50% as compared to metallic cover.

***Keywords:*** CFC, Finite Element Methods, and Isotropic Plates

## I. INTRODUCTION

Conflict aircraft, or "fighter planes", are classified into multi-role fighters, bombers, attackers, and electronic warfare support. Mutation which, includes fighter-bombers, like the MiG-23 ground-attack aircraft also Soviet Ilyushin Il-2 Shturmovik. Also like the long-range maritime patrol aircraft, Hawker Siddeley Nimrod and S-3 Viking equipped to attack with anti-ship missiles also anti-submarine weapons.

Composite material has a long history of usage. There beginning is unknown, but all recorded history contains references to some form of composite materials. Which is a combination of more materials on macroscopic scale to a useful material? The properties of composite usually reveal the best grade of their constituent and usually some qualities are neither constituent possesses. Composite materials can be molded efficiently to meet the requirements like strength, stiffness and other specification in all assorted directions.

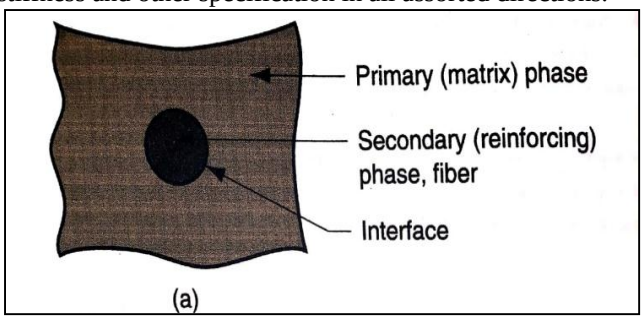



Fig. 1: composite material parts

Composite materials usage in the Aircraft Industry have overcome complications that have been encountered the usage of materials individually. Constituent materials retain their properties in composites which either dissolve or otherwise combine completely into each other. The materials can be of 'hybrid' material with modified structures.

The development of high-temperature, light-weight resistant composite materials that allow next generation of high-performance, economical aircraft designs to occur. Usage of such materials with improved efficiency and reduce the costs of aircraft. Composite materials can be formed into various forms and the fibers to be wounded tight to increase strength. The composites can be layered, with fiber each layers fuming in various directions. That allows for design models with distinctive properties

Fuel utilization depends on certain parameters, including: aircraft dry weight, payload weight, and grade of fuel, takeoff speed, climatic changes, and other things. The weight of an aircraft materials made by composites is reduced by approximately 20%, in the case of the 787 Dream liners. A simple calculation of overall fuel savings with 20% weight reduction done below for the Airbus A340-300 aircraft.

The review of available literature on topics such as aerodynamics, modeling tools and analysis tools available that are relevant to this project. This chapter has been classified to various sections. The various forces on the airplane n flight, the axes of the airplane, modeling tool, UNIGRAPHICS, finite element methods and analysis package MSC/NASTRAN and PATRAN.

## II. METHODOLOGY

Finite element analyses are conducted for the stress concentration analyses of rectangular plate. The Finite plates have dimensions 330 mm (x-direction), 290mm (y-direction), and 5 mm (z-direction) as shown in Fig.2. Exploded view of CFC assembly of 17 layers as shown in Fig.3. Material properties and load cases for CFC and Aluminum shown in table 1.

To clearly observe the affect under load, MSC/NASTRAN, a general purpose finite element program, is used for the analysis.

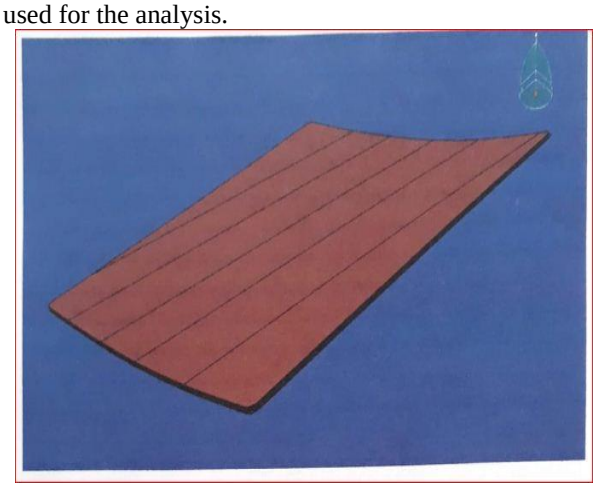


Fig. 2: Model of Finite Plate using CATIA.

All rights reserved by www.ijsrd.com 

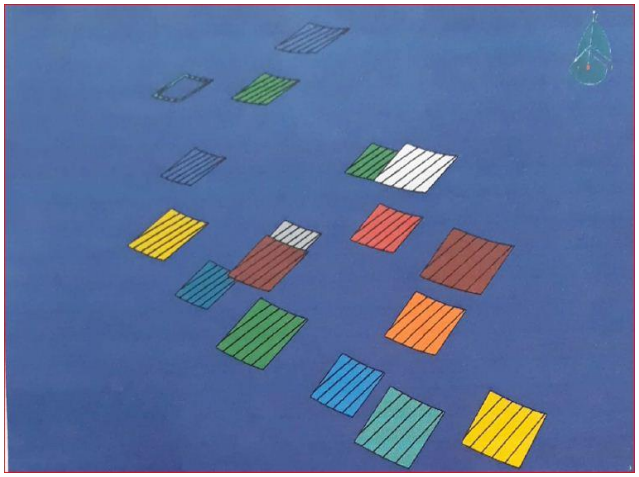


Fig. 3: Exploded view of CFC assembly

| Material | CFC | Aluminum |
|---|---|---|
| Young's modulus | 65 GPa | 75 GPa |
| Poisson's ratio | 0.235 | 0.3 |
| Density & /or Areal weight | 250 g/m$^2$ | 2780 Kg/m$^3$ |
| Surface pressure distribution | Normal to surface | Normal to surface |
| Pressure on the cover | 50 Kpa | pa |

Table 1: material properties and load cases

For analysis the material is considered to isotropic ductile material, for some combinations of supports conditions and loading conditions the data is not readily available. Hence the free edge condition with doublers resting on a member is assumed to have a value, little lesser than that of a simply supported member without doublers with free edge.

Initial buckling of an isotropic flat plate whether it is compression or in-plane bending or shear is described by the following governing equation:

$$\sigma_{CR} = \frac{k\pi^2 E}{12(1-\nu^2)}\left(\frac{t}{b}\right)^2$$

a- Panel dimension b - Panel dimension t - panel thickness $\sigma_{cr}$ - Critical stress k - Buckling coefficient η - Plasticity correction factor.

## III. Finite Element Model

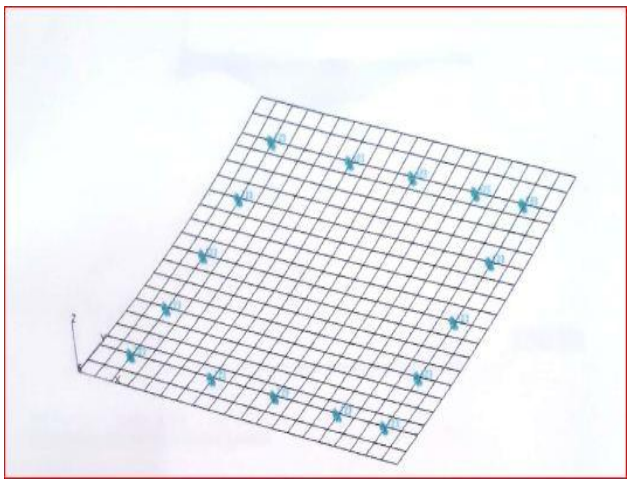


Fig. 4: Boundary conditions

The Figure 4 shows the component, in which rigidly fixed all degrees of freedom in a rectangular manner with equal edge distance. The pressure acting on the cover plate or modeled cover is normal to the surface as shown in figure 5.

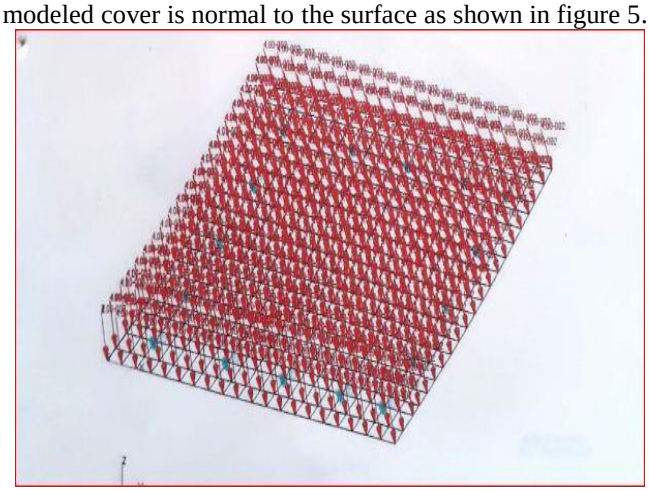


Fig. 5: Pressure acting normal to the surface

## IV. Results and Discussion

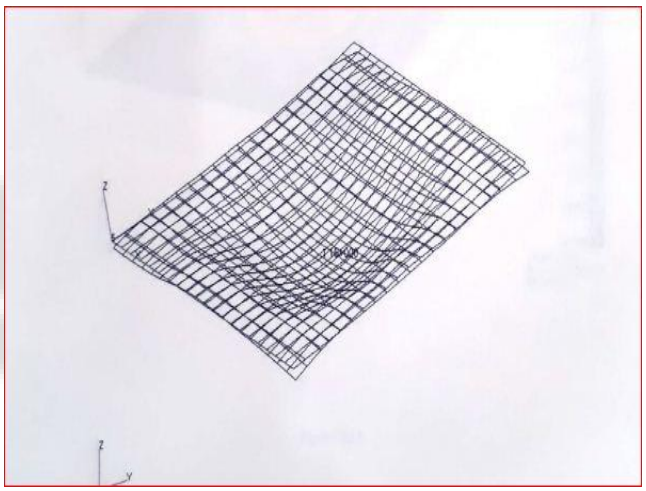


Fig. 6: displacement due to pressure force

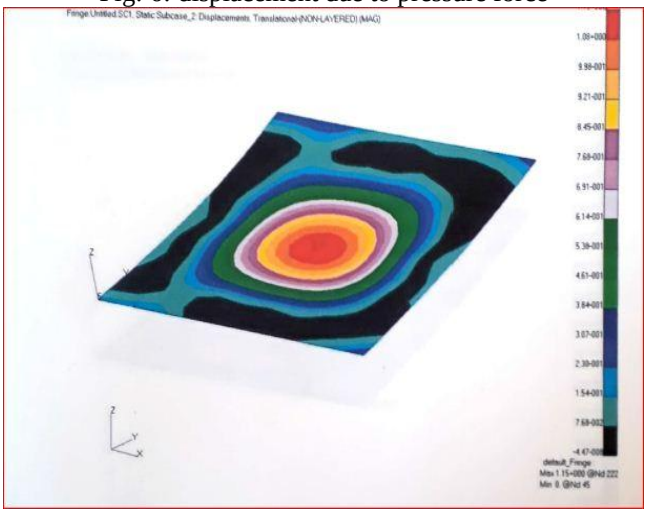


Fig. 7: Displacements

All rights reserved by *www.ijsrd.com* 

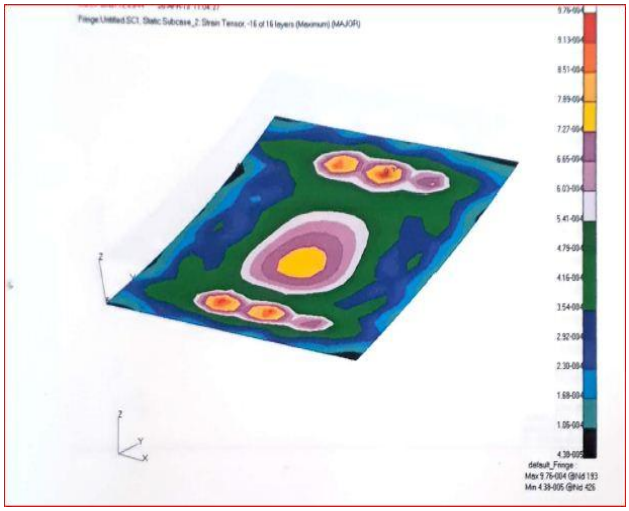


Fig. 8: maximum principle strain

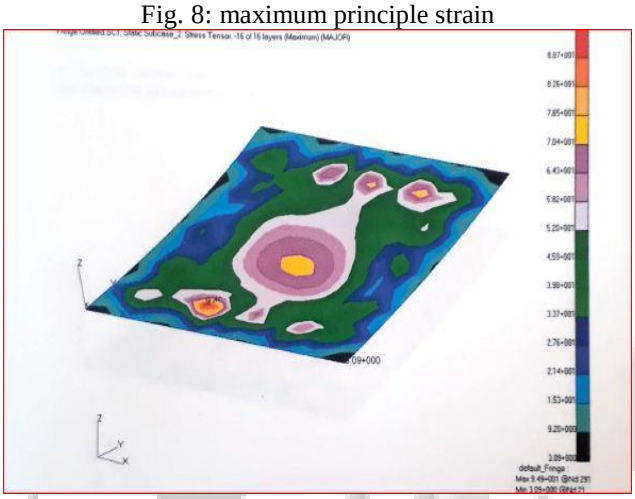


Fig. 9: maximum principle stress

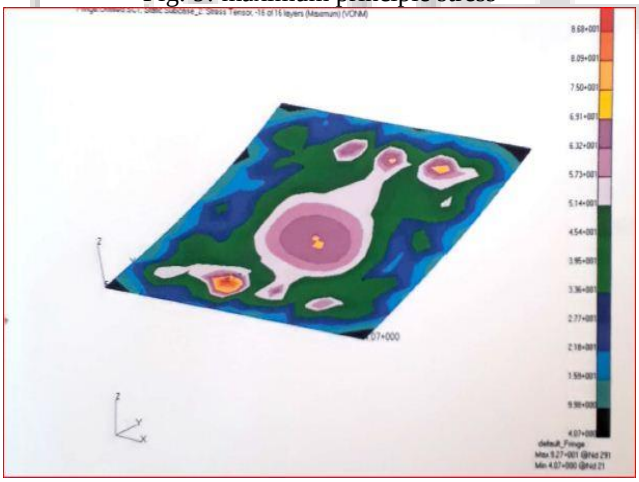


Fig. 10: von mises stress

Percentage of weight reduction
Composite cover weight calculation
Area = a * b
Area = 0.390 * 0.290 = 0.0957 m2
Copper weight = areal weight * area
= 0.0957 * 0.120 = 0.01196 kg
Glass cloth weight = 0.0957 * 0.230 = 0.022011 kg
CFC weight = 16 * 0.0957 * 0.240 = 0.3674 kg
Total weight of composite cover is sum of CFC weight, Copper cover weight and Glass cloth weight = 0.4015 kg
Metal cover weight calculations:
Weight of metal cover = area * thickness * density + stiffener weight
= 0.0957 * 2.7 E-3 * 2780 + 0.059 = 0.7773 kg
Therefore % weight reduction = (0.7773 – 0.4015) / 0.7773
= 0.483 i.e. 48% weight reduction.

## V. CONCLUSIONS

Weight reduction is the greatest parameter of composite material usage and its key factors in decisions regarding its selection. Other benefits includes is high corrosion resistance and resistance to damage from fatigue. These will play major role in minimizing the operating costs of the aircraft, further enhancing its efficiency.

Composites are used as a replacement material for aircraft structures, replacing aluminum alloy that has been used for last decades. Introduction of composites materials in advanced aircrafts has once again proves that more reliable than conventional materials. However, composites are expensive to fabricate.

- Airframe composites have the advantages of:
- high specific strength and stiffness
- tailored directional properties
- non-corroding in salt environments
- excellent fatigue resistance
- dimensional stability
- Reduced number of parts required (compared to metal components)

However, these composites are susceptible to:

- impact damage
- moisture pick-up
- lightning strikes
- extremes of temperature

## VI. FUTURE SCOPE

Self-repairing composites are composites that are able to repair cracks on the aircrafts as they happen. By designing a network of glass rods filled with resin, it is possible to stop the crack from propagating and repair the aerodynamics characteristic of the aircraft when crack happen in flight.

However, there are limitations in self-repairing like the supply of the resin in the webbing. A system with vascular network should be used to resupply the resin so that self-repairing composites serve their purpose from time to time.

## REFERENCES

[1] Athreya Nagesh, Ola Rashwan and Ma'moun Abu-Ayyad "Optimization of the Composite Airplane Fuselage for an Optimum Structural Integrity" Volume 1: Advances in Aerospace Technology Pittsburgh, Pennsylvania, USA, November 9–15, 2018.
[2] Adrien Boulle, Martine Dubé "Parametric study of an elliptical fuselage made of a sandwich composite structure" Mechanics Research Communications 69 (2015) 129–135.
[3] Ohapkin, S. Serokhvostov "optimization of spar mass and fuselage location to decrease loss of airplane lift force" ISSN 1648-7788. AVIATION, vol XI, no 3, 2007.
[4] D. Liu,H. Lohse-Busch,V. Toropov,C. Hühne &U. Armani "Detailed design of a lattice composite fuselage

All rights reserved by *www.ijsrd.com* 

structure by a mixed optimization method' taylor and francis online Pages 1707-1720 | Received 29 Apr 2015, Accepted 21 Nov 2015, Published online: 29 Dec 2015

[5] chongxin Yuan Otto Bergsma "Optimization of Sandwich Composites Fuselages Under Flight Loads" Applied Composite Materials February 2012, Volume 19, Issue 1, pp 47–64

[6] Y Prem Chand, K Krishna Veni. Weight and Strength Optimization of Airplane Fuselage Structure for different Materials, International Journal of Mechanical Engineering Research and Technology, Vol. 1, No. 2, November 2015.

[7] Edwin L. Fasanella and Karen E. Jackson, Yvonne T. Jones, Gary Frings and Tong Vu. Crash Simulation of a Boeing 737 Fuselage Section Vertical Drop Test

[8] Marampalli Shilpa, M. Venkateshwar Reddy, Dr. A. Siva Kumar. Design and Analysis of Fuselage Structure using Solidworks and Ansys, International Journal of Engineering Sciences and Research Technology, 3(9): September, 2014.

[9] Khairi Yusuf, Nukman Y., S. Z. Dawal, Devi Chandra, N. Sofia. Conceptual Design of Fuselage Structure of Very Jet Aircraft, Latest Trends on Theoretical and Applied Mechancis, Fluid Mechancis and Heat & Mass Transfer.

[10] Han – Gi Son, Deepak Kumar, Yong-Bin Park, Jin-Hwe Kweon and Jin-Ho Choi. Structural Design and Analysis of Composite Aircraft Fuselage Used to Developo AFP Technology, Aerospace and Informatics Engineering, Japan, February21-23, 2013.

[11] B. Karthick, S. Balaji, P. Maniiarasan. Structural Analysis of Fuselage with Lattice Structure, International Journal of Engineering Research & Technology, Vol. 2 Issue 6, June – 2013.

All rights reserved by *www.ijsrd.com* 

# Performance and Efficiency of Swamp Cooling System

**Bharathnaidu P N[1] Babu K S[2] A V Sumanth[3] Veeresh[4] Dr. Kantharaj D G[5]**
[1]Professor [2,3,4,5]Student
[1,2,3,4,5]Department of Mechanical Engineering
[1,2,3,4,5]Nagarjuna College of Engineering and Technology, Bengaluru, India

*Abstract*—Now days due to energy crisis and harmful effect to environment, there is a urgent need of energy saving in air conditioning and water cooling demands in mainly consideration of all the free cooling techniques. Among them evaporative cooling is well known technique from long time which gives good results and wide number of applications in residential, commercial, agricultural, and institutional buildings to industrial applications such as spot cooling in power plants, foundries, etc. So in this paper the evaporative cooling, it's potential, and different trends in evaporative cooling are studied, which are environment friendly as it uses only natural energy as latent heat of water. The efficiency and effectiveness of evaporative cooling depends on surrounding climatic conditions which are studied in this paper, faster the evaporation rate we gate maximum cooling effect.

***Key words:*** Evaporative Cooling System (Swamp Cooling System); Ambient Conditions; Wick Material; Direct-Indirect Evaporative Cooling

## I. INTRODUCTION

Evaporative coolers, often called "swamp coolers" , are cooling systems that use only water and a blower to circulate air. Conventional direct evaporative coolers consist of a large water reservoir, a pump that draws water from the reservoir and discharges it through spray nozzles directly into air stream or through cooling pads. Evaporative cooling has been in use for many decades in India for cooling water and for providing thermal comfort in hot and dry regions. Evaporative air conditioning systems offer an attractive alternative to the conventional summer air conditioning systems in places, which are hot and dry. Evaporative air conditioning systems also find applications in hot industrial environments. In addition, evaporative cooling systems are more environmentally friendly as they consume less energy and their performance improves as air temperature increases and humidity decreases.

### *A. Classification of Evaporative Cooling*

The principle of evaporative cooling can be used in different ways. Evaporative cooling can be further classified as follows-

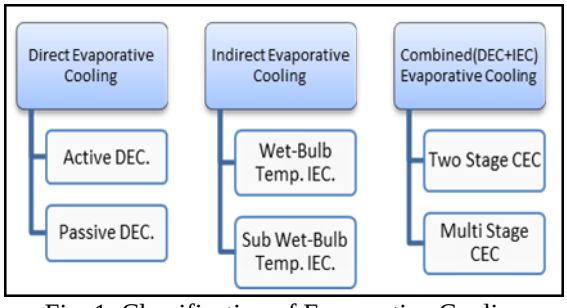



Fig. 1: Classification of Evaporative Cooling

*1) Direct Evaporative Cooling (open circuit)*

Direct evaporative cooling introduces water directly into the supply airstream (usually with a spray or some sort of wetted media). As the water absorbs heat from the air, it evaporates and cools the air. In direct evaporative cooling the dry bulb temperature is lowered but the wet bulb temperature remains unchanged. The efficiency of direct cooling depends on the pad media.

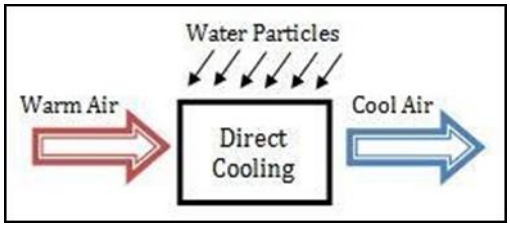



Fig. 2: Direct Evaporative Cooling

*2) Indirect Evaporative Cooling (closed circuit)*

Indirect evaporative cooling lowers the temperature of air via some type of heat exchanger arrangement, in which a secondary airstream is cooled by water and which in turn cools the primary airstream. The cooled air never comes in direct contact with water or environment. In indirect evaporative cooling system both the dry bulb and wet bulb temperatures are reduced. Indirect evaporative coolers do not add humidity to the air, but cost more than direct coolers and operate at a lower efficiency.

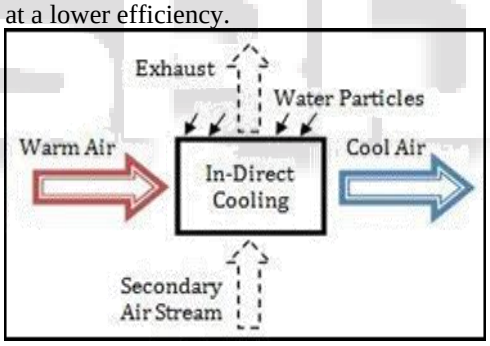



Fig. 3: Indirect Evaporative Cooling

*3) Combined Evaporative Cooling*

This type of evaporative coolers combines both direct and indirect evaporative cooling. This is accomplished by passing air inside a heat exchanger that is cooled by evaporation on the outside.In the second stage the pre cooled air is passes through a water soaked pad and picks up humidity as it cools.Because the air supply to the second stage evaporator is pre cooled less humidity is added to the air whose affinity for moisture is directly related to temperature. In many cases the two stage systems provide better comfort.

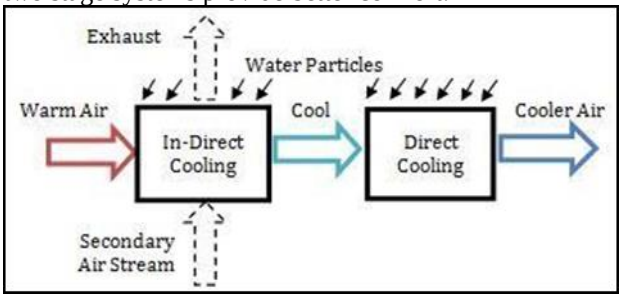



Fig. 4: Combined Evaporative Cooling

All rights reserved by www.ijsrd.com 

*B. Working Principle:*

Evaporative cooling system is based on the principle that when moist but unsaturated air comes in contact with a wetted surface whose temperature is higher than the dew point temperature of air, some water from the wetted surface evaporates into air. The latent heat of evaporation is taken from water, air or both of them. In this process, the air loses sensible heat but gains latent heat due to transfer of water vapor. Thus the air gets cooled and humidified. The cooled and humidified air can be used for providing thermal comfort.

## II. OBJECTIVES

- To utilise a heat exchanger for two stage evaporative cooling system.
- Testing the performance of the two stage evaporative cooling system and comparing it with conventional cooling media.
- To evaluate the performance study of an evaporative cooling system such as dry bulb temperature, wet bulb temperature, and relative humidity.
- Evaluating the performance of cooler by combining three different cooling pads.
- Evaluate the economics of evaporative cooling system.

## III. MATERIALS AND METHODOLOGY

A water supply system that intermittently sprays water into the air flowing over the cooling pad.

- A coarse fabric cooling pad fitted across the air flow onto the condenser. The water is sprayed onto this to keep it wet. The surface area of the cooling pad needs to be as large as possible to make the system effective in lowering the air temperature.
- Water can be controlled either by a sensor measuring machine. To prevent corrosion problems, you should fit non-metallic sprays.

*A. AHU (Air Handling unit)*

- It is a device used to regulate and circulate air as part of a HVAC system.
- An air handler is usually a large metal box containing a blower, heating or cooling elements etc.
- The AHU used in our experiment made up of galvanized steel and aluminium die cast corner.

Fig. 5: AHU Box

*B. Tank with support for Heat Exchanger*

- Tank is made up of SS 304 sheet, which is made leak proof.
- Provisions are given for water inlet, overflow and drain.
- Tank is designed in a way to ensure the complete drain of water in order to avoid water stagnation.

Fig. 6: Tank with support for heat exchanger

*C. Main blower and motor*

- The Blower-Motor is assembled on aluminum blower rails which are assembled in perpendicular directions.
- The blower is fixed on one set of rails and the motor on second set which is fixed perpendicular to it.
- Capacity, Blower: 675 CFM,
- Motor : 0.55 kW

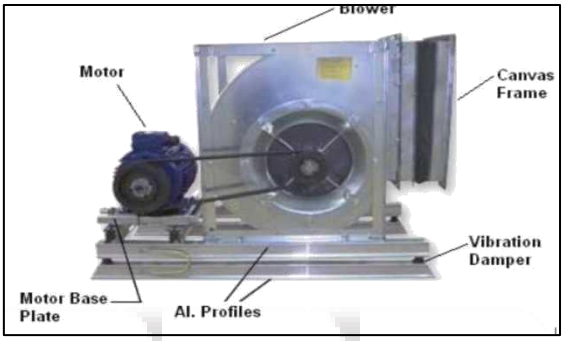



Fig. 7: Main Blower and Motor

*D. Sensible Heat Exchanger*

- Individual pumps lifts water from the tank to the top surface of both the heat exchangers.
- Monoblock pumps are used for recirculation of water from the tank continuously thereby wetting the heat exchangers.
- The water flow is controlled by gate valves so as to maintain the required wetness of the heat exchangers.

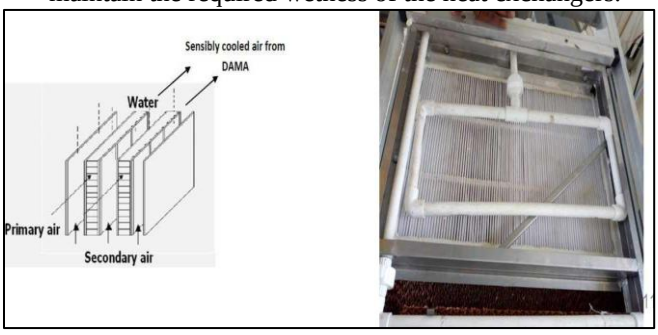



Fig. 8: Sensible heat exchanger

*E. Adiabatic Heat Exchanger*

- The cellulose cooling pad is constantly kept wet with a water sprinkler.
- The air coming from the sensible heat exchanger further moves through this cellulose pad section.
  Provides maximum cooling by volume expansion humidification of the conditioned air.
- Highly efficient evaporative cooling media.

All rights reserved by *www.ijsrd.com* 

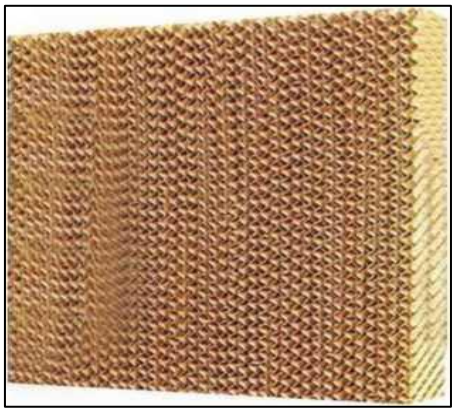


Fig. 9: Adiabatic Heat Exchanger

*F. Filters*

- It comprises of a high quality synthetic media made of High-Density Polyethylene pleated with Aluminum mesh.
- The entire set is housed in G.I casing which filters the incoming air.
- The filtered air then passes to heat exchangers after which it flows through the outlet.

Fig. 10: Filters

By using this 2 equipments we can find the humidity and air velocity of system

1) Sling Psychrometer
2) Digital anemometer

*G. Sling Psychrometer*

Sling Psychrometer is used to measure both the dry bulb and wet bulb temperatures at time. These temperatures are a measure of humidity content in air.

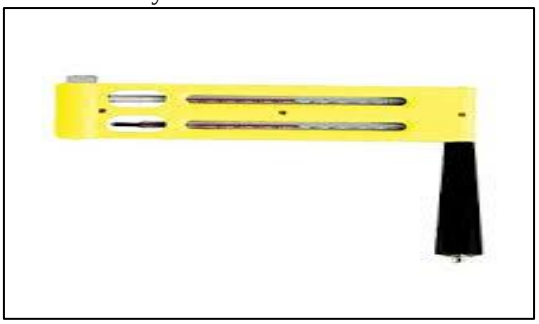


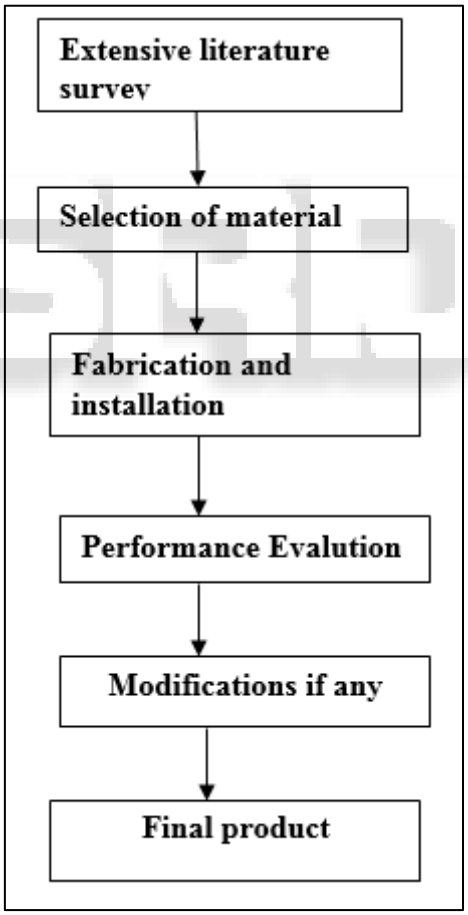
Fig. 11: Sling Thermometer

*H. Digital Anemometer*

The digital Anemometer is a device used for measuring the air velocity of the air and the speed of air from the Evaporative Cooling System

Fig. 12: Digital Anemometer

## IV. METHODOLOGY




All rights reserved by *www.ijsrd.com* 

## V. WORKING MODEL OF AN EVAPORATIVE COOLING SYSTEM


Fig. 13: Working model of an Evaporative Cooling System

## VI. RESULTS AND DISCUSSION

| Ambient Temperature in °c | Inlet DBT in °c | Inlet WBT in °c | Outlet DBT in °c | Outlet WBT in °c |
|---|---|---|---|---|
| 28.5 | 28.5 | 24.5 | 26 | 23.5 |
| 28 | 28 | 22.5 | 23.5 | 22 |

### *A. Case 1*

Ambient temperature Ta: 28.5°C
Condition 1: Indirect evaporative cooling.

- Inlet Condition
  DBT: 28.5°C WBT: 24.5°C
- Outlet Condition
  DBT: 26°C WBT: 23.5°C
  Efficiency,

$\epsilon = .db - To.db / Ti.db - Ti.wb$ *100

- Ti.db : inlet dry bulb temperature
- To.db : outlet dry bulb temperature
- Ti.wb : inlet wet bulb temperature
  Efficiency,
- $\epsilon$ =28.5 − 26 /28.5 − 24.5∗ 100
- $\epsilon$ = 62.5%

### *B. Case 2*

Ambient temperature Ta: 28°C
Condition 2: Indirect and direct evaporative cooling

- Inlet Condition
  DBT: 28°C WBT: 22.5°C
- Outlet Condition
  DBT: 23.5°C WBT: 22°C
  Efficiency,
  $\epsilon$ =28.5 − 26/ 28.5 -24.5*100
  $\epsilon$ = **81.8**%

The result obtained shows us that the Efficiency of a two stage evaporative cooling (Direct and indirect) is more when compared to that of a single stage Evaporative cooling ( Indirect Evaporative cooling).

## VII. CONCLUSION

- New type of sensible heat exchanger was tested successfully
- It provides higher DBT difference due to cross flow heat exchange
- Efficiency of two stage evaporator with sensible heat exchanger is higher than single stage indirect method.
- Cost of this type of evaporator is higher than the split AC
- Energy consumption of this evaporator is lower than the split AC
- As the water temperature increases, the performance of evaporative cooling system decreases.

## VIII. FUTURE SCOPE

Using nano-particle embedded media

- As seen earlier, nano-sized $A1_2O3$ particles can be used as a media in addition to the existing setup.
- A simple experiment conducted with mesh made of cotton fibre embedded with nano-$Al_2O_3$ particles.
- The mesh were positioned at the inlet portion behind the sensible heat exchanger and at the outlet portion after the adiabatic heat exchanger.

## REFERENCES

[1] Prachi K. Tawele & Laukik P. Raut, "Warpage in casting: A Review", International Journal of Advance Research in Engineering, Science & Technology, April-2015.
[2] D.A. Hindoliya, "Direct Evaporating For Thermal Comfort in a Building in the Summer Months for Four Climatic Zones of India", 2004
[3] Velasco Gomez & Rey Martinez, "The Phenomenon of Evaporative Cooling from a Humid Surface as an Alternative Method for Air Conditioning", International Journal of Energy & Environment, 2010.
[4] S. S. Kachhwaha and Suhas Prabhakar, Heat and mass transfer study in a direct evaporative cooler, Journal of Scientific 7 Industrial Research, Vol. 69, September 2010.
[5] Vivek W. Khond, "Experimental Investigation of Desert Cooler Performance Using Four Different Cooling Pad Materials", American Journal of Scientific & Industrial Research, 2011.
[6] Poonia M. P., "Design & Development of Energy Efficient Multi-Utility Desert Cooler", Universal Journal of Environmental Research & Technology, 2011.

All rights reserved by *www.ijsrd.com* 

[7] Seth I. Manuwa, "Evaluation of Pads & Geometrical Shapes For Constructing Evaporative Cooling System", Journal of Modern Applied Science, 2012.
[8] M. S. Sodha and A. Somwanshi, "Variation of Water Temperature along the Direction of Flow: Effect on Performance of an Evaporative Cooler", Journal of Fundamental of Renewable Energy and Applications, Vol. 2(2012).
[9] R. K. Kulkarni, "Comparative Performance Analysis of Evaporative Cooling Pads & Alternative Configurations & Materials", International Journal of Advanced In Energy & Technology, 2013.
[10] Singh "Comparative performance of Evaporative cooling pads of alternative materials". International Journal of Advanced Engineering Sciences and Technologies, Vol. 10, Issue 2, pp 239-244.
[11] Giabaklou and Ballinger "Principles and Application of Evaporative Cooling Systems for Fruits and Vegetables Preservation." International Journal of Current Engineering and Technology ISSN 2277 - 4106© 2013 INPRESSCO.
[12] Kulkarni, R.K. and Rajput, S.P.S. (2011). "Comparative performance of Evaporative cooling pads of alternative materials". International Journal of Advanced Engineering Sciences and Technologies, Vol. 10, Issue 2, pp 239-244.
[13] J.T. Libertya, B.O. Ugwuishiwua, S.A Pukumab and C.E OdoC. "Principles and Application of Evaporative Cooling Systems for Fruits and Vegetables Preservation." International Journal of Current Engineering and Technology ISSN 2277 - 4106© 2013 INPRESSCO.
[14] R. H. Turner and F. C. Chen, "Research Requirements In The Evaporative Cooling Field", ASHRAY Transaction, New York, Vol.93 Part1(1987)
[15] Zhang X, Chen PL ―Analysis of non-equilibrium thermodynamics on the transport processes in direct evaporative cooling‖ Journal of Tongji University, 23(6),638 –43,1995 [in Chinese].
[16] Arora and Domkundwar, A course in Refrigeration and Air-Conditioning,7th Edition, Delhi, Dhanpat Rai & Co., 2002 Santos JC, Barros GDT, Gurgel JM, Marcondes F (2013) Energy and energy analysis applied to the evaporative cooling process in air washers. International Journal of Refrigeration.
[17] ASHRAE, (1982). Handbook of Standards. American Society of Heating and Refrigeration and Air Conditioning.
[18] Nobel. N. (2003). Evaporative Cooling, practical action technology, challenging poverty, Bourton, UK.
[19] Heidarinejad, G., et al., 2009. Experimental investigation of two-stage indirect/direct evaporative cooling system in various climatic conditions, Building and Environment, 44 (2009): 2073-2079. Hui, S. C. M. and Lam, J. C., 1992. Test reference year for comparative energy study, Hong Kong Engineer, 20 (2): 13-16, February.

All rights reserved by *www.ijsrd.com* 

# Performance Study of an Evaporative Cooling System

**Jayanth Kumar S[1] Girish Kumar K J[2] Deekshith Kumar Y S[3] Airaj M[4] Hareesh Naik[5]**
[1,2,3,4]Student [5]Assistant Professor
[1,2,3,4,5]Department of Mechanical Engineering
[1,2,3,4,5]Nagarjuna College of Engineering and Technology, Bangalore, India

*Abstract*— Now days due to energy crisis and harmful effect to environment, there is a urgent need of energy saving in air conditioning and water cooling demands in mainly consideration of all the free cooling techniques. Among them evaporative cooling is well known technique from long time which gives good results and wide number of applications in residential, commercial, agricultural, and institutional buildings to industrial applications such as spot cooling in power plants, foundries, etc. So in this paper the evaporative cooling, it's potential, and different trends in evaporative cooling are studied, which are environment friendly as it uses only natural energy as latent heat of water. The efficiency and effectiveness of evaporative cooling depends on surrounding climatic conditions which are studied in this paper, faster the evaporation rate we gate maximum cooling effect.

***Key words:*** Evaporative Cooling; Ambient Conditions; Wick Material; Direct-Indirect Evaporative Cooling

## I. INTRODUCTION

Evaporative coolers, often called "swamp coolers" , are cooling systems that use only water and a blower to circulate air. Conventional direct evaporative coolers consist of a large water reservoir, a pump that draws water from the reservoir and discharges it through spray nozzles directly into air stream or through cooling pads.. Evaporative cooling has been in use for many decades in India for cooling water and for providing thermal comfort in hot and dry regions. Evaporative air conditioning systems offer an attractive alternative to the conventional summer air conditioning systems in places, which are hot and dry. Evaporative air conditioning systems also find applications in hot industrial environments. In addition, evaporative cooling systems are more environmentally friendly as they consume less energy and their performance improves as air temperature increases and humidity decreases.

### *A. Classification of Evaporative Cooling*

The principle of evaporative cooling can be used in different ways. Evaporative cooling can be further classified as follows-

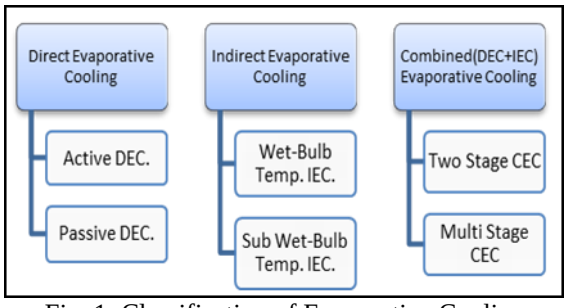



Fig. 1: Classification of Evaporative Cooling

*1) Direct Evaporative Cooling (open circuit)*

Direct evaporative cooling introduces water directly into the supply airstream (usually with a spray or some sort of wetted media). As the water absorbs heat from the air, it evaporates and cools the air. In direct evaporative cooling the dry bulb temperature is lowered but the wet bulb temperature remains unchanged. The efficiency of direct cooling depends on the pad media.

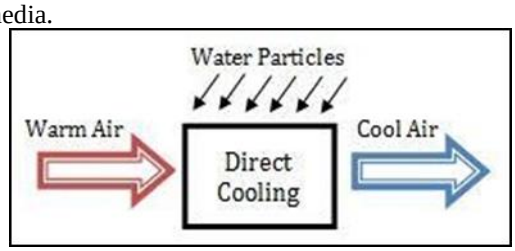



Fig. 2: Direct Evaporative Cooling

*2) Indirect Evaporative Cooling (closed circuit)*

Indirect evaporative cooling lowers the temperature of air via some type of heat exchanger arrangement, in which a secondary airstream is cooled by water and which in turn cools the primary airstream. The cooled air never comes in direct contact with water or environment. In indirect evaporative cooling system both the dry bulb and wet bulb temperatures are reduced. Indirect evaporative coolers do not add humidity to the air, but cost more than direct coolers and operate at a lower efficiency.

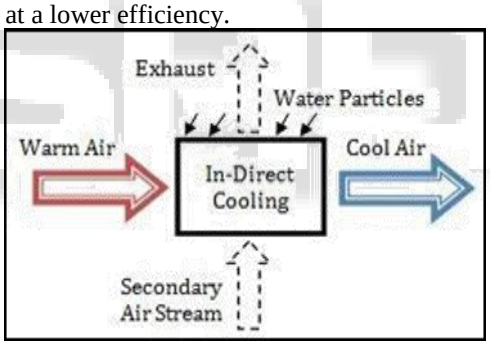



Fig. 3: Indirect Evaporative Cooling

*3) Combined Evaporative Cooling*

This type of evaporative coolers combines both direct and indirect evaporative cooling. This is accomplished by passing air inside a heat exchanger that is cooled by evaporation on the outside.In the second stage the pre cooled air is passes through a water soaked pad and picks up humidity as it cools.Because the air supply to the second stage evaporator is pre cooled less humidity is added to the air whose affinity for moisture is directly related to temperature. In many cases the two stage systems provide better comfort.

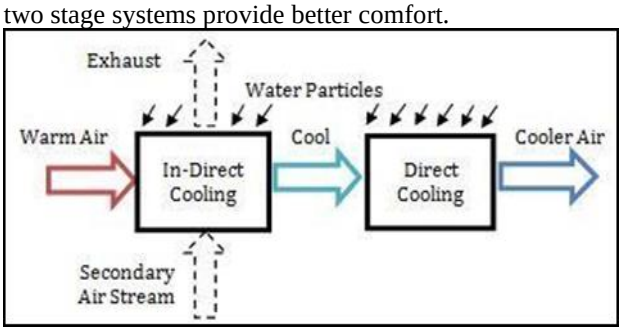



Fig. 4: Combined Evaporative Cooling

All rights reserved by www.ijsrd.com

*B. Working Principle:*

Evaporative cooling system is based on the principle that when moist but unsaturated air comes in contact with a wetted surface whose temperature is higher than the dew point temperature of air, some water from the wetted surface evaporates into air. The latent heat of evaporation is taken from water, air or both of them. In this process, the air loses sensible heat but gains latent heat due to transfer of water vapor. Thus the air gets cooled and humidified. The cooled and humidified air can be used for providing thermal comfort.

## II. OBJECTIVES

- To utilise a heat exchanger for two stage evaporative cooling system.
- Testing the performance of the two stage evaporative cooling system and comparing it with conventional cooling media.
- To evaluate the performance study of an evaporative cooling system such as dry bulb temperature, wet bulb temperature, and relative humidity.
- Evaluating the performance of cooler by combining three different cooling pads.
- Evaluate the economics of evaporative cooling system.

## III. MATERIALS AND METHODOLOGY

A water supply system that intermittently sprays water into the air flowing over the cooling pad.

- A coarse fabric cooling pad fitted across the air flow onto the condenser. The water is sprayed onto this to keep it wet. The surface area of the cooling pad needs to be as large as possible to make the system effective in lowering the air temperature.
- Water can be controlled either by a sensor measuring machine. To prevent corrosion problems, you should fit non-metallic sprays.

*A. AHU (Air Handling unit)*

- It is a device used to regulate and circulate air as part of a HVAC system.
- An air handler is usually a large metal box containing a blower, heating or cooling elements etc.
- The AHU used in our experiment made up of galvanized steel and aluminium die cast corner.

Fig. 5: AHU Box

*B. Tank with support for Heat Exchanger*

- Tank is made up of SS 304 sheet, which is made leak proof.
- Provisions are given for water inlet, overflow and drain.
- Tank is designed in a way to ensure the complete drain of water in order to avoid water stagnation.

Fig. 6: Tank with support for heat exchanger

*C. Main blower and motor*

- The Blower-Motor is assembled on aluminum blower rails which are assembled in perpendicular directions.
- The blower is fixed on one set of rails and the motor on second set which is fixed perpendicular to it.
- Capacity, Blower: 675 CFM,
- Motor : 0.55 kW

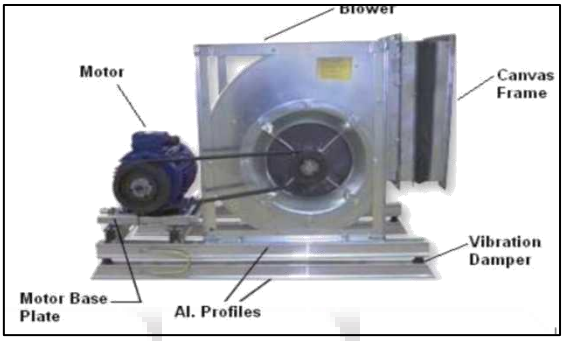



Fig. 7: Main Blower and Motor

*D. Sensible Heat Exchanger*

- Individual pumps lifts water from the tank to the top surface of both the heat exchangers.
- Monoblock pumps are used for recirculation of water from the tank continuously thereby wetting the heat exchangers.
- The water flow is controlled by gate valves so as to maintain the required wetness of the heat exchangers.

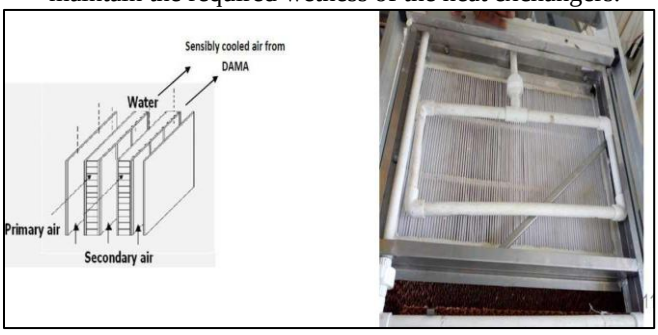



Fig. 8: Sensible heat exchanger

*E. Adiabatic Heat Exchanger*

- The cellulose cooling pad is constantly kept wet with a water sprinkler.
- The air coming from the sensible heat exchanger further moves through this cellulose pad section.
  Provides maximum cooling by volume expansion humidification of the conditioned air.
- Highly efficient evaporative cooling media.

All rights reserved by *www.ijsrd.com*

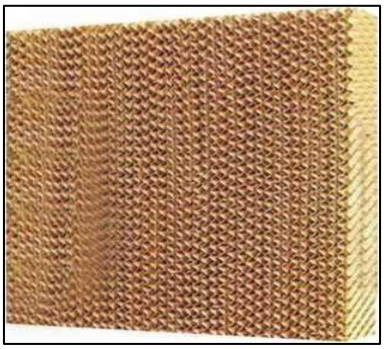


Fig. 9: Adiabatic Heat Exchanger

*F. Filters*

- It comprises of a high quality synthetic media made of High-Density Polyethylene pleated with Aluminum mesh.
- The entire set is housed in G.I casing which filters the incoming air.
- The filtered air then passes to heat exchangers after which it flows through the outlet.

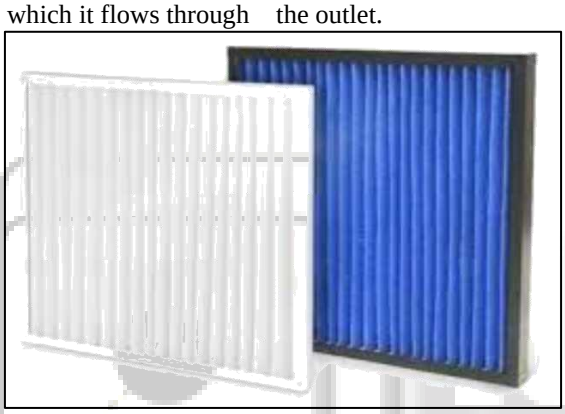


Fig.10: Filters

By using this 2 equipments we can find the humidity and air velocity of system

1. Sling Psychrometer
2. Digital anemometer

*G. Sling Psychrometer*

Sling Psychrometer is used to measure both the dry bulb and wet bulb temperatures at time. These temperatures are a measure of humidity content in air.

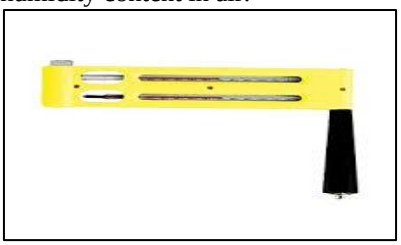


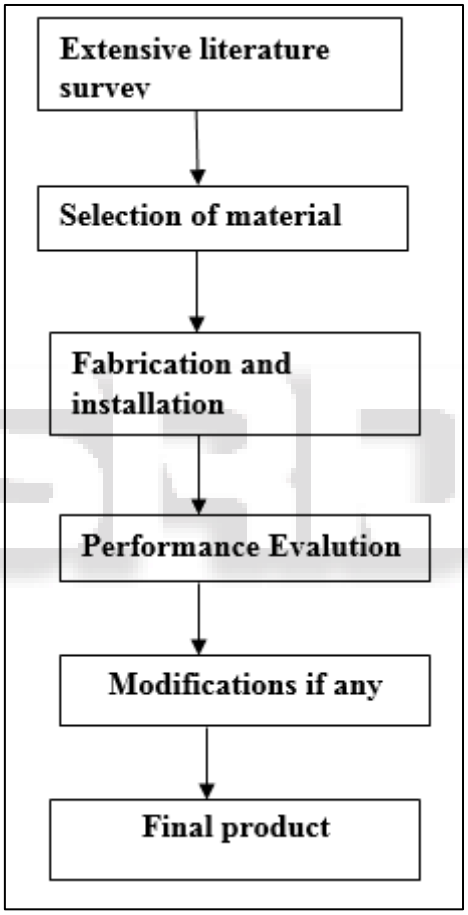
Fig. 11: Sling Thermometer

*H. Digital Anemometer*

The digital Anemometer is a device used for measuring the air velocity of the air and the speed of air from the Evaporative Cooling System

Fig. 12: Digital Anemometer

## IV. METHODOLOGY




All rights reserved by *www.ijsrd.com*

## V. WORKING MODEL OF AN EVAPORATIVE COOLING SYSTEM


Fig. 13: Working model of an Evaporative Cooling System

## VI. RESULTS AND DISCUSSION

| Ambient Temperature in °c | Inlet DBT in °c | Inlet WBT in °c | Outlet DBT in °c | Outlet WBT in °c |
|---|---|---|---|---|
| 28.5 | 28.5 | 24.5 | 26 | 23.5 |
| 28 | 28 | 22.5 | 23.5 | 22 |

### *A. Case 1*

Ambient temperature Ta: 28.5°C
Condition 1: Indirect evaporative cooling.

– Inlet Condition

DBT : 28.5°C WBT : 24.5°C

– Outlet Condition

DBT : 26°C WBT : 23.5°C

Efficiency,

$$\epsilon = \frac{i.db - To.db}{Ti.db - Ti.wb} * 100$$

– Ti.db : inlet dry bulb temperature
– To.db : outlet dry bulb temperature
– Ti.wb : inlet wet bulb temperature

Efficiency,

– $\epsilon = 28.5 - 26 / 28.5 - 24.5 * 100$
– $\epsilon = 62.5\%$

### *B. Case 2*

Ambient temperature Ta : 28°C

– Condition 2: Indirect and direct evaporative cooling
– Inlet Condition DBT : 28°C WBT : 22.5°C
– Outlet Condition DBT : 23.5°C WBT : 22°C
– Efficiency,
– $\epsilon = 28.5 - 26 / 28.5 - 24.5 * 100$
– $\epsilon = \mathbf{81.8}\%$

The result obtained shows us that the Efficiency of a two stage evaporative cooling (Direct and indirect) is more when compared to that of a single stage Evaporative cooling ( Indirect Evaporative cooling).

## VII. CONCLUSION

– New type of sensible heat exchanger was tested successfully
– It provides higher DBT difference due to cross flow heat exchange
– Efficiency of two stage evaporator with sensible heat exchanger is higher than single stage indirect method.
– Cost of this type of evaporator is higher than the split AC
– Energy consumption of this evaporator is lower than the split AC
– As the water temperature increases, the performance of evaporative cooling system decreases.

## VIII. FUTURE SCOPE

Using nano-particle embedded media

– As seen earlier, nano-sized $A1_2O3$ particles can be used as a media in addition to the existing setup.
– A simple experiment conducted with mesh made of cotton fibre embedded with nano-$Al_2O_3$ particles.
– The mesh were positioned at the inlet portion behind the sensible heat exchanger and at the outlet portion after the adiabatic heat exchanger.

## REFERENCES

[1] Prachi K. Tawele & Laukik P. Raut, "Warpage in casting: A Review", International Journal of Advance Research in Engineering, Science & Technology, April-2015.
[2] D.A. Hindoliya, "Direct Evaporating For Thermal Comfort in a Building in the Summer Months for Four Climatic Zones of India", 2004
[3] Velasco Gomez & Rey Martinez, "The Phenomenon of Evaporative Cooling from a Humid Surface as an Alternative Method for Air Conditioning", International Journal of Energy & Environment, 2010.
[4] S. S. Kachhwaha and Suhas Prabhakar, Heat and mass transfer study in a direct evaporative cooler, Journal of Scientific 7 Industrial Research, Vol. 69, September 2010.
[5] Vivek W. Khond, "Experimental Investigation of Desert Cooler Performance Using Four Different Cooling Pad Materials", American Journal of Scientific & Industrial Research, 2011.
[6] Poonia M. P., "Design & Development of Energy Efficient Multi-Utility Desert Cooler", Universal Journal of Environmental Research & Technology, 2011.

All rights reserved by *www.ijsrd.com*

[7] Seth I. Manuwa, "Evaluation of Pads & Geometrical Shapes For Constructing Evaporative Cooling System", Journal of Modern Applied Science, 2012.
[8] M. S. Sodha and A. Somwanshi, "Variation of Water Temperature along the Direction of Flow: Effect on Performance of an Evaporative Cooler", Journal of Fundamental of Renewable Energy and Applications, Vol. 2(2012) .
[9] R. K. Kulkarni, "Comparative Performance Analysis of Evaporative Cooling Pads & Alternative Configurations & Materials", International Journal of Advanced In Energy & Technology, 2013.
[10] Singh "Comparative performance of Evaporative cooling pads of alternative materials". International Journal of Advanced Engineering Sciences and Technologies, Vol. 10, Issue 2, pp 239-244.
[11] Giabaklou and Ballinger "Principles and Application of Evaporative Cooling Systems for Fruits and Vegetables Preservation." International Journal of Current Engineering and Technology ISSN 2277 - 4106© 2013 INPRESSCO.
[12] Kulkarni, R.K. and Rajput, S.P.S. (2011). "Comparative performance of Evaporative cooling pads of alternative materials". International Journal of Advanced Engineering Sciences and Technologies, Vol. 10, Issue 2, pp 239-244.
[13] J.T. Libertya, B.O. Ugwuishiwua, S.A Pukumab and C.E OdoC . "Principles and Application of Evaporative Cooling Systems for Fruits and Vegetables Preservation." International Journal of Current Engineering and Technology ISSN 2277 - 4106© 2013 INPRESSCO.
[14] R. H. Turner and F. C. Chen, "Research Requirements In The Evaporative Cooling Field", ASHRAY Transaction, New York, Vol.93 Part1(1987)
[15] Zhang X, Chen PL ―Analysis of non-equilibrium thermodynamics on the transport processes in direct evaporative cooling‖ Journal of Tongji University, 23(6),638 –43,1995 [in Chinese].
[16] Arora and Domkundwar, A course in Refrigeration and Air-Conditioning,7th Edition, Delhi, Dhanpat Rai & Co., 2002 Santos JC, Barros GDT, Gurgel JM, Marcondes F (2013) Energy and energy analysis applied to the evaporative cooling process in air washers. International Journal of Refrigeration.
[17] ASHRAE, (1982). Handbook of Standards. American Society of Heating and Refrigeration and Air Conditioning.
[18] Nobel. N. (2003). Evaporative Cooling, practical action technology, challenging poverty, Bourton, UK.
[19] Heidarinejad, G., et al., 2009. Experimental investigation of two-stage indirect/direct evaporative cooling system in various climatic conditions, Building and Environment, 44 (2009): 2073-2079. Hui, S. C. M. and Lam, J. C., 1992. Test reference year for comparative energy study, Hong Kong Engineer, 20 (2): 13-16, February.

All rights reserved by *www.ijsrd.com* 

# Development And Evaluation Of Thermo-Acoustic Refrigeration System

Naveen A[1], Suneelkumar Odu[2], Viveka V M[3], Yashawanth M V[4],
Dr. Vijaykumar M Patil[5]

[1, 2,3,4,5] Department Of Mechanical Engineering, Nagarjuna College Of Engineering And Technology, Bangalore.

**Abstract** - Thermo acoustic refrigeration (TAR) is a phenomenon that uses high intensity sound waves in a pressurized gas tube to pump heat from one place to the other to produce refrigeration effect. This system completely eliminates the need for lubrications and results in 40% less energy consumption.in which compressor replaces with loudspeaker and inert gasses replaces the refrigerant. Experiments were conducted on a reconstructed thermoacoustic refrigerator. The construction utilized the design and various reusable components from a previous major qualifying project.

## 1. Introduction

Refrigeration in thermodynamics refers to a cycle in which heat is pumped out of a system by doing work on it. Conventional refrigerators use a working fluid that absorbs the heat out of a chamber by using phase transitions. Thermoacoustic refrigeration uses sound waves to transfer heat from one area to another; thereby carrying heat away from a system to an exhaust. The concept of "thermoacoustic" forms naturally when thinking about sound and temperature. Both phenomena involve the oscillation of particles. Sound is a pressure wave that transfers kinetic energy from one air molecule to the next using compression and expansion of the medium; and, temperature measures average kinetic energy of particles in a volume.

### Thermoacoustic refrigeration summarized

In thermo acoustic refrigeration system the sound is allowed to pass through a resonator tube, this sound wave is sinusoidal in nature and it is of constant frequency. Air or anyother gasses like inert gasses are introduced in the pipe. When the sound wave propogates the compression and rarefaction takes place for every positive and negative half cycle.so in the region of compression we have high temperature and in the region of rarefaction we have low temperature. Thus we can see the temperature difference in system

which is the soul purpose of our project. The thermoacoustic effect acts like a conveyor belt for thermal energy. For this to occur, one must exploit two physical principles concerning thermodynamics and acoustics inside the stack. First, through the relation of pressure to temperature by the ideal gas law PV=nRT, the small changes in pressure caused by sound also cause small changes in temperature.

# 2. Objectives

- To develop environment friendly thermo acoustic refrigeration system.
- To fabricate a working model based on the design using low cost and readily available materials.
- To achieve at least 10 ºC of cooling from thermo acoustic refrigeration system.
- To evaluate the thermo accoustic refrigeration system.
- To better understanding of the fundamental process and necessary to improve the d

# 3. Materials And Methodology

## Working Medium gas

High pressure air can also use as working medium. Thermal penetration depths & the natural frequency of the resonator are also dependent on the choice of working fluid. The helium tank had a pressure gage and the pressures mentioned in the report are in absolute atms based on the readings from this gage which had an uncertainty of .1 atms. Since the refrigerator was not necessarily prepared for a full hard vacuum alternating between vacuum and helium feeds would eventually fill it with helium. For the experiments, the procedure went as follows: 1. Turn on vacuum and leave it for 10 minutes 2. Turn on Helium and leave it for 10 minutes 3. Repeat. Because Helium escapes easily, the helium feed valve and tank were left on throughout the experiment the idea being that any leaks would be forced leaks and would be promptly replaced by more helium.

## Speaker

The speaker itself was a 5” diameter Pyle (250X) with a wattage of 200. Instead of a fragile paper speaker panel, it is made of rubber and plastic for more durability, and is thus capable of creating more power amplitudes of sound waves in the apparatus. The speaker was placed

into the speaker housing just above a holding so that the He gas could travel beneath and into the resonator/stack

The amplifier itself has a max amplifying capacity of 250 watts, so the speaker itself came within safe boundaries, not overloading the system. The speaker was only about $20 and took 5 days shipping overseas from the manufacturer in china.

**Figure** speaker

## Resonator tube

The resonator is a long copper pipe which connects on one end to the PVC stack housing and has a glass bulb on the other end to simulate and open end. The copper heat exchangers were placed right at the female end of the thin copper tube.

A resonator is necessary to contain the stack and heat exchangers of a Thermoacoustic engine. The resonator should have a high quality factor (Q) to minimize thedissipation of acoustic power into heat. The resonator is designed in order that the length,weight, shape and losses are optimal. The resonator has to be compact, light and strongenough. The shape and length can be determined by the frequency and minimal losses at thewall of the resonator. The cross sectional area (A) of the resonator at the stack location is determined

**Figure** Resonator tube with buffer volume

## Stack

Our construction of the apparatus began by disassembling pieces of the old TAR made by the previous group. We recycled their resonator and stack, but not the stack holding. First, we assembled and sealed the PVC components of the stack holding using PVC cement and caulk. The PVC components had to be drilled through in their insides due to unnecessary rings which blocked the ability for us to put the stack in. Each time we applied caulk or any other sealant or adhesive, we usually waited about 4-6 hours for it to completely dry before moving the pieces around and beginning new tasks. After the stack housing was assembled, the stack fit snugly inside it.

After the stack and copper pipe were assembled, the copper wool was placed inside the resonator tube adjacent to where the stack would connect, and 5 layers of copper mesh were put in to hold the wool and increase the heat exchanging capability. The same process was applied to the copper tube that would connect on the other side of the stack. Teflon tape was then wrapped around the male ends of the PVC stack and then screwed onto the resonator and copper tube.

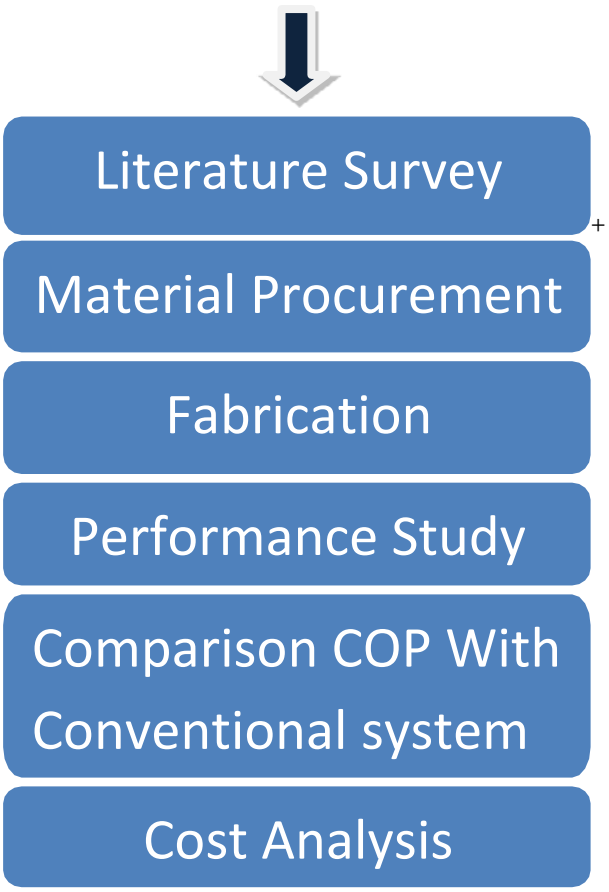
**Figure** stack housing

## Heat Exchanger

Heat exchanger is a component or a device which is use to transfer thermal energy between fluids, it may be two or more than two. There is no external heat or work interaction in heat exchanger. The working of heat exchanger is to remove the heat from high temperature source. In thermo acoustic refrigerator the heat exchanger is used to remove the heat from the stack so that temperature is maintain as per requirement. In thermo acoustic refrigerator two heat exchangers are required one work as hot heat exchanger and other work as cold heat exchanger. The heat exchangers used comprised of two primary components, sections of a copper mesh cut up into 1.5" diameter circles and having 5 placed on either side of the stack. Also, on both the speaker housing and resonator side of the stack.

**Figure** Heat Exchangers

## Methodology




As shown in above figure represents the flowchart of methodology. It represents the steps that will be followed during this project. A thermo acoustic refrigerator functions as follows the procedure.

The next step in the project was to test the constructed apparatus. Because of the problems with helium leaks and other issues, there was no clear distinction between the "construction" and "experimental" stage. As some experiments were being done, the apparatus was modified (i.e. sealing leaks, modifying heat exchangers etc.). There are three subsections in the "Experiments section". The "Measurements" section details the work done to set up the experiment and the measurement tools (both hardware and software) used. As explained above, the nature of the project was such that experiments were modified

# 4. Result And Discussion

We analyze the performance of thermo acoustic refrigeration system and we got **The Experimental Values** and temperature difference of **5 ºC** between the two ends of the stack. And where $T_C$ is temperature at cold side end , $T_h$ is temperature at hot side end of resonator tube. $\Delta T$ is teperature difference between two ends.

| Time (Hour) | Cold side $T_C$ (ºC ) | Hot side $T_h$ (ºC) | ΔT |
|---|---|---|---|
| 0.00 | 36.00 | 36.00 | 0.0 |
| 0.50 | 35.80 | 36.50 | 0.70 |
| 1.00 | 35.00 | 36.90 | 1.90 |
| 1.50 | 34.40 | 37.00 | 2.40 |
| 2.00 | 33.90 | 37.10 | 3.20 |
| 2.50 | 33.00 | 37.30 | 4.30 |
| 3.00 | 32.50 | 37.30 | 4.80 |
| 3.50 | 32.30 | 37.50 | 5.20 |
| 4.00 | 32.20 | 37.50 | 5.30 |

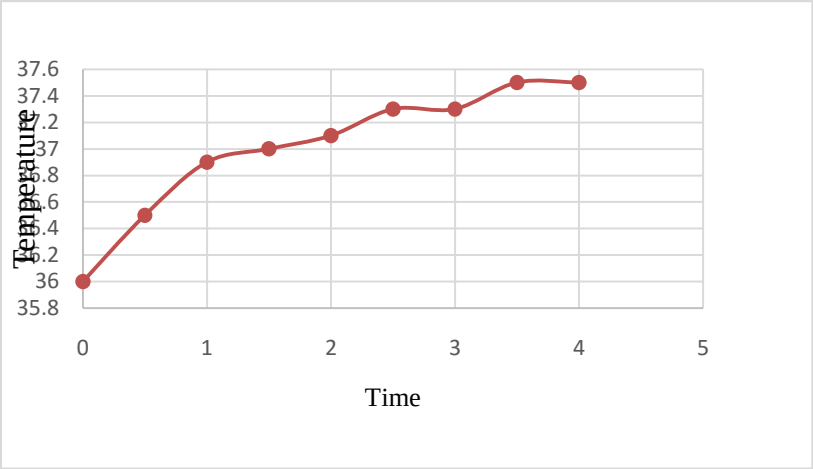



**Figure 5.1** Time Vs Temperature Profile

As shown in above fig, at 0 time the temperature at cold side end and hot side end of the stack was 36.0 ºC , after some time period about 4.0 hours then the temperature at cold side end decreases to 32 ºC, there by making temperature difference in system.

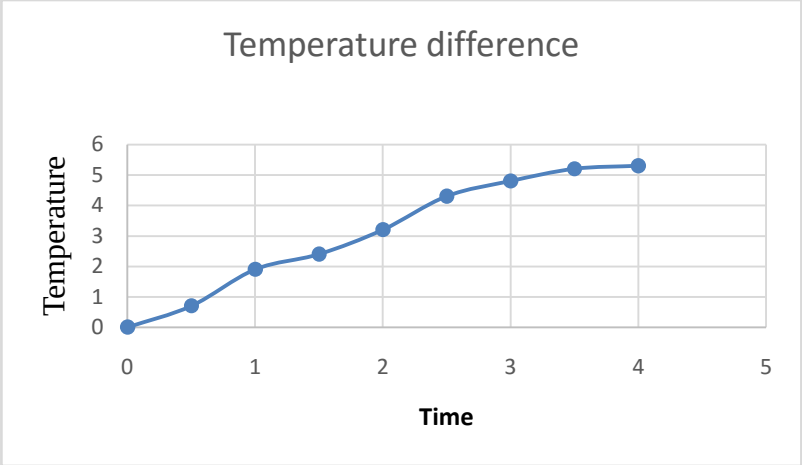



**Fig:** Temperature difference profile

From above fig, the temperature difference obtained , since the cooling effect has achieved from thermo accoustic refrigeration system.

## Conclusion

The goals for this project were to create a better thermoacoustic refrigerator by reconstructing the previous refrigerator and improving measurement techniques. The former was accomplished by putting in a more powerful speaker (our speaker had a power of 200 watts as compared with a speaker with 50 watts with the previous project) and by increasing the pressure of the working fluid, helium, inside the refrigerator. The increase in pressure, however, turned out to be a meaningless step because of the various helium leaks which created a mix of helium and air. The advanced measurement techniques worked well. The thermocouples recorded the temperature of the hot exchanger, cold exchanger, and ambient accurately. The resonance was also measured satisfactorily; but, the process was more tedious than it should have been. A more advanced technique would automatically generate the resonant frequency for any given system.

## References

1. Mathewlal.T et al,.(2014) Demonstration of Thermo Acoustic Refrigeration by Setting up an Experimental Model, IOSR Journal of Mechanical and Civil Engineering (IOSR- JMCE), 29-33.
2. Normah Mohd-Ghazali.et al., (2014) Optimization of the Stack Unit

in a Thermoacoustic Refrigerator
3. Swift G.W.(2002)"Thermoacoustics: A Unifying Perspective for Some Engines and Refrigerators", Acoustical Society of America, New York.
4. N. Rott."Thermo acoustics", Adv. 1980, Appl. Mech. 20,135.
5. Garrett S.L et al,.(1991) "Magnetohydrodynamic and Thermoacoustic Mechanisms for Generation of Sound in Seawater," Power Transducers for Sonics and Ultrasonics, Springer-Ver- lag, pp. 162-177.
6. Tijani et al,.(2001) Construction and performance of thermoacoustic refrigerator Cryogenics.
7. T. Jin et al,.(2016) Acoustic Field Characteristics and Performance Analysis of a Looped Travelling-Wave Thermoacoustic Refrigerator, Energy Conversion and Management, 243-251.
8. B. Higgins,(1802) Nicholson's journal I,130.
9. P.L. Rijke,(1859)"Notiz uber eine art, die in einer an beiden enden ofnen rohreenthaltane luft in Schwingungen zu versentzen".Ann.Phys, 107,339.
10. C.Sondhass,(1850)"ueber die schallscwingungen der luft in erhitzten glas-Rohrenund in gedeckten Pfeifen von ungleicher Weite".Ann.Phys.79,1.

RESEARCH ARTICLE OPEN ACCESS

# Enhancement of Mechanical Properties for Conventional and Heat Treated "High Carbon Steel"

**Nethravathi B N[1], N Kapilan[2]**

Department of Mechanical Engineering

Nagarjuna College of Engineering and Technology, Bengaluru, INDIA

[1] nethra.abc@gmail.com, [2] kapil_krecmech@yahoo.com

----------**********----------

## Abstract:

The aim of project is to improve the material properties of the specimen of conventional HCS by heat treated at different temperature will changes its physical,chemical,and mechanical properties compare to conventional HCS. By an overall analysing the graphs, the hardness value due to specimen in quenching process compare to other process will be more efficient and excellent tool performance. UTS, YS, YM, CS and SS value observed increases at 500deg of normalizing process and 500deg of quenching process ,%elongation and % reduction will decreases respectively compare to others and normal HCS respectively. Also wear rate by volume, time and specific wear rate increases the micro structure changes from hyper to hypoeutectic particles so refine size of grain structure with homogeneous arrangement of grains consist ,better elastic characteristic and observed so it has changed from brittle to ductility ,improve mach inability, increased hardness and improve internal stress of material improves life of specimen.

*Keywords* **— High carbon steel, heat-treatment, quenching and normalizing, Chemical, Physical and mechanical properties.**

----------**********----------

## I. INTRODUCTION

According to this paper tell about study of improvement of the material properties of MS and SS with the heat treatment process. sequence of heating and cooling process will change the chemical, physical and chemical properties for different industrial applications. initially required shape and size of material has been cutted into required length and placed in muffle furnace used to heat the specimen at different temperature and time based. There are different heat treated process like annealing, normalizing,quenching and tempering .the treatment continued 200 deg c ,300 deg c, 450 deg c, 600 deg c and 850 deg c/900 deg c, Siliconization process 1050 deg c [1,2,3,5,9,6] , 250 deg c,350 deg c ,450 deg c ,and 550 deg c [8] heat treatment process conducted on the specimen NST 37-2 steel for the changes observed the mechanical properties and the microstructure[4] for heating and cooling process will modify the mechanical properties of steel.YS,UTS,YM ,% elongation and % reduction.annealing process performed in project for the specimen heated at 900 deg c left it cool in furnace and remove out the specimen is quenched in water bath and also another specimen in air cooling process same is followed,MS which is used in the application of agriculture to improve the properties for long usage without failure of specimen in service. So,. author says that the mechanical properties has been improved by different heat treatment process like annealing ,normalizing, quenching and tempering

 ©IJSRED: All Rights are Reserved 

compare to the conventional process of MS and SS.Different testing conducted for the specimen in UTM machine for tensil,ompressive and shear test ,Izod test will be conducted to studied the different mechanical properties .the heat treated process of the specimen has better results compare to conventional MS and SS. But the SS specimen Without heat-treated process results are poor for %elongation than the heat treated process (Normalizing, Annealing and quenching) SS specimens. Then final results comparison done for all the temperature specimen wrt to quenching and normalizing process analyzed that observed the high hardness value found for the specimen with quenching process in water. But low alloy HCS is high in hardness value but the microstructure and strain deformation unfortunately not clearly understood the performance for the first time . Work based on the super duplex stainless steel and duplex steel of ferrous material with 26% of Cr,5%Mn,0.3% N which are used in multiple applications in source containing ions like C halogen family. The material with the combination of Cu and Ni is called cupronickel which is used during the emergence of despite represent good resistance of corrosion and its material properties for steel properties.[13].Tensile and compressive test conduct with the help of UTM machine to study the behavior of mechanical properties. Also compared to properties w r t to tensile versus compressive deformations.[14].It's an investigation study for an experimental on shear stress for the effects on the steel fiber and polymer latex in concrete .due to variation of the % of composition of steel fibers from 0-7% at an interval of 1%for latex polymer matrix 15% of concrete used .prisms has 2 different dimension of single and double type blocks larger in the size broken under double shear test [11]. in this paper describe about both micro and nano the compressive stability will be present in the austenite formation in HCS.so by using standard test method like compressive testing, electron backscattering diffraction imaging, X-ray diffraction, optical microstructure, nano-indentation, electron probe micro-analysis and micro-indentation instrument used to measure the stability of retain of austenite and martensite in HCS under CS and transformation take place from micro to nano level.Intally it will plastic deformation with martensite due to increase in the load this lead strain hardening with increase of hardness value by 30%.Based on the characteristic of stress obtained which control microstructure in HCS and its properties.[18]..They found that phase stability and modify grain size of structure for the hardness value. Due to increase the hardness value of HCS grain refinement, increase the dislocating of density, formation of nano twinning etc Due to tempering process in the solution the ferrite phase decreases in microstructure consequently. If ferrite phase dissolved in solution but material hardness changes to ferrite and austenite presence in the structure..[12].The fracture interface with base and heat affected zone material for studying the mechanical properties of tensile and shear test. The similar and dissimilar metals combine the various grade of steel which has different strength and the hardness value. Critical interface avoids the accuracy greater than 90 %.but experiment conduct will have 5% greater than the calculated value to avoid fracture.[15]

## II. MATERIAL AND METHODOLOGY

In this work, high carbon steel was purchased and the samples were prepared as per ISO standards. The samples were subjected heat treatment for different temperature such as 500, 700 and 900 degree C in muffle furnace and subjected to both normalizing and quenching process. Figure 1 shows the specimens prepared for different tests. the specimens are placed into muffle furnace subjected quenching and normalizing process. The properties of the samples were determined using universal testing machines, hardness testing machine, shear testing machine and wear testing machine. The scanning electron microscope tests were

 ©IJSRED: All Rights are Reserved 

conducted to find the microstructure of the samples.

Figure 1: All Specimens for different test

Normalizing is the process of heating specimen at high temperature in muffle furnace and cooling in atmospheric air-cooling medium which should be equal to room temperature. The specimen were heated to 500, 700 ,900 deg C and cooled to room temperature. This is the most common form of heat treatment and gives steel high strength and hardness. Also this process can refine grain structure, improves hardness, tensile strength and mach inability, causes low ductility and removes both strain and dislocation. The microstructure mainly consists of the ferrite and cementite.

Quenching is the process of heating specimen at high temperature in muffle furnace and cooling in oil bath as medium which maintain to room temperature. In this work, the specimens were heated to 500, 700 , 900 deg C and cooled in oil bath until the specimen temperature reaches the room temperature. The quenching increases the hardness of the steel, however it also increase brittleness and the steel is susceptible to breaking and cracking. The formation of pearlite changes to austenite because of fast cooling oil so microstructure consists of ferrite marten site and cementite.

## III. EXPERIMENTAL WORK

### 1.Test Conducted on UTM

Generally to find the mechanical performance of the specimen tensile,compression,shear

**A.Tensile Test:**

Tensile testing study of Specimen subjected on UTM machine to controlled tension until the failure occurs and the material behavior of mechanical properties of conventional and different heat treated specimen of HCS. The values directly measure from computer software system and calculation done like ultimate tensile strength, % elongation, % reduction, yield strength and young modulus of the material. Uniaxial tensile testing used for isotropic materials and anisotropic materials used for composite materials, textiles, are required biaxial tensile testing is required.

**B. Compression Test:**

To study the material behaviour of mechanical properties of conventional and different heat treated specimen of HCS. the specimen is compressed, and data obtained directly is deformation versus the applied load is recorded .The values directly measure from software and calculation done like compressive strength, percentage elongation, percentage reduction , yield strength and young modulus of the material

**C. Shear Test**

A shear test is a method for determining the behaviour of materials under a shear load. Due to force body to slider relative to each other in parallel direction to their plane of contact is called shear forceultimate load obtain , the stress wrt to shear force to end also note produce fracture in the plane of cross section is called shear strength. The shear test is used to determine ultimate shear

 ©IJSRED: All Rights are Reserved 

stress of single shear when load applied in plane will result single specimen into 2 pieces.

**2. Hardness Testing Of Specimen On RHM**

Hardness test conducted on the specimen to determine Rockwell hardness no on conventional and heat treated at different temperature of HCS specimens using "Rockwell hardness tester ".Hardness is the ability to resist permanent indent, generally this permanent indentation represents with respective load applied. If the hardness is higher in metal the it causes high resistance to deformation.

**3. Wear Test**

Generally wear test was conducted by "pin on disk" machine with ordinary condition. Test will be done for different applied load and sliding speed which is used to measure the wear rate by volume, time and specific wear rate of the specimen directly measured from the computer software in system.

**4.Microstructure Test**

To study its microstructure by using SEM analysis.Selection of particular area of the specimen for investigating the material properties of a metal or alloy cutted into small size Flat surface should be obtained on the specimen using fine coarse filing or grinding process.Different grades of emery paper are used for intermediate and fine grinding.Rough polishing should be carried out with small amount of diamond powder covered with nylon cloth on rotating surface of polishing wheel.

## IV. RESULTS &DISCUSSION

The high carbon steel specimens were subjected to heat treatment processes and subjected to varioustesting to find properties. We have used electric muffle furnace for heating the specimens. There as on of heat-treating steel is to control its mechanical properties by changing the distribution of carbon within the product and microstructure of specimen.Also the heat treatment process soften the metal, changes the grain size, adjusts the structure of the material and relieves the stress set up in the material due to hot working process and cold working process.The specimens were subjected to tensile test by using universal testing machine. The specimens' ultimate tensile strength, percentage elongation, percentage reduction, yield strength and young modulus of the material were determined.The hardness test conducted on the specimens to determine Rockwell hardness no using rockwell hardness tester. The hardness is the ability to resist permanent indent, generally this permanent indentation represents with respective load applied. If the hardness is higher in metal then it causes high resistance to deformation. Scanning electron microscope was used to study the microstructure and chemical composition of the specimens. The election of particular area of the specimen for investigating the material properties of a metal or alloy was cut into small size. The flat surface was obtained on the specimen using fine coarse filing. The different grades of emery paper were used for intermediate and fine grinding. The rough polishing was carried out with small amount of diamond powder covered with nylon cloth on rotating surface of polishing wheel. The chemical composition of specimens is shown in the Table 1. From the table it is observed that the carbon content is gradually reduced compare to conventional HCS. The Si, Mn and Cu content of higher in normalizing and lower in quenching process. The Fe content is higher than the HCS. The Cu content is the lowest as compared to HCS .

 ©IJSRED: All Rights are Reserved 

Table I: Chemical composition of specimen

| SMPL | C% | Si% | Mn% | S% | P% | Fe% | Cu% |
|---|---|---|---|---|---|---|---|
| HCS | 0.9 | 0.19 | 0.4 | 0.02 | 0.18 | 97.7 | 0.54 |
| 900Q | 0.57 | 0.19 | 0.22 | 0.02 | 0.12 | 98.7 | 0.1 |
| 700Q | 0.65 | 0.2 | 0.51 | 0.02 | 0.28 | 96.7 | 0.4 |
| 500Q | 0.61 | 0.38 | 0.11 | 0.02 | 0.22 | 98.4 | 0.1 |
| 900N | 0.54 | 0.26 | 0.41 | 0.02 | 0.19 | 98 | 0.4 |
| 700N | 0.49 | 0.13 | 0.41 | 0.02 | 0.08 | 98.2 | 0.17 |
| 500N | 0.39 | 0.22 | 0.56 | 0.02 | 0.26 | 96.3 | 0.1 |

**A. Graphical representation of a Hardness**

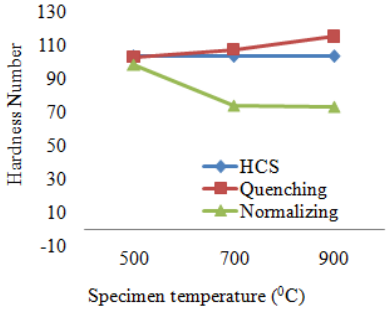



Figure 2 Effect of heat treatment on hardness at different temperature

Figure 2 shows the effect of heat treatment temperature on HCS, Quenched and normalized specimens. From the figure it is observed that the heat treatment process affects the hardness of the specimen significantly. The hardness values of the normalized specimens decreases with increase in temperature. However a small difference in changes in hardness of HRC specimens was observed. It is observed that the value of hardness of HCS after quench in oil is higher than quench by open air. This is due to faster cooling in oil as compared to air cooling and also oil is a best quenching media than the air. It is also reported in the literature that the liquid medium is one of the efficient and best quenching media when maximum hardness is required.

**B. Graphical representation of a Tensile test**

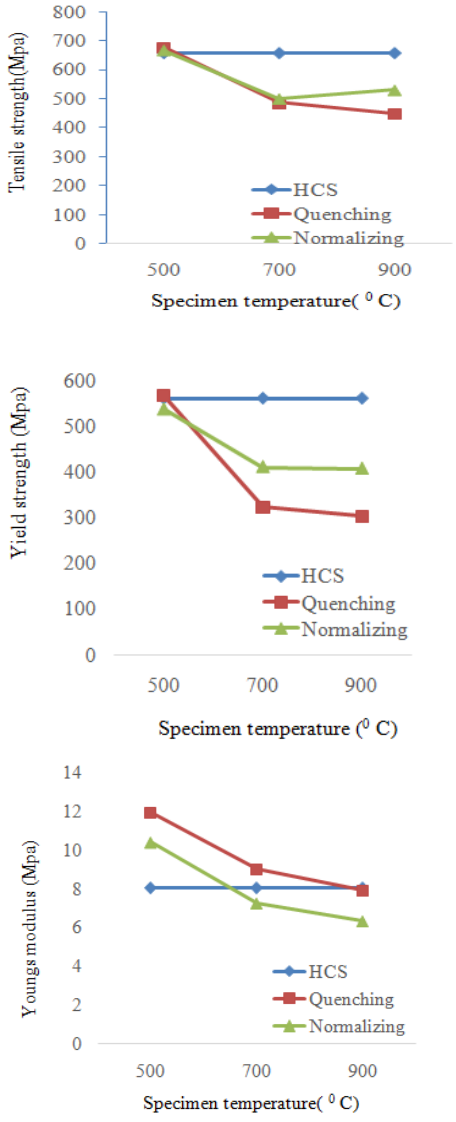



Figure 3 Effect of heat treatment on tensile strength ,yield strength, young's modulus at different temperature

The variation in tensile strength,yield strength,youngs modulus of heat treated specimens at different temperature is shown in figure 3. From the figure, it is observed that the heat treatment significantly affects the

 ©IJSRED: All Rights are Reserved 

tensile strength, yield strength, youngs modulus of the specimens. The tensile strength,yield strength,youngs modulus value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment process the carbon content reduced gradually fast and unfiorm cooling which modified grain size due to elastic deformation It is observed that the tensile strength of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like tensile strength has been increased ,while hardness decreases respectively compare to conventional HCS.

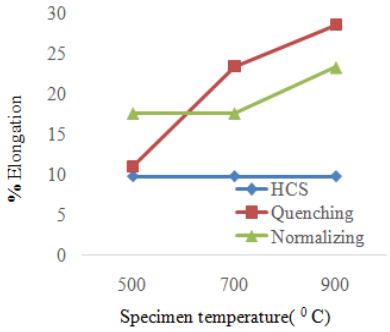



Figure 7 Effect of heat treatment on % elongation at different temperature

Figure 4 shows the variation in % elongation of heat treated specimens at different temperature. From the figure 4, it is observed that the heat treatment significantly affects the % elongation of the specimens. The % elongation value of the specimens subjected to quenching and normalizing increases with increase in temperature. The % elongation of normalizing is lower than the quenching. during quenching process is uniform and fast cooling rate behave super plastic characteristic with %C reduce gradually the hyper to hypoeutectic particles so modifying size of grain structure with non-homogeneous arrangement of grains It is could be as a result of ferrite and cementite formed from the martensite. This is because tempering treatment at elevated temperature is able to increase the number of planes of treated sample for dislocation movement to occur so this process will remove the residual stresses to re-crystallization. Increases hardness and ,% elongation,resistance of material from deformation with increase in temperature .

**C. Graphical representation of a Compression test**

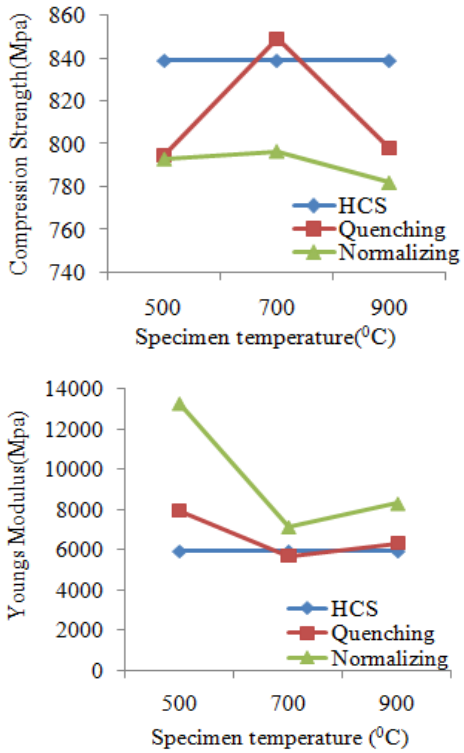


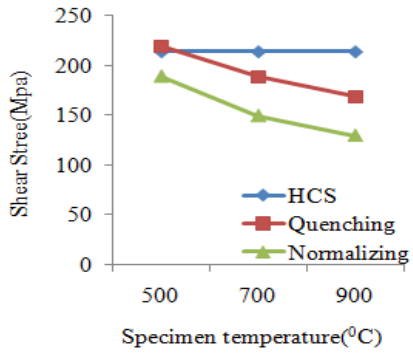

Figure 5 Effect of heat treatment compression strength and young's modulus at different temperature for CT

The variation in compression strength of heat treated specimens at different temperature is shown in figure 5. From the figure, it is observed that the heat treatment significantly affects the compression strength of the specimens. The compression strength value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment

 ©IJSRED: All Rights are Reserved 

process the carbon content reduced gradually fast and uniform cooling which modified grain size due to elastic deformation It is observed that the compression strength of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like compression strength has been increased , while medium hardness. The youngs modulus value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment process the carbon content reduced gradually fast and uniform cooling which modified grain size due to elastic deformation It is observed that the young's modulus of normalized specimen is higher than the quenched specimen. These results conclude that young's modulus increases for the specimen when oil quenching and air cooling process at $500^0$ C temperature compare to conventional HCS .but compression strength increases for the specimen when oil quenching and air cooling process at $700^0$ C temperature compare to conventional HCS.

**D. Graphical representation of a Shear test**



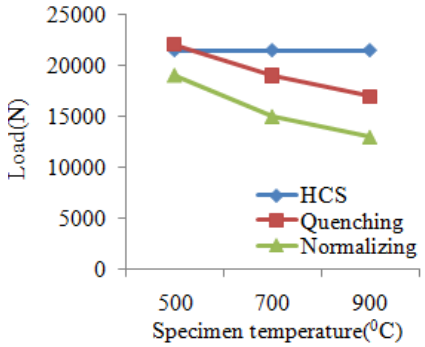
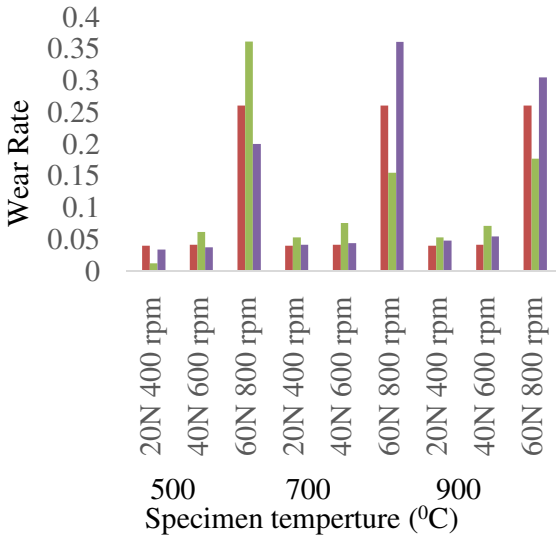



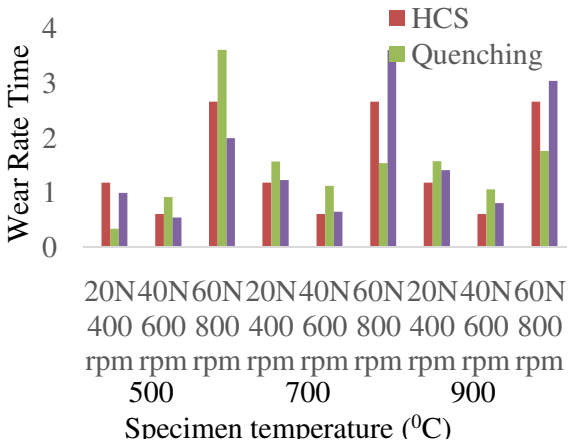

Figure 6 Effect of heat treatment shear stress and load at different temperature for ST

The variation in shear stress and load of heat treated specimens at different temperature is shown in figure 6. From the figure, it is observed that the heat treatment significantly affects the ultimate shear stress and ultimate load of the specimens. The ultimate shear stress and ultimate load value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment process the carbon content reduced gradually fast and uniform cooling which modified grain size due to elastic deformation It is observed that the ultimate shear stress and ultimate load of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like ultimate shear stress and ultimate load has been increased , while hardness decreases. These results conclude that shear stress and ultimate load increases for the specimen when oil quenching and air-cooling process at $500^0$C temperature compare to conventional HCS.

 ©IJSRED: All Rights are Reserved 

**E. Graphical representation of a Wear test**



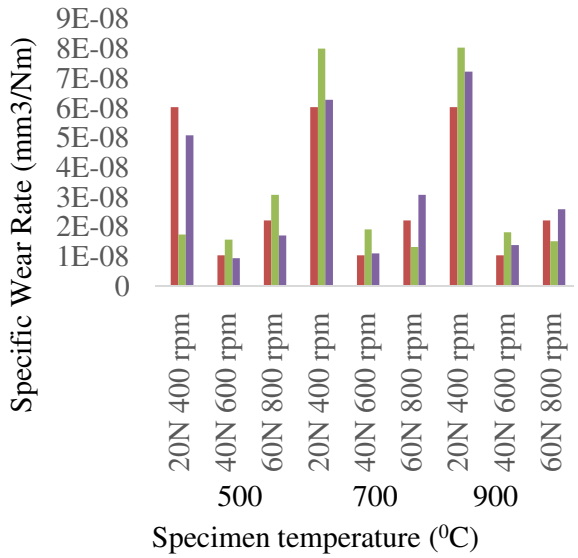




Figure 7 Effect of heat treatment on specific wear rate at different load and speed for WT

Figure 7 shows the Effect of heat treatment Comparison of wear rate by volume, time and specific wear rate conduted for different speed and load like 20N(400rpm) ,40N(600rpm) , 60N(800rpm) value of conventional HCS with heat treated process for quenching and normalizing process. These results conclude that Wear rate by volume,time and specific wear rate increase for specimen $700^0$ C when oil quenching process for 20N(400rpm) ,40N(600rpm) and also increase for specimen $900^0$ C when air cooling and oil quenching process ,but for 60N(800rpm) and also increase for specimen $700^0$ C when air cooling and $500^0$ C oil quenching process compare to conventional HCS.

**F. SEM image representation of a Microcture test**

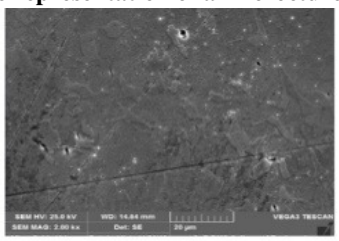


Figure 8 (a) SEM image of HCS at 20 µm of 2000x

 ©IJSRED: All Rights are Reserved 

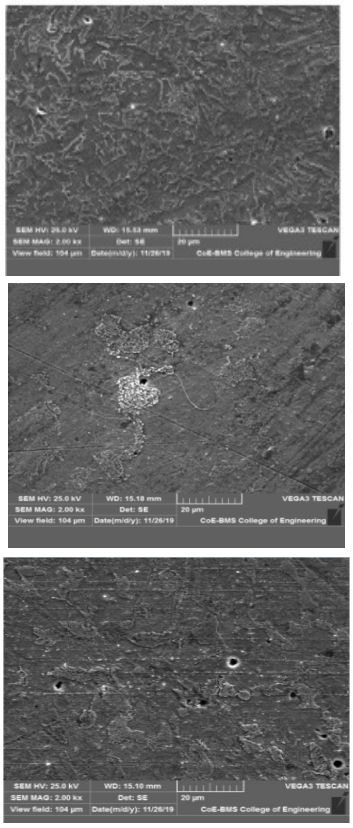
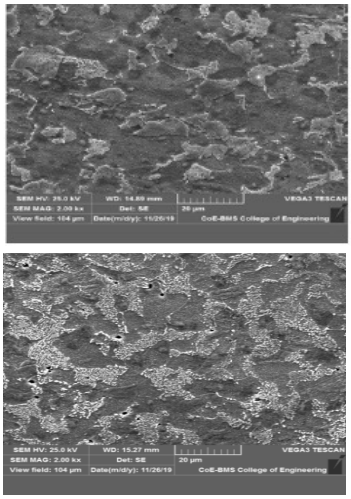


Figure 8 (b) SEM images of 900Q,700Q,500Q at 20 µm of 2000x



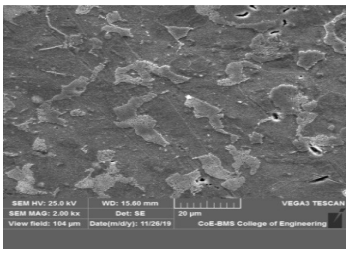


Figure 8 (c) SEM images of 900N,700N,500N at 20 µm of 2000x

Figure 8(a) shows that the microstructure of HCS specimen primarily consist ferrite and cementite(Fe3) and the transformation takes as pearlite. It is observed that the ultra-fine grains of white patches indicate ferrite and discontinuous proeutectoid carbide particles these steel are superplastic.Figure8(b,c) shows the microstructures of 900Q, 700Q,500Q and 900N,700N,500N respectively. It shows that the specimen mainly consists ferrite, pearlite, cementite and austenite due to heating and fast cooling and austenite transformation due to Fe into martensite. Conventional HCS has some properties with high carbon content, ultra-fine grains of white patches indicate ferrite and discontinuous pro eutectoid carbide particles with high hardness and strength, wear resistance and improves the toughness. Similarly other specimens carried out heat treatment at different temperature to study the effect of quenching and normalizing process .during quenching process is uniform and fast cooling rate behave super plastic characteristic with %C reduce gradually the hyper to hypoeutectic particles so modifying size of grain structure with non-homogeneous arrangement of grains so this process will remove the residual stresses to re-crystallization. Increases hardness and resistance of material from deformation. normalizing process is non uniform and slow cooling rate behave super elastic characteristic based on %C reduce gradually the hyper to hypoeutectic particles so refine size of grain structure with homogeneous

 ©IJSRED: All Rights are Reserved 

arrangement of grains and observed so it has changed from brittle to ductility ,improve mach inability, increased hardness and improve internal stress of material improves life of specimen. based on this microstructure mechanical performance improvised with increase in temperature with high hardness,% elongation,% reduction, very good wear resistance and decreases tensile ,yield strength, ductility, toughness and young's modulus, improve mach inability, improve internal stress of material improves life of specimen. Similarly vice-versa for performance decrease as temperature reduces.

## VI. CONCLUSION

In this work, heat treatment of high carbon steel was carried out to study the effect of quenching and normalizing on the properties of high carbon steel. From this work, we observed that the hardness value is higher in quenching in oil as compared to quenching in open air. The oil quenching gives efficient and excellent tool performance to HCS. From the material testing it is observed that the tensile strength, yield strength and young's modules of quenching is higher than the normalizing and % of elongation, % reduction of normalizing is higher than the quenching. In this work, heat treatment of high carbon steel was carried out to study the effect of quenching and normalizing on the properties of high carbon steel. From this work, we observed that the Compression strength is is higher in quenching in oil as compared to quenching in open air. when we observed that the medium hardness value. shear strength value is observed that the ultimate shear stress and ultimate load of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like ultimate shear stress and ultimate load has been increased , while hardness decreases respectively compare to others and normal HCS respectively.Wear rate by volume, time and specific wear rate has been with respective different load and different speed which depends on the hardness of the specimen.Wear rate by volume,time and specific wear rate increases at 900 deg c of normalizing process and 700 deg c of quenching process for different speed and load for 20N at 400rpm and 40N at 600rpm but for 60N at 800 rpmincreases at 700 deg c of normalizing process and 500 deg c of quenching process compare to others and normal HCS respectively Microstructure study with SEM analysis was investigated chemical, physical properties of the specimen. Conventional HCS has some properties with high carbon content, ultra-fine grains of white patches indicate ferrite and discontinuous pro eutectoid carbide particles with high hardness and strength, wear resistance and improves the toughness.Based on this microstructure mechanical performance improvised with increase in temperature with high hardness,% elongation,% reduction, very good wear resistance and decreases tensile ,yield strength, ductility, toughness and young's modulus, improve mach inability, improve internal stress of material improves life of specimen. Similarly vice-versa for performance decrease as temperature reduces.

## ACKNOWLEDGEMENT

I would like to heartfelt thanks to the Management & all staffs of Nagarjuna College of Engineering and Technology, Bengaluru provided facilities to conduct heat treatment analysis on various materials testing for giving constant support and encouragement. We gratefully acknowledge the technical support provided by non technical and technical staffs of BMS College of Engineering and Technology & Reva college of Engineering,

 ©IJSRED: All Rights are Reserved 

Bengaluru for with technical support for carrying few tests conducted out for project work at their organization.

## REFERENCES

[1] Dr. M. Jinnah Sheik Mohamed, A. Abdul Munaf, Dr. Mohammed Musthaf *2018* "Enhancement of Mechanical Properties of MS and SS through Various Heat Treatment Processes" *International Journal for Research in Applied Science & Engineering Technology (IJRASET)and Faculty in Mechanical Engineering, Shinas College of Technology, Shinas, Sultanate of Oman.*

[2] Amit Kumar, Tanwer ,*2014*, "Effect of Various Heat Treatment Processes on Mechanical Properties of MS and SS" *American International Journal of Research in Science, Technology, Engineering & Mathematics.*

[3] Noor Mazni Ismail, Nurul Aida Amir Khatif, Mohamad Aliff Kamil Awang Kecik, Mohd Ali Hanafiah Shahabuddin 2016 "The effect of heat treatment on the hardness and impact properties of medium carbon steel" *Faculty of Manufacturing Engineering, University Malaysia Pahang, 26600 Pekan, Malaysia iMEC-APCOMS 2015*

[4] Fadare D.A., Fadare T.G. and Akanbi D.Y.*2011* "Effect of heat treatment on mechanical properties and microstructure of NST 37-2 steel" *Journals of minerals and materials characterization and engineering.*

[5] V. Mounika, K. Priyanka, Ch. Nagarjuna, G. Anil Kumar, D.S. Arjun," Effect of Heat Treatment on Mechanical and Corrosion Properties of Stainless Steel" *Rajiv Gandhi University of Knowledge Technologies, Nuzvid APIIIT Krishna (D)*

[6] Ahaneku I. E., A. R. Kamal, O. A. Ogunjirin, *2012*"effects of heat treatment on the properties of mild steel using different quenchants", *frontiers in science*

[7] Marcelo Martins, Luiz Carlos Casteletti c *2005* "Heat treatment temperature influence on ASTM A890 GR 6A super duplex stainless steel microstructure" *Aeronautics and Automobiles Engineering Department at the Sa˜o Carlos Engineering School of the Sa˜o Paulo University (USP), Brazil*

[8] O. I. Sekunowo, S. O. Adeosun, and O. E. Ojo *2014* "Mechanical Properties Enhancement of Conventional Mild Steel for Fastener Application" *International Journal of Engineering and Technology (IJET) and Federal Institute of Industrial Research Oshodi (FIIRO), Lagos.*

[9] Motagi B.S. and Bhosle R.*2012* "Effect of heat treatment on microstructure and mechanical properties of medium carbon steel", *International Journal of engineering research and development*

[10] MahyarMohammadnezhad, Vahid Javaheri 2012" The effects of heat treatment on the mechanical properties of wear resistant Cr-Mo Steel" *International Conference on Materials Heat Treatment, Islamic Azad University, Isfahan, Iran..*

[11] Uttam B. Kalwane, Yuwaraj M. Ghugal and Ajay G. Dahak *2016* "Shear strength of polymer modified steel fiber reinforced concrete" *The Indian Concrete Journal.*

[12] Rumana Hossain, FarshidPahlevani and Veena Sahaj Walla *2018* "Evolution of Microstructure and Hardness of High Carbon Steel under Different Compressive Strain Rates" *Centre for Sustainable Materials Research and Technology and The University of New South Wales, Sydney.*

[13] Ezio Cadoni, Daniele Forni, Roman Gieleta and Leopold Kruszka, *2018* "Tensile and compressive behaviour of S355mild steel in a wide range of strain rates" *Faculty of Civil Engineering and Geodesy, Military University of Technology,00-908 Warsaw, Poland and University of Applied Sciences of Southern Switzerland, Canobbio, Switzerland.*

[14] Minjung Kang, In-Hwan Jeon, Heung Nam Han and Cheolhee Kim, *2018* "Tensile–Shear Fracture Behaviour Prediction of High-Strength Steel Laser Overlap Welds" *Department of Materials Science and Engineering and RIAM, Seoul National University, Seoul 08826, Korea.*

[15] Hossain, R.; Pahlevani, F.; Quadir, M.; Shahjalal's *2016* "Stability of retained austenite in high carbon steel under compressive stress" *An investigation from macro to nano scale.*

 ©IJSRED: All Rights are Reserved 

International Journal of Scientific Research and Engineering Development-– Volume 3 Issue 3, May – June 2020

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

# Compressive and Wear Properties of Heat Treated "High Carbon Steel"

**Nethravathi B N[1], N Kapilan[2]**

Department of Mechanical Engineering

Nagarjuna College of Engineering and Technology, Bengaluru, INDIA

[1] nethra.abc@gmail.com, [2] kapil_krecmech@yahoo.com

----------**********----------

## Abstract:

The aim of this project is ,tells about to improve the material properties of the specimen of conventional HCS by heat treated at different temperature like 500deg C,700deg C,900deg C both normalizing and quenching processwill changes its physical, chemical, and mechanical properties compare to conventional HCS. Initially specimen preparation will be done with the help of lathe and shaper machine . specimen subject on UTM machine for compression test and shear test, wear test on pin on disc and micro structure with SEM analysis .By an overall analyzing the graphs, compression strength and shear strength value observed increases at 500deg of normalizing process and 500deg of quenching process ,%elongation and % reduction will decreases respectively compare to others and normal HCS respectively. Also wear rate by volume, time and specific wear rate increases the micro structure changes from hyper to hypoeutectic particles so refine size of grain structure with homogeneous arrangement of grains consist ,better elastic characteristic and observed so it has changed from brittle to ductility ,improve mach inability, increased hardness and improve internal stress of material improves life of specimen.

*Keywords* **— High carbon steel, heat-treatment, Quenching and Normalizing, compressive, shear, wear and microstructure properties.**

----------**********----------

## I. INTRODUCTION

This the study regarding the wear test properties on different heat treatment process .wear resistance varies with respective alloy steel with % C 2.3,%Fe0.7,%Cr 0.4,5%Mo 0.5and some % of Si which is used for lining manufacturing for rolling mill .the specimen will be heated at the 900deg C and quenching process is done in oil bath which shows hardness value increases but further increase in the temperature about 960 deg C the hardness value decreases with the further increase in the temperature. It has been moderate at 940 deg C if its heat above less hardness if it's bellow high hardness .this effect of quenching will fall an impact on toughness it decreases due to increase temperature above 960 deg C. Due to tempering process if temp is greater than 400 deg C hardness value will reduce .but if its tempering process done around 300 deg C has good wear resistance which can be used for increase the service life of the rolling mill liner .[1] It's an investigation study for an experimental on shear stress for the effects on the steel fiber and polymer latex in concrete .due to variation of the % of composition of steel fibers from 0-7% at an interval of 1%for latex polymer matrix 15% of concrete used .prisms has 2 different dimension of single and double type blocks larger in the size broken under double shear test [2]. They found that phase stability and modify

 ©IJSRED: All Rights are Reserved 

grain size of structure for the hardness value. Due to increase the hardness value of HCS grain refinement, increase the dislocating of density, formation of nano twinning etc Due to tempering process in the solution the ferrite phase decreases in microstructure consequently. If ferrite phase dissolved in solution but material hardness changes to ferrite and austenite presence in the structure..[3].Tensile and compressive test conduct with the help of UTM machine to study the behavior of mechanical properties. Also compared to properties wrt to tensile versus compressive deformations.[4].The fracture interface with base and heat affected zone material for studying the mechanical properties of tensile and shear test. The similar and dissimilar metals combine the various grade of steel which has different strength and the hardness value. Critical interface avoids the accuracy greater than 90 %.but experiment conduct will have 5% greater than the calculated value to avoid fracture.[5] in this paper describe about both micro and nano the compressive stability will be present in the austenite formation in HCS.so by using standard test method like compressive testing, electron backscattering diffraction imaging, X-ray diffraction, optical microstructure, nano-indentation, electron probe micro-analysis and micro-indentation instrument used to measure the stability of retain of austenite and martensite in HCS under CS and transformation take place from micro to nano level.Intally it will plastic deformation with martensite due to increase in the load this lead strain hardening with increase of hardness value by 30%.Based on the characteristic of stress obtained which control microstructure in HCS and its properties.[6].

## II. MATERIAL AND METHODOLOGY

In this work, high carbon steel was purchased and the samples were prepared as per ISO standards. Thesamples were subjected heat treatment for different temperature such as 500, 700 and 900 degree C in muffle furnace and subjected to both normalizing and quenching process. Figure 1 shows the specimens prepared for different tests. the specimens subjected to Quenching and normalizing process. The properties of the samples were determined using universal testing machines, wear testing machine(pin on disc). The scanning electron microscope tests were conducted to find the microstructure of the samples.

Figure 1: All Specimens for different test

Normalizing is the process of heating specimen at high temperature in muffle furnace and cooling in atmospheric air-cooling medium which should be equal to room temperature. The specimen were heated to 500, 700 ,900 deg C and cooled to room temperature. This is the most common form of heat treatment and gives steel high strength and hardness. Also this process can refine grain structure, improves hardness, tensile strength and mach inability, causes low ductility and removes both strain and dislocation. The microstructure mainly consists of the ferrite and cementite.

Quenching is the process of heating specimen at high temperature in muffle furnace and cooling in oil bath as medium which maintain to room temperature. In this work, the specimens were heated to 500, 700 , 900 deg C and cooled in oil bath until the specimen temperature reaches the room temperature. The quenching increases the hardness of the steel, however it also increase brittleness and the steel is susceptible to breaking and cracking. The formation of pearlite changes to austenite because of fast cooling oil so microstructure consists of ferrite marten site and cementite.

 ©IJSRED: All Rights are Reserved 

## III. EXPERIMENTAL WORK

### 1.Test Conducted on UTM

Generally to find the mechanical performance of the specimen,compression,shear

#### A. Compression Test:

To study the material behaviour of mechanical properties of conventional and different heat treated specimen of HCS. the specimen is compressed, and data obtained directly is deformation versus the applied load is recorded .The values directly measure from software and calculation done like compressive strength, percentage elongation, percentage reduction , yield strength and young modulus of the material

#### B. Shear Test

A shear test is a method for determining the behaviour of materials under a shear load. Due to force body to slider relative to each other in parallel direction to their plane of contact is called shear forceultimate load obtain , the stress wrt to shear force to end also note produce fracture in the plane of cross section is called shear strength. The shear test is used to determine ultimate shear stress of single shear when load applied in plane will result single specimen into 2 pieces.

#### 2. Wear Test

Generally wear test was conducted by "pin on disk" machine with ordinary condition. Test will be done for different applied load and sliding speed which is used to measure the wear rate by volume, time and specific wear rate of the specimen directly measured from the computer software in system.

#### 3. Microstructure Test

To study its microstructure by using SEM analysis.Selection of particular area of the specimen for investigating the material properties of a metal or alloy cutted into small size Flat surface should be obtained on the specimen using fine coarse filing or grinding process.Different grades of emery paper are used for intermediate and fine grinding.Rough polishing should be carried out with small amount of diamond powder covered with nylon cloth on rotating surface of polishing wheel.

## IV. RESULTS &DISCUSSION

The high carbon steel specimens were subjected to heat treatment processes and subjected to varioustesting to find properties. We have used electric muffle furnace for heating the specimens. There as on of heat-treating steel is to control its mechanical properties by changing the distribution of carbon within the product and microstructure of specimen.Also the heat treatment process soften the metal, changes the grain size, adjusts the structure of the material and relieves the stress set up in the material due to hot working process and cold working process.The specimens were subjected to tensile test by using universal testing machine. The specimens' ultimate tensile strength, percentage elongation, percentage reduction, yield strength and young modulus of the material were determined.The hardness test conducted on the specimens to determine Rockwell hardness no using rockwell hardness tester. The hardness is the ability to resist permanent indent, generally this permanent indentation represents with respective load applied. If the hardness is higher in metal then it causes high resistance to deformation. Scanning electron microscope was used to study the microstructure and chemical composition of the specimens. The election of particular area of the specimen for investigating the material properties of a metal or alloy was cut into small size. The flat surface was obtained on the specimen using fine coarse filing. The different grades of

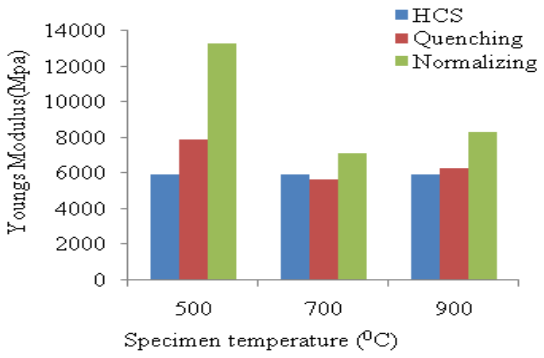
 ©IJSRED: All Rights are Reserved 

emery paper were used for intermediate and fine grinding. The rough polishing was carried out with small amount of diamond powder covered with nylon cloth on rotating surface of polishing wheel. The chemical composition of specimens is shown in the Table 1. From the table it is observed that the carbon content is gradually reduced compare to conventional HCS. The Si, Mn and Cu content of higher in normalizing and lower in quenching process. The Fe content is higher than the HCS. The Cu content is the lowest as compared to HCS .

Table I: Chemical composition of specimen

| SMPL | C% | Si% | Mn% | S% | P% | Fe% | Cu% |
|---|---|---|---|---|---|---|---|
| **HCS** | 0.9 | 0.19 | 0.4 | 0.02 | 0.18 | 97.7 | 0.54 |
| **900Q** | 0.57 | 0.19 | 0.22 | 0.02 | 0.12 | 98.7 | 0.1 |
| **700Q** | 0.65 | 0.2 | 0.51 | 0.02 | 0.28 | 96.7 | 0.4 |
| **500Q** | 0.61 | 0.38 | 0.11 | 0.02 | 0.22 | 98.4 | 0.1 |
| **900N** | 0.54 | 0.26 | 0.41 | 0.02 | 0.19 | 98 | 0.4 |
| **700N** | 0.49 | 0.13 | 0.41 | 0.02 | 0.08 | 98.2 | 0.17 |
| **500N** | 0.39 | 0.22 | 0.56 | 0.02 | 0.26 | 96.3 | 0.1 |

A. **Graphical representation of a Compression test**



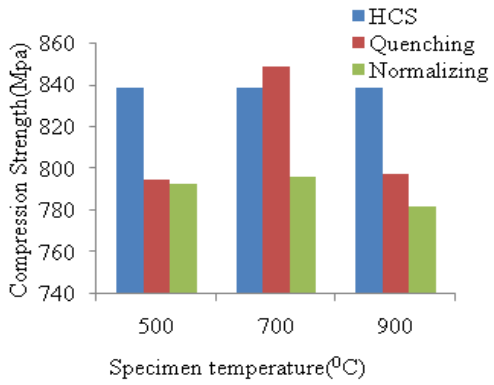




Figure 2 Effect of heat treatment compression strength and young's modulus at different temperature for CT

The variation in compression strength of heat treated specimens at different temperature is shown in figure 2. From the figure, it is observed that the heat treatment significantly affects the compression strength of the specimens. The compression strength value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment process the carbon content reduced gradually fast and uniform cooling which modified grain size due to elastic deformation It is observed that the compression strength of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like compression strength has been increased , while medium hardness. The youngs modulus value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment process the carbon content reduced gradually fast and uniform cooling which modified grain size due to elastic deformation It is observed that the young's modulus of normalized specimen is higher than the quenched specimen. These results conclude that young's modulus increases for the specimen when oil quenching and air cooling process at $500^0$ C temperature compare to conventional HCS .but compression strength

 ©IJSRED: All Rights are Reserved 

increases for the specimen when oil quenching and air cooling process at $700^0$ C temperature compare to conventional HCS.

**B. Graphical representation of a Shear test**

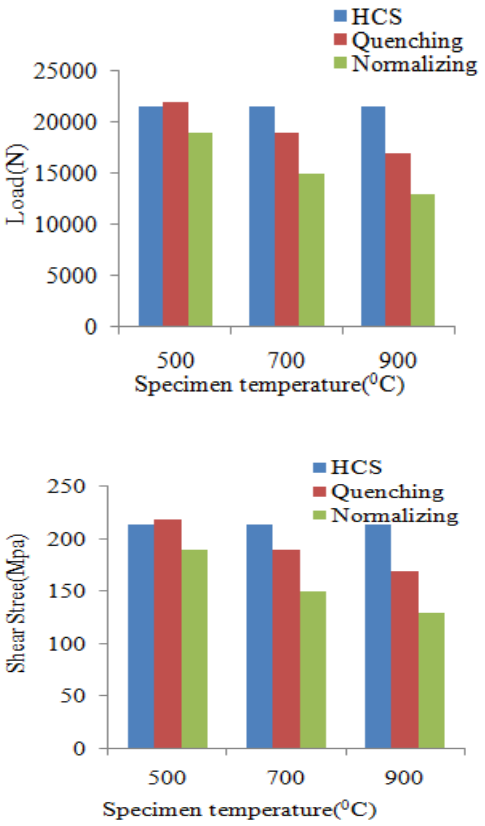
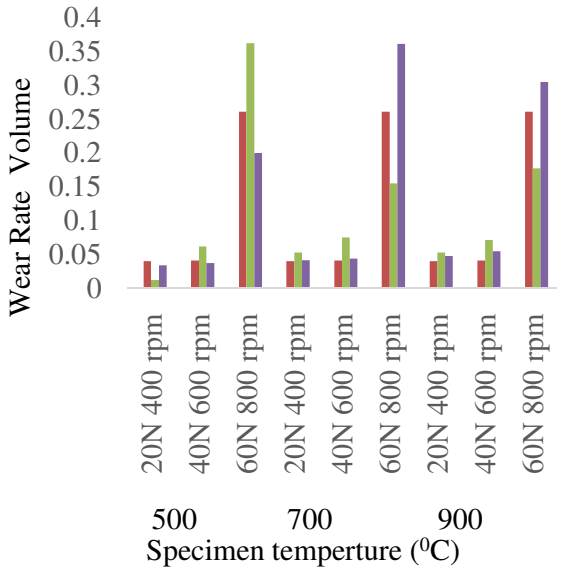
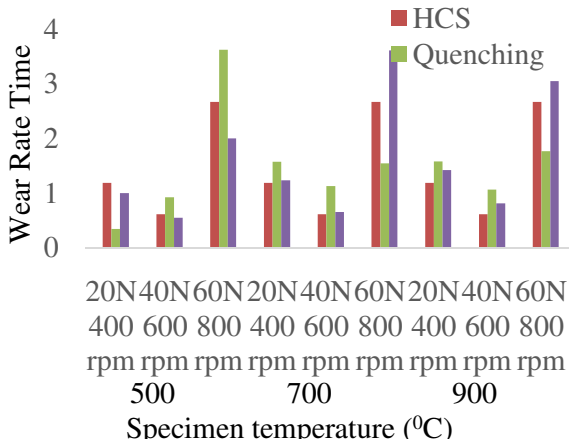



Figure 3 Effect of heat treatment shear stress and load at different temperature for ST

The variation in shear stress and load of heat treated specimens at different temperature is shown in figure 3. From the figure, it is observed that the heat treatment significantly affects the ultimate shear stress and ultimate load of the specimens. The ultimate shear stress and ultimate load value of the specimens subjected to quenching and normalizing reduces with increase in temperature, because during heat treatment process the carbon content reduced gradually fast and uniform cooling which modified grain size due to elastic deformation It is observed that the ultimate shear stress and ultimate load of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like ultimate shear stress and ultimate load has been increased , while hardness decreases. These results conclude that shear stress and ultimate load increases for the specimen when oil quenching and air-cooling process at $500^0$C temperature compare to conventional HCS.

**C. Graphical representation of a Wear test**




 ©IJSRED: All Rights are Reserved 

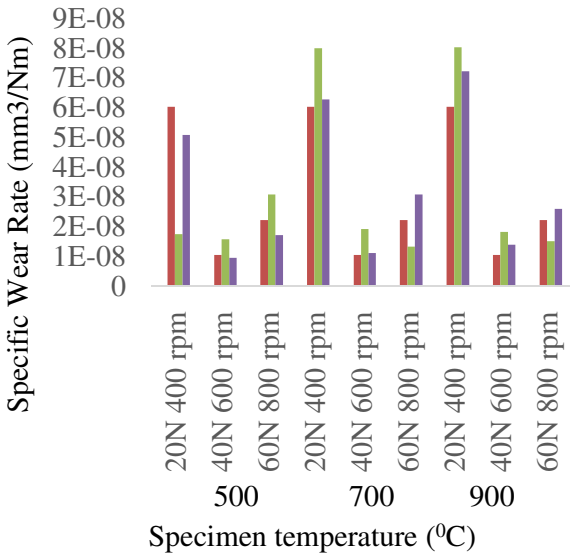



Figure 4 Effect of heat treatment on specific wear rate at different load and speed for WT

Figure 4 shows the Effect of heat treatment Comparison of wear rate by volume, time and specific wear rate conduted for different speed and load like 20N(400rpm) ,40N(600rpm) , 60N(800rpm) value of conventional HCS with heat treated process for quenching and normalizing process. These results conclude that Wear rate by volume,time and specific wear rate increase for specimen $700^0$ C when oil quenching process for 20N(400rpm) ,40N(600rpm) and also increase for specimen $900^0$ C when air cooling and oil quenching process ,but for 60N(800rpm) and also increase for specimen $700^0$ C when air cooling and $500^0$ C oil quenching process compare to conventional HCS.

**D. SEM image representation of a Microcture test**

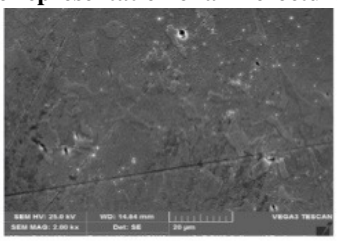


Figure 5 (a) SEM image of HCS at 20 µm of 2000x

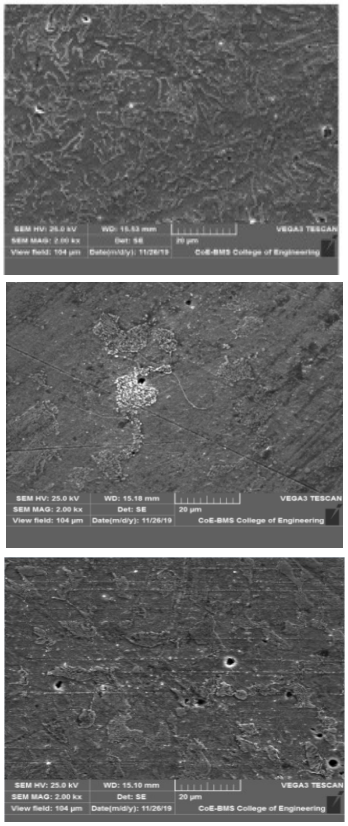
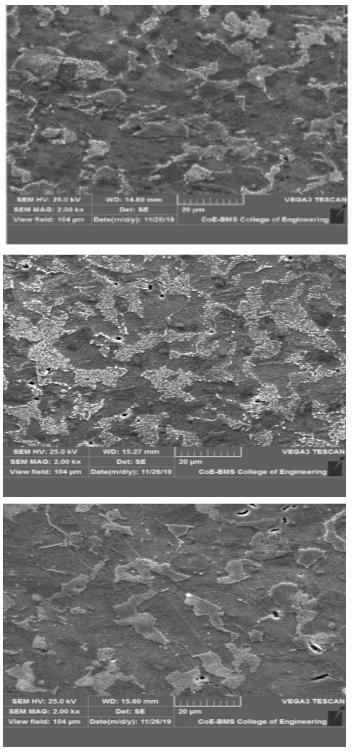


Figure 5 (b) SEM images of 900Q,700Q,500Q at 20 µm of 2000x



 ©IJSRED: All Rights are Reserved 

Figure 5 (c) SEM images of 900N,700N,500N at 20 µm of 2000x

Figure 5(a) shows that the microstructure of HCS specimen primarily consist ferrite and cementite(Fe3) and the transformation takes as pearlite. It is observed that the ultra-fine grains of white patches indicate ferrite and discontinuous proeutectoid carbide particles these steel are super plastic .Figure 5(b,c) shows the microstructures of 900Q, 700Q,500Q and 900N,700N,500N respectively. It shows that the specimen mainly consists ferrite, pearlite, cementite and austenite due to heating and fast cooling and austenite transformation due to Fe into martensite. Conventional HCS has some properties with high carbon content, ultra-fine grains of white patches indicate ferrite and discontinuous pro eutectoid carbide particles with high hardness and strength, wear resistance and improves the toughness. Similarly other specimens carried out heat treatment at different temperature to study the effect of quenching and normalizing process .during quenching process is uniform and fast cooling rate behave super plastic characteristic with %C reduce gradually the hyper to hypoeutectic particles so modifying size of grain structure with non-homogeneous arrangement of grains so this process will remove the residual stresses to re-crystallization. Increases hardness and resistance of material from deformation. normalizing process is non uniform and slow cooling rate behave super elastic characteristic based on %C reduce gradually the hyper to hypoeutectic particles so refine size of grain structure with homogeneous arrangement of grains and observed so it has changed from brittle to ductility ,improve mach inability, increased hardness and improve internal stress of material improves life of specimen. based on this microstructure mechanical performance improvised with increase in temperature with high hardness,% elongation,% reduction, very good wear resistance and decreases tensile ,yield strength, ductility, toughness and young's modulus, improve mach inability, improve internal stress of material improves life of specimen. Similarly vice-versa for performance decrease as temperature reduces.

## VI. CONCLUSION

In this work, heat treatment of high carbon steel was carried out to study the effect of quenching and normalizing on the properties of high carbon steel. From this work, we observed that the Compression strength is is higher in quenching in oil as compared to quenching in open air. when we observed that the medium hardness value. shear strength value is observed that the ultimate shear stress and ultimate load of quenched specimen is higher than the normalized specimen. It is also reported in the literature that the effect of specimen quenching in oil on mechanical properties like ultimate shear stress and ultimate load has been increased , while hardness decreases respectively compare to others and normal HCS respectively.Wear rate by volume, time and specific wear rate has been with respective different load and different speed which depends on the hardness of the specimen.Wear rate by volume,time and specific wear rate increases at 900 deg c of normalizing process and 700 deg c of quenching process for different speed and load for 20N at 400rpm and 40N at 600rpm but for 60N at 800 rpmincreases at 700 deg c of normalizing process and 500 deg c of quenching process compare to others and normal HCS respectively Microstructure base metal with high carbon content, with high hardness and strength, improves resistance value from deformation, will remove the residual stresses to re-crystallization with respective % of c .But heat treated specimen at different temperature changes its physical ,chemical, and mechanical properties for both normalizing and quenching process. So modifying size of grain structure, better elastic characteristic with non-homogeneous arrangement of grains which has superplastic characteristic, has changed from brittle to ductility ,improve machinability, increased

 ©IJSRED: All Rights are Reserved 

hardness and improve internal stress of material improves life of specimen.

## ACKNOWLEDGEMENT

I would like to heartfelt thanks to the Management & all staffs of Nagarjuna College of Engineering and Technology, Bengaluru provided facilities to conduct heat treatment analysis on various materials testing for giving constant support and encouragement. We gratefully acknowledge the technical support provided by non technical and technical staffs of BMS College of Engineering and Technology & Reva college of Engineering, Bengaluru for with technical support for carrying few tests conducted out for project work at their organization.

## REFERENCES

[1] Mahyar Mohammadnezhad, Vahid Javaheri *2012*" The effects of heat treatment on the mechanical properties of wear resistant Cr-Mo Steel" *International Conference on Materials Heat Treatment, Islamic Azad University, Isfahan, Iran.*

[2] Uttam B. Kalwane, Yuwaraj M. Ghugal and Ajay G. Dahak *2016* "Shear strength of polymer modified steel fiber reinforced concrete" *The Indian Concrete Journal*.

[3] Rumana Hossain, Farshid Pahlevani and Veena Sahaj Walla *2018* "Evolution of Microstructure and Hardness of High Carbon Steel under Different Compressive Strain Rates" *Centre for Sustainable Materials Research and Technology and The University of New South Wales, Sydney.*

[4] Ezio Cadoni, Daniele Forni, Roman Gieleta and Leopold Kruszka, *2018* "Tensile and compressive behaviour of S355mild steel in a wide range of strain rates" *Faculty of Civil Engineering and Geodesy, Military University of Technology,00-908 Warsaw, Poland and University of Applied Sciences of Southern Switzerland, Canobbio, Switzerland*

[5] Minjung Kang, In-Hwan Jeon, Heung Nam Han and Cheolhee Kim, *2018* "Tensile–Shear Fracture Behaviour Prediction of High-Strength Steel Laser Overlap Welds" *Department of Materials Science and Engineering and RIAM, Seoul National University, Seoul 08826, Korea*

[6] Hossain, R.; Pahlevani, F.; Quadir, M.; Shahjalal's *2016* "Stability of retained austenite in high carbon steel under compressive stress" *An investigation from macro to nano scale.*

 ©IJSRED: All Rights are Reserved 

# Effect of Mechanical and Tribological properties on Aluminium - Graphene reinforced composites

**Vinod Kumar R, [1] Reddappa H. N. [2] & Chandrashekar A [3]**

*[1]Assistant Professor, Department of Mechanical Engineering,*
*Nagarjuna College of Engineering & Technology, Bangalore-562 164*

*[2 & 3]Associate Professor and Assistant Professor, Department of Mechanical Engineering*
*Bangalore Institute of Technology, Bangalore-560 004*

*[1]viniparv@gmail.com [2] reddyhn@gmail.com [3]acsmech@gmail.com*$_2$

**Abstract :** *In recent years, the utilization of Metal Matrix Composites has increased in various areas of science and technology, due to their special physical, mechanical, and wear properties. Of all the Metal Matrix Composites, aluminium-based composites particularly are finding a lot of scope, due to their excellent high strength to weight ratio, high stiffness, higher thermal conductivity as well as corrosion, and wear resistance properties. Therefore, aluminium based composites have the potential to replace the conventional materials in the field of automobile, aerospace, construction, house-hold appliances, and food packaging industries. In the past decades, various materials have been used as reinforcements to fabricate aluminium composites, such as alumina oxide, silicon carbide, titanium carbide, Graphene, Red mud, tungsten carbide, and titanium di boride, etc.,.*

*The main objective of this study is to develop Graphene reinforced aluminium composites using Stir casting, Squeeze casting and the Powder metallurgy process.*

*The aluminium of 2024 selected as a metal matrix composite with graphene as reinforced material. 0.25%, 0.5%, 0.75%, 1% of graphene will be added to the metal to form composite was synthesized to investigate the effects of graphene dispersion by Stir casting / Squeeze casting technique.*

*This AMMC's can be fabricated in Stir casting/Squeeze casting set up with little effort and at low cost. The prepared composites are characterized by the mechanical properties, structural properties and tribological properties on graphene.*

***Keywords :*** *Aluminium alloy, Nano Graphene, Ultimate Tensile Strength, Yield Strength, Hardness, Stir casting, wear rate.*

## INTRODUCTION

Composite materials are playing vital and major role in research and development of various engineering and aeronautical sectors. In the past three decades composite materials are replaced most of the traditional materials because of obtaining superior properties such as higher specific strength, high hardness, high wear resistance, high thermal resistance and low density. For obtaining best result of mechanical properties specifically aluminium metal matrix composites have preferred in aeronautics, marine and automotive industries. Composite materials are manufactured through solid and liquid method. In the liquid metallurgy route following methods are preferred such as stir casting method, electromagnetic stir casting method, centrifugal cast and in-situ method.

Composite materials are classified into based on matrix material such as if matrix material is polymer it is called as polymer matrix composite (PMC), if matrix material is metal it is called as metal matrix composite (MMC) and if the matrix material is ceramic it is called as ceramic matrix composite (CMC).

Aluminium alloys are common lightweight materials that are known to have good thermal conductivity. However, the thermal conductivity of aluminium alloys may not be high enough for use in the manufacture of compact heat exchangers for specific applications including fuel cells. One method to enhance the thermal conductivity of aluminium alloys while maintaining their light weight is fabricating metal matrix composites (MMC) using materials with extremely high thermal conductivity as reinforcement.

Composite materials are gaining wide spread acceptance, due to their characteristic behaviour and high strength-to weight ratio. Of these Aluminium metal matrix composites are finding increased applications, because of their improved mechanical and Tribological properties. The fabrication techniques of MMC's play a major role in the improvement of the mechanical and Tribological properties.

Metal matrix may be aluminium and its alloys, Copper and its alloys, titanium and its alloys, magnesium and its alloys and Nickel based super alloys etc. They're appropriate where the working temperatures are very harsh or high.

Aluminium2024 Metal matrix composites(MMC's) have seen significant research by reinforcing various ceramic material ,heat treatment and various manufacturing processes ,various process parameters for improving the mechanical, thermal and corrosion related properties. Aluminium 2024 MMC's utilize ceramics like Al2O3, TiB2, TiO2,SiC, Tic, B4C,Graphite powder ,Carbon Nano particles ,E-glass fibres, Fly ash ,Red mud with individual and multiple particulate reinforcements like Hybrid Metal matrix composites Al2024 MMC's reinforced in various Wt. % and various particle size.

Al2024 metal matrix composites shows various benefits over monolithic materials including high strength to weight ratio, higher specific strength, and corrosion resistance, good wear resistance, higher thermal conductivity, lower coefficient of thermal expansion. Al 2024 reinforced composite finding increased applications in aerospace, automobile, space, underwater, and transportation applications.

The particle that is the particulate was reinforced with injection process into liquid matrix through liquid metallurgy route by die casting process. Die casting process is preferred because of less expensive and fit for mass production process. Among the entire liquid state production processes, stir casting is the simple and economical one.
To overcome this issue of metal can be alloyed with other metals to obtaining superior mechanical and thermal properties. Most of the aluminium available in the market, manufacturers has been alloyed with at least one other element. The typical alloying elements are copper manganese, magnesium, tin and zinc. There are two principal classifications, namely casting alloys and wrought alloys, both of which are further sub divided into the categories heat treatable and non-heat-treatable.

Graphene, which was experimentally demonstrated in 2004, is a basic building block for various graphitic materials including zero dimensional fullerenes (C60), one-dimensional carbon nanotubes (CNT), and three-dimensional graphite. Graphene shows excellent thermal conductivity (~5.30×103 W/mK),2 charge carrier mobility (~2×105 cm2/ Vs), 3 intrinsic strength (~130 GPa), Young's modulus (~1.0 TPa),4 and surface area (~ 2600 m2/g).5 Due to its excellent thermal conductivity, graphene is a good candidate for the reinforcement of an aluminium matrix to enhance the thermal conductivity.

This paper guides the engineers towards proper selection of materials by their properties in the relevant field and different techniques involved in manufacturing of metal matrix composites, particularly Liquid metallurgy technique like Stir casting processes, Preparation of AMC using aluminium 2024 as matrix form and Graphene as reinforcements by varying proportion.

Various manufacturing methods, mostly based on casting or powder metallurgy are available to fabricate Nano-size (or micro-size) particle/metal composites. However, uniform dispersion of Nano-size particles in molten metal can be extremely difficult. Also, micro-level porosity, a common casting defect, can be detrimental to fabrication of micro-level geometry, for example, micro-channels in a heat exchanger. While techniques based on powder metallurgy are effective for successful fabrication of MMC, the fabrication process is generally quite time-consuming and may not be cost-effective for fabrication of bulk composites.

*Among the available casting techniques, stir casting has the following major advantages:*

(i) The parts produced are without gas porosity or shrinkage porosity;

(ii) Feeders or risers are not required, and therefore no metal wastage occurs;

(iii) Alloy fluidity (cast ability) is not critical in stir casting, as both common casting alloys and wrought alloys can be squeeze cast to finished shape with the aid of pressure, and

(iv) Stir castings can have mechanical properties as good as wrought products of the same composition

Stir casting is an attractive processing method for producing Aluminium MMC's as they exhibit better mechanical properties due to the presence of fewer common defects such as porosity and shrinking cavities, and the elimination of segregation of the reinforcement. Stir casting employs low die filling velocity, with minimum turbulence and high-applied pressure, to produce good quality products. There are two different forms of stir casting, i.e., direct SC and indirect SC. In the direct stir casting process, the pressure is applied on the entire surface of the liquid metal during solidification by a punch, which produces castings of full density.

In the indirect stir casting process, the metal is injected into the die cavity by a small diameter piston. In the casting of metal matrix composites, the dispersion of the reinforcement particles within the matrix plays an important role in achieving the desired properties in the material. The wettability of the reinforcement particles in molten metal is improved by applying high pressures during casting.

In the present study, graphene/Al MMC is fabricated by Stir casting in order to take advantage of the extremely high thermal conductivity of graphene while maintaining a lightweight aluminium matrix. It involves the mechanical and tribological properties of stir cast aluminium matrix composites containing single and multiple reinforcement. The thermal conductivity and the mechanical property under quasi-static tensile loads of the graphene/Al MMC are evaluated. Addition of a graphene to aluminium has shown an increase in its mechanical and Tribological properties.

## OBJECTIVES

1. To prepare the metal matrix composite by varying reinforcement particles (0.25%, 0.5%, 0.75%, 1%) by using liquid metallurgy technique.
2. To characterize the structural properties of the prepared composites by SEM technique.
3. To characterize the prepared composite for their mechanical properties such as tensile test, hardness test and impact strength as per ASTM standards.
4. To characterize the tribological properties of the prepared composite by using Pin on disc wear test equipment.

### PREVIOUS WORK

Chi Hoon Jeon, Et Al , "Material properties of graphene/aluminium metal matrix composites fabricated by friction stir processing", Volume:15, 5th June-2015, has done that Graphene/aluminium metal matrix composites with enhanced thermal conductivity fabricated by friction stir processing. In fabrication of the MMC, graphene reinforcement is applied in the form of a graphene oxide (GO)/water colloid for safer and simpler processing. The thermal conductivity of the graphene/ aluminium MMC is measured to increase by more than 15% in comparison with that of the aluminium matrix. FSP and graphene reinforcement both improve the ductility of the fabricated MMC.

B.Sai Jagadish, Et Al, "Synthesis and characterization of aluminium2024 and graphene metal matrix composites by powder metallurgy", Volume: 2, 7thJuly -2015□, involve the development of metal matrix composite materials by combining the desirable attributes of metals and reinforcements. Here aluminium of 2024 issued as metal matrix composite with graphene as reinforced material. 0.25%, 0.5%, 0.75%, 1% of graphene are added to the metal to form composite.

Pulkit Garg, Pallav Gupta, Devendra Kumar And Om Prakash, et al "Structural and mechanical properties of graphene reinforced aluminium matrix composites", 20-feb-2016 studied that effect of sintering temperature on structural and mechanical properties of graphene reinforced aluminium matrix composites has been investigated. Addition of graphene as reinforcement in aluminium matrix increases the strength of aluminium.

Strength of the composite increases with increase in the percentage of graphene. The aim of this paper is to study effect of sintering temperature on density, phase, microstructure, hardness and compressive strength of graphene reinforced aluminium matrix composites containing 0.1 wt. %, 0.3 wt. % and 0.5 wt. % of graphene respectively.

A Baradeswaran & A. Elaya Perumalhor,et al, “Effect of graphite on Tribological and mechanical properties of al 7075 composites”,18-aug -2014, has shown that the materials were fabricated by a liquid casting technique. Composites with 5–20 wt. % graphite particles were processed. The hardness of the composites is measured using a Brinell hardness tester and their tensile strength is measured using a universal testing machine.

Lokesh K S,ChethanIc, Naveen Kumar Kr, Vinayaka Kannantha, et al, “Determination of compressive strength of graphene reinforced with aluminium-7075 metal matrix composites”, Volume: 9, 1- Jan -2018 , has concluded that the Graphene is added to aluminium matrix with 0.5%, 1%, 1.5%, and 2.0% by weight of the matrix. The aluminium powder used here is 7075 grade which the aluminium powder used here is meant for aerospace structure to retain as better matrix material.

T.W. Clyne and P.J. Withers et al., “An Introduction to Metal Matrix Composites”, Volume 4, Issue 9, September-2013 Structurally, MMCs consist of continuous or discontinuous fibers, whiskers, or particles in an alloy matrix which reinforce the matrix or provide it with requisite properties not achievable in monolithic alloy.

S.V. Prasad and R. Asthana et al “Aluminium Metal-Matrix Composites for Automotive Applications: Tribological Considerations”, Volume 4, Issue 9, September-2013, has explained the quest for improved performance has resulted in a number of developments in the area of MMC fabrication technology .These includes both the preparation of the reinforcing phases and the development of fabrication techniques. A number of composite fabrication techniques have been developed that can be placed into four broad categories. These are powder metallurgical techniques, liquid metallurgy. The liquid metallurgy techniques include unidirectional solidifications to produce directionally aligned MMCs, suspension of reinforcement in melts followed by solidification, compo casting, squeeze casting, spray casting, and pressure infiltration. The liquid metallurgy techniques are the least expensive of all, and the multi-step diffusion bonding techniques may be the most expensive.

B.C.Pai, P.K.Rohatgi, S.Venkatesh et al “Wear resistance of cast graphitic aluminium alloys” has shown that that the Wear rates of several cast aluminium base alloys have been measured for lubricated rubbing against a rotating hardened steel disk. Wear rates of cast graphitic aluminium-silicon-nickel alloys were lower than those of pure Al, Al-Si and Al-Si-Ni alloys especially above pressures of 0.02 kg/mm2. The high wear resistance is attributed to the presence of graphite particles in the matrix which act as a solid lubricant. Additions of nickel alone to Al-Si alloys decrease the wear resistance. Graphitic aluminium-silicon-nickel alloys containing above 2% graphite can be mated unlubricated against the rotating steel disk after a one minute lubricated run-in period.

**CURRENT WORK**

*BASE METAL*

The base metal used in this project work is aluminium 2024. 2024 aluminium alloy is an aluminium alloy, with zinc as the primary alloying element. It is strong, with strength comparable to many steels, and has good fatigue strength and average machinability. It has lower resistance to corrosion than many other aluminium alloys, but has significantly better corrosion resistance than the 2000 alloys. Its relatively high cost limits its use.

2024 aluminium alloy's composition roughly includes 0.25% zinc, 1.2–1.8% magnesium, 3.8–4.9% copper, and less than a half percent of silicon, iron, manganese, titanium, chromium, and other metals. It is produced in many tempers, some of which are 2024-0, 2024-T6, 2024-T651.

Aluminium 2024 is the major alloy in 2000 Series and Zinc is the major alloying element in this series. Aluminium 2024 possesses high static strength and is used in airframe structures and for highly stressed parts. Aluminium 2024 is available in several types of tempers such as T6, T651, T73, T7351 and T76.

The materials used in the present study were Aluminium alloy 2024 (Al2024) which served as matrix and graphene powder which was used as reinforcement. The composition of Al 2024 is shown in table.

| ELEMENTS | Zn | Cu | Mn | Mg | Fe | Cr | Si | Ti |
|---|---|---|---|---|---|---|---|---|
| Wt % | 0.25 | 3.8-4.9 | 0.3-0.9 | 1.2-1.8 | 0.50 | 0.10 | 0.50 | 0.15 |

## REINFORCEMENT

Graphene Nano-Powder is the reinforcement used. Generally metal matrix composites use three types of reinforcements: particulate, fibrous, and continuous. Particulate reinforcements consist of powders such as silicon carbide that are used in metal matrices. Fibrous reinforcements include silicon carbide fibres dispersed in an aluminium alloy matrix. Continuous reinforcements include filament-wound, carbon fibre, magnesium composites, or woven carbon fibre cloth reinforced aluminium alloys. Here this reinforcement comes under particulate reinforcement.

- Graphene is an allotrope of carbon that exists as a two-dimensional planar sheet.
- One way to think of graphene is as a single atomic graphite layer
- Graphene is technically a non-metal but is often referred to as a quasi-metal due to its properties being like that of a semi-conducting metal.

Graphene is selected because of its unique property i.e., this is the only form of carbon (or solid material) where every atom is available for chemical reaction from two sides thus resulting in ease of combining with it matrix and also in general improvement of mechanical tensile strength.

## PROPERTIES OF GRAPHENE

Important physical & Mechanical properties of Graphene are:

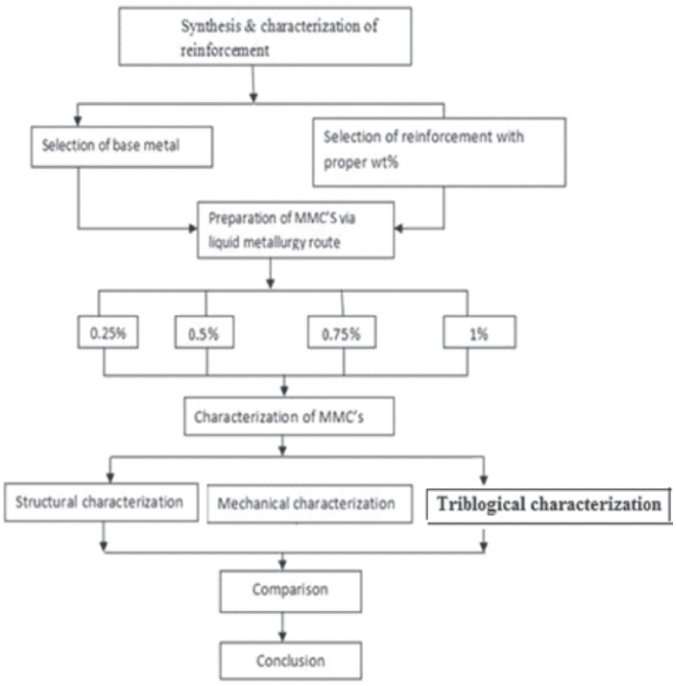
*Table : Properties of Graphene*

| Property | Graphene | Ref |
|---|---|---|
| Electron Mobility | 1500 cm2 V−1 s−1 | 14 |
| Resistivity | 10-6 Ω -cm | 14 |
| Thermal conductivity | 5.3 ×103 Wm_1K_1 | 14 |
| Transmittance | >95% for 2nm thick film<br>>70% for 10nm thick film | 15 |
| Elastic modulus | 0.5 ?1 Tpa | 15 |
| Coefficient of thermal expansion | -6×10-4/K | 15 |
| Specific surface area | 2630m2 g−1 | 16 |
| Tensile strength | 130 GPa | 16 |

The carbon–carbon bond length in graphene is about 0.142 nanometer. Graphene is the strongest material ever tested, with an intrinsic tensile strength of 130.5GPa and a Young's modulus of 1 TPa (150000000 psi).The Nobel announcement gave the strength as 42 N/m; the mass of 1 m2 as 0.77 mg, and the electrical resistance of a square as 31 Ω.

Despite its strength, graphene is also relatively brittle, with a fracture toughness of about 4 MPa √ m. This indicates that imperfect graphene is likely to crack in a brittle manner like ceramic materials, as opposed to many metallic materials that have fracture toughness's in the range of 15–50 MPa √ m.

## METHODOLOGY



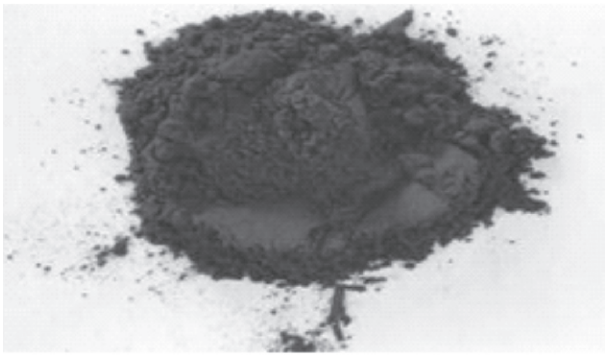
**Selection of base metal (Aluminium 2024alloy)**

Aluminium alloys have strong corrosion resistance. At sub-zero temperatures, their strength increases, thus making them a useful low- temperature alloy. Their strength decreases if they are subjected to very high temperatures. The aluminium 2024 alloy has high strength. Aluminium 2024 alloy can be machined in the annealed condition. Oil lubricants are used for performing machining operations. An aluminium 2024 alloy is forged at 372 to 483°C (700 to 900°F).

Aluminium 2024 alloy can be cold worked using conventional methods in soft and annealed condition Aluminium 2024 alloy is annealed at 413°C (775°F) for 3h followed by controlled cooling at 10 to 260° C (50 to 500°F) per hour, and cooling in air Aluminum 2024 alloy can be aged at 122°C (250°F) for 24 h to obtain the T 6 temper. The T 73 temper can be heated at 108°C (225°F) for 8h and at 163°C (325°F) for 24h followed by air cooling. Aluminum 2024 alloy can be hardened by precipitation heat treatment. Aluminum 2024 alloy is mainly used in manufacturing aircraft and other aerospace application.

***Selection of reinforcement with proper % (Graphene)***

Graphene powder, flakes, ribbons, and sheets, Graphene research involves the study of several different physical forms of the material: powders, flakes, ribbons, and sheets and others not yet named or imagined. Within those forms, graphene can include a single layer, two layers, or $\leq$ 10 sheets of $sp^2$ carbon atoms. They made graphene by using pieces of sticky tape to pull off flakes of graphite, then folding the tape and pulling it apart to cleave the graphite into even smaller layers.



Graphene is the strongest material known to man. It is over 200 times stronger than steel. The strength of graphene could be used in composites and coatings for applications in areas such as aerospace and automotive industries. Potential graphene applications include lightweight, thin, flexible, yet durable display screens, electric/photonics circuits, solar cells, and various medical, chemical and industrial processes enhanced or enabled by the use of new graphene materials.

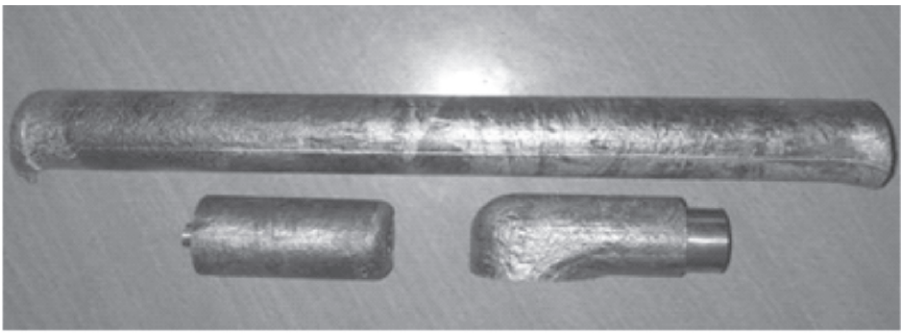
**Preparation of MMC's Via Liquid Metallurgy Route**

To prepare the metal matrix composite by varying reinforcement particles (0.25%, 0.5%, 0.75%, 1%) by using liquid metallurgy technique. A solution containing metal ions loaded with reinforcing particles is co-deposited forming a composite material. Discontinuous reinforcement is stirred into molten metal, which is allowed to solidify. Discontinuous reinforcement is stirred into molten metal, which is allowed to solidify. A chemical reaction occurs, with one of the reactants forming the matrix and the other the reinforcement. The aluminium of 2024 selected as a metal matrix composite with graphene as reinforced material. 0.25%, 0.5%, 0.75%, 1% of graphene will be added to the metal to form composite was synthesized to investigate the effects of graphene dispersion by Stir casting.

This AMMC's can be fabricated in stir casting or squeeze casting set up with little effort and at low cost. The prepared composites are characterized by the mechanical properties, structural properties. A solution containing metal ions loaded with reinforcing particles is co-deposited forming a composite material. Discontinuous reinforcement is stirred into molten metal, which is allowed to solidify. Discontinuous reinforcement is stirred into molten metal, which is allowed to solidify. This AMMC's can be fabricated in stir casting or squeeze casting set up with little effort and at low cost.

*Table : Composition of specimens*

| Specimen | **Al2024 (gm )** | **Graphene (gm )** | **Graphene (Wt. %)** |
|---|---|---|---|
| A | 1500 | 0 | 0 |
| B | 1500 | 3.75 | 0.25 |
| C | 1500 | 7.5 | 0.50 |
| D | 1500 | 11.25 | 0.75 |
| E | 1500 | 15 | 1.0 |



*Casting part of Aluminium-Graphene reinforced composites*

***Characterization of MMC's***

MMC's is characterized in two ways.

1. Structural characterization.
2. Mechanical characterization.
3. Tribological characterization.

***VARIOUS TESTS CONDUCTED***

The following tests were conducted to assess the properties of the composites produced:

- Microstructure test-Scanning Electron Microscopic Test
- Tensile test- to determine tensile strength
- Hardness test-to determines the hardness of the prepared specimen by using Brinell' hardness test.
- Impact test- to determine the strength of the specimen by using IZOD test.
- Wear test- to determine wear on the prepared specimens by using pin on disc wearing test machine.

## MICRO STRUCTURAL CHARACTERIZATION

¡cro structural characterization studies were conducted on unreinforced and reinforced samples. This is accomplished by using scanning electron microscope. The composite samples were metallographic ally polished prior to examination. Characterization is dne in etched conditions. Etching was accomplished using Keller=s reagent. The SEM micrographs of composite and wear debris were obtained using the scanning electron microscope.

The images were taken in both secondary electron (SE) and back scattered electron (BSE) mode according to requirement. Microscopic studies to examine the morphology, particle size and micro structure were done by a scanning electron microscope (SEM). Micrographs are taken at suitable accelerating voltages for the best possible resolution using the secondary electron imaging.

## SCANNING ELECTRON MICROSCOPY (SEM)

Scanning Electron Microscope (SEM) also known as SEM analysis or SEM microscope is effectively used in microstructure analysis of composite materials. Scanning electron microscope carried out at high magnifications which generates high-pixel images and accurately measures very small features. Sample preparation plays an important and vital role in getting accurate results for the microscope analysis. For analyzing microstructure, the specimens were polished using emery papers with different grit sizes. Grit paper of 200 -1500 grit is used for finishing the specimen surface followed by polishing and etched with Keller's reagent. SEM is carried out using field emission scanning electron microscope brand name as ZEISS. The scanning electron microscope (SEM) is used to view at particular place and check the microstructure of the prepared sample.

SEM produces the image when electrons in microscope contact with the surface of the sample it collides with the atoms and that contains the surface topography and composition. The electron beam is generally scanned in a raster scan pattern and the beam's position is combined with the detected signal to produce an image. SEM can achieve better resolution. SEM analysis will be carried out for three different samples Fig.5.1 to 5.4shows the microstructures of fabricated Al2024 alloy matrix as well as Al2024 alloy matrix reinforced graphene with various weight fractions.

Microstructure of cast Al2024 alloy matrix presented in different figures which reveals that the formation of a aluminum dendritic network structure which is formed due to the super cooling of composite during solidification. The surfaces of the composites specimens are examined directly by scanning electron microscope. The specimens sample are well cleaned thoroughly using acetone prior to observed under SEM. Samples are mounted on stubs are examined. The favorable sites for graphene particle incorporation were identified by SEM method.

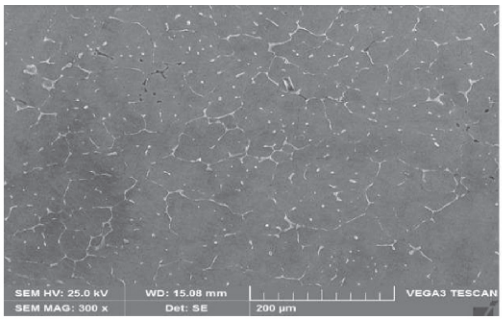



Figure : Scanning Electron Microscope Image of A1-2024+0.25%graphene

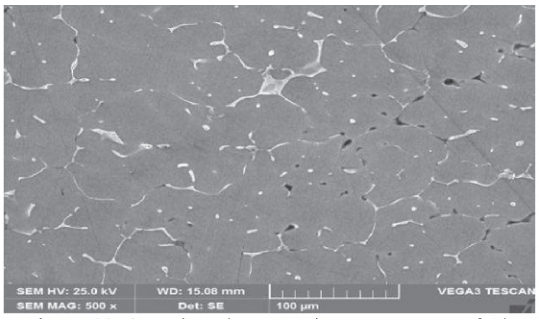



Figure : Scanning Electron Microscope Image of A1-2024+0.5%graphene

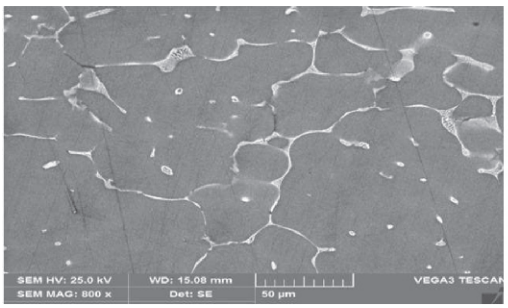



Figure : Scanning Electron Microscope Image of A1-2024+0.75%graphene

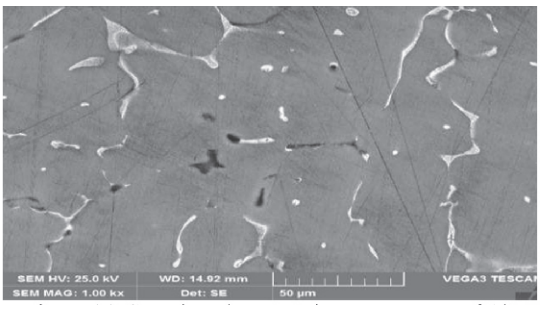



Figure : Scanning Electron Microscope Image of A1-2024+1%graphene

The above figures clearly show a morphological change in the microstructure of the specimen. In the base matrix sample the microstructure is dendritic whereas in the other stir cast samples the primary dendrites are fragmented due to mechanical stirring and graphene weight fractions. However, with the continued stirring the plastic strains within the fragmented grains would be considerably less and the process of coarsening will generate. Since the coarsening is driven by interfacial energy, the process will lead to a reduction in the surface area and eventually spheroidal morphology was obtained. The microstructure observations well support the results of the mechanical properties of the alloys reinforced with nano particles using mechanical stirring.

## MECHANICAL CHARACTERIZATION

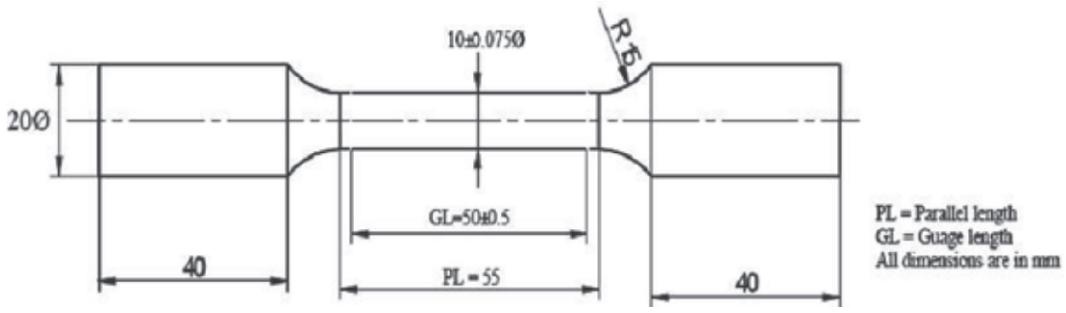
### TENSILE TEST

The tensile test is one of the most widely used of the mechanical tests. The tensile tests were carried out according to the ASTM E8 standard by universal testing machine to determine the amount of tensile strength to withstand during fracture. A tensile test of a material is performed on ductile materials to determine tensile properties such as:

1) Limit of proportionality
2) Yield point
3) Maximum tensile strength
4) Breaking strength
5) Percentage elongation
6) Percentage reduction in area

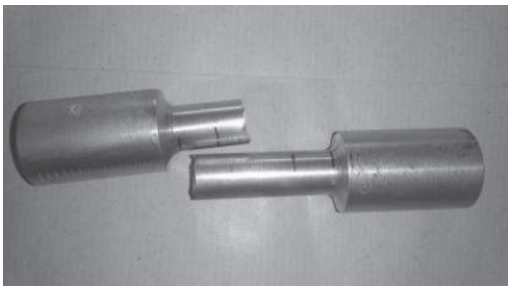
Specimen calculations : -

- Initial diameter in mm
- Diameter at fracture in mm
- Initial area of cross section in mm2
- Final area of cross section in mm2
- Initial length in mm
- Final length in mm
- % elongation = ( )/ x 100
- % reduction = ( )/ x 100
- Yield strength - YS= YP/ Ao
- Ultimate tensile strength UTS= UL/Ao.




*Specification of a tensile specimen for machining*

*Tensile specimen before fracture*

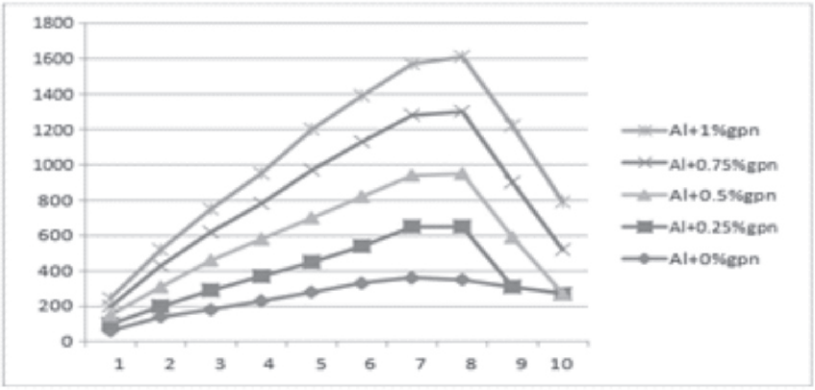


*Tensile specimen after fracture*

The following are the tensile test values for aluminium 2024 reinforced with graphene

Comparison of ultimate Tensile strength to Yield strength

| Composition | UTS in MPa | YTS in MPa | %Elongation |
|---|---|---|---|
| Al+0%gpn | 179.443 | 157.075 | 1.94 |
| Al+0.25%gpn | 183.392 | 161.337 | 1.98 |
| Al+0.5%gpn | 187.404 | 167.662 | 2.10 |
| Al+0.75%gpn | 191.721 | 173.206 | 2.50 |
| Al+1%gpn | 196.340 | 179.343 | 2.74 |



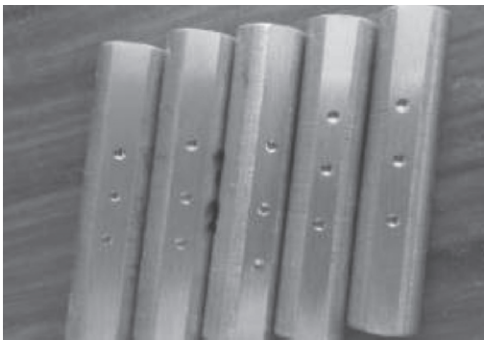

*Ultimate tensile strength with different variations of graphene reinforced*

From the above figure we can conclude that ultimate tensile strength is increased with 1.0% graphene reinforced with Aluminium 2024. So it is a better composition for improvement in the mechanical properties referred from the table.

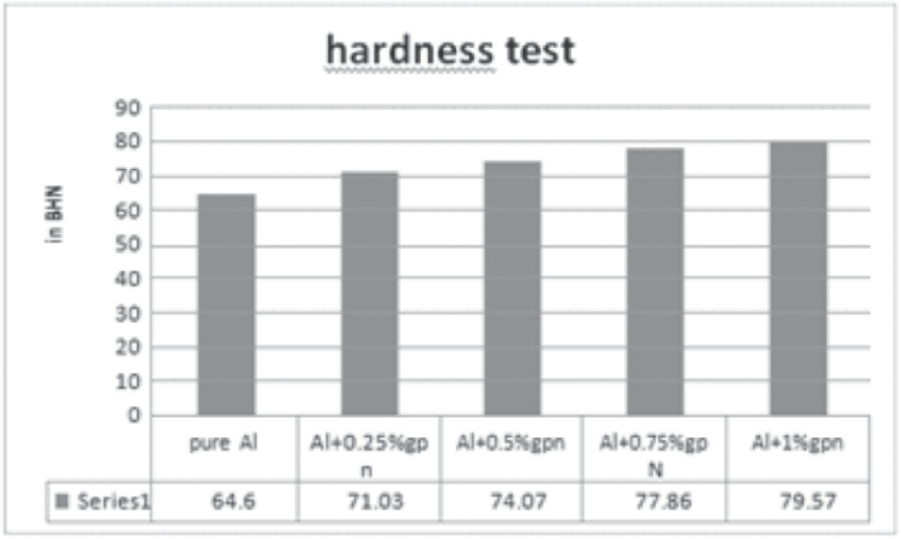
**HARDNESS TEST**

The hardness tests were conducted by Brinell hardness tester in accordance to the ASTM E8standard with the ball indenter diameter 10mm, load applied 500 kg and 30 seconds. The test were carried out in the room temperature atmosphere in the range of 30 to 32°C and measurements of hardness were obtained from five different places on each sample then considered as average hardness value.

*Specimens for Hardness test*



*Indent Specimens*




*Graph showing the Hardness value of BHN for different % of graphene reinforced with Al2024*

From the calculation and graphs, it is clear that there is increases in the hardness of the aluminium – graphene metal matrix composites. So, as the percentage of graphene reinforcement increases the hardness of the composites also increases and this is useful for aerospace application and automobile industries.

**WEAR TEST**

For the pin-on-disk wear test, two specimens are required. One, a pin with a radius used tip, is positioned perpendicular to the other, usually a flat circular disk. A ball, rigidly held, is often used as the pin specimen. The test machine causes either the disk specimen or the pin specimen to revolve about the disk centre. In either case, the sliding path is a circle on the disk surface. The plane of the disk may be oriented either horizontally or vertically.

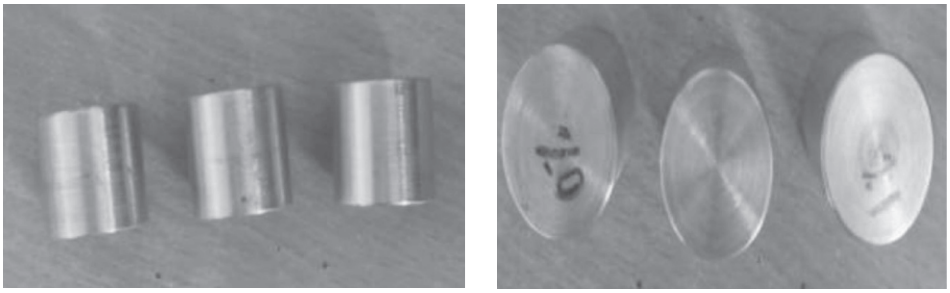
Length on pin on disc= 30 mm

Diameter on pin on disc= 8mm

Weight loss = Initial weight – Final weight

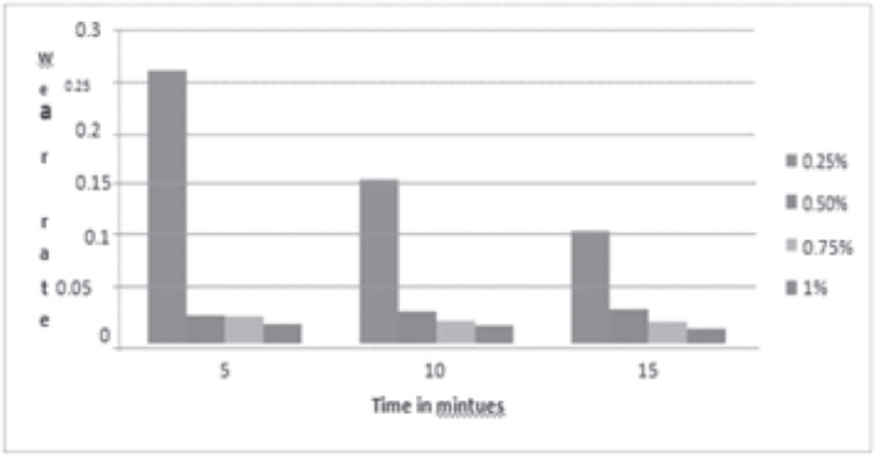
Wear rate = weight loss / sliding distance

Sliding distance = πDNT / 1000



*Specimens before wear test*

| Level | Load (kg) | Speed (rpm) | Time (min) | Weight (gm) | Wear rate $M^3/Nm$ $-10^6$ |
|---|---|---|---|---|---|
| 0.25% | 1 | 500 | 5 | 4.2856 | 0.261799 |
| | 2 | 500 | 10 | 4.2786 | 0.157079 |
| | 3 | 500 | 15 | 4.2667 | 0.10758 |
| 0.50% | 1 | 500 | 5 | 4.2856 | 0.026989 |
| | 2 | 500 | 10 | 4.2635 | 0.030679 |
| | 3 | 500 | 15 | 4.2431 | 0.032907 |
| 0.75% | 1 | 500 | 5 | 4.4209 | 0.02644 |
| | 2 | 500 | 10 | 4.3772 | 0.0214 |
| | 3 | 500 | 15 | 4.3366 | 0.020668 |
| 1% | 1 | 500 | 5 | 4.3122 | 0.018567 |
| | 2 | 500 | 10 | 4.2624 | 0.017055 |
| | 3 | 500 | 15 | 4.1904 | 0.014358 |




*Graph showing the Hardness value of wear for different % of graphene reinforce with Al2024.*

**Impact Test**

Impact tests are used in studying the toughness of material. A material's toughness is a factor of its ability to absorb energy during plastic deformation. Brittle materials have low toughness as a result of the small amount of plastic deformation that they can endure. The impact value of a material can also change with temperature. Generally, at lower temperatures, the impact energy of a material is decreased. The size of the specimen may also affect the value of the Izod impact test because it may allow a different number of imperfections in the material, which can act as stress risers and lower the impact energy.

Izod impact test as per ASTM standard method of determining the impact resistance of materials. A pivoting arm is raised to a specific height (constant potential energy) and then released. The arm swings down hitting a notched sample, breaking the specimen. The energy absorbed by the sample is calculated from the height the arm swings to after hitting the sample. A notched sample is generally used to determine impact energy and notch sensitivity.

Breadth of Specimen = 10mm

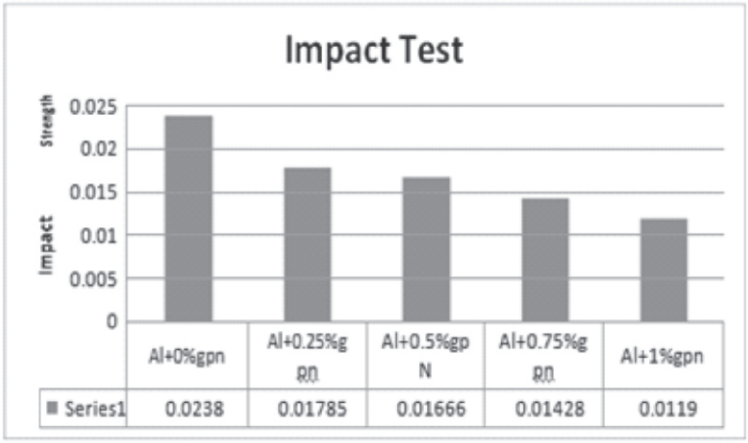
Depth of Specimen = 8.4mm

Length of Specimen = 100mm

Impact test Specimen

Table 6.9: Tabular column of Impact Test

| Graphene(%) | Breadth (mm) | Depth below Notch(mm) | C/s Area of Notch D*d(mm) | Initial reading (R1) | Final reading (R2) | Energy absorbed (joules) | Impact strength |
|---|---|---|---|---|---|---|---|
| 0% | 10 | 8.4 | 84 | 3 | 1 | 2 | 0.02380 |
| 0.25% | 10 | 8.4 | 84 | 2.5 | 1 | 1.5 | 0.01785 |
| 0.5% | 10 | 8.4 | 84 | 2.4 | 1 | 1.4 | 0.01666 |
| 0.75% | 10 | 8.4 | 84 | 2.1 | 1 | 1.2 | 0.01428 |
| 0.1% | 10 | 8.4 | 84 | 1.8 | 1 | 1 | 0.01190 |




*Graph showing the Impact values for different % of graphene reinforcement*

## CONCLUSION

From this project work, the following results were obtained quantitatively.

1. Defect free aluminium metal matrix reinforced with graphene was produced by stir casting method. No porosity noticed in the samples.
2. The SEM micrographs revealed that the presence of graphene weight fraction obtained homogeneous dispersion.
3. The reinforcement of graphene particles made the tensile strength of aluminium matrix composites from 270.14 to 329.34MPa. It means that it increased 60% of base material.
4. Graphene 1.0% reinforced with Al2024 composites hardness value maintaining optimum value.
5. The wear loss of the Al/Gr composite decreases and the worn surfaces look smoother with increasing the graphite particle size.
6. The wear rate of Al/Gr composites initially decrease slightly by increasing sliding speed and after a critical speed, wear rate changes dramatically.

## REFERENCES

[1] Chi HoonJeon, —Material properties of graphene/aluminum metal matrix composites fabricated by friction stir processing□,Volume:15, 5-June -2015.

[2] Dattatraya N. Lawate, Shriyash S. Shinde, Tushar S. Jagtap, volume 3, jan.-2016.

[3] B.SaiJagadish, —Synthesis and characterization of aluminium2024 and graphene metal matrix composites by powder metallurgy□, Volume: 2, 7thJuly -2015.

[4] PulkitGarg, Pallav Gupta, Devendra Kumar And Om Parkash,"Structural and mechanical properties of graphene reinforced aluminium matrix composites□, 20-feb-2016.

[5] Muhammad Rashada, FushengPana, AitaoTanga, Muhammad Asifd, ,—Effect of graphenenano platelets addition on mechanical properties of pure aluminum using a semi-powder method□23-feb-2014.

[6] Jinghang Liu, Umar Khan , Jonathan Coleman , Bea Fernandez , Pablo Rodriguez , SumsunNaher And Dermot Brabazon, — graphene oxide and graphenenano sheet reinforced aluminium matrix composites: powder synthesis and prepared composite characteristic7-jan - 2016.

[7] Rajeshprabha.N, □ mechanical property evaluation on aluminum based metal matrix composite reinforced with graphite and nickel coated graphite, Volume: 3, 11-nov-2014.

[8] Mina Bastwros, Gap-Yong Kim, Can Zhu, Kun Zhang, Shiren Wang, Xiaoduan Tang, And Xinweiwang □ effect of ball milling on graphene reinforced al6061 composite fabricated by semi-solid sintering, 22-dec-2013.

[9] A. Baradeswaran& A. ElayaPerumalhor□effect of graphite on Tribological and mechanical properties of al 7075 composites,18-aug -2014.

[10] LokeshKs,ChethanIc, Naveen Kumar Kr, VinayakaKannantha□determination of compressivestrength of graphenereinforcedwith aluminium-7075 metal matrix composites, Volume: 9, 1- Jan -2018.

[11] T.W. Clyne and P.J. Withers"Volume 4, Issue 9, September-2013,Structurally, MMCs consist of continuous or discontinuous fibers.

[12] S. Ray et al [12]". Volume 4, Issue 9, September-2013, Composite materials are attractive since they offer the possibility of attaining property combinations.

## ACKNOWLEDGMENTS

We are gratefully to Mechanical Engineering Department, Bangalore Institute of Technology & Nagarjuna College of Engineering & Technology for their kind help for giving their laboratory facilities to complete this research. We heartedly thank all those who have directly or indirectly motivated by giving me their precious time and advice.

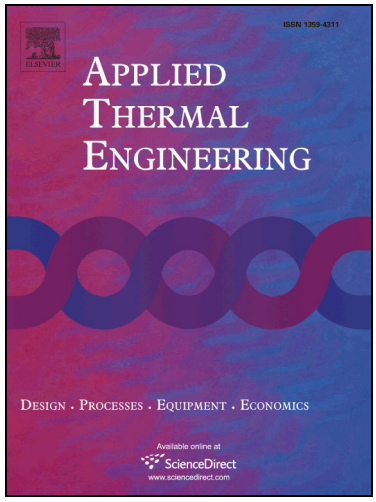
**Author(s)**

Vinod Kumar R received his Bachelors Degree in Mechanical Engineering from the SJCIT, Chickkaballapur (2006), Master of Technology from the MSRIT,Visveswaraya Technological University (2008). He has having industrial experience of 5 years & teaching experience of 05 Years and currently working as Assistant Professor, Department of Mechanical Engineering, Nagarjuna College of Engineering & Technology, Bangalore.

Dr H N Reddappa received his Bachelors Degree in Mechanical Engineering from the University of Mysore, Mysore (1996), Master of Technology from the Visvesvaraya Technological University, Belagavi (2000) and Ph.D., in Composite Materials, VTU, Belagavi (2013). He has having teaching experience of 15 Years and currently working as Assistant Professor, Department of Mechanical Engineering, Bangalore Institute of Technology, Bangalore, India and has published 30 papers in international and national peer reviewed journals and proceedings of conferences and attended 44 workshops/conferences both in India and Abroad also. Presently guiding 3 Ph.D research scholars. He has visited countries like Malaysia & China for the presentation of his research papers in various international conferences.

Dr Chandrashekar A received his Bachelors Degree in Mechanical Engineering from the SJCIT, Chickkaballapur (2006), Master of Technology from the MSRIT,Visveswaraya Technological University (2008). He has having teaching experience of 10 Years and currently working as Assistant Professor, Department of Mechanical Engineering, Bangalore Institute of Technology Bangalore. Actively involoved in research activities. He is a reviewer For Taylor & Francis (Journal of the chinese advanced materials society), Elsievier (Diamond & related materials), Springer (Silicon), Surface topology: Matrology and properties, NISCAIR (Indian Jpurnal of Engineering & Mateials science), etc. Presented /published more than 32 papers in national and international level. Life member of Indian welding Society, Institute of Engineers (India), ITEEA etc. Field of Specialization: Composite materials, Friction stir welding, Severe plastic deformation, etc.

Accepted Manuscript




# An Experimental and Numerical Study on Effects of Exhaust Gas Temperature and Flow Rate on Deposit Formation in Urea-Selective Catalytic Reduction (SCR) System of Modern Automobiles

Sadashiva Prabhu S, Nagaraj S Nayak, Kapilan N, Vijaykumar Hindasageri

PII: S1359-4311(16)31885-3
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2016.09.134
Reference: ATE 9159

To appear in: *Applied Thermal Engineering*

Received Date: 1 May 2016
Revised Date: 2 September 2016
Accepted Date: 23 September 2016

Please cite this article as: S. Prabhu S, N.S. Nayak, K. N, V. Hindasageri, An Experimental and Numerical Study on Effects of Exhaust Gas Temperature and Flow Rate on Deposit Formation in Urea-Selective Catalytic Reduction (SCR) System of Modern Automobiles, *Applied Thermal Engineering* (2016), doi: http://dx.doi.org/10.1016/j.applthermaleng.2016.09.134

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

# An Experimental and Numerical Study on Effects of Exhaust Gas Temperature and Flow Rate on Deposit Formation in Urea-Selective Catalytic Reduction (SCR) System of Modern Automobiles

**Sadashiva Prabhu S[1, a] Nagaraj S Nayak[2, b], Kapilan N[3, c], Vijaykumar Hindasageri[4,d]**

**[a] Canara Engineering College, Visvesvaraya Technological University, India-574219**

**[b] Caledonian Engineering College, Sultanate of Oman**

**[c] Nagarjuna College of Engineering and Technology,**

**Visvesvaraya Technological University, India-562110**

**[d] National Institute of Technology Karnataka ,Surathkal, Mangalore, India-575025**

**ss.prabhu97@gmail.com[1] nagarajsnayak@gmail.com[2], kapil_krecmech@yahoo.com[3]**

**vkhnitk@gmail.com[4]**

**ADDRESS FOR CORRESPONDENCE**

**Sadashiva Prabhu S,**

**Faculty, Department of Mechanical Engineering,**

**Canara Engineering College, Benjanapadavu-Bantwal Taluk,**

**D K, Karnataka, INDIA -574219**

**E-mail:ss.prabhu@gmail.com**

**Telephone: (+91) 0824-2278666**

**Fax: (+91) 0824-2278675**

ACCEPTED MANUSCRIPT

**ABSTRACT**

Urea Water Solution (UWS) is injected to generate $NH_3$ in Urea- Selective Catalytic Reduction (SCR) system of modern automobiles. Thermal and fluid dynamic conditions such as temperature and Reynolds number of the flow favors ammonia generation in terms of heat transfer to UWS droplets by forced convection. During extremely cold weather conditions and low exhaust temperatures, the overdosing of UWS results in deposits of urea and its byproducts. As deposit depletion changes the stoichiometry of $NO_x/NH_3$, any predictive method becomes complementary to experimental studies on deposit formation. In the present work, we experimentally investigated deposit formation and its rate by a newer concept of usage of Stainless Steel (SS) foils considering temperature and flow rate as variables. According to numerical results, the droplet evaporation of UWS decreases as flow rate increases. Quantity of deposits decrease with increase in temperature and flow rate. Accordingly, structural changes are observed. Numerical values of time dependent gravimetric analysis found slightly superior to experimental values. The study revealed that deposit areas at low temperatures are comparable to numerical values. Phenomenological model is proposed to find deposit conversion factor for low temperatures (150-250$^0$C) which helps in tuning of UWS dosage strategy to prevent $NH_3$ slip.

**Keywords:** SCR, deposit formation, temperature, flow rate, simulation, Fire v2011.1

ACCEPTED MANUSCRIPT

## Nomenclature

| Symbol | Name | Unit |
|---|---|---|
| A | Pre exponent factor | [1/s] |
| $A_c$ | Average contact area | [$m^2$] |
| $A_{cell}$ | Surface area of cell | [$m^2$] |
| $A_d$ | Surface area of droplet | [$m^2$] |
| $A_r$ | Pre-exponential factor of reaction | [1/s or kg/m s] |
| $B_{M,T}$ | Spalding numbers | |
| b | Heat penetration co-efficient | |
| c | Concentration | |
| $c_p$ | Heat capacity | [J/kg K] |
| D | Diameter | [m] |
| $E_a$ | Activation energy | [$Jmol^{-1}$] |
| h | Specific enthalpy | [kJ/kg] |
| $\Delta h$ | Heat of reaction | [J/mole] |
| *k* | Deposit conversion factor | |
| K | Dimensionless impact parameter | |
| Le | Lewis number | |
| m | Mass | [kg] |
| $\dot{m}$ | Evaporating mass flux | [$kg/sm^2$] |
| Nu | Nusselt number | |
| p | Pressure | [$N/m^2$] |
| $\dot{q}$ | Rate of surface energy per unit area | [$W/m^2$] |
| $\dot{Q}$ | Rate of surface energy | [W] |
| R | Universal gas constant | [kJ/kgmol K] |

ACCEPTED MANUSCRIPT

| | | |
|---|---|---|
| Re | Reynolds number | |
| S | Source term | [kg/sec] |
| Sh | Sherwood number | |
| t | Time | [s] |
| T | Temperature | [K] |
| $T^*$ | Characteristic wall temperature | |
| u | Velocity | [m/sec] |
| U | General heat transfer co-efficient | [$W/m^2K$] |
| w | Mass fraction(vapour) | |
| We | Weber number | |
| *x* | Deposit conversion factor | |
| x,y | Co-ordinates | |
| Y | Mass fraction(liquid) | |
| $\Delta t$ | Time step | |
| $\Delta x$ | Volume grid width | |

**Greek symbols**

| | | |
|---|---|---|
| $\alpha$ | Urea conversion fraction | |
| $\tau$ | Shear stress | [$N/m^2$] |
| $\beta$ | Evaporation rate | [$mm^2$/sec or $m^2$/sec] |
| $\mu$ | Dynamic viscosity | [N-s/$m^2$] |
| $\nu$ | Kinematic viscosity | [$m^2$/sec] |
| $\sigma$ | Surface tension | [N/m] |
| $\varepsilon$ | Turbulent eddy viscosity | [$m^2$/sec] |
| $\lambda$ | Thermal conductivity | [W/mK] |
| $\rho$ | Density | [$kg/m^3$] |
| $\delta$ | Film thickness | [m] |

ACCEPTED MANUSCRIPT

| | | |
|---|---|---|
| $\Gamma$ | Diffusion co-efficient | [$m^2$/sec] |

**Subscripts**

| | |
|---|---|
| I | interfacial |
| 1, 2 | directions, phase, initial, after |
| dc | droplet contact |
| dep | deposit |
| d,g | droplet, gas |
| f | film |
| l,vap | liquid, vapor |
| o | original |
| ref | reference |
| g | gas phase |
| m | mass |
| s | droplet surface |
| sat | saturation |
| u | urea |
| uws | urea water solution |
| v | vapour |
| w | wall |
| ∞ | fluid or gas |

**Superscripts**

| | |
|---|---|
| * | characteristic |

ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

## 1. Introduction

In countries where large amounts of coal and diesel were consumed annually caused a series of pollution problems, such as high levels of $NO_x$, $SO_2$ and dust emissions [1].The research indicated that NO in the flame base was formed through a combination of thermal, prompt and $N_2O$ pathways [2]. The basic characteristics of $NO_x$ formation and its control with type of mixture and flame temperature are found in literature for different fuels [3]. Even the exhaust gas of diesel engines contains considerable amount of nitrogen oxides ($NO_x$) and generation of $NO_x$ is related to oxygen content and flame temperature [4]. The detailed flame characteristics during combustion of fuels are found in literature [5, 6].

These $NO_x$ should be effectively removed to meet the upcoming stringent emission norms. Selective Catalytic Reduction (SCR) is an efficient method to remove the $NO_x$ from exhaust gas of stationary and automobile diesel engines. In SCR technique, the Urea Water Solution (UWS, 32.5% aqueous solution) is injected in to hot exhaust gas. After evaporation of water from UWS, the urea decomposes and gives ammonia which is the reducing agent for the reduction of $NO_x$ [7].

Incomplete decomposition of urea and deposit formation are the major problems in SCR system of automobiles. Using mixers the evaporation of water and thermal decomposition of urea can be enhanced. But, the engine performance may be slightly reduced due to the effect of back pressure when mixers are introduced. Also, the deposition of urea and its byproducts over mixer blades along with other exhaust gas constituents is another serious problem over the period of time. Recent emphasis is on further improvement of low temperature De-$NO_x$ performance to reduce $NO_x$ emission and to overcome the deposit formation during cold-start and urban driving at low-load conditions. The new ammonia generating system based on the heated solid urea,

ACCEPTED MANUSCRIPT

ammonium carbamate, and metal ammine chloride salts are under development [7]. However, it would take several years for complete implementation.

The De-$NO_x$ behavior of SCR system starts with UWS spray, followed by evaporation, urea thermolysis, hydrolysis of Isocyanic acid (HNCO) and $NO_x$ reduction reactions over catalyst. The behavior of UWS spray in the heated environment plays a major role and incomplete decomposition of UWS leads to deposits. Various studies found in literature on UWS decomposition into $NH_3$ and deposit formation are summarized and discussed in following sections.

### 1.1. UWS spray and evaporation

Appropriate spray properties of UWS will increase the urea decomposition and avoid deposition of urea on walls [8]. For complete evaporation of UWS, atomization is necessary and it is achieved by air assisted injectors. Homogenization of spray is obtained by providing mixing elements at the upstream of the catalyst [9]. The subsequent evaporation behavior after mixing is very complex in flowing exhaust gas. Various suggestions, numerical methods and experimental studies on UWS spray, evaporation of UWS along with thermolysis of urea are found in the literature [10–11]. Furthermore, spray behavior varies with respect to mass flow rate of UWS and mixing characteristics alters accordingly [12]. Evaporation of UWS droplets within available residence time depends mainly on droplet size. To do numerical studies on evaporation characteristics of UWS, droplet size and distribution are very significant boundary conditions. Various methods are used to obtain spray and droplet size distribution experimentally and some of them are found in literature [12, 13].

ACCEPTED MANUSCRIPT

### 1.2. Decomposition of urea

The behavior of decomposition of UWS droplet is complex phenomenon. The decomposition of urea occurs after water evaporation or simultaneously is not yet clear. Koebel et al. [14] revealed that evaporation of UWS results in a solid or molten urea in hot exhaust gas environment. The initial decomposition of solid or molten urea is usually faster but the second stage decomposition, hydrolysis of HNCO is slower reaction and it requires catalyst. To predict the amount of ammonia, modelling is to be done using kinetics of these reactions. Experimental data of Kim et al. [15] revealed that generation of reducing agent ammonia from UWS depends strongly on temperature and residence time. Birkhold et al. [16] implemented Rapid Mixing (RM) model into CFD code Fire v 8.3 and validated the results with experimental data of Kim et al. [15]. Some researchers revealed that urea decomposition is homogeneous gas phase reaction going to occur after evaporation of UWS to water vapor and gaseous urea [17]. Pyrolysis is another phenomenon occurs in hot exhaust gas when the droplet sizes are small. The products of pyrolysis of urea are revealed by Scaber et al.18] on basis of thermal decomposition (pyrolysis) of urea in an open reactor vessel. Additionally, some of the process parameters affect the decomposition efficiency of urea[19]. Some more details on thermal decomposition of urea are found in literature [20, 21, 22, 23]

### 1.3. Wall film and deposit formation

Wall film formation due to droplet impingement over the walls act as precursor for deposit formation. Liquid film formed results in liquid accumulation, liquid film flow and liquid film evaporation. Spray impaction leads to the formation of liquid film after certain characteristic time and it varies with temperature and flow rate [12]. The formation of liquid film varies with type of injection system, spray properties, temperature, flow rate, etc. in SCR aftertreatment

ACCEPTED MANUSCRIPT

system. Munnannur et al. [24] have given some fundamentals of thermal and fluid dynamic factors that affect deposit formation and its removal and required design parameters using both simulations and experiments. The experimental studies of Strots et al. [25] revealed that deposits could be found everywhere within the aftertreatment system from the injector to the SCR catalyst face. To understand the severity deposit formation in SCR systems, various testing procedures with simplified set-ups and geometries with optical access have been used and the studies on the wall wetting characteristics over impact plate for various injection strategies are presented by many authors [26, 27, 28]. Optical and numerical investigation is done at some operating conditions for over-stoichiometric UWS dosage [29]. Numerous studies showed that increased exhaust and ambient temperatures reduces the risk of deposit formation and recommended the usage of thermal insulation [24, 25]. Furthermore, alternatives to the classic SCR technology are discussed based on thermodynamic considerations and required model parameters are proposed [30, 31]. The frequent evaluation of ammonia uniformity at the upstream of the SCR catalyst can also help to identify the situations of urea deposition [32, 33].

Deposit formation strongly depends on mounting positions of UWS injector. Usually, UWS is sprayed to exhaust pipe in two different positions. They are 1) positioning in an axial direction which is possible for S-bend type pipe 2) positioning in an inclined position which is for straight pipe [34]. In an axial injection system, the UWS is injected axially, the droplets of UWS move with relative velocity and deposition is more prone to occur over catalyst rather than on pipe wall. In an inclined position, the UWS is injected with an angle to the axis of the exhaust pipe and deposition occurs over the walls.

ACCEPTED MANUSCRIPT

### 1.4. CFD Simulation on deposit formation

The combined application of numerical and experimental techniques has become a common practice. CFD simulations have proven to be capable to substantially support the development process of SCR systems. Complex interaction and multitude of influencing factors to be considered in the complex flow field and spray dynamics while analyzing deposit formation. Based on CFD results, the area of the injector dome, recirculation zones and welding gaps were correlated to locate deposit formation and geometry optimizations [24, 26, 31]. Most of the works on CFD simulation of SCR deposits focused on the identification of deposit areas rather than quantification. Some commercial CFD codes deal with formation of wall film as an indication of deposit formation. However, the formation of a wall film does not necessarily result in deposit formation but amount of deposition directly relates with time dependent wall film when evaporation and thermolysis is considered from wall film.

### 1.5. Significance of studies on deposit formation in Urea SCR system

The formation of wall film and subsequent deposition is a complex phenomenon which depends on individual injection system, type of SCR mixing chamber, surface condition of exhaust pipe, etc. Quantifying the deposition at various locations is very important as depletion of urea deposits may alter the stoichiometry of ammonia when engine exhaust temperature increases. This requires correction in the dosage strategy when engine load condition changes over. Very less parametric studies and its numerical predictions are done on wall film formation and deposit formation without many experimental and numerical investigations. So, it requires experimental and numerical investigation on timescale considering parameters affecting deposit formation. Very importantly, the time dependent deposit formation behavior is not found in the literature.

ACCEPTED MANUSCRIPT

Another aspect is design of SCR mixing chamber depends on catalyst shape, size and configuration, type of UWS injection system, space constraints, etc. The mixing pipe should be so chosen that conversion efficiency of urea to be maximum with very low deposition at all operating conditions. The deposit formation characteristics vary with respect incoming hot gas velocity for a particular diameter mixing pipe. On the other hand, if the flow rate is fixed and the diameter is varied, then flow velocity, heat transfer, dispersion characteristics vary. This exhibits different deposit formation characteristics. For a SCR designer, on least deposit perspective, these characteristics are very significant to optimize mixing chamber design based on L/D ratio constraints in a particular automobile.

Additionally, more computational time is involved for in CFD solution for transient vehicle load conditions to estimate the deposits. So, if there is any predictive model to determine deposit growth rate, one can collectively determine amount of deposits based on engine load conditions. As number of repeated trials is involved, it is very suitable to work on hot air test bench rather than on actual engine. The results obtained by tests on hot air test bench are comparable to that at engine exhaust [34].

The objective of present work is identification of type, location of deposits and its time dependent behavior within temperature range of 150-250$^0$C for different flow rates using newer method of usage of foils in an approximately 3” diameter exhaust pipe. Study is to be extended for growth rate of urea deposits and its distribution by both experimental and numerical methods with which amount of deposit formation can be numerically predicted. Using validated data, a simple phenomenological model for deposit formation is to be proposed.

ACCEPTED MANUSCRIPT

## 2. CFD methodology

### 2.1. Flow domain for simulation and boundary conditions for simulation procedure

CFD code AVL Fire v 2011.1 is used for simulation. Figs. 1(a), (b) show portion of the exhaust pipe and the flow domain obtained for S-bend type flow upto end of foil-1 from point of injection. The total volume considered for flow analysis is 0.00297776$m^3$. FAME HEXA meshing procedure is followed to generate required quality grids. Grid sizes are obtained by giving trajectory cell length and cross section cell in resolution tab of ESE Aftertreatment modelling and meshing tool. Usually in SCR simulations concentrations of $NH_3$ and HNCO are checked in grid independence test. In our simulations, grid independence test is done for total wall film mass by varying cell sizes (10000, 20000, 40000, 80000,120000 and 200000) in flow domain. Simulation results are converging after 80000 cells. So, all the remaining simulations are done using 80000 cells. Reynolds number range is 5000-25000 and k–zeta–f turbulence model is used. In this turbulence model, k is turbulent kinetic energy and zeta ($\zeta$) is velocity scale ratio which is used to determine turbulent viscosity. The minimum time step is determined initially by using convergence criteria conditions (CFL condition, $u\Delta t/\Delta x \leq 1$, $\nu\Delta t/\Delta x^2 \leq 1/2$) used for convection diffusion problems. The data provided in Tables 1, 2 are the boundary conditions for simulation.

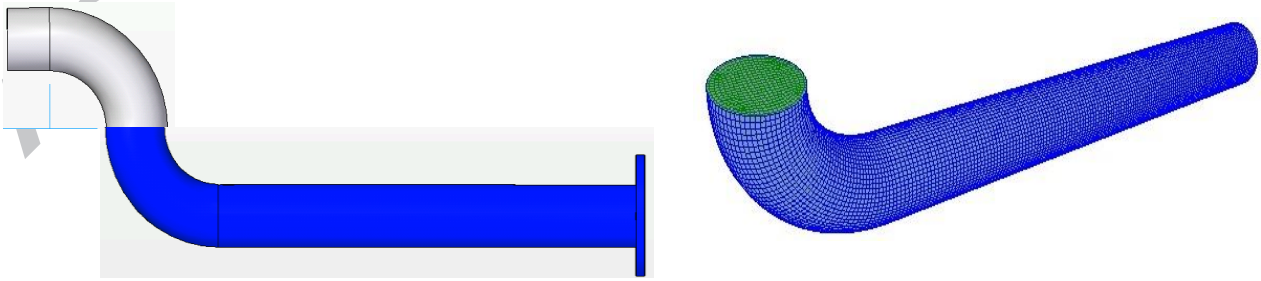


**Fig. 1. (a) Portion of the exhaust pipe for simulation (b) flow domain after mesh.**

ACCEPTED MANUSCRIPT

**Table 1 Properties of urea water solution (UWS)**

| | |
|---|---|
| Density[kg/m$^3$] | 1089 |
| Boiling point temperature[$^0$C] | 104 |
| Thermal conductivity[W/m K] | 0.57 |
| Specific heat[kJ/kg K] | 3.4 |
| Surface tension[N/m] | 0.0717 |
| Latent heat of vaporization[kJ/kg] | 2258 |

**Table 2 Concentration of various species**

| Species | Mass fraction of the species at inlet |
|---|---|
| NO | 0 |
| $NO_2$ | 0 |
| $NH_3$ | 1E-10 |
| $H_2O$ | 0 |
| $O_2$ | 0.29819 |
| $CO_2$ | 0 |
| HCNO | 1E-10 |
| $N_2$ | 0.701807 |

## 2.2. Numerical procedure

### 2.2.1. UWS spray model

Conservation equations for gas and liquid phase are simultaneously solved for spray simulations involving multiphase flow phenomena. Spray calculation for liquid phase was carried out using statistical Discrete Droplet Method (DDM). Droplet parcels are introduced in the flow domain with initial conditions. The atomization of droplet is done using required submodels. In this method, ordinary differential equations for trajectory, momentum, heat and mass transfer for single droplet are solved. The droplets are tracked in Lagrangian way through computation cells used for solving partial differential equations. The vapour of evaporating droplets is used as source term for additional transport equation for vapour void fraction in Eulerian simulation. The basic equations related to these processes are explained in subsequent sections.

ACCEPTED MANUSCRIPT

### 2.2.2. Evaporation model including urea thermolysis

**Droplet evaporation**

In general, evaporation behavior of a UWS droplet is non-linear due to transient heating and expansion. Thermal expansion and evaporation determines the size of the droplet when heat transfer takes place. The size of the droplet can be determined once the temperature inside droplet reaches a quasi-steady state and evaporation becomes effective. The initial heat-up period will be neglected during determination droplet evaporation characteristics if droplet sizes are small. The characteristic linear $D^2$-law[12] related to drop diameter 'D' after time interval 't' is given by,

$$D^2 = D_o^2 - \beta t \tag{1}$$

where the slope 'β' of graph determines the evaporation rate. From this equation, evaporation time required for particular droplet size can be determined. Based on evaporation time, the approximate length of exhaust pipe can be estimated for a range of flow rates.

**Liquid phase**

**Rapid Mixing model (RM model)** [35, 36] The temperature is assumed to be uniform on entire volume of droplet in the RM model. It considers high thermal conductivity, uniform spatial concentration and fluid properties in the droplet. But, these quantities are transient. The variation of concentration of urea of the droplet can be obtained by,

$$\frac{dY_u}{dt} = -\frac{\dot{m}}{m_d} Y_u \tag{2}$$

where the mass flow from liquid to gaseous phase is considered to be negative.

ACCEPTED MANUSCRIPT

**Gas phase**

Using 1/3-rule, the reference values for the temperature and mass fraction are determined [35, 36]. Using mixture averaging procedure, the vapor and gas properties are evaluated at the reference temperature and at reference mass fraction [35, 36]. The equations for droplet mass and temperature can be derived in the differential form using energy balance as given below [35, 36].

$$\frac{dm_d}{dt} = -\pi D_d \rho_{g,ref} \Gamma_{g,ref} Sh^* \ln(1+B_M) \tag{3}$$

$$\frac{dT_d}{dt} = \frac{\dot{m}_{vap}}{m_d c_{p,d}} \left( \frac{c_{p,vap,ref}(T_g - T_d)}{B_T} - h_{vap} \right) \tag{4}$$

where, $B_M = \frac{Y_{vap,s} - Y_{vap,g}}{1 - Y_{vap,s}}$ and

$B_T = (1+B_M)^a - 1$ and $a = \frac{c_{p,vap,ref}\, Sh^*}{c_{p,g,ref}\, Nu^* Le}$

The Eq. (3) can be modified as,

$$\frac{dm_d}{dt} = -\pi D_d \frac{\lambda_{g,ref}}{c_{p,vap,ref}} Nu^* \ln(1+B_T) \tag{5}$$

With $B_T = \frac{c_{p,vap,ref}(T_{g-} T_s)}{h_{vap}}$

**2.2.3. Mass, heat transfer and evaporation**

The spherical symmetry is considered for droplet. The model derived by Dukowicz [37] is applied for heat, mass transfer and further evaporation. The properties of the droplet considered

ACCEPTED MANUSCRIPT

uniform throughout. Assuming phase and thermal equilibrium exists at the droplet surface, the mass balance of the droplet is given by,

$$\frac{dm_d}{dt} = A_d \dot{m}_{vap} \tag{6}$$

The energy balance of the droplet is given by,

$$m_d c_{p,d} \frac{dT_d}{dt} = \Delta h_{vap} A_d \dot{m}_{vap} + \dot{Q} \tag{7}$$

By introducing a specific surface energy flux, $\dot{q} = \frac{\dot{Q}}{A_d}$ the balance equations of the mass and energy can be re-arranged as,

$$\frac{dm_d}{dt} = \dot{Q} \frac{\dot{m}}{A_d} \tag{8}$$

$$m_d c_{p,d} \frac{dT_d}{dt} = \dot{Q} \left( 1 + \Delta h_{vap} . \frac{\dot{m}}{\dot{q}} \right) \tag{9}$$

Eqs.(8-9) define the transient behavior of the droplet, provided that the expressions $\dot{Q}$ and $\frac{\dot{m}}{q}$ are known. The $\dot{Q}$ for convection heating is calculated as,

$$\dot{Q} = A_d U (T_g - T_d) \tag{10}$$

ACCEPTED MANUSCRIPT

U is a general heat transfer coefficient, which is obtained from Nusselt correlations [38].The mass and energy fluxes transferred between the individual droplets and the gas phase are applied as source terms in the balance equations of the fluid flow. Dukowicz [37] derived the following expression,

$$\frac{\dot{m}_{vap}}{\dot{q}} = \frac{Le(w_{vap,d} - w_{vap,\infty}).(1 - w_{vap,d})^{-1}}{h_{\infty} - h_d - (h_{vap,d} - h_{g,d})(w_{vap,d} - w_{g,d})} \quad (11)$$

where Le is the Lewis number, and $w_{vap,d}$, $w_{vap,\infty}$ are the mass fractions of vapor at the surface droplet and in the gas. Similarly, $h_d$ and $h_{\infty}$ are the specific enthalpies of the liquid at the droplet surface and in the gas. In addition, other two parameters $h_{vap,d}$ and $h_{g,d}$ represent the enthalpies of vapor at the droplet surface and in the gas. The mass and energy fluxes transferred between individual droplets and the gas phase are applied as additional source terms in the balance equations of the fluid flow in their Eulerian formulation. In order to model the melted urea in the gas phase, an additional artificial transport equation is introduced. All the above approaches are incorporated in CFD code Fire v2011.1 [39].

**2.2.4. Urea decomposition**

In Fire v2011.1, there is a separate submodel called 'SCR Thermolysis' which is multicomponent evaporation model in which evaporation process occurs as explained in earlier sections. For the modeling of thermolysis, there are different formulations that are mentioned in literature [10, 15].

The reaction rate is described by an Arrhenius-type equation used by Kim et al. [15] as follows.

ACCEPTED MANUSCRIPT

$$\frac{dm_{urea}}{dt} = -m_{urea} A \exp\left(-\frac{E_a}{RT}\right) \quad (12)$$

with A =382 $s^{-1}$, $E_a$ = 2.94×$10^7$ $Jmol^{-1}$, R-universal gas constant. Birkhold et al. [10] used the data of experiments done by Kim et al. [15] for a parameter fit and obtained A =0.42 kg/ms, $E_a$ =69,000 J/mol. For thermolysis, the following reaction is considered.

$(NH_2)_2CO_{(s\ or\ l)} \longrightarrow NH_3 + HNCO$ $\Delta H$=+185KJ/mol and the rate of urea conversion is

$$\frac{d\alpha}{dt} = -A_r (1-\alpha)^n \exp\left(-\frac{E_a}{RT}\right) \quad (13)$$

where the urea conversion fraction '$\alpha$' is given by,

$\alpha = \frac{m_{urea}(t=0) - m_{urea}(t)}{m_{urea}(t=0)}$ and Buchholz [40] suggests $A_r$ =1×$10^6$ $s^{-1}$, $E_a$ =7.3×$10^4$ J/mol and n=0.3. These approaches are incorporated in CFD code Fire v2011.1 under submodel "SCR thermolysis".

**2.2.5. Spray/wall-interaction model**

The physical mechanisms of interaction of spray with wall are very complex. The behavior of the impinging droplet is influenced by a variety of parameters such as velocity, diameter, viscosity, wall temperature and surface roughness [41]. There are many models proposed for spray wall interaction [42, 43]. Among them, model of Kuhnke [42] is an advanced wall interaction model, which in contrast to other models takes into account of wall temperature $T_w$ besides the impact parameter, K. On the other hand, the wall temperature is very significant in the study of UWS spray. The used model of Kuhnke[42] considers all relevant impingement phenomena consisting of four regimes of deposition, splash, rebound and thermal breakup(as shown in Fig.2) based on the two dimensionless parameters K and T* which are given by,

ACCEPTED MANUSCRIPT

$$K=(\rho D_d)^{0.75}u^{1.25}\sigma^{-0.5}\mu^{-0.25} \quad (14)$$

and $T^*=(T_w/T_{sat})$ (15)

Fig.2 reveals the spray wall interaction behavior developed by Kuhnke[42].For an individual impinging drop the average contact area $A_c=\pi\times D^2_{max}/4$ is based on the spreading equation, and the drop spreading diameter is given by equation[44],

$$D_{max}=0.613\,(D_d)We^{0.39} \quad (16)$$

where $D_d$ is the droplet diameter, We-Weber number

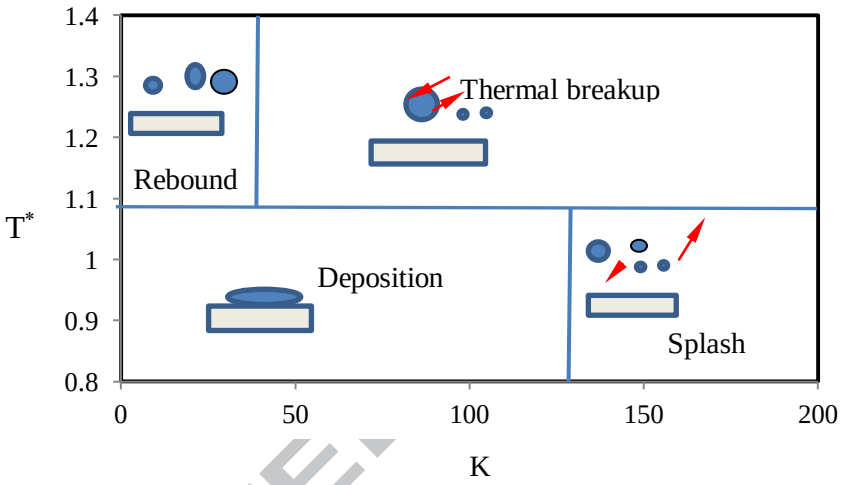



**Fig.2. Regime map for UWS of spray/wall-interaction (redrawn according to Kuhnke [42]).**

**Deposition:** If the characteristic wall temperature T* is less than 1.1 and droplet velocity is low, then the droplets impact on wall and create a wall film.

**Splash:** If the wall temperature T* is less than 1.1 and the velocity of the impacting droplet is higher, then particles break up into smaller secondary droplets after the impact. A fraction of the droplet mass forms wall film.

**Rebound:** At higher wall temperatures (T* > 1.1) and low impact velocity, a vapor layer between droplet and wall is formed. This sheet prevents a direct contact of the droplet with the wall,

ACCEPTED MANUSCRIPT

leading to a reflection of the impacting droplets. At this high wall temperature no wall film occurs.

**Thermal breakup:** At higher wall temperatures (T* > 1.1) and higher impact velocity, the droplet also disintegrates into secondary droplets. Here also no wall film is formed.

The Kuhnke model describes the mass of liquid, which is deposed at the wall as well as the diameters and velocities of the droplets after the impact. According to the Kuhnke model the wall film formation strongly depends on the wall temperature. Heat transfer between droplet and wall is also an important phenomenon, which should be taken into account, if the Kuhnke model is activated. To determine the heat transferred between the impinging drop and the wall a semi-infinite configuration is assumed. From this, the heat exchange can be calculated using equation,

$$Q_{w-d} = A_c \frac{2\sqrt{t_{dc}}}{\sqrt{\pi}} \frac{b_w b_d}{b_w + b_d} (T_w - T_d), \tag{17}$$

which depends on contact area $A_c$, contact time $t_{dc}$, heat penetration coefficient between both wall and droplet $b = \sqrt{\lambda \rho c_p}$.

### 2.2.6. Wall film modeling

In the numerical code, the wall film is modeled with a 2D finite volume approach. The film is transported due to shear forces, gravity and pressure gradients.

**Continuity equation**

$$\frac{\partial \delta}{\partial t} + \frac{\partial (\delta u_1)}{\partial x} + \frac{\partial (\delta u_2)}{\partial y} = \frac{1}{\rho A_{cell}} S_m \tag{18}$$

$\frac{\partial \delta}{\partial t}$ is rate of increase of film thickness. The usual step would be to employ the momentum

ACCEPTED MANUSCRIPT

equations for solving the unknown velocity components $u_1$ and $u_2$ for the known source term $S_m$. Now, the convective terms $\frac{\partial(\delta u_1)}{\partial x}, \frac{\partial(\delta u_2)}{\partial y}$ are evaluated and Eq. (18) can be solved explicitly. In general, viscosity increases with increasing urea concentration and leads to an increase of the film thickness and shear stress. For high urea concentrations, the above approach may only be a rough estimation of the film dynamics.

**Film velocity profiles**

In CFD code Fire v2011.1, the wall film module uses the analytical film velocity profiles instead of a momentum equation. The velocity profiles introduced here are steady state considering no inertia forces. Transient forces are neglected till wall film remains thin and the steady state conditions are prevailed. The forces acting upon the film result in shear forces which are directly related to the velocity profile. The shear forces on the film are result of viscous effects and turbulent effects. The turbulent shear stresses can be obtained by Boussinesq hypothesis in the form,

$$\tau_t = \rho\varepsilon\frac{\partial \bar{u}}{\partial y} \tag{19}$$

ε-is eddy viscosity which is function of wall distance 'y', $\bar{u}$-time averaged velocity. The equation for turbulent velocity profile is given by,

$$\frac{\varepsilon}{\nu} = \frac{3}{2}\left(y^+\right)^{\frac{3}{7}} - 1 \tag{20}$$

where $y^+$ dimensionless distance from wall, which is given by, $y^+ = yu_\tau/\nu$. The friction velocity $u_\tau$ is calculated using wall shear stress [39].

ACCEPTED MANUSCRIPT

The shear stresses produced is due to air viscosity as well as eddy viscosity due to turbulent effect is considered for determination velocity profile over wall film. The velocity profile of film due to total applied shear stress can be calculated as,

$$\frac{\tau}{\rho} = (\nu + \varepsilon)\frac{\partial u}{\partial y} \tag{21}$$

where ε-turbulent eddy viscosity, and τ –is total applied shear stress.

In this aspect, the mean film velocity, which is necessary for Eq.(18) is obtained by integrating over film thickness, δ as,

$$u_f = \frac{\delta}{6\mu}\left\{2\delta\left(\rho g - \frac{dp}{dx}\right) + 3\tau_I\right\} \tag{22}$$

where $\tau_I$ is interfacial shear force[39].

### 2.2.7. Evaporation and thermolysis from wall film

A multi-component model is used for the evaporation of UWS along with thermolysis process over wall film [39]. Here two stage process is considered. In the first stage, water is evaporated from the multi species film. In second stage, if the mass fraction water is less than 5 % then thermolysis of urea starts based on Arrhenius Equation. Evaporation of wall film based on Fick's law of diffusion is given by,

$$\dot{m} = \left[\frac{\rho_v(\Gamma_{12} + \Gamma_t)}{1 - c_I}\right]\frac{\partial c}{\partial y} \tag{23}$$

ACCEPTED MANUSCRIPT

where $\dot{m}$ is the evaporation mass flux (kg/(sm$^2$), or evaporation rate, which depends on concentration gradient $\frac{\partial c}{\partial y}$ which has the greatest influence on evaporation rate. If the gas above the film is already saturated with vapor, the gradient goes to zero and evaporation declines. On contrary, lean gas mixture causes a greater gradient and enhanced evaporation. The influence of temperature, which is also quite important, is reflected by the temperature dependent properties $c_I$ and $\Gamma_{12}$ .Additionally, time dependent diffusion property $\Gamma_t$ is taken into account for evaporation [39].

Among time dependent properties, $c_I$ is concentration at the interface of wall film and gas phase and $\Gamma_{12}$ is diffusion co-efficient, which is a physical property describes the volatility of a pair of fluids 1 and 2. Wall film energy equation and the evaporation routines are coupled in this study through a time step adaptation to avoid numerical instabilities and to solve the steep gradients of heating and evaporation of the wall film. The influence of flow conditions, exhaust tube properties and spray parameters on the film formation can be evaluated with the developed model. The derived models implemented in the numerical code help to predict the real processes during the layout of exhaust tube configurations and injector mounting positions with respect to the spatial distribution of the reducing agent at the upstream of the catalyst. The rate urea decay is given by equation,

$$\frac{dm_{urea}}{dt} = -Area_{filmpatch} A \exp\left(-\frac{E_a}{RT}\right) \tag{24}$$

Birkhold et al. [10] suggested the model

$$\frac{dm_{urea}}{dt} = -AD^{n}_{filmthick} \pi \exp\left(-\frac{E_a}{RT}\right) \tag{25}$$

ACCEPTED MANUSCRIPT

They utilized the experimental data from Kim et al. [15] for a parameter fit and got A =0.42 kg/ms, $E_a$ =69000 J/mol, n =1, $D_{filmthick}$ is the local film thickness. All these approaches are implemented in CFD code Fire v2011.1 in wall film module [39].

## 3. Experimental procedure

### 3.1. Experimental setup

The detailed view of an experimental setup is shown in Figs.3 (a), (b). Instead of exhaust gas of diesel engine we have used hot air for our experimental studies. Heater is used to heat the incoming air so as to meet the basic requirements of exhaust gas temperature. Heater coils (3 no.) made up of Inconel U type with Stainless Steel (SS) fins are used to heat the air upto temperature $550^0$ C. Mixing chamber of S-bend type is used to mix hot air and the UWS spray. S-bend type exhaust pipe is used in which both angular and axial injection of UWS is can be attained. Factors like turbulence created, temperature, UWS spray length, and mixing length are important parameters to be considered while designing mixing chamber. Blower with flow adjustment set up is used to supply the air so as to meet the requirements of exhaust flow conditions. Orifice meter is used before the heater to calibrate the flow rate. With the help of adjustable valve, one can vary the air flow rate upto 0-500 kg/hr, to meet the same flow rate as in the case of medium to heavy duty automobile diesel engine flow rates. Three thermocouples are placed in exhaust stream to detect the temperature at 3-different locations. The average value of 3 temperatures is taken for consideration.

ACCEPTED MANUSCRIPT

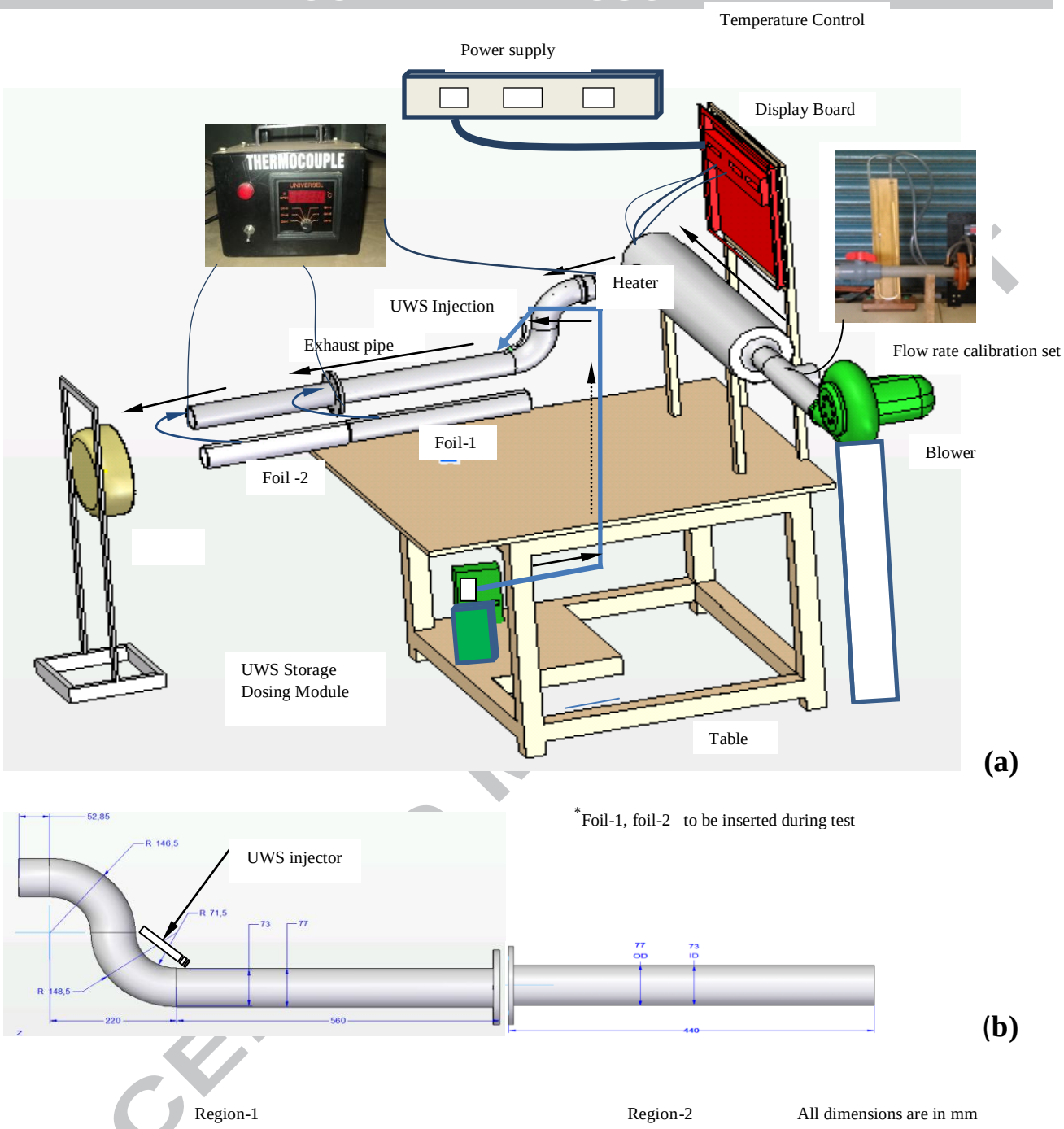



**Fig. 3. (a) Experimental setup (b) exhaust pipe configuration upto SCR catalyst.**

### 3.2. Spray characterization

UWS is sprayed at a pressure around 10 bar with spray velocity of 15m/sec at an injection frequency of 5Hz.Spray angle measured is approximately as $30^0$.An approximate measurement of droplet size is done using transparent film and optical profile projector. A film is held across

ACCEPTED MANUSCRIPT

the spray at ¾th of spray penetration length and weight difference of the film is taken after the spray. The weight difference for 1cm$^2$ area is calculated. The film is kept under optical profile projector and number of particles is counted for 1cm$^2$. Average mass of one particle 'm' is obtained as, m= mass of droplets in 1 cm$^2$ area/number of particles in 1cm$^2$. Then droplet diameter '$D_d$' of one droplet is calculated as,

$$\frac{D_d}{2} = \sqrt[3]{\frac{3m}{\rho_{uws} 4\pi}} \tag{26}$$

where $\rho_{uws}$ is density of UWS. The diameter obtained by above method for UWS flow rate of 4ml/min (72mg/sec) is 150µm.

### 3.3. Gravimetric analysis of deposits

To evaluate the amount of deposits, three regions are considered in exhaust line. They are sections of pipe from injection point of lengths 0.56m, 0.44m in succession (Fig.3 (b)) and a mesh which has to be kept across of pipe at the exit. Thin cylindrical metallic foils of Stainless Steel(SS) with same roughness value as that of pipe are inserted in the above two regions. They are namely foil-1, foil-2 as indicated in Fig 3(a).A mesh is held across the flow after foil-2 to capture the deposits which go along with hot air axially. For regular intervals (Table 3), the weight difference of foil-1, foil-2 and mesh are recorded in scale having accuracy level upto ±10mg. There are many advantages of using foils for deposit study. They are i) foils which we have used take exact shape of inner cylinder of the mixing chamber pipe without any slack ii) the small weight difference of deposits can be easily detected since weight of the foils are less ii) foils can be easily removed and replaced intermittently without fixtures. iii) with the help of foil, we can study the inner characteristics deposits as we take out the foil and open it longitudinally.

ACCEPTED MANUSCRIPT

iv) film area corresponds to deposits can be measured easily by opening the ends of the foil. The conditions for gravimetric analysis are given in the Table 3.

**Table 3 Test conditions for gravimetric analysis**

| Sl.No. | Air flow rate (kg/hr) | Temperature ($^0$C) | Total time of experiments(Intervals) | Dosage (mg/sec) |
|---|---|---|---|---|
| 1. | 34.74 | 150 | 20(3,6,10,20) | 72 |
| 2. | 86.86 | 150 | 20(3,6,10,20) | 72 |
| 3. | 121.60 | 150 | 20(3,6,10,20) | 72 |
| 4. | 34.74 | 200 | 20(3,6,10,20) | 72 |
| 5. | 86.86 | 200 | 20(3,6,10,20) | 72 |
| 6. | 121.60 | 200 | 20(3,6,10,20) | 72 |
| 7. | 34.74 | 250 | 20(3,6,10,20) | 72 |
| 8. | 86.86 | 250 | 20(3,6,10,20) | 72 |
| 9. | 121.60 | 250 | 20(3,6,10,20) | 72 |

## 4. Results and discussion

Birkhold et al. [16] revealed that wall film formation by UWS droplets varies with wall temperature by experimental and numerical methods. During the short period of contact between droplets and wall, the wall is cooled by transferring heat to the droplets. The cooling of the wall lead to deposition and splash, resulting liquid film accumulation especially when $T^*$ value less than 1.1 as seen in spray wall interaction diagram. The water in UWS film evaporates and remaining urea may not deplete completely at low temperature leading to formation of deposits of urea and subsequently different urea related complexes. The amount of deposition is mainly depends on evaporation characteristics in main stream, rate of evaporation from wall and depletion characteristics of urea. The location of deposits is mainly dependent on flow velocity which intern depends on pipe dimensions and flow rate. In our analysis, we have considered 3 locations in exhaust stream namely i) region-1-corresponds to foil-1, ii) region-2-corresponds to

ACCEPTED MANUSCRIPT

foil-2 and iii) Mesh-outside the exit of foil-2 to capture the deposits which go axially to catalyst in real SCR system. The splitting the flow regions enable us to do detailed study and physical observation. The weights of the deposits were taken intermittently at times 3min, 6min, 10min and 20 minutes duration. The total deposition amount is calculated by adding the weights of deposits obtained in foil-1, foil-2 and in mesh for required time intervals. Numerical study is done to estimate wall film mass leading to deposit formation in region-1 for all test conditions upto 10 minutes of UWS injection. The evaporation behavior, structure of deposits, gravimetric analysis of deposits and wall film formation behavior are explained in subsequent sections.

### 4.1. Numerical study on evaporation behavior of UWS spray

The design of SCR mixing chamber is based on evaporation and thermolysis time required, which intern depends on SCR mixing chamber diameter and the length. The effect of temperature on evaporation of UWS and subsequent thermolysis can be predicted theoretically by using various correlations.

UWS droplets show different characteristics in heated environment according to temperature. Wang et al.[45] have shown experimentally the distinct two stage decomposition characteristics for stationary droplet at low temperature and microexplosions kind of behavior at elevated temperature. But, when droplet moves with hot air, the relative velocity increases and thereby evaporation rate increases. This concept is evident by the fact that when liquid drop moves in the gas, the evaporation rate depends on forced convection heat transfer co-efficient (h). Nusselt number related to it is given Ranz and Marshall correlation i.e $Nu_0=2+0.552\ (Re_d)^{0.5}Pr^{0.33}$[12]. Accordingly, evaporation time decreases with decrease in diameter of the droplet and increase in

ACCEPTED MANUSCRIPT

temperature and relative velocity[12]. However, the spray with impaction on wall show different evaporation characteristics and the same we have considered in our simulation study.

When droplets hit the wall at high impaction velocities, they tend to break up and reflect partially. Depending on the impact Weber number (We), different phenomena occur (from complete deposition to total reflection and disintegration). As a complementary effect to evaporation process, if the flow rate of hot air increases, there is tendency of the reflected droplets to undergo break up resulting in faster atomization. However, when flow rate increases the residence time decreases, thereby the amount of evaporation for fixed length of pipe reduces. So, the effect of flow rate is very significant in evaporation characteristics.

To understand this behavior, a numerical study on evaporation is done for 3 different flow rates at $150^0$C, $200^0$C and $250^0$C. Figs. 4(a),(b),(c) indicate the droplet size variation along the length of the mixing pipe at $250^0$C for flow rates 34.74 kg/hr, 86.86 kg/hr and 121.6 kg/hr respectively. It is observed that, at lower flow rates, the droplet size is maximum at the region of impaction of the spray and drastically reduces after wall impact. The amount of evaporation of spray at the extreme end of region-1 is high due to increased residence time when flow rate is less. This nature is observed in Fig.4(a) without any appreciable amount of UWS droplets near the exit of region-1.As explained earlier, the amount of evaporation reduces as flow rate increases for fixed length of pipe due reduction in residence time which is available for evaporation. This effect is clearly seen in Figs. 4(b) , (c) with droplets of larger size at the extreme end of the mixing pipe.

In deposit formation perspective, the flow rate has substantial effect as it alters the momentum of droplets as well as dispersion characteristics. This fact is evident from Fig 4(a) that at lower flow rate of 34.74 kg/hr, hardly any dispersion of droplets are seen .For lower air velocities, the effect of interfacial shear is minimum and wall characteristics like roughness, friction etc. decide the

ACCEPTED MANUSCRIPT

film behavior after drop impaction. From Figs. 4(b), (c) we see that, for higher flow rates of 86.86 kg/hr and 121.6 kg/hr, the dispersion of the droplets increases. It is observed that droplets of higher size spread over entire volume of mixing pipe for higher flow rates, showing probable regions of deposit formation. At higher air velocities, the shear force at the film surface tears droplets back into the air flow. These droplets are generated at or near the surface waves. Additionally, at higher velocity of air flow, the entrainment of droplets from wall film lead to reduction in film thickness thereby reduces the deposition near the impaction area. However, increase in wall film area results increased number of deposit locations. The entrainment rate when droplets are small depends primarily on interfacial shear force, film viscosity and surface tension. If the temperature is low, these droplets stick on to surface of the pipe and lead to nucleation of localized deposits after water evaporation. However, if temperature increases, the decomposition process will be faster and deposition decreases.

ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

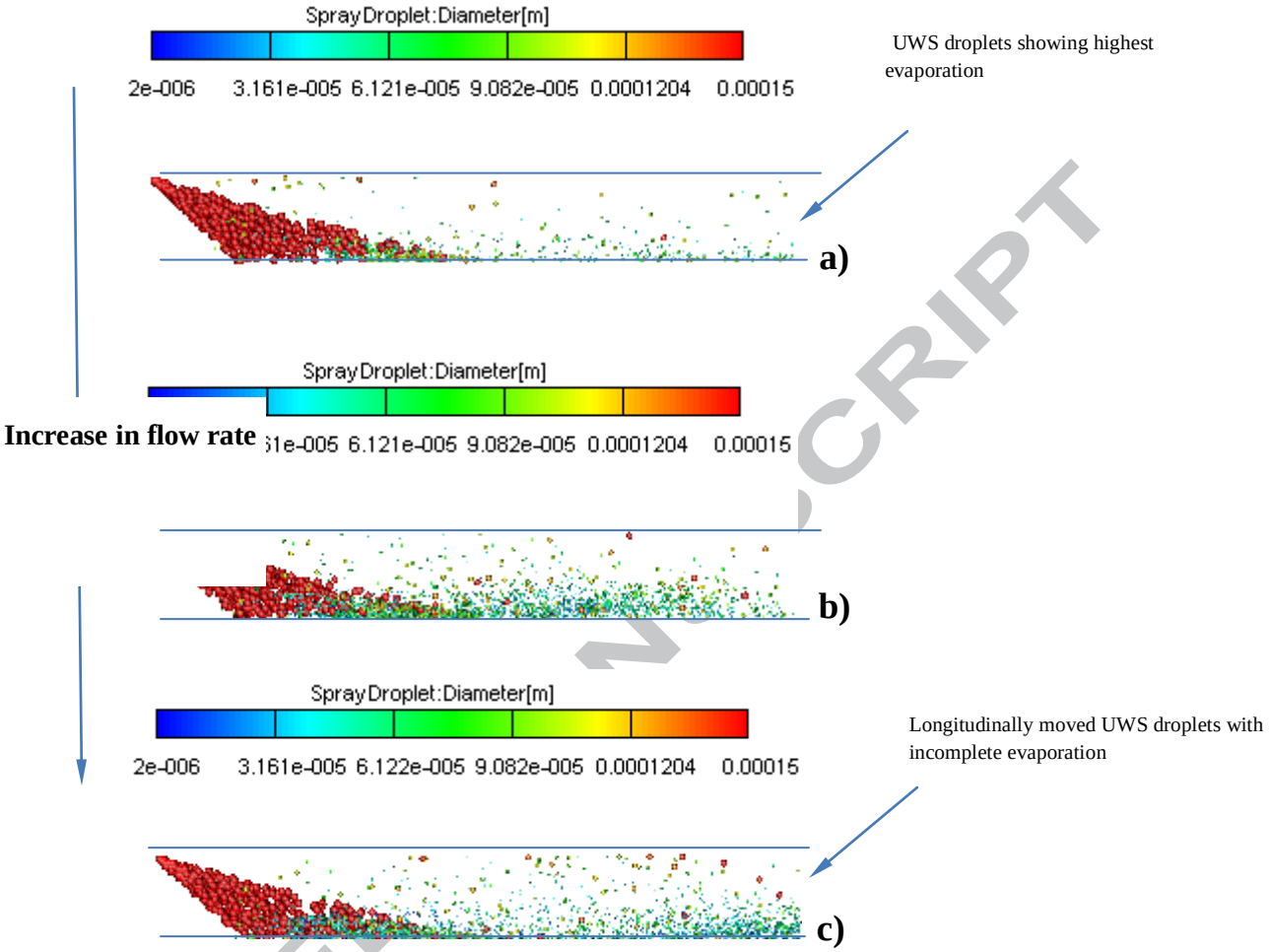



**Fig.4. Effect of flow rate on evaporation and dispersion of droplets at flow rates (a) 34.74 kg/hr, (b) 86.86 kg/hr and (c) 121.6 kg/hr at region -1.**

### 4.2. Structure of deposit formation –experimental and numerical investigation

The deposit formation initiates at the solid boundary which offers with some deposit favoring sites which are mainly the surface conditions like surface roughness and adhesive properties. Surface roughness increases the wetting and adhesion characteristics of the solid boundary which enhances the number of precursor sites for deposition. For smooth surfaces, UWS droplets of larger size at high impaction velocity leave the primary wall wetting areas and deposit at later stage. Once deposit of less than micron level grows, further growth depends on droplet-deposit

ACCEPTED MANUSCRIPT

surface interaction behavior. The growth of the layer progresses if the existing layer doesn't deplete. In such cases, particles undergo sintered with particles from the layer beneath it. Tendency to undergo sintering is more at lower temperature and at lower flow rate conditions.

Once temperature increases, deposit occurs within short time and start to deplete once temperature reaches $133^0$C. The liquid state sintering of urea particles occurs for short duration and they deplete due to continued heat transfer. If incoming air temperature increases further, the urea melting and evaporation proceeds. Accumulated liquid urea sometimes settles down by gravity. The small droplets sometimes undergo pyrolysis when they impinge on hot surfaces. This leads to formation of sticky compounds which may not deplete even at higher temperatures.

Incoming air flow increases the turbulence, momentum of the droplets and also contributes in atomization of UWS droplets. Additionally, high flow rate contributes in shearing of wall film. This shearing of wall film further depends on condition of layer beneath it whether it solid metal surface or the deposit layer already developed. As the air flow rate varies, the spray penetration alters and thus, the wall film and subsequent deposition take different patterns. The analysis of deposits is done at three different temperatures for different flow rates in our case.

In the numerical code Fire v2011.1, aspects of these structural changes are not modelled. Pictorial representation of simulated results indicates only wall film areas leading to deposit formation. As wall hitting is more dominant in the foil-1, we have considered the same region for numerical analysis of deposits. Figs.5 (a-h) represent pictures of deposit formation in foil-1 (towards left) when it is opened longitudinally and the respective simulated 3-D views of wall film (towards right) leading to deposit formation. Structural variations are presented according to temperature and flow rate in subsequent sections.

ACCEPTED MANUSCRIPT

**i) At temperature $150^0$C**

At low temperatures, especially if $T^*$<1.1 deposit is expected to occur. However, when impaction velocity of the spray is high, then droplets splash and even sometimes the smaller droplets may rebound. If the injection velocity of droplet is dominated, then no much of deposits are formed at impaction area, rather they splash and move towards periphery of impaction area and accumulate. The same behavior is exhibited in our experimental observation. At lower flow rates (34.74 kg/hr), the deposits formed are at the vicinity of spray wall impaction area (Fig.5(a)). When flow velocity is low, the momentum gained by the droplets is less. As a result, the droplets carried away by the flowing gas to the extreme end of the pipe are limited which results very thin layer of deposit at the farther end at later stages of impaction. The thin layer results out of smaller droplets carried away flowing gas. Same trend is observed in the simulation result wherein no much of wall film areas are observed at the extreme end of foil-1.

As the flow rate increases, the better dispersion of the UWS results in more uniformity along the length of the foil. This results in increased deposit area over the periphery with reduced average thickness over the surface of the foil. However, at higher velocity, the droplets of larger size accelerate and move towards rear end and deposit if condition prevails. So, deposit mass likely to be seen at rear end rather than near impaction area. This fact is marginally observed at 86.86kg/hr and greater extent at 121.6 kg/hr.

At intermediate flow rates (86.86 kg/hr), the effect of incoming air flow makes the urea spray more dispersed, which results in increased film area. From Fig 5(b) it is revealed that deposits formed move forward and segregate at $\frac{2}{3}^{rd}$ length of foil-1. From physical observation it is revealed that oriented peripheral growth resulting deposits in the form of canals or fissures. Even

ACCEPTED MANUSCRIPT

needle kind of deposits is seen at the peripheral area of urea clusters when foil is taken out of the pipe. The simulated results for the same indicate the dispersion of deposits in inner semicircular area. At higher flow rates (121.6 kg/hr), the effect of incoming air is comparatively more dominant than earlier two cases. The effect of impaction of UWS droplets and inertia of the droplets are overcome by incoming air stream resulting droplets disintegrate resulting segregation of urea deposits at the farther end of the foil-1. Also, some amount of deposits may move forward towards foil-2 also. However, the agglomeration of deposit mass in region near to $3/4^{th}$ of length of foil-1 in our case (Fig.5(c)). The fine globular nature of urea deposits is observed within the deposit mass accumulated end of foil-1 due to result of upstream and peripheral growth at higher flow rates (121.6 kg/hr).This effect is marginally seen in 3-D views simulation ,showing some localized colored spots and increased film area.

**ii) At temperature $200^0$C**

Urea melts above $133^0$C. At higher temperature $200^0$C, urea attains higher temperature due to increased heat transfer, thereby melting time decreases. However, complete melting depends on residence time. At lower flow rate (34.74 kg/hr), a semisolid kind of urea mass is observed at rear end of foil-1.The movement of urea mass is restricted once incoming velocity is not sufficient to shear the surface of semisolid urea (Fig.5 (d)). The simulated results of the same do not reveal any information related to nature of deposits and viscous nature of urea at higher temperatures. There is an indication of small region of wall film in simulated results before the entry to foil-2 without revealing about segregation. As the flow rate increases to 86.86 kg/hr, the amount of heat transfer to the urea deposits increases due to forced convection. The deposit urea start melting and move forward as fluidity of urea increases (Fig. 5(e)). As the flow rate increases to 121.6 kg/hr, turbulence increases further. This results in increased heat transfer

ACCEPTED MANUSCRIPT

leading to more urea melt. At higher velocity, the liquid urea moves forward due to shearing action. As a result, the remaining liquid urea reduces. When urea changes to semisolid or liquid form, the gravity effect predominates. So tendency of such deposit either to settle at the bottom as a layer or move according to inclination of mixing chamber. The liquid urea of small quantity or droplets exhibit different nature wherein surface tension and adhesive nature play a major role. Some sticky regions are found over the inner surface of the foil when UWS droplets impact and rebound. These sticky droplets undergo pyrolysis and form complex compounds of urea Fig.5 (f). The simulated results show only the reduction in deposit volume without revealing any physical nature. The region which is colored red is the indication of localized wall film leads to deposit formation.

**iii) At temperature 250$^0$C**

At higher temperature of the hot gas, increased wall temperature support the small UWS droplets undergo intense gasification, fragmentation and microexplosions. This enhances UWS mixing and decomposition characteristics, thereby reduces the deposition. In addition vaporization of liquid urea is more prone to occur at temperature above 200$^0$C.The combined effect of these processes, increases urea decomposition rate and thereby reduces deposit formation in totality. Fig.5 (g) shows the depletion of deposits even at lower flow rate 34.74kg/hr. At this condition, although temperature is sufficient to melt the deposited urea, the velocity of the flow is not sufficient to move the liquid melt in axial direction completely. As a result, the small quantity liquid urea accumulates in the region nearer to end of foil-1. Once the flow rate increases to 86.86 kg/hr, the melt moves forward and excess turbulence increases evaporation and decomposition resulting reduction in deposit mass. Simulation results do not reveal any information about liquid urea or deposit mass but it is very clear from 3-D view, there is further

ACCEPTED MANUSCRIPT

increase in dispersed deposit area for the increased flow rate. However, the artificial transport equations are introduced for liquid melt interaction with hot gas to capture wall film mass. In simulation results , if flow rate increases, the film area increases but thickness reduces and consequently there will be reduction in film mass . Fig.5 (h) indicates more dispersed deposit area at flow rate 86.86 kg/hr. Some droplets strike over hot surface of the foil wherein urea undergoes sudden pyrolysis resulting in formation of complex compounds as explained earlier. This nature is found at $250^0$C even at lower flow rates also. Similar trend is continued for flow rate 121.6 kg/hr without any urea melt left in lower region of the foil by direct physical observation. However, small tiny solid deposits over the inner surface of foil results in small weight difference which is considered for gravimetric analysis.

ACCEPTED MANUSCRIPT

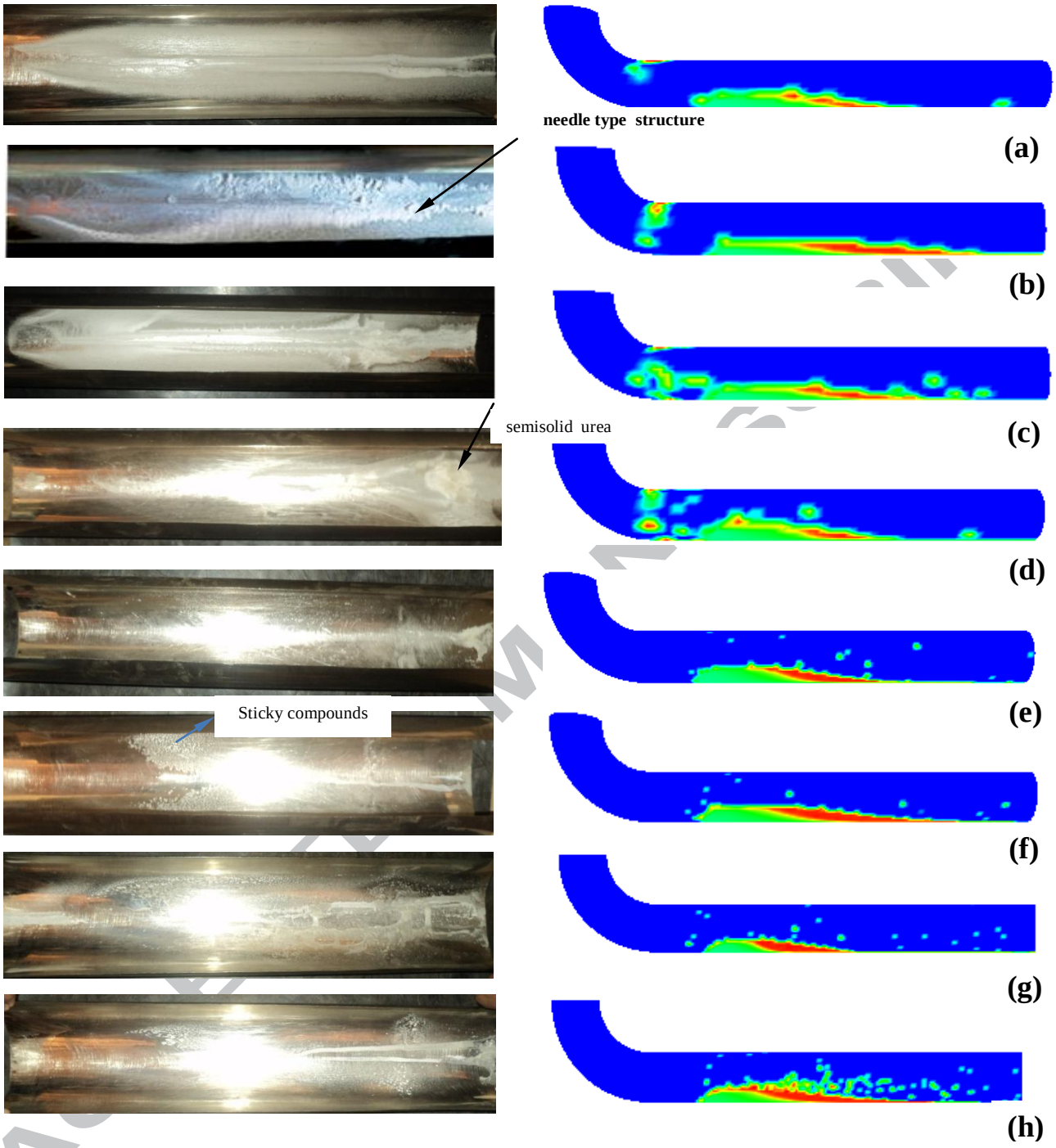



**Fig. 5. Experimental observation (left) and simulated diagrams (right) of region-1 for (a) 150$^0$C-34.74 kg/hr (b) 150$^0$C-86.86 kg/hr, (c) 150$^0$C-121.64 kg/hr, (d) 200$^0$C-34.74 kg/hr, (e) 200$^0$C-86.86 kg/hr, (f) 200$^0$C-121.6 kg/hr, (g) 250$^0$C-34.74 kg/hr and (h) 250$^0$C-86.86 kg/hr after 10 minutes of UWS injection.**

ACCEPTED MANUSCRIPT

### 4.3. Gravimetric analysis

Gravimetric analysis involves estimating the amount of deposits after certain duration of time. In actual SCR system, the dosage of UWS is more than stoichiometric (i.e in excess by amount 100-300%) at lower exhaust temperature to meet the requisite ammonia formation. For the study of deposit formation, the duration of test usually in hours to find detectable deposits with normal dosage conditions in actual SCR systems. With the intention of intermittent analysis of deposits and to shorten the simulation duration, we have curtailed the duration of the test to maximum of 20 minutes. Also, normal idle run duration of actual engines is in few minutes. Intermittent analysis of weights of deposits enables us to do study on time dependent behavior of deposit formation. The time dependent nature and growth of deposits can be numerically modelled and it is useful in predicting the deposit formation with varying operating conditions. When UWS spray occurs on steel pipe, factors like temperature, surface condition are responsible for wall interaction and deposition rate. Usually initial stage of deposition is faster due to interaction with wall. But in later stage, it is sluggish due interaction with existing layer of urea deposition. The results of gravimetric analysis of deposit formation are explained according to temperature range in subsequent sections.

#### 4.3.1. Experimental investigation

**At temperature $150^0$C**

Figs. 6(a-c) indicate the amounts of deposits for flow rates 34.74 kg/hr, 86.86 kg/hr and 121.6 kg/hr respectively. Comparing the individual plots at each time steps, it is observed that foil-1 has recorded highest deposition. This is due to the fact that region-1 is of highest impaction of UWS droplets. Foil-2 has recorded comparatively lesser weights for all time steps and flow rates. Mesh recorded least deposits. Comparing the Figs. 6(a-c), it is inferred that weight of the

ACCEPTED MANUSCRIPT

deposits successively reducing with increase in flow rate in all regions (foil-1, foil-2 and mesh).Fig.6(d) represents the comparison of total deposit(sum of the deposits in foil-1,foil-2 and mesh) for 3 different flow rates. The growth rate of deposit decrease with increase in flow rates. By considering individual plots it is understood that the growth rate is higher for initial 10 minutes and start decreasing thereafter. The growth rate in initial stage is very important in actual SCR system since deposits at early stage acts as substrate for further growth if it doesn't deplete.

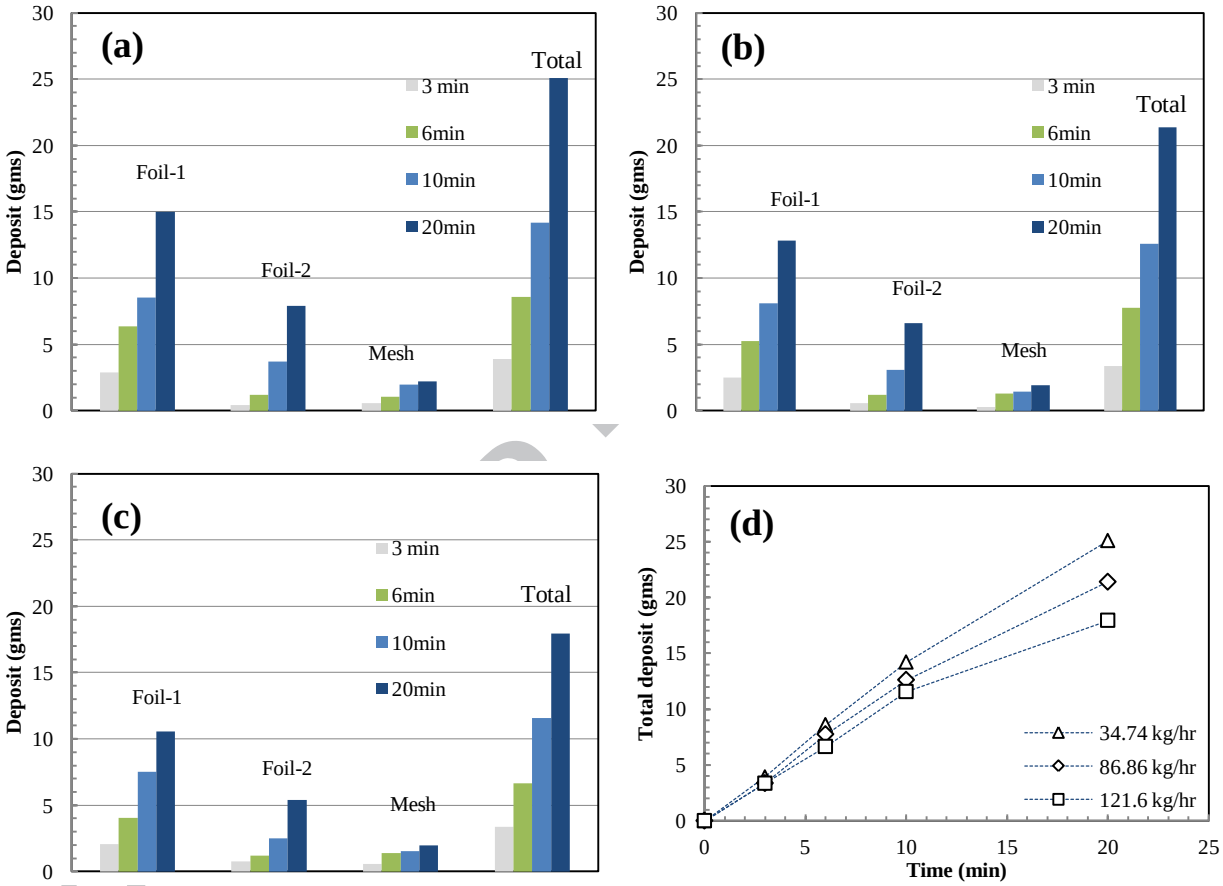



**Fig. 6. The amount of deposition after experiment in various areas at (a) 150$^0$C -34.74 kg/hr, (b) 150$^0$C -86.86 kg/hr, and (c) 150$^0$C -121.6 kg/hr (d)Total deposit vs Time at various flow rates.**

ACCEPTED MANUSCRIPT

**At temperature 200$^0$C**

As explained earlier, the behavior of deposit formation at 200$^0$C is quite different when compared at 150$^0$C for same flow rates. At 34.74 kg/hr, similar trend is seen as that of 150$^0$C in terms of gravimetric consideration. However, the effect higher temperature resulted in 20% reduction in the total deposit and 30% reduction in deposits of foil-1(Fig.7 (a)).No appreciable change is observed in quantity of deposits formed in foil-2 and mesh. As flow rate increases, the mechanism of deposit formation change and deposition decreases for flow rates 86.86 kg/hr. The increase in convection heat transfer decreases rate of deposit formation due to pronounced urea melting. Accordingly, the amount of deposits decreased by 60% (Fig.7 (b)). The changes in physical phenomenon and structural changes during the process are explained in earlier sections. As flow rate increases to 121.6 kg/hr, the deposits deplete further and the amount of deposit decrease as convection heat transfer predominates. At 121.6 kg/hr, the amount of total deposits reduced by 70% as that of 34.74 kg/hr. The respective variation is shown in Fig.7(c). There is drastic reduction in amount of deposits at higher flow rates and growth rate of deposits reduced substantially under those conditions (Fig.7 (d)). The important observation at 200$^0$C, is that the growth rate of deposit is comparable to that at 150$^0$C at lower flow rate of 34.74 kg/hr. At higher temperatures, urea turned to semisolid form and it observed from Fig.5(d), that semisolid urea mass has moved forward and segregated at one place nearer to rear end of foil-1. Although the weight of deposit marginally remains same as in case of 150$^0$C, there are appreciable changes in nature and distribution.

ACCEPTED MANUSCRIPT

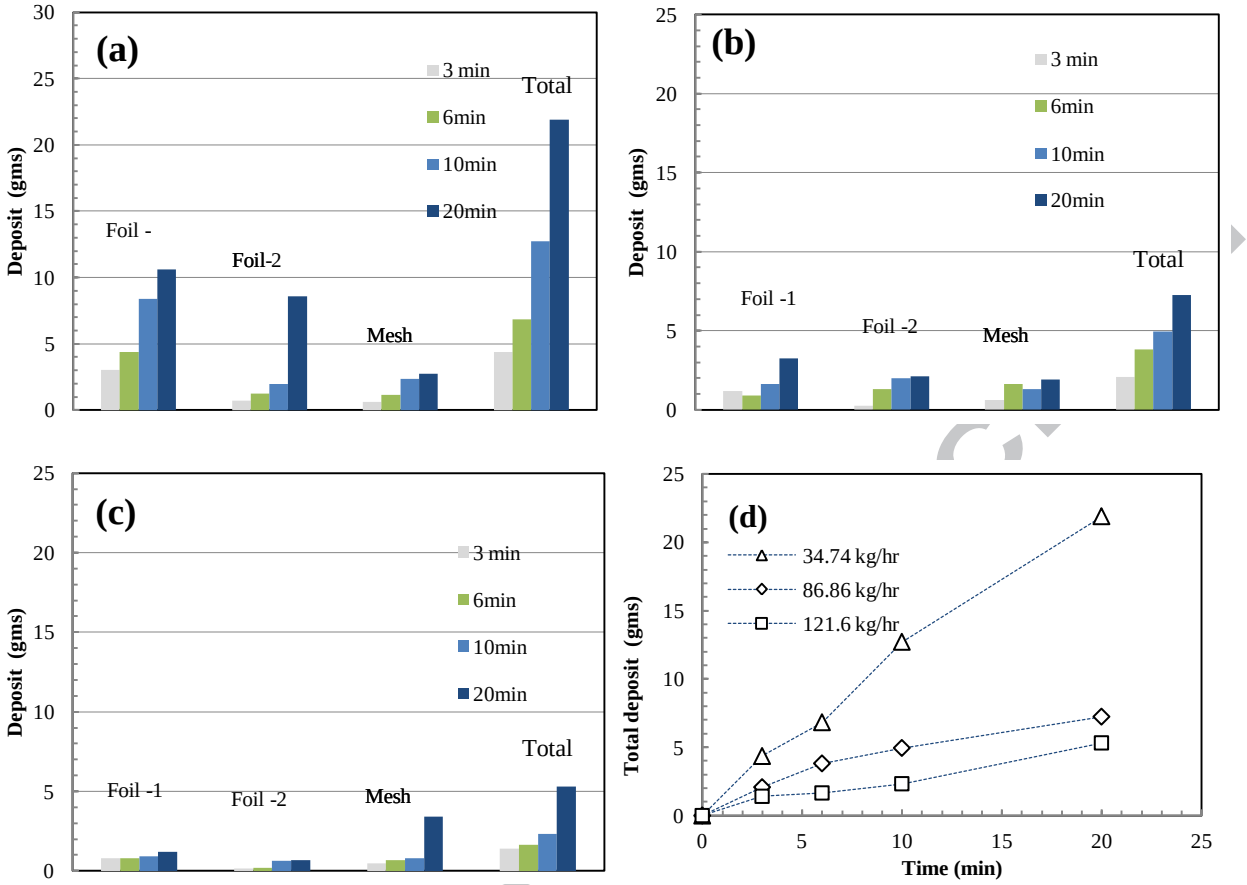



**Fig. 7.The amount of deposition after experiment in various areas at (a) 200$^0$C -34.74 kg/hr, (b) 200$^0$C -86.86 kg/hr, and (c) 200$^0$C -121.6 kg/hr (d) Total deposit vs Time at various flow rates.**

**At temperature 250$^0$C**

As temperature increases, the formation of gaseous urea predominates which results in drastic decrement in quantity of deposits. For all the 3 different flow rates, there is increase in amount of deposits as time progresses. Increase of fluidity of deposit after certain time interval makes the deposit move forward towards foil-2 due to surface shear. As time progresses, the liquid urea deposit increases Fig.8 (a-c). The comparison of deposits for all the flow rates indicates higher deposit rate initially for certain period of time and sluggish in later stages as shown in Fig.8 (d).

ACCEPTED MANUSCRIPT

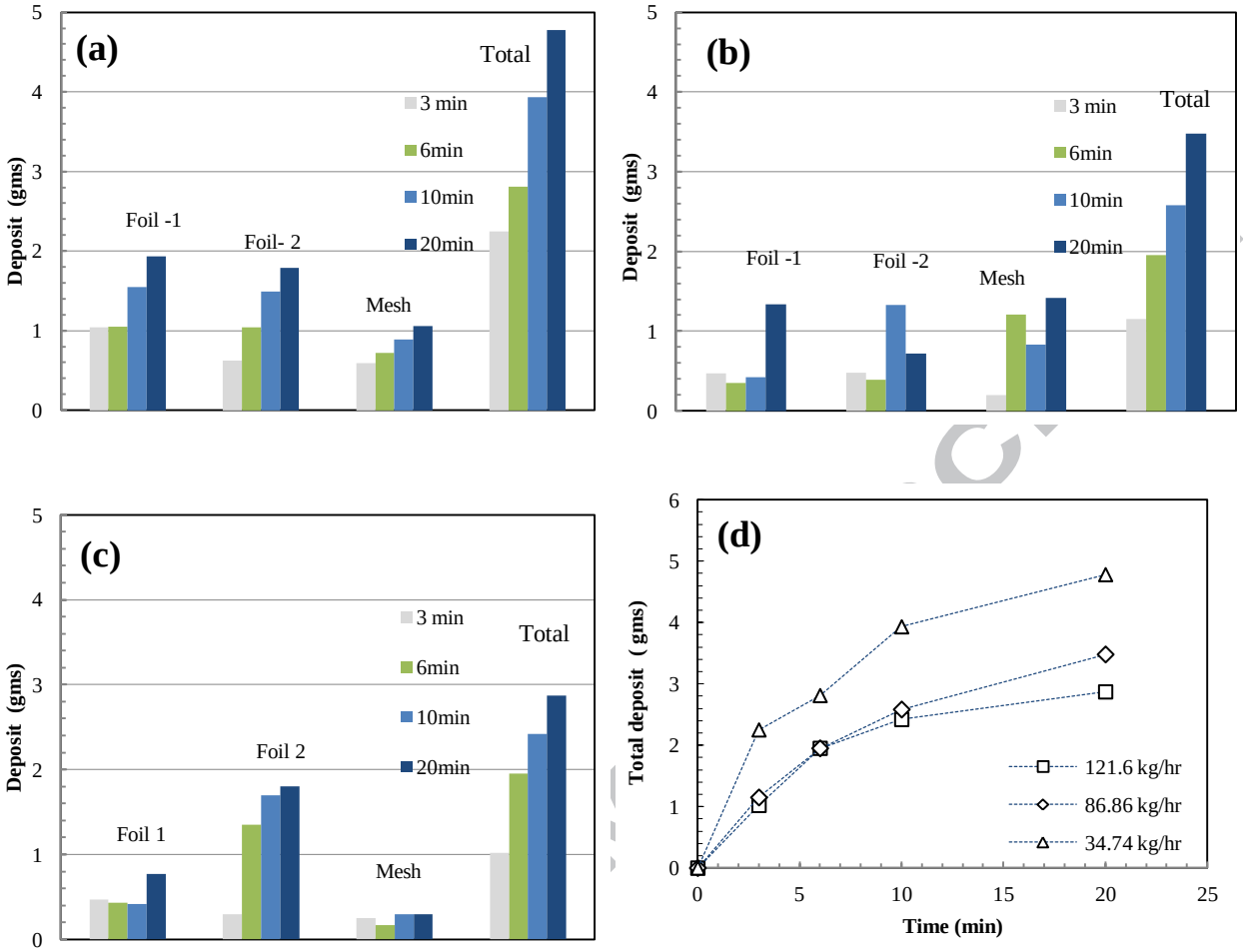



**Fig. 8.The amount of deposition after experiment in various areas at (a) 250$^0$C -34.74 kg/hr, (b) 250$^0$C -86.86 kg/hr, and (c) 250$^0$C -121.6 kg/hr (d) Total deposit vs Time at various flow rates.**

### 4.3.2. Numerical study and validation

As mentioned earlier, the flow domain of region-1 is considered for simulation study as it is the zone of highest deposit formation. The parameters like deposit mass and area of deposition are considered for numerical study and validation.

To study the deposit formation behavior numerically, we have considered wall film mass leading deposits at low temperatures. A *Deposit transformation index (k)* (ratio of cumulative

ACCEPTED MANUSCRIPT

amount of deposit formed (in gms) to total injected quantity of UWS (in gms) after total time duration) is introduced to quantify the deposit formation in timescale. The experimental values of deposits for the time intervals 3, 6 and 10 minutes durations at UWS flow rate of 4ml/min are used for validation of numerical results. The wall film mass leading deposit formation is numerically estimated using CFD code Fire v2011.1 and compared with experimental values at different temperatures. The results are discussed in subsequent sections.

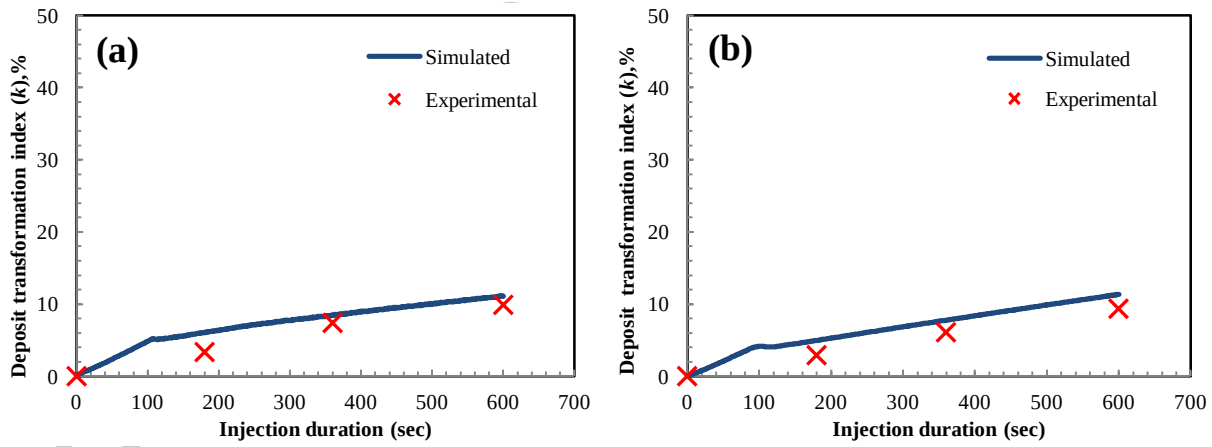
**i) At low temperature $150^0$ C**

The behavior of the impinging droplet is influenced by a variety of parameters such as droplet spray properties like velocity and diameter, fluid properties as well as surface properties like wall temperature, surface roughness or wall film height. Referring to Kunke model [42] of wall film interaction, for the condition $T^*$ less than 1.1 the deposition of droplets is more prone to occur leading to wall film. It is modelled in CFD code, that the water evaporation continues till it reaches 5% of its concentration and thermolysis progresses thereafter. Simulation results indicate two stages of deposit formation for all flow rates. The basic characteristics of wall film is once spray impaction takes place the deposition continues at faster rate because heat transfer takes place from droplets to pipe wall as it reaches solid boundary where conduction is predominant. This process continues till spray covers entire possible area for given flow rate. These aspects have been modelled in CFD code Fire v2011.1. As film thickness increases, the possible heat transfer reduces as impaction characteristics vary as it reaches boundary of deposits rather than pipe wall. This behavior inhibits the further growth rate. Subsequently the growth rate reduces. Once the flow rate varies, there will be some changes in some physical effects like interfacial shearing , pressure gradient, film evaporation, heat transfer between film and solid wall , gas phase interaction with impinging droplet, spray film entrainment (film rupture or shearing off at

ACCEPTED MANUSCRIPT

the surface due to high shear forces) which influence the film formation and film flow rate. These physical phenomena are modeled in sub models of wall film module. All these phenomena lead to decrease in wall film mass and increase in film area as flow rate increases. This aspect is common at higher temperature also.

Initial growth rate is faster at $150^0$C for all flow rates (Fig. 9(a-c)) and it reduces after certain time interval. The slight deviation of experimental values is mainly due to the intermittent gravimetric analysis and evaporation of remaining water content during the course of gravimetric analysis. During gravimetric analysis, the foils are exposed to environment and convection heat transfer leads to evaporation of film which contains deposits. So in all the cases, the simulated values are slightly superior to experimental values. As time intervals were limited, some of the initial characteristics of deposit formation could not be captured in our experiment.



ACCEPTED MANUSCRIPT

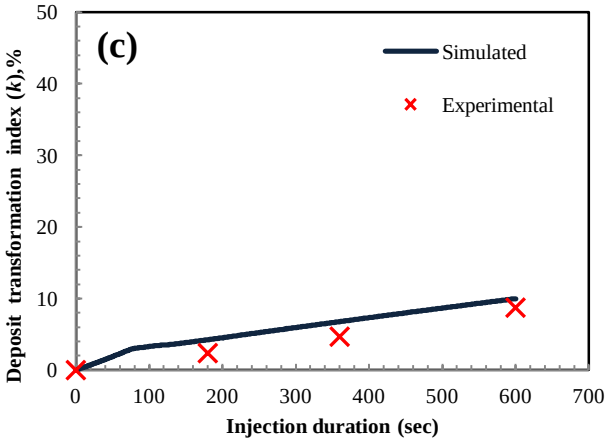



**Fig. 9. Plot of Deposit transformation index (*k*) vs Injection duration at temperature 150$^0$C for flow rates (a) 34.74 kg/hr, (b) 86.86 kg/hr, and (c) 121.6 kg/hr.**

**ii) At intermediate temperature 200$^0$C**

Melting characteristics of urea at higher temperature has decisive role in the formation of deposits at higher temperatures. Melted urea is modelled by introducing artificial transport equations in CFD code. The numerical results at flow rate 34.74 kg/hr have shown similar trend as in the case of 150$^0$C for the same flow rate. In our experimental studies, linear trend is observed at 34.74 kg/hr (Fig.10 (a)) and it is lower to numerical values. At higher flow rates, the numerical results show two stage deposit progression, in which initial stage is successive growth, approximately for 2 minutes and the second stage is with constant value. Also, the simulated results have shown drastic decrement in deposit growth after 2 minutes. But, in our experimental analysis, this trend is not observed as we see in the plots (Figs. 10(b), (c)) due to limited number of experimental values. Once heating is progressive, and if the flow rate increases, the liquid urea starts vaporizing and some part of liquid urea starts moving towards foil-2 also. As a result, the foil-1 has recorded lesser amount of deposition with steady growth at higher flow rates (Figs.10

ACCEPTED MANUSCRIPT

(b),(c)). Liquid urea flows at higher film velocity, which may lead to increase in deposition in foil-2 or in some cases in the region of mesh.

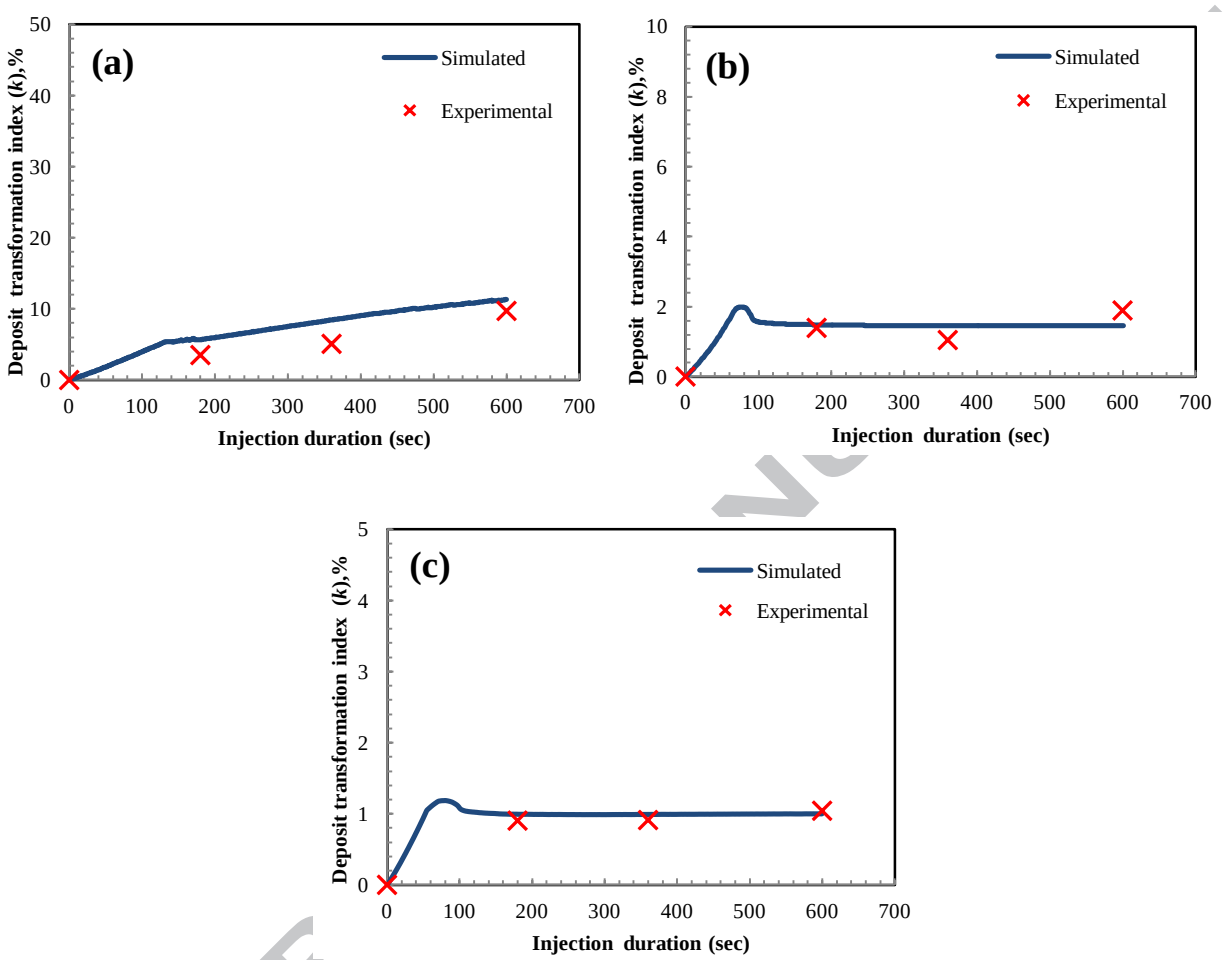



**Fig. 10. Plot of Deposit transformation index (*k*) vs Injection duration at temperature at 200$^0$C for flow rates (a) 34.74kg/hr (b) 86.86 kg/hr and (c) 121.6 kg/hr.**

**iii) At higher temperature 250$^0$C**

At higher temperatures, the melting of urea further increases and vaporization continues. The deposit transformation is in the order of 0-2%. There is hardly any difference of weights for shorter durations. However, the obtained experimental values are plotted and compared with numerical results. The simulated values are superior to values of experimental results (Fig.11 (a),

ACCEPTED MANUSCRIPT

(b)) in some cases. The molten urea is not stagnant when incoming air flow shears the surface of liquid.

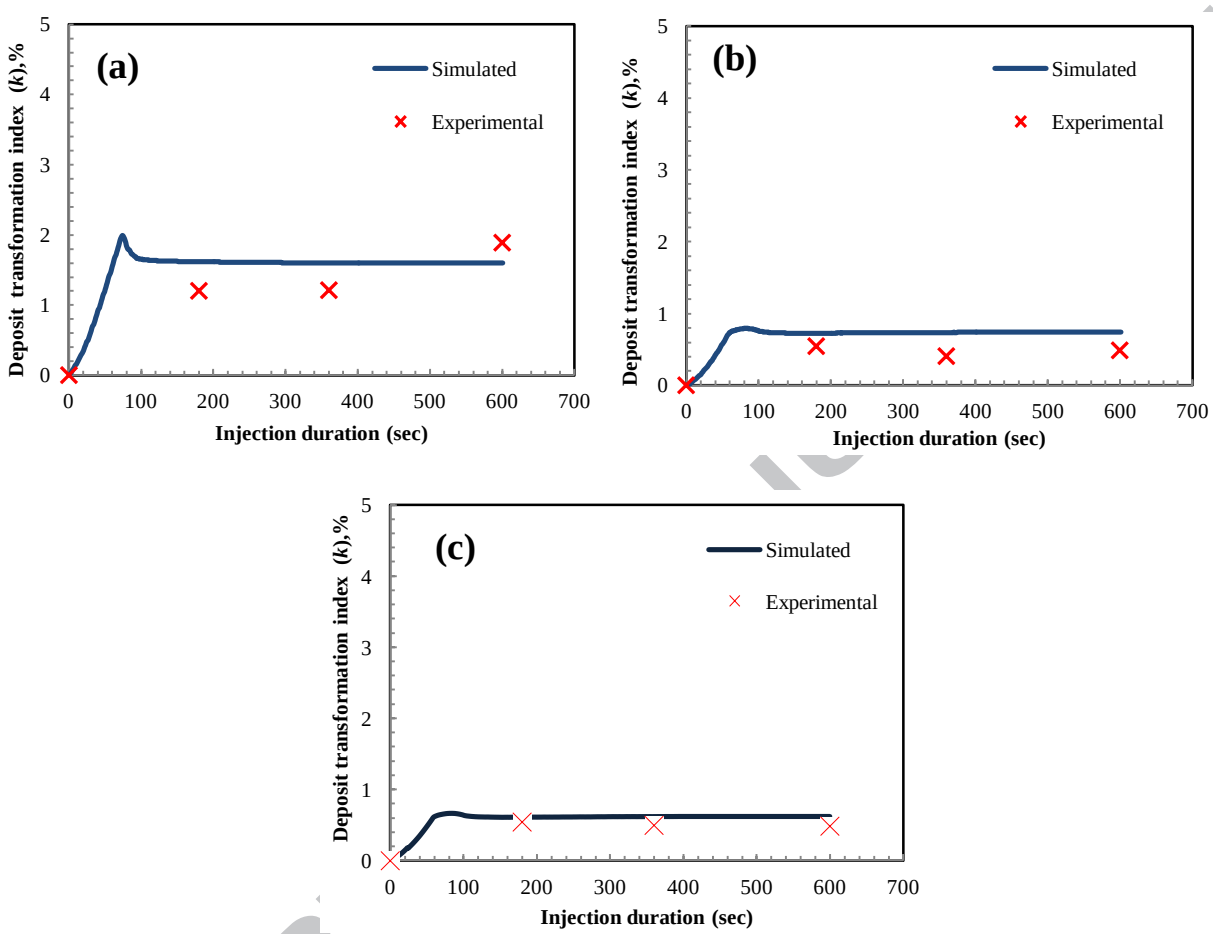



**Fig. 11. Plot of Deposit transformation index (*k*) vs Injection duration at temperature at 250$^0$C for flow rates (a) 34.74 kg/hr ,(b) 86.86 kg/hr and (c) 121.6 kg/hr.**

As result, the foil-2 records higher values of deposits in some cases as discussed in earlier sections. At higher flow rate (121.6 kg/hr), the deposit quantity is too low and there is no detectable change with respect time as we observe in Fig.11(c).

In many cases, we find numerical values are superior to experimental values. In our simulation cases diameter of the droplet kept constant value of 150µm. However, it is varying for most of

ACCEPTED MANUSCRIPT

the spray conditions within range 20-200 µm in actual spray. Evaporation and depletion behavior varies accordingly for varying droplet diameters. Additionally, we did steady state simulation even though spray condition requires quasi-steady simulation. This will lead to deviation from experimental results.

Referring Figs.10 (b), (c) and Figs.11 (a-c), we observe that a small kink is observed after a characteristic time and later graph plateaus. Initially when droplets impinge on heated surface, the droplets disperse over larger volume due to increased rebound and splash characteristics caused by heated wall. Droplets find newer areas other than impaction for deposit nucleation in such cases. This will continue till substantial dispersion of deposits takes place for certain characteristic time. Deposits so formed receive continuous heat from flowing hot air and start deplete. The droplet rebound and splash characteristics over solid urea or depleting urea will be different when compared to that at initial stages over pipe wall. Further accumulation of mass over liquid film occurs in steady manner as liquid surface does not support the deposition like solid surface do. Any urea inclusion to liquid layer is undergoes continuous thermolysis, thereby film mass remains same and trend remains straight line with time.

**4.4. Investigation on film area**

The film area increases due to combination of radial spreading of UWS droplets and the longitudinal progression linked to the effects of air stream. The temporal history of wall film area for varying temperature and flow rate is depicted by Grout et al.[12] with help of experiments on glass chamber. According to them, the liquid film area increases with respect to time and flow rate and the same decreases with respect to temperature. The thermal conductivity and surface roughness are the parameters additionally influence the wall film area. So, these characteristics

ACCEPTED MANUSCRIPT

may vary with steel pipe when compared with glass chamber. In numerical code, it is modelled with properties of steel pipe at the boundary. The typical nature of film area is to increase till its characteristic time and remain same at higher temperatures with variation only in thickness. At high temperatures, it is observed experimentally that deposit area reduces as urea turn to melt and urea melt doesn't form uniform layer. So, it is not suitable to compare numerical and experimental results at higher temperatures.

In our studies, the area of the deposit is determined from the segmentation of deposit area using transparent film with $1cm^2$ graduations. The deposit area is plotted as a function of flow rate at 3 different temperatures for UWS flow rate of 4ml/min. Fig.12(a) represents the experimental comparison of film area (which is represented deposit coverage area) for varying flow rates. At lower temperature, the film area increases since UWS spray cannot evaporate and decompose completely. At higher temperatures, the liquefaction of urea results in decrease of film area. When flow rate is increased, then dispersion of the droplet leads to faster decomposition of urea resulting lesser film area.

Fig.12 (b) compares the numerical results obtained for varying flow rates at $150^0$C. It is observed that the film area increases with respect time for certain initial characteristic time and corresponding plot plateaus thereafter. It is the fact that the film area increases only during initial stages and further growth of the same is sluggish for continuous injection of UWS. At higher temperature, evaporation of the UWS spray is faster and urea liquefaction and gasification is more predominant. The deposit area cannot be found for urea deposits of type semisolid and liquid melt. The liquid urea accumulates at the lower region foil due to gravity effect as we see in Fig.5 (e-h).

ACCEPTED MANUSCRIPT

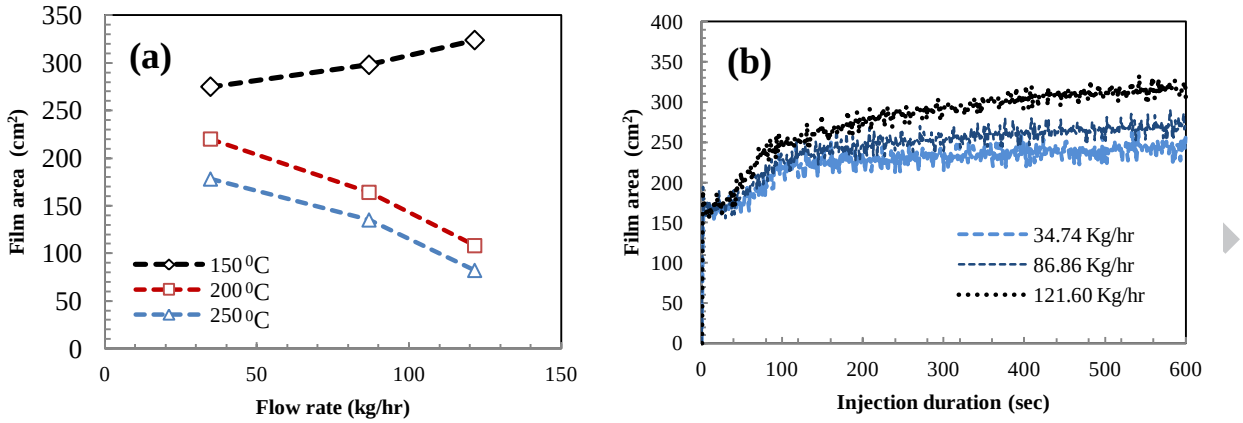



**Fig.12. (a) Film area vs flow rate for temperatures 150$^0$C, 200$^0$C and 250$^0$C (b) Film area vs Injection duration 150$^0$C.**

### 4.5. A Phenomenological model for deposit formation

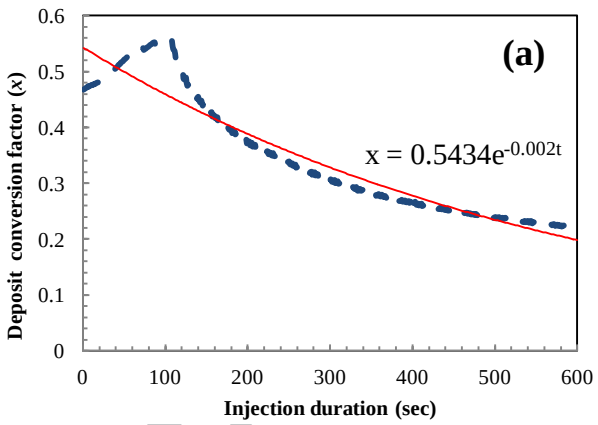
To avoid the computational time involved in 3-D simulation, a simple phenomenological model can be developed for predicting deposit formation for individual SCR system at particular temperature. Similar model can be extended to other temperatures and for different SCR mixing chambers considering other influencing parameters also. With help such models, SCR designers can go with best choice of SCR designs with least deposits perspective. The developed model at 150$^0$C is explained here.

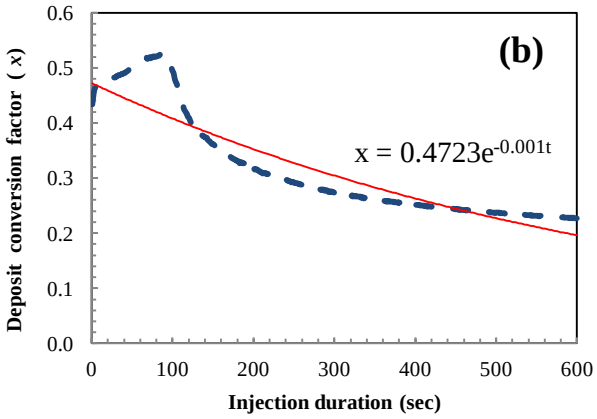
It is noticed that foil-1 has recorded highest deposition compared to foil-2 and mesh at 150$^0$C.For our modeling, we have considered the numerical values of deposits of foil-1 at different flow rates at 150$^0$C. Here, we determine a non-dimensional term called "*Deposit conversion factor (x)"* which is defined as the ratio of cumulative amount of deposit formed (in gms) to cumulative amount of UWS injected (gms) with respect to time. The *Deposit conversion factor (x)* is plotted with respect to time for different flow rates(Figs.13 (a-c)).From the graphs shown in Figs.13 (a-c)) for different flow rates, it is possible to obtain an equation for '*x'* by curve fitting. The

ACCEPTED MANUSCRIPT

respective equations are shown in Figs.13 (a-c).The variation of '*x*' can be expressed in a general form, $x = c_1 e^{-c_2 t}$ where $C_1$ and $C_2$ are the constants in respective equations. The constants $C_1$ and $C_2$ in each equation are correspond to different flow rates they are tabulated separately in Table 4. So $C_1$ and $C_2$ are plotted against flow rates and respective curve fits (Figs .13 (d-e)).

At lower temperature, the foil-1 has recorded highest deposits out of total deposits and foil-1 numerical results are validated with experimental values and also the deposits at foil-2 and mesh are comparatively lesser. But at higher temperatures, some urea deposits are found even in foil-2 and mesh and it has to be accounted as they contribute substantially for total deposits. So, at higher temperatures ($200^0$C and $250^0$C), total deposits from experimental results can be taken for accurate phenomenological modelling rather than the values of numerical simulation in foil-1.



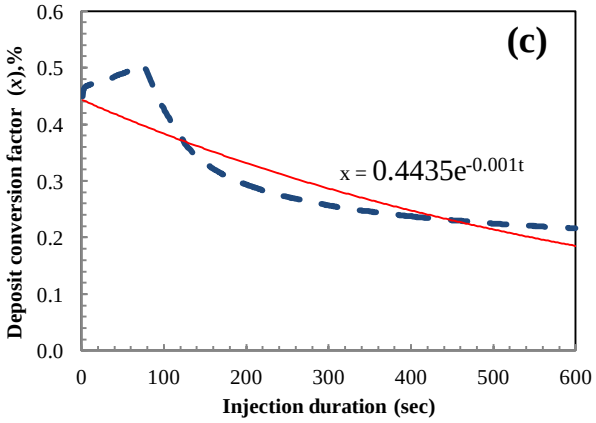




**Table 4 Constants $C_1$ and $C_2$ at $150^0$C**

| Flow rate | $C_1$ | $C_2$ |
|---|---|---|
| 34.74 | 0.543 | 0.002 |
| 86.86 | 0.4723 | 0.001 |
| 121.6 | 0.4435 | 0.001 |

ACCEPTED MANUSCRIPT

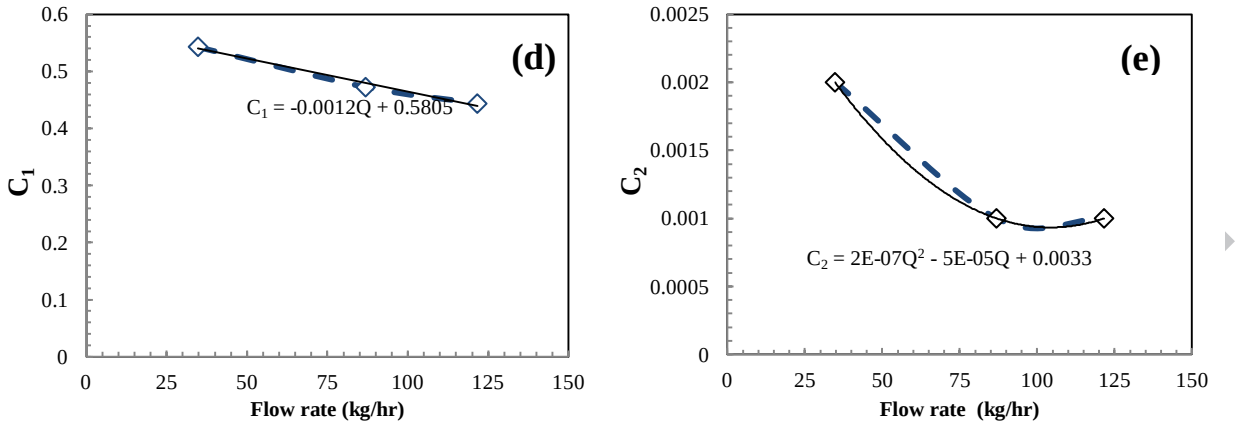
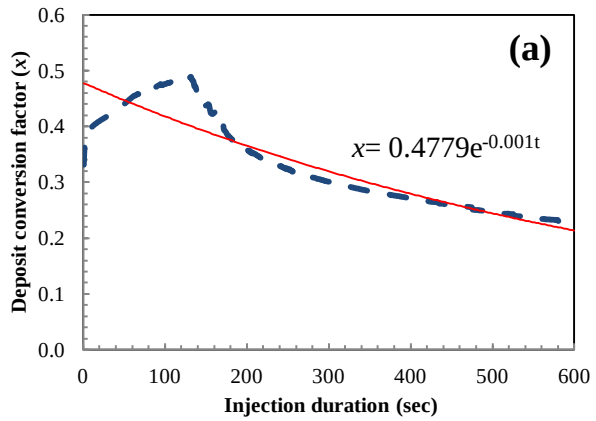
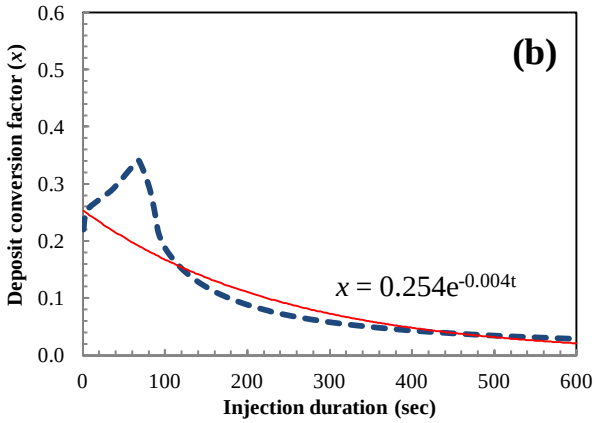



**Fig.13. (a) Deposit conversion factor (*x*) vs Flow rate at 34.74 kg/hr (b) Deposit conversion factor (*x*) vs Flow rate at 86.86 kg/hr (c) Deposit conversion factor (*x*) vs Flow rate at 121.6 kg/hr (d) Constant $C_1$ vs Flow rate (e) Constant $C_2$ vs Flow rate at 150$^0$C**

The deposit conversion factor, '*x*' can be found for intermediate flow rates by finding $C_1$ and $C_2$ with respect to time. This model can be calibrated and refined again. The values of '*x'* can be obtained at different stages in run cycle i.e during start, steady run etc. The graph of '*x'* vs time can be extrapolated after steady growth of deposit is observed. This process can be extended to other temperatures and generalized equation for deposit conversion factor can be found out. The deposit amount at any time interval can be calculated as, $m_{dep}=x \times$*mass flow rate of UWS* $\times$ *time*. For transient cycle, instantaneous value of '*x'* at particular temperatures and flow rate should be taken. In that case, $m_{dep}=\Sigma[$*instantaneous value of*$(x)\times$*instantaneous flow rate of UWS*$\times$*time interval]*.Here, the *time interval* for which particular temperature and flow rate prevails should be considered. This procedure is continued for temperatures 200$^0$C and 250$^0$C and the results are shown in Figs.14.(a-e) and Figs.15(a-e) with respective constants $C_1$ and $C_2$ (Tables 5 and 6).

ACCEPTED MANUSCRIPT



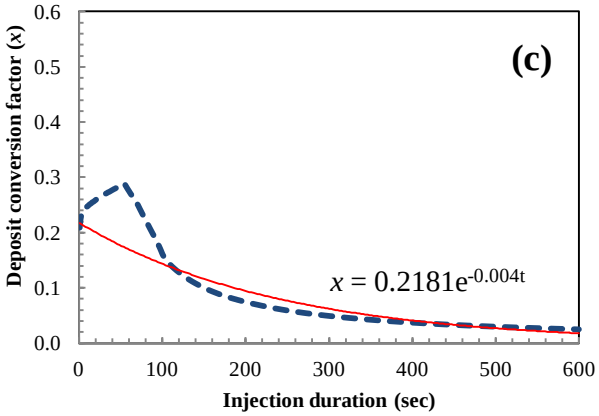
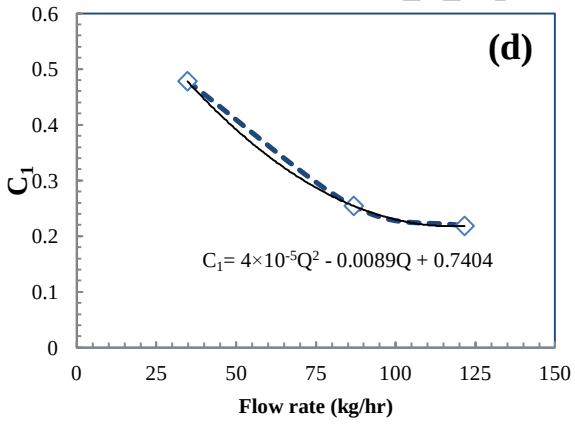




**Table 5 Constants C1 and C2 at 200$^0$C**

| Flow rate (kg/hr) | $C_1$ | $C_2$ |
|---|---|---|
| 34.74 | 0.4779 | 0.001 |
| 86.86 | 0.254 | 0.004 |
| 121.6 | 0.218 | 0.004 |



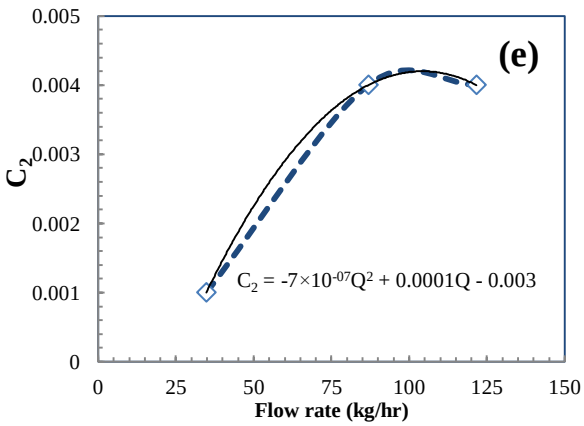
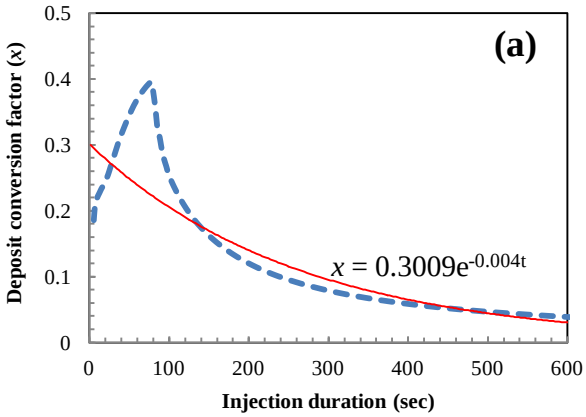
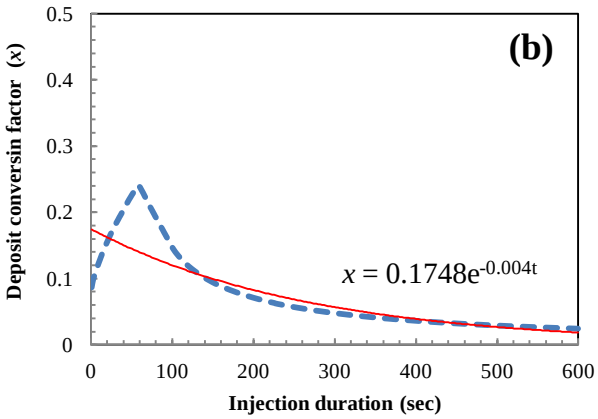




**Fig.14. (a) Deposit conversion factor ($x$) vs Flow rate at 34.74 kg/hr (b) Deposit conversion factor ($x$) vs Flow rate at 86.86 kg/hr (c) Deposit conversion factor ($x$) vs Flow rate at 121.6 kg/hr (d) Constant $C_1$ vs Flow rate (e) Constant $C_2$ vs Flow rate at 200$^0$C.**



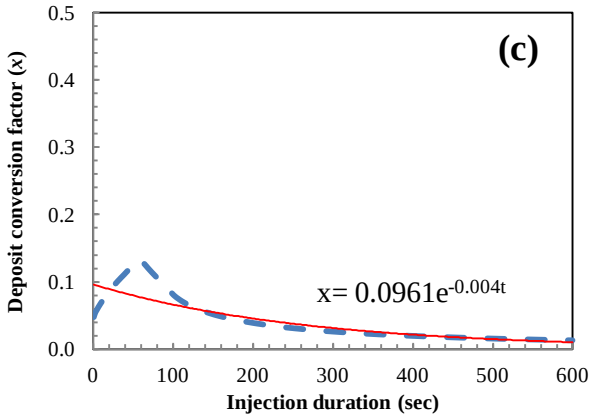
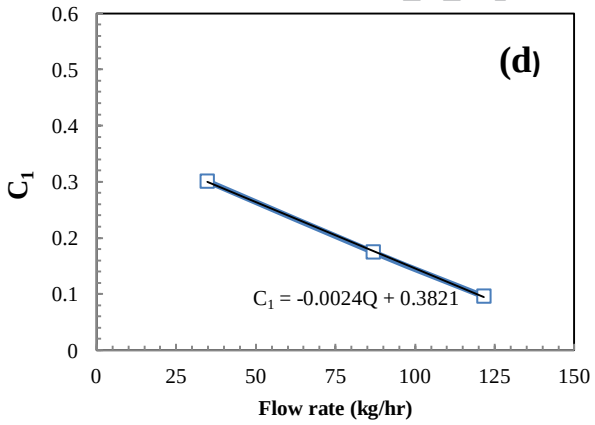




**Table 6. Constants $C_1$ and $C_2$ at $250^0$C**

| Flow rate | $C_1$ | $C_2$ |
|---|---|---|
| 34.74 | 0.3009 | 0.004 |
| 86.86 | 0.1748 | 0.004 |
| 121.6 | 0.0961 | 0.004 |



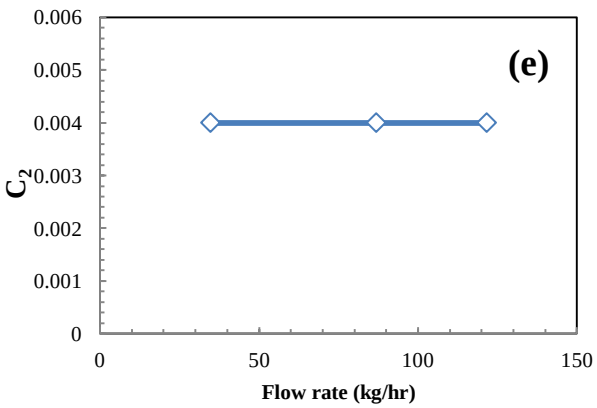




**Fig.15. (a) Deposit conversion factor (*x*) vs Flow rate at 34.74 kg/hr (b) Deposit conversion factor (*x*) vs Flow rate at 86.86 kg/hr (c) Deposit conversion factor (*x*) vs Flow rate at 121.6 kg/hr (d) Constant $C_1$ vs Flow rate (e) Constant $C_2$ vs Flow rate at $250^0$C.**

ACCEPTED MANUSCRIPT

## 5. Conclusion

The deposit formation is a major concern in SCR system which occurs at low temperature of engine exhaust and at cold weather conditions. The understanding of evaporation, urea decomposition and deposit formation at low temperature from UWS decomposition in SCR system helps in fine tuning dosage strategy to avoid ammonia slip. Adopting mixer to SCR mixing chamber requires additional effort in overcoming backpressure and deposits over the mixer blades. Evaporation of UWS spray is thus a step that deserves a particular attention. In our study, we have shown time dependent deposit formation behavior at low temperatures in the range 150-250$^0$C using new concept of using stainless steel foils and mesh. Analysis of SCR performance and side effects like deposit formation finds new shape with use of CFD and with experimental validation. So, numerical predictions over deposit formation are done using appropriate boundary conditions. Based on validation, phenomenological model is developed. The overall conclusions drawn are as follows.

1) From numerical studies, we see that when air mass flow rate is high, the atomization of UWS droplets takes place leading to faster evaporation. Simultaneously when flow rate is high, residence time decreases which gives lesser amount of evaporation for a particular length of mixing pipe. When temperature increases both the evaporation, urea decomposition increases and consequently deposit formation decreases. So flow rate and temperature have significant effect on decomposition UWS and deposit formation.

2) The quantity and nature of deposits found varying according temperature and flow rates. The analysis of structure of deposit physically at various operating conditions reveals the nature of deposit and deposit risk areas. The temperature effect on deposit formation is clearly distinguished as solid, semisolid and liquid type at respective temperatures. It is also observed

ACCEPTED MANUSCRIPT

that movement of liquid film or semisolid form of urea to successive regions with increase in air flow rate. Effect of gravity and surface tension should be taken care when liquid urea persists. This information very relevant to predict location of the deposits and nature of deposits for a given SCR mixing chamber.

3) The time dependent gravimetric analysis at various operating conditions and numerical results of the same have shown good agreement by comparison with slight over predictions. So, by knowing the amount of deposit at various locations, it is possible to work on side effects and also to improve the dosage strategy.

4) The increase of film area results due to the combination of the radial spreading of the liquid film and the longitudinal progression linked to the effects of the air flow. The thermal conductivity and surface roughness are the parameters additionally influence the wall film area. The film area increases only during initial stages and further spray of UWS makes the deposit thickness to increase rather than film area

5) To avoid computational time involved in 3-D simulation, if a simple phenomenological model is very useful in predicting deposit formation for individual SCR system with fixed mounting conditions at particular temperature. Similar model can be extended to other temperatures and other parameters also. This type study could extended to other kinds of mixing chamber with different L/D ratio which could be a valuable information for SCR designers.

## Acknowledgements

Authors greatly acknowledge AVL–AST for providing us the software AVL FIRE for conducting simulation work. We also would like to thank the Department of Mechanical Engg, NITK Surathkal for the support in providing AVL FIRE software facility.

ACCEPTED MANUSCRIPT

## References

[1] Yin-Hu Kang , Quan-Hai Wang , Xiao-Feng Lu , Xuan-Yu Ji , Shan-Shan Miao , Hu Wang, Qiang Guo, Hong-Hao He, Jie Xu., Experimental and theoretical study on the flow, mixing, and combustioncharacteristics of dimethyl ether, methane, and LPG jet diffusion flames, Fuel Processing Technology 129 (2015) 98–112, http://dx.doi.org/10.1016/j.fuproc.2014.09.004.

[2] Yinhu Kang, Xiaofeng Lu, Quanhai Wang, Xuanyu Ji Shanshan Miao Chen Zong Guangyu Luo, Hai Liu., An experimental and modeling study of $NO_x$ and CO emission behaviors of dimethyl ether (DME) in a boiler furnace, Fuel Processing Technology 122 (2014) 129–140, http://dx.doi.org/10.1016/j.fuproc.2014.01.030.

[3] Yinhu Kang , Quanhai Wang, Xiao Feng Lu , Hu Wan, Xuanyu Ji , Hu Wang , Qiang Guo , Jin Yan , Jinliang Zhou., Experimental and numerical study on $NO_x$ and CO emission characteristics of dimethyl ether/air jet diffusion flame ,Applied Energy 149 (2015) 204–224, http://dx.doi.org/10.1016/j.apenergy.2015.03.135.

[4] Yinhu Kang,Tianfeng Lu,Xiaofeng Lu,Quanhai Wang,Xiaomei Huang,Shini Peng,Dong Yang,Xuanyu Ji,Yangfan Song., Study on combustion characteristics of dimethyl ether under the moderate or intense low-oxygen dilution condition, Energy Conversion and Management Volume 108, 15 January 2016, 549–565, doi:10.1016/j.enconman.2015.11.039.

[5] Yinhu Kang, Tianfeng Lu , Xiaofeng Lu , Xiaolong Gou , Xiaomei Huang ,Shini Peng , Xuanyu Ji , Yang Zhou , Yangfan Song, On predicting the length, width, and volume of the jet diffusion flame, Applied Thermal Engineering 94 (2016) 799‑812 http://dx.doi.org/10.1016/j.applthermaleng.2015.11.006

[6] Yinhu Kang Quanhai Wang , Xiaofeng Lu , Xuanyu Ji Hu Wang, Qiang Guo , Ye Chen ,

ACCEPTED MANUSCRIPT

Jin Yan , Jinliang Zhou Experimental and theoretical study on radiative heat transfer characteristics of dimethyl ether jet diffusion flame Fuel 158 (2015) 684–696, http://dx.doi.org/10.1016/j.fuel.2015.06.015.

[7] Bin Guan, Reggie Zhan, He Lin, Zhen Huang, Review of state of the art technologies of selective catalytic reduction of $NO_x$ from diesel engine exhaust, Applied Thermal Engineering 66 (2014) 395-414. doi:10.1016/j.applthermaleng.2014.02.021.

[8] H.L. Fang, H.F.M. DaCosta, Urea thermolysis and $NO_x$ reduction with and without SCR catalysts, Applied Catalysis B: Environmental 46 (2003) 17–34. doi:10.1016/S0926-3373(03)00177-2.

[9] Chen, M. and Williams, S., Modelling and Optimization of SCR-Exhaust Aftertreatment Systems, SAE Technical Paper 2005-01-0969, 2005, doi: 10.4271/2005-01-0969.

[10] Birkhold, F., Meingast, U., Wassermann, P., and Deutschmann, O., Modeling and Simulation of the Injection of Urea-Water Solution for automotive SCR De-NOx-systems, Applied Catalysis B: Environmental 70:119-127, 2007, doi:10.1016/j.apcatb.2005.12.035

[11] Sébastien Grout, Jean-Bernard Blaisot, Karine Pajot Experimental Characterization of an urea water solution spray in hot air stream. Application to the Selective Catalytic Reduction. ILASS-Europe 2011, 24$^{th}$ European Conference on Atomization and Spray System. Estoril, Portugal, September 2011.

[12] Sébastien Grout, Jean-Bernard Blaisot, Karine Pajot, Giovanni Osbat Experimental investigation on the injection of an urea–water solution in hot air stream for the SCR application: Evaporation and spray/wall interaction, Fuel 106 (2013) 166–177 doi:10.1016/j.fuel.2012.09.022

ACCEPTED MANUSCRIPT

[13] van Helden, R., Verbeek, R., Willems, F., and van der Welle, R., Optimization of Urea SCR de-NOx Systems for HD Diesel Engines, SAE Technical Paper 2004-01-0154, 2004, doi:10.4271/2004-01-0154.

[14] Koebel, M. Elsener, M. Kleemann, Urea-SCR: a promising technique to reduce $NO_x$ emissions from automotive diesel engines, Catalysis Today.59 (2000)335–345.doi: 10.1016/S0920-5861(00)00299-6.

[15] J.Y.Kim, S.H.Ryu, J.S.Ha, Numerical prediction on the characteristics of spray-induced mixing and thermal decomposition of urea solution in SCR system, in: Proc.2004 Fall Technical Conference of the ASME Internal Combustion Engine Division, Long Beach, California USA, 2004. doi: 10.1115/ICEF2004-0889

[16] Birkhold, F., Meingast, U., Wassermann, P., and Deutschmann, O.,Analysis of the Injection of Urea-Water-Solution for Automotive SCR De-NOx-Systems: Modeling of Two-Phase Flow and Spray/ Wall-Interaction, SAE Technical Paper 2006-01-0643, 2006,doi:10.4271/2006-01-0643.

[17] J.C.Wurzenberger, R.Wanker, Multi-Scale SCR Modeling, ID Kinetic Analysis and 3D System Simulation. SAE Technical Paper 2005-01-0948, 2005. doi:10.4271/2005-01-0948.

[18] Schaber, P.M., Colson, J., Higgins, S., Thielen, D., Anspach, B., and Brauer, J.,Thermal decomposition (pyrolysis) of urea in an open reaction vessel, Thermochimica Acta 424:131-142, 2004,doi:10.1016/j.tca.2004.05.018

ACCEPTED MANUSCRIPT

[19] Yim, S.D., Kim, S.J., Baik, J.H., Nam, I.-S., Mok, Y.S., Lee, J.-H.,Cho, B.K., and Oh, S.H., Decomposition of Urea into $NH_3$ for the SCR Process, Industrial & Engineering Chemistry Research 43:4856-4863, 2004, doi:10.1021/ie034052j

[20] Dong, H., Shuai, S., and Wang, J., Effect of Urea Thermal Decomposition on Diesel $NO_x$-SCR Aftertreatment Systems, SAE Technical paper 2008-01-1544, 2008, doi:10.4271/2008-01-1544.

[21] Fang, H.L. and DaCosta, H.F.M., Urea thermolysis and $NO_x$ reduction with and without SCR catalysts, Applied Catalysis B: Environmental 46(1):17-34, 2003, doi:10.1016/S0926-3373(03)00177-2

[22] Ebrahimian, V., Nicolle, A., and Habchi, C., Detailed Modeling of the Evaporation and Thermal Decomposition of Urea-Water Solution in SCR Systems, AIChE Journal 58(7):1998-2009, 2012,doi:10.1002/aic.12736

[23] Lundström, A., Andersson, B., and Olsson, L., Urea thermolysis studied under flow reactor conditions using DSC and FTIR, Chemical Engineering Journal 150(2-3):544-550, 2009,doi:10.1016/j.cej.2009.03.044

[24] Munnannur, A., Chiruta, M., and Liu, Z., "Thermal and Fluid Dynamic Considerations in After treatment System Design for SCR Solid Deposit Mitigation," SAE Technical Paper 2012-01-1287,2012, doi:10.4271/2012-01-1287.

[25] Strots, V., Santhanam, S., Adelman, B., Griffin, G. et al., Deposit Formation in Urea-SCR Systems, SAE Int. J. Fuels Lubr. 2(2):283-289, 2010, doi: 10.4271/2009-01-2780.

ACCEPTED MANUSCRIPT

[26] Way, P., Viswanathan, K., Preethi, P., Gilb, A. et al., SCR Performance Optimization Through Advancements in Aftertreatment Packaging, SAE Technical Paper 2009-01-0633, 2009, doi:10.4271/2009-01-0633

[27] Xu, L., Watkins, W., Snow, R., Graham, G. et al., Laboratory and Engine Study of Urea-Related Deposits in Diesel Urea-SCR After-Treatment Systems, SAE Technical Paper 2007-01-1582, 2007, doi: 10.4271/2007-01-1582.

[28] Nishioka, A., Sukegawa, Y., Katogi, K., Mamada, H. A Study of a New Aftertreatment System (2): Control of Urea Solution Spray for Urea-SCR, SAE Technical Paper 2006-01-0644, 2006, doi: 10.4271/2006-01-0644.

[29] Henrik Smith, Thomas Lauer and Mattias Mayer , Optical and Numerical Investigations on the Mechanisms of Deposit Formation in SCR Systems SAE International Journal of Fuels and Lubricants June 2014 vol. 7 No. 2 pp 525-542,doi: 10.4271/2014-01-1563.

[30] Koebel, M., and Strutz, E.O., Thermal and Hydrolytic Decomposition of Urea for Automotive Selective Catalytic Reduction Systems: Thermochemical and Practical Aspects, Industrial& Engineering Chemistry Research 42:2093-2100, 2003, doi: 10.1021/ie020950o

[31] Das, S., Das, K., Abidin, Z., and Mehta, D., Effects of Various Model Parameters in the Simulation of a Diesel SCR System, SAE Technical Paper 2012-01-1297, 2012, doi: 10.4271/2012-01-1297.

[32] Fischer, S., Bitto, R., Lauer, T., Krenn, C. et al., Impact of the Turbulence Model and Numerical Approach on the Prediction of the Ammonia Homogenization in an Automotive SCR System, SAE Int. J. Engines 5(3):1443-1458, 2012, doi:10.4271/2012-01-1291.

ACCEPTED MANUSCRIPT

[33] Fischer, S., Simulation of the Urea-Water-Solution Preparation and Ammonia-Homogenization with a Validated CFD-Model for the Optimization of Automotive SCR-Systems. PhD thesis, Vienna University of Technology, 2012

[34] Zheng, G., Fila, A., Kotrba, A., and Floyd, R., Investigation of Urea Deposits in Urea SCR Systems for Medium and Heavy Duty Trucks SAE Technical Paper 2010-01-1941, 2010, doi: 10.4271/2010-01-1941.

[35] Sirignano, Fuel Droplet Vapourization and Spray Combustion Theory, Prog. Energy Combustion System 9(1983) 291-322.

[36] G.M Faeth, Evaporation and Combustion of Sprays, Prog. Energy Combustion Sci. 9(1983) 1-76 doi: 10.1016/0360-1285(83)90011-4

[37] J. K. Dukowicz. Quasi-Steady Droplet Phase Change in the Presence of Convection. Informal Report LA-7997- MS, Los Alamos Scientific Laboratory, Los Alamos, New Mexico, 1979.

[38] Verein Deutscher Ingenieure, editor. VDI-Warmeatlas, Berechnungsblätterfürden Wärmeübergang.VDI-Verlag, Dusseldorf, 6th edition, 1991.

[39] User Manual -Fire v2011.1 AVL LIST GmbH, A-8020 Graz, Austria, www.avl.com

[40] Buchholz, Einsatz von festem Harnstoff als Reduktionsmittel für die $NO_x$-Minderung nach dem SCR-Verfahren", Dissertation, Universität Karlsruhe, 2000.

[41] Chr. Mundo, M. Sommerfeld, and C. Tropea. Droplet wall collisions: Experimental studies of the deformation and breakup process. Int.Journal.of Multiphase Flow, 21(2):151–173, 1995.doi:10.1016/0301-9322(94)00069-V

ACCEPTED MANUSCRIPT

[42] D.Kuhnke.Spray/Wall-Interaction Modelling by Dimensionless Data Analysis. PhD thesis, Universit at Darmstadt, 2004

[43] Abu-Ramadan, E., Saha, K., and Li, X., Numerical Modeling of the Impingement Process of Urea-Water Solution Spray on the Heated Walls of SCR Systems, SAE Technical Paper 2012-01-1301, 2012, doi:10.4271/2012-01-1301.

[44] J. Akao, K. Araki, S. Mori, and A. Moriyama. Deformation behaviors of a liquid droplet impinging on to hot metal surface. Trans. Iron and Steel Institute of Japan, 20:737–743, 1980.

[45] Tae Joong Wang, Seung Wook Baek, and Seung Yeol Lee, Experimental Investigation on Evaporation of Urea-Water- Solution Droplet for SCR Applications AIChE Journal December 2009 Vol. 55, No. 123267. doi: 10.1002/aic.11939

ACCEPTED MANUSCRIPT

ACCEPTED MANUSCRIPT

**LIST OF FIGURES**

ACCEPTED MANUSCRIPT

**Fig. 10.** Plot of Deposit transformation index ($k$) vs Injection duration at temperature at $200^0$C for flow rates (a) 34.74kg/hr (b) 86.86 kg/hr and (c)121.6 kg/hr.

**Fig. 11.** Plot of Deposit transformation index ($k$) vs Injection duration at temperature at $250^0$C for flow rates (a) 34.74 kg/hr (b) 86.86 kg/hr and (c)121.6kg/hr.

**Fig.12.** (a) Film area vs Flow rate for temperatures $150^0$C, $200^0$C and $250^0$C, (b) Film area vs Injection duration $150^0$C.

**Fig.13.** (a) Deposit conversion factor ($x$) vs Flow rate at 34.74 kg/hr (b) Deposit conversion factor($x$) vs Flow rate at 86.86 kg/hr (c) Deposit conversion factor ($x$) vs Flow rate at 121.6 kg/hr (d) Constant $C_1$ vs Flow rate (e) Constant $C_2$ vs Flow rate $150^0$C

**Fig.14**. (a) Deposit conversion factor ($x$) vs Flow rate at 34.74 kg/hr (b) Deposit conversion factor($x$) vs Flow rate at 86.86 kg/hr (c) Deposit conversion factor ($x$) vs Flow rate at 121.6 kg/hr (d) Constant $C_1$ vs Flow rate (e) Constant $C_2$ vs Flow rate at $200^0$C

**Fig.15.** (a) Deposit conversion factor ($x$) vs Flow rate at 34.74 kg/hr (b) Deposit conversion factor ($x$) vs Flow rate at 86.86 kg/hr (c) Deposit conversion factor ($x$) vs Flow rate at 121.6 kg/hr (d) Constant $C_1$ vs Flow rate (e) Constant $C_2$ vs Flow rate at $250^0$C

ACCEPTED MANUSCRIPT

**LIST OF TABLES**



ACCEPTED MANUSCRIPT

**Graphical Abstract**

ACCEPTED MANUSCRIPT

ACCEPTED

ACCEPTED MANUSCRIPT

HIGHLIGHTS

- Experimental investigation deposit formation by using foils in hot air test bench .
- Increase of temperature and flow rate decreases the deposit formation.
- Time dependent deposit formation helps for SCR designers to predict deposit formation.
- Deposit film area , location and nature at different temperature and flow rate
- Phenomenological modelling helps in choosing optimum SCR design

ACCEPTED MANUSCRIPT

**Cite this article**
Gunge A, Kivade SB, Nagamadhu M and Rajole S
Mechanical properties of chemically treated woven banana/polyvinyl alcohol composites.
*Emerging Materials Research*,
https://doi.org/10.1680/jemmr.18.00028

**Composite Materials Research Article**
**Paper 1800028**
Received 02/03/2018; Accepted 21/08/2019

ICE Publishing: All rights reserved

**Keywords:** composite materials/ mechanical properties/scanning electron microscopy

Emerging Materials Research

ice Publishing

# Mechanical properties of chemically treated woven banana/polyvinyl alcohol composites

1 **Amaresh Gunge** PhD
Assistant Professor, Department of Mechanical Engineering, Nagarjuna College of Engineering and Technology, Bengaluru, India

2 **Sangshetty Bheemanna Kivade** PhD
Principal, Department of Mechanical Engineering, Basavakalyan Engineering College, Basavakalyan, India

3 **Mahadevappa Nagamadhu** PhD
Assistant Professor, Department of Mechanical Engineering, Acharya Institute of Technology, Bengaluru, India

4 **Sangamesh Rajole** PhD
Research Scholar, Department of Metallurgical and Materials Engineering, National Institute of Technology Karnataka, Mangalore, India (corresponding author: rajolesangmesh@gmail.com)
(Orcid:0000-0002-4200-7855)




**The present work investigated the effect of chemical treatment on the mechanical properties of plain-woven banana fabrics reinforced with a polyvinyl alcohol (PVA) biodegradable matrix. Woven banana fabrics were chemically treated with different concentrations (0·5, 1·0, 2·0, 3·0 and 4·0%) for 4 h at room temperature. The banana fabrics and PVA were used in ratios of 55 and 45% weight fractions, respectively. Composites were prepared using the hand-layup method. The samples were tested according to different ASTM standards for tensile, flexural and impact strength. The results showed that tensile, flexural and impact properties improved with potassium permanganate ($KMnO_4$) treatment. The fabrics treated with 1·0% potassium permanganate showed very good mechanical properties compared with the untreated fabrics and the 0·5, 2·0, 3·0 and 4·0% treated fabrics. The 1% treated fabric composite showed a 68·07% increase in tensile strength compared with the untreated fabric composite. Scanning electron microscopy revealed that the 1% treated fabric had better interfacial bonding between the fabric and matrix. This contributes to improvement in the mechanical properties of the composite.**

## 1. Introduction

Natural fibers have become a popular new material because of their high stiffness, high strength, easy availability, eco-friendliness, low cost, renewability and biodegradability in nature.[1] There are different types of natural fibers available today; some examples in use include banana, sisal, jute, bamboo, hemp and oil palm fibers. Generally, raw natural fabrics consist of hemicellulose, impurities, dust and other unwanted particles. Due the presence of these constituents, there is no proper bonding between the fabric and the matrix. This could lead to lowering of the mechanical strength of the composite.[2] Chemical treatment plays a significant role in improving the strength of fabrics, as well as internal adhesion between the fabric and matrix.[3] Many researchers have worked on the alkali treatment of natural fibers by different concentrations and reported how the bonding and strength changes with various concentrations.[4–8]

Bachtiar *et al.*[9] investigated the effect of alkaline treatment on the tensile properties of sugar palm fiber and reported that the treated fibers had better tensile properties than the untreated fibers. Barreto *et al.*[10] studied sisal fibers treated with an alkali solution (5 and 10%) and concluded that the 5% treated fiber had higher strength compared with the untreated and 10% treated fibers. Rong *et al.*[11] studied different chemical treatments, including alkalization, acetylation, cyanoethylation, use of a silane coupling agent and heating. Asim *et al.*[12] concluded that sodium hydroxide (NaOH), silane and sodium hydroxide–silane treatments improved the mechanical properties. Preet Singh *et al.*[13] studied the mechanical properties of treated and non-treated natural fibers, such as tensile strength, flexural strength and impact strength, and concluded that the treated fiber achieved good mechanical strength. Bakri *et al.*[14] concluded that treated fiber composites have superior properties compared with untreated fiber composites. Martelli-Tosi *et al.*[15] investigated changes in the chemical composition and structure of soybean straw treated with alkali (5·0 and 17·5%). Ridzuan *et al.*[16] discussed the effect of soaking time during alkali treatment on the tensile strength of napier grass fiber and its morphology. Yahaya *et al.*[17] concluded that treated kenaf improves the mechanical properties of hybrid composites. Aseer *et al.*[18] analyzed changes due to chemical treatment by Fourier transform infrared and X-ray diffraction methods. Nagamadhu *et al.*[19] studied alkali treatment of sisal and jute fibers at different concentrations – 0, 4 and 6% – and

Offprint provided courtesy of www.icevirtuallibrary.com
Author copy for personal use, not for distribution

concluded that the 4% sodium hydroxide results in high–strength hybrid composites.

A literature survey revealed that there had been no work carried out on permanganate treatment of natural fibers. The present work is a new class of work and discusses the treatment of plain-woven banana fabrics with various concentrations of potassium permanganate ($KMnO_4$) and their mechanical characterization and morphological characterization using scanning electron microscopy (SEM).

## 2. Materials and methods

Plain-woven banana fabric (400 g/m$^2$) was collected from Jolly Enterprise, Kolkata, and polyvinyl alcohol (PVA) purchased from local dealers (Pragathi Industries, Bangalore) was used for preparing the composite specimens; resin and hardener was mixed at a 2:1 ratio. The plain-woven banana fabric was immersed in a potassium permanganate solution with different concentrations (0·5, 1·0, 2·0, 3·0 and 4·0%) for 4 h. The fabrics were thoroughly washed with regular water after treatment and cured naturally for 2–3 d. The banana fabrics and PVA were used in ratios of 55 and 45% weight fractions, respectively. Composites were prepared using the hand-layup method.[20] The rectangular mold used for preparing composite laminates measured 250 × 200 × 4 mm and was made from mild steel. Initially, the top and bottom plates were cleaned with a smoother for easy removal of any unwanted/dust particles from both plates. The releasing agent was applied to the top and bottom plates, which facilitated easy removal of composite laminates from the mold. The fabrics were cut as per the mold dimensions. Layers of untreated and treated fabrics were used for preparing the composite laminates as per weight fraction. A polyethylene sheet was laid on the clean and dry mold before preparation of composite laminates. The resin and hardener were mixed together, and then a fabric layer was placed inside the mold. Then, a mixture of resin and hardener was poured slowly into the mold. The same procedure was followed until the thickness reached 4 mm. Once the thickness was reached, the sample was covered with the top plate and bottom plate; the top plate had a nut-and-bolt assembly for compressing, as shown in Figure 1(a). Pressure was applied by tightening the nuts, and the sample was allowed to cure for 24 h. Cured samples were removed after 24 h and were cut to the required dimensions shown in Figure 1(b).

## 3. Mechanical strength

A specimen for tensile testing was prepared as per ASTM D 638M[21] to measure the tensile strength of untreated and treated fabrics; the size of the specimen was 160 × 12·5 × 4 mm. The test specimen was placed in the testing machine, and load was applied gradually until the specimen fractured. The elongation of the specimen during the test was measured and three samples were tested with a 5 mm/min cross-head speed and a 100 mm gauge length. Average values were taken; sample testing with the fixture is shown in Figure 2(a). Specimens for flexural testing were prepared as per ASTM D 790M[22] to measure the bending strength of untreated and treated fabrics. The size of the specimen was 127 × 12·7 × 4 mm. Three samples were tested with a 5 mm/min cross-head speed and a 70 mm span length. The tensile and flexural strengths were measured using a Venus universal testing machine (model UTV-40 PC-M). Sample testing with the fixture is shown in Figure 2(b). Specimens for impact testing were prepared as per ASTM D 256M[23] to measure the impact strength of untreated and treated fabrics. The size of the specimens was 94 × 12·7 × 4 mm. The impact test was carried out using a Venus impact testing machine (model VI-300). Sample testing is shown in Figure 2(c). Interfacial properties, such as fabric–matrix interaction, fracture behavior and fabric pull-out of samples after mechanical testing were observed using a Tescan Vega 3-LMU scanning electron microscope at BMS College, Bangalore.

## 4. Results and discussion

This section highlights the mechanical strength of untreated and potassium permanganate-treated fabrics, The results of tensile, flexural and impact strength are discussed and reported in Figures 3(a)–3(c). The effect of different concentrations on tensile strength was determined using a universal testing machine as per

(a) (b)

**Figure 1.** (a) Mold for sample preparation; (b) prepared samples after cutting

Offprint provided courtesy of www.icevirtuallibrary.com
Author copy for personal use, not for distribution


**Figure 2.** Testing of samples with fixture for (a) tensile loading, (b) flexural loading and (c) impact loading

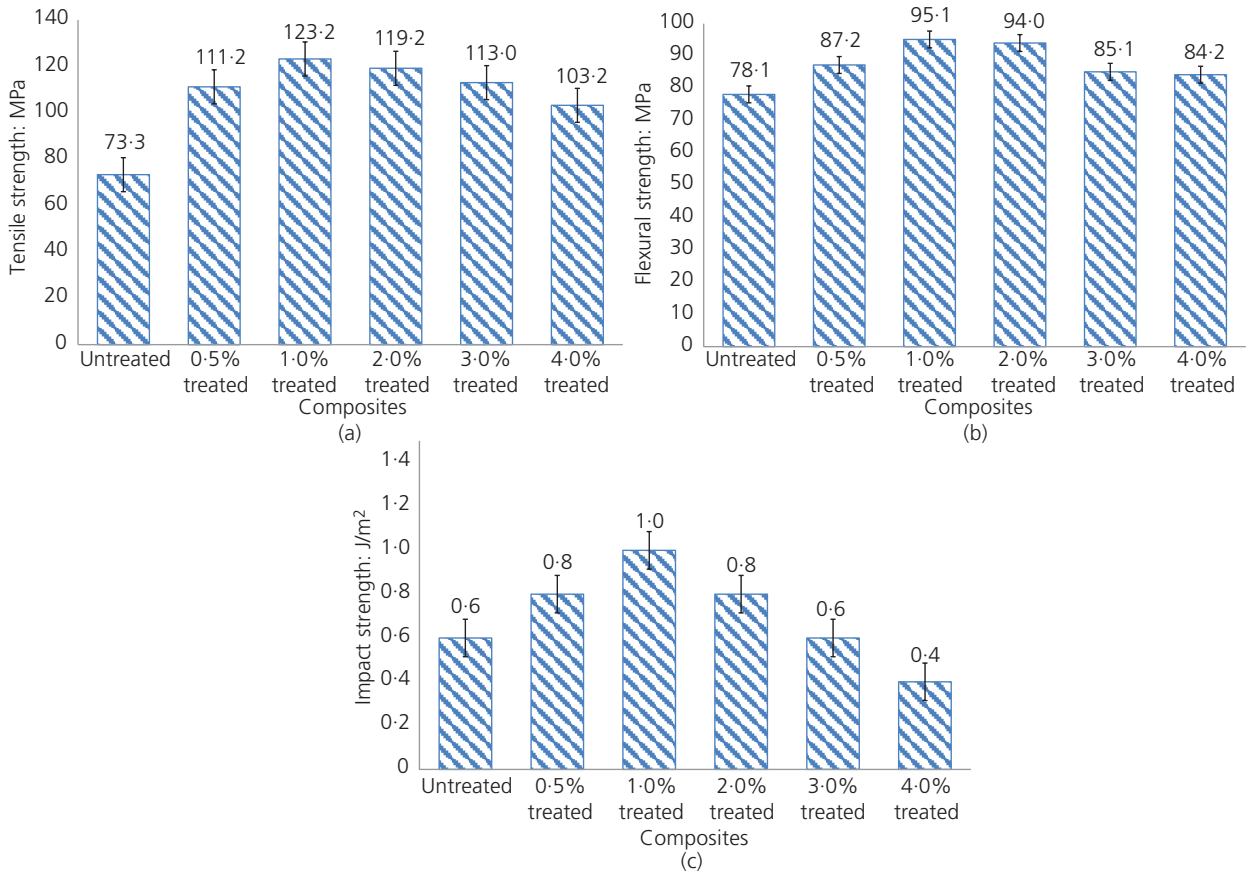



**Figure 3.** (a) Tensile strength, (b) flexural strength and (c) impact strength of composites

Offprint provided courtesy of www.icevirtuallibrary.com
Author copy for personal use, not for distribution

ASTM standards. The tensile strengths of untreated and 0·5, 1·0, 2·0, 3·0 and 4·0% treated fabrics were 73·3, 111·2, 123·2, 119·2, 113·0 and 106·2 MPa, respectively, as shown in Figure 3(a). The tensile strength of 0·5% treated fabric composite increased by 51·70% compared to the untreated fabric composite, increased by 10·79% compared to the 0·5% treated fabric composite and decreased by 3·24% compared to the 1% treated fabric composite. From the experimental results, it was found that the 1·0% potassium permanganate-treated fabric composite had better tensile strength compared with the untreated and 0·5, 2·0, 3·0 and 4·0% treated fabrics. For the 1·0% treated fabric composite, the tensile strength was 123·20 MPa, which is 68·07% higher than that of untreated fabrics composite.[7] Upon increasing the treatment, over 1% decrease in the strength was observed; this could be due to the fiber damage caused by permanganate treatment, which led to improper bonding between the fabrics and matrix. Hence, 1% treatment is the superior permanganate treatment that provides the best internal bonding between the fabrics and the matrix.

The flexural test was carried out in a universal testing machine under three-point bending mode. Figure 3(b) shows the experimental results of flexural strength of untreated and treated fabric composites; the figure also shows that the flexural strength of the treated fabric composites was higher than that of the untreated fabric composite. The 1·0% treated fabric composite

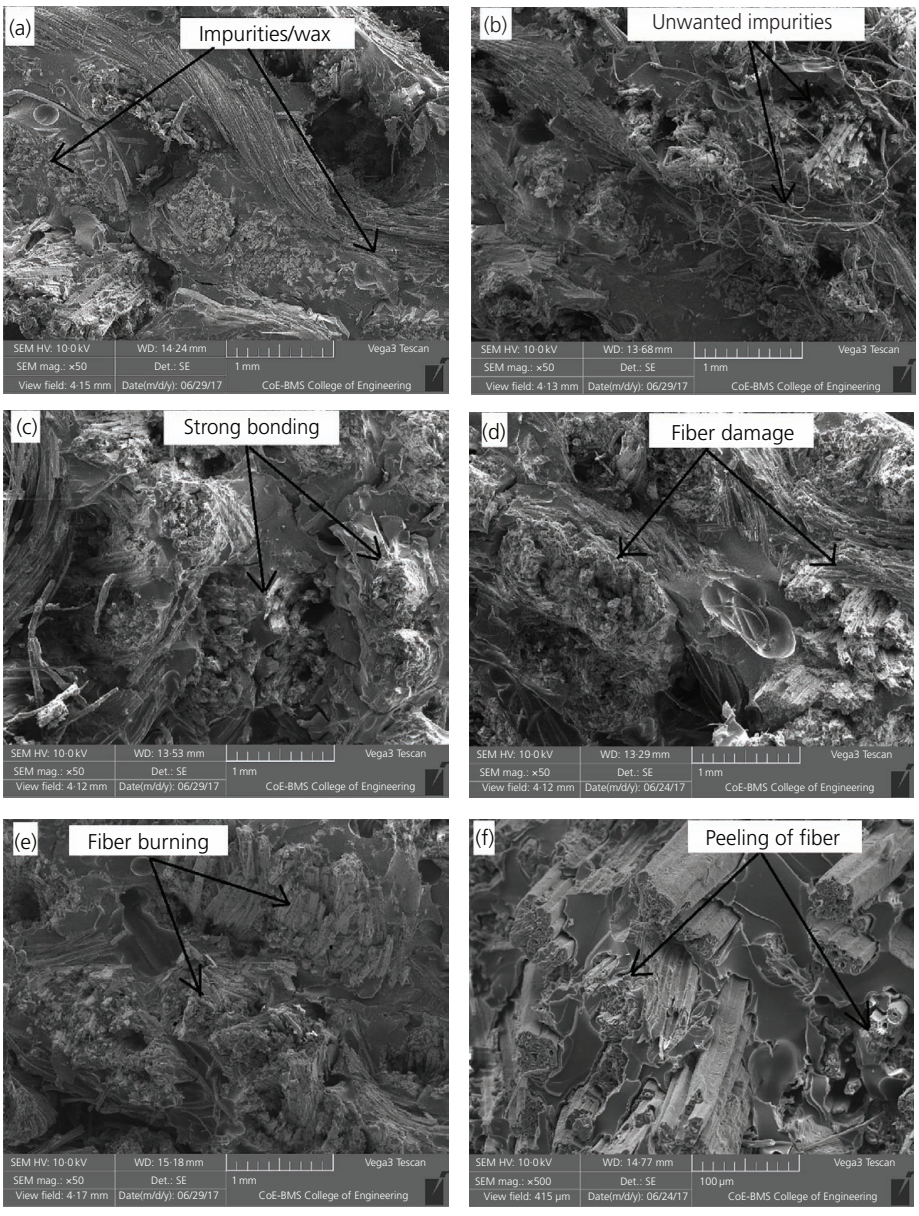



**Figure 4.** SEM of (a) untreated, (b) 0·5% treated, (c) 1% treated, (d) 2% treated, (e) 3% treated and (f) 4% treated fabric composites

Offprint provided courtesy of www.icevirtuallibrary.com
Author copy for personal use, not for distribution

had better flexural strength compared with the untreated and 0·5, 2·0, 3·0 and 4·0% treated fabric composites. For the 1% treated fabric composite, the flexural strength was 95·10 MPa, which is 21·92% higher than that of untreated fabric composite. Compared with the untreated fabric composite, there was gradual improvement in the flexural strength up to 1%. As the concentration increased, the strength of the fabric composite reduced, caused by permanganate treatment. Due to this, there was no proper bonding between fabrics and matrix, which could lead to a decrease in the flexural strength of fabrics.

Impact strength was measured as the energy required to break the composite laminate when a sudden load was applied. The impact strength of treated and untreated composite laminates is presented in Figure 3(c). The impact strengths of untreated and 0·5, 1·0, 2·0, 3·0 and 4·0% composites were 0·6, 0·8, 1·0, 0·8, 0·6 and 0·4 J/m$^2$, respectively. The impact strength of the 0·5% treated fabric increased by 33·33% compared to the untreated fabric composite; increased by 25·0% compared to the 0·5% treated fabric composite and decreased by 20% compared to the 1·0% treated fabric composite. Experimental results revealed that the 1·0% treated fabric composite had better impact strength compared to the untreated and 0·5, 2·0, 3·0 and 4·0% treated fabric composites.

### 4.1 Fractography study

To know the nature of fracture and internal bonding of composite laminates after mechanical testing, a micrograph study was necessary. Figure 4(a) shows the SEM of the untreated composite laminate. Generally, fabrics are available as raw materials. Raw fabrics consist of hemicellulose, impurities, dust and other unwanted particles. Due to the presence of these constituents, there was no proper bonding between the fabrics and the matrix. This is clearly observed from the figure and could lead to lowering of the mechanical strength. To overcome this, chemical treatment plays a significant role in improving the strength of the fabrics, as well as internal adhesion between the fabrics and matrix.

Figure 4(b) shows the SEM of the 0·5% treated composite laminate. There was a small amount of impurities, hemicellulose and other dust/unwanted particles removed compared with untreated laminates, which is observed in the figure. Due to this small amount of improvement in the bonding between fabrics to matrix, as observed, there was a smaller amount of unwanted particles, which led to changes in strength compared with untreated fabrics. Figure 4(c) shows the SEM of 1% treated composite laminates. From this figure, it could be observed that almost all the unwanted particles had been removed from the fabric and the formation of smooth surfaces had taken place, which led to enhancing the strength of the composite.[19] Figure 4(d) shows the SEM of the 2% treated composite laminate. There was loose bonding between the fiber bundles and matrix, and fiber damage also occurred, which could lead to a decrease in the strength. Figures 4(e) and 4(f) show the SEM of 3 and 4% treated composites. As the treatment percentage increased, the strength of fabrics decreased; this may be due to peeling or burning of fabric surfaces.

## 5. Conclusion

Chemically treated plain-woven banana fabrics with PVA were successfully fabricated using the hand-layup technique. Chemical treatment plays a major role in improving the strength and bonding between the fabrics and matrix. Tensile, flexural and impact properties were evaluated as per ASTM standards; from the results, it was concluded that the 1% potassium permanganate-treated composite laminates had better mechanical strength. The tensile strength of the 1% treated composite increased by 68·07%, its flexural strength increased by 21·92% and its impact strength increased by 66·66% compared with those of the untreated composite laminates. Increasing the potassium permanganate concentration up to 1% resulted in proper removal of dust and other unwanted particles, which led to increase in the strength of the fabric composite. When the percentage of concentration was increased above 1%, the fiber surface became damaged, which may lead to a decrease in the mechanical strength of the composites. The nature of fracture behavior, internal bonding and surface modification was observed by SEM, which supported the conclusion of using treatment concentrations of up to 1%.

REFERENCES

1. Sangamesh R, Kumar N, Ravishankar KS and Kulkarni SM (2017) Mechanical characterization and finite element analysis of jute–epoxy composite. *MATEC Web of Conferences* **144**: 02014.
2. Edeerozey AMM, Akil HM, Azhar AB and Ariffin MIZ (2007) Chemical modification of kenaf fibers. *Materials Letters* **61(10)**: 2023–2025.
3. Stocchi A, Lauke B, Vázquez A and Bernal C (2007) A novel fiber treatment applied to woven jute fabric/vinylester laminates. *Composites Part A: Applied Science and Manufacturing* **38(5)**: 1337–1343.
4. Kabir MM, Wang H, Lau KT and Cardona F (2012) Chemical treatments on plant-based natural fibre reinforced polymer composites: an overview. *Composites Part B: Engineering* **43(7)**: 2883–2892.
5. Rokbi M, Osmani H, Imad A and Benseddiq N (2011) Effect of chemical treatment on flexure properties of natural fiber-reinforced polyester composite. *Procedia Engineering* **10**: 2092–2097.
6. Keener TJ, Stuart RK and Brown TK (2004) Maleated coupling agents for natural fibre composites. *Composites Part A: Applied Science and Manufacturing* **35(3)**: 357–362.
7. Venkateshwaran N, Elaya Perumal A and Arunsundaranayagam D (2013) Fiber surface treatment and its effect on mechanical and visco-elastic behaviour of banana/epoxy composite. *Materials & Design* **47**: 151–159.
8. Mylsamy K and Rajendran I (2011) Influence of alkali treatment and fibre length on mechanical properties of short Agave fibre reinforced epoxy composites. *Materials & Design* **32(8–9)**: 4629–4640.
9. Bachtiar D, Sapuan SM and Hamdan MM (2008) The effect of alkaline treatment on tensile properties of sugar palm fibre reinforced epoxy composites. *Materials & Design* **29(7)**: 1285–1290.
10. Barreto ACH, Rosa DS, Fechine PBA and Mazzetto SE (2011) Properties of sisal fibers treated by alkali solution and their application into cardanol-based biocomposites. *Composites Part A: Applied Science and Manufacturing* **42(5)**: 492–500.
11. Rong MZ, Zhang MQ, Liu Y, Yang GC and Zeng HM (2001) The effect of fiber treatment on the mechanical properties of unidirectional sisal-reinforced epoxy composites. *Composites Science and Technology* **61(10)**: 1437–1447.
12. Asim M, Jawaid M, Abdan K and Ishak MR (2016) Effect of alkali and silane treatments on mechanical and fibre–matrix bond strength of kenaf and pineapple leaf fibres. *Journal of Bionic Engineering* **13(3)**: 426–435.

Offprint provided courtesy of www.icevirtuallibrary.com
Author copy for personal use, not for distribution

13. Preet Singh JI, Dhawan V, Singh S and Jangid K (2017) Study of effect of surface treatment on mechanical properties of natural fiber reinforced composites. *Materials Today: Proceedings* **4(2)**: 2793–2799.
14. Bakri MKB, Jayamani E and Hamdan S (2017) Processing and characterization of banana fiber/epoxy composites: effect of alkaline treatment. *Materials Today: Proceedings* **4(2)**: 2871–2878.
15. Martelli-Tosi M, Assis OBG, Silva NC *et al.* (2017) Chemical treatment and characterization of soybean straw and soybean protein isolate/straw composite films. *Carbohydrate Polymers* **157**: 512–520.
16. Ridzuan MJM, Majid MSA, Afendi M *et al.* (2015) The effects of the alkaline treatment's soaking exposure on the tensile strength of Napier fibre. *Procedia Manufacturing* **2**: 353–358.
17. Yahaya R, Sapuan SM, Jawaid M, Leman Z and Zainudin ES (2015) Effect of layering sequence and chemical treatment on the mechanical properties of woven kenaf–aramid hybrid laminated composites. *Materials & Design* **67**: 173–179.
18. Aseer JR, Sankaranarayanasamy K, Jayabalan P, Natarajan R and Dasan KP (2013) Morphological, physical, and thermal properties of chemically treated banana fiber. *Journal of Natural Fibers* **10(4)**: 365–380.
19. Nagamadhu M, Kumar GCM and Jeyaraj P (2014) Evaluation of free vibrational and mechanical properties of natural fibre-reinforced hybrid (sisal/jute) polyvinyl alcohol composites. *Proceedings of the 2014 International Conference on Polymer Composites (ICPC 2014), Mangalore, India*, pp. 2–6.
20. Sangamesh, Ravishankar KS and Kulkarni SM (2017) Synthesis and comparison of mechanical behavior of fly ash–epoxy and silica fumes–epoxy composite. *IOP Conference Series: Materials Science and Engineering* **225(1)**: article 012299.
21. ASTM (1998) D 638M–96: Standard test method for tensile properties of plastics (metric) withdrawn. ASTM International, West Conshohocken, PA, USA.
22. ASTM (2007) D 790M-07: Standard test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials. ASTM International, West Conshohocken, PA, USA.
23. Kajaks J, Kolbins A and Kalnins K (2016) Some exploitation poperties of wood plastic composites (WPC) based on high density polyethylene (HDPE) and plywood poduction waste. *IOP Conference Series: Materials Science and Engineering* **111(1)**: 012003.

## How can you contribute?

To discuss this paper, please submit up to 500 words to the journal office at journals@ice.org.uk. Your contribution will be forwarded to the author(s) for a reply and, if considered appropriate by the editor-in-chief, it will be published as a discussion in a future issue of the journal.

ICE Science journals rely entirely on contributions from the field of materials science and engineering. Information about how to submit your paper online is available at www.icevirtuallibrary.com/page/authors, where you will also find detailed author guidelines.

**Journal of Data Mining and Management**

**e-ISSN: 2456-9437**
**Volume-6, Issue-2 (May-August, 2021)**

www.matjournals.com

https://doi.org/10.46610/JoDMM.2021.v06i02.002

# Evaluation of Women Protection using Machine Learning

Bindu M[1], Chandini JV[1], Kavitha N[1], Kola Prem Kumar[1], Vivek Sharma[2], Swetha Vura[3*]

[1]UG Student, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Devanahalli, Bengaluru, Karnataka, India

[2]Assistant Professor, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Devanahalli, Bengaluru, Karnataka, India

[3]Assistant Professor, Department of Electronics and Communication Engineering, School of Engineering and Technology, CMR University, Bengaluru, Karnataka, India

*Corresponding Author: vuraswetha@gmail.com

**ABSTRACT**

**In this era, as we know there are various preceding cases in the world regarding women harassment which is starting from stalking leading to abusive harassments such as acid attacks, rape cases, obscenity, pornography etc. With such issues, an analysis of women safety in Indian cities has been proposed using Machine Learning on Tweets. The Sentimental Analysis is taken as the main idea and is performed through machine learning, taking an input from tweets to ensure safety. This sentimental analysis on tweets helps in creating awareness among people. As we know Twitter and Instagram are responsible to spread information far and wide among the people across the globe, this helps the women in expressing her feelings to the world. We have taken Twitter as an important resource because it provides text, audio, video message and are easy to handle. This can help our research to overcome the sentiments of people around us.**

**Keywords**-- Comments, Harassments, Sentimental analysis, Tweets

## INTRODUCTION

Firstly, we focus on tweets as we know tweets are worldwide emerging network which spreads the messages in fraction of seconds which consists of over 100 million users and can generate over 500 million messages known to be tweets every day. There is hectic news which is arising every minute all over the world. This helps us to know what is happening in each and every corner of the world. By using twitter, we can overcome all the obesity, complexity, information, harassments all the uncertainties and we can reach the person using sentimental analysis. On twitter, every user will share common opinions and perspectives regarding their emotions using slangs, paragraphs, short forms and abbreviations.

Taking into account each and every tweet sentimental word is extracted from it using sentimental analysis by using machine learning. After extracting this it is used to analyze the opinion of the people, how they react to each and every scenario happening all over the world. The criteria we have used to tackle the sentimental analysis is by using only machine learning algorithm and models by taking twitter data as input.

Now, focusing on women harassment since very long-time women are facing such situations. Due to this till now women is not free to travelling independently during night. This makes women to be confined to a particular place. She is not given the freedom to be like men. Government has taken certain measures to give equal rights to women and men. But unfortunately, women are not able to enjoy their rights due to lack of safety to women. Since, social media plays a key role in everybody's life today, we are making use of it in our project to spread the information around the world. One among that technology is twitter which is the fastest network. By monitoring the sentiments behind the tweets, it is possible to safeguard women to some extent.



Page 12-22 © MAT Journals 2021. All Rights Reserved

# Segmentation and Recognition of Handwritten Kannada Text Using Relevance Feedback and Histogram of Oriented Gradients – A Novel Approach

Karthik S
Research Scholar, Bharathiar University &
Department of ISE, P E S Institute of Technology-BSC
Bangalore, India

Srikanta Murthy K
Department of Computer Science & Engineering
P E S Institute of Technology Bangalore South Campus
Bangalore, India

***Abstract*—India is a multilingual country with 22 official languages and more than 1600 languages in existence. Kannada is one of the official languages and widely used in the state of Karnataka whose population is over 65 million. Kannada is one of the south Indian languages and it stands in the 33rd position among the list of widely spoken languages across the world. However, the survey reveals that much more effort is required to develop a complete Optical Character Recognition (OCR) system. In this direction the present research work throws light on the development of suitable methodology to achieve the goal of developing an OCR. It is noted that the overall accuracy of the OCR system largely depends on the accuracy of the segmentation phase. So it is desirable to have a robust and efficient segmentation method. In this paper, a method has been proposed for proper segmentation of the text to improve the performance of OCR at the later stages. In the proposed method, the segmentation has been done using horizontal projection profile and windowing. The result obtained is passed to the recognition module. The Histogram of Oriented Gradient (HoG) is used for the recognition in combination with the support vector machine (SVM). The result is taken as the feedback and fed to the segmentation module to improve the accuracy. The experimentation is delivered promising results.**

***Keywords*—Optical character recognition; Histogram of oriented gradients; relevance feedback; segmentation; Support Vector Machine; handwritten Kannada documents***

## I. INTRODUCTION

Optical character recognition (OCR) refers to a process of transforming the images of either handwritten or printed document to a machine readable and editable format. In general, all OCR systems have the following stages: image preprocessing, segmentation, extraction of features and finally recognition of characters. The results of each of these stages are greatly affected by the performance of the previous stages. To make the results of the subsequent stages more accurate, segmentation plays an important role. The extraction of region of interest from the given image is termed as segmentation. In the segmentation of document images, first we extract the lines then the words and finally the characters. Segmentation of characters from a document is still a open challenge in the are of developing efficient OCR systems.

Because of the large dataset and structural complexity, the development of OCR for some of the Indian languages like kannada and telugu is considered to be a tedious task [1]. To add to these complexities in some cases the characters may overlap with each other. In spite of several attempt, the development a high accuracy OCR system for all the Indian languages is still a open challenge. The rest of the paper is organized as follows: In section II a brief discussion about the previous work is reported, the proposed method details can be found in section III. Section IV discusses the experiments and results followed by the conclusion in section V.

## II. LITERATURE

In the recent past, due to the existence of digital library of India, the amount of document images for various Indian languages has grown tremendously. The library has taken care to collect documents from different sources and also retaining the original structure, size, font etc. Developing a robust OCR to handle all these issues is still a open challenge. In [1] the authors have highlighted the complexities involved in the segmentation of handwritten documents for some of the south Indian languages like tamil, telugu and malyalam. The existence of the curved characters poses special challenges in the segmentation process. Different strategies like Graph based, Hough transform based, and projection based techniques are proposed for the segmentation of the documents [2]. Arivazhagan et al. [3] proposed the projection-based algorithm in which first obtains candidate lines from the piece-wise projection profile of the document .The lines traverse around any obstructing handwritten connected component by associating it to the line above or below. The author claims that the proposed method is invariant to the skew present in the documents. A level set based new approach for the text line segmentation was proposed by Li et al [4].

In [5] a grouping approach for segmentation was suggested in which a block of connected components are grouped together to identify the characters in a text document. But this approach cannot be used on degraded documents as claimed by the authors. A combination of iterative hypothesis validation through hough transformation and connected components was proposed in [6]. This method is found to be effective in skewed

Criterion - III | Criterion - III | Microsoft Wor | IJCA - An Over | Question Pape | Python Except | How to Define | Python Errors
ijcaonline.org/archives/volume154/number6/26499-2016911834
Apps
Reading list



**Call for Paper - August 2021 Edition**
IJCA solicits original research papers for the August 2021 Edition. Last date of manuscript submission is **July 20, 2021**.
Read More

# An Overview of Image Security Techniques

Like 0 Tweet Share IJCA Social Web Research {LEARN MORE}

International Journal of Computer Applications
Foundation of Computer Science (FCS), NY, USA
Volume 154 - Number 6
Year of Publication: 2016
*Authors: Madhu B., Ganga Holi, Srikanta Murthy K.*
doi 10.5120/ijca2016911834

Full Text
Download Full Text

Citation
Madhu B., Ganga Holi and Srikanta Murthy K.. An Overview of Image Security Techniques. *International Journal of Computer Applications* 154(6):37-46, November 2016. BibTeX

## Abstract

Today, the world is going to be digitalized in all the ways. Every business units, government and private sectors, research units are g the digital image as transferring mode for every critical data. These images over the internet which will not be secure. efore there is a need of image security. Currently, there exists various image security techniques like encryption, watermarking

https://www.ijcaonline.org/archives/volume154/number6/madhu-2016-ijca-911834.pdf
INDJCSE16-07-03-....pdf 0ad5faa45e80caca....pdf Adnaced Java La....docx Show all
9:31 AM 6/29/2021

Criterion - III - Inv | Criterion - III - Goo | PKP A Survey on Energ | Question Papers - | Python Exceptions | How to Define Cu | Python Errors and
Not secure | ijecs.in/index.php/ijecs/article/view/2314
Apps | Reading list

International Journal of Engineering and Computer Science
an Open Access Publication ISSN: 2319-7242 |



Total : PDF: 143 | Total views: 143

PDF

Article Section

Abstract

**Articles | Open Access**
Vol. 5 No. 8 (2016) | Page No.: |

# A Survey on Energy Efficient, Secure Routing Protocols for Wireless Sensor Networks

Yogeesh A C, Dr. Shantakumar B Patil, Dr. Premajyothi Patil+

Google Scholar Published: 2018-01-01

## Abstract

The Wireless Sensor Network (WSN) in present generation has gained its popularity due its applicability nature in various areas Such as monitoring system of Oceans, wide life, manufacturing plants, earthquake prediction unit, military units, etc. The cost and structural complexity of a WSN are very low. In general, a WSN consists a sensor node

Download Citation

How to Cite

B Patil, Dr. Premajyothi Patil, Y. A. C. D. S. (2018). A Survey on Energy Efficient, Secure Routing Protocols for Wireless Sensor Networks. *International Journal of Engineering and Computer Science*, *5*(8). Retrieved from http://www.ijecs.in/index.php/ijecs/article/view/2314

More Citation Formats

2.0
1.5
1.0
0.5

INDJCSE16-07-03-....pdf | 0ad5faa45e80caca....pdf | Adnaced Java La....docx | Show all

9:32 AM
6/29/2021

Criterion - III | Criterion - III | Shantakumar B | Extraction of m | Question Paper | Python Except | How to Define | Python Errors
researchgate.net/scientific-contributions/Shantakumar-B-Patil-2084460641
Apps
Reading list

Advertisement

Pay Premium for 5 Years & Get Life Cover till 85 Years*
Check Premium
*T&C apply W/II/2868/2020-21

Overview

### Integrated Framework for Secure and Energy Efficient Communication System in Heterogeneous Sensory Application

Article | Full-text available | Aug 2019

Yogeesh AC · Shantakumar B. Patil · Premjyoti Patil · Roopashree Hr

Irrespective of different forms and strategies implementing for securing Wireless Sensor Network (WSN), there are very less strategies that offers cost effective security over heterogeneous network. Therefore, this paper presents an integrated set of different processes that emphasize over secure routing, intellectual and delay-compensated routing,...

Cite | Download full-text

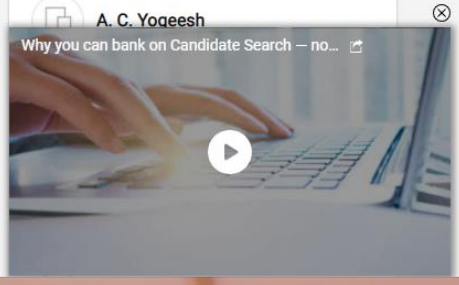
### DSP-IR: Delay Sensitive Protocol for Intelligent Routing with Medium Access Control

Chapter | Jan 2019

A. C. Yogeesh · Shantakumar B. Patil · Premajyothi Patil · Roopashree Hr

The wireless sensor network has been positioned itself from a complete network system to a sub-net of future internet namely Internet of Things, where a communications among anything to anything is possible. The extensible use of wireless sensor network makes it more risky if the security threats are not handled wisely.

Roopashree Hr
Christ University, Bangalore
Swetha Vura
CMR University
Premajyothi Patil
A. C. Yogeesh




9:38 AM
6/29/2021

Criterion - III - Inv | Criterion - III - Goo | Extraction of mela | Question Papers - | Python Exceptions | How to Define Cu | Python Errors and
sciencepubco.com/index.php/ijet/article/view/10012
Apps
Reading list

ARTICLE TOOLS
Print this article
Indexing metadata
How to cite item
Finding References
Email this article (Login required)
Email the author (Login required)

ABOUT JOURNAL
Aims and Scopes
Indexing and Abstracting
Editorial Board
Author Guidelines
Submit a Manuscript



# Extraction of melanoma 3d features from tensor representation

Sushmita N S, Gururaj Murtugudde, T Y Satheesha



## Abstract

Melanoma is one of the unsafe growth to be dealt with too to recognize in introductory stage. Here we take the skin sore by ROI and after that we take out highlights of it then it should be sectioned whether the specific picture is malignant or not. In the event that it is destructive at that point group the extricated includes and examine about kind of stages. This paper presents a non-obtrusive electronic dermoscopy framework that considers the evaluated profundity of skin sores for determination. For test assessments, the PH2 and ATLAS dermoscopy datasets is considered. A novel 3D remaking calculation from 2D dermoscopic pictures is proposed. Here we remove the 3D highlights from tensor portrayal. The discovery of 3D picture shape and RGB are to be done. In this paper, we have proposed this work for 3D profundity parameter, which will improve the grouping rate.

9:38 AM
6/29/2021

Criterion - III - | Criterion - III - | Wavelet Packe | Anomaly Dete | Question Pape | Python Except | How to Define | Python Errors |
springerprofessional.de/en/anomaly-detection-in-manet-using-zone-based-aodv-routing-protoco/17595830
Apps
Reading list
SEARCH
Automotive Books Journals Events Individual access Access for companies

# Anomaly Detection in MANET Using Zone Based AODV Routing Protocol


Authors: G. S. Prasanna Lakshmi, Shantakumar B. Patil, Premjyothi Patil

Publisher: Springer Singapore

Published in: Advanced Informatics for Computing Research

» Get access to the full-text

## Abstract

Intrusion Detection System (IDS) is a famous approach for finding attacks in anomalies. This system is used for monitoring the attacks happening in mesh or computers. The anomaly intrusion detection technique plays the significant part in the intrusion detection systems to recognize the recent or a novel attacks by identifying any variation from common profile. This research provides the proof for enhancement of anomaly intrusion detection. The introduced method improves the security by using

9:40 AM
6/29/2021

Criterion - III - Inv | Criterion - III - Goo | Wavelet Packet Tra | Question Papers - | Python Exceptions | How to Define Cus | Python Errors and
link.springer.com/chapter/10.1007/978-981-15-5397-4_60
Apps
Reading list


Communication Software and Networks pp 597-605 | Cite as

# Wavelet Packet Transform-Based Image Classification for Computer-Aided Glaucoma Diagnosis Using Naïve Bayes Classifier

Authors | Authors and affiliations

Anisha Rebinth, S. Mohan Kumar

Conference paper
**First Online:** 04 October 2020

266
Downloads

Part of the Lecture Notes in Networks and Systems book series (LNNS, volume 134)

## Abstract

In this study, optic nerve head image classification for glaucoma diagnosis using Wavelet Packet Transform (WPT) and Naïve Bayes Classifier (NBC) is presented. Initially, the input optic nerve head images are decomposed by WPT which produces high and low-frequency sub-bands. From these sub-bands, entropy features like Shannon and sure entropy are extracted.

Chapter EUR 24.95
Price excludes VAT

- DOI: 10.1007/978-981-15-5397-4_60
- Instant PDF download
- Readable on all devices
- Own it forever
- Exclusive offer for individuals only

Buy Chapter

eBook EUR 160.49
Softcover Book EUR 199.99

Learn about institutional subscriptions

Cite paper

9:40 AM
6/29/2021

*International Journal of Engineering & Technology*, 7 (1.9) (2018) 273-278

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Extraction of melanoma 3d features from tensor representation

**Sushmita N S [1] *, Gururaj Murtugudde [2], T Y Satheesha [3]**

[1] *Dept. of ISE, NCET Bengaluru, India*
[2] *Dept. of ISE, SVCE Bengaluru, India*
[3] *Dept. of ECE, NCET Bengaluru, India*
**Corresponding author E-mail: sushsushmita@gmail.com*

**Abstract**

Melanoma is one of the unsafe growth to be dealt with too to recognize in introductory stage. Here we take the skin sore by ROI and after that we take out highlights of it then it should be sectioned whether the specific picture is malignant or not. In the event that it is destructive at that point group the extricated includes and examine about kind of stages. This paper presents a non-obtrusive electronic dermoscopy framework that considers the evaluated profundity of skin sores for determination. For test assessments, the PH2 and ATLAS dermoscopy datasets is considered. A novel 3D remaking calculation from 2D dermoscopic pictures is proposed. Here we remove the 3D highlights from tensor portrayal. The discovery of 3D picture shape and RGB are to be done. In this paper, we have proposed this work for 3D profundity parameter, which will improve the grouping rate.

***Keywords***: *Preprocessing; Segmentation; Feature Extraction; Melanoma.*

## 1. Introduction

The number of melanoma dye due to continuous improvement of the results of a number of diseases. This disease is the main cause is due to ultraviolet light exposure. This is a change in color of the skin resulting in skin pigmentation. It can occur in any part of the body. This is a melanoma has spread it deep inside the skin layer needs to be discovered and cured before. This can be treated with chemotherapy. It is common, but when appropriate treatment is not very dangerous.

Melanoma is usually based on the ABCD rule, (asymmetry, irregular border, color changes, and prison), 7-point checklist of diagnosis [1] and texture. In this paper, we took a skin image for our segment. A portion of the segment are then extracted from the various features, and finally, we go for the divided. We classified [2] includes RGB images for the individual pixel data 3d Register. Here, a higher rate of discrimination is part of the feature extraction depth parameter is proposed.

The remaining paper is presented below. Section II and Section III, we carried out the background of work related to the proposed system. DISCUSSION specifies. Section IV is about the test results. Reported Finally, part V Conclusion home.

## 2. Background

ABCD features for melanoma skin cancer [3] Total Dermatoscopic Value (TDV) is used to calculate.

Asymmetry features of the lesions consist of information asymmetry and long index. Border irregular feature lesions Compact index, fractal dimension from the edge of the sudden transition coloring consist of information. Color homogeneous feature of homogeneous lesions with color photometry of the relationship between geometry and consist of information. The diameter of the cells from the lesions. In this research, the effect on melanoma, disease, doubt and benign skin lesions [4]. The paper "Use of Texture and color features for Dermoscopy for melanoma detection systems [5] the author of" In the first two isolated lesions of the skin and the second one to decide about the objectives of the two is to determine the color and texture. Presentation features.

The only drawback of the document classification accuracy rate, we can increase the rate of discrimination as a result of the depth of the feature as they entered our proposed system less.

## 3. Proposed system

Part of the skin lesions detection and feature extraction of important aim of our paper. This involves the following

a) Preprocessing:

The preprocessing stage in the first example, as shown in Figure 1 (a) of red, green and blue color components are converted into the image by adding gray. The gray image as shown in Figure 1 (b) by a Gaussian filter needs to be filtered. The image shown in Figure 1 (c) with the aid of 0s and 1s of the binary image needs to be converted by the Gaussian filter is filtered.

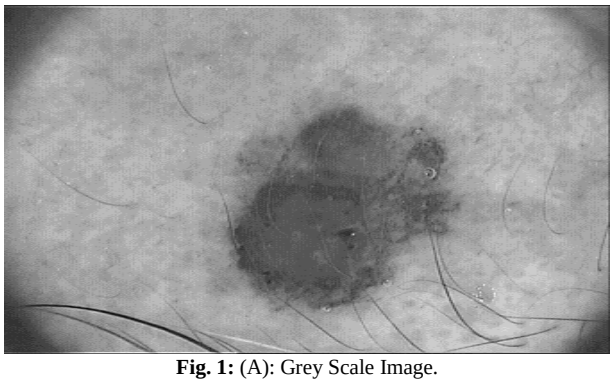


**Fig. 1:** (A): Grey Scale Image.

**Copyright © 2018 Sushmita N S et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**

# Anomaly Detection in MANET Using Zone Based AODV Routing Protocol

G. S. Prasanna Lakshmi(✉), Shantakumar B. Patil, and Premjyothi Patil

Department of Computer Science and Engineering,
Nagarjuna College of Engineering and Technology, VTU, Belgavi, India
prasannalakshmigs@gmail.com

**Abstract.** Intrusion Detection System (IDS) is a famous approach for finding attacks in anomalies. This system is used for monitoring the attacks happening in mesh or computers. The anomaly intrusion detection technique plays the significant part in the intrusion detection systems to recognize the recent or a novel attacks by identifying any variation from common profile. This research provides the proof for enhancement of anomaly intrusion detection. The introduced method improves the security by using anomaly based intrusion detection process and zone based AODV routing protocol to discover shortest path. First it contains selection of the features for anomaly IDS. Next is essential to identify the novel or recent attacks by achieved decision rules from database.

**Keywords:** Anomaly based intrusion detection technique
Security mobile Ad-hoc network (MANET) zone based AODV routing protocol

## 1 Introduction

Mobile Ad-hoc Networks (MANETs) contains mobile node interrelated by wireless links in communication-less atmospheres with no relying on any federalized power like base station as shown in Fig. 1. The nodes which will not be inside the communication range of one another, will converse by intermediate nodes known as the relay nodes. The Mobile Ad-hoc Networks are organized in the regions or such conditions where communications is not accessible or when operation of communication is not possible or costly, like environmental disasters, emergency operations etc. Because of the distributed architecture, dynamic mesh topology and the nonappearance of the centralized authority, the MANETs are helpless to the packet routing attack [13].

The MANET is a self structured grouping of mobile nodes which will converse with each other without the assist of any permanent infrastructure or central coordinator. A node is any mobile device with capability to converse with another device. The node acts as router and also host in MANET. A node planning to converse with other node that is not within conversion range, then it will take the help of intermediate nodes to send out its message. Network topology is robustly modified over time as nodes travel about. Several novel nodes link the network or some nodes separate themselves from network [13].

© Springer Nature Singapore Pte Ltd. 2019
A. K. Luhach et al. (Eds.): ICAICR 2018, CCIS 956, pp. 454–468, 2019.
https://doi.org/10.1007/978-981-13-3143-5_37

# DSP-IR: Delay Sensitive Protocol for Intelligent Routing with Medium Access Control

A. C. Yogeesh[1(✉)], Shantakumar B. Patil[1], Premajyothi Patil[1], and H. R. Roopashree[2]

[1] Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, VTU, Bengaluru, India
yogeeshl3@gmail.com
[2] Publicis Sapient Consulting Pvt. Ltd., Bengaluru, India
roopashree.r@res.christuniversity.in

**Abstract.** The wireless sensor network has been positioned itself from a complete network system to a sub-net of future internet namely Internet of Things, where a communications among anything to anything is possible. The extensible use of wireless sensor network makes it more risky if the security threats are not handled wisely. The conventional methods adopted for securing the WSN vulnerability based attacks introduces delay, which brings congestion in the routing flow as well as influence the quality of service. The proposed DSP-IR is a secure routing algorithm to handle security with delay sensitivity. The DSP-IR framework evaluates MAC protocols including S-MAC, Q-MAC and IH-MAC along with RSA, AES and DSP-IR encrypt process. For all the three combinations performance evaluation is done by simulating the model to know the behavior of residual energy, energy consumption and average packet delay with varying interval of message arrival time and it is found that the proposed IH-MAC with DSP-IR exhibits better performance.

**Keywords:** Wireless sensor network · Secure routing
MAC for sensor network

## 1 Introduction

Wireless Sensor Network (WSN) either as an independent network or sub-net of internet of things (IoT) along with pervasive and ubiquitous future generation applications in Industry 4.0 vision may provision many intelligent applications in the wide variety of domains of IBM vision of smart planet as well as many cyber physical world based any-to-any communication based applications [1]. In future, all these applications will be critical applications, which will be treated as a lifeline. There are two requirements that ensures success of this vision (1) optimal quality of service

© Springer International Publishing AG, part of Springer Nature 2019
R. Silhavy (Ed.): CSOC 2018, AISC 765, pp. 393–402, 2019.
https://doi.org/10.1007/978-3-319-91192-2_39

ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/350091249

# A STUDY ON VARIOUS OBJECT DETECTION METHODS IN SATELLITE IMAGERY

**Article** *in* Indian Journal of Applied Research · March 2018

CITATION
1

READS
26

**1 author:**

Swetha Vura
CMR University
**13** PUBLICATIONS **2** CITATIONS

SEE PROFILE

**Some of the authors of this publication are also working on these related projects:**




satellite based lossless image compression View project

All content following this page was uploaded by Swetha Vura on 16 March 2021.

The user has requested enhancement of the downloaded file.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 11 | Nov 2019 www.irjet.net p-ISSN: 2395-0072

# A Survey on Predictive Analytics and Parallel Algorithms for Knowledge Extraction from Data Received through Various Satellites

**Bharani B R[1], Dr Gururaj Murtugudde[2]**

[1]*Assisstant Professor, Cambridge Institute of Technology, Bangalore, India.*
[2]*Prof & Head, Dept of CSE, Nagarjuna College of Engineering and Technology, Bangalore, India.*

---

**Abstract:-** *The remote sensing satellites produce large volumes of data that cannot be stored in standard relational databases every day. Many software components extract information in unstructured form from the raw data producing information such as pictures, log files, pdf user instructions, word etc. there is a need for developing efficient data mining algorithms to tag the datasets for facilitating efficient buildup of archival and retrieval. Advances in remote sensing instruments and technology are transforming the way satellite data is collected, managed and analyzed[1]. Recently, efforts have been directed towards knowledge extraction and analysis of satellite data[9]. However, the approach poses complex computational problem in terms of processing huge volume of varied form of data[8]. Still, many current and future satellite applications require the incorporation of Apache Spark and Hadoop Distributed File Systems(HDFS) technologies with real time processing capabilities. SQL database servers have traditionally held gigabytes of information. In the past 15 years, data warehouses and enterprise analytics expanded these volumes to terabytes. In the last five years, the distributed file systems that store big data now routinely house petabytes of information. This paper presents a comparative study of the data storage techniques and the different Apache tools used for data storage and the methodologies to incorporate them[7].*

***Key Words***: **Apache Spark, Apache Hadoop, Big Data, Remote Sensing, Knowledge Extraction**

## 1. INTRODUCTION

Big data is applied to information sets whose size or type goes beyond traditional relational databases' capacity to collect, handle and process low latency information. It has one or more of the following features - high volume, high speed, high range. Big data is available from sensors, computers, video/audio, networks, log files, transactional applications, internet and social media, much of it is produced in actual time and on a very big scale. These information is collected in extraordinarily growing databases that are complex to contain, form, store, handle, share, process, evaluate and visualize through typical software instruments for databases. Continuous high velocity data stream or offline high volume data to "Big Data" brings us to a new challenge[2]. Big data enables analysts, scientists and company users to make better and quiker choices using previously inaccessible or unusable information. Using sophisticated analytical methods such as text analysis, machine learning, predictive analytics, information mining, statistics and natural linguistic processing, companies can evaluate earlier untapped information sources independently or in conjunction with current business information to obtain new ideas resulting in considerably better and quicker choices. Predictive analytics is a collective word for methods intended to predict the future on the basis of static or historical information. Techniques will be used in the areas of statistics and machine learning. A predictive analysis engine or program of forecasting will comprise models of regression and/or machine learning neural networks. In predictive analysis, the concept of a model is crucial; the model determines the data based prediction. This model is constantly adapted, tuned, optimized and educated in accordance with the setting and changing user perspectives. The most effective prediction algorithms are kmeans, decision trees, rule based classifiers, deep learning and random forests. The data is aquired from satellites and collected in the base stations in the earth[1][3][4][5]. The received data is processed using the HDFS and Apache Spark tools. The processing of data involves cleaning the data and transforming the data in the required format. Then knowledge, patterns, trends are extracted from the processed data using machine learning algorithms[6][10]. The patterns and trends extracted are presented in the graphical form. This paper lists the different methodologies to process the data, different data sources for sourcing the data and machine learning algorithms.

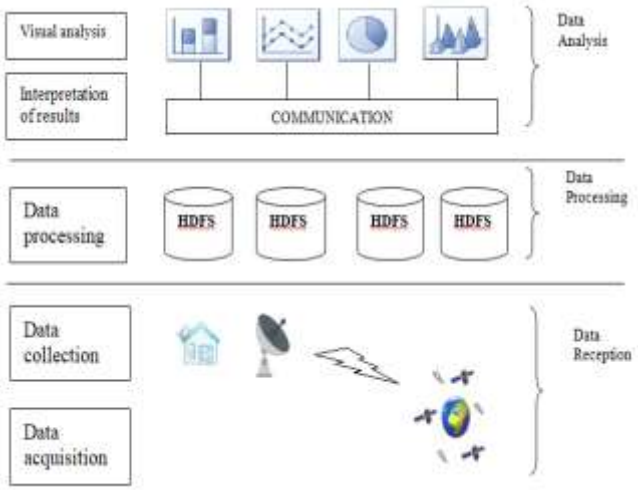



**Fig -1**: Satellite Data Processing

# Elucidation: Scantiness of Electricity and its Effective Utilization during Peak Hours

**Shantakumar B P, Premjyoti P, Nagashree N, Sangeetha Choudhary S , Nischal S, Pathipati Sujith Kumar, Ranjith Kumar V**

***Abstract***: ***The paper titled "Elucidation: Scantiness of "electrower" is an electric energy and its effective utilization during peak hours" is used to book the electrower according to requirement of the customers so that everyone can use the electrower effectively and efficiently without any wastage. The electricity usage is more than the generated during peak hours, due to this there is a shortage of electricity. To overcome this problem, we are proposing a system called Elucidation: Scantiness of electricity and its effective utilization during peak hours. There are separate modules for customer and administrator. The customer module has the page where the customer can book for electricity, request for cancellation, request for incrementing the power supply. The admin module can accept the requests from the customers and has the rights to cut off the electricity when threshold limit of the power is reached. The entire concept will be demonstrated through model.***

***Keywords : Elucidation, Electrower, Loel, Adel.***

## I. INTRODUCTION

Electrower is an energy. It is an electrons flow in a circuit. It is a basic requirement and it is one of most extensively used energy source. Electrower is the subordinate source of energy which is produced using energy efficient sources such as coal, nuclear power and water. Many metropolitan and township were built alongside water falling from the height (a efficient source of force) that turned water turbines to rotate. Before begin of electric energy generation slightly over seventy-five years ago, houses were illuminated with lamps, food was freeze in iceboxes, and rooms temperature were controlled by burning wood or charcoal.

**Revised Manuscript Received on March 04, 2020.**

**Dr. Shantakumar B P ***, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: shantakumar.p@gmail.com

**Dr. Premjyoti P**, Electronics and Communication Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: premjyoti.p@gmail.com

**Nagashree N**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: astrodamsel@gmail.com

**Sangeetha Choudhary S**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: sangeetha4198@gmail.com

**Nischal S**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: nischalshashi143@gmail.com

**Pathipati Sujith Kumar**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology. Email: sujithchowdary1223@gmail.com

**Ranjith Kumar V**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology. Email: appuranjithv@gmail.com

Electric power usage is one of our largest concerns of natural world, and of good reason. While the development of various different types of inexhaustible energy has reduced our dependency on fossil fuel for electricity, the second is still our main source of energy. Saving of power at home not only help to reduce our requirement for energy and in turn help reduce usage of using polluting fossil fuel along with that we can cut-down our budget used for electric energy. According to survey, we can save around twenty percentage by stopping electricity desolation every month.

Electrower desolation is one of the major problems in India. Because of the desolation of electrower, in future there might be electricity shortage. Electricity shortage may result in shortage of basic needs such as water, food etc.

Most of the time, electricity is used more than requirement, this is ok when surplus energy is available and there is no restriction on the usage of electricity. When appliances are not used the socket is connected to power board which in-turn consume some power. One of the most obvious energy-wasting habits is leaving the lights on, and it's also one of the easiest habits to fix. Appliances and electronic goods use energy even when they're turned off. One tip to help save on utility bills is to unplug all electronic goods including TVs, computers, and phone chargers when they aren't in use.

One of the issues related to electricity is electricity tripping. This occurs when the circuit breaker trips when too much electricity flows through it or when it cannot handle the excess current load. This means that the flow of electricity is cut off to keep your circuits from overheating or causing more damage. To avoid this, the project "Elucidation: Scantiness of Electricity and its effective utilization during peak hours" is introduced.

## II. LITERATURE SURVEY

A typical house wastes 30 percent more energy than an efficient one does. On average, that means that 51 MMBtu's are being wasted by a typical home every year.

According to Times of India in 2014-15 over 3 billion units of electricity or a day's national consumption, were wasted as congestion in the transmission highways blocked trading between surplus and deficit regions. Data from various power exchanges show a higher wastage in 2013-2014 at 5.3 billion units, Delhi's consumption for roughly 56-60 days. Interior-region transfer through Short-term open access stood at 78.38 billion units during this period.

Cluster Computing (2019) 22:S4673–S4681
https://doi.org/10.1007/s10586-018-2274-0

# Deep belief network based approach to recognize handwritten Kannada characters using distributed average of gradients

S. Karthik[1] · K. Srikanta Murthy[2]

Received: 25 November 2017 / Revised: 7 February 2018 / Accepted: 22 February 2018 / Published online: 12 March 2018
© Springer Science+Business Media, LLC, part of Springer Nature 2018

**Abstract**
Even though various advances have been made in recent years, the recognition of handwritten characters is still an open challenge in the Pattern Recognition field. Different approaches are invented for the recognition of printed characters of Indian languages. However, few attempts are done for the recognition of handwritten characters. A high degree of recognition accuracy for the handwritten characters is yet to be achieved. In this paper, a new approach based on deep belief network with the distributed average of gradients feature is presented for the recognition of isolated handwritten characters of Kannada, which is the official language of Karnataka state in India. In the proposed methods, a better accuracy is achieved.

**Keywords** Deep belief network · Distributed average of gradients · Handwritten Kannada character recognition · Optical character recognition

## 1 Introduction

English language along with many other regional languages are used in many applications i.e. different offices like sales tax, banks, railways, transport system etc. Often, forms need to be filled in these places and they are stored by scanning these forms. If there is no character recognition system, then image is directly captured and there is no option those for editing documents. Everyday a lot of such forms need to be converted to machine editable form in these organizations. These are very time consuming tasks. One of the techniques to save the time is to have an automatic reading system. Even though various advances have been made in recent years, the recognition of handwritten characters still poses an interesting challenge in the field of Pattern Recognition. Commercial Optical Character Recognition (OCR) systems are accessible for many languages like English, Chinese, Roman, Japanese and Arabic languages [1–4]. However, not many works are carried out in the direction of development of OCR system for the Indian languages. From the literature it is visible that a lot of focus was towards the recognition of printed characters of the Indian languages. However, recognition of handwritten characters is still an open challenge. Literatures that are found in the area of handwritten character recognition are mostly for the Devnagari and Bangla languages [5–8]. Few works are reported for other Indian languages like Marathi, Malayalam, Tamil, Telugu, Oriya, Kannada, Punjabi, Gujarathi [9–18]. The research in the development of OCR for the south Indian languages was presented in detail in [19]. From the literature it is seen that very few works on Kannada language are reported. Most of the works are on the recognition of machine printed Kannada characters and very few works is reported for handwritten characters [20, 21]. It is clear that in the Indian context, handwritten character recognition is still a open research area, in particular for handwritten Kannada character recognition.

✉ S. Karthik
karthik_s1980@outlook.com

K. Srikanta Murthy
srikantamurthy.k@outlook.com

[1] Bharathiar University, Coimbatore, India

[2] Nagarjuna College of Engineering & Technology, Bengaluru, India



Content courtesy of Springer Nature, terms of use apply. Rights reserved.

# Elucidation: Scantiness of Electricity and its Effective Utilization during Peak Hours

**Shantakumar B P, Premjyoti P, Nagashree N, Sangeetha Choudhary S , Nischal S, Pathipati Sujith Kumar, Ranjith Kumar V**

***Abstract***: ***The paper titled "Elucidation: Scantiness of "electrower" is an electric energy and its effective utilization during peak hours" is used to book the electrower according to requirement of the customers so that everyone can use the electrower effectively and efficiently without any wastage. The electricity usage is more than the generated during peak hours, due to this there is a shortage of electricity. To overcome this problem, we are proposing a system called Elucidation: Scantiness of electricity and its effective utilization during peak hours. There are separate modules for customer and administrator. The customer module has the page where the customer can book for electricity, request for cancellation, request for incrementing the power supply. The admin module can accept the requests from the customers and has the rights to cut off the electricity when threshold limit of the power is reached. The entire concept will be demonstrated through model.***

***Keywords : Elucidation, Electrower, Loel, Adel.***

## I. INTRODUCTION

Electrower is an energy. It is an electrons flow in a circuit. It is a basic requirement and it is one of most extensively used energy source. Electrower is the subordinate source of energy which is produced using energy efficient sources such as coal, nuclear power and water. Many metropolitan and township were built alongside water falling from the height (a efficient source of force) that turned water turbines to rotate. Before begin of electric energy generation slightly over seventy-five years ago, houses were illuminated with lamps, food was freeze in iceboxes, and rooms temperature were controlled by burning wood or charcoal.

**Revised Manuscript Received on March 04, 2020.**

**Dr. Shantakumar B P ***, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: shantakumar.p@gmail.com

**Dr. Premjyoti P**, Electronics and Communication Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: premjyoti.p@gmail.com

**Nagashree N**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: astrodamsel@gmail.com

**Sangeetha Choudhary S**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: sangeetha4198@gmail.com

**Nischal S**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology, Bangalore, India. Email: nischalshashi143@gmail.com

**Pathipati Sujith Kumar**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology. Email: sujithchowdary1223@gmail.com

**Ranjith Kumar V**, Computer Science and Engineering, Nagarjuna College of Engineering & Technology. Email: appuranjithv@gmail.com

Electric power usage is one of our largest concerns of natural world, and of good reason. While the development of various different types of inexhaustible energy has reduced our dependency on fossil fuel for electricity, the second is still our main source of energy. Saving of power at home not only help to reduce our requirement for energy and in turn help reduce usage of using polluting fossil fuel along with that we can cut-down our budget used for electric energy. According to survey, we can save around twenty percentage by stopping electricity desolation every month.

Electrower desolation is one of the major problems in India. Because of the desolation of electrower, in future there might be electricity shortage. Electricity shortage may result in shortage of basic needs such as water, food etc.

Most of the time, electricity is used more than requirement, this is ok when surplus energy is available and there is no restriction on the usage of electricity. When appliances are not used the socket is connected to power board which in-turn consume some power. One of the most obvious energy-wasting habits is leaving the lights on, and it's also one of the easiest habits to fix. Appliances and electronic goods use energy even when they're turned off. One tip to help save on utility bills is to unplug all electronic goods including TVs, computers, and phone chargers when they aren't in use.

One of the issues related to electricity is electricity tripping. This occurs when the circuit breaker trips when too much electricity flows through it or when it cannot handle the excess current load. This means that the flow of electricity is cut off to keep your circuits from overheating or causing more damage. To avoid this, the project "Elucidation: Scantiness of Electricity and its effective utilization during peak hours" is introduced.

## II. LITERATURE SURVEY

A typical house wastes 30 percent more energy than an efficient one does. On average, that means that 51 MMBtu's are being wasted by a typical home every year.

According to Times of India in 2014-15 over 3 billion units of electricity or a day's national consumption, were wasted as congestion in the transmission highways blocked trading between surplus and deficit regions. Data from various power exchanges show a higher wastage in 2013-2014 at 5.3 billion units, Delhi's consumption for roughly 56-60 days. Interior-region transfer through Short-term open access stood at 78.38 billion units during this period.

# Spamdoop: A Privacy Preserving Big Data Platform for Collaborative Spam Detection

1.Mrs Vidya V,2. Archana C K,3. Bindhu Shree M, 4.Meenakshi N,5. Tanuja R
1Professor, Department of CS&E, NCET, Bangalore, India
2,3,4,5 Student, Department of CS&E, NCET, Bangalore, India
swapnaka9@gmail.com

## ABSTRACT

Spam has turned into the stage of decision utilized by digital law breakers to spread malignant payloads, for example, infections and Trojans. The issue of early recognition of spam causes has been addressed. Communitarian spam location procedures can manage huge scale email information contributed by diverse sources. Separation upkeep hashes are one of the normal arrangements applied for saving the security of email content while allowing message grouping for spam recognition. Separate safeguarding hashes are not adaptable, along these lines making massive scale synergistic arrangements hard to represent. Spamdoop, a Big Data security safeguarding community oriented spam discovery stage based over a standard Map Reduce office has been projected. Spamdoop employs a very parallel encoding system that empowers the recognition of spam battles in aggressive circumstances. The outline has been judged by the execution, by utilizing a massive manufactured spam base and prove that the system performs positively against the creation of spam.

## INTRODUCTION

The massive unsolicited emails sent is normally said to be spam. It is quite not possible to describe the word spam more accurately. A spam is considered as one of the difficult challenges of the linked generation. This return a massive amount of research towards opposing it. The mentioned effort led to the gradual decline of spamming activities which made many to end up believing spam is no longer a threat. However, recent thorough studies and statistics have concluded otherwise. In fact, about 66.34% of all e-mails sent worldwide are considered spam e-mails according to Kaspersky's Spam and Phishing Statistics for the first quarter of 2014 which leads us to conclude that it is still an evolving phenomenon and is still an active cyber threat E-mail these days has become a popular and most favored means of communication over the Internet. While some spam campaigns advertise products and services, others serve more malicious and sinister

*Turkish Journal of Computer and Mathematics Education Vol.12 No.13(2021), 2217-2224*

*Research Article*

# Trust Aware Data Aggregation mechanism for malicious node identification in WSN based IoT Environment

**Swathi S.[a], , Yogish H. K.[b]**

[a]Research scholar, Department of Computer Science and Engineering, M. S. Ramaiah Institute of Technology, Bengaluru, India
[b]Professor & Head, Department of MCA, M. S. Ramaiah Institute of Technology, Bengaluru, India
Corresponding author. [a]Email:s.swathieswar@gmail.com

**Article History**: Received: 11 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 4 June 2021

**Abstract:** As a promising paradigm, the increase in the productivility of Internet of Things (IoT) has contributed largely to the design of modern technology. WSN is an integral part of IoT and founds its application almost in every area of human life such as healthcare, agriculture. Moreover, data collected through these sensors is vulnerable for few application such as health domain , defence domain etc. Hence data collection and analysis is a major challenge. Data Aggregation is considered to be influential and effective mechanism for avoiding the issue of data redundancy and efficient designing of IoT. Despite of such successful implementation and plethora of work in data aggregation, security remains the top priority. Hence, in this research work we design and develop TADA (Trust Aware Data Aggregation) mechanism to provide the efficient and secure environment for data aggregation. In this mechanism, in order to achieve the trade-off between privacy and accuracy, noise are added to data, accuracy parameter and malicious node identification parameter is introduced; further considering these two general constraint is designed and optimization is carried out for malicious node identification and. Furthermore, TADA is evaluated considering the three important parameter i.e. malicious packet identification rate, throughput and packet misclassification rate

**Keywords:** TADA-mechanism, Secure Data aggregation, malicious node Identification

## 1. Introduction

Internet of Things (IoT) comprises of smart devices in order to exchange information with each other [1]. The IoT have been developed through multiple intelligent sensory elements and wearable smart devices [2] and play major role in many areas like healthcare, buildings, transportation, mining, agriculture, cities, Industries and automated systems [3]. Sensor networks consist of large number of sensor nodes, which are connected to each other wirelessly. The information obtained by the sensor nodes are transferred to a specific node, called the sinkhole. Lot of work has been done with regard to the construction of sensor networks and the solutions offered to resolve the issues related to the layers and the protocols connecting them some of them being, error tolerance, optimum use of energy resources in sensors, hardware, scalability, environment, energy consumption, low cost, change in network regulations and so on. Being the problems of utmost priority, these issues are to be addressed by the researchers [4]. One such issue is data aggregation in wireless sensor networks [5], wherein the sensor device senses certain physical parameters of a system or region and converts it into electrical signals. These signals are then transmitted to the base station by means of wireless radio. Wireless sensors use small batteries, for which recharging in remote areas becomes tedious. Hence, they have limited energy, unlike the conventional sensors. Thus, the amounts of data that can be sent are reduced by using data aggregation techniques, which in turn increases the lifetime of the network.

Usually, the sensors in the wireless sensor are scattered randomly in spaces, with less human intervention. Using the multi-hop system architecture, the sensors collect the data and send them to the base station or the sink. The main concern in such situations is the conservation of energy and hence proper management of packets. This can be achieved either by merging data through middle sensors or data compression [6]. This leads to effective energy utilization of the sensors, thereby increasing the lifetime of the network and increased bandwidth. Thus, data aggregation (collecting the data from multi-sensors) is considered as effective technique for combining data. Another advantage of using data aggregation is that, the data are delivered in a very efficient manner with minimal data latency. Different data aggregation algorithms to improve the lifetime of sensor network exist.

# Chatbot For Disease Prediction And Treatment Recommendation

**Mrs. Swathi S[a], Sushruth S[b], Rajamani R[c], Manjunath S[d], Ullas R[e]**

[a] Assoc.Prof, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India
[b,c,d,e] B.E. Students, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India

**Article History**: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 28 April 2021

**Abstract:** The hospital is a universal method by which any patient can undergo medical examinations, diagnose diseases and get recommendations for any type of treatment. Most people all over the world follow this custom. People have considered this to be the most suitable and authentic way to keep a check on their physical body state. The proposed system is to find another alternative to this formal way of having to visit a hospital and to make an appointment for a check-up or diagnosis with a doctor. This particular research study will help to apply the concepts of natural language processing and machine learning to create a chatbot application. Just like people interact with each other, here people can easily interact with the chatbot through a series of questions and doubts, meanwhile the chatbot will find and identify the person's symptoms and thereby can predict which disease the person is affected with and suggest the related remedies and treatment. This system can be proved to be of great use especially to people who have to conduct diurnal check- ups, It can also enable people to understand their health and encourage more people to take appropriate measures to maintain their health. This research also suggests that such a system is not very popularly used and people lack knowledge about this. Putting into action this framework can be of great help to people in avoiding long-distance trips to the hospital just by using this free app no matter where you are.

**Keywords:** medical scrutiny, disease prognosis, chatbot, diurnal check-ups

## 1. Introduction

A flourishing society is a point at which the entirety of its individuals is solid. It is imperative to keep up wellbeing if one wishes to be glad. Just a solid body can have a sound mind and positively affect individuals' presentation. In their bustling lives, they neglect to take fitting measures to keep themselves sound and are less mindful of their wellbeing status. In the most recent news from TOI [1], we can see that individuals don't join significance to their wellbeing that testing in clinics takes too long. A bustling planned life has a bad situation for well-being. The majority of individuals who make up the local area's branch of work claim that their furious timetable doesn't allow them to have normal clinical checks and that they overlook any nervousness their bodies show until it turns out to be excessively extreme.

The principal motivation behind the task is to make the language hole between the client and wellbeing specialist organiza- tions by giving prompt reactions to the in- quiries posed by the client. There are three analyzes of tongue comprehension, that is, the completeness of identifying the main lin- guistic relationships for analyzing the topic in the subject of sentences. At that point, the portrayal of the writings is finished. Seman- tic understanding uses knowledge of the word that implies Chatbot is a substance that mirrors hu n banter in its satisfactory setting alongside a book or phonetic language (NLP). The objective of this framework is to

rehash the individual's conversation. Regu- larly the chatbot application occasion winds up making an interface for sending inputs and accepting a reaction. It is a framework that interfaces with the client by following the situation with the connection and recol- lecting past orders to give usefulness. Clini- cal chatbots are regularly evolved utilizing manufactured calculations that examine cli- ent requests, remember them, and give the response to the pertinent query framework gives response utilizing a proficient graph- ical interface like if the genuine individual is conversing with the client. A chatbot can be utilized in different fields like instruction, medical care, and emergency aides. The Central District of Chatbots incorporates MySQL. It is an intuitive framework that set- tles clients' requests identified with medica- tion. With the goal that they get the right guidelines for treatment through the web ap- plication utilizing Google API.

## 2. Literature Survey

In the paper by Rashmi Dharwadkar [5], the working of a chatbot relies upon Natural language preparation that causes clients to advance their issues about actual wellbeing. The patient can ask his wellbeing- related issues/inquiries through the clinical chatbot, it isn't required to test the client/patient should mandatorily go to the medical clinic rather by utilizing Google API for text-voice or voice-text discussion. Chatbot gets the inquiry from the client and showcases the connected arrangement through an android app.

TEST Engineering & Management

*January - February 2020*
*ISSN: 0193 - 4120 Page No. 8971 - 8977*

# Aquarium Monitoring System

Dr. Anitha Patil, Professor and HoD,panitha243@gmail.com,NCET
Mr. Sudhakar Reddy, Assistant Professor,sudhakar.reddy268@gmail.com,NCET
Sreerajavenkatareddy Velagala, vsrvenkatareddy@gmail.com
Narendra Kumar Verma, narendraverma986@gmail.com

***Article Info***
***Volume 82***
***Page Number: 8971 – 8977***
***Publication Issue:***
***January-February 2020***

***Article History***
***Article Received****: 18 May 2019*
***Revised****: 14 July 2019*
***Accepted****: 22 December 2019*
***Publication****: 09 February 2020*

***Abstract:***
Aquarium Monitoring System is new generation innovative project based on Arduino. This Aquarium is fully automated and works on the input supplied to the system through ours Smartphone or Laptop. This project is help to those people who are handicapped as well as normal human beings. The utilization of this checking framework the clients can screen and keep up their aquarium consistently. This Aquarium Monitoring System is deals with Arduino and Sensors. The job of this framework is to empower the clients to screen the Aquarium, for example, sustaining the fishes on schedule, maintain their water level and changing water on time, cleaning all glasses and inside base of the aquarium which are covered with small stones. In order to continuously check all these above working status. In this project we are using databases to store all the status information record. The Arduino is the central part of the project to get all the data from the sensors which are using in this project and sent to the databases to update the status. This monitoring system is operating by using of Smartphone, Laptop or Tablet.

***Keywords:*** *Monitoring System, Arduino, and aquarium.*

## I. Introduction

An Aquarium is a holder or fake lake wherein living oceanic creatures or plants are kept. Aquarium is utilized for fishkeeping reason for leisure activity and for indoor and open air adornment. Other than that fishkeeping in aquarium is additionally identified with different societies. Aquarium is ideal blend of amicability and parity. The water symbolizes the progression of life, development and exercises of living things. The movement and hints of the percolating water as it moves all through the fish tank initiates and builds the positive vitality around the territory, in this manner bring favorable luck, riches and wealth.Aquarium is generally use for the decoration purpose in ours home, industry and tourist places etc. The Aquarium gives a sense of peace and feeling connection to the nature. Nowadays we can see most of the people are interested to petting the fish therefore they collect Different types of fishes. This time it is very difficult to maintain and monitor the Aquarium. So we are going to make advance Aquarium as a Automated Aquarium. In this project we will add features like that to changing and maintaining water level, temperature, walls cleaning, fish feeding etc. All these features will do automatically by giving input through ours smartphones, laptop. We can operate from anywhere. After all these features added in the normal aquarium then Aquarium will become an Automated Aquarium. This Aquarium will give perfect environment simulated from natural environment where the fish came from and to help the fish to live longer and healthier. An Aquarium is a holder or fake lake wherein living oceanic creatures or plants are kept. Aquarium is utilized for fishkeeping reason for leisure activity and for indoor and open air adornment. Other than that fishkeeping in aquarium is additionally identified with different societies. Aquarium is ideal blend

International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST

# A Survey of Text Steganography Methods

**Vivek Sharma S[1], Monika Raj[2], Swathi S[2]**
[1]Assistant Professor, Nagarjuna College of Engineering and Technology, Bangalore, Karnataka, India
[2]B.E Student, Nagarjuna College of Engineering and Technology, Bangalore, Karnataka, India

**Article Info**
Volume 8, Issue 3
Page Number : 238-241

**Publication Issue**
May-June-2021

**Article History**
Accepted : 14 May 2021
Published : 22 May 2021

## ABSTRACT

Phishing is that the most typical and most dangerous attack among cybercrimes. The aim of these attacks is to steal the data that's utilized by people and organizations to perform transactions or any vital info. The goal of this is often to perform an Extreme Learning Sending encrypted messages frequently will draw the attention of third parties, i.e. hackers, perhaps causing attempts to break and reveal the original messages. In a digital world, steganography is introduced to hide the existence of the communication by concealing a secret message inside another unsuspicious message. This paper presents an overview of text steganography and a brief history of steganography along with various existing text-based steganography techniques.

**Keywords :** Steganography, data hiding, steganography text in text, media, information, security.

## I. INTRODUCTION

Steganography is the art of hiding data or information in ways that prevent the detection of hidden messages. In computing a computer files, message, image or video is concealed within another file, message, image or video. The historic use of steganography is the concealing of communications. This has been accomplished in a number of ways from microdot printing and invisible ink to spread spectrum communications. This differs from cryptography in that cryptosystems assume that the enemy can access and modify the communication if possible. Steganography can augment cryptography by obscuring communication and prevent the enemy from knowing a communication is even being sent. However, it should not be considered a replacement for cryptography. Using computers to hide data or information on a hard drive is easily done with free tools. The world of computing has developed some interesting applications for steganography that instead of hiding information seeks to fingerprint or watermarking. These techniques can be used to protect distributed intellectual property such as films, audio recordings, books, and multimedia products by embedding copyright information.

**Basic theory** - This section will focus on the history of steganography, steganography on text, text steganography methods, mechanism of text steganography.

**Copyright: ©** the author(s), publisher and licensee Technoscience Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited

International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST218393

# High Accuracy Phishing Detection Based on Convolutional Neural Network

[1]AjithKumar Reddy K, [2] Darshith M P, [3] Divya Megha H S, [4] Omshree V, [5] Sudhakara Reddy M
[1,2,3,4]Student, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bengaluru, Karnataka, India.

[5] Assistant Professor, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bengaluru, Karnataka, India

**Article Info**
Volume 8, Issue 3
Page Number : 454-457

**Publication Issue**
May-June-2021

**Article History**
Accepted : 25 May 2021
Published : 31 May 2021

**ABSTRACT**

There are numerous web security dangers yet one of the significant web security issues is Phishing sites that focus on the human weaknesses instead of programming weaknesses. It tends to be depicted as the way toward acquiring the online clients to get their touchy data, for example, usernames and passwords. These days, phishing is one of the greatest regular web dangers as for the critical increase of the World Wide Web in volume over the long run. Phishing aggressors consistently utilize new (multi day) and complex procedures to beguile online clients. Thus, it is important that the counter phishing framework is ongoing and quick and furthermore influences from a shrewd phishing recognition arrangement. Here, we build up a very much established location framework which can adaptively coordinate with the changing climate and phishing sites. Our strategy is an on the web and highlight rich AI procedure to separate the phishing and real sites. Since the proposed approach removes various sorts of various highlights from URLs and pages source code, it is a totally customer side arrangement and doesn't need any assistance from the outsider. In this task, we offer a clever framework for finding phishing sites. The framework depends on an AI technique, explicitly managed learning. We have chosen the Logistic Regression strategy because of its great presentation in grouping. Our point is to acquire a better classifier by considering the attributes of phishing site and pick the better mix of them to prepare the grouped.

**Keywords :** Phishing website, anti-phishing, Logistic regression technique.

## I. INTRODUCTION

Each exploration identified with phishing assaults has been enormously centered on arrangement leaving the wrongdoing and issue unknown. The writing additionally distinguished that giving the arrangement without investigating the issue isn't the best approach to deal with this danger. Consequently,

**Copyright: ©** the author(s), publisher and licensee Technoscience Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited

**Achievements after Dr Muthukumar S Dean R&D NCET**

**PATENTS**

- **INDIAN Patent 1**

  Patent Name : SYSTEM AND METHOD FOR VEHICLE ELECTRONIC VEHICLE REPAIR ESTIMATION BASED ON AI AND IOT SENSORS

  Patent App No : 202141018987

  Patent status : published

  Organisation : Intellectual Property Rights, Government of India

- 

- **International Patent 2** IPR, Australian Innovation Patent

  Patent Name : INTELLIGENT EARPHONE SYSTEM FOR REMOTE HEALTH MONITORING USING ARTIFICIAL INTELLIGENCE

  Patent status : FILED

  Patent No : 2021102658

- **INDIAN Patent 3 (ApplicantS : Dr. Jitendra Mungara and Dr. Muthukumar S)**

  Patent Name : COVID – 19 MASK BASED ON AI TO AUTOMATICALLY DETECT AND KILL VIRUS

  Patent status : to be Filed today (04/06/2021)

  Organisation : Intellectual Property Rights, Government of India

**RESEARCH PAPERS**

ARTICLE 1: **(Scopus indexed)**

Empirical analysis of Student Performance Using Data Mining Approaches,

International Journal of Design Engineering, pp: 737-748

ARTICLE 2: **(SCI indexed)**

Machine Learning System in image Manipulation and fake detection

Turkish Journal, ISSN 2651-4451

**International Technical Committee member of a Conference:**

# 6th Annual International Conference on Information System and Artificial Intelligence [ISAI2021]

**International Conference Participant:**

"Build Your Iconic Career" CONDUCTED BY IIHRD

**National Webinar Participations:**

1. NEP 2020: vision to Action: organized by IIIT Kalyani

2. Implementation of NEP 2020: in Technical Institutions: organized by VTU, Belagavi

Funding Proposals (Under Progress)

Proposal 1: Bio-plant at NCET for waste disposal using IOT and AI

Status : Under Progress

Organization : Department of Bio-Technology

Proposal 2: Autonomous air purification system to free from Viruses and Bacteria

Status : Under Progress

Organization : SERB, Government of India

Webinar Proposals (Under Progress)

NEP 2021 : Implementation challenges at Higher Educational Institutions

Agency : AICTE / MHRD (MoE)

Status : Under Progress

# Smart Agriculture Monitoring System using ML

**Pramoda R, Preethi R M, Spoorthi V, Samarth Y M, Shashank S**

***Abstract*: *Agriculture plays vital role in every individual's life. As the technology improves, agricultural sector has been improving by the needs of people. Basically, the idea here deals with monitoring of weather, temperature, soil moisture and other agriculture related aspects. The objective of this paper is to upgrade -growth probability. So by making use of Advance technologies good and efficient crop can be yield. Cloud (Firebase) is typically used to store the pre-computed data (data sets) and the data from the efficiency of agriculture sector. This idea comprises of Machine Learning techniques, Cloud Computation [5] and IoT. Here we will use machine learning techniques for predicting crop sensors and comparison between these. IoT includes NPK sensors, temperature sensor, and humidity sensor. The mechanism goes like this- initially the data from humidity, temperature sensor will be noted and NPK sensors will be placed in the soil, the values from the sensors will be sent to cloud by making use of any communication technology (ZigBee, IoT gateway devices). In cloud comparison of pre-computed data and data from sensors happens by making use of machine learning. The outcome from cloud may be stored in the server (Admin) or directly be notified to authorized person of the land in the form for notification. By taking all these parameters into consideration, we can predict the best suitable crop that can be grown and farmers will earn profit in a cost-effective manner.***

***Keywords* : *Firebase, IOT gateways, NPK Sensors, s ZigBee .***

## I. INTRODUCTION

"Agriculture" is the process of producing food, feed, fiber and many other desired products by the cultivation of certain plants and the raising of domesticated animals (livestock). But now a days it is losingit's potential because of various factors like low profits, failure of monsoon, soil fertility, wrecked weather conditions and even some farmers don't know the base condition like which crop is suitable for their land. So these are hindering India's back-bone. By making use of booming technologies like Machine Learning, IoT and Data Mining, if prior information of weather forecast for a month or even months, fertility of soil, and which crop is going to have good economy in future, farmers can get good yield and even earn profit. By making use of particular rectification is not possible.

**Revised Manuscript Received on April 27, 2020.**
***** Correspondence Author
**Pramoda R**, Department of CSE, Nagarjuna College Of Engineering And Technology, Bangalore, India. Email: pramodgowda.ndr@gmail.com
**Shashank S**, Department of CSE, Nagarjuna College Of Engineering And Technology, Bangalore, India. Email: shashank24448@gmail.com
**Samarth Y M**, Department of CSE, Nagarjuna College Of Engineering And Technology, Bangalore, India. Email: samarthym@gmail.com
**Spoorthi V**, Department of CSE, Nagarjuna College Of Engineering And Technology, Bangalore, India. Email: spoorthidevang18@gmail.com
**Preethi R M**, Department of CSE, Nagarjuna College Of Engineering And Technology, Bangalore, India. Email: preethi.rm18@gmail.com

sensors we can get soil nutrient content, based on this fertilizers can be applied. This will result in good yield of crop and can prevent excessive fertilizer levels. Agriculture sector contributes major of 18 per cent of India's gross domestic product (GDP) providing 50% of countries workforce. With

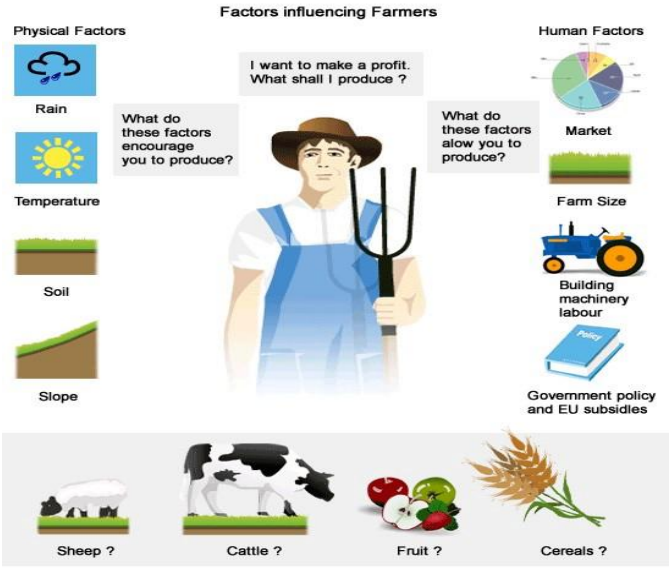



**Fig.1. Factors influencing farmers**

the rapid growth of population, it is necessary to meet the needs of every individual and feed them. So we need solution to overcome this, i.e. by harnessing technology of machine learning using artificial neural networks, data mining, data sets can be fed and accurate values can be obtained. By the combined efforts of all these we can implement a good project. Then comes the idea of "Smart Agriculture Monitoring System Using Machine Learning". In our project we use Machine Learning algorithms to predict the yield of the crop. Machine learning is a great boon for agriculture it helps in predicting agriculture related yields or crop. Machine learning in agriculture used to upgrade the productivity and quality of the crop with the help of prediction algorithms, it defines the mapping and estimated marketing value of the crop on the basis of past yield results. Whether crop increase or decrease are associated with a specific pattern in the usage of fertilizer we could predict how much amount of fertilizer has to be used for the particular crop with the help of some k-means and identity cluster. The theme here is to provide farmers with an smart system that help farmers to get rid of agricultural issues, therefore there will be best utilization of resources, time saving, money and manpower. So our goal

INSTITUTION'S INNOVATION COUNCIL
(Ministry of HRD Initiative)

**Karnatak Law Society's**

**Gogte Institute of Technology**

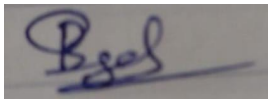
# CERTIFICATE

OF APPRECIATION

This Certificate is Proudly Presented to

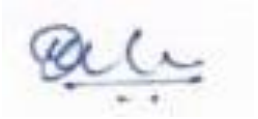
## Dinesha Hagare Annappaiah

has successfully completed **Understanding Intellectual Property** 26/06/2021. During this **Webinar**, we found the participant to be a keen and enthusiastic candidate.



**Prof. P.S.Khanagoudar**
Event Co-ordinator, GIT IIC

**Dr. Vijay S. Rajpurohit**
HOD of CSE



**Dr. J.K.Kittur**
Principal, KLS GIT

Made for free with Certify'em

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8037

20-May-2021

This is to certify that **Vivek Sharma S, Hemalatha R, Kavyashree Y B** have published a research paper entitled ***'Review Process on URL Phishing'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 241-244 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218344

**DOI : https://doi.org/10.32628/IJSRST218344**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8037

20-May-2021

This is to certify that **Vivek Sharma S** has published a research paper entitled ***'Review Process on URL Phishing'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 241-244 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218344

**DOI : https://doi.org/10.32628/IJSRST218344**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8037

20-May-2021

This is to certify that **Hemalatha R** has published a research paper entitled ***'Review Process on URL Phishing'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 241-244 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218344

**DOI : https://doi.org/10.32628/IJSRST218344**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8037

20-May-2021

This is to certify that **Kavyashree Y B** has published a research paper entitled ***'Review Process on URL Phishing'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 241-244 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218344

**DOI : https://doi.org/10.32628/IJSRST218344**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8037

20-May-2021

This is to certify that **Vivek Sharma S, Hemalatha R, Kavyashree Y B** have published a research paper entitled ***'Review Process on URL Phishing'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 241-244 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218344

**DOI : https://doi.org/10.32628/IJSRST218344**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8042

20-May-2021

This is to certify that **Vivek Sharma S, Monika Raj, Swathi S** have published a research paper entitled ***'A Survey of Text Steganography Methods'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 238-241 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218348

**DOI : https://doi.org/10.32628/IJSRST218348**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8042

20-May-2021

This is to certify that **Vivek Sharma S** has published a research paper entitled ***'A Survey of Text Steganography Methods'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 238-241 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218348
**DOI : https://doi.org/10.32628/IJSRST218348**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8042

20-May-2021

This is to certify that **Monika Raj** has published a research paper entitled ***'A Survey of Text Steganography Methods'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 238-241 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218348

**DOI : https://doi.org/10.32628/IJSRST218348**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8042

20-May-2021

This is to certify that **Swathi S** has published a research paper entitled ***'A Survey of Text Steganography Methods'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 238-241 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218348

**DOI : https://doi.org/10.32628/IJSRST218348**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8042

20-May-2021

This is to certify that **Vivek Sharma S, Monika Raj, Swathi S** have published a research paper entitled ***'A Survey of Text Steganography Methods'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 238-241 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218348

**DOI : https://doi.org/10.32628/IJSRST218348**

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **Srikanth M S, Dr. Jitendranath Mungara, Shivani Singh S, S Pavani, Charitha B N, Anusha S** have published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218349
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **Srikanth M S** has published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218349

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **Dr. Jitendranath Mungara** has published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218349

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **Shivani Singh S** has published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218349

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **S Pavani** has published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218349

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **Charitha B N** has published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218349

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8044

15-May-2021

This is to certify that **Anusha S** has published a research paper entitled ***'Voice Assistance for Dumb People Based on Hand Gestures'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 172-176 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218349

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Srikanth M S, Dr. Jitendranath Mungara, Karuna S Kashyap, Kavyashree HM, Shrividya Bhatt S, Shubha G** have published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Srikanth M S** has published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Dr. Jitendranath Mungara** has published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Karuna S Kashyap** has published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Kavyashree HM** has published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Shrividya Bhatt S** has published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8047

15-May-2021

This is to certify that **Shubha G** has published a research paper entitled ***'Prediction of Cancer in situ using Machine Learning'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 177-182 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218350

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **Srikanth M S, Dr. Jitendranath Mungara, Deekshitha S N, Divya Khandekar, Bharath Kumar O, I V S Mahesh Varma** have published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218351

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **Srikanth M S** has published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218351

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **Dr. Jitendranath Mungara** has published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218351

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **Deekshitha S N** has published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218351

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **Divya Khandekar** has published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218351
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **Bharath Kumar O** has published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218351
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8048

15-May-2021

This is to certify that **I V S Mahesh Varma** has published a research paper entitled ***'IOT Based Camouflage Surveillance Robot'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 183-187 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218351

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Srikanth M S, Dr Jitendranath Mungara, Monisha N, Pramod C R, Roopika T C, Vinod B S** have published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218352
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Srikanth M S** has published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218352

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Dr Jitendranath Mungara** has published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218352

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Monisha N** has published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218352

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Pramod C R** has published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218352

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Roopika T C** has published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218352

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8049

15-May-2021

This is to certify that **Vinod B S** has published a research paper entitled ***'Password Authentication Using Gaze Based Eye Tracking'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 188-192 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218352

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **Prof (Dr) Mohan Kumar S, Prof (Dr) Jitendranath Mungara, Manoj Kumar Reddy, K Nishanth Kumar, Mulla Dada Khalandar, Sai Bharat Reddy BS** have published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218354
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **Prof (Dr) Mohan Kumar S** has published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218354

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **Prof (Dr) Jitendranath Mungara** has published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218354

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **Manoj Kumar Reddy** has published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218354
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **K Nishanth Kumar** has published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218354

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **Mulla Dada Khalandar** has published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218354

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8055

15-May-2021

This is to certify that **Sai Bharat Reddy BS** has published a research paper entitled ***'Farm Management System'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 193-199 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218354

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Dr. S. Mohan Kumar, Dr. Jitendranath Mungara, Alluri Sai Shilpa Sri, Gagan Gowda T C, Lavanya K 5, Leelavathy J** have published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218355

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Dr. S. Mohan Kumar** has published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218355

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Dr. Jitendranath Mungara** has published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST218355
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Alluri Sai Shilpa Sri** has published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218355

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Gagan Gowda T C** has published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218355

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Lavanya K 5** has published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218355

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8056

15-May-2021

This is to certify that **Leelavathy J** has published a research paper entitled ***'Automatic Skin Cancer Detection'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 200-207 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST218355

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Dr. Mohan Kumar S, Dr. Jitendranath Mungara, Pearl Priya, Komal Devi, Subham Verma, Shubham Raj** have published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST1218353

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Dr. Mohan Kumar S** has published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST1218353

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Dr. Jitendranath Mungara** has published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST1218353
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Pearl Priya** has published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST1218353
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Komal Devi** has published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST1218353
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Subham Verma** has published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link

https://ijsrst.com/IJSRST1218353

IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214

Peer Reviewed and Refereed International Journal

Online ISSN : 2395-602X
Print ISSN : 2395-6011
[ UGC Journal No : 64011 ]

# International Journal of Scientific Research in Science and Technology

## Certificate of Publication

Ref : IJSRST/Certificate/Volume 8/Issue 3/8105

20-May-2021

This is to certify that **Shubham Raj** has published a research paper entitled ***'Burglar Prevention IOT Model'*** in the International Journal of Scientific Research in Science and Technology (IJSRST), Volume 8, Issue 3, May-June-2021 [ Page No 316-322 ].

This Paper can be downloaded from the following IJSRST website link
https://ijsrst.com/IJSRST1218353
IJSRST Team wishes all the best for bright future

Editor in Chief
IJSRST
website : http://ijsrst.com

Scientific Journal Impact Factor = 7.214
Peer Reviewed and Refereed International Journal

Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 6, July, 2021: 8414 -8424

Research Article

# Chatbots: Cross-Domain Engineering Applications

Ajay Sudhir Bale[1], Subhashish Tiwari[2*], B C Hemapriya[3], Subramanya S G[4], Vinay N[1], Baby Chithra R[1], Nithin Gowda N[1], Dixit Shetty[1], Ravindra V[5] ,M Kaushik[6] and Anandhakumar Ramasamy[7]

## Abstract

This paper overviews the cross-domain engineering applications of Chatbots. Chatbots are powerful software built using artificial intelligence and machine learning algorithms that respond to user input data and have impacted a wide range of working fields, including healthcare, journalism, and finance. In Journalism, chatbots mean the rise of interactive news communication, spreading awareness more effectively among the younger generation. In the Healthcare systems, chatbots prove to be extensively useful in emergencies where identifying symptoms for individual patients can be difficult, but having stored a vast amount of personalized data, chatbots can predict quite accurately what problem the patient might be facing – including chronic illnesses. In Finance, chatbots are used to customize responses to each user based on factors like age which vary their intention of using their account to secure financial stability. Further research on chatbots will thus prove to enhance their efficiency in several fields like these where they have immense potential**.**

***Keywords-*** Healthcare, Finance, Journalism, Growth, Restrictions.

## I. INTRODUCTION

The Chatbot is a word contracted using two words Chat and Bot, where the word bot is derived from robot. Chatbots are intelligent software that reacts to the input data or the information [1-5]. In recent years chats bots are built above the most powerful algorithms of artificial intelligence and machine learning, showcasing the impressive User interfaces (UI) with a natural humanistic response. However, with the advanced development of natural language processing (NLP), chatbots are also integrated with voice-to-voice responsive technology [6-7]. There are many applications of chatbots in the field of manufacturing industry, marketing, medical and education, etc. For many years, businesses have benefited from the use of social,

[1]Department of ECE, School of Engineering and Technology, CMR University, Bengaluru, India-562149
[2]Department of ECE, Vignan's Foundation for Science, Technology & Research, Guntur, India, 522213
[3]Department of CSE, Sir MVIT, Bengaluru, India, 562157
[4]Department of CSE, Nagarjuna College of Engineering and Technology, Bengaluru, India, 562164
[5]Department of ECE, Reva University, Bengaluru, India-562149
[6]Department of ECE, Bannari Amman Institute of Technology, Satyamangalam,Tamilnadu, India- 638401
[7]Cloud Architect, Mississauga, Ontario, Canada, L5B 4A1
[*]drst_ece@vignan.ac.in

2021 First International Conference on

# Advances in Electrical, Computing, Communications and Sustainable Technologies (ICAECT 2021)

19 - 20, February 2021 | Bhilai, Chhattisgarh, India | www.icaect.com

# CERTIFICATE

Sponsored by

IEEE
Advancing Technology for Humanity

## Best Paper Award

Based on the evaluation reports by the reviewers and the session chairs, the following paper has been conferred as BEST PAPER among the papers presented in the technical session

**Paper ID & Title of the paper**

CHCS 1081A - Resource Allocation Techniques in Edge/Fog Computing

Author(s)
Darpan Majumder, S. Mohan Kumar, D. V. Ashoka and A.Shajin Nargunam

Date & Session
20.02.2021 / CS16

Dr. Shimpy Ralhan
Conference Chair

Dr. P. B. Deshmukh
General Chair

Ms. Jaya Mishra
President, SGES

Organized by

Electrical and Electronics Engineering
Shri Shankaracharya Group of Institutions, SSTC
Bhilai, Chhattisgarh, INDIA

Conference Management Services
DILIGENTEC SOLUTIONS


Google Cloud

**5 Courses**

- Google Cloud Platform Fundamentals: Core Infrastructure
- Essential Cloud Infrastructure: Foundation
- Essential Cloud Infrastructure: Core Services
- Elastic Cloud Infrastructure: Scaling and Automation
- Reliable Cloud Infrastructure: Design and Process

10/28/2019

Google Cloud Training

## Bhargava R

has successfully completed the online, non-credit Specialization

# Architecting with Google Compute Engine

In this five-course accelerated specialization, learners explored and deployed solution elements, including infrastructure components such as networks, systems and applications services using Google Cloud Platform, with a focus on Compute Engine.

The online specialization named in this certificate may draw on material from courses taught on-campus, but the included courses are not equivalent to on-campus courses. Participation in this online specialization does not constitute enrollment at this university. This certificate does not confer a University grade, course credit or degree, and it does not verify the identity of the learner.

Verify this certificate at:
coursera.org/verify/specialization/8CU9NVQ5UG5Z

Google Cloud

# COURSE CERTIFICATE

09/11/2019

## Bhargava R

has successfully completed

## Essential Cloud Infrastructure: Foundation

an online non-credit course authorized by Google Cloud and offered through Coursera


Google Cloud Training

Verify at coursera.org/verify/DBPS53DZ5VMR

Coursera has confirmed the identity of this individual and their participation in the course.

Google Cloud

10/12/2019

# Bhargava R

has successfully completed

## Elastic Cloud Infrastructure: Scaling and Automation

an online non-credit course authorized by Google Cloud and offered through Coursera

Google Cloud Training

COURSE CERTIFICATE


Verify at coursera.org/verify/KJ4KW6CFRJML

Coursera has confirmed the identity of this individual and their participation in the course.

Google Cloud

# COURSE CERTIFICATE

10/11/2019

## Bhargava R

has successfully completed

## Reliable Cloud Infrastructure: Design and Process

an online non-credit course authorized by Google Cloud and offered through Coursera


Google Cloud Training

Verify at coursera.org/verify/X32F4X2YTM9F

Coursera has confirmed the identity of this individual and their participation in the course.

Design Engineering

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

# Empirical Analysis of Student Performance Using Data Mining Approaches

[1]Dr Amala Nirmal Doss
Assistant professor, Department of computing, Muscat College, Oman
amala@muscatcollege.edu.om

[2]Ratchana Rajendran
Adjunct Faculty - Department of Professional Studies, CHRIST (deemed to be) University
r.ratchana@gmail.com

[3]Muthukumar Subramanian
Dean, Nagarjuna College of Engineering & Technology, Bangalore.
drsm.iiit@gmail.com

[4]Dr. Jnaneshwar Pai Maroor
Assistant Professor, Department of Business Administration,
NMAM Institute of Technology, Nitte
jnan_pai@yahoo.com

[5]Md. Khaja Mohiddin
Senior Assistant Professor
Bhilai Institute of Technology, Raipur, Chhattisgarh, India
khwaja7388@gmail.com

**Abstract:**This paper offers a method for student results for data mining. In order to improve the performance of high school students, special methods such as expanded cluster analysis and regression trees and variable selection are used earlier on the analysis and study of individual characteristics. In the next point, numerous additional, predictable, ways to life-specific prediction models were created, while recognition criteria were discovered that account for educational attainment in the following examinations. with the approach thus used captures an accurate representation of the current assessments, since findings were based on authentic documents.

**Key Words:**Frequent Pattern Analysis, Data mining, Regression tree, Clustering.

## 1. INTRODUCTION

The enormous amount of information contained in the computer devices of various organisations, both private and community, has helped introduce new information management

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

and tracking technologies. Treatment of Data is a tool with the objective of evaluating the hidden and non-trivial relations between data of a different type. This set of processes, used in a wide range of sectors, and in the learning institution, focusses on common knowledge management techniques and has the attribute of being able to handle large amounts of data.

Education data mining will mainly be a latest study space for student repositories to analyze and analyze the data to understand and improve the effectiveness of the coed learning method. Calculation in the information square was studied with the incorporation of applied mathematics, artificial intelligence, data extraction, academic research issues, and the advancement of the entire educational system. In the past, intellectual code tools and student data bases seem to be expanding, and we have massive reflective data repositories, but students learn. Moreover, the use of the Internet in education provides a platform for e-learning or web-based education in which extensive knowledge of the relations between learning and education is continually produced. The study of education data aims to use these data to enhance the comprehension of learners and to build strategies to improve the educational method by dividing up applicable theoretical data. The spread of rapid data sets and the increase in the production of information as well as the collection of information, both horizontally and vertically, of all subject matter knowledge have become increasingly prevalent in computer science terminology. Informatics, schooling or economics interfere with the identification of behavioral patterns of the observing human and mechanical components of the system.

Classification of students is a maturity practice in which individual educational achievement is found. The fundamental issue remains unfortunately a mystery, not to talk about what factors make students more effective than others. This entire report aims, through the application of final grades and other social-cultural characteristics and training, to identify some of the key factors in the student's educational productivity.

## 2. LITERATURE SURVEY

As has already been established, often the square measure of data analysis tools implemented to massive information sets. Consequently, in the sense of learning, we are frequently presented with information sets that adore small teams of students pursuing the same programme. Relating to the schooling setting, for example, even when a programme is used by several students, the knowledge of relevance relates to comparatively limited sets of data. The recent article (Natek & Zwilling, 2014)[6] involves the study of data frameworks techniques have been applied to small data sets relating to educational institutions and confirms that use of such strategies in real-life circumstances is beneficial and encouraging and can provide administrators with useful call tools.

Over the time, several models of data analysis have been developed and applied to investigate the output of intellectuals. For example, in Delavari, Shirazi, (2004) and Somnuk, (2008)[18], A framework is developed that shows the benefits of knowledge mining techniques in higher

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

education systems; researchers provide a framework that helps management find ways to improve such activities. In Daimi and Miller (2009),[8] the researchers present a study model on the profile of scholars who may leave school without finishing their careers. Above all, they use a few of the classification techniques developed by the system of wood hen (Witten, Frank) in 2011. [19] Recommendations for acceptable courses for student square measurements tested with entirely different methods in Ydzov and Popel ns y[4] to predict student success. Damasevicius[9], a system for the regulations on mining of educational information is designed for the organization of unfair treatment. In the previous time , Romero, Zafra, Luna, (2013)[6] are proposing the application of the mining association rule to improve questionnaires, modules and (Saarela et al., 2014) were adapting prevalent things as well as the mining and association rules of students who are learning previously categorized by cluster approaches. In Guruler, Istanbullu, (2010)[18], a method focused on the selection of tree classification algorithm is proposed in order to explore the factors that have an impact mostly on progress of university graduates. Cluster is utilized in Campagni, Merlini (2014)[18] to evaluate information on the study of programs taken by learners, combined with the accompanying tests.

The work bestowed in Dutt, Aghabozrgi, Ismail, (2015)[18] explores entirely different cluster techniques adapted to that same field of academic data acquisition, while (Pena ayel, 2014) integrates an interesting analysis of recent training data analysis trends, the components of which are squarely measured and progressively analysed with a data mining methodology.As has already been established, data analysis methods have been used collectively in computer based, e-learning and web-based education models (Bouchet, Harley, 2013; Bogaran, Romero, Cerezo, 2014; Socialist, Vellido, Nebot, 2007; Hemalenan, Laine, 2006; Koedinger, Cunningham, 2008; Mostow & motion, 2006; Merceron, 2005; Romero, Luna, 2010; Romero, Ventura, 2008; Romero, Lopez, 2013).

[18][19][20]Available studies on the use of knowledge mining in education systems is especially concerned with methodologies such as clustering , classification and affiliation rules Tan, Kumar, 2006; Witten et al., 2011.[7] The university discipline often specifies a chosen education program which places certain types of constraints on, therefore, scholars are required. Such restrictions usually define a set of programs and a relationship that exist among them. Inside the existing framework, moreover, learners have several degrees of independence, thus assisting learners to settle on lessons, finding trends and main courses, designing potential courses and refining curricula based on input from scholars, squarely measuring critical educational tasks, as recently recognised in Aher (2013), Kardan, Sadeghi, (2013), Mandez, Ocho.

[18] In general, we prefer to implement the concept of an ideal career, which is to say, the tenure of a institute student The World Health Organization considers every review at the very end of the accompanying course simply and proposes a data mining technique, a sponsored cluster and an organised pattern analysis, to analyse the coed attitudes of an ideal student career. The organised pattern framework was used in the sense of educational data processing,

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

predominantly in computer-based contexts.
Soundranayagam (2010)[9], for example, discuss the sequence wherein students have access to e-learning tools as they complete set evaluation tasks, such as assessments, coursework and examinations, as well as ties with learning students. The device for the mechanical visualization of student and tutor dialog patterns of cooperative movements is demonstrated in D-Mello, Olney, and Person (2010). Paper (Martinez, 2011) [18] Mines and clusters periodic patterns to check low-and high-performance teams' distinct behavior around the related collaborative work surface. Data mining procedure for the identification and analysis of studying habits of students practicing communication traces is given in Kinnebrew, Loretz, (2013);[19] above all, the article suggests an associated theory that uses a special perfect blend of sequential mining algorithms to detect preferentially recurrent trends among groups of students. Paper (Guerra, Sahebi, 2014)[7] models and explores student activity trends with parametric exercise. A recent research that has emerged in a manner identical to ours is seen in Asif, Merceron, (2014) [7], where even the pupil's success is evaluated by forming a tuple that nevertheless displays the results of each year.

**2.1ProblemIdentification**

Unstructured data learning is one of life's most daunting challenges. There are a number of data objects in broad databases that can or cannot be specifically grouped into fixed groups. The knowledge of the data could only be established using proper methods and physical endeavor to determine the importance of our data sets, which are a disguised gift. Measuring the clusters is the first question in the grouping. The groups to be assigned will rely on clustering; for instance, a set of characteristics of the repair business could be divided through labels chosen or denied. Still, on the other hand, if we are using 3 clusters, they would have a moderate mark of quality for both the item that can be calculated. Cluster strategy, like k-means working on a distributed database system, space complexity can be a challenge to extensive data in this case. Remote data points in databases are often declared redundant, i.e., not used when clustering. Manual action is then taken to resolve the task of data mining with clustering criteria. In the sense of score data, output values usually do not have a constant level; for specific attributes, the appropriate limits need to be assumed.

**2.2Selection of Mining Technique**

Processing a large amount of data will have to deal precisely with the off trading. While selecting data mining, one should imagine the specimen's size or represent the system's data. Academic performance by the review was objective data for the understanding of data patterns. They can section set of data to top achievers, low goalies using Support Vector Machine (SVM), section vector field linearly, and then use linear data set separation to remove particular regions

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

that restrict accuracy. For instance, if the training set comes from a year in which a more comfy complicated set of exam questions is accessible, there would be differences in data due to a missed factor, and in this case, is the level of expertise of the test.

### 2.3 Clustering

Classification is focused on the identification of produced naturally groups inside the database. As they forces applied by raising discrepancies (distances) in data gathering and reducing them to similar data sets, we have a natural group through maintaining the information set intact, unsupervised clustering learning would provide accurate result. Standardized data classes are detected by grouping. A most famous k-Means clustering method has been used for this study. K – Aspect of the method is by far the most clear based method that sees into k pair wise sets by determining a Distance measure between data sets. The difficulty with k-means would be that the value of k needs to be fixed through experimentation because we have a very turn of events for the various budgets of k. Clustering is not a basic algorithm; however it is a specific task that needs to be addressed. Specific algorithms that vary significantly throughout their notions about what constitutes a group as well as how to locate it efficiently could be accomplished by linking each collection to a centroid, so each point is assigned to a group with both the nearest centroid to give importance to the nearest centroid. This distance measure takes into account that notion of a nearest one, including the Distance measure, the Manhattan, or the correlation coefficient, depending on the type of the information under consideration. The number of clusters, K, must be specified, as well as the initial K centers are usually randomly selected on between data set points. This initial choice defines the following clusters whose excellence needs to be measured with a quality measure. That summary of a squares of the errors is determined using the following formulas.

$$sse = \sum_{i=0}^{k} dist(Ci, x)^2 , \qquad \forall\, x \in Ci$$

### 2.4Regression Trees

Classification and random forest are logical methods, generally defined in graphic or biological words. Usually, grass produces on the upper part, beginning only at the root of the tree. Research progresses via a sequence with splits where an improvement call is made based on 1 of the response variable's value. The terminal node or leaf becomes reached, and the required response is given. Forests divide their variables into a set of frames (leaves) reflecting a most homogeneous spectrum of potential outcomes. The creation of splits is similar to a selection of a correlation variable. Fruits are widely produced by discrete asynchronous differentiation. The term binary refers to the fact that the parental nodes may be split into dual baby nodes. The term

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

recurrent is being used to imply that every new child, in turn, will be a parent node unless it is an, e.g., time that creates a simple split that uses a single informative feature.

The vector and the separated location are proposed to reduce the inconsistency of the nodes at that point. There are a few ways to mitigate the vulnerability of each node. They are known as cacophonic laws. The two factors arising from the initial separation will then be divided according the parameters. That tree should increase once there is no room for more splits or even some browser criteria will stop the operation. The plant can then be reduced in size by a method called repotting. The assignment of the value foretold to the terminal nodes may be achieved in several ways. Usually, the terminal node values in the classification tree are assigned to the group; most of the cases are represented in that node. Class assignment rules may be modified to endorse a value function, account for the consequences of constructing an error for specific classes, or accommodate unequal class sampling. Terminal node cases are assigned to terminal node victimization in regression trees [27]. This approach minimizes a maximum squared deviation from the median node. The benefit of it over the smallest triangles is that this is not as open to outsiders but offers a more stable model. The disadvantage is intolerance when dealing with sets of data with a high proportion of zeros. One of three tests can measure the impurity of a logistic regression classification.

## 3. METHODOLOGY

Throughout this study, researchers used the student database across two institutes. Database include age , gender, background details including such family education and jobs, activities, breaks, etc. as well as final exam grades. Data mining phase has five main steps of the KDD

- Choice
- Pre-Processing
- No Transformation
- Data Gathering
- Relevant definition

Normalization is a comprehensive way to ensure that the database layout is appropriate for general purpose compiling and free of any undesirable features which might result in a reduction of information security. Normalization is usually a refining process just after preliminary phase of analyzing the data entities that is already in the dataset, determining their associations, and specifying the appropriate tables and columns in each row.

Design Engineering

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

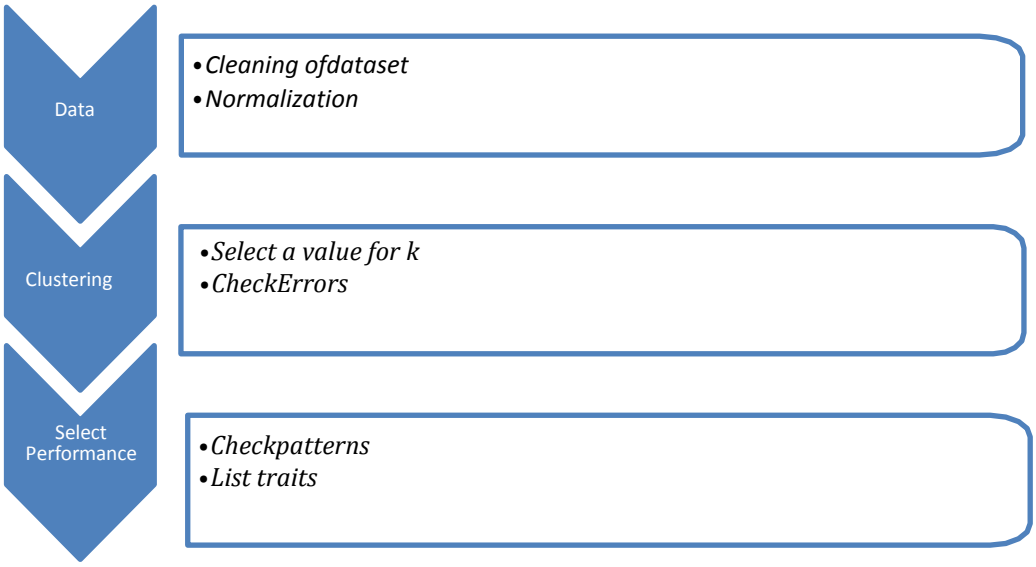



**Fig.1 – Brief methodology**

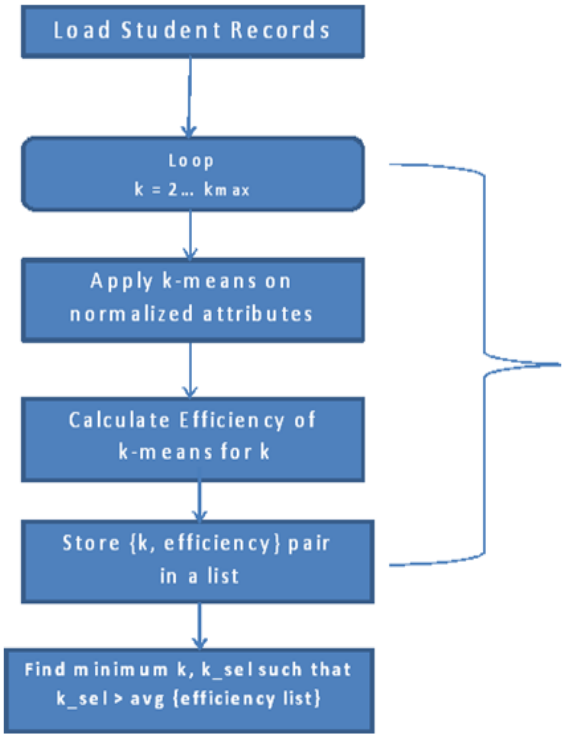



**Fig.2 Usage of K-means clustering**

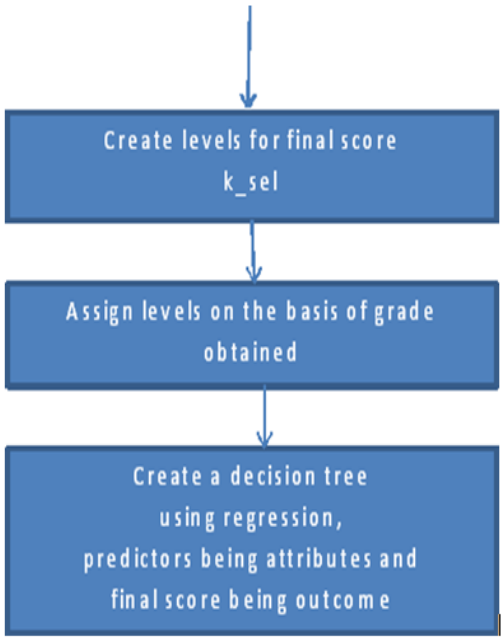



**Fig.3 - Continued Analysis using Regression Trees**

Design Engineering

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

## 4. RESULTS

The accompanying is a graph representing the cluster diagram for the final assignment versus the quarterly grade relation. The characteristics are normalized here. The five color-coded clusters reflect the student's performance; they see that this is not an optimal grouping since we have seen scattered results in the same group; the simple demarcation of groups can be seen in this graph.

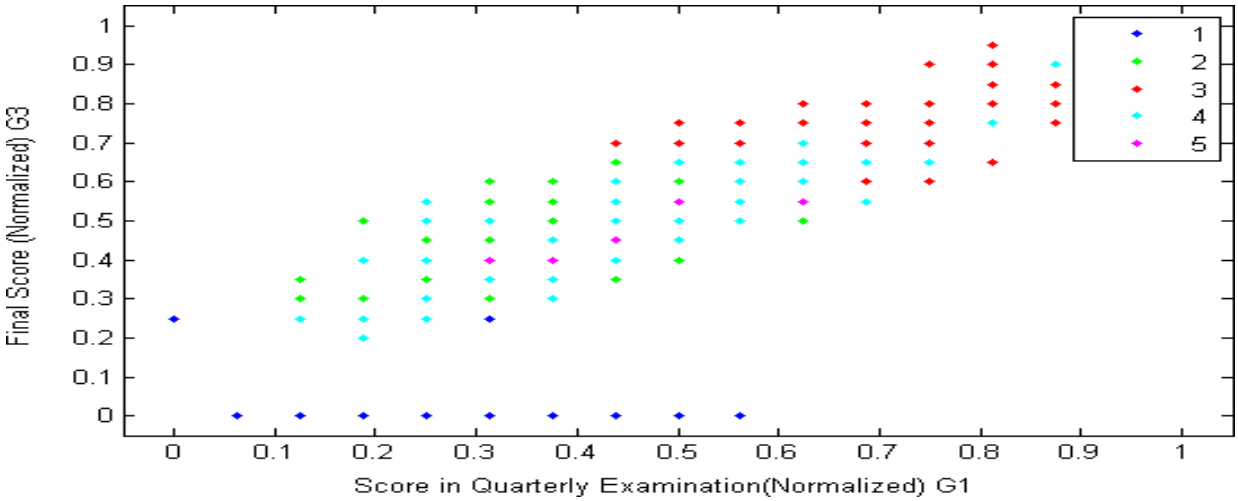



**Fig.4Cluster Visualization for G1 versus G3**

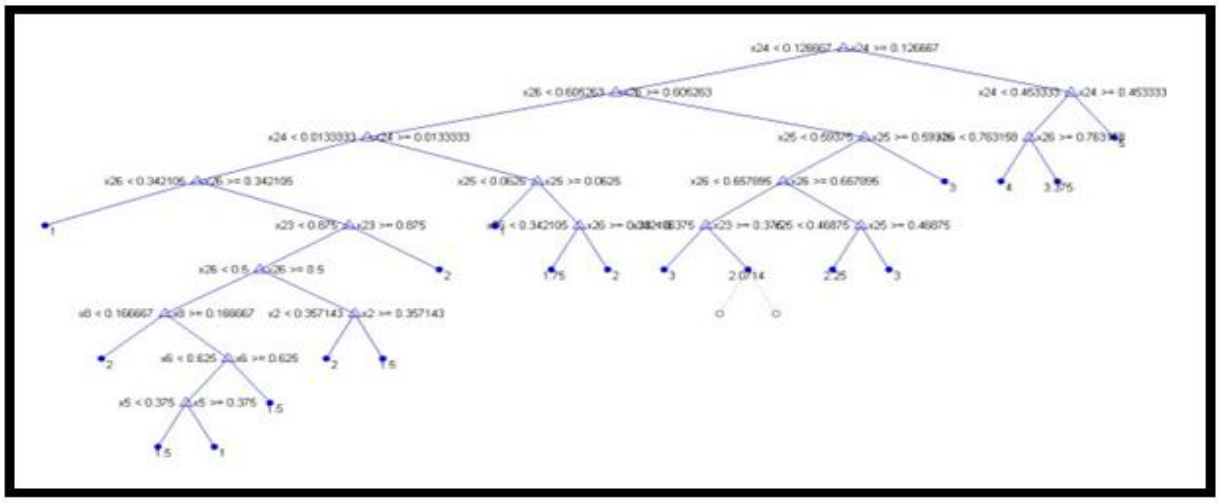


**Fig. 5 Regression decision tree for the cluster membership**

We measure the membership using the regression tree; using these shown clusters, the dataset's 26 parameters are used as the predictors to determine the final score. The use of the regression tree produces a visual framework to display the factors accountable that can be used to forecast grades utilizing cluster membership. Observation of attributes responsible for the decision-making of tree events, whereas follows,

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

- Previous scores of review (25,26)
- Attendance/Absence; (24)
- health services (23)
- Mothers' education (6)
- Age of age (2)
- Time to prepare (8)
- Schooling of the Fathers (5)

The numbers are the attributes (predictor) index in the dataset.

**Table 1 - Classification accuracies**

| Experiment | Accuracies | | |
|---|---|---|---|
| | Authors | | |
| | Agarwal.R | Aher. SB | Asif. R. |
| Best | 91.05 | 93.6 | 92.76 |
| Worst | 82 | 73.8 | 87.5 |
| Average | 84 | 88 | 86 |

**Table 2. Observation of efficiency**

| Experiment | Overall Accuracy | K-means Accuracy |
|---|---|---|
| best | 91.3 | 90.27 |
| worst | 81 | 75.05 |
| average | 89.87 | 83.41 |

## 5. CONCLUSION

The results of this paper would mean that there are related students but that the average user base can fairly be expected to achieve success. The students studied in this article were chosen because of their activities within the MATHS family, as it is the category most often studied in the database. It is important to bear in mind that this main indicator can be improved by collecting more information. The more ideas students can find, the more data they fill out to Fig. 5 - Efficiency versus k-value

allow accurate equivalence calculations among students, as the predictor discovers correlations only using the concepts that both students have accomplished. Although the classification of k-means did not indicate large cluster groups, there are no clusters. Also, it suggests that research

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

shows obvious comparisons between students and also that performance of students can be forecast based on various concepts based on past performance.

The effects of clustering may be explored further by changing the size of the cluster or finding a new way of demonstrating a student's results if the conceptual quiz has not been completed. Further study of the clustering production may also be carried out in future research using silhouette. The consultant provided in this undertaking offers valuable insight; it also raises more questions which can be discussed and dealt with to be found in future work. Concepts are preconditions for those who reflect on the effectiveness of students and which are important to understand, as an overarching area such as mathematics.

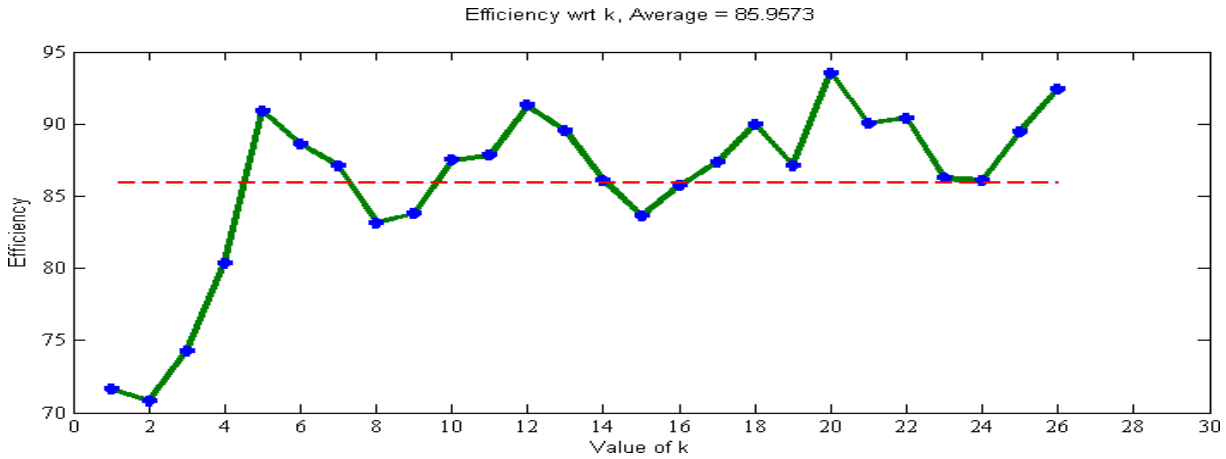



**Fig. 5 - Efficiency versus k-value**

## REFERENCES

1. Vikram Singh, Sapna Nagpal, “A guided clustering technique for knowledge discovery- A case study of Liver Disorder Dataset”, International Journal of Computing and Business research, Vol.1, no.1,Dec2010.
2. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, SecondEdition.
3. D.Hand, “Principles of Data Mining, “Drug safety, vol.3, pp.6 -622,Jul.2007.
4. C.K. John Wang, Ni os L.D.on “Achievement goal profiles in school physical education: Differences in self- determination, sport ability beliefs, and physical activity”, ritish Journal of Educational Psychology, Volume 72, Issue 3, pages 433–445, September 2002
5. SZ Salim, MA Ismail, “K-means-type algorithms: a generalized convergence theorem and characterization of local optimality”, IEEE 1994, Pattern Analysis and Machine Intelligence, IEEE Transactions on (Volume:PAMI-6 , Issue:1
6. Agrawal, R., & Srikant, R. (1995). Mining sequential patterns. In: Proceedings of the eleventh international conference on data engineering (pp.3–14).

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

7. Aher, S. B., & Lobo, L. (2013). Combination of machine learning algorithms for recommendation of courses in e- learning system based on historical data. Knowledge-Based Systems, 51,1–14.
8.Anderberg, M. R. (1973). Cluster analysis for applications. New York: AcademicPress.
9. Asif, R., Merceron, A., & Pathan,M.(2014).Investigating performances‟s progress of students Investigating performances‟s progress of students. In: Proceedings of DeLFI workshops 2014 colocated with 12th e-learning conference of the German Computer Society, Freiburg, Germany (pp.116–123).
10. Ayres, J., Gehrke, J., Yiu, T., & Flannick, J. (2002). Sequential pattern mining using a bitmap representation. In: Proceedings of the eighth ACM SIGKDD international conference on knowledge discovery and data mining (pp. 429–435).
11. Baker,R.S.J.D.(2010).Dataminingforeducation.InB. McGaw, P. Peterson, & E. Baker (Eds.). International encyclopedia of education (3rd ed.) (Vol. 7,pp. 112–118). Oxford, UK: Elsevier.
12. Baker, R. S. J. D. (2014). Educational data mining: An advance for intelligent systems in education. IEEE Intelligent Systems, 29(3),78–82.
13. Baker, R. S. J. D., & Yacef, K. (2009). The state of educational data mining in 2009: A review and future visions. Journal of Educational Data Mining, 1(1),3–17.
14. Bian, H. (2011). A preliminary study on clustering student learning data. In: Proceedings of the 22nd midwest artificial intelligence and cognitive science conference, Cincinnati, Ohio, USA (pp.128–132).
15. Bogarín, A., Romero, C., Cerezo, R., &Sánchez-Santillán,M. (2014). Clustering for improving educational process mining. In: Proceedings of learning analytics and nowledge conference, LAK‟ , Indianapolis, IN, USA (pp. 11–15).
16. Bouchet, F., Harley, J. M. ., & Trevors, G. J. (2013). Clustering and profiling students according to their interactions with an intelligent tutoring system fostering self-regulated learning. Journal of Educational Data Mining, 5(2),104–146.
17. ydzovs a, H., & Popel ns y , L. . Course recommendation from social data course recommendation from social data. In: Proceedings of CSEDU 2014 – the 6th international conference on computer supported education, Barcelona, Spain (Vol. 1, pp.268–275).
18. Campagni, R., Merlini, D., & Sprugnoli, R. (2012). Analyzing paths in a student database. In: Proceedings of EDM 2012, 5th international conference on educational data mining, Chania, Greece (pp.208–209).
19. Campagni, R., Merlini, D., & Sprugnoli, R. (2012). Data mining for a student database. In: Proceedings of ICTCS 2012, 13th Italian conference on theoretical computer science, Varese,Italy.
20. Campagni, R., Merlini, D., & Sprugnoli, R. (2012).

ISSN: 0011-9342
Issue: 5 | Pages: 737 - 748

Sequentialpatternsanalysisinastudentdatabase.In: ECML-PKDD workshop: Mining and exploiting interpretable local patterns (I-Pat 2012), Bristol

21. Campagni, R., Merlini, D., & Verri, M. C. (2014). Finding regularities in courses evaluation with K-means clustering. In: Proceedings of CSEDU 2014 – the 6th international conference on computer supported education (Vol. 2, pp. 26–33).
22. Castro, F., Vellido, A., Nebot, A., & Mugica, F. (2007). Applying data mining techniques to e-learning problems. In Evolution of teaching and learning paradigms in intelligent environment (pp. 183–221). New York: Springer-Verlag.
23. Clow, D. (2013). MOOCs and the funnel of participation. In: Proceedings of learning analytics and knowledge conference 2013, LAK‟ 3, Leuven, elgium pp. 85–189).
24. Daimi, K., & Miller, R. (2009). Analyzing student retention with data mining. In:Proceedings of the 2009 international conference on data mining (pp. 55–60).
25. Damaševicˇius,R.Analysis of academic results for informatics course improvement using association rule mining. In Information systems development (pp. 357–363). Springer.
26. Delavari, N., Shirazi, M. R. A., & Beikzadeh, M. R. (2004). A new model for using data mining technology in higher educational systems. In: Proceedings of the fifth international conference on information technology based higher education and training.
27. Breiman, L., J. Friedman, R. Olshen, and C. Stone. Classification and Regression Trees. Boca Raton, FL: CRC Press, 1984.

Cyber Octet

**CYBER OCTET PRIVATE LIMITED**
D-109, Titanium City Center, Nr. Sachin Tower,
Prahlad Nagar Road, Satellite, Ahmedabad-380015.
Mobile : +91 98244 35293, +91 97268 96628
Email : info@cyberoctet.com

# Certificate of Accomplishment

This is to certify that Dr Dinesh HA professor, Dept. of CSE, NCET, Bangalore and Director Cybersena (R&D) India Private Limited has been associated with us as a Consultant and Investigating Officer from 12th May 2021 to 10th June 2021 for investigating the cyber-attacks of many UAE case. His collaboration helped us to take proper decisions to address while addressing cyber-attacks and Ransomware attacks. His proficiency on cyber security, forensic investigation, vulnerability assessment and penetration testing are highly appreciable.

Cyber Octet Pvt. Ltd. AHMEDABAD

**CHRIST (Deemed to be University)**
**School of Engineering and Technology**
**Kanminike, Kumbalagudu Post, Mysuru Road, Bengaluru – 560074.**

# ATTENDANCE CERTIFICATE

This is to certify that Dr Dinesh H A of Nagarjuna College of Engineering and Technology has conducted Dissertation Phase-II lab with subject code MTCS48 3 for Fourth Semester M.Tech End Semester Practical Examinations at School of Engineering and Technology, CHRIST (Deemed to be University) from 8/6/ 21 to 8/6/21.

Total number of days 1 and batches 1.

Date: 8th June 2021

For Controller of Examinations

CHRIST (Deemed to be University),Bengaluru – 560074.

भारत सरकार
दूर संचार तथा सूचना प्रौद्योगिकी मंत्रालय
राष्ट्रीय सूचना विज्ञान केंद्र बेलगाम
जिल्ला कंपूटर केंद्र
तालूका पंचायत भवन डी. सी. कॅम्पाउन्ड
बेलगाम - ५९०००१

सत्यमेव जयते

Government of India
Ministary of Communication Information Technology
**National Informatics Centre**
District Computer Centre
B.D.O. Building, D. C. Compound
Belgaum - 590001
✆ : 2452507 , 2424700

Date : 14-06-2021

# CERTIFICATE

This is to certify that Dr Dinesha H A. Director Cybersena (R&D) India Private Limited, Shreenagar Belagavi - 590016, ~~He~~ is working as technical person for COVID 19 at NATIONAL INFORMATICS CENTRE, Taluk Panchayat Office, DC office compound, Belagavi since 3/05/2021. This certificate is issued on his request for vaccination purpose for FLW/Priority group and Emergency Travel.

(S.R. Kshirasagar)
Senior Technical Director

EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

(Affiliated to VTU, Karnataka)

Jnana Prabha, East Point Campus,Virgo Nagar Post, Avalahalli, Bengaluru-49, Karnataka

## Department of Information Science and Engineering

# *CERTIFICATE OF APPRECIATION*

**DR . DINESHA . H.A**

Professor and HOD, Dept. of CSE,Nagarjuna College Engineering and Technology, Bengaluru

Director,

Cybersena(R&D) , India Private Limited.562110

In recognition of his significant contribution as Keynote Speaker for National Conference on **"Engineering Innovations in Emerging Technologies"** conducted by the Department of Information Science and Engineering at East Point College of Engineering and Technology, Bengaluru-49 on 19th July 2021. Your willingness, enthusiasm, dedication and devotion contributed towards the success of the National Conference is highly appreciated.

Thank you for the pearls of your wisdom that will shine in our minds forever

Prof. Kemparaju N.
Professor & Head
Dept. of ISE, EPCET

Dr. T K Sateesh
Principal
EPCET

**Dr.Dinesha H.A.B.E., M.Tech., Ph.D.,MISTE,AMIE,MIEEE.,**
**©: +91-7767076988 /9113660060**
**✉ : dineshameet@gmail.com / sridini@gmail.com**

**About 13 Years of Experience with Ph.D. in prime areas of Computer Science and Engineering**

## Objectives

- To achieve best in research, teaching and innovations through a continuous learning and dedication for attaining the growth of organization. To contribute to societal growth by transferring the knowledge, discipline, IT skills into implementable IT Innovations.

## Professional Experience ($10^{T}+2^{2R}+1^{I}$=13 Years) Summary

- Worked as **Associate Professor and H.O.D. Computer Science and Engineering**, S.G. Balekundri Institute of Technology, Belagavi-10. Since **29th July 2019 to 27th April 2021**. Take The Lead dept. towards all academic and accreditation process, guiding cyber forensic and robotics projects (VTU and KCTU), given consultation to govt. of Karnataka Bi-Eelection 2019-20. Have been guiding for 4 Ph.D. scholars at VTU, one submitted thesis. Have been Contributing to ISO, NAAC and NBA preparation. NBA Prequalified and SAR submission completed. Projects fund received for KSCST and VTU FOSS under my supervision. Contributed to get increase intake from 60 to 120 and VTU Ph.D Research Center approval. **Incorporated Cybersena (R&D) India Private Limited on 30th January 2020 as a Founder.** It is a Pvt. India limited startup initiative**, s**tarted a on **30th January 2020** for the research and investigations on cybercrime/cyberfraudster. It has been recognized by MSME, IISc.-Cyseck, startup Govt. of Karnataka and India. Cyber forensic investigation carried on data theft, fake emails, and social media profiles etc. Having MNC customers such as Grabanoid, Dubai and IDS, Belagavi to address their cyber security issues, more detail found in www.cybersenarnd.com.
- **Served as Assistant Professor and HOD of Dept. of Computer Science Engineering, SGB Institute of Technology,** Belagavi, Since 1st September 2015 to 1st July 2017. Worked on various roles and responsibilities such as heading the CSE department, faculty guidance and pedagogy, student's motivation and skill development, and intuition roadmap for accreditations etc. Taught key subjects like Information and Network security, cloud computing, and programming inc etc. Initiated many research and in-house software development and student innovative project activities. Worked to improve the overall CSE academic's process. Achieved successful guidance towards interdisciplinary UG project solutions for Ministry of Railway, Ministry of Food processing, and Ministry of Defense problem statements at AICTE Smart India Hackathon 2017.
- **Worked as Associate Professor, at Jain College of Engineering (JCE-JGI), Belagavi, 8thAugust-2017 to 29th July 2019.** Taught advanced subjects viz. Cryptography and Network Security, Cybercrime and Cyber law, Computer Network subjects for UG and PG. Initiated research on Cyber Forensic technologies, CSE Research center, and Startup R & D coordination. Achieved successful guidance

towards UG and PG projects which was live casted for Delhi Govt., Ministry of Information & Broadcasting (GOI) and Ministry of Defense (GOI) problem statements held at Bombay, Jaipur, and Bangalore respectively for AICTE Smart India Hackathon 2018.Assisted to Belgaum Smart city project as a tender evaluation technical expert. Worked on IT cell for Karnataka Election May-2018 and April 2019 as a social media monitoring committee member and cyber security expert. Working as a Visiting Professor in Department of Computer Science and IT in Jain University, JGI , Bangalore since **27th April 2021 to till date.**

- **Served as Officer In-Charge, Data Center, Dept. of Computer Science and Engineering, DIAT(DU), DRDO, Pune, 18thJuly 2013 to 31st August 2015.**Worked on many key and roles such as heading Data Center, training staffs, solving live cyber security issues, internet attacks, DRDO Gateway problems, website and email operations and its protection etc. Major role and responsibility taken to improve IT Infrastructure such as deployment for internet securities, mail services, web services, video conferencing, and virtual classroom. Contributed to enhance the IT Infrastructure by deploying VMware server virtualization where users are facilitated to get on demand VMs and its services. Achieved successful execution of more than **2 crores DRDO funded projects.**
- **Worked as Assistant Professor, Dept. of Information Science and Engineering, PESIT (PESU), Bangalore,17thMarch 2010to 17Th July 2013.** Worked on many roles to fulfill academic requirements. Trained students towards learning Advanced Java Programming, J2EE (JSP, SERVLETS, JMS etc), Cloud Computing and Security, IBM Rational Rose for UML in OOAD, Logic Design, UNIX System and operating system. Worked on inter disciplinary research and development for building student small satellites and robotics. I had excelled research exposure on Cloud Computing, Information Security and Small satellites (PISAT) at **PESU CORI R & D**. I had published 20+ research articles in national and international level across the world. Lead, small satellite OBC and Ground Station software development team. Achieved best publication records and awards on cloud computing security domain.
- **Served as Lecturer, Basava Academy of Engineering, Dept. of Computer Science and Engineering, Bangalore, 1stJuly 2009 to 16thMarch 2010. Role:** Worked on many academic roles such as teaching, examinations, practical conduction, project guidance and etc. Taught students towards learning programming in C, Logic Design, UNIX System, and operating system. Achieved 100% results in handled subjects.
- **Worked as Quality Assurance (R&D) Intern, VMWare Pvt. India Ltd. 7thJuly 2008 to 30th June 2009.** Role: QA Tester. Experience in both Manual and Automation Testing on VM Ware Virtual Networking. Developed Automation scripts to Storage, Permission and Networking feature of V Sphere Client 4.0 using silk test tool 2006,2008**. Achieved 100% ATLAS test results in test automation.**

## Academic Qualifications

- **Awarded Ph.D. in Faculty of Computer and Information Sciences at VTU-RRC,** Belagavi-14, Duration **10th October 2012 to 21st September 2017.** Submitted on 7th June 2016 and Accepted on **20th July 2016,** thesis entitled with "Design and Development of Techniques for Secure Cloud Service", under the guidance of **Dr. D. H. Rao**, Former Dean VTU, Belagavi and initial phase supervision of Dr.V.K. Agrawal, Director CORI R & D, PESIT. Successfully completed Viva on 23rd August 2017 (Delayed Due to VC recruitment process was ON). Received Ph.D. PDC on 28th September 2017 (w.e.f. 21st September 2017 EC meeting). Final degree certificate felicitated during 17th VTU Convocation held on 9th January 2018.
- **Achieved M.TECH. in Software Engineering**, **R.V. College of Engineering (VTU), Bangalore,** During **August 2007 to July 2009**.
- **Graduated B.E. in Information Science at Malnad College of Engineering (VTU), Hassan**, **During June 2004 to July 2007**.
- **Earned DIPLOMA in Computer Science at Smt. L.V. (GOVT) Polytechnic, Hassan**, from Board of Technical Education During June 2001 to May 2004.
- **Finished SSLC at S.G.S High School, Hagare**, from Karnataka Secondary Education Examination Board in May 2001.

## Awards

- Received InSc Research Excellence and Young achiever-2020 award by institution of scholars for attaining highest citation in IEEE publications done in 2012.
- Received Global Teaching Excellence Awards 2021 for contributing student development, virtual ceremony held on 27th December 2020.
- Received Best Paper Award, for the presentation on "Wireless Sensor-Cloud Integration Using Ant Colony Routing Algorithm", International Conference on cloud computing and service engineering (CLUSE2012), R. Monica, Dinesha H A, V.K Agrawal, held at Raja Rajeshwari College of Engineering & KINGSTON, UK, 11-13 April 2012, 294-298, Referred to ISEEC Journal.

## Membership and Recognition

- Member of Institute of Electrical and Electronics Engineers ( **MIEEE)**
- Member Computer Society of India – 2020.
- Associate Member of Institution of Engineer (**AMIE**)
- Life Time Member of Indian Society for Technical Education **(MISTE)**
- Member of **(IACSIT)**International Association of Computer Science and Information Technology
- Board of Studies (BOS) Member of M.C.E, Hassan, since-2011.
- Member in Institute for Computer Sciences, Social Informatics and Telecommunications Engineering (**MICST**).

- Associate Member of Universal Association of Computer and Electronics Engineers-(AMUACEE) **AM1004805**
- Member of Michigan Association for Computer Users in Learning (**MACUL**).
- Member of (IAEng) International Association for the Engineers and the Computer Scientists (**MIAEngg).**
- Associate Member of IRED - Institute of Research Engineers and Doctors (**AMRED**)
- Senior Member of International Association of Engineers and Scientists (**MIAES**).
- Member in European Alliance for Innovation (**MEAI**)
- Member of Computer Science Teacher Association (**MCSTA**)
- Member of Cloud Computing Association (**MCCA**).

## Research Patents Filled/Published

- Invention Titled: Snake intrusion detection system empowered with Artificial Intelligence, Field of Invention: Management of Safety using Computer Science, Patent filed successfully with Application No.202111017097, Date of Filing: 12/04/2021 19:49:40
- Invention Titled "Alerting System for Identification of Public without Mask", Application Number: 202141020021, Date of Filing: 01/05/2021 12:49:53, published on 07-05-2021.
- Invention Titled - "A Novel Model for Work Life Balance and Methods Thereof", Application No.202041043056, filed on 03/10/2020 has been published ON 09/10/2020, The Patent Office Journal No. 41/2020 Dated 09/10/2020 52484.
- Invention Titled - "Shabdkosh Device for Women Safety In Public", filled at 09/10/2020 22:17:13, with Application Number 202041044161 published on 16/10/2020.
- Invention Titled "Automated Location Identification System Using Text and Image Data" filled on 12/01/2021, Australian patent with application number 2021100154. It has been granted and awarded on March 31 2021.

## International Journal Publications

[1] Prof.Sagargouda S Patil, **Dr.Dinesha H A ,** "Survey of Cyber Crime affecting Global era of Digitalization with Cyber Forensics & Cyber Security perspective" , Journal of Huazhong University of Science and Technology ISSN-1671-4512,scopus indexed, Q3 Journal, Vol 50, Issue 3, page1-9, March 2021.

[2] Parutagouda.S. Khanagoudar, Dr. G.M. Patil and Dr.Dinesha H.A. "Security aware routing protocol for WMNs using Hybrid Meta-Heuristic Techniques", in Journal of Huazhong University of Science and Technology, Volume 50, Issue 02, February-2021.

[3] Kalyan D. Bamane, Dr. Dinesha H.A , Development and Design of Cloud Customer Services Usage Pattern based attack Detection with Encase tool 7.0 Forensic Investigation for enabling quick reporting and recovery of cloud data, IInt. J. of Electronic Security and Digital Forensics,Peer Reviewed , Elseviewer scopus Journal, 2020, IJESDF-67549, 3912-3916 ,Cleared plagiarism and in review process.

[4] Mr.Kalyan D.Bamane and **Dinesh H.A.,** "Design and Analysis of Multisource Logs Forensic with Lock

Technique for Cloud Security Enhancement, International Journal of Innovative Technology and Exploring Engineering", Scopus Indexed,2019.

[5] Mr.Kalyan D.Bamane and **Dinesh H.A**., "A Study of Cloud Forensics: Technical Issues, Challenges, Tools and Technologies", International Journal on Emerging Trends in Technology (IJETT), 2019

[6] Mr.Kalyan D.Bamane and **Dinesh H.A.** "A Review on Cyber Forensic and its tools", Volume 5, Issue 3 www.ijrar.org (E-ISSN 2348-1269, P- ISSN 2349-5138), 2019,1-8.

[7] Ms. Supriya Manglekar, **Dinesha H.A.,** Block Chain: An Innovative Research Area, 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), 978-1-5386-5257-2/18/$31.00 ©2018 IEEE,1-4.

[8] P.S. Joshi and **Dinesh H.A.** "Study Report of existing forensic tools and technologies to identify Darknet", International Journal of Computer Sciences and Engineering, Vol.-6, Issue-10, Oct 2018 E-ISSN: 2347-2693

[9] Prof.Sagargouda S Patil, Dr.Shweta goudar, ***Dr.Dinesha H A,***Dr.Shivaleela Arlimatti ," Designing Efficient Technique For Secured Data Aggregation In Cluster Based Wireless Sensor Network", (Submitted).

[10] Praveen Y. Chitti, **Dinesha H.A.,** K.Prabhushetty, "Investigation of Image Forensic Techniques to Determine Faked Images", World Journal of Technology, Engineering and Research, Volume 2, Issue 1 (2017) 414-420, December 2017, received best paper award in technology development.

[11] Prof Sagargouda S.Patil, Dr Dinesha H.A. " Secure Cyber Forensic Frameworks For Internet Of Things" is Published in IJEAST | Volume 5, Issue 1 May 2020 | ISSN: 2455-2143

[12] Prof.Sagargouda S Patil, Dr.Piyush Kumar Pareek, ***Dr.Dinesha H A,***Dr.ShivaleelaArlimatti ," Review Of Relay Selection Techniques In Multi-Hop Wireless Sensor Network With IOT", International Journal of Creative Research Thoughts(IJCRT), Volume 5, Issue 4 November 2017 | ISSN: 2320-2882, 846-850.

[13] SagargoudaS.Patil, ***Dinesha H A***, Ekta Badiger, "Android Based Conference Hall Booking And Reservation System**",** International Journal of Advanced Research (IJAR),18970, August 2017.

[14] SagargoudaS.Patil, ***Dinesha H A,*** Mahesh, H, "Train Wagon Weighing And Number Tracking System", **ELSEVIER,** International Journal of emerging trends in engineering and development,(IJETED) ISSN 2249-614, ISSUE 7, VOL. 4, July 2017.

[15] ***DineshaH.A,***D.H.Rao, "Evaluation of Secure Cloud Transmission Protocol", International Journal of Computer Network and Information Security(IJCNIS), Vol.9, No.3, pp. 45-53, 2017.DOI:10.5815, March 2017.

[16] ***Dinesha H.A,*** D. H. Rao, "Improved Secure Cloud Transmission Protocol", International Journal on Cloud Computing: Services and Architecture, Vol.7, No.1, pp 17-23, February 2017.

[17] SwetaPattar, ***Dinesha H.A,*** "Implementation of Home Automation through Internet of Things", Journal of Network Communications and Emerging Technologies, Volume 6, Issue 12, December (2016), p.p 1-6.

[18] ***Dinesha H.A,*** Dr. V. K Agrawal, "Development of Secure Cloud Transmission Protocol (SeCTP) Engineering Phases: Multilevel Security and Cryptography", International Journal on Cryptography and Information Security, Vol. 5, No. 3/4, ISSN: 1839-8626, December 2015.

[19] ***Dinesha H A***, Dr.V.K Agrawal, "Multilevel Cryptography with Metadata and Lock Approach for Storing Data in Cloud", Transactions on Networks and Communications, Volume 2, Issue 6, 10.14738/tnc.26.591.Dec 2014, 48-56.

[20] ***Dinesha H A,***Dr.V.K Agrawal, "Usage Profile Based Intruder Detection System for accessing cloud service", Transactions on Networks and Communications, Volume 2, Issue 6, 10.14738/tnc.26.590.Dec 2014, 13-27.

[21] ***Dinesha H A,***"Achieving Data Centre Efficacy through Virtualization Technology", Defence Institute Advanced Technology (DIAT), DRDO, Ministry of Defence, Govt of India, Girinagar, Pune 411025 India, submitted in July-2014, 1-9, Selected to DIAT JOURNAL: A Journal devoted to Science and Technology in Defence.

[22] ***Dinesha H A,*** Poonam , Rakesh R, Sourabh V Savanur and V.K Agrawal, "Smoothing up the Research Proposal Submission through Research Proposal Generation Tool", International Journal of Innovative Research in Computer and Communication Engineering,Volume 1, Issue 10, 2320 – 9801, December 2013.

[23] ***Dinesha H A***, Dr.V.K Agrawal, "Test case generation for On Board Computer Software Major Components", International Journal of Advanced Computer Research,2277-7970 Volume-3 Number-4 Issue-13 December-2013, 58-62.

[24] ***Dinesha H A***, Dr.V.K Agrawal, "Test case generation for student satellite software", International Journal of Technology Enhancements and Emerging Engineering Research, VOL 1, ISSUE 5 20 ISSN 2347-4289,December 2013,20-24.

[25] ***Dinesha H.A,*** H.N. Bhagavan, Dr.V.K Agrawal, "Design of Component Based Software for Telemetry, Tracking and Commanding operations of Nano Satellite",International Journal of Tech. Enhancements and Emerging Engineering Research,VOL 1, ISSUE 5 29, ISSN 2347-4289,Dec. 2013, 29-35.

[26] ***Dinesha H A,***Dr.V.K Agrawal, **"**Designof telemetry in Student Imaging Satellite", International Journal of Innovative Research in Computer and Communication Engineering,Vol. 1, Issue 9, November 2013, ISSN (Online): 2320-9801, 2075-2081.

[27] Sumathi M, Sharvani G.S, ***Dinesha H A***, "Implementation of multifactor authenticationsystem for accessing cloud service", International Journal of Scientific and Research PublicationsIJSRP Volume 3 Issue 6 June 2013,1-8.

[28] Manu A R, ***Dinesha H A***, Manoj Kumar M, "An Approach to Enhance Security of Cloud Computing Services using Software Engineering Model", International Journal of Computer Applications (0975 – 8887)Volume 67,No.11, April 2013, 23-30.

[29] ***Dinesha H A***, V. K Agrawal, "Framework Design of Secure Cloud Transmission Protocol", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 1, No 1, January 2013, ISSN (Print):

1694- 0784 | ISSN (Online): 1694-0814,74-81.

[30] ***Dinesha H A***, V. K Agrawal, "Multi-dimensional Password Generation Technique for accessing cloud services", Special Issue on: "Cloud Computing and Web Services", International Journal on Cloud Computing: Services and Architecture, Vol.2, No.3, June 2012, 31-39.

[31] ***Dinesha H A***, R Monica and V.K. Agrawal, "Formal Modeling for Multi-Level Authentication in Sensor-Cloud Integration System", International Journal of Applied Information Systems 2(3) (IJAIS) Published by Foundation of Computer Science, New York, USA, May 2012, 16-21.

[32] Mr.G.Raman Gouda, ***Dinesha H A***, V.K Agrawal and R. Suguna, "Simplified Scheme for Data Acquisition in Student Imaging Satellite", International Journal of Scientific & Engineering Research, Volume 3, Issue 3, March-2012, ISSN 2229-5518,1-6.

[33] ***Dinesha H A***, V. K Agrawal, "Advanced Technologies and Tools for Indian Rural School Education System", International Journal of Computer Applications (IJCA) (0975 – 8887) Volume 36– No.10, December 2011, 54-60.

## International Conference Publications

[34] Kalyan D. Bamane, Dr. Dinesha H.A, Encase tool Forensic Investigation : Enhancement in development of Cloud Customer Services Usage Pattern based attack Detection and log security with lock for enabling quick reporting and recovery of cloud data 8th ICRAIR 2021,In process, Paper Accepted.

[35] Kalyan D. Bamane, Dr. Dinesha H.A, Development of Multisource Cloud Logs Forensic with encase Tool for performing Lock Technique using Deep Analysis and Reporting, ICCIDS 2021 Peer Reviewed, Elsevier Scopus Journal, 2020,Best Paper Award, Accepted and will be published in Elsevier

[36] P.S. Joshi and ***Dinesh H.A.*** "Survey on Identification of Malicious Activities by Monitoring Darknet Access", Third International Conference on Smart Systems and Inventive Technology (ICSSIT), Aug 2020.

[37] SupriyaManglekar, ***Dr.DineshaH.A***", Block Chain: An Innovative Research Area", 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), 978-1-5386-5257-2/18/$31.00 ©2018 IEEE.

[38] Manu A.R, ***Dr. Dinesha H.A.,*** "A Comparative Case study on: influence of scope creep on multilateral cloud computing mission success: linking conventional approach versus agile approach.", IEEE Cloud Computing, CCM-2017-06-0072.

[39] Manu A R, Manojkumar M Kumar, ***Dinesha H.A***, "An Ameliorated Design of Software Testing Methodology using Reverse Engineering", Joint International Conference ICPCIT 2016 and ICICA 2016 held at D. Y. Patil college of engineering, akurdi, pune-44, referred to Scopus indexed journal.

[40] R Monica, ***Dinesha H.A***, V.K Agrawal, "Cloud Computing – Phone Call as a Service: A Concept", IEEE International Conference on Advances in Computing, Communications and Informatics (ICACCI-2013), 978-1-4799-2432-5, 13861185, 22-25 Aug. 2013, 236 – 242.

[41] R. Monica, ***Dinesha H A,*** V.K Agrawal, "Wireless Sensor-Cloud Integration Using Ant Colony Routing

Algorithm", International Conference on cloud computing and service engineering (CLUSE2012), held at Raja Rajeshwari College of Engineering & KINGSTON, UK, 11-13 April 2012, 294-298, Received Best Paper Award, Referred to ISEEC Journal.

[42] ***Dinesha H A***, V.K.Agrawal, "Multi-level Authentication Technique for Accessing Cloud Services", IEEE International Conference on Computing, Communication and Applications (ICCCA-2012), Dindigul, Tamilnadu, India, 22-24 February 2012, 978-1-4673-0270-8, 1 – 4.

[43] Abhishek A, ***Dinesha H A***, V. K Agrawal, "Cloud Computing Technologies in Indian Rural Schools and Engineering College Education " ,International conference on Intelligent computational systems (ICICS's2012), Dubai, January7-8, 2012, 67-70.

[44] ***Dinesha H A***, V. K Agrawal,"Virtualization Technologies and Techniques in Education Learning Applications ", International Conference on e-Education and e-Learning ICEEEL, held at World Academy of Science, Engineering and Technology, PARIS-FRANCE on November 14-16, 2011, 984-991.

## National Conference Publications & Reports

[45] Dr.Dinesha H.A., "Ancient science and technology: An origin of recent research, innovation and invention", Invited talk and Research paper, 1st national conference on "recent trends in science and technology" held at SGMCOE, Maharashtra,, Page No. 30-31.

[46] Prof Sagargouda S Patil, Dr.Dinesha H A, "Iot Based Vehicle Tracking and Alcoholic Detection System", Proceedings of the 48th ISTE National Annual Faculty Convention - 2019 on "Technical Education for Smart Society" held at VTU Belagavi, Page.No. 122-130.

[47] Sana, Sahar, ***Dinesha H A,*** "Low cost asset tracking system", National Level Smart India Hackathon Coding for Ministry of Defence, Govt. of India, held at Bangalore SVCE, March 2017.

[48] Satyamurthy G, Vinayak Indulkar, ***Dinesha H A***, "App to connect farmers directly with retailers and Food Processing industries", National Level Smart India Hackathon Coding for Ministry of Food Processing, Govt. of India, held at Panjab, March 2017.

[49] Pooja S Hirekodi, ***Dinesha H A***, "Review On Data Mining Techniques And it's Applications", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,125, ISBN No. 978-93-5254-015-0.

[50] ***Dinesha H A***, V.K Agrawal," Secure Cloud Transmission Protocol for Cloud Novel Mobile As A Service: A Cloud Phone and Cloud SIM : A Make In India ", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,125, ISBN No. 978-93-5254-015-0.

[51] Deepali Gomanche,Shubangi,***Dinesha H A***, "Syntax Directed Translation to Evaluate Algorithms in Different Languages", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,124, ISBN No. 978-93-5254-015-0.

[52] Neha Betageri,ManaliKamkar, ***Dinesha H A***, "Survey on Applications of Cloud Computing Technologies", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,124, ISBN No. 978-93-5254-015-0.

[53] Divya. S .Salimath, Kavya M. P,***Dinesha H A***, "Virtual SIM(Soft-SIM): An Novel Idea for Startup", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,122, ISBN No. 978-93-5254-015-0.

[54] Kangana ,***Dinesha H.A***, "Investigation on Wireless Sensor Network for Sensor Node Power Management and Security",National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,119, ISBNNo978-93-5254-015-0.

[55] Ashok K Patil,S.S.Patil, M Prabhakar, ***Dinesha H . A***, "Investigation on Data Mining of Biological Networks of Some Special Species", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,118, ISBN No. 978-93-5254-015-0.

[56] Sriraksha R Bhat, KomalShah ,***Dinesha H A***, " Investigation on Challenges and Effects of Software Defined Networking", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,117, ISBN No. 978-93-5254-015-0.

[57] Sabeeya Sultana, Spoorthy Kulkarni,***Dinesha H.A***,"Effectuation of Service-oriented architecture in wireless sensor networks", National Conference on Make In India, held at SGBIT, Belagavi, in February 5-6, 2016,117,118, ISBN No. 978-93-5254-015-0.

[58] ***Dinesha H A***, Reports on “Improved Energy Efficiency in University Data Centre”, Defence Institute Advanced Technology (DIAT), DRDO, Ministry of Defence, Govt of India, Girinagar, Pune 411025 India, February-2014,1-5.

[59] ***Dinesha H A***, G N Srinivasan, “Automation on Networking in VMware Infrastructure, National Level Student Technical paper presentation heldat S.J.B.I.T Bangalore in 2009.

## Research Portal details

[1]. Dinesha H A https://orcid.org/0000-0003-4668-7322 orchid email id : sridini@gmail.com

[2] DBLP H. A. Dinesha: https://dblp.org/pid/138/1548

[3] Google scholar Dinesha H A , https://scholar.google.co.in/citations?hl=en&user=QgHFPxcAAAAJ

[4] Research Gate; https://www.researchgate.net/profile/Dinesha_Annappaiah

[5] Linkedin : linkedin.com/in/dr-dinesha-h-a-b912a241

## Research & Technical Consultation

- Reviewed research presentation as a session chair for the SGBIT international E-conference on Application of intelligent computing, ICAIC-2020 held at SGBIT Belgavi on 28th Nov 2020
- Reviewed research presentation as a session chair for the IEEE international E-conference on emerging technology (INCET-2020), 5-7 June 2020, held at JCE, Belagavi.
- Presented Network Forensic technical talk in The Hackers Meet up India held on 19$^{th}$ July 2020.
- Technical Member of Management Information System and Information Technology Team for COVID-19, Belagavi.
- Tender Evaluation Committee member of Smart city Belagavi in June 2018
- Member of media monitoring committee of election during 2018 and 2019
- Analyst for cyber-crime cases in Belagavi.

## Research Project Completed /Submitted

- Received KSCST grant of Rs. 3000/- for the student project which I supervised.
- Received VTU FOSS project grant of Rs. 5000/- for the student project which I supervised.
- Submitted proposal on "Infrastructure Setup for Digital Forensic R&D Lab" of Rs.50,00,000/- to Karnataka Council for Technological Up gradation (KCTU) in September 2017 (Approved).
- Submitted proposal on "Investigation of Cyber Attacks Using Cyber Forensic Tools and Technologies" of Rs. 4,25,000/- to Vision Group on Science and Technology under RGS/F scheme in November 2017 (Under process).
- Received grant of Rs. 1, 50,000/- AICTE travel allowance for SMART INDIA HACHATHON 2017, for the 5 projects selected under my guidance and as a SPOC.
- Completed "Virtual Classroom and Video Conferencing setup" at DIAT-DRDO, Pune for Rs. 85, 24,019, completed in 2015 (6 Months).
- Completed "Server Virtualization and SAN" project at DIAT-DRDO, Pune for Rs: 47, 16,900, completed in 2014 (1 year).
- Completed "Unified Threat Management Device "project at DIAT-DRDO, Pune Rs 8, 67, 644/- completed in July-2013 (3 Months).
- Executed and submitted technical report on "Study on Pitfalls of Cloud Computing Security" to GE India in 2012.
- Dinesha H A , Dr. V. K Agrawal submitted Proposal on "Investigation of cryptography & data security algorithms for cloud computing data storage technique" Rs. 14 Lakhs to Department of Science & Technology, INDIA in 2011.
- Dinesha H A, Dr. V. K Agrawal submitted Proposal on "Software Architectures for Cloud Based Applications" Rs. 2 Lakhs to University Grant Commission, INDIA, in 2011.
-

## P.G. & Ph.D. Research Students Details

- Prof. K.D. Bamane bearing USN 5VW16PEJ70 submitted thesis at VTU RRC.
- Prof Vinod Desai bearing USN 2JI17PEA02 completed Ph.D. comprehensive viva at SGBIT RC.
- Prof. P.S. Khangoudar bearing USN 5VY16PEJ07 completed Ph.D Comprehensive viva, OS1,OS2 at VTU RRC
- Prof. Sagargouda Patil bearing USN 2JI18PCS02 completed Ph.D. Comprehensive viva at JCE-VTU, Belagavi.
- Prof. Preethi D. Kulkarni (P.S.Joshi) bearing 2JI19PCS03 completed Ph.D. course work at JCE.
- Prof. S. M. Manglekar (ETR186776) qualified VTU Ph.D. entrance.
- *Ms. Monica Ravishankar completed her master thesis in 2012.*
- *Mr. Ramangouda Patil completed his M.Tech thesis in 2013.*
- *Mrs. Sumathi M. completed her M.Tech thesis in 2013.*

## Training, Conferences, Committee, and Technical Talk Participated/Coordinated

- Demonstrated through Webinar on "cyber security and forensic" held for DSAT&M, Bangalore on 27th April 2021.
- Trained Group B officer on "cyber security and defense techniques", held on 23rd March 2021 at Belagavi, GCTE.
- Trained Group 'A' Officers on "cyber security, cyber hygiene, and How to handle cybercrime" , 24th February 2021 held at DTI , Belagavi.
- KSRP Training held on "cyber security principles to safeguard from cybercrime / cyberfrauds", held at KSRP Belagavi on 27th Febrauary 2021.
- TV9 interview on cryptocurrencies impact in national economy and society held on 16th February 2021. The foundation Technologies and probable cybercrime / cyber frauds through these virtual currencies have been discussed.
- Demonstrated through online "cyber security attacks and forensic investigations" , on 2nd feb 2021 to pg students of Melbourne Institute of Technology , Melbourne and Sydney, Australia.
- Undergone AICTE sponsored STTP "Awareness for intellectual property rights for engineers and industrialists" , held in SGBIT, Belagavi during 21-12-2020 to 26-12-2020.
- During Covid-19 First wave, Delivered many webinars on cybercrime, cyber law, cyber forensic , cyber investigation and cyber security in Reva University, East west college of engineering, Country club Belagavi, IE Belagavi and AIT Belagavi in 2020.
- Invited talk on "Ancient science and technology: An origin of recent research, innovation and invention", 1st national conference on "recent trends in science and technology" held at SGMCOE, Maharashtra,, Page No. 30-31
- Technical paper evaluation as a Jury in HIT Nodasoshi 11th National Level Technical competition, Quest, March 2019.
- Marketing and technical paper scrutiny as a Jury in JCE MBA during March 2019.
- Advisory member in PCCE, Goa college affiliation visit during in March 2019.
- Presented expert talk on research avenues in FDP held in SIT, Ichalkaranji Nov-18,
- Participated CISCO-RVCE IOT workshops as experts talk which held in SCET, Belagavi on Feb. 2018.
- Appointed as panel expert to scrutinize the smart city project proposal of Belagavi district in January 2018.
- Nominated for SKILL INDIA event on career opportunity and skillsas a panel moderator and expert which was held on 16th January 2018 conducted by Skill on Wheel, Ministry of Skill Development, Govt of India.
- Participated in National Cyber Defence Summit' 17 on 15th & 16th of Dec, 2017 at Birla Institute of Technology and Science (BITS) Goa Campus.
- Trained on "VTU Sponsored Faculty Development Program on Python Application Development" on November 25th and 26th 2017 held at JCE, Belagavi-14.
- Trained on 5 Days faculty development program on Android App Development conducted by Google, held at KLEIT, Hubli, July 2017.

- Trained on Turnitin plagiarism checker tool at DIAT (DU), Pune on February 4th 2015.
- Undergone for 3 days training on "RAILTEL internet setup" workshop held at RAILTEL Corporation, Gurgaon, New Delhi, in Nov 12-14 2014.
- Trained one-week DRDO-Information Security Awareness program held in IIIT, Delhi in June 30 - July 4, 2014.
- Trained one-week IBM Faculty Residency program on cyber security, organized by IBM, Bangalore during June 4-6 2014.
- 5 Days Trained on MATLAB Fundamentals and SIMLINK from MATHWORK technologies which held in DIAT-DRDO April- 21 – 25 2014.
- Undergone 7 Days training on Virtualization Technologies and Techniques held in DRDO-DIAT from HCL Virtualization Team in 4th – 12th February 2014.
- Trained on "Research Methodologies and Latex" from VTU E –Learning held in KSEEM Bangalore In February 20-22 2014.
- Tutorials on Virtualization & Cloud Computing tutorials in "ICEMC2 2011 Sixth Innovative Conference on Embedded Systems Mobile Communication and Computing" held at PESIT in 2011.
- Trained on Advanced Computer Architecture to Bangalore Institute of Technology M.Tech Computer Science Students in 2011.
- Trained on Cryptography and Network Security to Bangalore University MCA Students in 2011.
- Trained on Object Oriented Analysis & Design to Kuvempu University & Karnataka State Open University M. Sc Students in 2011.
- Undergone JAVA Training in VMware, Inc in 2009
- Undergone 'CCNA Exploration Version 4.0' training conducted by CISCO in Jun 13, 2011 to June 25, 2011.
- Coordinated Fourth International Conference on Security, Privacy, and Applied Cryptography Engineering (SPACE 2014) held at Defense Institute of Advanced Technology, Pune, India, 18th - 22nd October 2014.
- Attended workshop on Center of Excellence conducted by TEQUIP-SPFU which held in B.M.S.C.E in 28 November 2012.
- Attended session on "Space Engineering & Satellite Integration" held at CORI, PESIT in 30th Mar 2012.
- Attended session "On Board Computer Design and Development & Satellite Systems" held at CORI, PESIT in 10th June, 2011by Dr. M Anna DuraiProgram Director, IRS/ small satellite and Project Director Chandrayaan I/II.
- Attended work shop on Cloud Computing and Internet of Things held at NITK, Surathkal-during July 23-25th 2012.
- Attended work shop on FPGA BASED EMBEDDED SYSTEM DESIGN held at JSSATE, Bangalore. 03 Jan 2012.
- Attended Research Methodologies workshop held at PESIT Bangalore in May 3rd& 4th 2012.

- Attended Silicon India Cloud Developer Conference held at NIMHANS Convention Centre, Hosur Road, Near Diary Circle, Bangalore – 560029 in April 28th.
- Attended IEEE IISc Technical Writing one day workshop held at IISc Bangalore in March 16th 2012.
- Attended Cloud computing work shop held at BMS College of Engineering in 24th and 25th MARCH 2012.
- Attended v Seminar conducted by VMware Pvt. India Ltd in 2011
- Attended "Research Paper writing skills" which presented by HiPC in July 23, 2011
- Coordinated SANKALPA Student Innovative Idea Competition in February 25, 2012
- Coordinated "Entrepreneurship Awareness Drive" which is conducted by IIT Kharaghpur held at PES School of Engineering in 11 July 2011.
- Attended one-week work shop in "Probability and Statistics" which held in PESIT during 8th-11th June, 2010
- Attended two days FDP on Digital Media Processing at PESIT Bangalore in 2011
- Attended one-month work shop on "Random Process" which is conducting in PESIT in 2011
- Attended two-day workshop on "NS2" which held in PESIT in 9-10 August 2010
- Coordinated "Second International Conference on Multimedia and Content Based Image Retrieval (ICMCBIR-2010)" which will be held in PESIT Bangalore in 2010.
- Coordinated "ICEMC2 2010 Fifth Innovative Conference on Embedded Systems Mobile Communication and Computing" which will be held in PES Institute of Medical Sciences and Research
- Participation in International Conference held at R.V.C.E in 2007.

## Academic Project

**Ph.D Project #1**

Project Title : Design and Development of Techniques for Secure Cloud Service

Environment: Cloud IaaS, LAN , HTTP,JAVA, SERVLETS, JSP and Petrinet

Duration : 4 Year, during 2012-2016

**Description:** Objectives are to provide secured internet channel with effective multilevel and multidimensional authentication and authorization techniques. A multi-dimensional and multi-level authentication techniques has been developed for ensuring strong user authentication and authorization. Multilevel cryptography has been derived for cloud confidentiality.

**M.Tech Project #2**

Project Title : **Automation on 'Networking' in VMware Infrastructure**

Environment : Silk Test Tool 2006/2008, Racetrack, Virtual Center.

Duration : 1 Year, in 2009

**Description:** The main objectives of the project is to automate the functionalities of Creation, maintenance and management of the Virtual Network Components and its infrastructure like Virtual Switch, Virtual

machines and Virtual NIC Card's. Around 300 important functionalities of VI has automated using silk, after automation, tested the automated scripts in Unit, Sanity, Regression, GUI, FVT, Batch, ATLAS unattended testing. And triage the failures results in racetrack.

**B.E Project #3**

Project Title :**Intelligent Library Management System**

Duration : 1 Year, In 2007

Environment : Visual Basic 6.0.NET, Oracle 9i.

**Description:** The main objectives of the project is Email Notification to Student, Login and Lock the user, searching the book, Addition and Deletion of user, Add or Remove the Data Entry, Issue and Renewal, Procuring Demand Books, Banning Students, Help Screens, Data Reports. Currently it's running in M.C.E.

**Diploma Project #4**

Project Title : **Development of TM-TC Ground Station Software for Small Satellite**

Environment : Visual Basic 6.0.

Duration :1 Year in 2004

Description: The small-satellite is a low weight spin stabilized satellite with spin axis along with negative orbit normal. The On-Board-Computer (OBC) does the functions of attitude control, telemetry, tele-command and data acquisition. Attitude control includes functions like de-tumbling of initial rates, initial spin up, spin rate control (SRC) and Spin Axis Orientation control (SAOC).

## Personal Profile

Date of Birth : 20-07-1985

Gender : Male

Identity Proofs : PASSPORT, PAN CARD, ADHAR CARD, VOTER ID

Marital Status : Married

Children Details : Baby Girl Ms. Samruddhi M.D. 2 yrs

Spouse Details : Dr.Madhura MBBS, MD
Assistant Professor, KLE-JNMC,Belagavi.

Present Address : #S3, Moon Residency, Plot No.628, CTS No.8174, Sector 5, Shreenagar, Belagavi-590016
Hagare , At post, Madhihally Hobli, Belur Tq, Hassan - 573216

Languages Known : Kannada, English, and Hindi

## References

**Dr. D.H.Rao**
Professor, of Computer Science &Engg ,
Former Dean (Skills & Research Development) VTU,
At present Professor CSE and Dean (R & D)in CIT,
Bangalore
Email: dr.raodh@gmail.com
Phone: 09972040344

**Dr.Prahlada Ramrao,**
**Padmashri Awardee 2015**,
Former Vice Chancellor, DIAT(DU),
Distinguished Scientist, DRDO, Ministry of Defence, Govt. of India. Newdelhi,
prahlada.ramarao@gmail.com
Phone: 07760785666

All the above furnished information is true to the best of my knowledge**.**

**Dr. Dinesha H.A**

# HYBRID MOBILE APPLICATION DEVELOPMENT IN APPZILLON MADP

[1]Mrudulla A, [2]M Rajesh, [3]Aswathy A, [4]Bhagya M, [5]Yagnyadatta Bairiganjan,

[1,2,3]Student, [4]Associate Professor, [5]Project Leader,

[1,2,3,4,] Department of Computer Science & Engineering, [5]I-Exceed technology solutions Pvt. Ltd,

[1,2,3,4]Nagarjuna College of Engineering and Technology, Bengaluru – 562110, Karnataka, India,

[5]I-Exceed technology solutions Pvt. Ltd, Koramangala, Bengaluru -- 560034, Karnataka, India.

**Abstract:** In today's world there are more mobile users than desktop/laptop users. As mobile devices are integral part of today's life, it's safe to say that mobile apps have substantial effects in our daily life. Digital platform has soon become an integral part of every enterprise's DNA. Legacy systems are slowly transforming into efficient digital solutions and early adaptors stand to gain a lot in the digital race. So as building a good quality mobile app is important, you need a trusted and secured mobile application development platform to go with. Several factors come into the pictures while developing a mobile app; such as investment, time to market, better UI experience, availability of resources, and easy access to the development platform as major ones. There have been debates over native mobile apps vs. hybrid mobile apps, then again choosing a hybrid MADP seem to be more reasonable and profitable than a native MADP when you consider above reasons. Appzillon, the flagship product of I-exceed technology solution private limited, is a hybrid MADP, where you can build Omni-channel apps for smartphones, tablets, feature phones, desktops and laptops. Appzillon provides Microapp/Microservice architecture and low code visual design approach where developers code less and develop more functionalities in less time with less dependencies.

***Index Terms – Hybrid MADP (Mobile application development platform), Low Code, Microapp architecture, Omni-channel solution.***

## I. INTRODUCTION

Appzillon Development Platform is a unified app development environment to build omni-channel apps for smartphones, tablets, feature phones, desktops and laptops. It supports all leading mobile operating systems viz., Android and iOS as well as all leading browsers viz., Internet Explorer, Google Chrome, Mozilla Firefox, Apple Safari and Opera. Appzillon also supports Social Media channels. Its robust and state-of-the-art architecture facilitates a unified channel strategy. Appzillon Development Platform includes a world-class development environment that is built on open technologies and enables rapid development of end-to-end apps. The intuitive nature of the platform abstracts the technical complexities of app development from developers. Appzillon comprises a host of innovations that includes template based development approach and ability to build apps automatically using enterprise services that help in building and deploying cross-channel apps in the shortest possible time.

Appzillon offers the following business benefits to enterprises

1. Build apps that is simple to use, aesthetically pleasing and targeted towards high adoption & usage
2. Build apps that are functionally complete & market relevant
3. Provide uniform user experience across channels and allow users to opt for a device of their choice
4. Zero compromise on enterprise security
5. Mobilize the workforce with enterprise apps, leveraging existing internal systems & integration architecture
6. Identify & handle on-ground challenges associated with newer development models and infrastructure requirements
7. Future-proof mobility strategy to handle platform independence, upgrades & migrations
8. Minimize new skillset requirements and associated trainings.

## II. EXISTING SYSTEM

In the world of mobile app development, there are basically two types of apps.

- Native Apps
- Hybrid Apps

A lot has changed since we started building apps for mobile devices like iPhone 4s and Samsung galaxy with 4.5-inch screen. For an instance, developers didn't have to worry about responsive design, form factors and progressive design much as providers had single or similar resolution devices. Multiple providers have come with different types of devices with a range of resolutions now; Apple, itself has a range of devices like 4s, 5,5s, 6,7 ... etc. Native MADPs do provide features to accommodate the latest technology stack but as building a native app is expensive both in financially and technically, providers came up with a solution alternative to native app, called hybrid app. Basically, your minus out all the X factors that's there in native app development as discussed above. Hybrid app development has become more business and developer friendly. Let's talk a little more about these two.

# DESIGN AND IMPLEMENTATION OF HEART DISEASES PREDICTOR SYSTEM USING MACHINE LEARNING ALGORITHM OVER LIVE CLOUD INFRASTRUCTURE

[1] M V Manjunath, [2] K Jayaprakash Reddy, [3] I C S Siva Madhav, [4] Kiran A J, [5] Raghavendra B

[1,2,3,4]Student,[5] Assistant Professor,

[1,2,3,4,5]Department of Computer Science & Engineering,

[1,2,3,4,5]Nagarjuna College of Engineering and Technology, Bengaluru – 562110, Karnataka, India.

***Abstract :*** The Rampant increment in the heart stroke rate at young age, we have to set up a framework to ready to distinguish the manifestations of a heart stroke at a beginning time and along these lines forestall it. It is unreasonable for ordinary man to every now and again experience expensive tests like the ECG and in this way there should be a framework set up which is convenient and simultaneously meaningful, in foreseeing the odds of a heart diseases. Subsequently we reason to build up an application which can anticipate the failure of a heart diseases given fundamental side effects like age, sex and so on. The Machine Learning calculation neural systems has demonstrated to be the most exact and dependable calculation and henceforth utilized in the proposed framework.

***Index Terms*** **– Heart Diseases Predictor, Machine Learning, Neural Network Algorithm.**

## I. INTRODUCTION

The product item delivered is an application by name "Plan and Implementation of Heart Diseases Predictor framework utilizing Machine Learning Algorithms over Live Cloud Infrastructre". There is no lack records in regards to clinical side effects of patients enduring heart strokes. Anyway the potential they need to assist us with prognosticating comparable conceivable outcomes in apparently sound grown-ups are going unnoticied. For example , As pre the Indian Heart Association, half of heart stroke happen under 50 years old of 25% of all heart stroke under 40 years old of Indians. Urban populace is thrice as helpless against cardiovascular failures as provincial populace. We propose to gather a revelant information relating all components identified with our field of study, train the information according to the proposed calculation of AI and anticipate how solid is there a possibilityfor a patitent to get a heart sicknesses. Examination is the way toward breaking a mind boggling subject or substance into littler parts to increase a superior comprehension of it. Examiners in the field of designing see necessities, structures, components, and frameworks measurements. Examination is an exploratory action.

## II. EXISTING SYSTEM

All the specialists fill in as independent arrangement where the patitent or the end client needs to either truly send the wearable gadgets or access the arrangement in their own PC or versatile application. none of the arrangement are been made accessible over the cloud utilizing as-an administration model in this manner broadening the accessibility of the arrangement over the globe.

## III. PROPOSED SYSTEM

Right now propose to build up an application which can anticipate the helplessness of heart maladies give essential side effects like age , gender and so on the AI calculation neural systems has demonstrated to be the most exact and solid calculation and henceforth utilized in proposed framework. We propose to gather important information relating all components identified with our field of study, train the information according to the proposed calculation of AI and anticipate how solid is there a likelihood for a patient to get a coronary illness. Arrangements is been made accessible over the cloud utilizing as-an administration model in this way broadening the accessibility of the arrangement over the globe. It is Most exact and Simple and computationally light weight along these lines sparing time and server memory.

## IV. ARCHITECTURE

The Entire engineering has been executed in nine modules which we will find in significant level plan and low level structure.

### 1. Information Access Layer

Information get to layer is the one which uncovered all the potential procedure on the information base to the outside world. It will contain the DAO classes, DAO interfaces, POJOs, and utils as the inner segments. The various modules of this undertaking will speak with speak with the DAO layer for their information get to needs.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 11 | Nov 2019 www.irjet.net p-ISSN: 2395-0072

# A Survey on Predictive Analytics and Parallel Algorithms for Knowledge Extraction from Data Received through Various Satellites

**Bharani B R[1], Dr Gururaj Murtugudde[2]**

[1]*Assisstant Professor, Cambridge Institute of Technology, Bangalore, India.*
[2]*Prof & Head, Dept of CSE, Nagarjuna College of Engineering and Technology, Bangalore, India.*

---

**Abstract:-** *The remote sensing satellites produce large volumes of data that cannot be stored in standard relational databases every day. Many software components extract information in unstructured form from the raw data producing information such as pictures, log files, pdf user instructions, word etc. there is a need for developing efficient data mining algorithms to tag the datasets for facilitating efficient buildup of archival and retrieval. Advances in remote sensing instruments and technology are transforming the way satellite data is collected, managed and analyzed[1]. Recently, efforts have been directed towards knowledge extraction and analysis of satellite data[9]. However, the approach poses complex computational problem in terms of processing huge volume of varied form of data[8]. Still, many current and future satellite applications require the incorporation of Apache Spark and Hadoop Distributed File Systems(HDFS) technologies with real time processing capabilities. SQL database servers have traditionally held gigabytes of information. In the past 15 years, data warehouses and enterprise analytics expanded these volumes to terabytes. In the last five years, the distributed file systems that store big data now routinely house petabytes of information. This paper presents a comparative study of the data storage techniques and the different Apache tools used for data storage and the methodologies to incorporate them[7].*

***Key Words***: **Apache Spark, Apache Hadoop, Big Data, Remote Sensing, Knowledge Extraction**

## 1. INTRODUCTION

Big data is applied to information sets whose size or type goes beyond traditional relational databases' capacity to collect, handle and process low latency information. It has one or more of the following features - high volume, high speed, high range. Big data is available from sensors, computers, video/audio, networks, log files, transactional applications, internet and social media, much of it is produced in actual time and on a very big scale. These information is collected in extraordinarily growing databases that are complex to contain, form, store, handle, share, process, evaluate and visualize through typical software instruments for databases. Continuous high velocity data stream or offline high volume data to "Big Data" brings us to a new challenge[2]. Big data enables analysts, scientists and company users to make better and quiker choices using previously inaccessible or unusable information. Using sophisticated analytical methods such as text analysis, machine learning, predictive analytics, information mining, statistics and natural linguistic processing, companies can evaluate earlier untapped information sources independently or in conjunction with current business information to obtain new ideas resulting in considerably better and quicker choices. Predictive analytics is a collective word for methods intended to predict the future on the basis of static or historical information. Techniques will be used in the areas of statistics and machine learning. A predictive analysis engine or program of forecasting will comprise models of regression and/or machine learning neural networks. In predictive analysis, the concept of a model is crucial; the model determines the data based prediction. This model is constantly adapted, tuned, optimized and educated in accordance with the setting and changing user perspectives. The most effective prediction algorithms are kmeans, decision trees, rule based classifiers, deep learning and random forests. The data is aquired from satellites and collected in the base stations in the earth[1][3][4][5]. The received data is processed using the HDFS and Apache Spark tools. The processing of data involves cleaning the data and transforming the data in the required format. Then knowledge, patterns, trends are extracted from the processed data using machine learning algorithms[6][10]. The patterns and trends extracted are presented in the graphical form. This paper lists the different methodologies to process the data, different data sources for sourcing the data and machine learning algorithms.

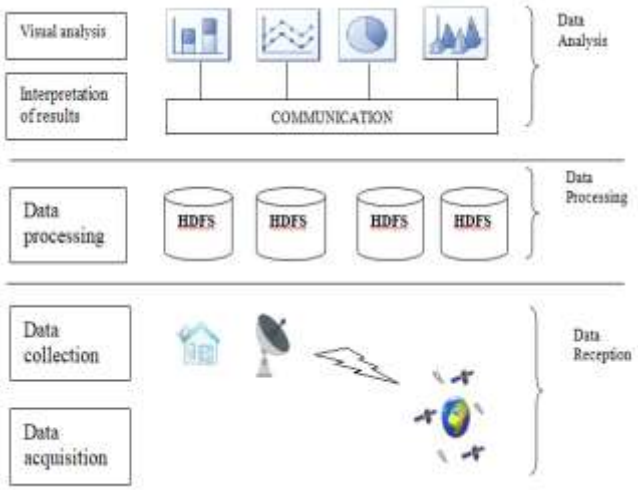
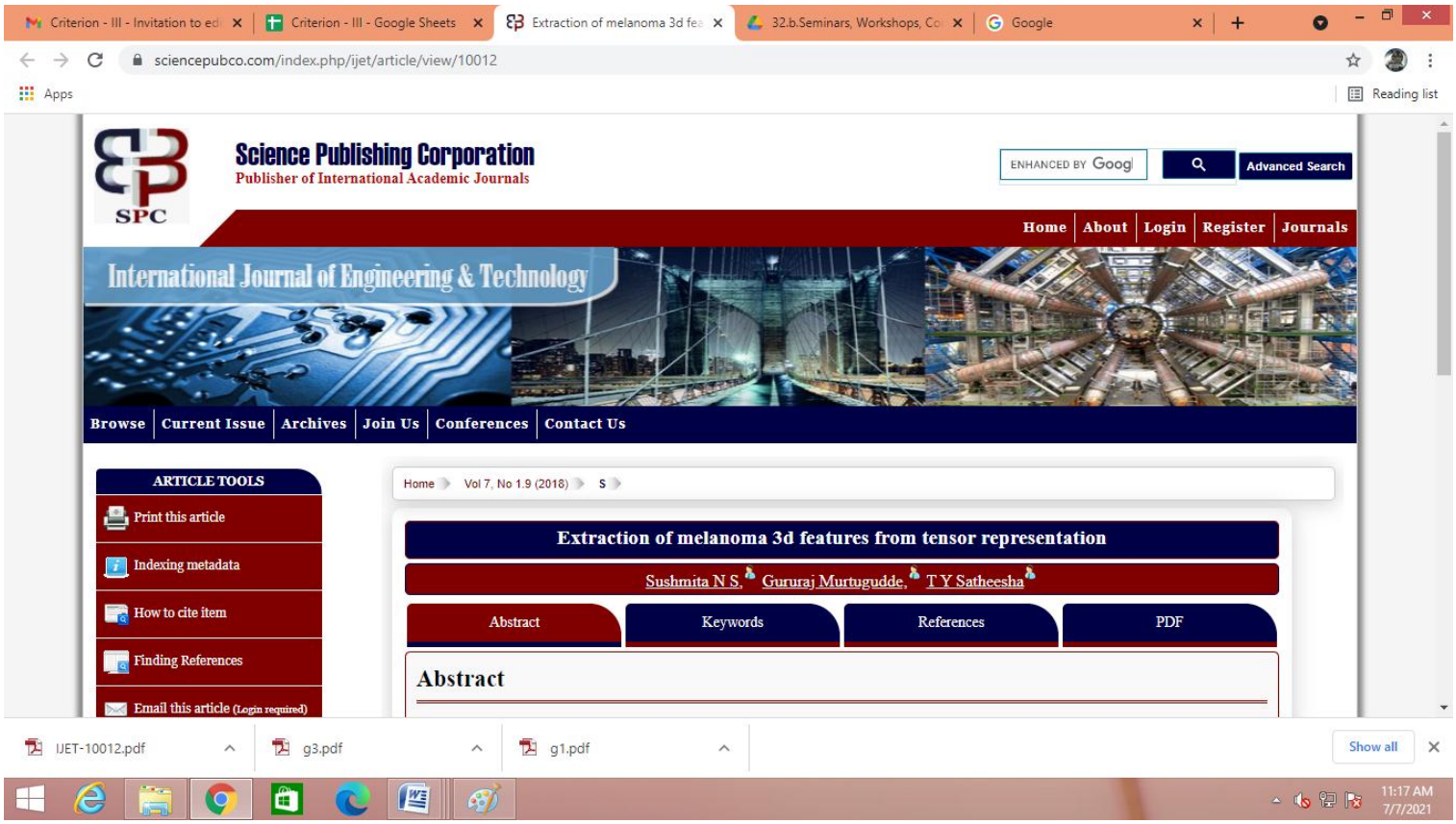



**Fig -1**: Satellite Data Processing


Criterion - III - Invitation to edi
Criterion - III - Google Sheets
Extraction of melanoma 3d fea
32.b.Seminars, Workshops, Co
Google
sciencepubco.com/index.php/ijet/article/view/10012
Apps
Reading list
Science Publishing Corporation
Publisher of International Academic Journals
SPC
ENHANCED BY Goog
Advanced Search
Home | About | Login | Register | Journals
International Journal of Engineering & Technology
Browse | Current Issue | Archives | Join Us | Conferences | Contact Us
ARTICLE TOOLS
Print this article
Indexing metadata
How to cite item
Finding References
Email this article (Login required)
Home Vol 7, No 1.9 (2018) S
Extraction of melanoma 3d features from tensor representation
Sushmita N S, Gururaj Murtugudde, T Y Satheesha
Abstract
Keywords
References
PDF
Abstract
IJET-10012.pdf
g3.pdf
g1.pdf
Show all
11:17 AM
7/7/2021

**International Journal of Pure and Applied Mathematics**
**Volume 118 No. 24 2018**
ISSN: 1314-3395 (on-line version)
**url:** http://www.acadpubl.eu/hub/
Special Issue

http://www.acadpubl.eu/hub/

# A Cloud Security with Performance Increase and Energy Efficient using AI with DCS and PDC

Mamatha C M, Dr. Gururaj Murthugudde
Research Scholar,Prof. and Head,
Dept. of CSE NCET,
Dept. of ISE SVCE,
Bengaluru
Karnataka, India
mamathacm.cm@gmail.com

May 23, 2018

**Abstract**

Now a day, the contents construction is changed dynamically according to a user's request, and has been widespreading across the sensor nodes. This paper proposes a technique to fast response to the dynamic content of various sensor nodes by the help of cache segmentation between server and the user, and describes the design of our proposed network cache system and provides security to Cluster nodes in Cloud in cloud by using Artificial Intelligence (AI) as a barrier where every data files goes inside cluster, it gets scanned by AI for viruses and makes data virus-free. The paper contains a new concept where Cluster of sensor nodes in cloud are energy efficient by last level cache (LLC), secured by AI, and performance is increased by using dynamic cache segmentation (DCS). It explains how AI actually safeguards Cluster of sensor nodes. Though AI is used for many purposes such as Gaming, Robotics etc., it is not yet used for Cluster of sensor nodes. In detail, the paper presents

Criterion - III - Invitatio | Criterion - III - Google S | 521.pdf | Solar Powered Smart A | 32.b.Seminars, Worksh | Google
jardcs.org/backissues/abstract.php?archiveid=5067
Apps
Reading list

JARDCS




# Solar Powered Smart Agricultural Practises using Multi-purpose Agribot

*Chethan C, Tejaswini N P, Gururaj Murtugudde

**Abstract:**

Agriculture plays a vital role in the economy of developing countries like India. Since the dawn of history agriculture has been one of the significant earnings of producing food for human utilization. The field of agriculture involves various operations that require handling of heavy materials. For example, in manual ploughing, harvesting etc., these operations are repetitive, or require strength and skill for the workers. In this [illegible]le that will be able to plough the land, sow the seeds, water the crops, level the

Sign In

Username

Password

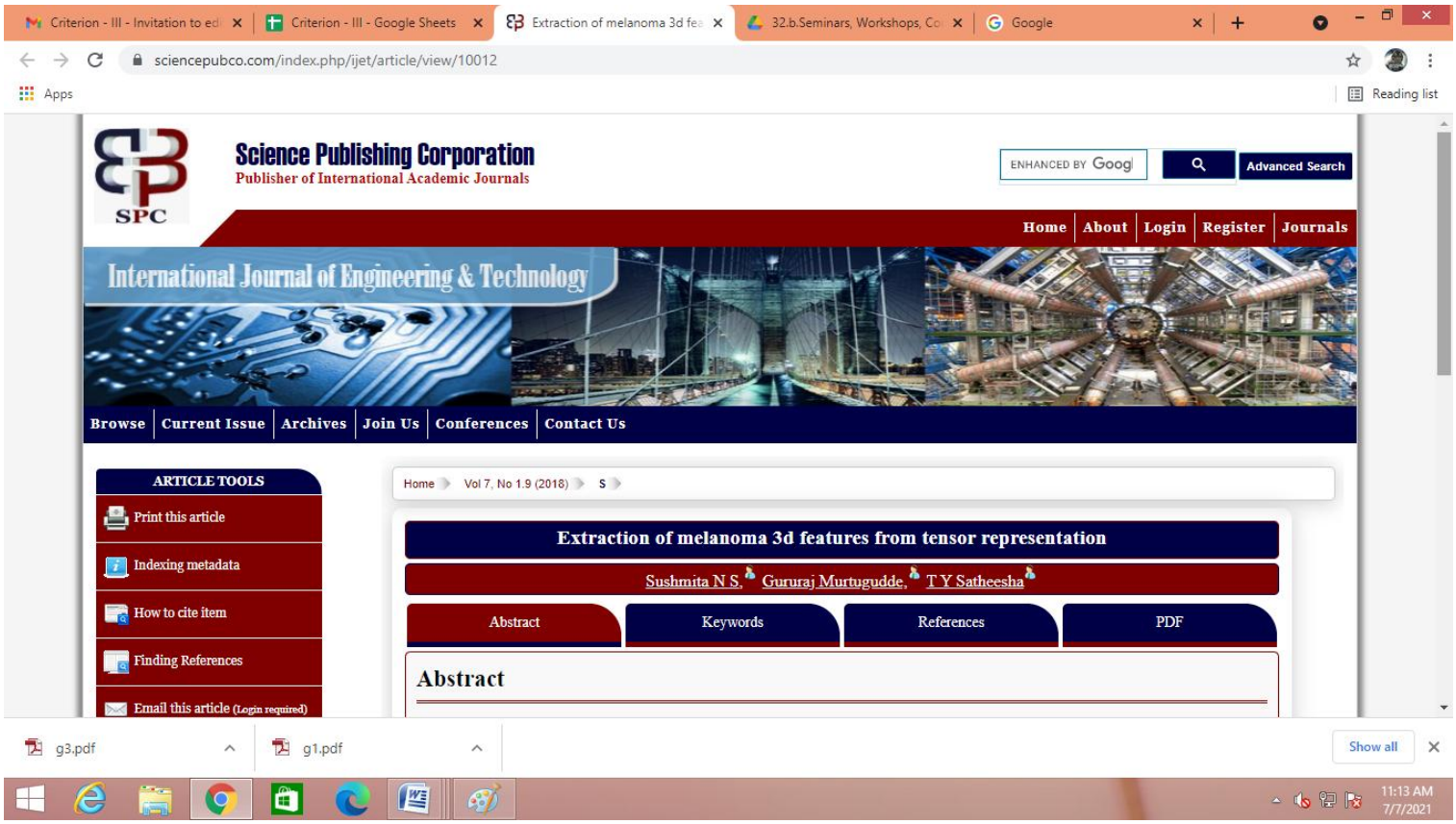
Login

https://www.jardcs.org/backissues/abstract.php?archiveid=5067#

g1.pdf

Show all

11:10 AM
7/7/2021


Criterion - III - Invitation to edi
Criterion - III - Google Sheets
Extraction of melanoma 3d fea
32.b.Seminars, Workshops, Co
Google
sciencepubco.com/index.php/ijet/article/view/10012
Apps
Reading list
Science Publishing Corporation
Publisher of International Academic Journals
SPC
ENHANCED BY Goog
Advanced Search
Home
About
Login
Register
Journals
International Journal of Engineering & Technology
Browse
Current Issue
Archives
Join Us
Conferences
Contact Us
ARTICLE TOOLS
Print this article
Indexing metadata
How to cite item
Finding References
Email this article (Login required)
Home
Vol 7, No 1.9 (2018)
S
Extraction of melanoma 3d features from tensor representation
Sushmita N S,
Gururaj Murtugudde,
T Y Satheesha
Abstract
Keywords
References
PDF
Abstract
g3.pdf
g1.pdf
Show all
11:13 AM
7/7/2021

*International Journal of Engineering & Technology*, 7 (1.9) (2018) 273-278

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Extraction of melanoma 3d features from tensor representation

**Sushmita N S [1] *, Gururaj Murtugudde [2], T Y Satheesha [3]**

[1] *Dept. of ISE, NCET Bengaluru, India*
[2] *Dept. of ISE, SVCE Bengaluru, India*
[3] *Dept. of ECE, NCET Bengaluru, India*
**Corresponding author E-mail: sushsushmita@gmail.com*

**Abstract**

Melanoma is one of the unsafe growth to be dealt with too to recognize in introductory stage. Here we take the skin sore by ROI and after that we take out highlights of it then it should be sectioned whether the specific picture is malignant or not. In the event that it is destructive at that point group the extricated includes and examine about kind of stages. This paper presents a non-obtrusive electronic dermoscopy framework that considers the evaluated profundity of skin sores for determination. For test assessments, the PH2 and ATLAS dermoscopy datasets is considered. A novel 3D remaking calculation from 2D dermoscopic pictures is proposed. Here we remove the 3D highlights from tensor portrayal. The discovery of 3D picture shape and RGB are to be done. In this paper, we have proposed this work for 3D profundity parameter, which will improve the grouping rate.

***Keywords***: *Preprocessing; Segmentation; Feature Extraction; Melanoma.*

## 1. Introduction

The number of melanoma dye due to continuous improvement of the results of a number of diseases. This disease is the main cause is due to ultraviolet light exposure. This is a change in color of the skin resulting in skin pigmentation. It can occur in any part of the body. This is a melanoma has spread it deep inside the skin layer needs to be discovered and cured before. This can be treated with chemotherapy. It is common, but when appropriate treatment is not very dangerous.

Melanoma is usually based on the ABCD rule, (asymmetry, irregular border, color changes, and prison), 7-point checklist of diagnosis [1] and texture. In this paper, we took a skin image for our segment. A portion of the segment are then extracted from the various features, and finally, we go for the divided. We classified [2] includes RGB images for the individual pixel data 3d Register. Here, a higher rate of discrimination is part of the feature extraction depth parameter is proposed.

The remaining paper is presented below. Section II and Section III, we carried out the background of work related to the proposed system. DISCUSSION specifies. Section IV is about the test results. Reported Finally, part V Conclusion home.

## 2. Background

ABCD features for melanoma skin cancer [3] Total Dermatoscopic Value (TDV) is used to calculate.

Asymmetry features of the lesions consist of information asymmetry and long index. Border irregular feature lesions Compact index, fractal dimension from the edge of the sudden transition coloring consist of information. Color homogeneous feature of homogeneous lesions with color photometry of the relationship between geometry and consist of information. The diameter of the cells from the lesions. In this research, the effect on melanoma, disease, doubt and benign skin lesions [4]. The paper "Use of Texture and color features for Dermoscopy for melanoma detection systems [5] the author of" In the first two isolated lesions of the skin and the second one to decide about the objectives of the two is to determine the color and texture. Presentation features.

The only drawback of the document classification accuracy rate, we can increase the rate of discrimination as a result of the depth of the feature as they entered our proposed system less.

## 3. Proposed system

Part of the skin lesions detection and feature extraction of important aim of our paper. This involves the following

a) Preprocessing:

The preprocessing stage in the first example, as shown in Figure 1 (a) of red, green and blue color components are converted into the image by adding gray. The gray image as shown in Figure 1 (b) by a Gaussian filter needs to be filtered. The image shown in Figure 1 (c) with the aid of 0s and 1s of the binary image needs to be converted by the Gaussian filter is filtered.

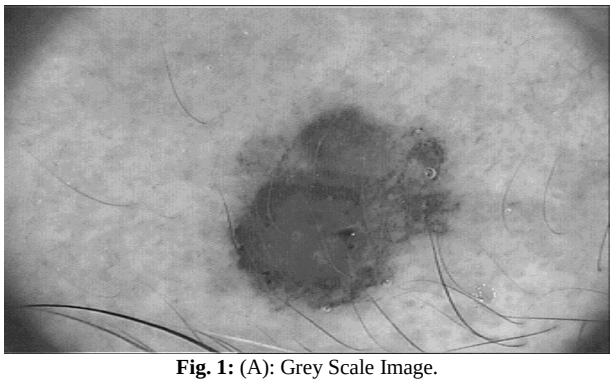


**Fig. 1:** (A): Grey Scale Image.

**Copyright © 2018 Sushmita N S et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**

# Low-Cost Interactive Humanoid Robot

**Gopinath A R, Sushan Sharma, Sushmitha Prathap, Priya Jha, Megha Singh**

***Abstract:*** ***Humanoid robots have been on the frontier of robotic science for several decades, where human alike capabilities have been replicated into electromechanical units. Humanoid robots hold promises in the field of rescue, quarantine, hazardous conditions, radiation leakage, medical trials, etc. Building a humanoid robot is very complicated as it has to deal with locomotion, power, drive train, sensors and computing at the real time. With the development of Single board computers (SBC), the cost of computers has drastically fallen in last 2 decades. At the same time the computation power (GF/Sec) has also increased exponentially. Similarly, MEMS and sensors have also become industrially available with micro sized, robust and reliable. The power source used by robots has also advanced from dry cell to Li-Ion batteries with 5 to 8 times more energy density, resulting in higher operation time. The objective of this paper is to propose a low-cost Humanoid platform comprising a computational platform, sensors, power unit and drive train to deliver basic human alike functions like speech, visual signs, and navigation.***

***The proposed humanoid robot uses a single board computer (SBC) capable of executing python-based AI frameworks combined with Ultrasonic sensors, Li-ion battery and DC motor drives. A top mounted touch screen is used for human machine interface (HMI). This human robotics used in a mid-size campus to guide people to their respective destination, display brief information to new users and navigate to different locations. The humanoid robot adds an aesthetical value to the campus***.

***Keywords: AI Frameworks, Convolutional Neural Network, SLAM, Natural Language Processing, Raspberry Pi.***

## I. INTRODUCTION

A Humanoid robot is essentially a robot with its body shaped to take after the human body. The structure might be for utilitarian purposes, for example, interfacing with humans and situations, for trial purposes, or for different purposes. As a rule, humanoid robots have a middle, a head, two arms, and two legs. In spite of the fact that a few types of humanoid robots may demonstrate just a piece of the body; for instance, from the midriff up. Some humanoid robots additionally have made a beeline for reproducing human facial highlights, for example, eyes and mouths. Androids are humanoid robots worked to take after a male human, and Gynoids are humanoid robots worked to take after a human female. Humanoid robot are currently utilized as a research devices in a few logical regions

**Revised Manuscript Received on April 1, 2020.**
*correspondence Authors
**Gopinath AR,** Department of Computer Science and Engineering. Email: ar.gopinath@ncetmail.com
**Sushan Sharma,** Department of Computer Science and Engineering. Email: susansharma65@gmail.com
**Sushmitha Prathap,** Department of Computer Science and Engineering. Email: mithaarshi78@gmail.com
**Priya Jha,** Department of Computer Science and Engineering. Email: priyajha834@gmail.com
**Megha Singh**, Department of Computer Science and Engineering. Email: imeghasingh97@gmail.com

Other than the research, humanoid robots hold guarantees in the field of salvage, isolate, unsafe conditions, radiation spillage, clinical preliminaries and also humanoid robots are being created to perform human errands like individual help, through which they ought to have the option to help the sick and elderly, and messy or risky employments.

Humanoids are likewise reasonable for some procedurally-based occupations, for example, front counter heads and car fabricating line laborers. In essence, since they can utilize instruments and work gear and vehicles intended for the human structure, humanoids could hypothetically play out any undertaking an individual can, inasmuch as they have the correct programming. Notwithstanding, the multifaceted nature of doing so is gigantic. Building a humanoid robot is confounded as it needs to manage velocity, power, drive train, sensors and registering at continuous.

## II. EXISTING SYSTEM

The studies are made in Humanoid Robots. There are several Robot that has been developed and integrated to work in real time.

Until 1970s, Japanese robotics technologies have led the field.[1] Waseda University launched the WABOT program in 1967 and developed the first electronic, massive-scale humanoid smart robot, WABOT-1 in 1972.[2]Its joint control system enabled it to walk with the lower limbs and grasp and hand-held artifacts utilizing tactile detectors [3].

KITECH has examined and established in South Korea EveR-1[4], the android model of effective communication that can mimic human emotional expression using facial "musculature" and can express in fundamentals with a 400-word vocabulary. The advanced computer processing power of EveR-1 enables vocal recognition and synthesis when processing lip synchronization and visual recognition through micro-CCD cameras with face recognition technology

EveR-2, later called EveR-2 Muse [5] performed at Robot World 2006 in Seoul [6]. Vision and emotional expressiveness as well as several other improvements have been developed. [7] In 2008 EveR-2, together with 100 gestures, may convey the facial representation of joy, sorrow, fear, surprise, anger and disgust. [8]

It was the first model of the EveR series to be mobile with locomotive wheels and equipped in long rows to hide spokes. EveR-3[9] was the successor to EveR-2, demonstrated in 2009.

EveR-4, it is modular in construction, 64 degrees of freedom with 33 in its head (30 in its face and 3 in its neck), and 5 in its base (3 on its legs and 2 in its base wheel).[10]It has a modular design, which also has a design called EveR-4M,[10] it also has a modular design with 64 degrees of freedom

ISSN-1671-4512

# CERTIFICATE

## OF PUBLICATION

This is to certify that

# Dr. Dinesha H. A

**Founder and Director, Cybersena (R&D) India Private Limited Head and Associate Professor, Dept. of CSE, SGBIT, India-10**

Published a paper entitled

**"Browser Security and Privacy issues: A Cyber Forensic Approach"**

in

**Journal of Huazhong University of Science and Technology**

VOLUME 50 ISSUE 05 - 2021

PAPER ID: HST-0521-136

http://hxstxxjns.asia

Chief Editor

UGC APPROVED JOURNAL

ELSEVIER

DOAJ DIRECTORY OF OPEN ACCESS JOURNALS

Scopus®

# Secure Data Aggregation in IoT using Efficient-CSDA

**Swathi S[1],Dr. YOGISH H K [2]**

[1]Associate Professor, Dept of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Devana Halli,Bengaluru, Karnataka 562110
s.swathieswar@gmail.com*

[2]Professor & Head Department of MCA M S Ramaiah Institute of Technology, Bangalore - 560054
yogishhk@gmail.com.

## *Abstract*

***In recent days, IoT has been widely accepted and WSN (Wireless Sensor network) isbeing used for variety of the applications such as transportation, medical, environmental, military, it moreoverthe main aim to deploy the WSN is to collect the data about the given set of phenomena. The common task of WSN is to sense the data and send over the network. Moreover, due to the various purpose such as statistical analysis,the data aggregation is required. However, the when the dynamic network topology is considered, it is considered to be the very difficult task to provide the secure and efficient data aggregation. The main issue here is to ensure the security and accuracy of the data aggregation. Hence, in this research we have proposed an algorithm named as E-SDA (Efficient Secure Data Aggregation) in order to provide the secure data. In this, the algorithm provides the flexibility to detect the dishonest honest through neighbor monitoring. Later, extensive simulation has been done in order to prove the convergence of our algorithm.***

***Keywords: IoT, WSN, Security, Data Aggregation, E-CSDA.***

## 1. Introduction

IoT is nothing but the network of different physical devices that are embedded with the actuators, sensors and connectivity, which allows these things to connect as well as exchange the data. The growth in the IoT devices over the years are enormous, and it has increased almost up to 8.4 billion in 2017, also it has been approximated that by the year 2020,the number of devices will be 30 billion. The market value is estimated to be 7.1 trillion dollar by 2020.IoT extends the connectivity of internet beyond the standard devices such as smartphones, desktop, laptop [1].

By the beginning of the third millennium, from the research as well as the industrial perspective WSNs gained interest [2]. WSN is generally defined as the network of several network devices (these devices are generally known as nodes) that senses and capable of controlling the interaction between the computers and the environment [3].It can sense as well as communicate

ISSN No:-2456-2165

# 2DCrypt: Image Scaling and Cropping Without Physical Interface

Sudhakara Reddy M[1]
Computer Science and Engineering
Nagarjuna College of Engineering and Technology

Sindhuja M[2]
Computer Science and Engineering
Nagarjuna College of Engineering and Technology

Sireesha K[3]
Computer Science and Engineering
Nagarjuna College of Engineering and Technology

Tejaswini M[4]
Computer Science and Engineering
Nagarjuna College of Engineering and Technology

Geethika R V[5]
Computer Science and Engineering
Nagarjuna College of Engineering and Technology

**Abstract:- In this project we are using the concept of encryption and decryption. Firstly, we use encryption to store the data in the cloud without any physical interface later we use decryption to decrypt the data from the cloud. If you want the decrypt the data from the cloud. We use key to decrypt. Any user can easily fetch the decrypted message with the key provided by the authorized user but not by the unauthorized users.**

**For Example, Basically we store the data manually as we need to maintain the records physically so by this we may face many issues like data theft or data may be replaced. So, overcome all this scenario we can store the information in the cloud for maintaining data and to secure the data.**

## I. INTRODUCTION

Cloud computing is a platform for accessing the unlimited and the computational resources with this client access fast and reliable hardware. Now a days, building applications for multimedia content infrastructure are common in cloud providers.

Images may contain personal information if image is not protected in cloud then it shows an unauthorized access or you cannot access this image.

If once the image is stored in cloud we cannot encrypted the images and we cannot perform any operations of cropping, zooming and penning etc.

If the any user is downloading the encrypted images some encryption techniques should be downloaded before so that the user can easily perform the operations for the encrypted images. If the downloaded resources are not then the user cannot perform any operations.

Big Data is a formal product that has a advanced research efforts to reallocate the ITC business and cloud computing in the olden years. The technologies that developed in ICT technologies are communication, storage, computation. It has a innumerous information that helps in business, science. These roles helps to generate, think about the information and discover the worth of the data. Now a days, ITC industries and scientists are using the petabytes of package of information that stored in cloud computing. For examples, in companies, Google, yahoo!, Amazon uses a large amount of data in our daily life for supporting information in useful manners.

In olden days, many technologies are introduced to change a large amount of information, i.e. ranging from terabytes to petabytes of information. These techniques allows users to do data in parallel ways.

Now, there are several isuses that are facing in developing Map Reduce i.e. load balancing, exchanging information among large sets of data allocated around one-third of time particularly in job running time in the Hadoop especially on Facebook. Here, our main aim is to focus on big data that is one of the needed communication in distributed systems.

## II. 2D ENCRYPTION

The 2DEncryption Mode(2DEM) is elobrated to 1DEncryption. The 2DEncryption mode takes and analyzes its input as a images, photos and also data in the binary format. The 2DEM modes is mainly used on 2D data. Information is useful and supplied to two-dimensional array of bytes called “Data”. It can be in the form of bytes. These bytes are access in the form of rows numbers and column numbers.

The Data Encryption Standard (DES) is a symmetric-key block cipher. It is announced by National Institute of Standards and Technology (NIST). It has a block of 64 bits and its key-length is 64 bits. DES has effective and useful key length of 56 bits.

# INDIAN SOLIDARITY COUNCIL

## NATIONAL EDUCATION EXCELLENCE AWARD

Certificate of Excellence

*Presented to*

Prof. Dr. JITENDRANATH MUNGARA

PRINCIPAL
NAGARJUNA COLLEGE OF ENGINEERING AND TECHNOLOGY
DEVANAHALLI, BENGALURU

**FOR OUTSTANDING ACHIEVEMENTS AND REMARKABLE ROLE IN THE FIELD OF EDUCATION**

at New Delhi on 5th May, 2021

Dr. N.S.N. Babu, Ph.D.
*Secretary General*

# Nagarjuna College of Engineering & Technology

NGI
NAGARJUNA
GROUP OF INSTITUTIONS

## Certificate of Appreciation

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

*This certificate is awarded to*

Mr. Vivek Sharma

*for organizing and coordinating the Webinar on "Trends in Brain Computer Interface" held online on 22.05.2021 jointly organized by the Department of Computer Science & Engineering and Department of Information Science & Engineering in association with IQAC , Nagarjuna College of Engineering & Technology, Bengaluru - 562164.*

| Dr. Dinesha H.A | Dr. Anil Kannur | Dr. Jitendranath Mungara |
|---|---|---|
| HoD, Dept. of CSE, NCET | HoD, Dept. of ISE, NCET | Principal, NCET |

# WEB SERVICE CLASSIFICATION WITH MULTILAYER PERCEPTRON

A. Syed Mustafa*

Research Scholar, Dept. Of Computer Science and Engineering,
Sathyabama University, Chennai, India and Professor, HKBK College of Engineering, Bengaluru.
Email: Syedmustafa_blr@yahoo.com

Dr. Y.S. Kumaraswamy

Dean R&D , Dept. Of Computer Science and Engineering,
Nagarjuna College of Engineering & Technology, Bengaluru, India
Email: yskldswamy2@yahoo.com

**Abstract - Web services are made of software components for expressing the application information, communicating messages and for interacting with open XML and Internet technologies. Web services are software applications accessible on the web, used for machine to machine interaction using Uniform Resource Identifier (URI) on distributed internet environment.With the explosion of Web Services accessible on the web, automatic categorization of the services to organize the data becomes essential. In this paper we use 3 different classifiers for web service classification. Multilayer perceptron is trained with back propagation and genetic algorithm.**

**Keywords:** Web Services, Naïve Bayes, MultiLayer Perceptron, Back propagation and Genetic Algorithm (GA), QWS dataset.

## 1. INTRODUCTION

Web services are software applications that are available on the web and used for machine to machine interaction by usingUniform Resource Identifier (URI) on the distributedenvironment of internet. Simple Object AccessProtocol (SOAP) messages are used for communication mechanism by using Hyper Text Transfer Protocol (HTTP) protocol. Each web service has an Application Program Interface (API) thatcan be accessed over the network and executes the web serviceat host location [1]. Every service provides a role, such asservice provider, a requester or a broker. In other words, webservices make possible the effective processing of machinereadable information.

Web services are a novelset of Web applications. They are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web. Web services perform functions that can be anything from simple requests for information to creating and executing complicated business processes [2]. Once a Web service is deployed, it can be discovered and invoked by other applications (or other Web services).

The key advantage of using Web services is the ability to create applications on the fly through the use of loosely coupled, reusable software components. This has fundamental implications in both technologies and business applications. Web Services can be classified as follows [3]:

***User-centric Web Services:*** User-centric Web Services are used to provide user personalization, interface customization, andsupport forvarious languages that helps in the enhancement of user experience. Logical separation of layouts (presentation) in a particular formatlike HyperText Markup Language (HTML) andactual datapresent in Extensible Markup Language (XML) exists.

***Application-centric Web Services*:** These are utilized for integration of enterprise as well as business-to-businessapplications. Application-centric Web Services enable companies to integrate applications and business processes withoutthe constraints of a proprietary infrastructure, platforms and operating systems.

Both user- and application-centric Web Services, make full use of open standards, including HTTP, Extensible Markup Language (XML), SOAP, Web Services Description Language(WSDL), and Universal Discovery, Description, and Integration (UDDI).

Operations in a Web Service Architecture [4]:

Publish - To be accessible, a service description needs to be published so that the service requestor can find it.

Find - The service requestor retrieves a service description directly or queries the service registry for the type of service required

Bind - The servicerequestor invokes or initiates an interaction with the service at runtime using the bindingdetails in the service description to locate, contact and invoke the service.

Office of the Controller General of Patents, Designs & Trade Marks
Department of Industrial Policy & Promotion,
Ministry of Commerce & Industry,
Government of India

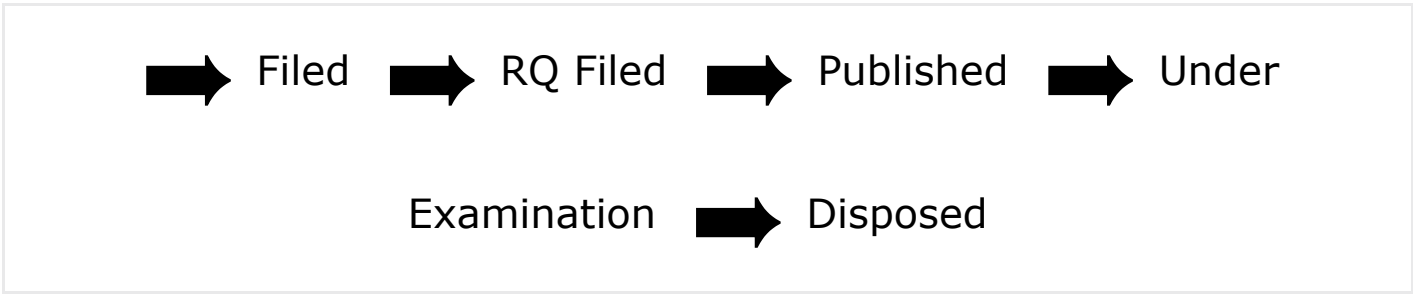
(http://ipindia.nic.in/index.htm)

(http://ipindia.nic.in/index.htm)

| Application Details | |
|---|---|
| APPLICATION NUMBER | 201941052812 |
| APPLICATION TYPE | ORDINARY APPLICATION |
| DATE OF FILING | 19/12/2019 |
| APPLICANT NAME | **1 . Dr ANITHA PATIL**<br>**2 . G. SIVA KRISHNA**<br>**3 . Dr SREEDHAR BHUKYA**<br>**4 . MIDDE RANJIT REDDY** |
| TITLE OF INVENTION | TECHNOLOGY DRIVEN-REAL TIME AIR POLLUTION MONITORING |
| FIELD OF INVENTION | COMPUTER SCIENCE |
| E-MAIL (As Per Record) | patentagent@prometheusip.com |
| ADDITIONAL-EMAIL (As Per Record) | shivagujju@gmail.com |
| E-MAIL (UPDATED Online) | |
| PRIORITY DATE | |
| REQUEST FOR EXAMINATION DATE | 19/12/2019 |
| PUBLICATION DATE (U/S 11A) | 03/01/2020 |

| Application Status | |
|---|---|
| APPLICATION STATUS | **FER Issued, Reply not Filed** |

View Documents


Filed
RQ Filed
Published
Under
Examination
Disposed

# VIRTUAL ASSISTANT USING ARTIFICIAL INTELLIGENCE AND

**A. Sudhakar Reddy M, Vyshnavi, C. Raju Kumar, and Saumya**

***Abstract*— An intelligent virtual assistant (IVA) or intelligent personal assistant (IPA) may be a software agent which will perform tasks or services for a private supported commands or questions. Sometimes the term "chatbot" is employed to ask virtual assistants generally or specifically accessed by online chat. In some cases, online chat programs are exclusively for entertainment purposes. Some virtual assistants are ready to interpret human speech and respond via synthesized voices. Users can ask their assistants questions, control home automation devices and media playback via voice, and manage other basic tasks like email, to-do lists, and calendars with verbal commands.**

**Keywords- VPA, NLP, Speech to text, Text Analyzing, Artificial Intelligence.**

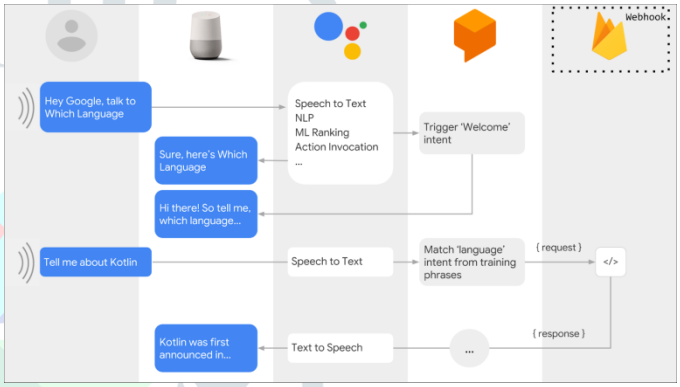
## I. INTRODUCTION

Gone are the days when humans depended on other humans for help or services. The digitalization of the world made sure that humans no need to contact anyone else to seek help, they could depend on a far more efficient and reliable device which can take care of their everyday needs. The computers, mobiles, laptops, etc., became a part of us and our daily life, It could carry out simple calculations to complex programs to reduce monotonous work and waste of manpower.

Virtual Personal Assistant has almost become a basic necessity in all electronic devices so as to execute the required problems easily. More than just being a bot , VPA can make life easier for the user in various ways. Speech recognition is one of the relatively new integration into the VPA. But, though its moderately efficient , it is not very helpful and are not used by the user due to its high amount of error. Though the error percentage of the upcoming VPAs is around 5 percent, it still is not quite up to the mark to where it becomes a basic part of the users life. Thus the projects aim is to build a VPA with speech recognition which has a very minimal error percentage.

Voice recognition is a complex process using advanced concepts like neural networks and machine learning. The auditory input is processed and a neural network with vectors for each letter and syllable is created. This is called the data set . When a person speaks the device compares it to this vector and the different syllables are pulled out with which it has the highest correspondence.

Another market driver for the electronic assistant is that the automobile has become a mobile office, making safety an increasingly important issue. Using voice commands instead of touch-tones is not only a convenience, it is being perceived by consumers as a safety necessity. The global market for unified messaging services is expected to be a considerable share of the telecomm applications. It is estimated that it will be worth several billions by 2007.




While indirect revenues for the carriers will be several folds. A few companies has started offering converging products in the VPA direction, e.g. Conita, WildFire, VoxSurf, VoiceGeneie, and VoiceTel, and Mitel Networks, though one or two provide solutions for mobile carrier environment.

In summary, VPA promises to provide hands-free, eyes-free access to the web anywhere, any time, from any phone.

# 9th INTERNATIONAL CONFERENCE ON CONTEMPORARY ENGINEERING AND TECHNOLOGY 2021

ORGANIZED BY

ORGANIZATION OF SCIENCE & INNOVATIVE ENGINEERING AND TECHNOLOGY (OSIET), CHENNAI, INDIA.

IN ASSOCIATION WITH

## PRINCE SHRI VENKATESHWARA PADMAVATHY ENGINEERING COLLEGE
## PRINCE DR. K. VASUDEVAN COLLEGE OF ENGINEERING & TECHNOLOGY

(Approved By All India Council For Technical Education, Affiliated To Anna University)
Medavakkam - Mambakkam Main Road, Ponmar, Chennai - 600 127.

## Certificate of Appreciation

This is to certify that Dr/Mr/Mrs **Prof. Dr. Jitendranath Mungara, Principal** from **Nagarjuna College of Engineering and Technology, Bangalore** has supported as **KEYNOTE SPEAKER**

in the "9th International Conference On Contemporary Engineering And Technology" held on 10th & 11th, April 2021.

**Dr. P. Aravinthan,** M.E., Ph.D.,
Co-Convener - ICCET

**Dr. A. Krishnamoorthy,** M.E.,Ph.D
Convener - ICCET

**K.Janani,** M.Tech.,
CEO, OSIET
Director

**Entry Restricted** **Admit : One**


## *Physical & Virtual Function*

The Managing Committe of

# INDIAN SOLIDARITY COUNCIL

*Request the pleasure of your company at a seminar and Presentation of Awards*

**On 05th May, 2021 at 2:30 P.M.**

**At The Indian Society of International Law**

**204, conference Hall 2nd Floor, Krishna Menon Bhawan,**

**Opposite Supreme Court, Gate Number - C,**

**Bhagwan Dass Road, New Delhi - 110001**

***Please bring this card with you***

# AI BASED SHOOT AT SIGHT MISSILE

[1]Shivam Dhar, [2]B.Venkatesulu, [3]CH.Manoj Kumar, [4]Vijay Chowdary [5]Subramanya S.G,

[2,3,4]Student, [5]Assistant Professor, [1]Project Leader,

[1,2,3,4,5] Department of Computer Science & Engineering

[1,2,3,4,5]Nagarjuna College of Engineering and Technology, Bengaluru – 562110,

Karnataka, India.

**Abstract:** Until now the border security was totally depending on soldier. In highly secured area the soldier detected the enemy and targets him. But if the soldier was not able to detect the enemy , the enemy could easily enter the secure area. So for increasing the security level microcontroller based automatic missile targeting system is introduced. The basic purpose of this automatic missile targeting system is to secure the border using automation and this will reduce the human effort . Current system is capable to detect any PIR radiation in the range of border and automatically target its position. The introduced system is based on PIR sensor. The PIR sensor senses the temperature differences and then these signals are coded by microcontroller and transmitted toward the receiver on watch tower . As it is an Artificial Intelligence based system, it can be controlled from anywhere, and beside this it allows us to take quick and immediate actions, without actually reaching and controlling the bot.

***Index Terms – AI Based Shoot At Sight Missile (Artificial Intelligence, Ultrasonic Sensor, Missile, Wi-Fi Module, Android Application, Dc Motors.).***

## I. INTRODUCTION

The prior concept of Automatic Missiletargeting System is to detect and target the living object or any movement in highly secured area such as Border by using automation.The automatic Missiletargeting is primary basedon PIR sensors, microcontroller and RF transmitting and receiving unit with targeting gun. Until then, border is done by Iron Spike wires, and a watch tower from which a person continuously flashing the light over the border area day and night. Those persons are fully responsible for border security. Automatic Missiletargeting System will not fully remove the responsibility from their soldiers, but shares the maximum responsibility and will reduce human mistake on the border.

The sensors will sense any living object within the provide range. The signal of sensor is provide to microcontroller, in response, microcontroller generates the code and it will transmit that code using RF transmitter to the watch tower where the RF receiver receives the code. The microcontroller at receiver side control targeting gun, buzzer and motor drivers circuit as per received code and targeting gun at receiver will target the living object.

The buzzer will indicate that target is sensed by sensor. So the person on watch tower can easily interpret the location of the object. The automatic Missiletargeting system will enhance the border security using automation which may reduce the human efforts to large extents.

## II. EXISTING SYSTEM

- At present the surveillance of International border areas is a difficult task. The border guarding forces are patrolling the border seriously, but it is not possible to watch the border at each and every moment.
- This project describes the TALOS project, which is a new way to use autonomous robotic vehicles to strengthen the security of land borders of the European Union.
- The increasing number of robots in home environments leads to an emerging coexistence between humans and robots. Robots undertake common tasks and support the residents in their everyday life. People appreciate the presence of robots in their environment as long as they keep the control over them.

Basically Army Robot is capable of performing tasks such as locomotion, sensing the harmful gas, sensing the humans beneath the surface, metal detection. Army robot is an autonomous robot comprising of wireless camera which can be used as a spy and Bluetooth used to control it wireless. The existing systems suffered many problems like high cost to set up communication between robot and rescue control unit, noisy wireless communication link between robot and control unit which ultimately stopped robot to function etc.In these systems, distance is a limiting factor because the Bluetooth has a specified range that cannot be increased.

# LIDAR BASED ADAPTIVE CRUISE CONTROL SYSTEM

*(SELF DRIVING AUTOMOBILE)*

Swathi S[1], Rahul Yadav[2], Riya[3], Siddharth Mehta[4], R Karan Kumar[5]

[1]Assoc. Professor, [2,3,4,5] Students
[1,2,3,4,5] Department of Computer Science & Engineering ,
[1,2,3,4,5] Nagarjuna College of Engineering & Technology, Bangalore - 562110, India.

***Abstract :*** Due to an increase in population, transportation has increased a lot these days. So here we have developed an automated driving system which will drive the car automatically. The main goal is to save people's time by changing the use of the car fundamentally. A technology for car is developed which will drive the car automatically. We have designed an automated vehicle that will give automated driving experience to the user. The car is capable of sensing the surrounding, navigating and fulfilling the transportation capabilities with any input of the humans. LiDAR is used for sensing the environment it continuously sense the environment and if any obstacle is found vehicle will move around and will avoid the obstacle. The main advantage of an autonomous car is fewer traffic collisions, increased road capacity and less congestion in the traffic. We believe the autonomous car is the necessity of human life as it overcomes the obstacles without any human input and also human life has to be safe and secured. It is also the efficient, cost-effective and comfortable means of transport.

**Keyword: LiDAR (Light Detection and Ranging)**

## I. INTRODUCTION

Technology has been developed for cars that drive it automatically. We have designed an automated vehicle that is basically focused to give automated driving experience to the user. The spinning object we see on most top of the cars is the LiDAR. It fires out millions of laser beams, measures how long they take to bounce back and then uses the data to build a 3D map that is rather more precise for computers to understand than a 2D camera image. It's also crazy expensive, hard to manufacture at scale and nowhere near robust enough for a life of potholes and even in extreme temperatures. Dozens of start-ups and tech giants are pouring millions of dollars fixing it.

Our goal is to prevent accident and save people's time by changing the car use fundamentally. Due to the development of various sensors including Radars, LiDARs, camera systems and also wireless communication autonomous vehicle have made significant advances in recent years. The major requirements which are imposed on autonomous vehicle are ability to cover long distance in safer way while decreasing the rate of accidents and traffic and also obeying the traffic rules and this all to be followed without any human interaction. There are more than millions of vehicles driven every year with a lot of complexity and novel conditions generating situations in which autonomous vehicle could fail miserably. The highly intelligent systems of an autonomous vehicle should take into account a broader a range of information about current road situation and car itself on the same way as human driver.

## II. EXISTING SYSTEM

The SAE sets some standards for driving automation and these are divided into six levels of driving automation. Level 0, level 1, level 2, level 3, level 4, level 5 driving automation.in this paper we are focused on the adaptive cruise control system.

**Adaptive cruise control system:**

The existing adaptive cruise control ACC as well as its collision mitigation braking system CMBS now both of these systems are a part sense which is an available suite for safety and driver-assistive technologies. The most important pieces used for ACC and CMBS are a millimetre wave radar which is located upfront concealed behind the grille and a camera that is mounted between the rear view mirror and the front windshield radar is good for measuring the distance of vehicles ahead and their change in speed that said any metallic object can return a signal that's where the camera comes in as it's much better object recognition though not as good at judging distance. adaptive cruise control work the primary purpose of the system is to travel at the speed selected by the driver just like traditional cruise control however if the vehicle detects another car in front of it that is travelling at a slower speed the vehicle will reduce its speed to match that the detected car and then maintain a selected interval behind the car.

The system works by emitting radar waves which bounced off of vehicles ahead and returned to the unit this informs the system of the distance between the two vehicles and changes in that distance inform the system of the vehicles relative speeds throttle position is adjusted to maintain a set following interval or light braking can be applied now how does the collision mitigation braking system work the goal of the system is to alert the driver if a collision with a detected vehicle is likely and then to apply the brakes to reduce the severity of a collision if it's unavoidable the system scans up to certain distance of the road in front of the vehicle and works in three stages if the driver begins to come close to a vehicle detected ahead for Stage one the system flashes a brake warning and can also provide an audible warning for Stage two the system provides visual and audible alerts and applies light braking for Stage three

# Smart Supervisory Stick for Blind Using Raspberry Pi

[1]Vubbara Deekshitha, [2]Pasupulety Sai Teja, [3]Jakka Madhurima, [4]Shailaja P, [3]Pramoda K V

[1]Student, [2]Student, [3]Student, [4]Student, [5]Assistant Professor,
Computer Science And Engineering Department,
Nagarjuna College of Engineering and Technology, Devanhalli, Bangalore- 562 164, INDIA.

***Abstract*— Blindness is one the issues over which humans still have no control. It takes away the very right of the person to witness the everlasting visual beauty of the world from one's life. But on the other side, the worries are even more worse, the endless problems faced by them during performing even the simplest of the tasks in day to day life hinders their existence. Being independent is the very right that everyone is born with, which is to live and lead life without being controlled by any action, or acumen from any external factors is rightfully termed as being independent. Traveling is the most dominant problem for people with blindness, for instance during finding a transport, crossing roads, travelling through trains or bus, and it becomes an impossible task to commute through public places. These issues lead to their lack of confidence and even deteriorate their health. With the present technology driven era solution lies in developing a smart stick which enables the people with blindness to ease their problems and help them in carrying out daily tasks. Thus the proposed work presents a smart stick for the people with blindness. It is developed and designed using Ultrasonic sensors, GPS module and has the ability to provide voice command to people through headsets. There by helping the people with blindness to safely navigate through public places independently and helping in carrying out daily tasks.***

***Index Terms —Blind Stick, smart Stick, Ultrasonic sensor, obstacle avoider, Raspberry pi.***

## I. INTRODUCTION

Blindness is a major problem that world is dealing with at present. According to an online survey, around 39 million people are blind, 940 million people have some amount vision loss, while 246 million people had very low vision. Of all the above mentioned cases complete blindness is almost impossible to treat. The effect it has on the person life and mental health is unthinkable [1][2][3]. One of the startling facts is that now Indian is home to the largest number of blind people, of the 39 million blind people around the world, 15 million blind people are from India [4]. India is house to one of the largest eye donations, 2.5 lakhs eyes are donated every year of which only 70% are useable [5]. The problems faced by people with blindness are of very high concern and needs instant solution to this rapidly growing issue. One of the most sought after solution is the development of guidance system for people with blindness. Various devices have been built for the navigation and obstacle identification for the blind. As with the advancement of technologies many variants have been developed. The most common is the Electronics Travel aids (ETA), these devices are usually equipped with navigation and obstacle identification technology. But many of these devices have limited functions and are lack accuracy. Thus to overcome and address the issues of these presently available devices a smart stick using raspberry pi has been proposed. The smart stick is integrated with various sensors and electronics devices which enable the people with blindness in ease of travel and in carrying out their day to day activities.

## II. REVIEW OF PREVIOUS WORK

It is always necessary to review the work of the researchers done previously to deduce out the problem statement and solution for it. This leads to the development of device which overcomes the problems posed by the earlier ones.

A smart stick has been proposed for the blind in [6]. It uses various sensors to overcome the obstacles, but the limitations are that it can sense only till the stick range. This issue was overcome using echolocation and image processing as proposed in [7]. Where as in [8] [9] [10] [11] a smart stick is build using ultrasonic sensors, buzzer and vibration sensor for travelling and to avoid obstacles.

An Arduino based GPS and GSM enabled smart stick is proposed in [12] [13] which also sends the details of the location to the family in case of emergency. While on the other side various devices have been developed. Table 1 presents the details of different methodologies used in the literature.

TABLE I. Description of different methodologies in Survey

| SL. NO | Device Details | Description |
|---|---|---|
| 1 | C-5 Laser Cane [14] | Developed in 1973, uses optical triangulation technology. Has a range up 3.5 Meters |
| 2 | Sonic Torch [15] | Uses ultrasound transmitting and is battery operated. |
| 3 | Mowat Sensor [14][15] | Uses ultrasonic sensors and tactile vibrations. The distance is inversely proportional to the frequency of vibrations. |

# LIDAR BASED ADAPTIVE CRUISE CONTROL SYSTEM

*(SELF DRIVING AUTOMOBILE)*

Swathi S[1], Rahul Yadav[2], Riya[3], Siddharth Mehta[4], R Karan Kumar[5]

[1]Assoc. Professor, [2,3,4,5] Students
[1,2,3,4,5] Department of Computer Science & Engineering ,
[1,2,3,4,5] Nagarjuna College of Engineering & Technology, Bangalore - 562110, India.

***Abstract :*** Due to an increase in population, transportation has increased a lot these days. So here we have developed an automated driving system which will drive the car automatically. The main goal is to save people's time by changing the use of the car fundamentally. A technology for car is developed which will drive the car automatically. We have designed an automated vehicle that will give automated driving experience to the user. The car is capable of sensing the surrounding, navigating and fulfilling the transportation capabilities with any input of the humans. LiDAR is used for sensing the environment it continuously sense the environment and if any obstacle is found vehicle will move around and will avoid the obstacle. The main advantage of an autonomous car is fewer traffic collisions, increased road capacity and less congestion in the traffic. We believe the autonomous car is the necessity of human life as it overcomes the obstacles without any human input and also human life has to be safe and secured. It is also the efficient, cost-effective and comfortable means of transport.

**Keyword: LiDAR (Light Detection and Ranging)**

## I. INTRODUCTION

Technology has been developed for cars that drive it automatically. We have designed an automated vehicle that is basically focused to give automated driving experience to the user. The spinning object we see on most top of the cars is the LiDAR. It fires out millions of laser beams, measures how long they take to bounce back and then uses the data to build a 3D map that is rather more precise for computers to understand than a 2D camera image. It's also crazy expensive, hard to manufacture at scale and nowhere near robust enough for a life of potholes and even in extreme temperatures. Dozens of start-ups and tech giants are pouring millions of dollars fixing it.

Our goal is to prevent accident and save people's time by changing the car use fundamentally. Due to the development of various sensors including Radars, LiDARs, camera systems and also wireless communication autonomous vehicle have made significant advances in recent years. The major requirements which are imposed on autonomous vehicle are ability to cover long distance in safer way while decreasing the rate of accidents and traffic and also obeying the traffic rules and this all to be followed without any human interaction. There are more than millions of vehicles driven every year with a lot of complexity and novel conditions generating situations in which autonomous vehicle could fail miserably. The highly intelligent systems of an autonomous vehicle should take into account a broader a range of information about current road situation and car itself on the same way as human driver.

## II. EXISTING SYSTEM

The SAE sets some standards for driving automation and these are divided into six levels of driving automation. Level 0, level 1, level 2, level 3, level 4, level 5 driving automation.in this paper we are focused on the adaptive cruise control system.

**Adaptive cruise control system:**

The existing adaptive cruise control ACC as well as its collision mitigation braking system CMBS now both of these systems are a part sense which is an available suite for safety and driver-assistive technologies. The most important pieces used for ACC and CMBS are a millimetre wave radar which is located upfront concealed behind the grille and a camera that is mounted between the rear view mirror and the front windshield radar is good for measuring the distance of vehicles ahead and their change in speed that said any metallic object can return a signal that's where the camera comes in as it's much better object recognition though not as good at judging distance. adaptive cruise control work the primary purpose of the system is to travel at the speed selected by the driver just like traditional cruise control however if the vehicle detects another car in front of it that is travelling at a slower speed the vehicle will reduce its speed to match that the detected car and then maintain a selected interval behind the car.

The system works by emitting radar waves which bounced off of vehicles ahead and returned to the unit this informs the system of the distance between the two vehicles and changes in that distance inform the system of the vehicles relative speeds throttle position is adjusted to maintain a set following interval or light braking can be applied now how does the collision mitigation braking system work the goal of the system is to alert the driver if a collision with a detected vehicle is likely and then to apply the brakes to reduce the severity of a collision if it's unavoidable the system scans up to certain distance of the road in front of the vehicle and works in three stages if the driver begins to come close to a vehicle detected ahead for Stage one the system flashes a brake warning and can also provide an audible warning for Stage two the system provides visual and audible alerts and applies light braking for Stage three

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

# Brain Image Classification by Deep Neural Network with Pyramid Design of Inception Module

**Prof.Dr.S.Mohan Kumar[1], Prof. Dr. K. P. Yadav[2]***
[1]Post Doctoral Research Scholar Doctor of Science, Sangam University, Bhilwara, Rajasthan.
[2]Vice-Chancellor, Sangam University, Bhilwara, Rajasthan.
Email: drsmohankumar@gmail.com[1],drkpyadav732@gmail.com[2]

**Abstract.** In Deep Neural Network (DNN), the convolution filters of different sizes are stacked to abstract features from the input data, making weight updating difficulties and causes overfitting. A conventional Inception Module (IM) overcomes the abovementioned drawbacks by designing the architecture wider rather than deeper. In this study, DNN with Pyramid Design of Inception Module (PDIM) is designed for brain image classification using Magnetic Resonance Imaging (MRI). Depth of the architecture is increased by stacking PDIM units, and their performances are evaluated. This study's MRI images are obtained from the REpository of Molecular BRAin Neoplasia DaTa (REMBRANDT) database. The newly proposed architecture achieves 99% accuracy with 98% and 100% sensitivity and specificity. The performance comparison shows the system's effectiveness that could help the physicians for accurate brain cancer classification.
**Keywords:** Deep neural network, artificial neural network, backpropagation algorithm, brain image classification, inception module.

## 1. Introduction

The human brain is the primary organ of our body. A primary brain tumor (Gliomas) starts in the brain, whereas secondary tumors can randomly start elsewhere in the body and spread to the brain. As brain cancer causes are still unknown, an early diagnosis with the highest accuracy is required to decrease the mortality rate. In MRI scanned brain images, the Glioma tumor is classified into the normal, low, and high grades using Convolutional Neural Networks (CNN) [1] includes preprocessing unit where the primary feature extraction of image datasets is followed by a CNN network where the extracted features are mapped with secondary features and fed for classification.

The automated MRI brain tumor classification is done for specifying meningiomas, pituitary, and gliomas type diseases using the CNN and Support Vector Machine (SVM) classifiers [2]. In this, the confusion matrix-based polynomial and linear SVM classifiers are used. As the datasets are downsized and reduced for computation, the salty noise is added to make a robust performance analysis model.

The wavelet autoencoder-based DNN technique is used for compressing the brain image dataset [3], integrates the autoencoder feature reduction with the decomposed wavelet transform the image to resize the image feature set for enhancing DNN classification. In [4], the brain MRI scanned image classification using various techniques such as decision tree, K-nearest neighbor, SVM, artificial neural network, and CNN are reviewed. The classification and identification of abnormal brain and normal brain images with various neurological disorders are analyzed.

Various wavelet transformation techniques like stationary wavelet transform, discrete wavelet transform and Dual-Tree M-band Wavelet Transform (DTMBWT) [5] are used for rank-

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

based feature extraction and coefficient selection of MRI image datasets. The decomposed sub-band images with ranked features use an SVM classifier for abnormal and normal image classification. The automated binary classification of MRI brain images enables a high-resolution image of living tissues to provide important structural information of tumors[6]. It utilizes the integration of CNN and transfers learning pre-trained sixteen layered network model. The efficient automated diagnosis and classification of test data image accuracy are assured.

The Neural Network (NN) based MRI brain image classification employs WT to extract the image features, and then the Principle Component Analysis (PCA) technique [7] is applied to reduce the feature dimensionality. The reduced features are sent to a Back Propagation NN (BPNN) to find the optimal weight by adopting the NN's scaled conjugate gradient. The NN technique's three stages are preprocessing, reducing the dimensionality, and classification [8]. In this stage, the MRI brain image data is converted into encoded information stored, computed, and transmitted through digital devices. The second stage is dimensionality reduction by PCA; finally, the BPNN is used to classify the subjected image as normal or abnormal.

A computer-Aided Diagnosis (CAD) system, an efficient system is presented [9], which analyzes the normal and abnormal MRI brain image using the DTMBWT for statistical feature extraction. An SVM classifier, the maximum margin classifier with a k-fold approach, is used to classify and validate the extracted feature dataset. The four-stage statistical analysis is employed to enhance MR image quality, which comprises preprocessing stage, feature extraction method, feature reduction model, and classification network [10]. The DWT-based image enhancement technique is used for feature extraction with three sub-stages, including a median filter for noise removal. The image contrast is enhanced using the histogram equalization technique by RGB conversion gray-scale image. Finally, to categorize the scanned brain MRI images, pathological details utilize an advanced trained DNN.

Gliomas image classification based on hybrid statistical and wavelet feature extraction [11] is discussed. The statistical features are extracted based on multi-layer Perceptron classifier MRI modalities and DWT. DWT is also used with SVM for brain image classification in [12]. Another frequency domain transformation named Tetrolet transform is utilized in [13]. The energy-based features are extracted and given to the SVM classifier for classification.

The internet of medical things is the healthcare domain with IT systems linking through the computer networks via medical devices and other applications [14]. An optimized DL classifier model with an opposition-based crow search algorithm picks the optimal features from the preprocessed image and classifications based on these featured images.

The newly automated multiclass diagnosis system is used to classify pathological brain MRI into various categories [15]. The texture feature subset extraction is done using the entropy and sub-bands within the MRI, plays a significant role in the detection and segregation of pathological brain images. Fast curvelet transform is used for simple and fast feature extraction that is finally to kernel-based machine learning model for classification.

DWT and SVM based hybrid approach are integrated to classify the MR brain tumor images [16]. It includes feature extraction, followed by feature reduction using genetic algorithm and SVM classifier for brain tumor image classification that classifies benign or malign type. The CAD system helps doctors and radiologists diagnose the proper tumor types using artificial intelligence [17]. The deep learning algorithm gives the optimum performance in the computerized world that enhances the CAD-based deep learning approach for classifying the various types of brain tumors using residual networks.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

In this study, an effective brain image classification system by DNN-PDIM for brain cancer diagnosis is developed. The paper follows DNN-PDIM architecture methodologies in section 2. The results obtained from the analysis of DNN-PDIM on MRI images are discussed in section 3, and the final section summarizes the conclusions of this study with future recommendations.

## 2. Methods and Materials

NNs are structures of interconnected nodes capable of receiving input, processing it, and producing some output. Input can either be external or from other nodes' output, so in this sense, a task is performed collectively and concurrently by the whole network rather than a node on its own. It is inspired by how biological networks of neurons function in humans and mammals and offer a new computation model. They are a mathematical tool for pattern recognition for classification. The field of applications is now very diverse, with many different methods. In DNN, features are abstracted deeply using convolutional filters before using BPNN to update the weights. Figure 1 shows the architecture of DNN-PDIM.

Although many of the DNN methods are considerably different, they have many common features. All provide a non-linear mapping from an 'input' feature space to some unique output corresponding to that input. NNs learn in a method analogous to that perceived to be employed by the human brain. The mapping from input to output is derived by experience of previously defined and classified mappings. The method of learning is therefore supervised. The Visual Geometry Group (VGG) [18] architectures use deeper architecture with small-sized convolution layers (only 3x3). Due to the deeper structure of VGG, VGG is computationally expensive as well as overfitting. To avoid this, GoogLeNet[19] uses IM to allow more computation through a dimension reduction with stacked convolutions of 1x1. The architecture of IM is shown in Figure 2. A single IM is used in PDIM-1, and two IMs are used in PDIM-2. Thus the DNN-PDIM system is stacked with PDIM-n to form a pyramid design.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

**Figure 1**: DNN-PDIM architecture

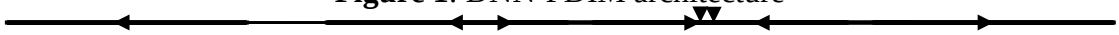


**Figure 2:** Architecture of IM (MPL – Max Pooling Layer)

In a BPNN, data (inputs) are admitted at the inputs and travel in one direction towards the outputs with one or more hidden layers trained to perform virtually any regression or discrimination task [22]. Figure 3 shows two hidden layers in the architecture of a multi-layered FFNN.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

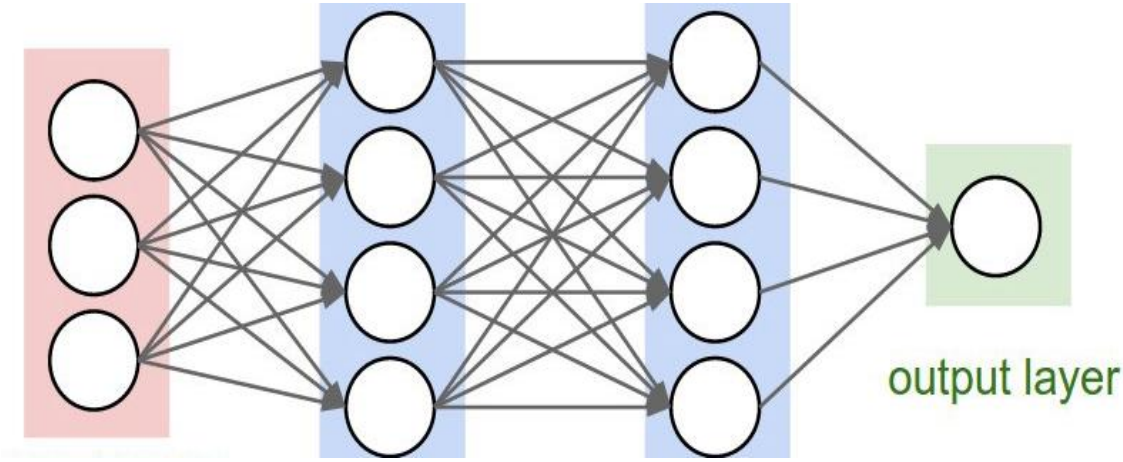



**Figure 3: A multi-layered FFNN (Input layer (pink), Hidden layers (blue), Output layer (green))**

The backpropagation algorithm compares the network output to that expected. It computes an error-based measure on squared differences and then minimizes gradient descent by altering the network's weights. Denoting a training member of the set by $v^i$, the actual output by $y^i$ , and the desired outputs by $x^i$, the error is:

$$E = \sum_i \sum_j (y_j^i - x_j^i)^2 \tag{1}$$

And the algorithm performs iterative weight updating until the error is small:

$$w_{ij}(k+1) = w_{ij}(k) - \in \frac{\partial E}{\partial w_{ij}} \tag{2}$$

The convergence algorithm can be very slow, and there is extensive literature on speeding the algorithm. The best-known technique is the introduction of momentum, which controls behavior so that the process does not get stuck in local minima. Equation 2 is rewritten as,

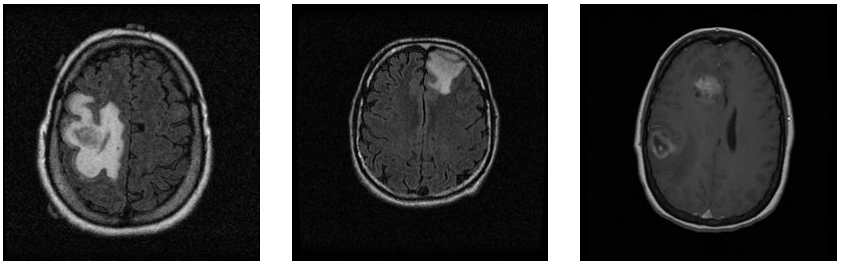
$$w_{ij}(k+1) = w_{ij}(k) + \in \delta_j z_i(k) + \alpha[w_{ij}(k) - w_{ij}(k-1)] \tag{3}$$

Here $\alpha$ is the constant momentum and is chosen to be between zero and one. In general, BPNNs are good candidates for tackling almost any image processing task. This study uses a momentum factor of 0.9 with 20 epochs. The optimizer used is stochastic gradient descend with backpropagation. The input layer's and output's layer activation functions are rectified linear unit and softmax functions

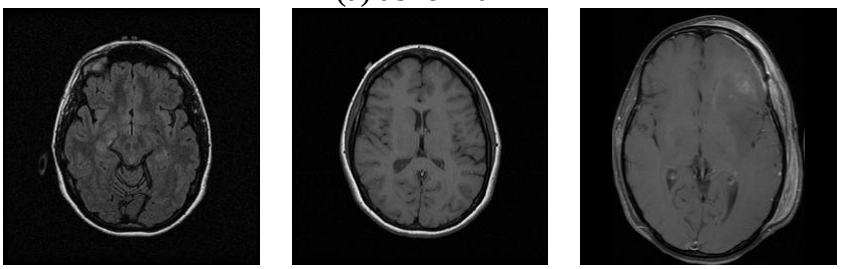
## 3. Results and Discussions

In this section, the performances of the DNN-PDIM system are discussed. It uses 400 MRI- DICOM images obtained from the REMBRANDT database [20]. Each DICOM image has a resolution of 256x256 pixels, and they are converted to bitmap images initially. The obtained MRI images are grouped into two groups; normal (200) and abnormal (200). A randomly chosen 100 images from each category are used for training the DNN-PDIM system, while the remaining is used for testing the DNN-PDIM system. Figure 4 shows sample images from the REMBRANDT database[21].

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.



(a) abnormal



(b) Normal

**Figure 4:** Sample images from REMBRANDT database

Table 1 shows the performance metrics and their corresponding formulae used to analyze the DNN-PDIM system on the REMBRANDT database.

**Table 1**: Performance metrics of the DNN-PDIM system

| Performance metrics | Formula | Description |
|---|---|---|
| Accuracy | $\frac{TP+TN}{TP+FN+TN+FP}$ | It gives overall performance of the system. |
| Specificity | $\frac{TN}{TN+FP}$ | It gives the DNN-PDIM system performance on normal cases. |
| Sensitivity | $\frac{TP}{TP+FN}$ | It gives the DNN-PDIM system performance on abnormal cases. |
| True Negative (TN) – number of correct classification of normal cases<br>True Positive (TP) - number of correct classification of abnormal cases<br>False Positive (FP) - number of incorrect classification of normal cases and<br>False Negative (FN) - number of incorrect classification of abnormal cases. | | |

The performance of the DNN-PDIM system is analyzed by randomly chosen training and testing images. Hence, for proper validation of the DNN-PDIM system, the system is executed ten times with randomly chosen images, and the obtained performance accuracies are shown in Table 2.

**Table 2: Obtained Accuracies of the DNN-PDIM system**

| Run | DNN-PDIM-1 | DNN-PDIM-2 | DNN-PDIM-3 | DNN-PDIM-4 | DNN-PDIM-5 |
|---|---|---|---|---|---|
| 1 | 82.5 | 90 | 96 | 99 | 99 |

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

| | | | | | |
|---|---|---|---|---|---|
| 2 | 84.5 | 89.5 | 95.5 | 99.5 | 98.5 |
| 3 | 86.5 | 94 | 97.5 | 99 | 98.5 |
| 4 | 81.5 | 89 | 95 | 99.5 | 98 |
| 5 | 79.5 | 87 | 92 | 99.5 | 99 |
| 6 | 79.5 | 85 | 91 | 99 | 98 |
| 7 | 84.5 | 91.5 | 96.5 | 98 | 99 |
| 8 | 82.5 | 88.5 | 94.5 | 99 | 98 |
| 9 | 86.5 | 92 | 96.5 | 99.5 | 99 |
| 10 | 87.5 | 94 | 98 | 98 | 98 |
| **Avg** | **83.5** | **90.05** | **95.25** | **99** | **98.5** |

It is inferred from Table 2 that the average classification accuracies increase while increasing the depth of the architectures. The architecture is initialized with DNN-PDIM-1 that gives only 83.5% average accuracy. DNN-PDIM-4 obtains maximum accuracy of 99% and further increases the depth; the accuracy is reduced to 98.5%, and it is due to the redundant data by the higher depth of the architecture. Tables 3 and 4 show the sensitivities and specificities of DNN-PDIM.

**Table 3: Obtained Sensitivities of the DNN-PDIM system**

| Run | DNN-PDIM-1 | DNN-PDIM-2 | DNN-PDIM-3 | DNN-PDIM-4 | DNN-PDIM-5 |
|---|---|---|---|---|---|
| 1 | 80 | 87 | 94 | 98 | 98 |
| 2 | 82 | 85 | 92 | 99 | 97 |
| 3 | 84 | 91 | 97 | 98 | 97 |
| 4 | 79 | 86 | 93 | 99 | 96 |
| 5 | 77 | 85 | 90 | 99 | 98 |
| 6 | 77 | 83 | 90 | 98 | 96 |
| 7 | 82 | 89 | 94 | 96 | 98 |
| 8 | 80 | 87 | 94 | 98 | 96 |
| 9 | 84 | 88 | 96 | 99 | 98 |
| 10 | 85 | 92 | 98 | 96 | 96 |
| **Avg** | **81** | **87.3** | **93.8** | **98** | **97** |

**Table 4: Obtained Specificities of the DNN-PDIM system**

| Run | DNN-PDIM-1 | DNN-PDIM-2 | DNN-PDIM-3 | DNN-PDIM-4 | DNN-PDIM-5 |
|---|---|---|---|---|---|
| 1 | 85 | 93 | 98 | 100 | 100 |
| 2 | 87 | 94 | 99 | 100 | 100 |
| 3 | 89 | 97 | 98 | 100 | 100 |
| 4 | 84 | 92 | 97 | 100 | 100 |
| 5 | 82 | 89 | 94 | 100 | 100 |
| 6 | 82 | 87 | 92 | 100 | 100 |
| 7 | 87 | 94 | 99 | 100 | 100 |
| 8 | 85 | 90 | 95 | 100 | 100 |
| 9 | 89 | 96 | 97 | 100 | 100 |
| 10 | 90 | 96 | 98 | 100 | 100 |
| **Avg** | **86** | **92.8** | **96.7** | **100** | **100** |

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

It is observed from Tables 3 and 4 that DNN-PDIM-4 and DNN-PDIM-5 give the highest specificity of 100%, whereas DNN-PDIM-1 obtains the lower specificity is 86%. Though DNN-PDIM-5 gives 100% specificity, its sensitivity is 97% which is 1% lower than the sensitivity obtained by DNN-PDIM-4 (sensitivity of 98%). Figure 5 visually shows the performances of different DNN-PDIM architectures. A comparative study of the DNN-PDIM system with other classification systems is made and shown in Figure 6.

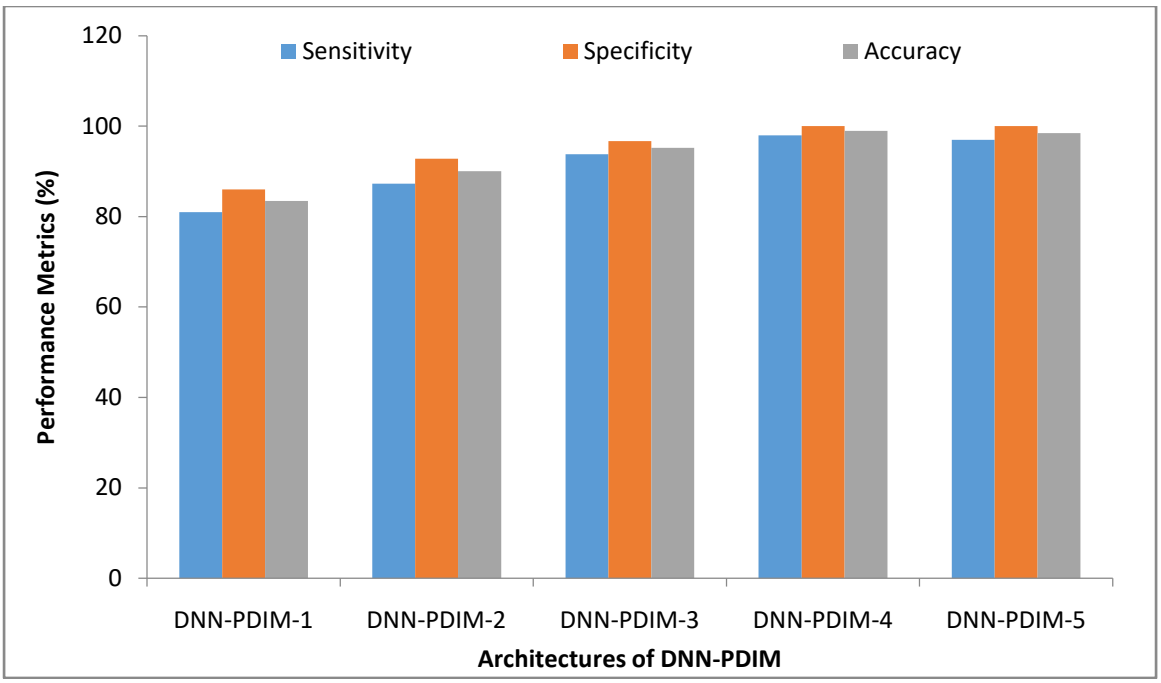



**Figure 5:** Performance of different DNN-PDIM architectures

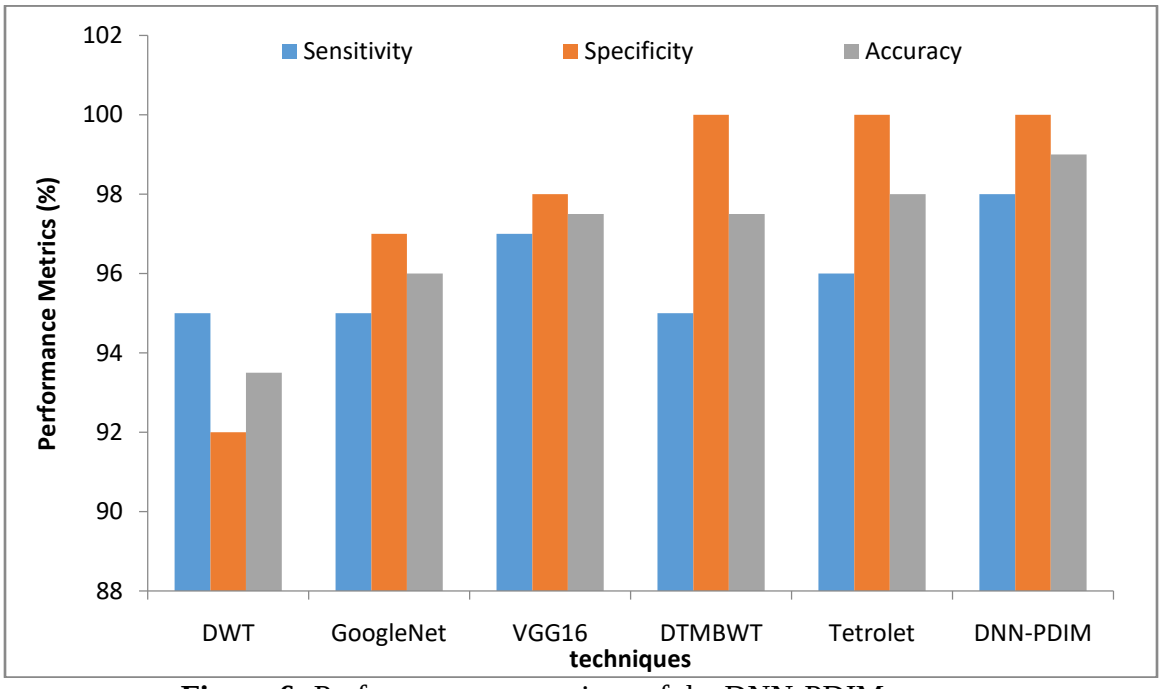



**Figure 6:** Performance comparison of the DNN-PDIM system

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

It is observed from Figure 6 that the DNN-PDIM gives better results than other classification systems. When compared to GoogLeNet[19], VGG16 [18] improves the classification from 96% to 97.5%. The proposed deep learning system, DBB-PDIM, further improves the accuracy to 99%. Other classification systems, which do not consider deep learning provides a maximum classification of 98% by Tetrolet, transform [13], 97.5% by DTMBWT [9], and 93.5% by DWT [12].

## 4.Conclusion

A new deep learning architecture, DNN-PDIM is developed for brain cancer diagnosis in this paper. The depth of the architecture is increased in each module to extract features. And then, the backpropagation with cross-entropy loss is employed for classification. The maximum average accuracy of 99% is obtained for classification, the sensitivity of 98%, and specificity of 100% are obtained by DNN-PDIM-4 architecture. The results contained in this study demonstrate that the DNN-PDIM can induce adverse effects on MRI brain image classification. The outcomes of the DNN-PDIM system may help the physician to diagnose brain cancer more accurately. Further, the DNN-FDIM will provide useful tools to design new architectures for medical image diagnosis. To further analyze the DNN-PDIM architecture, a residual module can be implemented to classify the MRI brain scans more accurately.

## References

[1]. Tyagi, V., 2019, September. A review on image classification techniques to classify neurological disorders of brain MRI. In 2019 International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT) (Vol. 1, pp. 1-4). IEEE.

[2]. Baranwal, S.K., Jaiswal, K., Vaibhav, K., Kumar, A. and Srikantaswamy, R., 2020, July. Performance analysis of Brain Tumor Image Classification using CNN and SVM. In 2020 Second International Conference on Inventive Research in Computing Applications (CIRCA) (pp. 537-542). IEEE.

[3]. Mallick, P.K., Ryu, S.H., Satapathy, S.K., Mishra, S., Nguyen, G.N. and Tiwari, P., 2019. Brain MRI image classification for cancer detection using deep wavelet autoencoder-based deep neural network. IEEE Access, 7, pp.46278-46287.

[4]. Gondi, FB, and Khotanlou, H., 2019, October. Glioma Brain Tumors Diagnosis and Classification in MR Images Based on Convolutional Neural Networks. In 2019 9th International Conference on Computer and Knowledge Engineering (ICKE) (pp. 1-5). IEEE.

[5]. Mishra, S.K. and Deepthi, V.H., 2020. Brain image classification by the combination of different wavelet transforms and support vector machine classification. Journal of Ambient Intelligence and Humanized Computing, pp.1-9.

[6]. Ambily, N. and Suresh, K., 2020, July. Classification of Brain MRI Images Using Convolution Neural Network and Transfer Learning. In 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (pp. 1-6). IEEE.

[7]. Narayanan KL, Ramesh GP, "Discrete Wavelet Transform Based Image Compression using Frequency Band Suppression and Throughput Enhancement," International Journal of MC Square Scientific Research, Vol. 9, No.2, pp.176-182, 2017.

[8]. Ibrahim, W.H., Osman, A.A.A. and Mohamed, Y.I., 2013, August. MRI brain image classification using neural networks. In 2013 international conference on computing, electrical and electronic engineering (IEEE) (pp. 253-258). IEEE.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 1871 - 1880
Received 25 April 2021; Accepted 08 May 2021.

[9]. R.R. Ayalapogu, S. Pabboju, and R.R. Ramisetty, “Analysis of dual-tree M-band wavelet transform based features for brain image classification”, Magnetic resonance in medicine, vol. 80, no. 6, pp. 2393-2401, 2018.
[10]. Ullah, Z., Farooq, M.U., Lee, S.H. and An, D., 2020. A hybrid image enhancement-based brain MRI images classification technique. Medical Hypotheses, 143, p.109922.
[11]. Latif, G., Iskandar, D.A., Alghazo, J.M. and Mohammad, N., 2018. Enhanced MR image classification using hybrid statistical and wavelets features. IEEE Access, 7, pp.9634-9644.
[12]. S. Mohankumar, “Analysis of Different Wavelets for Brain Image Classification Using Support Vector Machine,” International Journal of Advances in Signal and Image Sciences, vol. 2, no. 1, pp. 1-4, 2016.
[13]. BS. Babu, and S. Varadarajan, "Detection of a brain tumor in MRI scan images using Tetrolet Transform and SVM classifier," Indian Journal of Science and Technology, vol. 10, no. 19, pp. 1-10, 2017.
[14]. Raj, R.J.S., Shobana, S.J., Pustokhina, I.V., Pustokhin, D.A., Gupta, D. and Shankar, K., 2020. Optimal feature selection-based medical image classification using deep learning model on the internet of medical things. IEEE Access, 8, pp.58006-58017.
[15]. Nayak, D.R., Dash, R., Chang, X., Majhi, B. and Bakshi, S., 2018. Automated diagnosis of pathological brain using fast curvelet entropy features. IEEE Transactions on Sustainable Computing, 5(3), pp.416-427.
[16]. Mohan, G. and Subashini, M.M., 2018. MRI-based medical image analysis: Survey on brain tumor grade classification. Biomedical Signal Processing and Control, 39, pp.139-161.
[17]. Ismael, S.A.A., Mohammed, A. and Hefny, H., 2020. An enhanced deep learning approach for brain cancer MRI image classification using residual networks. Artificial intelligence in medicine, 102, p.101779.
[18]. Simonyan K, Zisserman A. Very deep convolutional networks for large-scale image recognition, 2014.
[19]. Szegedy, C et al. Going deeper with convolutions. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, Boston, MA, USA, 7–12 June 2015; pp. 1–9.
[20]. Scarpace et al., (2015). Data from REMBRANDT. The Cancer Imaging Archive. http://doi.org/10.7937/K9/TCIA.2015.588OZUZB
[21]. DATABASE Link: https://wiki. cancerimagingarchive.net/ display /Public/REMBRANDT.
[22]. Narayanan, K. L., & Ramesh, G. P. “Discrete Wavelet Transform Based Image Compression using Frequency Band Suppression and Throughput Enhancement”. International Journal of MC Square Scientific Research, Vol. 9(2), pp.176-182,(2017).

| | |
|---|---|
| NAME | Dr. Dinesha HA |
| DESIGNATION | Professor & HOD |
| QUALIFICATION | M.Tech, Ph.D., MISTE |

| Title of patent | Year of publication | Application Number | Publication Date |
|---|---|---|---|
| Integration with Student Lifecycle Management with SAP ( SLcM) | 2021 | 202141022954 | 23/05/2021 12:59:35 |
| A Novel System for Controlling Employees Attrition Rate | 2021 | 202141023567 | 27/05/2021 14:16:15 |

# CERTIFICATE OF PARTICIPATION

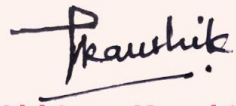
LEARNTOCODE.LIVE | LIVE ONLINE PROGRAMMING

This is to certify that

Bhargava R

has successfully completed the 2 Days Python Workshop with learntocode.live and now has a working knowledge of Python concepts and best practices.

Keep Learning more.
We wish you all the very best for your Future.



**Abhinav Kaushik**
abhinav@lrntocode.live

**learntocode.live**

International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST218344

# Review Process on URL Phishing

**Vivek Sharma S[1], Hemalatha R[2], Kavyashree Y B[2]**

[1]Assistant Professor, Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, Karnataka, India

[2]B.E Student, Information Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, Karnataka, India

**Article Info**
Volume 8, Issue 3
Page Number : 242-245

**Publication Issue**
May-June-2021

**Article History**
Accepted : 14 May 2021
Published : 22 May 2021

## ABSTRACT

Phishing is that the most typical and most dangerous attack among cybercrimes. The aim of these attacks is to steal the data that's utilized by people and organizations to perform transactions or any vital info. The goal of this is often to perform an Extreme Learning Machine (ELM) primarily based upon the classification of options together with Phishing Websites information among the UC Irvine Machine Learning Repository information. For results assessment, ELM was compared with different machine learning (SVM), Naive Thomas Bayes (NB) strategies and detected to possess the best possible accuracy.

**Keywords :** Extreme Learning Machine, Features Classification, Reporting Phishing.

## I. INTRODUCTION

Internet use has become a crucial and a section of our daily activities as a result of speedy growing technology, because of this zoom of technology and intensive use of digital systems, information security of these systems has gained nice importance. The primary objective of maintaining security in information technologies is to form certain necessary precautions that are taken against threats and dangers that seem to be moon-faced by users throughout the employment of these technologies.

Phishing is outlined as imitating reliable websites to induce the proprietary information entered into websites every day for varied functions, like usernames, passwords, and citizenship numbers. Individual(s) committing the fraud sends the pretend website or e-mail info to the target address as if it comes from an organization, bank, or the opposite reliable supply that performs reliable transactions.

Contents of the net website or the e-mail embrace requests reaching to lure the people to enter or update their personal info or to vary their passwords additionally as links to websites that seem as if precise copies of the websites of the organizations involved.

**Copyright: ©** the author(s), publisher and licensee Technoscience Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited

# RTC BASED EXAM PAPER LEAKAGE PROTECTION SYSTEM

**Sudhakara Reddy M[1] ,Sai Keerthana S [2],Sushma S M [3]**

[1]Assistant.Professor, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India

[2,3]B.E. Student, Department of Information Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India

**Abstract:** Education is sincerely the soul of a society and examination is the coronary heart of the schooling system. Today, when we come throughout the news of malpractice in checks we realize that, knowingly or unknowingly schooling has obtained irrecoverably corrupted. So we suggest an electronic gadget right here to detect and forestall examination paper leakages. This paper narrates RTC based Exam paper Leakage Protection device for the examination paper leakage which is a quite secured device in this calculated system, the query papers which are in the electronically locked field will be dispatched to the universities/Examination Centers. The container will be opened in a preset date and time solely and with the aid of authorized user only. In this device we are the use of a buzzer for any sort of unauthorized involvements.

***Keywords:*** Examination papers, Arduino UNO, RFID, GSM

## I.INTRODUCTION

An assessment is a measure that is used to ascertain a person's intelligence, aptitude, physical ability or category in a number of subjects. A check may also be provided verbally , on paper, on a laptop device, or in a restricted area that allows an examinee to physically display a range of abilities. The number of examination documents is enormous .The imperial examination was the first national standardized test used in china, and its primary aim was to identify qualified applicants for various government roles. Every year, at any stage during the examination period, reports appear in the newspaper and on television that now the examination is being delayed or cancelled owing to the leaking of question articles. The exclusive approach involves the college sending an e-copy of the questionnaire papers to the school prior to the review. The schools then print the issue papers and distribute them to the examinees. The concept for the proposed computer unit, which includes digital security, is based on current day functions such as digital lockers in financial institutions, home security systems, and place of enterprise security systems, as well as other security higher digital mechanisms.

## II.SYSTEM REQUIREMENTS

### 2.1 Hardware Requirements:-

1) The Arduino UNO
2) A DC motor
3) Pump Motor
4) GSM module
5) Battery
6) LCD Display
7) Rfid Tags
8) Rfid module
9) RTC
10) Power Section

### 2.2 Software Requirement:-

1) Arduino 1.6.13 Software
2) Embedded C Language

## III.COMPONENTS DESCRIPTION

**1) Arduino UNO: -** Arduino Uno is a single board Computer based on the ATmega328P microcontroller. It comes equipped with fourteen optical input/output pins, six analogue inputs, a sixteen MHz quartz crystal, USB networking, a power port, an ICSP header and a reset switch.

# "Screening System For Early Detection of Diabetic Retinopathy"

**Mr.Sudhakara Reddy M [1] , Jayashree B S [2] ,Kavya S [3] ,Lavanya K E [4] , Vikas Reddy P [5]**

*[1] Asst Professor, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India.*

*[2,3,4,5] B.E. Students, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India.*

## 1. ABSTRACT

The purpose of this paper is to conduct a review of various literatures in order to conduct a comprehensive study.

Diabetic Retinopathy (DR) research is being conducted, and various machine learning techniques are being used to detect DR. Diabetic Retinopathy (DR) is an eye disease that occurs in people who have diabetes and can harm the retina of the eye, resulting in total visual impairment. As a result, detecting diabetics is critical.

Our goal is to use machine learning classifying algorithms to detect the presence of diabetic retinopathy. As a result, we attempt to summarise the various models and techniques used, as well as the methodologies employed, and analyse the accuracies and results. It will tell us which algorithm will be more appropriate and accurate for prediction.

## 2. INTRODUCTION

Diabetes is a metabolic disease in which an individual's blood glucose level is elevated, either because the body does not produce enough insulin or because the cells are unable to use the insulin that is produced effectively. Diabetes is associated with damage to the small blood vessels of the retina, resulting in diabetic retinopathy (DR).

Diabetic retinopathy can cause the blood vessels within the retina to leak fluid or bleed, resulting in blurred or impaired vision. In its later stages, new abnormal blood vessels proliferate on the retina's surface, causing scarring and cell loss within the retina. Diabetes retinopathy is one of the most common complications of diabetes.

It is a serious and widespread disease. Because the risk of the disease increases with age, diabetics in their middle and older years are more vulnerable to Diabetic Retinopathy. Laser treatment can be used to prevent visual impairment or blindness in people with DR whose eyesight is at risk. However, there is currently no treatment that can restore vision that has already been lost.

Detecting DR is a time-consuming and manual process that necessitates the examination and evaluation of digital colour fundus photographs of the retina by a trained clinician. As a result, detecting DR at an early stage is critical.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 09 | Sep 2019 www.irjet.net p-ISSN: 2395-0072

# CHRONIC KIDNEY DISEASE PREDICTION BASED ON NAIVE BAYES TECHNIQUE

**Amogh Babu K A[1], Priyanka K[2], Raghavendra Babu T M[3]**

*[1]B.E. in Computer Science & Engineering, Mandya, Karnataka, India.*
*[2]Asst. Professor, Dept. of CSE, Nagarjuna College of Engineering & Technology, Bangalore, Karnataka, India.*
*[3]Asst.Professor, Dept. of CSE, P.E.S. College of Engineering, Mandya, Karnataka, India.*

---

**Abstract –** *Data Mining has been a recent trend for obtaining a diagnostic result. Huge amount of unmined data is collected by the healthcare department in order to discover the hidden facts for effective diagnosis and also decision making. Data mining is defined as the process of extracting the huge hidden data from a large dataset, categorizing valid and unique patterns in data. There are lot of DM techniques like clustering, classification, association, analysis, regression etc. The main aim of this paper is to predict a YES or NO for Chronic Kidney Disease (CKD) using the classification technique i.e. Naïve Bayes.*

***Key Words***: Naive Bayes, Clustering, User Interface (UI), Data Mining (DM), Chronic Kidney Disease (CKD).

## 1. INTRODUCTION

Data Mining is one among the foremost encouraging areas of analysis with the aim of finding helpful information from voluminous knowledge of datasets. It's been employed in several domains like image mining, opinion mining, web mining, text mining, graph mining etc. Its applications embody anomaly detection, money knowledge analysis, medical knowledge analysis, social network analysis, marketing research etc. It's become common in health department as there's a demand of analytical methodology for predicting and finding unknown patterns and obtaining info in health data. It plays a significant role for locating new trends in aid business.

Data Mining is especially helpful in medical field once no handiness of proof favouring a treatment choice is found. Great deal of advanced knowledge is being generated by aid business regarding patients, diseases, hospitals, medical equipments, claims, treatment price etc. That needs process and analysis for information extraction. Data processing comes up with a group of tools and techniques that once applied to the present processed knowledge, provides information to aid professionals for creating acceptable choices and enhancing the performance of patient management tasks. Patients with similar health problems is sorted along and effective treatment plans may well be recommended supported patient's history, physical examination, designation and former treatment patterns. Chronic Kidney Disease (CKD) has become a world health issue and is a locality of concern. It's a condition wherever kidneys become broken and can't filter nephrotoxic wastes within the body. Our work preponderantly focuses on police work life threatening diseases like chronic nephrosis (CKD) victimization Classification algorithms like Naive Bayes.

## 2. LITERATURE SURVEY

At present, health care industry is providing several benefits like fraud detection in health insurance, availability of medical facilities to patients at inexpensive prices, identification of smarter treatment methodologies, and construction of effective healthcare policies, effective hospital resource management, better customer relation, improved patient care and hospital infection control. Disease detection is also one of the significant areas of research in medical. Data mining approaches have become essential for healthcare industry in making decisions based on the analysis of the massive clinical data. Data mining is the process of extracting hidden information from massive dataset. Techniques like classification, clustering, regression and association have been used by in medical field to detect and predict disease progression and to make decision regarding patient's treatment. Classification is a supervised learning approach that assigns objects in a collection to target classes. It is the process which classifies the objects or data into groups, the members of which have one or more characteristic in common. The techniques of classification are SVM, decision tree, Naive Bayes, ANN etc.

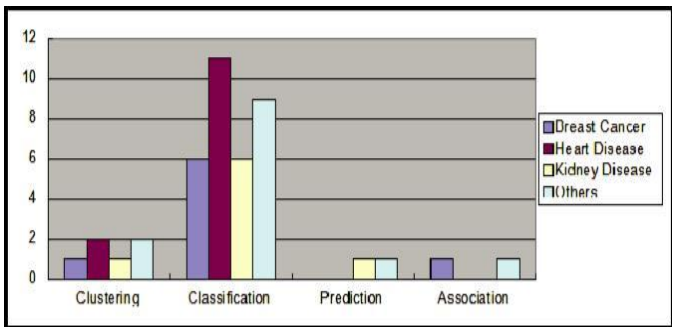



**Fig 2.1: potential use of data mining techniques**

The feasibleness study of employing a distributed approach for the management of alarms from chronic renal disorder patients. The key problems relating to alarm definition, classification and prioritization consistent with on the market standardization efforts area

Criterion - III - Invitation to edit
Criterion - III - Google Sheets
Deep belief network based appr
32.b.Seminars, Workshops, Confe
researchgate.net/publication/323714457_Deep_belief_network_based_approach_to_recognize_handwritten_Kannada_characters_using_distributed_average_of_gradients
Apps
Reading list
Advertisement

Hire the best researchers
in any discipline
ResearchGate

using distributed average of gradients

Springer

March 2019 · Cluster Computing 22(7)

DOI:10.1007/s10586-018-2274-0

Authors:

S. Karthik

K. Srikanta Murthy
Global Academy of Technology

Request full-text PDF

To read the full-text of this research, you can request a copy directly from the authors.

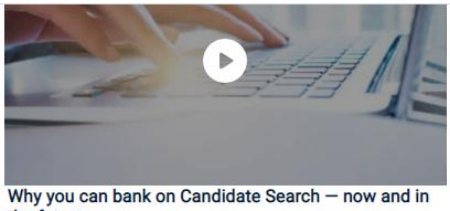
Download citation

Copy link

Citations (11) References (45) Figures (6)

Abstract and Figures

ResearchGate



Why you can bank on Candidate Search — now and in the future Read More

Advertisement


IJET-10012.pdf
g3.pdf
g1.pdf
Show all

11:22 AM
7/7/2021

Criterion - III - Invitation to edi | Criterion - III - Google Sheets | Shantakumar B. Patil's researc | 32.b.Seminars, Workshops, Co | Google

researchgate.net/scientific-contributions/Shantakumar-B-Patil-2084460641

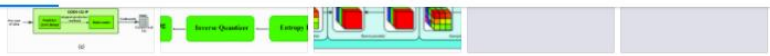
Apps | Reading list

Advertisement

Hire the best researchers
in any discipline

ResearchGate

Overview



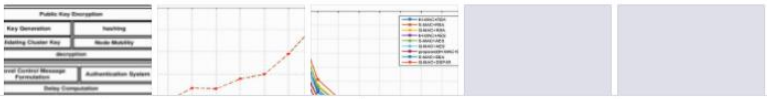
## A study of different compression algorithms for multispectral images

Article | Full-text available | Jun 2021

Swetha Vura · Premjyoti Patil · Shantakumar B. Patil

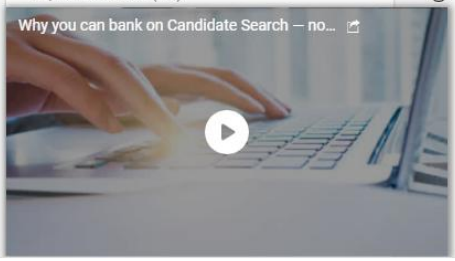
Remote Sensing satellites acquire information about an area by analyzing the transmitted and reflected radio waves. The Earth Imaging satellites capture high resolution images which occupy more storage space on-board and consume a lot of bandwidth for downlink transmission. Multispectral sensors represent information of the images in multiple bands...

Cite | Download full-text



ResearchGate

Top co-authors (10)




IJET-10012.pdf | g3.pdf | g1.pdf | Show all

11:18 AM
7/7/2021

Criterion - III - Invitation to edi | Criterion - III - Google Sheets | Anomaly Detection in MANET | 32.b.Seminars, Workshops, Co | Google

springerprofessional.de/en/anomaly-detection-in-manet-using-zone-based-aodv-routing-protoco/17595830

Apps | Reading list

Newsletter English

Springer Professional

Register Login

SEARCH | Automotive | Books | Journals | Events | Individual access | Access for companies

2019 | OriginalPaper | Chapter

# Anomaly Detection in MANET Using Zone Based AODV Routing Protocol


Authors: G. S. Prasanna Lakshmi, Shantakumar B. Patil, Premjyothi Patil

Publisher: Springer Singapore

IJET-10012.pdf | g3.pdf | g1.pdf | Show all

11:19 AM 7/7/2021

Criterion - III - Invitation to edit
Criterion - III - Google Sheets
A Secure Based New Intrusion D
32.b.Seminars, Workshops, Confe
ijert.org/a-secure-based-new-intrusion-detection-a-secure-based-new-intrusion-detection
Apps
Reading list
ISSN : 2278-0181
English
HOME ABOUT JOURNAL CALL FOR PAPERS TOPICS AUTHORS GUIDE ARCHIVE CONFERENCES CONFERENCE PROCEEDINGS THESIS PUBLICATION CONTACT US LOGIN

NCACCT - 2015 (VOLUME 3 - ISSUE 14)

# A Secure Based New Intrusion Detection A Secure Based New Intrusion Detection

Share

DOWNLOAD FULL-TEXT PDF
CITE THIS PUBLICATION


- **Open Access**
- Article Download / Views: 27
- **Total Downloads** : 8
- **Authors :** Prasanna Lakshmi G S, Swathi.S, Sudhakara Reddy.M
- **Paper ID :** IJERTCONV3IS14025
- **Volume & Issue :** NCACCT – 2015 (Volume 3 – Issue 14)
- **Published (First Online):** 24-04-2018
- **ISSN (Online) :** 2278-0181


CURRENT ISSUE
SUBMIT PAPER



g1.pdf
IJET-10012.pdf
g3.pdf
g1.pdf
Show all
11:23 AM
7/7/2021

# Chatbot For Disease Prediction And Treatment Recommendation

**Mrs. Swathi S[a], Sushruth S[b], Rajamani R[c], Manjunath S[d], Ullas R[e]**

[a] Assoc.Prof, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India
[b,c,d,e] B.E. Students, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India

**Article History**: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 28 April 2021

**Abstract:** The hospital is a universal method by which any patient can undergo medical examinations, diagnose diseases and get recommendations for any type of treatment. Most people all over the world follow this custom. People have considered this to be the most suitable and authentic way to keep a check on their physical body state. The proposed system is to find another alternative to this formal way of having to visit a hospital and to make an appointment for a check-up or diagnosis with a doctor. This particular research study will help to apply the concepts of natural language processing and machine learning to create a chatbot application. Just like people interact with each other, here people can easily interact with the chatbot through a series of questions and doubts, meanwhile the chatbot will find and identify the person's symptoms and thereby can predict which disease the person is affected with and suggest the related remedies and treatment. This system can be proved to be of great use especially to people who have to conduct diurnal check- ups, It can also enable people to understand their health and encourage more people to take appropriate measures to maintain their health. This research also suggests that such a system is not very popularly used and people lack knowledge about this. Putting into action this framework can be of great help to people in avoiding long-distance trips to the hospital just by using this free app no matter where you are.

**Keywords:** medical scrutiny, disease prognosis, chatbot, diurnal check-ups

## 1. Introduction

A flourishing society is a point at which the entirety of its individuals is solid. It is imperative to keep up wellbeing if one wishes to be glad. Just a solid body can have a sound mind and positively affect individuals' presentation. In their bustling lives, they neglect to take fitting measures to keep themselves sound and are less mindful of their wellbeing status. In the most recent news from TOI [1], we can see that individuals don't join significance to their wellbeing that testing in clinics takes too long. A bustling planned life has a bad situation for well-being. The majority of individuals who make up the local area's branch of work claim that their furious timetable doesn't allow them to have normal clinical checks and that they overlook any nervousness their bodies show until it turns out to be excessively extreme.

The principal motivation behind the task is to make the language hole between the client and wellbeing specialist organiza- tions by giving prompt reactions to the in- quiries posed by the client. There are three analyzes of tongue comprehension, that is, the completeness of identifying the main lin- guistic relationships for analyzing the topic in the subject of sentences. At that point, the portrayal of the writings is finished. Seman- tic understanding uses knowledge of the word that implies Chatbot is a substance that mirrors hu n banter in its satisfactory setting alongside a book or phonetic language (NLP). The objective of this framework is to

rehash the individual's conversation. Regu- larly the chatbot application occasion winds up making an interface for sending inputs and accepting a reaction. It is a framework that interfaces with the client by following the situation with the connection and recol- lecting past orders to give usefulness. Clini- cal chatbots are regularly evolved utilizing manufactured calculations that examine cli- ent requests, remember them, and give the response to the pertinent query framework gives response utilizing a proficient graph- ical interface like if the genuine individual is conversing with the client. A chatbot can be utilized in different fields like instruction, medical care, and emergency aides. The Central District of Chatbots incorporates MySQL. It is an intuitive framework that set- tles clients' requests identified with medica- tion. With the goal that they get the right guidelines for treatment through the web ap- plication utilizing Google API.

## 2. Literature Survey

In the paper by Rashmi Dharwadkar [5], the working of a chatbot relies upon Natural language preparation that causes clients to advance their issues about actual wellbeing. The patient can ask his wellbeing- related issues/inquiries through the clinical chatbot, it isn't required to test the client/patient should mandatorily go to the medical clinic rather by utilizing Google API for text-voice or voice-text discussion. Chatbot gets the inquiry from the client and showcases the connected arrangement through an android app.

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

# Track and monitor platform for election commission using altered voter ID card to make compulsory voting

**Mr.Vivek sharma [1], Neema K R [2], Nisha K R [3], Sankalpa C M [4] , Soniya G [5]**

[1] *Assistant Professor, Nagarjuna College of Engineering and Technology, Bangalore, India*

[2,3,4,5] *B.E. Students, Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*

## ABSTRACT

The main objective of the democracy is "vote" by which the people can elect the candidates for forming an efficient government to satisfy their needs and requests such that their standard living can be improved. Being a democratic country, India should celebrate the voting exercise as a festival! How can we even think of a cohesive society where only a few take part in the most vibrant festival of our democracy. In the existing scenario, the voters who exercise their voting rights represent merely a segment of the total population. In order to make this democratic institution more inclusive, there are certain measures which should be introduced. For example, replacing the electronic voting machines with cell phone-based individual voting mechanism has been introduced in Australia. A new mechanism like this can certainly ensure the highest possible percentage of voter turnout during elections. Making the voting exercise mandatory will certainly get more people involved in solving India's social issues.

## INTRODUCTION

Voting as an exercise by the citizens the nation should not only be considered as a right but also as a responsibility. It is one of the most significant rights of the citizens but is also as an act of taking responsibility for the general well-being of the society. The direction to the political and social well-being of the nation is fundamentally decided by the act of voting by the citizenry itself. The idea behind making it mandatory does not arise out of the necessity of providing equity to the citizens of the nation rather it arises because the need of the hour is to find solutions to existing problems in Indian

INTERNATIONAL JOURNAL OF INNOVATIVE SCIENCE AND RESEARCH TECHNOLOGY

IJISRT A DIGITAL LIBRARY

ISSN NO :- 2456-2165

# AUTHOR CERTIFICATE

THIS IS TO CERTIFY THAT THE MANUSCRIPT, ENTITLED

2DCrypt: Image Scaling and Cropping without Physical Interface

AUTHORED BY

Sudhakara Reddy M

HAS BEEN PUBLISHED IN

Volume 5 | Issue 4 | April - 2020

ARTICLE DIGITAL NO.

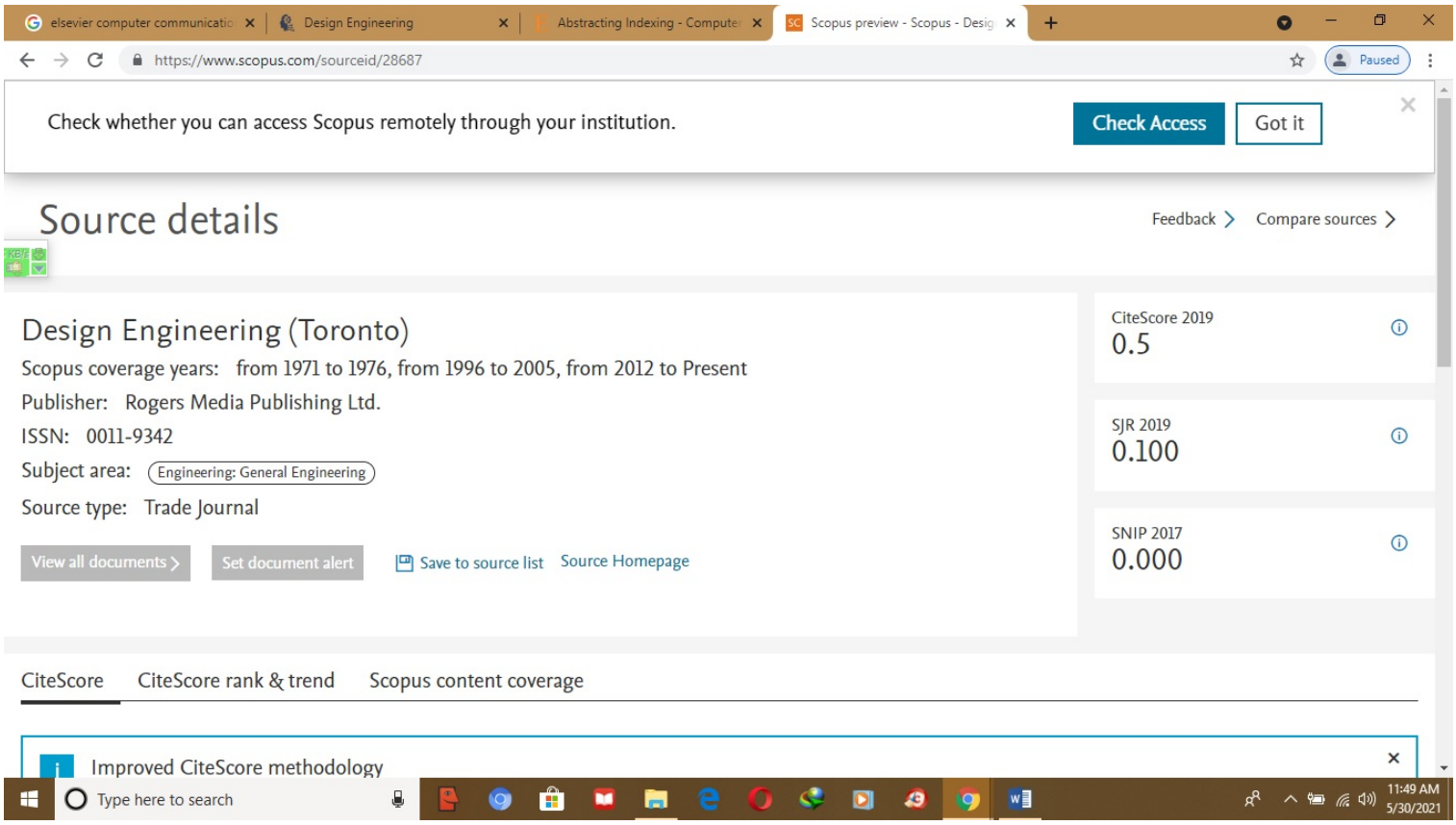
IJISRT20APR055

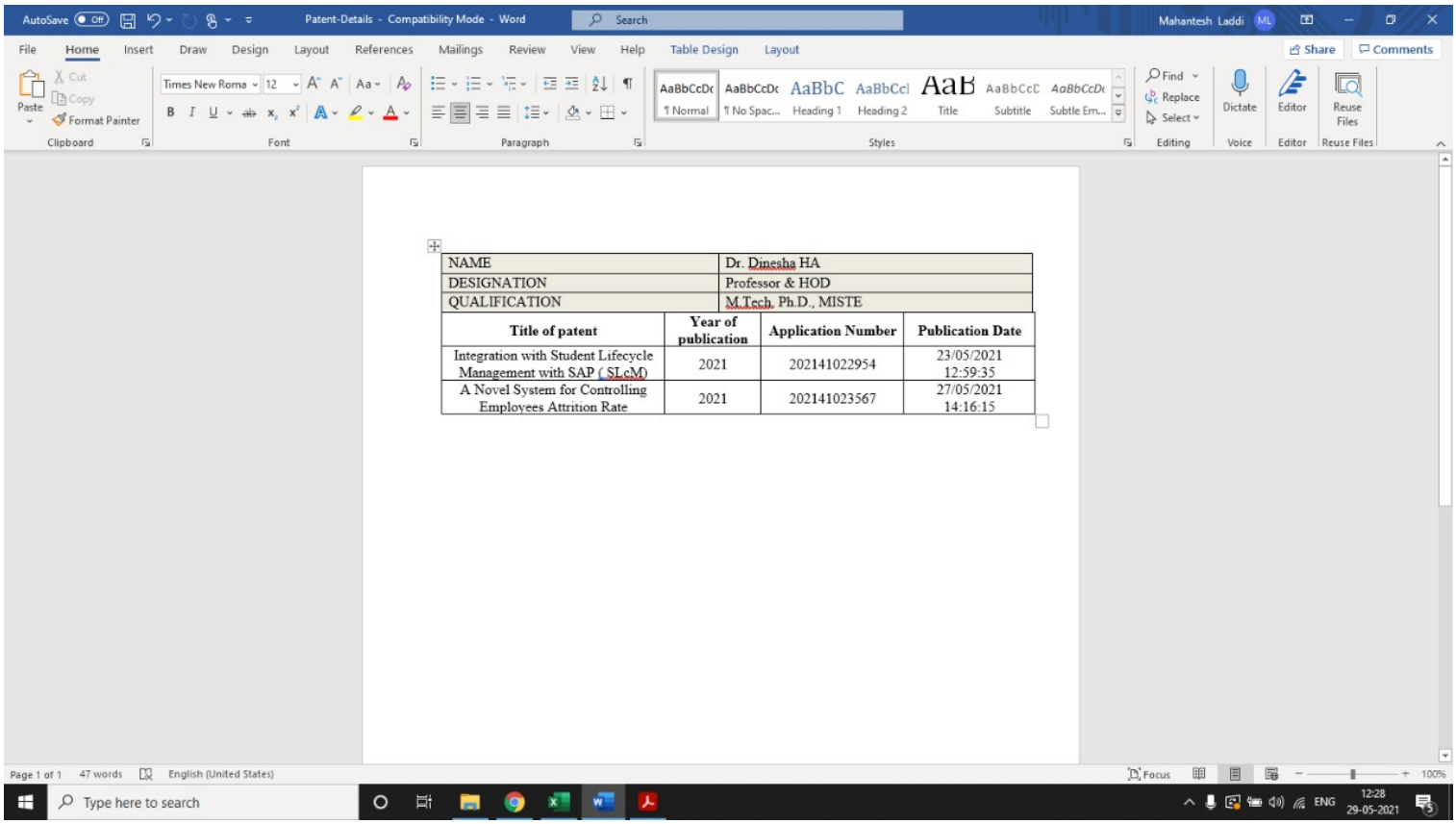
EDITOR IN CHIEF IJISRT

This document certifies that the manuscript listed above was submitted by above said respected author
To verify the submitted manuscript please visit our official website: www.ijisrt.com
Or Email us: editor@ijisrt.com

A DIGITAL LIBRARY

WWW.IJISRT.COM


elsevier computer communicatio
Design Engineering
Abstracting Indexing - Compute
Scopus preview - Scopus - Desig
https://www.scopus.com/sourceid/28687
Paused
Check whether you can access Scopus remotely through your institution.
Check Access
Got it
Source details
Feedback
Compare sources
Design Engineering (Toronto)
Scopus coverage years: from 1971 to 1976, from 1996 to 2005, from 2012 to Present
Publisher: Rogers Media Publishing Ltd.
ISSN: 0011-9342
Subject area: Engineering: General Engineering
Source type: Trade Journal
View all documents
Set document alert
Save to source list
Source Homepage
CiteScore 2019
0.5
SJR 2019
0.100
SNIP 2017
0.000
CiteScore
CiteScore rank & trend
Scopus content coverage
Improved CiteScore methodology
Type here to search
11:49 AM
5/30/2021



| NAME | Dr. Dinesha HA |
|---|---|
| DESIGNATION | Professor & HOD |
| QUALIFICATION | M.Tech, Ph.D., MISTE |

| Title of patent | Year of publication | Application Number | Publication Date |
|---|---|---|---|
| Integration with Student Lifecycle Management with SAP ( SLcM) | 2021 | 202141022954 | 23/05/2021 12:59:35 |
| A Novel System for Controlling Employees Attrition Rate | 2021 | 202141023567 | 27/05/2021 14:16:15 |

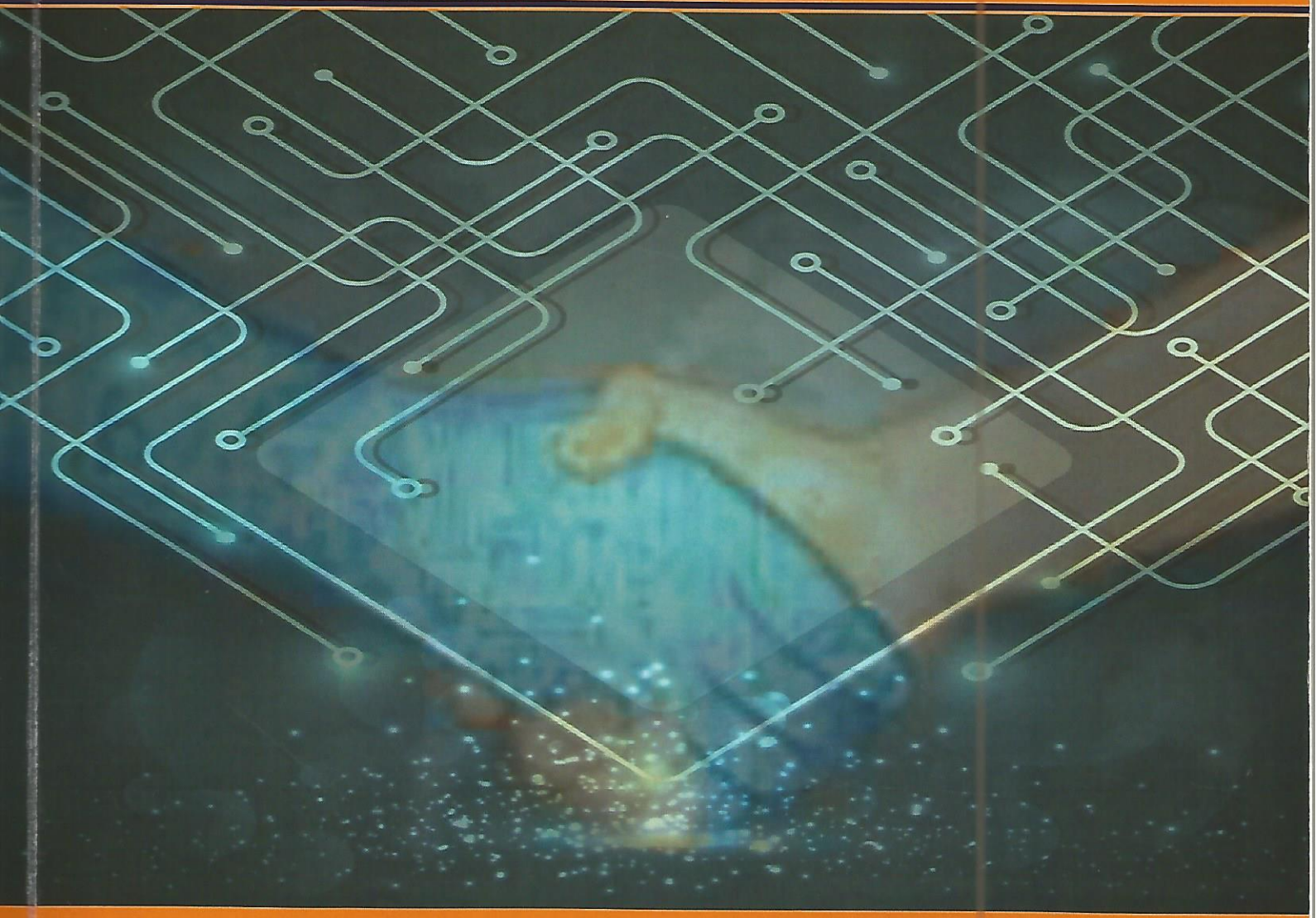
# INTERNATIONAL CONFERENCE ON

# INNOVATIONS IN TECHNOLOGY, BUSINESS & MANAGEMENT

NGI
NAGARJUNA
GROUP OF INSTITUTIONS

Knowledge is Power
DIU
Estd. 7th April, 1995

MTC Global™




**Editors**

**Dr. Srikanta Murthy. K § Dr. Bhavani M. R.**

**Dr. Anandamma S. § Dr. Serajul Islam Prodhan § Dr. Prachi Beriwala**

INTERNATIONAL CONFERENCE
ON

# INNOVATIONS IN TECHNOLOGY, BUSINESS & MANAGEMENT

February 7th, 2020

Organized
by
Nagarjuna Education Society
in Collaboration with

NAGARJUNA
GROUP OF INSTITUTIONS

Knowledge is Power
DIU
Estd. 7th April, 1995
Dhaka International University
Dhaka, Bangladesh

MTC Global
Bengaluru


Editors

Dr. Srikanta Murthy. K

Dr. Bhavani M. R.

Dr. Anandamma S.

Dr. Serajul Islam Prodhan

Dr. Prachi Beriwala

# Table of Contents

# Chapter 19

# AN EMPIRICAL STUDY ON CUSTOMER-BUYING BEHAVIOR AND ITS IMPACT ON CUSTOMER SATISFACTION WITH SPECIAL REFERENCE TO MARUTHI CARS AT MANDOVI MOTORS BENGALURU

Dr. Senthilkumar
School of Management
Presidency Universtiy
Bengaluru

Dr. Vala Ghanshyam Kantilal
Department of Management Studies
Nagarjuna College of Engineering & Technology, Bengaluru

**ABSTRACT:**

*In today's competitive automobile world, knowing the preference and buying behavior of a customer is very essential to gain the competitive edge. It can be very helpful in designing the best possible product that can satisfy the consumer by knowing their buying behavior and preferences. This study can also play a role in marketing as it will help to identify the consumer's needs more efficiently and further can be used to satisfy the consumers more effectively than the competitors. The main aim of this study is to study and understand the customer buying behavior towards Maruti car. Also to identify the factors influencing the customer buying behavior and the importance of brand image and the attributes which influence purchasing a car.*

*The data needed to carry out the research was collected through a well framed questionnaire which consists of both open ended and close ended questions for both prospective and possessing customers. According to the survey findings the main factors to be considered while buying a car are price, mileage, brand image and technology. Results also show that brand image plays a vital role in influencing the decision while purchasing a car. Customers also said that the advertisements helped them to choose a car to an extent. Even though Maruti have a wider range of customers by providing a good installment and insurance scheme Maruti can attract more customers.*

**Keywords:** *Consumer Behavior, Brand Image, Customer Satisfaction*

## INTRODUCTION:

India until 1950 has an automotive Industry of its own. Previously cars were imported from the countries like U.K, Belgium, Italy, Germany, Canada, & U.S. The cars which British India used on its road were Buick, Ply mouth, Pontoon ford, Dodge, Rolls Royce's for the elite class. Morris Minor, Limo etc, didn't stay for much longer period as the government had laid restrictions on the imports to conserve foreign exchange. In 1950, India came out with its first car from Hindustan motors, by the name "Baby Hindustan" later "Land Master" and "Ambassador" later came out with different models Mark I,II and IISI.

The latest "Nova" version of the present age is that of mark IV version, another car Contessa Classic was real driving one in the company.

The other players of this car segment are standard motors originally in collaboration with Vanguard Motors produce the Standard Vanguard Motors. Later they came out with models Standard 8, Standard 10, Standard 2000, Standard payment and Standard Gazelle. They then shifted to standard herald with mark II, IV versions and I. Lastly we had fiat in the joint venture with Premier Automobiles Limited came out with its first model of Fiat 1100 followed by Fiat Elegant, Fiat Minnicent, Premier, Premier Padmini etc., the Ambassador and the Fiat were in front with Hearld coming in the third place.

**Maruthi's Entry:** The first car came in 1984 with the advent of Maruti Suzuki; Indian customers got taste of modern technology, reliability and an awareness of international quality standards. The Indian automobile industry, which had ever faced competition due to policy; protected and closed economy was still slumbering and was slow to react.

A limited number of manufacturers continued to provide old and out dated technology. Despite the rumbling in the industry which was started by the entry of Maruti Suziki; the existing two auto manufactures did very little to upgrade their old outdated technology. Hence Maruti became the predominant player in the Indian passenger car market. But sadly owing to the foreign exchange constraint Maruti could not keep place with global technological advances. In spite joint venture with one if the reputed manufacturers, India did not gain much by the way of technological advancement. Many of the auto components including the gearbox were still imported negating much of the advantage. Otherwise India would have gained by a technology transfer. In 1984, Maruti Udyog Limited over took all the dominant players with its attractive prices and with the introduction of fresh designs by 1988, Maruti controlled 84% car market with its new models Maruti-800, Omni and Zen.

**Background and Inception of the Study:** MUL was formed in 1981, but its true origin can be traced back to mid 1970, when late Sri Sanjay Gandhi with his vision and ambition of building a peoples car´ and started this company. The company did produce only 31 cars but it did not cross the testing stage. Company started declining and then for survival, it has to depend on assembling road rollers, building bus, truck bodies etc. Then a special team which consisted of all successful and leading personalities of Indian automobile industries was incorporated on 22nd April 1981, to make an attempt to achieve Mr. Gandh is vision of Peoples Car´. Mr. Sumanth Moolgaanker (from Telco) was made the Chairman; Mr. Krishna Murthy was made the vice chairman and the M. D. Mr. R. C Bhargava was the special officer on duty. They met almost every manufacturer of importance and they included Opel, Renault, Volkswagen, Peugeot, etc. Suzuki Motor Company (SMC) started the match over the rest by giving the best proposal.

The Indian Govt. and SMC signed a collaboration agreement in October 1982.Suzuki held the strake of 26% equity and rest by the Indian Govt. The main objective of this was to produce high quality, fuel efficient vehicles in India to achieve high volumes of production at low cost, so that the company never made loss.

Mandovi Motors was a firm set up in the year 1963 as partnership firm, which was the dealer for Volkes Wagon cars and spare parts and in 1965 appointed as the dealer for Suvega Motors. After that, Maruti Udyog Ltd. has appointed Mandovi motors as dealer for Maruti vehicles in the year 1983. Mr. Ashok Rao is the M.D of the company. It is managed by one of the prominent business families in the district with a good track record of promoting successful enterprises like Supreme Motors, Arvind Motors under the dynamic leadership of Late Aroor Sripathi Rao, Mandovi grew very fast year after year and also started Maruti Suzuki's authorized dealership at Mysuru in 1985 and later in 1989 dealership in Bengaluru.

SIF

ISSN - 2348-2397
APPROVED UGC CARE

SHODH SARITA

SHODH SARITA
Vol. 7, Issue 27, July-September, 2020
Page Nos. 101-106

AN INTERNATIONAL BILINGUAL PEER REVIEWED REFEREED RESEARCH JOURNAL

# A STUDY ON CHALLENGES AND PROSPECTS OF STARTUPS WITH REFERENCE TO COVID-19

Geethanjali G*
Dr. R. Jayaprakash Reddy**

## ABSTRACT

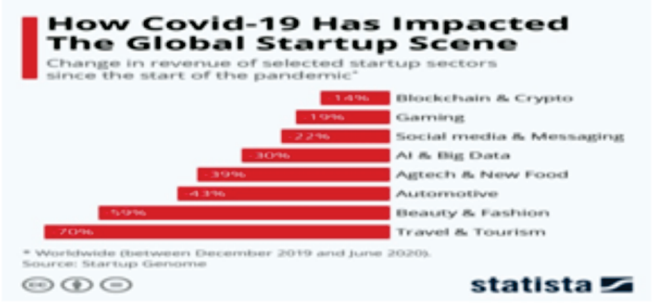
Startups in any country play a vital role in its economic development. It creates spillover effect by providing jobs and other commercial opportunities to the local region. With more than 8500 startups, Bengaluru, the startup hub of India has fostered startup culture and there is massive increase in number of startups being established in Bengaluru. Government initiates and the support mechanism from the startup ecosystem are adding to the spirit of startup entrepreneurship. But the current global pandemic has disrupted the countries across the world leading to a great recession of all times. It has impacted the way the business used to function. The various sectors have disrupted and those sectors which have strategically adapted to the change and managed the crisis have the high probability to sustain. Pivot or perish has become the new normal for these startups. The current study analyses the challenges and opportunities faced by the startups in Bengaluru.

**Keywords :** Covid-19, Pandemic, Bengaluru Entrepreneurship, De-globalization, Startups.

## 1. Introduction :

In the history of mankind, the world has faced global crisis ranging from the great depression of 1932 to the global economic recession 2008-09, which has created a lot of hardship to millions of people across the countries. Most of these crises emerged from the advanced countries and badly impacted all other countries. The recent corona virus outbreak from China has created havoc and impacted the countries across the world irrespective of the status of the development of these countries. Leading advanced countries as well as poor countries experience loss on all fronts and thereby making it a global crisis.

The countries across the world forced to impose curfews, quarantines, practice of social distancing, screenings at airports and various other measures to contain the great pandemic of all times. This has resulted in the great world lockdown which has pushed the economies across the globe to move towards recession. The IMF had estimated that the global economy is growing at -3% which is so far, a worse scenarios than any other global crisis leading to collapse of many economies worldwide. The covid-19 situation has restricted the international travels thereby disrupting the global supply chains. The sectors such as travel, tourism, hospitality and entertainment have highly disrupted due to pandemic and countries relying on these sectors are at higher risk. These economic disruptions are adding to the trend of de-globalization. The present study analyses the challenges faced by the startups and opportunities created due to Covid 19 crisis.




*Ph.D Research Scholar - AIMS Institutes, Bangalore, India
**Professor - Department of Commerce, AIMS Institutes, Bangalore, India

# BBRC

**Bioscience Biotechnology Research Communications**

**Special Issue Vol 13 Number (13) 2020**
**Print ISSN: 0974-6455**
**Online ISSN: 2321-4007**
**CODEN BBRCBA**
**www.bbrc.in**
**University Grants Commission (UGC)**
**New Delhi, India Approved Journal**

Bioscience Biotechnology Research Communications
Special Issue Volume 13 Number (13) 2020

Special Issue Volume 13 Number (13) 2020

On

Computational Data Prediction
in Recommendation Systems

An International Peer Reviewed Open Access Journal

**Published By:**
Society For Science and Nature
Bhopal, Post Box 78, GPO,
462001 India

Indexed by Thomson Reuters, Now
Clarivate Analytics USA

SJIF 2020=7.728
Online Content Available:
Every 3 Months at www.bbrc.in

SOCIETY
FOR SCIENCE AND NATURE
SCIENCE FOR LIFE

Registered with the Registrar of Newspapers for India under Reg. No. 498/2007
Bioscience Biotechnology Research Communications
Special Issue Volume 13 No (13) 2020



ISSN 0974-6455

Registered with the Registrar of Newspapers for India under Reg. No. 498/2007
Bioscience Biotechnology Research Communications
Special Issue Volume 13 No (13) 2020

Registered with the Registrar of Newspapers for India under Reg. No. 498/2007
Bioscience Biotechnology Research Communications
Special Issue Volume 13 No (13) 2020

Registered with the Registrar of Newspapers for India under Reg. No. 498/2007
Bioscience Biotechnology Research Communications
Special Issue Volume 13 No (13) 2020

# CONTENTS

BBRC
Bioscience Biotechnology Research Communications

VOLUME 13 • NUMBER (13) • SPECIAL ISSUE 2020

## REFERENCES

K B Shiva Kumar, K B Raja, R K Chhotaray, Sabyasachi Pattanaik (2010) Bit Length Replacement Steganography Based On DCT Coefficients. International Journal of Engineering Science and Technology, 2(8): 3561-3570.

Subramani, Prabu, Ganesh Babu Rajendran, Jewel Sengupta, Rocío Pérez de Prado, and Parameshachari Bidare Divakarachari. "A Block Bi-Diagonalization-Based Pre-Coding for Indoor Multiple-Input-Multiple-Output-Visible Light Communication System." Energies 13, no. 13 (2020): 3466.

Kousik Dasguptaa, Jyotsna Kumar Mondalb and Paramartha Dutta (2013) Optimized Video Steganography Using Genetic Algorithm (GA). International Conference on Computational Intelligence, Elsevier 10:131 - 137.

Ramandeep Kaur and Pooja (2014) XOR Encryption Based Video Steganography. International Journal of Science and Research, 2(11): 2319-7064.

Shahzad Alam, S. M. Zakariya and Nadeem Akhtar, "Analysis of Modified Triple A Steganography Technique Using Fisher Yates Algorithm", pp. 207-212. IEEE, 2014.

Amritha Sekhar, Manoj Kumar and M. Abdul Rahiman (2015) A Novel Approach for Hiding Data in Videos Using Network Steganography Methods. Procedia Computer Science, Elsevier, 70: 764-768.

C. Aishwarya and J. R. Beny (2015) Novel Architecture for Data – Shuffling Using Fisher Yates Shuffle Algorithm. International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), 1(6): 387-390.

Nithiya Devi.G, Sharmila.S, Saranya.N, Rajkumar.K.K, and Gomathi (2016) Novel Architecture for Data – Shuffling Using Enhanced Fisher Yates Shuffle Algorithm. International Journal of Engineering Science and Computing (IJESC), 6(5): .4932-4935.

Ramadhan J. Mstafa and Khaled M. Elleithy (2016) A novel video steganography algorithm in DCT domain based on hamming and BCH codes. IEEE: 208-213.

Parameshachari, B. D., Rashmi P. Kiran, P. Rashmi, M. C. Supriya, Rajashekarappa, and H. T. Panduranga. "Controlled partial image encryption based on LSIC and chaotic map." In ICCSP, pp. 60-63. 2019.

Mumthas S and Lijiya A (2017) Transform Domain Video Steganography Using RSA, Random DNA Encryption and Huffman Encoding. International Conference on Advances in Computing & Communications, Elsevier, 115: 660–666.

TRANS STELLAR
•Journal Publications •Research Consultancy

**Paper Id:** IJSMMRDJUN20213 **Date:** 05/15/2021

# Certificate of Publication

*This is to certify that the research paper entitled " A STUDY ON EMAIL MARKETING OPTIMIZATION FOR LEAD GENERATION " authored by " T RANJANI, SRIRAM S & DR. BIRAJ AMEET ANIL " had been reviewed by the board and published in " INTERNATIONAL JOURNAL OF SALES & MARKETING MANAGEMENT RESEARCH AND DEVELOPMENT (IJSMMRD); ISSN (ONLINE): 2249-8044; ISSN (PRINT): 2249-6939; IMPACT FACTOR(JCC) (2020): 8.6084; INDEX COPERNICUS VALUE (ICV) - (2016): 61.33; NAAS RATING: 3.37; VOL - 11, ISSUE - 1; EDITION: JUN-2021 "*

L. Gayathri
Associate Editor-TJPRC

Chief Editor-TJPRC

International Journal of Research in Engineering, Science and Management
Volume-3, Issue-2, February-2020
www.ijresm.com | ISSN (Online): 2581-5792


# Introduction to Mobile Technology 6G – A Revolution

G. Mamatha[1], Bhavana N. Prasad[2], Niharika[3]
[1]*Professor, Department of Information Science Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*
[2,3]*Student, Department of Information Science Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*

***Abstract*: Wireless correspondences is the exchanging of data between at least two points which are not physically associated. Separations can be short, which is utilized for TV remote control and even far separation which is utilized for deep-space radio communications. The paper manages the advancements of technologies and its favourable circumstances and near investigation on 3G, 4G, 5G and 6G and outline of 6G innovation.**

***Keywords*: Mobile Technology, 6G.**

## 1. Introduction

Mobile technology is a technology used for cellular communication. It has evolved rapidly over that last few years. Since the start of this millennium, a standard mobile device has gone from being no more than a simple two-way pager to being a mobile phone, GPS navigation device, an embedded web-browser and an instant messaging client, and a handheld gaming console. It is an innovation which is convenient. An assortment of assignments can be performed at whenever and anyplace. The integration of information technology and communication technology is bringing great changes to our social life. Through the use of high-coverage mobile communication networks, high-speed wireless networks, and various types of mobile information terminals, the use of mobile technologies has opened up a vast space for mobile interaction. And has become a popular and popular way of living and working. There are various transmissions medium like radio wave, microwave, infra-red, GPS and Bluetooth is used to trade of data by methods for voice, content, video, 2-dimensional scanner tags and anything is possible from that point.

COMPARISON BETWEEN 1G, 2G, 3G, 4G AND 5G

| *Technology / Features* | *1G* | *2/2.5G* | *3G* | *4G* | *5G* |
|---|---|---|---|---|---|
| **Start/ Deployment** | 1970/ 1984 | 1980/ 1999 | 1990/ 2002 | 2000/ 2010 | 2010/ 2015 |
| **Data Bandwidth** | 2 kbps | 14.4-64 kbps | 2 Mbps | 200 Mbps to 1 Gbps for low mobility | 1 Gbps and higher |
| **Standards** | AMPS | 2G: TDMA, CDMA, GSM 2.5G: GPRS, EDGE,1xRTT | WCDMA, CDMA-2000 | Single unified standard | Single unified standard |
| **Technology** | Analog cellular technology | Digital cellular technology | Broad bandwidth CDMA, IP technology | Unified IP and seamless combination of broadband, LAN/WAN/ | Unified IP and seamless combination of broadband, |

Fig 1. Comparison of different generation of mobile technology

### A. Advantages

- Access speed
- Higher efficiency
- Reduced cost of operations
- Endless possibilities
- Increase availability of social networks

Fig. 2. Mobile technology

## 2. Existing system and its drawbacks

### A. Existing System

5G technology alludes to fifth era technology, which was begun in 2010 and the wide deployment began in 2019. The frequency spectrum in 5G is divided into millimeter wave, mid-band and low-band. Low-band uses the same frequency as the predecessor, 4G. 5G millimeter wave is the fastest, with actual speeds often being 1-2Gb/s down. It gives up-to 25Mbps network speed. Frequencies are above 24 GHz reaching up to 72 GHz which is above the extremely high frequency band's lower boundary. The reach is short, so more cells are required. Millimeter waves have difficulty traversing many walls and windows, so indoor coverage is limited. It underpins the virtual private system. 5G mid-band is the most widely deployed, in over 20 networks. Speeds in a 100 MHz wide band are usually 100–400 Mbit/s down. In the lab and occasionally in the field, speeds can go over a gigabit per second. Frequencies deployed are from 2.4 GHz to 4.2 GHz. Sprint and China Mobile are using 2.5 GHz, while others are mostly between 3.3 and 4.2 GHz, a range which offers increased reach. Many areas can be covered simply by upgrading existing towers, which lowers the

International Journal of Research in Engineering, Science and Management
Volume-3, Issue-1, January-2020
www.ijresm.com | ISSN (Online): 2581-5792


# Crowdsourcing Towards Blockchain

G. Mamatha[1], B. R. Bharath Roshan[2], S. R. Vasudha[3]
[1]*Professor & HoD, Department of Information Science and Engineering , Nagarjuna College of Engineering and Technology, Bangalore, India*
[2,3]*Student, Department of Information Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*

***Abstract*: Publicly supporting has been sought after as an approach to use the intensity of the group for a wide range of purposes in assorted segments from gathering data, amassing assets, and social occasion representatives to perform errands of various sizes among different targets. Information trustworthiness and nonrepudiation are of most extreme significance in these frameworks and are at present not ensured. Blockchain innovation has been demonstrated to enhance these perspectives. Right now, explore the advantages that the selection of Blockchain innovation can get publicly supporting frameworks. To this end, we give instances of genuine publicly supporting use cases and investigate the advantages of utilizing Blockchain, chiefly as a database.**

***Keywords*: Crowdsourcing, Blockchain, Ledger.**

## 1. Introduction

Crowdsourcing is a practice of obtaining information or input by enlisting the services of a large number of people, via the internet. When there are complex problems like labelling the image and Natural Language Processing which is difficult for a machine to do. Rather than waiting and relying on an algorithm, using crowdsourcing can be helpful for dividing this complex job between the machine and human. Using cloud sourcing can save lot of time and lot of memory has the data is stored on the cloud.

The Benefits of cloud sourcing are:

- *Saves Time:* When there are large number of people working, the processing of data is much faster.
- *Saves Internal Resources:* Since crowdsourcing saves all the data in the cloud. It is easier to access the data from anywhere and is also cost effective.
- *To keep up the document as you grow:* As the organisation grows the number of people working grows drastically and more data is accumulated.
- *Realtime analytics:* When there is lot of real-time data the consumer demand increases. As nowadays people only rely on present data to get accurate analytics.

Blockchain, sometimes spoken as Distributed Ledger Technology (DLT), makes the history of any digital asset unalterable and transparent through the utilization of decentralization and cryptographic hashing. A simple analogy for understanding blockchain technology may be a Google Doc. after we create a document and share it with a bunch of individuals, the document is distributed rather than copied or transferred. This creates a decentralized distribution chain that offers everyone access to the document at identical time. nobody is locked out awaiting changes from another party, while all modifications to the doc are being recorded in real-time, making changes completely transparent.

## 2. Background

Deep Learning is a piece of a more extensive group of AI techniques dependent on counterfeit neural systems with portrayal learning. Learning can be directed, semi-administered or unsupervised.

Deep learning models, for example, profound neural systems, profound conviction systems, intermittent neural systems and convolutional neural systems have been applied to fields including PC vision, discourse acknowledgment, common language handling, sound acknowledgment, informal organization sifting, machine interpretation, bioinformatics, medicate structure, restorative picture examination, material investigation and pre -packaged game projects, where they have created results practically identical to and sometimes out performing human master performance.

Artificial neural systems (ANNs) were propelled by data handling and dispersed correspondence hubs in natural frameworks. ANNs have different contrasts from organic cerebrums. In particular, neural systems will in general be static and representative, while the natural mind of most living life forms is dynamic (plastic) and simple.

## 3. Algorithm

Bootstrap aggregating, likewise called bagging, is an AI group meta-calculation intended to improve the solidness and precision of AI calculations utilized in factual characterization and relapse. It additionally diminishes fluctuation and assists with abstaining from overfitting. In spite of the fact that it is generally applied to choice tree strategies, it very well may be utilized with a technique. Sacking is a unique instance of the model averaging approach.

Given a standard preparing set D of size n, stowing produces m new preparing sets D_{i}}D_{i}, every one of size n′, by

International Journal of Research in Engineering, Science and Management
Volume-3, Issue-1, January-2020
www.ijresm.com | ISSN (Online): 2581-5792


# IoT Based Air and Noise Pollution Monitoring System in Urban and Rural Areas

S. Soniya[1], A. R. Sindhu[2], G. S. Manasa[3], D. N. Mohan[4]
[1,2,3]*B.E. Student, Department of Information Science & Engineering, Nagarjuna College of Engineering and Technology, Bengaluru, India*
[4]*Assistant Professor, Department of Information Science & Engineering, Nagarjuna College of Engineering and Technology, Bengaluru, India*

***Abstract*: The main environmental and public issues today are air pollution and noise pollution. According to the World Health Organization (WHO), air and noise pollution are important risk factors for a variety of health conditions, including skin and eye infections, nose irritation, sore throat, and headache. It can also cause serious illnesses such as heart disease, lung cancer, and difficulty breathing. India is the fourth largest carbon dioxide emitter in the world, and it is important to understand the country's current emissions and possible emissions. Therefore, one of the main reasons is the increase in cars, which eventually leads to an increase in air and noise pollution, because the unit area of cars is the main source of environmental pollution. The main goal of our project is to monitor the noise and air level of the vehicle using various sensors, GSM / GPRS and cloud servers. Using cloud servers, we will update the information and keep people informed about pollution levels.**

***Keywords*: Arduino Uno, LM393, MQ135, GPRS, Cloud.**

## 1. Introduction

It turns out that India's environmental pollution is a serious problem in the 21st century. The main source of pollution in India is cars. The Indian government has developed many regulations to control environmental pollution caused by vehicle emissions, but most of them have not been successful. It is necessary to monitor air and noise pollution levels to ensure a healthy and safe environment. Carbon monoxide gas in the atmosphere reduces the blood's ability to carry oxygen; hydrocarbons in the atmosphere can affect the heart, brain, kidneys and bone marrow. Nitric oxide can affect the lungs and cause breathing problems. In an era of urbanization due to the rapid growth of motor vehicles, it is difficult to inspect all vehicles. Examining all these vehicles requires a lot of manpower. To easily monitor all vehicles, we have developed an air and noise pollution monitoring system called IoT, through which we can easily monitor all vehicles. With the rapid growth of infrastructure and industrial plants, environmental issues have greatly affected the demand for intelligent monitoring systems. The project proposes an embedded system using a wireless sensor network that provides a framework for collecting sensor data anywhere using the Internet of Things. In the proposed system, sensors and active RFID are used together to monitor IoT based vehicle pollution.

## 2. Related work

First, L. Ezhilarasi et al. A monitoring technology using a Zigbee wireless sensor network has been proposed to monitor various environmental parameters. It uses RFID to store and retrieve data by electromagnetic transmission to RF integrated circuits. The WSN gateway method is used to conveniently collect data anytime, anywhere. [1]. Mahantesh B Dalawai et al. Their paper used a GPRS/GSM module and a web server to effectively monitor various pollution levels. In this module, smoke and noise sensors will upload data to a server or cloud at every moment so that the level of pollution can be monitored using the internet [2].

Dr. A Sumithra and others. The concept of a smart city is proposed. Technology and communications are the foundation of this smart city. Various sensors and modules have also been used to monitor various environmental parameters. The system uses air and sound sensors to monitor the data and then uploads the data as digital data to a cloud server. The cloud storage manager analyzes the data and notifies accordingly. [3]

Giovanni B. Fioccola et al. An Arduino-based air pollution monitoring system Polluino has been proposed. Data is then uploaded to a cloud-based platform that manages data from sensors [4].

Somansh Kumar et al. The idea of a real-time air quality monitoring system was proposed, which includes P.M. 2.5, carbon dioxide [5].

## 3. Sensors and modules used

### *A. Smoke sensor MQ135*

To monitor the air pollution and to determine the air quality index, a gas sensor, MQ135 is used. It efficiently detects the smoke and CO2 level in air. This sensor is chosen for its wide detecting scope, fast response, high sensitivity, stable and long life and lastly, a simple drive circuit. It is used in air quality monitoring devices in buildings and homes.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 8 Issue XI Nov 2020- Available at www.ijraset.com*

# Efficient Reliability Estimate for Weibull Class Models

B. Roopashri Tantri
*Director, Aghanasha Consulting LLP, Bangalore, India*

***Abstract:*** ***Software quality is a major concern for all software developers. Quality of the software can be assessed using various measures such as - the failure intensity function, the mean time to failure, failure rate etc. Several methods of estimation, like - the maximum likelihood estimation, the least square estimation etc are used in estimating these quantities. However, the software reliability, which is the probability of failure free operation of the software over a specified period of time, is an important measure of the quality of the software that helps the developers of the software to ensure that the user requirements are met. Software reliability models having certain failure time distribution are used to find the estimators of reliability and software failure data obtained during testing are used to estimate these values. Since most of the software failures have Weibull failure time distribution, herein, it is intended to estimate the reliability for the Weibull class models. The technique of Blackwellization has been used to find the minimum variance unbiased estimator of the reliability function. Few case studies have been considered to explain the behavior of this estimator.***

***Keywords: Blackwellization, Minimum Variance Unbiased Estimator, Software reliability, Software reliability models, Weibull class models.***

## I. INTRODUCTION

Software plays a major role in every filed. Failing to have good quality software can result in economic damage to even loss of life. Thus, software quality is an essential concern of every software developer. Software failures occur randomly and the behavior of these failures with time are described by software reliability models. The software reliability models are often expressed in terms of failure times, which follow certain probability distribution. Depending on the distribution of the failure times, these software reliability models are categorized into several classes. Most of the models fall into Weibull class, where failure times are assumed to follow Weibull distribution. Several estimation procedures like - the method of maximum likelihood estimation, method of least squares, method of minimum variance unbiased estimation, etc are available. The method of minimum variance unbiased estimation is considered as the most efficient method of estimation, since it always provides an unbiased estimator and has the minimum variance among the class of all such unbiased estimators. However, because of the complexity involved in estimating it, the method is rarely used. Here, it is intended to obtain the minimum variance unbiased estimator of reliability using the technique of Blackwellization. The method is applied to Weibull class models, with known value of the parameter $\beta$.

### A. Notations

1) $f(t)$ : Probability density function (pdf) of $T$.
2) $L$ : Likelihood function.
3) $f(x|y)$ : Conditional pdf of $X$ given $Y$.
4) $E(X)$ : Expectation of $X$.
5) $E(U|S)$ : Conditional expectation of $U$ given $S$.
6) $W(\beta, \Phi)$ : Weibull distribution with parameters $\beta$ and $\Phi$.
7) $\Gamma(n)$ : Gamma function.

### B. Terminologies

Software reliability [1]: It is the probability of failure free operation of a computer program in a specified environment for a specified period of time. Thus, if $T$ denotes the failure time distribution of the given software, then, its reliability at time $t$, denoted by $R(t)$ is defined as $R(t)=P(T>t)$.

Software reliability models [2]: These describe the behavior of failure with time, by expressing failures as random processes in either times of failure or the number of failures, at fixed times.

©IJRASET: All Rights are Reserved

# Software Reliability Estimation of Gamma Failure Time Models

B. Roopashri Tantri
Department of ISE
Nagarjuna College of Engineering and Technology
Bangalore, India
e-mail: roopatantri@gmail.com

Murulidhar N. N.
Department of MACS
National Institute of Technology Karnataka
Surathkal, India
e-mail: murulidharnn@gmail.com

***Abstract*— With the increasing role of software in every field, concern has grown over the quality of software products. One such measure of software quality is the reliability, which is the probability of failure-free operation of a computer program in a specified environment for a specified time. Prior to the release of software, failure data are obtained during testing, using which, future reliability of software can be assessed. Reliability assessment can be done using various measures like Mean Time To Failure, failure intensity function, mean value function, etc. To assess the reliability, one should have a mathematical model that describes the behavior of failure with time. Such models are called software reliability models. Several classes of software reliability models have been defined based on the failure time distribution. One such class of models is the gamma failure time models, where failure times are assumed to follow gamma distribution. In this paper, software reliability estimates of gamma failure time models have been obtained using the method of Maximum Likelihood Estimation and method of Minimum Variance Unbiased Estimation. Using these methods, reliability of the software at a future time point can be estimated. Case studies have been considered to compare the two estimates.**

***Keywords-Blackwellization; Gamma class models; Maximum Likelihood Estimator; Minimum Variance Unbiased Estimator; Software reliability; Software reliability models.***

**Notations:**

**L:** Likelihood function
**f(t):**Probability density function (pdf) of T.
**R(t):** Reliability function at time point t.
**f(x|y):** Conditional pdf of X given Y.
**E(U|S):** Conditional expectation of U given S.

**Terminologies:**

**Software reliability [1]:** Software reliability is the probability of failure free operation of a computer program in a specified environment for a specified time. If the random variable T denotes the time to failure, then, the reliability function, denoted by R(t), is given by R(t)=P(T>t)=1-F(t), where F(t) denotes the cumulative distribution function of T.

**Software reliability models [2]:** These describe the behavior of failure with time, by expressing failures as random processes in either times of failure or the number of failures, at fixed times.

**Gamma class models [2]:** In this finite failures model, failure times are assumed to be distributed as gamma with probability density function, $f(t) = \Phi^2 te^{-\Phi t}$, t>0., where $\Phi$ is the failure rate.

**Estimation [3]:** Statistical techniques are used to estimate the unknown parameters. The best estimator amongst the available alternatives is the one that possesses the properties: unbiasedness, sufficiency, consistency and efficiency.

**Method of Maximum Likelihood Estimation [4]:** It is an estimator that maximizes the likelihood function. If L is the likelihood function for the parameter θ, then, the MLE of θ is the solution of $\frac{\partial(lnL)}{\partial\theta} = 0$ with $\frac{\partial^2(lnL)}{\partial\theta^2} < 0$.

**Method of Minimum Variance Unbiased Estimation [3]:** If a statistic T based on a sample of size n is such that, T is unbiased for the parameter θ and has the smallest variance among the class of all unbiased estimators of θ, then, T is called the MVUE of θ. It is found that such an MVUE is always unique. To find this MVUE, a procedure called Blackwellization is used.

**Blackwellization [3]:** The technique of obtaining MVUE through the use of sufficient statistic is called Blackwellization. Here, an unbiased estimator say U is found for the parameter and then a complete sufficient estimator say S is found. The MVUE is then obtained as the conditional expectation, E(U|S).

## I. INTRODUCTION

Computer plays a major role in almost every field in the modern era. Various software products are available for any application and hence there is a tough competition among these software products. Because of the availability of a wide range of software products, users prefer the one that is more durable or reliable. Thus, reliability is a major concern for all software developers and hence assessing the reliability of software before its release will help users to have an idea of its durability in the long run. Musa and Okumoto [1] have proposed different classes of software reliability models based on the distribution of failure times. Failure data obtained during testing phase can be used to assess the future reliability of software. Researchers have assessed reliability using various measures like Mean Time To Failure (MTTF) [2,4], failure intensity function, mean value function etc, which are found by estimating the parameters, usually by the method of maximum likelihood estimation or method of least squares. Najla Akram AL-Saati et al [5] used Cuckoo Search in Estimating the Parameters. Hiroyuki Okamura et al

ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/319065287

# Estimation of Software Reliability for Littlewood Pareto Failure Time Model

**Article** *in* International Journal of Software Engineering and its Applications · June 2017

DOI: 10.14257/ijseia.2017.11.6.03

CITATIONS
0

READS
196

**2 authors:**

B Roopashri Tantri
Aghanasha Consulting LLP
**7** PUBLICATIONS **7** CITATIONS
SEE PROFILE

Murulidhar N. N.
National Institute of Technology Karnataka
**8** PUBLICATIONS **47** CITATIONS
SEE PROFILE

**Some of the authors of this publication are also working on these related projects:**



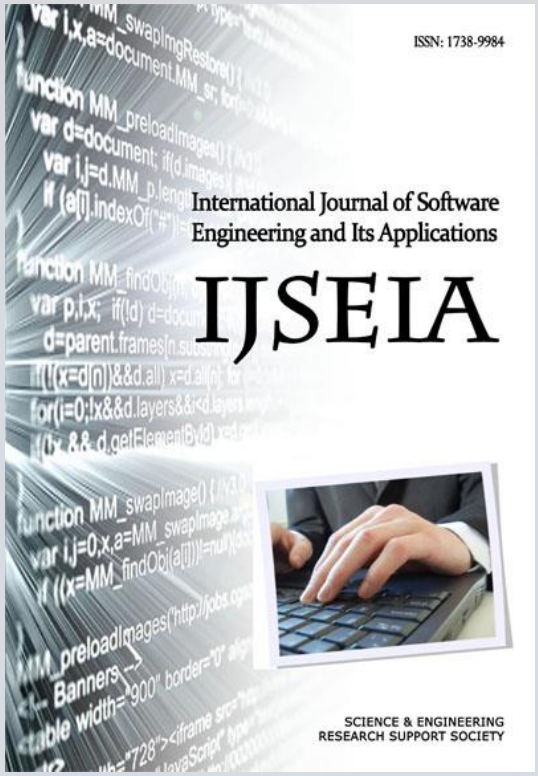
Software reliability estimation View project

All content following this page was uploaded by B Roopashri Tantri on 04 January 2018.

The user has requested enhancement of the downloaded file.

# Estimation of Software Reliability for Littlewood Pareto Failure Time Model

**B. Roopashri Tantri and Murulidhar N. N.**




**ISSN 1738-9984**
**Volume 11, Number 6, 2017**

**International Journal of Software Engineering and Its Applications**
**Vol. 11, No. 6 (2017), pp.25-34**
**http://dx.doi.org/10.14257/ijseia.2017.11.6.03**

SERSC
Science & Engineering Research Support soCiety
Copyright © 2017 SERSC
All rights reserved

International Journal of Software Engineering and Its Application
Vol.11, No.6 (2017), pp.25-34
http://dx.doi.org/10.14257/ijseia.2017.11.6.03

# Estimation of Software Reliability for Littlewood Pareto Failure Time Model

B. Roopashri Tantri[1*] and Murulidhar N. N. [2]

[1]*Professor, Department of ISE, NCET, Devanahalli, Bangalore, India*
[2]*Professor, Department of MACS, NITK, Surathkal, India*
[1]*roopatantri@gmail.com*
[2]*murulidharnn@gmail.com*

***Abstract***

*The concept of software reliability is very important for every software developer. Many researchers have developed different types of software reliability models, based on the probability distribution of the failure times, such as exponential, Weibull, Gamma, Pareto etc. Estimating the reliability of the software enables the developers to ensure that the reliability objectives specified by the user are met. It also helps the users to decide whether or not to accept the software, based on the reliability estimates. The reliability estimates have been obtained by many researchers using various techniques, for the models mentioned above. In most of these cases, the method of least squares has been used. Few researchers have used Bayes methods for estimating reliability. Herein, Littlewood Pareto class models have been considered and expressions for reliability estimates have been derived using the methods of Maximum Likelihood Estimation and Minimum Variance Unbiased Estimation. Considering the statistical properties of the two estimates, it is recommended that the reliability estimate obtained using the method of minimum variance unbiased estimation may be preferred over that obtained using the method of maximum likelihood estimation. A few case studies have been considered and the estimates of reliability obtained by the above two methods have been compared.*

***Keywords****: Blackwellization, Littlewood model, Maximum Likelihood Estimation, Minimum Variance Unbiased Estimation, Software reliability, Software reliability models*

## Notations:

*f(t) :* Probability density function (pdf) of *T*.
*R(t) :* Software Reliability at time point $t = P(T>t)$.
*L :* Likelihood function.
$f(x|y)$ *:* Conditional pdf of *X* given *Y*.
*E(X) :* Expectation of *X*.
*E(U|S) :* Conditional expectation of *U* given *S*.
$G(n,\alpha)$ *:* Gamma distribution with parameters *n* and $\alpha$.

## Terminologies:

***Software reliability [1]:*** It is the probability of failure free operation of a computer program in a specified environment for a specified period of time.

***Software reliability models [2]:*** These describe the behavior of failure with time, by expressing failures as random processes in either times of failure or the number of failures, at fixed times.

[1] * Corresponding Author

ISSN: 1738-9984 IJSEIA
Copyright ⓒ 2017 SERSC

*International Journal of Engineering & Technology*, 7 (1.9) (2018) 273-278

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Extraction of melanoma 3d features from tensor representation

**Sushmita N S [1] *, Gururaj Murtugudde [2], T Y Satheesha [3]**

[1] *Dept. of ISE, NCET Bengaluru, India*
[2] *Dept. of ISE, SVCE Bengaluru, India*
[3] *Dept. of ECE, NCET Bengaluru, India*
**Corresponding author E-mail: sushsushmita@gmail.com*

**Abstract**

Melanoma is one of the unsafe growth to be dealt with too to recognize in introductory stage. Here we take the skin sore by ROI and after that we take out highlights of it then it should be sectioned whether the specific picture is malignant or not. In the event that it is destructive at that point group the extricated includes and examine about kind of stages. This paper presents a non-obtrusive electronic dermoscopy framework that considers the evaluated profundity of skin sores for determination. For test assessments, the PH2 and ATLAS dermoscopy datasets is considered. A novel 3D remaking calculation from 2D dermoscopic pictures is proposed. Here we remove the 3D highlights from tensor portrayal. The discovery of 3D picture shape and RGB are to be done. In this paper, we have proposed this work for 3D profundity parameter, which will improve the grouping rate.

***Keywords***: *Preprocessing; Segmentation; Feature Extraction; Melanoma.*

## 1. Introduction

The number of melanoma dye due to continuous improvement of the results of a number of diseases. This disease is the main cause is due to ultraviolet light exposure. This is a change in color of the skin resulting in skin pigmentation. It can occur in any part of the body. This is a melanoma has spread it deep inside the skin layer needs to be discovered and cured before. This can be treated with chemotherapy. It is common, but when appropriate treatment is not very dangerous.

Melanoma is usually based on the ABCD rule, (asymmetry, irregular border, color changes, and prison), 7-point checklist of diagnosis [1] and texture. In this paper, we took a skin image for our segment. A portion of the segment are then extracted from the various features, and finally, we go for the divided. We classified [2] includes RGB images for the individual pixel data 3d Register. Here, a higher rate of discrimination is part of the feature extraction depth parameter is proposed.

The remaining paper is presented below. Section II and Section III, we carried out the background of work related to the proposed system. DISCUSSION specifies. Section IV is about the test results. Reported Finally, part V Conclusion home.

## 2. Background

ABCD features for melanoma skin cancer [3] Total Dermatoscopic Value (TDV) is used to calculate.

Asymmetry features of the lesions consist of information asymmetry and long index. Border irregular feature lesions Compact index, fractal dimension from the edge of the sudden transition coloring consist of information. Color homogeneous feature of homogeneous lesions with color photometry of the relationship between geometry and consist of information. The diameter of the cells from the lesions. In this research, the effect on melanoma, disease, doubt and benign skin lesions [4]. The paper "Use of Texture and color features for Dermoscopy for melanoma detection systems [5] the author of" In the first two isolated lesions of the skin and the second one to decide about the objectives of the two is to determine the color and texture. Presentation features.

The only drawback of the document classification accuracy rate, we can increase the rate of discrimination as a result of the depth of the feature as they entered our proposed system less.

## 3. Proposed system

Part of the skin lesions detection and feature extraction of important aim of our paper. This involves the following

a) Preprocessing:

The preprocessing stage in the first example, as shown in Figure 1 (a) of red, green and blue color components are converted into the image by adding gray. The gray image as shown in Figure 1 (b) by a Gaussian filter needs to be filtered. The image shown in Figure 1 (c) with the aid of 0s and 1s of the binary image needs to be converted by the Gaussian filter is filtered.

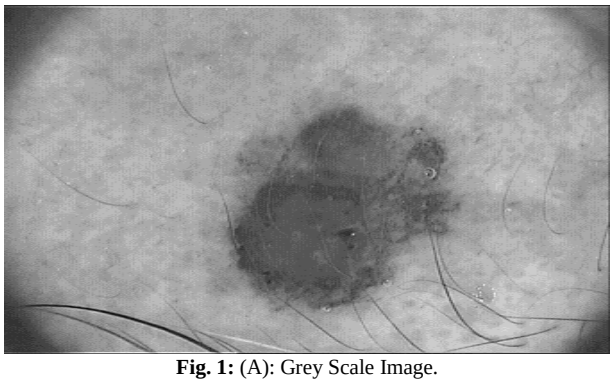


**Fig. 1:** (A): Grey Scale Image.

**Copyright © 2018 Sushmita N S et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**

**International Journal of Pure and Applied Mathematics**
**Volume 118 No. 24 2018**
ISSN: 1314-3395 (on-line version)
**url:** http://www.acadpubl.eu/hub/
Special Issue

http://www.acadpubl.eu/hub/

# A Cloud Security with Performance Increase and Energy Efficient using AI with DCS and PDC

Mamatha C M, Dr. Gururaj Murthugudde
Research Scholar,Prof. and Head,
Dept. of CSE NCET,
Dept. of ISE SVCE,
Bengaluru
Karnataka, India
mamathacm.cm@gmail.com

May 23, 2018

**Abstract**

Now a day, the contents construction is changed dynamically according to a user's request, and has been widespreading across the sensor nodes. This paper proposes a technique to fast response to the dynamic content of various sensor nodes by the help of cache segmentation between server and the user, and describes the design of our proposed network cache system and provides security to Cluster nodes in Cloud in cloud by using Artificial Intelligence (AI) as a barrier where every data files goes inside cluster, it gets scanned by AI for viruses and makes data virus-free. The paper contains a new concept where Cluster of sensor nodes in cloud are energy efficient by last level cache (LLC), secured by AI, and performance is increased by using dynamic cache segmentation (DCS). It explains how AI actually safeguards Cluster of sensor nodes. Though AI is used for many purposes such as Gaming, Robotics etc., it is not yet used for Cluster of sensor nodes. In detail, the paper presents

# Brain Tumor Classification from MRI Images Using Convolutional Neural Network

Md. Farhad Hossain
Dept. of Electronics and Telecommunication Engineering
Chittagong University of Engineering and Technology
Chittagong, Bangladesh
farhad.hossain@cuet.ac.bd

Debprosad Das
Dept. of Electronics and Telecommunication Engineering
Chittagong University of Engineering and Technology
Chittagong, Bangladesh
Debprosaddas 77@gamil.com

Ariful Islam
Dept. of Electronics and Telecommunication Engineering
Chittagong University of Engineering and Technology
Chittagong, Bangladesh
arifete08025@gmail.com

Md Nazmul Islam
Dept. of Electronics and Telecommunication Engineering
Chittagong University of Engineering and Technology
Chittagong, Bangladesh
nazmulnaeem425@gmail.com

Dr. Syed Naimatullah Hussain
Nagarjuna college of engineering and technology Bangalore (NCET Bangalore)
drsnuh@ncetmail.com

Mohammad Saydul Alam
Department of Computer Engineering
American International University Of Bangladesh

Dhaka, Bangladesh
websak2010@gmail.com

***Abstract*— Brain tumor is the most aggressive cancer, with a much shorter life expectancy in most advanced stages. In earlier, radiologists have to manually identify the tumors from MRI images or other imaging types. That is both time consuming and threatening to the misclassification that could affect the recovery plan of a patient. Technological innovations and machine learning assist radiologists to detect tumors without invasive procedures. One of the machine learning algorithms that has been shown to be effective at image segmentation and classification is the convolutional neural network (CNN). In this proposed work, a novel CNN architecture was used on a publicly available figshare dataset to identify three brain tumor types. The proposed CNN architecture outperformed most state-of-the-art approaches, achieving a classification accuracy of 96.90 %. Precision, recall, and F1-score are some of the other evaluation metrics used in the study. In addition, the paper includes an in-depth analysis of misclassifications.**

***Keywords— Brain Tumor, CNN, Classification, MRI***

## I. INTRODUCTION

Cancer is the second major cause of death worldwide, as per the World Health Organization. Cancer must be detected and treated as soon as possible, but this is not always possible. Unlike cancer, a tumor may be benign, pre-cancerous, or malignant. Benign tumors do not spread to other organs or tissues and can be surgically removed, whereas malignant tumors do spread to other organs [1].

Glioma, meningioma, and pituitary tumors are examples of primary brain tumors. Glioma tumors originate in tissues other than nerve cells and blood vessels. Meningiomas arise from the membranes that cover and surround the brain and central nervous system, whereas pituitary tumors are lumps inside the skull. The main difference between these three tumor types is that meningiomas are usually benign, while gliomas are almost always malignant. Pituitary tumors can cause medical problems even though this type of tumors are benign [2]. The effective identification of these three types of tumors is crucial in the clinical diagnosis and eventual patient evaluation process.

CT scans and EEGs are among the techniques used to diagnose a brain tumor, but magnetic resource imaging (MRI) is the most effective and widely used. MRI uses powerful and efficient magnetic fields and radio waves to construct internal images of the body's organs. In this work we used contrast enhanced MRI images.

The following segment provides a quick overview of related works. Section 3 summarizes the paper's main points and introduces the datasets used, preprocessing steps, model architecture and parameter tuning. Results using the proposed architecture, also comparison with other methods discussed in section 4. Furthermore, Section 5 summarizes key findings of the work.

## II. PREVIOUS WORKS

Developments of new machine learning algorithm have had a huge impact on the health care area, serving as a vital support method for a wide range of healthcare services, including imaging, detection. MRI image processing for segmentation and detection using machine learning algorithms provide a new way to help radiologist with their work. A number of proposed algorithms for extracting features and brain tumors classification have been proposed in recent research.

Tahir et al. [3] investigated various preprocessing approaches in order to improve the classification results of statistical models. To test their model, they used an SVM classifier. The highest accuracy recorded is 86%. Cheng et al. [4] used three feature extraction methods on the augmented tumor area. Bag of words, gray level covariance matrix, and intensity histogram were the feature extraction methods used. Their best-reported accuracy is 91.28%. Another statistical approach, Ismael and Abdel-Qader [5] used discrete wavelet transform (DWT) to extract the statistical features from MR images. They also used Gabor filter as feature extractor. Finally these statistical features were fed to a fully connected neural network. Their neural network classifier has 270 inputs and 90 neurons in hidden layer, three neurons in output layer. They achieved 91.90% accuracy using their approach. Afshari et al. [6] fed the MR

XXX-X-XXXX-XXXX-X/XX/$XX.00 ©20XX IEEE

# Generative Adversarial Networks Based Method for Generating Photo-Realistic Super Resolution Images

**[1]Darshana A Naik, [1]Sangeetha V and [2]Sandhya G**

*[1]Department of Computer Science & Engg., Ramaiah Institute of Technology, Bengaluru, India*
*[2]Department of Computer Science & Engg. Nagarjuna College of Engineering & Technology, Bengaluru, India*
*E-mail : darshananaik@msrit.edu, drsangeethav@msrit.edu, sandhyag.pooja@gmail.com*

***Abstract :-*** **Since the word picture was coined, resolution has always been a challenge. Many studies have been conducted to generate high-resolution photographs, but none have been able to develop a process that is both time and quality effective. As a result, the super resolution issue is discussed in this paper using single-processing techniques. Deep learning methods are used to solve the same problem. The method suggested here will transform a low-resolution image into a high-resolution image of a pleasant and satisfactory quality. This can be accomplished using GANs (Generative Adversarial Networks) with significant up scaling factors.**

***Keywords—Super resolution of image, Discriminator, Generator, Generative Models, adversarial process.***

## I. INTRODUCTION

Super resolution is a method of generating a higher resolution image from a lower resolution image, but image downscaling is a lossy operation. A downscale upscale function executed on an image will still result in any loss of high frequency data, regardless of how effective an up-scaling algorithm is. Also, the most advanced algorithms are unable to reconstruct data that does not exist. Deep learning has progressed in recent years, especially in the field of multimedia such as photographs, videos, and, most notably, depth-maps or range images, digital elevation models (DEMS), and multi-spectral images.

The most significant breakthrough in the area of Generative Adversarial Networks has resulted in a revolution in super resolution. Photo downscaling is a lossy method for converting a lower resolution image into a higher resolution image. Regardless of how good an upscaling algorithm is, a downscale upscale function performed on an image will always result in some loss of high frequency data. Also, the most advanced algorithms are incapable of reassembling data that does not exist. The Discriminator and the Generator are the two neural networks that make up the Generative Adversarial Network. The Generator creates synthetic yet realistic images to confuse or mask the Discriminator, and the Discriminator distinguishes between the generated images and the actual ones.

SR-GANS is used that takes a low-resolution image as an input and outputs a high-resolution image. Lossy image compression is commonly used to minimise the size of images for quicker network transfers and lower bandwidth consumption. However, once the picture has arrived at its destination, a good estimate to a high-resolution image might be necessary. Regardless of how good an up-scaling algorithm is, a downscale upscale function on an image will always result in some loss of high frequency data. CNN models yield good results, but they are based on pixel-wise loss methods that do not create multimodal distributions. Generative Adversarial Networks can be used to solve this problem. As a result, we propose a GAN-based method for generating photo-realistic super resolution on images in this paper.

The main objective of the proposed work is to develop a method for estimating high resolution images from low resolution images. Super Resolution is the name given to this form of estimation. Deep learning advances in recent years have allowed us to solve the problem. Super resolution has been transformed by the Generative Adversarial Network.

## II.RELATED WORK

Many research papers and literature reviews have been published in the area, which have supported us in learning about other researchers' approaches and how we can use GAN to provide a cost-effective and efficient system for super-resolution of photographs. Several research papers have proposed sources for datasets, as well as methods for removing noise and obtaining useful data, to make the project easier to complete. On the processed image, the majority of the researchers used CNN, machine learning, and Deep Convolutional Networks, as well as photo realistic single image super resolution.

Ian J. Goodfellow et al. [1], published their paper “Generative Adversarial Nets” in which they presented a different framework for calculating generative models via

International Journal of Research in Engineering, Science and Management
Volume-3, Issue-1, January-2020
www.ijresm.com | ISSN (Online): 2581-5792


# Object Recognition for Aged People Using Machine Learning

A. Shiwani Raj[1], B. R. Bharath Roshan[2], G. Mamatha[3]
[1,2]*Student, Department of Information Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*
[3]*Professor & HoD, Department of Information Science and Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*

***Abstract*: This paper exhibits an item acknowledgment framework dependent on Machine Learning (ML) calculations for ordering distinctive indoor articles to improve nature of old individuals' life. There is a straightforward outline of the datasets and profound learning calculations normally utilized in object acknowledgment. The situation of the item can be set apart in the info, or the information may be just an away from of article. The places of articles are either obtained from the information, or decided dependent on the information picture.**

***Keywords*: Object recognition, Machine learning.**

## 1. Introduction

Normally when people get old their vision get impacted. Some face problem of blurred vision due to cataract or weak optic nerves. These conditions challenge them to see the surroundings clearly. Resulting in fall and other injuries. This will help the aged people to identify the objects in front of them. Which will eventually help them to walk on their own without seeking others help. We can also incorporate ear phones / ear machines to guide their way.

CNN (Convolution Neural Network) has gained extraordinary ground in object recognition. Article discovery is creating from the single item acknowledgment to the multi-object acknowledgment. The significance of the first is simply from a picture to recognize a solitary article, including the specific area of the items.

## 2. Dataset

A Dataset is a collection of all the data points that is required by the algorithm to train itself to get a better prediction so that the result can be more accurate. The dataset consists of many columns and the columns header i.e., under which the data points are present. Dataset is one of the establishments of profound learning. Dataset for ML is the key fixing to apply the correct programming. A dataset is an assortment of information. In this paper the dataset used is COCO (Common Object in Context) Dataset. This dataset consists of more than 7 million images that is classified into 80 different classes.

### *A. Neural Network*

Deep learning utilized by the system has been continually improving, notwithstanding the adjustments in the system structure, the more is to do some tune dependent on the first system or apply some stunt to make the system execution to upgrade. The more notable calculations of article recognition are a progression of calculations dependent on R-CNN, for the most part in the accompanying.

## 3. Object detection with R-CNN

As a human when we see our surrounding, we perceive the objects around us in one shot. Besides, identifying little items by itself is an interesting issue because of a few difficulties. The framework can take an information picture, removes around 2000 base up locale proposition, registers highlights for every proposition utilizing an enormous convolutional neural system (CNN). The R-CNN calculation, which extricates discriminative highlights utilizing profound convolutional neural system from area recommendations, has been built up as the best in class approach for object recognition.

### *A. YOLO*

YOLO refers to You Only Look Once. YOLO is a deep learning algorithm that is used to detect and recognise the different objects present in the surrounding environment. We can use the YOLO algorithm to implement this paper.

## 4. Background

Nowadays Object recognition is one the most interesting area to work on. Object recognition plays an important role in Machine Learning and Artificial Intelligence. In object recognition the machine plays a vital role in finding the features of the objects under some of the predefined classes in the dataset. This classification is known as the object classification. In CNN, R-CNN one of the pre-built model is Object recognition.

## 5. Working

Aged people use optic glasses to see clearly, since they have

ISSN No:-2456-2165

# Microcontroller based Smart Crop Protection System to Detect Fire and Animals

Premjyoti G Patil[1], Professor
Electronics & Communication Engineering Department
Nagarjuna college of engineering & Technology Bengaluru, India

B. Pavan[2], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology Bengaluru, India

B. Praveen Kumar[3],
Student Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology Bengaluru, India

B. Siva Sai Reddy[4],
Student Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology Bengaluru, India

M. Sandeep Kumar[5],
Student Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology Bengaluru, India

**Abstract:- The problem of wild animal attacks on crop fields i.e. crop vandalization is becoming a very common phenomenon in all states. Animals cause a lot of damage to crops either by running over them or eating them and vandalizing them completely. This leads to poor yield of crops. These animals attack on fruit orchards and destroy the flowerings and fruits. In both cases, this leads to significant financial loss to the farmers and orchard owners. The problem is so pronounced that sometimes farmers decide to leave the area barren. It is not possible for farmers to barricade entire fields or stay on field 24 hours and guard it.**

**In this project we are designing automatic crop protection system from animals and fire. This is the smart system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire. In such a case the sensor will take action to give loud scary siren sound which make animals not to enter into the farm as well as sends SMS to the farmer. So, that farmer may know about the issue and come to the spot in case the animals don't turn away by the alarm. If there is a smoke then with the help of GSM module it will send SMS to the owner and the fire department. The proposed work also includes GPS device which sends location of the field to the fire department.**

***Keywords:-*** *Radio Frequency Identification technology.*

## I. INTRODUCTION

Nowadays the economy of many countries is dependent upon agriculture. Agriculture is the backbone of the country. It produces several raw materials for industries to meet the requirements of the people. Because of the animals interference and fire the agriculture lands are getting spoiled. This leads to huge loss to the owner of the farm. And the farmers are deciding to leave the area barren. To overcome this problem we are proposing a microcontroller based smart crop protection system. Which is used to prevent the entry of animals into the farm. It sends an alert message to the owner of the farm. By using this system we can avoid losses to the farmer.

The designed project is a high level security system to protect the farm.

## II. RELATED WORK

- *In First Paper.*

Sneha Nahatkar. In the proposed project is developed with a low cost security system. It consists of passive infrared sensor and smoke sensor. It sense the signal generated by the PIR sensor and it transmits the data to microcontroller. It also consists of siren. The smoke sensor detects the fire and it will turn the DC motor On. Automatically, it also consists of GSM module which is used to detect the location of the field [1]

- *In second Paper.*

T. Gayathri, this proposed system is an agriculturist using wireless sensor network that is facing lot of difficulties in the production of farmland. The microcontroller consists of 2 LDR sensors which are interfaced. It also consists of humidity sensor which will read the moisture level in the corn field. If the moisture level is decreased, then it will switch on the DC motor automatically to pump the water into the field. [2] Salha M.Alzahrani's sensing for the "Internet of Things and is Applications". Which gives the understanding of the IoT concept, components and its applications. In which the technology that allows the different things to communicate through the Internet and understanding the both. To process the collected data from the various sensors and taking the actions on those IOT uses the Artificial Intelligence technology [3].

S,R.Choury P.A.Amale, N.B. Bhawakar's "IoT based wireless sensor networks for prevention of crop from wild animals". Which provides the security for only users forming lands. That is the system is detect the presence of

ISSN No:-2456-2165

# Military Surveillance Robot

L Jyoti, Assistant Professor
Department of Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

Mahesh Totad , Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

R. Naveen Kumar Reddy, Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

Mahindhar Remata, Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

Vinay A , Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

**Abstract:- The main objective of this project is to design a system that will be useful in military real time applications. The proposed Raspberrypi based robotic vehicle system is designed to save the precious human life in some dangerous fields such as military during hostage situations. During war or when military people enter uncharted territory (hostage situations) they will sometimes become victims of surprise enemy attack. This robotic vehicle is a new method to trace out the enemies and use that information to make a tactical move. It is having all the necessary accessories to trace enemies like: long range camera which captures and live streams the video to the control station, sensors to detect the presence of human being and GPS/GPRS system to determine and transmit the position of the enemy targets. The system can substitute the solider in border to provide surveillance as well for reconnaissance circumstances.**

***Keywords:-*** *Robot, Arduino Uno, Raspberry Pi, Camera, Sensors, Android smartphone.*

## I. INTRODUCTION

Military personnel face many unique challenges on a daily basis in their work compared to civilians. Many of these challenges can be aided or overcome by having more information at the right times. Intelligence is generally gathered in many ways including covert operations, communication interception, interrogation, aerial surveillance, and ground surveillance. All of these techniques help gather intelligence that can promote successful missions and save the lives of troops on the ground. One of the most direct and relied upon forms of this intelligence is ground surveillance. Ground surveillance is so key because there is no more reliable intelligence that a person on the ground having visual confirmation of a target. Unfortunately, ground surveillance can also be the most dangerous form of intelligence gathering because of the proximity to the target that is required by the personnel on the ground. Covert operations are designed to be secretive, interrogation doesn't involve risk to the personnel conducting it, and aerial surveillance can now be easily done by unmanned drones. Ground surveillance however typically requires a soldier or reconnaissance team to physically see target, putting them at risk. This creates a need for an unmanned device that can be used on the ground to perform the reconnaissance without the need of a human being with it.

## II. RELATED WORK

J. Azeta, C.A. Bolu, D. Hinvi, A.A. Abioye, H. Boyo, P. Anakhu, P. Onwordi [1], "An Android Based Mobile Robot for Monitoring and Surveillance", Procedia Manufacturing, vol. 35, pp. 1129, IEEE 2019 .They developed a sustainable surveillance robot that is cost effective using an Arduino microcontroller together with a motor shield and an Android smartphone that runs the Operating System. The robot consists of a video camera and Wi-Fi robot link. Smartphone come with superb hardware that satisfies the above needs. This can be leveraged upon through the use of APIs (Application Programming Interfaces) that is provided for the operating system.

Harindravel, Letchumanan [2], "Mobile Robot Surveillance System with GPS tracking" 2013.GPS (Global Positioning System) is satellite based navigation system which provides global coordinates of current location of autonomous robot. The user gets current coordinates of robot using GPS and provides the coordinates of final location where robot has to reach with minimum distance coverage and collision with nearby objects.

Mubarak Shah, Omar Javed, Khurram Shafique [3]. The AVSS comprises of object detection, object tracking, object classification, behavior analysis, and action tasks. The object detection task detects the object such as a person, vehicle, or an animal in digital images and videos. Object tracking task is used to generate the trajectory of an object over time. Object classification task is used to label the detected object as a person, a group of person, vehicle, or an animal.

ISSN No:-2456-2165

# Modeling and Analysis of Parallel Boost Converter

Jyothi S K
Assistant Professor, Dept. of ECE
Nagarjuna College of Engineering and Technology
Bengaluru, India

Sreenivasulu K N
Assistant Professor, Dept. of ECE
Nagarjuna College of Engineering and Technology
Bengaluru, India

**Abstract:- Demand for Energy is ever increasing, mainly with the increase of populace and the appearance of more recent technology, strength want is already overwhelming. Therefore there may be a want to make use of strength resources. The major goal of this paper is to increase a mathematical modeling and to layout a excessive green Photovoltaic (PV) software with proposed parallel increase converter Improved technology for DC to DC converters has been implemented. "Simulation of the gadget built with the help of MATLAB/SIMULINK. State Space Modeling is performed for the parallel booster converter". This version is primarily based entirely on mathematical equations and is specified by an equal circuit that includes an MPPT supply from Photo Voltaic. In order to analyze the influence of temperature and insolation on the overall performance of the PV module, the MATLAB/PSPICE version of the PV module is advanced. This paintings is specifically advanced for the Photovoltaic (PV) software. MATLAB-primarily based totally modeling and simulation scheme that is appropriate for analyzing the I–V and P–V traits of a PV array below a no uniform insolation because of partial shading changed into proposed.**

***Keywords***:- *Solar energy; SPWM; Microinverter; Boost converter; Maximum Power Point Tracking, state space analysis.*

## I. INTRODUCTION

Solar energy is a renewable power supply that could update fossil gas established power sources. Sun energy rates according to kilowatt-hour, however, need to be aggressive with fossil gas power sources for that to happen. Sun panels are not very efficient at the moment; they have 12-20 efficiency to convert daylight into electric power. Due to various elements, along with the temperature of the sun panel and the conditions of cargo, the performance will drop similarly. In order to optimize the energy extracted from the sun panel, operating the panel at its most satisfying energy point is very important. In order to do this, it is important to design and enforce a method of fee control known as a Maximum Power Point Tracker In order to look at the effect of temperature and insolation on the overall performance of the PV module, the MATLAB version of the PV module [1-4] was created. MATLAB-a fully modeling and simulation framework based primarily that is suitable for the study of the I-V and P-V characteristics of a PV array below a non-uniform insolation due to partial shading[5] is proposed. Due to its many benefits, parallel dc to dc converters are prominently used. First, parallel dc-dc converters allow a reduction in the dimensions of additives, especially inductive ones. Pressure among individual converters is decreased by segmenting overall energy, which improves efficiency. This additionally ends in accelerated reliability and permits reconfiguration.

## II. PRINCIPLE AND OPERATION OF THE PARALLEL BOOST CONVERTER

PV panels generating low voltages are a problem in small PV systems, resolving this issue of a low voltage on the entry; with a conventional DC/DC Boost converter, the most efficient technique to achieve an elevation within the voltage stage is. It isn't feasible to attain an elevation of greater than three instances the voltage on the enter for the traditional enhance converter, because of balance and performance concerns [6]. This paintings recommend some other direction of motion located with inside the adjustment of the regular DC/DC Boost converter, that could accomplish a upward push share of 10 instances the estimation of the contribution, with the aid of using making no usage of galvanic transformer, and much less wide variety of additives that the proposition exhibited in past due proficient. The schematic diagram of this topology is offered with inside the Fig. which include changed Boost converters linked in parallel from the identical source. MPPT monitoring DC/DC Buck converter is hooked upin which the extracted voltage from renewable power is diminished and that voltage is fed to the parallel enhance converter. This new DC/DC converter proposition is prepared for undertaking a excessive elevation aspect with the aid of using connecting each outputs of voltage $V_{C1}$ and $V_{C2}$ in collection association with a unmarried load, if you want to deliver a excessive elevation share of maximum severe a 1:10 in comparison to the enter..

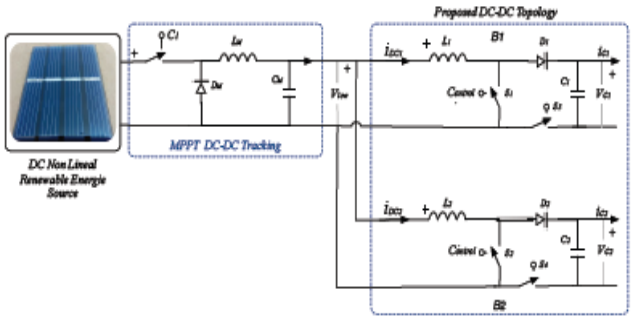



Fig.1. Proposed topology arrangement for multilevel converter

*International Journal of Engineering & Technology,* 7 (3.34) (2018) 156-159

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Optical Flow Approach Followed by SVM Classification Model to Recognize Abnormal Behavior of a Crowd

**Basavaraj G M[1], Dr. Ashok Kusagur[2]**

*[1]Associate professor, Dept. of ECE, Nagarjuna College of Engineering and Technology Bengaluru, India*
*[2]Associate Professor, Dept Electrical and Electronics Engg. UBDT College of Engineering, Davangere, Karnataka India,*
**Corresponding author E-mail: baswaraj832@gmail.com, ashok.kusagur@gmail.com*

**Abstract**

A many of researches have been carried out in the field of the crowd behavior recognition system. Recognizing crowd behavior in videos is most challenging and occlusions because of irregular human movement. This paper gives an overview of optical flow model along with the SVM (Support Vector Machine) classification model. This proposed approach evaluates sudden changes in motion of an event and classifies that event to a category: Normal and Abnormal. Geometric means of location, direction, and displacement of the feature points of each frame are estimated. Harris corner Detector is used in each frame for tracking a set of feature points. Proposed approach is very effective in real time scenario like public places where security is most important. After analyzing result ROC curve (receiver operating characteristics) is plotted which gives classification accuracy. We also presented frame level comparison with Ground truth and social force model (SFM) techniques. Our proposed approach is giving a promising result compare to all state of art methods.

***Keywords***: *Optical flow descriptor, Motion map, Harris corner detector, SVM classifier, ROC curve*

## 1. Introduction

The crowd is often seen at airport, railway station, shopping mall, multiplex, hotel, museums hospitals and other public places. It is growing day by day because of increasing population rapidly. Security of people in these places is very crucial. This topic is achieving more and more attention by researchers. Many challenges come when we talk about the understanding of a crowded event. Group level relationship, complex interaction and various semantics are challenges in crowd analysis.Recognition of crowd event involves multiple agents, which is described in most of previously paper. Motion pattern of individual or group defines the crowded event. Some well-known existing methods like particle flow [1] [2], optical flow [3] and local gradients methods simulate the crowd flow instead of tracking the individual object. Implementing this type of approaches are always related to the macroscopic model. Macroscopic models are not close to the behavior semantic. By implementing group structure [4], particle trajectory [5] [6], energy potentials [7], dense complex movement can also be captured. Group level architecture also offers a macroscopic interpretation of the crowd which is good for understand the crowd behavior.

In this paper, we are proposing an approach based on optical flow followed by Support Vector Machine classification model. The combined approach gives a good result in terms of classification accuracy. It is powerful enough to match or exceed the performance of state of art method.UMN dataset scenario is taken for experimental evaluation. Optical flow gives characteristics of a crowd and based on this characteristics SVM classifies the behavior of the crowd. In initial step motion the heat map is computed, which states the region of motion activity. Based on heat map points of interest is extracted. Once the point of interest is calculated, we start evaluating the optical flow pattern. Optical flow pattern gives a feature vector in the form of direction and distance parameter.

In [8] author describes the measurement of optical flow through the help of histogram representation, then based on threshold value we predict the abnormalities in the video. In [9] texture dynamic model is applied to model the appearance of the crowded scene. This method can explicitly detect the spatial and temporal anomalies. In [10] Spatio-temporal gradients are modeled with HMM model to detect irregularities in a densely crowded scene. Particle advection schemes [11] [12] makes a rectangular grid of particles for each frame and detect abnormalities using underlying motion. In this approach, each particle is supposed to be individual, so it overcomes the restriction of the tracking people in high crowd density. [11] describes a Social Force Model (SFM) which is carried out for analysis of crowd behavior.

In section 2 and 3, we introduced motion map and feature extraction process. We also included an overall block diagram of our proposed algorithm. An SVM classifier is described in section 4 and Section 5 describes the steps how our proposed algorithm works. In section 6 results are performed and finally concluding remarks.in section 7.

## 2. Motion Map Generation

Motion map is a 2D histogram representation of data, which shows the main region of motion activity. This is built from the accumulation of binary blobs of the objects which are in motion in the frame.Background subtraction method is implemented in detecting the region of motion in a frame [13].

The obtained motion map is responsible to define the region of interest (RoI), which is required for further processing such as feature detection. Detection of heat map improves result accuracy and reduces the processing time which is very important in real

**Copyright © 2016 Authors. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**

ISSN No:-2456-2165

# Pursuing Robot for Assisting Senior Citizen and Physically Challenged

Sunil Kumar B S[1], Asst.Professor
Electronics and Communication Engineering Department
Nagarjuna College of Engineering and Technology
Bengaluru, India

Vandana K[2], Student
Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

T M Vidyashree[3], Student
Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

Akshay M[4], Student
Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

Rajamani V[5], Student
Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

**Abstract:- Robots are electro-mechanical device, follows a set directions to raise positive tasks. Robot is made to observe senior citizen/physically challenged via pc vision, carrying his belongings. Robot appears for the barcode in the video body to understand the specific individual to lift there assets. Using image processing the system will keep a track of the particular person and the coordinates are noted These coordinates are in big difference with the middle of the graphic and based totally definitely totally on the characteristic of the person, suggestions are given to the robot, to go left, suitable or forward. This Robot makes use of picture processing with Open CV library and python programming. In this project the robots are take care the people with physical imparity. This project will help physically challenged and senior citizens travelling alone, so the robot will help them to assist their needs . The processor board used for the robotic is Raspberry pi for photograph processing and Arduino is used to the utilization of motors. An ultrasonic sensor is used to calculate the distance between the robotic and the senior citizens.**

***Keywords:-*** *Robot, Computer Vision, Barcode, Image processing, OpenCV, python, Raspberry pi, Arduino, Ultrasonic sensor.*

## I. INTRODUCTION

The Robotics constructions and elements are an developing large range of researched these days, the robotic features have come to be good sized due to the fact of their houses such as their effectivity and availability. The robots are made self reliant via the usage of a range of sensors such that it takes its private selections and does depend on senior citizens. After the line following robotic which has entered the industries, now it's time to accept as true with preceding the line, that is the robotic want to go somewhere and no longer simply to observe a detailed path, the robotic have to go with the human being autonomously. Robots are not able to work itself they need human guidance. Robots may be wired or wireless both should require power supply and controlling devices and also it as some advantages and disadvantages.This will be possible only when robots will have their eyes and the machine employs laptop imaginative and prescient algorithm. In pc imaginative and prescient primarily based on shade detection and function matching a variety of robots are manufactured on the other hand this has the drawbacks due to some associated type of shades and altering environment in a real-time environment. The unique variety of human following robots is specifically chiefly based totally on laser vary finders and distance sensors in which particular man or woman following is a problem. In our project, the robot is made to follow the physically challenged and senior citizen to carry there belongings. we already know that the robot doesn't have eyes hence we are using raspberry pi and camera .camera works has eyes where raspberry pi board will control and capture the image processing. Robot follows the person and carry their belongings to some limits .Robot will follow the person within certain distance .If the person cross the certain distance the robot doesn't move. Through this project, we put forth that specially based totally on barcode detection human following is possible. On the t-shirt of a person, the barcode is pasted, and this barcode is detected and determined with the aid of potential of the robot.

## II. RELATED WORK

This paper small print the improvement of a socially assistive domestic robotic partner for aged human beings with slight cognitive impairment (MCI) residing on my own at home. Required assistive functionalities of such a robotic companion are, huge and span from reminding functions, cognitive stimulation workouts with the aid of cell video-phony with spouse and children or care givers to the detection and evaluation of imperative stipulations like falls, coronary coronary heart attack, etc. and even act like a pet. Such a robotic confederate can also be regarded as a

ISSN No:-2456-2165

# Real-Time Flood Supervising and Forecasting using Simulated Neural Network

Vinaya Kumar S R[1], Assistant Professor
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

Geetha Kumari T M[2], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering &Technology
Bengaluru, India

Harshadha M[3], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

Meghana R[4], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

**Abstract:- As the monsoon kicks in, brings the hope to the farmers for good yield, where as darker side of it can be disastrous, FLOODS. They have adverse effect both economically and socially across globe while some artificial measures are been taken to overcome one of them like dams, How long do they could prevent? Here is our help to the society, where in by using the technology the social life could be saved. Our design of the project mainly concentrates on supervising characteristics like level of water, humidity, temperature and rainfall. These parameter help vitally in flood forecasting.**

**As the parameters are aggregatted and are collected by using from the controller and it sends the message over the internet. This affects the locals. After flood, also there is drastic effect, the victams can be detected by image processing are immersed. For the greater precision purpose ANN is used and further the information is passed to the rescue team near by via IOT. Along with this digital image processing technique is implemented to save life of victims. Our project mainly focuses on the flood forecasting and detecting the victams using IOT and Artificial neural network.**

***Keywords:-*** *Floods, Artificial Neural Network, Internet of Things, Digital Image Processing.*

## I. INTRODUCTION

The peninsular region of southern India and the areas around the perennial rivers are mostly prone to the disaster floods, during monsoon. Melting glaciers in the Himalayas are also one of its characteristic. The monsoons are weakened by Lanina effects, but still the Global warming plays the crucial role in floods, and parallel increasing in the ocean level any melting of glaciers. The monsoon winds can be tracked using the current technology. However, several other factors play major role in floods too like water level, flow rate which can be collected through the seasons.

The IOT along with the WSN, communication framework, rapidly transmit the data to the nearby center. The centers take the counter measures to tackle the flood. Other interdependency parameters like the flow rate, rainfall pressure are also the cause of floods. However significant numbers of seasons are then used for the accurate prediction. Our project proposes a system which uses IOT based flood forecasting using various seasons like humidity, temperature, rain, float etc. We also detect the victims via image processing and ANN.

## II. RELATED WORK

First, in paper "An Energy Efficient Communication Protocol for Low Power Energy Harvesting Sensor Modules" by D. Purkovic, M. Hönsch, T. R. M. K. Meyer [1] states that, in IOT market, energy consumption has become one of the main parameters in evaluating sensor systems. Long range sensor systems have application in outdoor environment where it combines energy harvesting mechanisms with the low power features. Techniques and mechanisms for harvesting and saving energy are presented in this paper and low power, energy efficient communication protocol is described. The protocol optimizes the information collected from environment, pack and transmits for long distance with minimal energy. The gathered information is transmitted in a form of two different packet types called Teach-in and Data telegrams, respectively. A detailed structure of these packets and the energy required for transmission is explained in this paper, along with a deeper protocol physical layer analysis.

In paper “Flood Modeling and Predicting using Artificial Neural Network” by A. R. Sanubari, P. D. Kusuma and C. Setianingsih [2] states that, in order to predict flood the flood water level prediction is very important. Flood is the most common natural disaster which causes huge losses to life n property. For early warning of the flood the ANN modeling is placed at the output for better performance. ANN works on the algorithm fed to it. The algorithm helps in reducing the error value function based on the complexity and performance of the Artificial Neural Network.

In paper, "Connectivity-based virtual potential field localization in wireless sensor networks" by Chao Yang, Zhu Weiping, Wei Wang, Lijun Chen, Chen Daoxua and Cao Jiannong [3] states that, in wireless sensor networks, due to low cost and no requirement for special hardware the

World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 5.218

# STUDY AND DESIGN THE PERFORMANCE ANALYSIS OF DIGITAL MODULATION TECHNIQUES

**Vinay R.*[1], Yaseen Basha[2] and Nagesh K. N.[3]**

P G Student[1], Assistant Professor[2], HOD and Professor[3]

Department of ECE, NCET, Bangalore, India.

**Article Received on 09/04/2019** **Article Revised on 30/04/2019** **Article Accepted on 20/05/2019**

***Corresponding Author**
**Vinay R.**
P G Student, Department of ECE, NCET, Bangalore, India.

## ABSTRACT

The paper presents study and design the performance of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Phase Shift Keying (QPSK). The design of these digital modulation techniques is performed by using general block diagram. The fundamental of the signal is based on quantization, sampling and this signal is verified in amplitude and time domain. The work is accomplished using Verilog hardware description language and the performance is done using Xilinx-ISE 14.6 and model sim 10.4b (Quartus prime 15.1).

**KEYWORDS:** ASK, FSK, PSK, QPSK, ortho normal.

## 1. INTRODUCTION

Since last few years ago, there may be some changes which causes the occurrence of large modification commencing analog modulation along with phase modulation and frequency modulation accent to the newest techniques in digital modulation. This type of techniques in digital modulation happen to be the basics and essentials in the communication network such as mobile network, wireless network, satellite communication network. These modulation techniques uses digital format in telecommunication system where the modulation of amplitude, phase, frequency of continuous waveform such as carrier signal uses input signal which causes the message signal is transmitted known as original signal.[2]

RESEARCH REVIEW JOURNALS
Volume-05
Issue-12
December-2020

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com[Peer Reviewed Journal]
DOI: https://doi.org/10.31305/rrijm.2020.v05.i12.026

# Target Tracking System Using Passive Radar: A Survey

[1]Dr.K N Nagesh, [2]Venkat Neeraj, [3]Sogane Rajesh Roopa and [4]Armugavel Vishnupriya

[1]*HOD Dept. Of ECE, Nagarjuna College of Engineering and Technology, Devanahalli, Bangalore, India*
[2]*Dept. of ECE, Nagarjuna College of Engineering and Technology, Devanahalli, Bangalore, India*
[3]*Dept of ECE, Nagarjuna College of Engineering and Technology, Devanahalli, Bangalore, India*
[4]*Dept of ECE, Nagarjuna College of Engineering and Technology, Devanahalli, Bangalore, India*

**ARTICLE DETAILS**

**Article History**
*Published Online:* 14 December 2020

**Keywords**
*radar systems, sensor, passive radars, AESA, MWP.*

***Corresponding Author**
*Email: neerajvenkat99[at]gmail.com*

**ABSTRACT**

*Most radar systems detect low-level processing of the first received sensor data and transfer the processed data to some higher-level processor (e.g. tracker or classifier) to achieve the computer purpose (target dynamics parameters). Passive radar has the following advantages: (i) no frequency allocation, no radiation, good electromagnetic compatibility, and good concealment; (ii) the obvious advantages of theft and low-altitude detection; (iii) Low growth and maintenance cost, small size, high mobility and easy deployment. Because of these characteristics, special attention was paid to their use in the military and key technologies were developed. Microwave radiation form radar antenna is harmful to operators. Hence antenna removing can address both issues. No study is found to support antenna removing of AESA radar with the help of MWP. Increasing complexity does not reduce erroneous goals that are classified as real goals. No more work on things designed for human safety. Research is needed to understand the harmful effects of lasers on the human body.*

## 1. Introduction

Most radar systems detect low-level processing of the first received sensor data and transfer the processed data to some higher-level processor (e.g., tracker or classifier) to achieve the computer purpose (target dynamics parameters). It extracts information to achieve computer purpose (e.g., target dynamic parameters and target type). The material mined from the sensor / processor can be adjusted to improve the design, transmission, monitoring and classification of subsequent fluorescence waves. Therefore, the knowledge system strives to improve performance. The information extracted from the sensor / processor can be adjusted to improve the design, transmission, monitoring and classification of subsequent fluorescence waves. Therefore, the knowledge system strives to improve presentation [1]-[4]. In [5] and [6] we have established a generic reasoning sensor / processor system configuration for computers affianced in target tracking. This typical includes the sensor's low-level radar processor (detector) and the processor's high-level task processor (tracker).

This paper further modifies the structure that assumes that the source sensor provides the data sensor to the processor, which now includes detectors and trackers. We have developed the Maximum a Posteriori Penalty Function (MAP-PF) tracking system which uses a two-step track evaluation procedure alike to the current for age onward discovery founded system, with the penalty function being linked to traditional monitoring data correlation. Use phase deleted. In the discovery procedure, the syntactic meaning uses the present target level estimation to leader the finder to that area of the detection surface. In the track grading process, the impact of the diagnostic measure on the final pathway assessment determines the performance of the penalty. This development allows for intelligent control of advanced performance sensors and processors [7].

Demonstrate the effectiveness of a pulsed Doppler radar system that avoids target Doppler and zero Doppler abnormalities when adjusting the pulse repetition frequency (PRF) to improve tracking performance. Presents results on data collected experimentally using software defined radar (SDR) system. Therefore, the target tracking methods are of two (i) Single target tracking and (ii) Multiple target tracking.

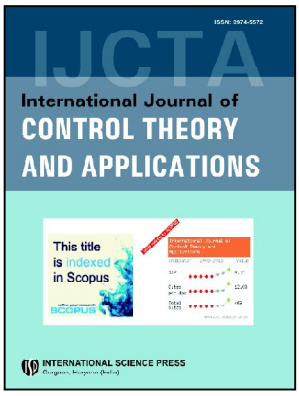
### *1.1. Single Target Tracking*

A model change in radar performance has been proposed since the beginning of cognitive radar [8]. Beforehand, radars functioned in a feed onward conformation. Standard radar parameters remained chosen to ensure consistent performance, but performance could vary significantly at any time. Conversely, cognitive radar project stipulates the level of performance required and adjusts computer sources to chance presentation objectives.

Cognitive radar takes notes on neuropsychology so that radar can logically detect animals around them as it interacts with the world around it. Pregnancy allows an animal or radar to "focus on outside or inside stimuli, classify these spurs, and strategy an expressive response to them" [9]. Foster labels the procedure of describing stimuli and preparation replies in a concept-action cycle [10]. He contends that reasoning depends on a range of cortical structures and that the cognitive-behavioral cycle is governed by different levels of contractions at each level.

Sensor networks with different levels of dispensation are a normal subject to discover based on hierarchical understanding. In [11], a large-scale sensor network operates based on the improvement of information theory functions.

RRIJM 2015, All Rights Reserved




International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 10 • Number 26 • 2017

# Array Synthesis of Circular and Planar Antenna Arrays for Pattern Nulling Using Invasive Weed Optimization Algorithm

**[1]P. Krishna Kanth Varma [2]Nagesh K. N., [3]P. V. Rama Raju and [4]P. B. Sai Dileep**

*[1] Asst Professor, ECE Department, SRKREC, Bhimavaram, Andhra Pradesh, India; E-mail: varmakk.pen2@gmail.com*
*[2] Professor & Head of the Department, ECE Department, NCET, Bangalore, Karnataka, India; E-mail: nageshlakmaya@gmail.com*
*[3] Professor & Head of the Department, ECE Department, SRKREC, Bhimavaram, Andhra Pradesh, India;*
*E-mail: pvrraju50@gmail.com*
*[4] PG Student, ECE Department, SRKREC, Bhimavaram, Andhra Pradesh, India; E-mail: dileep0474@gmail.com*

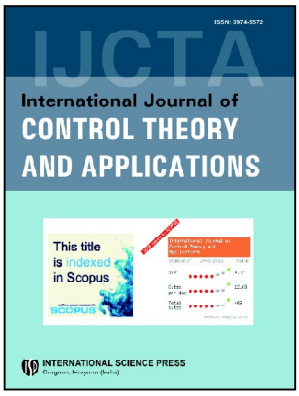
***Abstract:*** The current work presents the implementation of a metaheuristic algorithm Invasive Weed Optimization (IWO) for pattern nulling of Antenna array radiation pattern in prescribed directions. The IWO Algorithm is implemented for pattern nulling Synthesis of Uniform Circular (CA) and Planar Arrays (PA) by optimizing only amplitudes of array elements. Two design examples of introducing Deeper Nulls in both symmetrical and unsymmetrical directions are presented using IWO and compared with Real Coded Genetic Algorithm (RCGA). Numerical results illustrate that IWO is better in producing deeper Nulls and also in the rate of convergence for both Planar and Circular Arrays when compared with RCGA.

***Keywords:*** Pattern Nulling, Planar Antenna Array, Circular Antenna Array, Invasive Weed Optimization (IWO).

## 1. INTRODUCTION

For most wireless applications, antenna arrays have found distinct benefits when compared to a single element antenna. More prominent benefits include an increase in directivity and spatial diversity. Optimization of radiation pattern characteristics (pattern synthesis) of antenna arrays involves increasing directivity, reducing Side lobe level and placing nulls in the required directions can be obtained by finding the optimized values, amplitudes, distance between array elements and progressive phase shift between the elements. Over the past decade a rapid growth in the utilization of wireless mobile devices and technologies has lead to enormous increase in electromagnetic pollution. One of the more efficient ways to decrease this pollution is to suppress the electromagnetic radiation in unwanted directions. This objective can be achieved by a process of placing deeper nulls in the unwanted directions of radiation pattern of antenna arrays. These pattern nulling techniques are helpful in several applications which include wireless mobile, satellite and Defense applications in order to reduce degradation in SNR [1].

In the past several metaheuristic (evolutionary optimization) approaches namely Genetic Algorithm (GA) [2], Particle Swarm Optimization Algorithm (PSO) [3], Tabu Search Algorithm (TSA) [4], Firefly Algorithm




International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 10 • Number 26 • 2017

# Array Synthesis of Circular and Planar Antenna Arrays for Pattern Nulling Using Invasive Weed Optimization Algorithm

**[1]P. Krishna Kanth Varma [2]Nagesh K. N., [3]P. V. Rama Raju and [4]P. B. Sai Dileep**

*[1] Asst Professor, ECE Department, SRKREC, Bhimavaram, Andhra Pradesh, India; E-mail: varmakk.pen2@gmail.com*
*[2] Professor & Head of the Department, ECE Department, NCET, Bangalore, Karnataka, India; E-mail: nageshlakmaya@gmail.com*
*[3] Professor & Head of the Department, ECE Department, SRKREC, Bhimavaram, Andhra Pradesh, India;*
*E-mail: pvrraju50@gmail.com*
*[4] PG Student, ECE Department, SRKREC, Bhimavaram, Andhra Pradesh, India; E-mail: dileep0474@gmail.com*

***Abstract:*** The current work presents the implementation of a metaheuristic algorithm Invasive Weed Optimization (IWO) for pattern nulling of Antenna array radiation pattern in prescribed directions. The IWO Algorithm is implemented for pattern nulling Synthesis of Uniform Circular (CA) and Planar Arrays (PA) by optimizing only amplitudes of array elements. Two design examples of introducing Deeper Nulls in both symmetrical and unsymmetrical directions are presented using IWO and compared with Real Coded Genetic Algorithm (RCGA). Numerical results illustrate that IWO is better in producing deeper Nulls and also in the rate of convergence for both Planar and Circular Arrays when compared with RCGA.

***Keywords:*** Pattern Nulling, Planar Antenna Array, Circular Antenna Array, Invasive Weed Optimization (IWO).

## 1. INTRODUCTION

For most wireless applications, antenna arrays have found distinct benefits when compared to a single element antenna. More prominent benefits include an increase in directivity and spatial diversity. Optimization of radiation pattern characteristics (pattern synthesis) of antenna arrays involves increasing directivity, reducing Side lobe level and placing nulls in the required directions can be obtained by finding the optimized values, amplitudes, distance between array elements and progressive phase shift between the elements. Over the past decade a rapid growth in the utilization of wireless mobile devices and technologies has lead to enormous increase in electromagnetic pollution. One of the more efficient ways to decrease this pollution is to suppress the electromagnetic radiation in unwanted directions. This objective can be achieved by a process of placing deeper nulls in the unwanted directions of radiation pattern of antenna arrays. These pattern nulling techniques are helpful in several applications which include wireless mobile, satellite and Defense applications in order to reduce degradation in SNR [1].

In the past several metaheuristic (evolutionary optimization) approaches namely Genetic Algorithm (GA) [2], Particle Swarm Optimization Algorithm (PSO) [3], Tabu Search Algorithm (TSA) [4], Firefly Algorithm

RESEARCH ARTICLE OPEN ACCESS

# A Design of Sigma-Delta ADC Using OTA

Miss. Niveditha Yadav M[1], Mr. Yaseen Basha[2], Dr. Venkatesh kumar H[3]
[1]*Department of ECE, PG Student, NCET/VTU, and Bengaluru, India*
[2]*Department of ECE, Assistant professor, NCET/VTU, India, Bengaluru*
[3]*Department of ECE, Associate professor, NCET/VTU, India, Bengaluru*

**ABSTRACT**
Sigma-Delta Analog-to-Digital converter (ADC), is widely used in portable electronic products. An operational transconductance amplifier (OTA) is one of the most important components of ADC. This paper presents a new design of two stages OTA. The design incorporates Sleep insertion technique and leakage feedback current approach for improving design parameters such as gain, and power as compared to earlier work. The design is simulated in 0.18µm CMOS technology with supply voltage 1.8V.
***Keywords***: ADC, OTA, Sleep insertion Technique, Leakage feedback approach.

## I. INTRODUCTION

Modern VLSI devices demands for excessive information value with low energy consumption and needless speed. The key additives in the wireless receiver is the ADC, it is far way a margin in the middle of analog and digital design.

**Operational Transconductance Amplifier**

The OTA is a basic building blocks found in many analog devices such as data converter's (ADC &DAC). The OTA is a Transconductance device in which the input voltage controls the output current, it means that OTA is a voltage controlled current source whereas the op-amps are voltage controlled voltage source. An OTA is basically an opamp without output buffer, so it can only drive loads.

**Analog-to-digital converter**

ADC is a fundamental block in mixed-signal VLSI circuits. The rapid growth of mobile electronic systems increases the demand for developing low-cost and low-power circuit technique with high performance. Sigma delta (ΣΔ) modulators are one of the preferred architectures for high resolution converters. Power consumption and area are the key parameters for a sigma delta modulator these parameters cannot be changed once an ADC is designed. While it can operate at higher speed and will consume less power when operating at a lower resolution.

## II. PROPOSED OTA ARCHITECTURE

OTA is one of the basic building blocks of any analog circuit. OTA is in existence since very long time, this is not a recent technology. An OTA has all the characteristics of an operational voltage amplifier except that the output impedance ideally approaches infinity rather than zero. OTA is used to form the R- C integrator, which is the key block of ΣΔ modulator. An Two-Stage OTA topology with rail to-rail output swing is adopted for low voltage, low power designs. Two stage OTA is a configuration two stages are used. One of them provides high gain followed by second stage which provides high voltage swing. This modification increases the gain compared to single stage OTA. But increases complexity of design, Hence reduce the speed as compared to single stage amplifier[2].

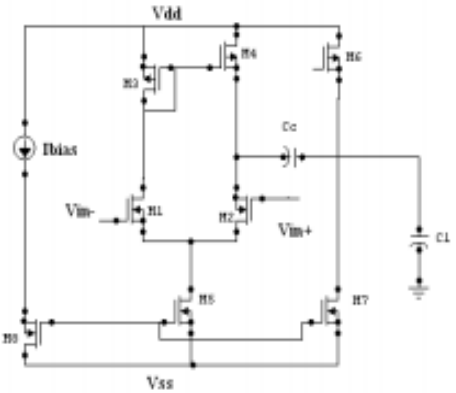



**Fig 1:** Two stage OTA

## III. BLOCK DIAGRAM OF ADC ARCHITECTURE

Fig 2. Shows The block diagram of a first order ΣΔ modulator which consists of a integrator, a comparator, which acts as an ADC and 1-bit DAC, which is placed in the feedback loop. The name first order is derived from the information that there is only one integrator in the circuit, placed in the forward path. When the output of the integrator is positive, the comparator feeds back a positive reference signal that is subtracted from the input

*International Journal of Engineering &Technology*, 7 (3.12) (2018) 1222 -1227

**International Journal of Engineering & Technology**

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# A Novel Compressed Encrypted and Encoded Watermark Embedding Scheme for Digital Images

**Rohith S[1], B K Sujatha[2]**

*[1]Department of Electronics and Communication Engg, Nagarjuna College of Engineering and Technology, Bengalur, Karnataka, India.*
*[2]Department of Telecommunication Engg, M S Ramaiah Institute of Technology, Bengalur, Karnataka, India*
**Corresponding Author Email: [1]rohithvjp2006@gmail.com , [2]bksujatha08@gmail.com*

**Abstract**

In this research work a novel idea of compressed, encrypted and encoded watermark embedding scheme for digital images is proposed. Initially watermark is compressed using Huffman encoder. Compressed watermark is encrypted using combined binary key sequence $\{K_i\}$ derived from sequence of logistic map and Lozi map. The compressed and encrypted binary watermark is encoded using (n,1) repetition code. This compressed, encrypted and encoded binary watermark is embedded in alternate locations of cover image pixels using of Least Significant Bit (LSB) and Second Least Significant Bit (SLSB). To study the watermarked image quality, parameters such as Signal to Noise Ratio (SNR) and Mean Square Error (MSE) are used. Also performance of the proposed system is compared with uncompressed, encrypted, encoded watermark embedding scheme. There is a significant improvement in MSE, SNR of watermarked image, when compressed watermark embedding scheme is compared to uncompressed watermark embedding scheme.

***Keywords:*** *Spatial domain watermarking, Lozi mapping, Logistic mapping, Huffman code, repetition code.*

## 1. Introduction

With rapid advancement of electronic based digital devices and modern internet services, transmission and storage of multimedia information is common practice. This also facilitates users to create, manipulate and exchange data over internet. This imposes a threat of copyright of original or actual content of the owner. Watermarking is one of the solutions to protect copyright of the owner [1][2]. It is the process of embedding a piece of useful information such as company logo, text, audio etc. which is also known as watermark into cover object. So obtained image is known as watermarked image or watermark embedded image. The cover object may be in the form of audio, video, image etc. Based on visibility of watermark, image watermarking may be broadly divided into visible or invisible watermarking technique[1][3]. If watermark is visible to normal human eye then it is visible watermarking. Where as in case of invisible watermarking, watermark is not visible to normal human eye. Hence it is difficult to identify hidden information. In general image watermarking algorithm should satisfy basic requirement such as robustness, transparency, computational complexity and stability etc [3].

Digital image watermarking can be broadly classified into spatial domain and transform domain watermarking[1]-[7]. In spatial domain watermarking schemes, watermark is embedded directly by modifying cover image pixels with watermark data. Hence it is computationally less complex and perceptual quality of watermark embedded image or watermarked image is better. Where as in case of transform domain technique, cover image is transformed using transformation technique to embed the watermark and inverse transformation is applied after embedding the watermark. Many researchers have used transformation techniques such as Discrete Cosine Transform (DCT) or Discrete Wavelet Transform (DWT) for obtaining robustness against compression and signal processing attacks. However, cover image transformation and inverse transformation involves high computation complexity, increased requirement of hardware circuitry and high power consumption when compared to spatial domain techniques [13][15].

Many researchers have developed algorithms using spatial domain and transform domain techniques [1]-[10]. In spatial domain techniques LSB based watermark embedding technique is popular [4][5]. Compressed watermark embedding scheme in LSB of the cover image is discussed in [6]. They have used run length coding for compressing the watermark. Compressed watermark was embedded in LSB of the cover image. Results show that compression improves perceptual quality of watermarked image. Block matching based LSB watermarking scheme is discussed in [7]. Watermark is encoded using Hamming code and embedded in cover image using LSB method. In [8] LSB technique for watermarking by using quick response encoding method is discussed. Result shows that the scheme is secured and robust against the attacks.

In [9] the author have used a Modified LSB algorithm with Singular Value Decomposition (SVD). They used SVD for watermark compression and compressed watermark is embedded in Modified LSB locations of cover image. The author also have performed

**Copyright © 2018 Authors. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**

# A Reversible Data Hiding Scheme in Encrypted Images for Medical Applications

**Dr. Rohith S[1] and Harish V[2]**

Associate Professor, Department of Electronics and Communication Engineering[1]

Assistant Professor, Department of Electronics and Communication Engineering[1]

Nagarjuna College of Engineering and Technology, Bengaluru, Karnataka, India

**Abstract:** *Storage and exchange of data of the patient images are common in medical applications. To protect the information of the patient and to avoid miss handling of the patient information data hiding scheme is very much essential. Reversible Data Hiding (RDH) scheme is one such scheme paid more attention to hide the data in encrypted images, since it maintains the excellent property that the original cover can be lossless recovered after embedded data is extracted while protecting the image content's confidentiality. In this paper initially space is reserved from the encrypted images, which may be used to embed the information later stage. Histogram shifting based Reversible Data Hiding scheme used to reserve the room before encryption process. The proposed method can achieve real reversibility, that is, data extraction and image recovery are free of any error. Experiments show that this novel method and achieves better perceptual quality.*

**Keywords:** Digital image watermarking, copy right protection, Reversible Data hiding scheme

Original Research Paper

Volume-8 | Issue-3 | March-2018 | ISSN - 2249-555X | IF : 5.397 | IC Value : 86.18

Engineering

# A STUDY ON VARIOUS OBJECT DETECTION METHODS IN SATELLITE IMAGERY

**Mrs. Swetha Vura** Research Scholar, Dept. of CSE, Nagarjuna College of Engineering and Technology (Visvesvaraya Technological University, Belagavi) Bengaluru, India

**Dr. Premjyoti Patil** Professor, Dept. of CSE, Nagarjuna College of Engineering and Technology Affiliated to VTU Bengaluru, India

**ABSTRACT** Image Processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. Satellites are man-made objects launched into space to take images useful for umpteen applications. Object detection is a computer technology related to image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, cars etc.) in digital images and videos. This paper is to review various object detection techniques in satellite images and its scope.

**KEYWORDS :** Object detection, satellite, edge detectors, filters, image processing

## I. INTRODUCTION

An image is a two-dimensional representation of objects in a real scene. Remote sensing images are representations of parts of the earth surface as seen from space. The images may be analog or digital. Aerial photographs are examples of analog images whereas satellite images acquired using electronic sensors are examples of digital images. A digital image consists of a two dimensional array of individual picture elements called pixels which are arranged in rows and columns. Each pixel represents an area of earth's surface that has an intensity value and a location address in the image. Resolution of an image is the smallest distance between two adjacent objects that the sensor can identify. The four types of resolutions defined for the remote sensing systems are

1) Spatial Resolution - It is the pixel size of an image representing the size of surface area.
2) Spectral Resolution - Gives the wavelength interval size and number of intervals that the sensor is measuring.
3) Temporal Resolution - The amount of time that passes between imagery collection periods for a surface location.
4) Radiometric Resolution - The ability of sensor to record many levels of brightness to the effective bit depth of the sensor.

Object detection in remote sensing images is to determine if a given aerial or a satellite image contains one or more objects belonging to the class of interest and locate its position of each predicted object in the image. Detecting and enumerating objects of interest over large areas is one of the primary aspects of satellite imagery analytics. An edge in an image is an abrupt change in intensity of pixels or discontinuity in image brightness or contrast. The important features are corners, lines and curves. One dimensional edge profiles are shown in the following Fig. 1.

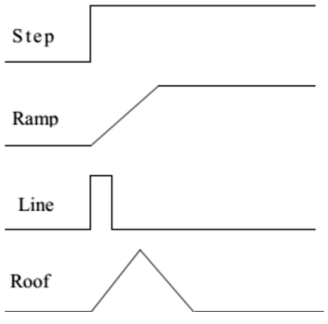



**Fig 1. One Dimensional edge profiles**

The four steps of edge detection are

1) Smoothing - Suppresses as much noise as possible, without destroying the true edges
2) Enhancement - Edge sharpening is done by applying a filter to enhance the quality of edges
3) Detection - Determines which pixels to discard as noise and which to retain, called Thresholding
4) Localization - Determines the exact location of an edge by edge thinning and linking

There are many ways to perform edge detection, but the majority may be grouped in two categories: Gradient based Edge Detection, Laplace based Edge Detection

## II. LITERATURE SURVEY

Teymur Azayev [1] in his thesis looks at a way of automating the detection of ships to track maritime traffic in a desired port or region. He proposes a machine learning approach using deep neural networks and explores the development, implementation and evaluation of such a pipeline, as well as methods and dataset used to train the neural network classifier. He also takes a look at a graphical approach to computation using TensorFlow which offers easy massive parallelization and deployment to cloud. The final result is an algorithm which is capable of receiving images from various providers at various resolutions and outputs a binary pixel wise mask over all detected ships.

N. Sai Kumar, B. Sukanya, B. Mohan and G.Prathibha [2] present an efficient method of extraction of roads from a given set of database. The extraction of roads plays an important role in urban planning. The other applications of road extractions are identification of isolated buildings that need to be detected and updating of GIS database according to the requirements of the human expertise. Edge detection techniques such as Canny, Sobel, and Prewitt were applied to the image. Morphological operations were applied to the resultant image which consisted of noise due to the edge detection operators. The noise present in the resultant image was reduced by applying Median filtering. The proposed method extracted roads with in less time compared to the earlier methods.

Adam Van Etten's [3] paper discusses a simpler approach using pre-filters and sliding windows paired with histogram of oriented gradient (HOG) based classifiers. In this post he showed how to combine Canny edge detector pre-filters with HOG feature descriptors, random forest classifiers, and sliding windows to perform object detection on satellite imagery. For boats of length [140, 100, 83, 66, 38, 22, 14, 10] meters, the entire classification pipeline took less than 30 seconds for the test image, translating to ~15 minutes for a full 8x8 kilometer DigitalGlobe image on a single CPU. This run-time could be greatly reduced by looking only for longer ships. For example, only searching for boats of length greater than 20m takes only ~3 minutes for a full DigitalGlobe image, a marked decrease from 15 minutes.

Chaitanya Malladi [4] says that objects in a satellite image can be identified using Machine Learning Techniques with Supervised and Unsupervised algorithms. Based on the literature survey, support vector machines and k-means were selected for supervised and unsupervised learning respectively. An experiment was performed to implement these algorithms with a dataset consisting of objects from satellite images. The results of the experiment were evaluated

International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8, Issue-1C, May 2019

# Adaptive Speech Spectrogram Approximation for Enhancement of Speech Signal

**Manju Ramrao Bhosle, Nagesh K N, Ravi Chaurasia**

***Abstract*: *The process of speech enhancement tends to decrease the noise with keeping undistorted speech signal amplitude. There are several benefits of speech processing systems which comes with the some challenges. In this paper, we proposed ASSA technique that used to tackle the de-noising and dereverberation in a single channel speech signal. The model is processed using sparse representation prototype in order to perform the de-noising process, where it remove the noise that present in speech signal more thoroughly. Where matrix factorization and SIFT is used to model the speech signal spectrogram, a time-varying filter is used to minimalize the noise more effectively. The noise adaptive model is implemented via iterative updating parameters in order to approximate the lower reverberant speech signal in a SIFT domain. Afterwards, the proposed ASSA technique compute the variation in estimated speech signal in order to decrease the noise components and to predict the final speech magnitude. In order to evaluate the performance of proposed system it is compared with state-of-art techniques using some performance metrics.***

***Index Terms*: *Adaptive Speech Spectrogram Approximation (ASSA), Short-Interval Fourier Transform (SIFT), Matrix Factorization, Noise, Dereverberation***

## I. INTRODUCTION

In general, the speech signals are corrupted via the noise, which create challenges for the researchers in order to reduce the noise in speech signal. It is very important and challenging field when it comes to make several communication devices such as mobile phones and hearing aids, where these devices should work reliably in contrary acoustic scenarios (i.e. busy road or crowded mall). The captured speech signals using different microphone have acoustic noise that provide detrimental impact on the speech signal performance. Overcoming these noise effect has been trending topic of research in several recent years as per the increasing requirement for efficient technologies of the speech communication under the challenging scenarios. However, some development has made in both multi and single channel speech processing, the process of single channel enhancement is tends to be the noise robust technique but inappropriate for processing speech signal in many real time speech datasets.

**Revised Manuscript Received on May 21, 2019.**

**Manju Ramrao Bhosle** currently working as assistant professor at Government Engineering college, Raichur and PhD scholar in VTU Belgavi

**Dr. Nagesh K. N** obtained his PhD in wireless communication from JNTUCE, Anantapur, India. Master degree in Digital electronics and communication from Visvesvaraya Technological University India

**Ravi Chaurasia** obtained his Bachelor degree in Electronics & Communication from Visvesvaraya Technological University

Commonly, the techniques of single-channel speech are classified into the following types; nonlinear mapping [1], inverse filtering [2], [3], and probabilistic based procedures [4]–[6] and spectral enhancement [7], [8], [9]. The approaches of non-linear mapping not consider any different prototype for noise reverberation, instead this make use of parallel training data computation to acquire the function of nonlinear mapping using spectrogram of reverberant speech in order to clean speech signal. In [1], a fully end-to-end Deep Neural Network (DNN) is considered, where mean squared error (MSE) of speech signal between noise free speech log-power spectrum and the outcome of DNN is computed to minimize the noise. In addition, the obtained outcome has also improved through taking 1$^{st}$ and 2$^{nd}$ order interval derivatives of speech input features, these technique of speech enhancement can provide decrement in overall quality of speech [10].

The techniques of inverse filtering are used to reconstruct the original speech signal through developing an inverse filter tends for room impulse response, depending upon this type of observation of clean speech linear prediction residual that fourth order has less residually than reverberant speech. In [2], the estimation of the impulse response is computed by inverse filter using maximization of fourth order moment under linear prediction of inverse filter. In [3], similar approach has been considered in order to maximize normalized third-order moment at linear prediction residual of inverse filter. However, these types of methods reimburse only for the effect of coloration that happened due to early reflections, which required to be used as the conjunction with preceding reverberation conquest techniques to obtain better performance of noise reduction. The scenario when room impulse response is estimated or known, then inverse filtering method can directly apply by using homomorhic methods [11], [12] or using frequency or time domain methods [13]. The noise reduction have major limitation that can provide negative on quality of speech and intelligibility. In [14], a single-channel filter using minimum-variance distortion-less-response is consider in a case of single channel in order to avoid speech distortion.

In [15], a framework is consider of higher-order sub-band filters for speech-distortion weighted using inter-frame Wiener filter (SDW-IFWF), where filters are used to utilize the μ parameters that sets a relation in between



*Retrieval Number: A10280581C19/19©BEIESP*

*Published By:*
*Blue Eyes Intelligence Engineering*
*& Sciences Publication*

# An Efficient VLSI Implementation of Double Error Correction Orthogonal Latin Square Codes

Malavika M. S.
M Tech Student
Electronics and Communication
Nagarjuna college of Engineering
Bengaluru, India

Rohith S.
Assistant professor
Electronics and Communication
Nagarjuna college of Engineering
Bengaluru, India

Venkatesh Kumar H., PhD
Associate professor
Electronics and Communication
Nagarjuna college of Engineering
Bengaluru, India

## ABSTRACT
There is a growing interest in multi-bit Error Correction Codes (ECCs) to protect SRAM memories. This has been caused by the increased number of multiple errors that memories suffer as technology scales. To protect an SRAM memory, an ECC has to be decodable in parallel and with low latency. Among the codes proposed for memory protection are Orthogonal Latin Square (OLS) codes that provide low latency decoding and a modular construction. It is more effective to provide different degrees of error correction for the different bits. This is done with Unequal Error Protection (UEP) codes. In this paper, UEP codes are derived from Double Error Correction (DEC) Orthogonal Latin Square (OLS) codes. The derived codes are implemented for an FPGA platform to evaluate the decoder complexity and latency. The Proposed encoder and decoder are done by Verilog HDL and Simulated by ModelSim 6.4 c and synthesized by Xilinx tool.

## Keywords
UEP codes, OLS codes, SEC-DED codes, OS-MLD codes

## 1. INTRODUCTION
Error Correction Codes (ECCs) are widely used to protect memories and other electronic circuits against errors. Traditionally, Single Error Correction Double Error Detection (SEC-DED) codes have been used. These codes can correct single bit errors in any word of the memory and can detect double bit errors, have moderate redundancy in terms of check bits and are relatively easy to decode. Decoding and correction are done via syndrome method which takes single cycle. A special class of SECDED codes known as Hsiao codes [Hsiao 70] was proposed to improve the speed, cost, and reliability of the decoding logic. There are also the double-error correcting triple-error-detecting (DEC-TED) codes, which come at the cost of much larger overhead in terms of both the check bits and more complex hardware to implement the error correction and detection. However in spite of their low check bits overhead and single cycle decoding, SEC-DED codes are not able to provide requisite reliability under certain conditions.

SRAM memories are one of the most commonly used electronic circuits. They are present as standalone devices and also embedded in most Digital Signal Processors (DSPs), microcontrollers, System on Chip (SoCs) and FPGAs Therefore their protection is critical to ensure system reliability. Traditionally, the ECCs used to protect SRAM memories have focused on providing Single Error Correction and Double Error Detection (SEC-DED). To correct multiple bit errors, more advanced ECCs are needed. Although there are many such codes, most of them do not fit the needs of an SRAM memory. To be used with an SRAM memory, encoding and decoding need to be done in parallel in less than one clock cycle.

However, there is a property called "one step majority logic decodable" (OS-MLD) that only a few ECCs have, that makes them suitable for fast parallel encoding. Orthogonal Latin Squares codes are derived from the concept of Latin Square and have been recently proposed to protect interconnects caches and memories. Their main advantage compared to other OS-MLD codes is that they provide a larger number of options in terms of word size and error correction capabilities rest of the parts are organized in section II Block diagram, section III Software requirements, Section IV simulation implementation respectively

## 2. BLOCK DIAGRAM

### 2.1 Encoder for the Proposed (48, 16, 16) DEC OLS Code Single Sub-Block Extended With SEC-DED
The encoder can be implemented as a combination of the DEC-OLS and SEC-DED encoders. DES OLS Encoder its Consist of Sixteen 4 input XOR Gate Design. The Inputs are Combination d and Outputs are Co. Another side we have SEC DED Encoder, It Consist of Four 3 Input XOR Gate design in Four Blocks. Both Encoders results are connected to two inputs XOR Gate and the Parity bits are generated. Parity Bits are named as C. This is illustrated in Figure 1. Basically, the encoders can operate in parallel and the final parity check bits are obtained doing the xor of the DEC-OLS results, (co bits in the Figure) and SEC-DED results, (ce bits in the Figure).

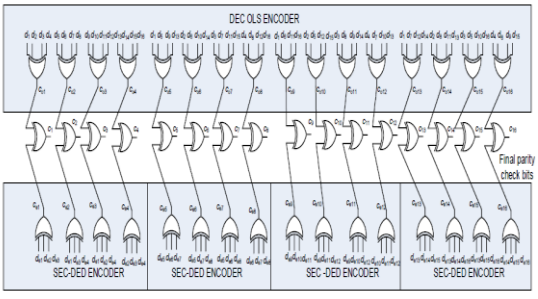



**Fig 1 Encoder for the proposed (48,16,16) DEC OLS code single sub-block extended with SEC-DED**

# An Efficient VLSI Implementation of Double Error Correction Orthogonal Latin Square Codes

Malavika M. S.
M Tech Student
Electronics and Communication
Nagarjuna college of Engineering
Bengaluru, India

Rohith S.
Assistant professor
Electronics and Communication
Nagarjuna college of Engineering
Bengaluru, India

Venkatesh Kumar H., PhD
Associate professor
Electronics and Communication
Nagarjuna college of Engineering
Bengaluru, India

## ABSTRACT
There is a growing interest in multi-bit Error Correction Codes (ECCs) to protect SRAM memories. This has been caused by the increased number of multiple errors that memories suffer as technology scales. To protect an SRAM memory, an ECC has to be decodable in parallel and with low latency. Among the codes proposed for memory protection are Orthogonal Latin Square (OLS) codes that provide low latency decoding and a modular construction. It is more effective to provide different degrees of error correction for the different bits. This is done with Unequal Error Protection (UEP) codes. In this paper, UEP codes are derived from Double Error Correction (DEC) Orthogonal Latin Square (OLS) codes. The derived codes are implemented for an FPGA platform to evaluate the decoder complexity and latency. The Proposed encoder and decoder are done by Verilog HDL and Simulated by ModelSim 6.4 c and synthesized by Xilinx tool.

## Keywords
UEP codes, OLS codes, SEC-DED codes, OS-MLD codes

## 1. INTRODUCTION
Error Correction Codes (ECCs) are widely used to protect memories and other electronic circuits against errors. Traditionally, Single Error Correction Double Error Detection (SEC-DED) codes have been used. These codes can correct single bit errors in any word of the memory and can detect double bit errors, have moderate redundancy in terms of check bits and are relatively easy to decode. Decoding and correction are done via syndrome method which takes single cycle. A special class of SECDED codes known as Hsiao codes [Hsiao 70] was proposed to improve the speed, cost, and reliability of the decoding logic. There are also the double-error correcting triple-error-detecting (DEC-TED) codes, which come at the cost of much larger overhead in terms of both the check bits and more complex hardware to implement the error correction and detection. However in spite of their low check bits overhead and single cycle decoding, SEC-DED codes are not able to provide requisite reliability under certain conditions.

SRAM memories are one of the most commonly used electronic circuits. They are present as standalone devices and also embedded in most Digital Signal Processors (DSPs), microcontrollers, System on Chip (SoCs) and FPGAs Therefore their protection is critical to ensure system reliability. Traditionally, the ECCs used to protect SRAM memories have focused on providing Single Error Correction and Double Error Detection (SEC-DED). To correct multiple bit errors, more advanced ECCs are needed. Although there are many such codes, most of them do not fit the needs of an SRAM memory. To be used with an SRAM memory, encoding and decoding need to be done in parallel in less than one clock cycle.

However, there is a property called "one step majority logic decodable" (OS-MLD) that only a few ECCs have, that makes them suitable for fast parallel encoding. Orthogonal Latin Squares codes are derived from the concept of Latin Square and have been recently proposed to protect interconnects caches and memories. Their main advantage compared to other OS-MLD codes is that they provide a larger number of options in terms of word size and error correction capabilities rest of the parts are organized in section II Block diagram, section III Software requirements, Section IV simulation implementation respectively

## 2. BLOCK DIAGRAM

### 2.1 Encoder for the Proposed (48, 16, 16) DEC OLS Code Single Sub-Block Extended With SEC-DED
The encoder can be implemented as a combination of the DEC-OLS and SEC-DED encoders. DES OLS Encoder its Consist of Sixteen 4 input XOR Gate Design. The Inputs are Combination d and Outputs are Co. Another side we have SEC DED Encoder, It Consist of Four 3 Input XOR Gate design in Four Blocks. Both Encoders results are connected to two inputs XOR Gate and the Parity bits are generated. Parity Bits are named as C. This is illustrated in Figure 1. Basically, the encoders can operate in parallel and the final parity check bits are obtained doing the xor of the DEC-OLS results, (co bits in the Figure) and SEC-DED results, (ce bits in the Figure).

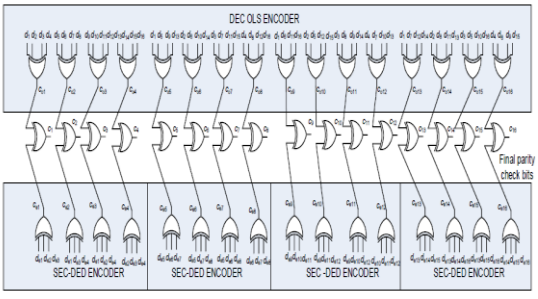



**Fig 1 Encoder for the proposed (48,16,16) DEC OLS code single sub-block extended with SEC-DED**

RESEARCH ARTICLE OPEN ACCESS

# Analysis Of High Speed Wallace Tree Multiplier Using Compressors For DSP Applications

Jayalakshmi N[1] , H. Venkatesh Kumar[2], Kasetty Rambabu[3]
[1] *Department of ECE, PG student, NCET, Bengaluru, india,*
[2] *Department of ECE, Professor, NCET, Bengaluru,india,*
[3] *Department of ECE, Assistant Professor, NCET, Bengaluru,india,*
*Corresponding author: Jayalakshmi N*

**ABSTRACT**
Multiplication is an important arithmetic operation employed in digital systems and signal processing applications. Most of the multipliers are time, area and power consuming circuits. Improvement in any of these parameters will improve the efficiency of the circuit. But ever increasing demand for faster multipliers motivated several researchers to go a step ahead and present some novel approach. This work presents an analysis & approach towards the reduction of delay in the Wallace tree multipliers by using compressors with full adders and half-adders for partial product reduction. The proposed multiplier has been analyzed using Xilinx ISE Design Suite 7.1, Modelsim and Cadence Virtuoso tool.
***Keywords*** **:** Binary counter, Compressors, Cadence, Xilinx

## I. INTRODUCTION

In present days speed, power and area are the important conflicts in VLSI design technology, because of ever increasing demand for the faster operations. Many technologies have been used to achieve high speed and low power [1] digital circuits and among that pass transistor logic has been intensively studied as a breakthrough for producing new advancement in the field of digital circuits. In digital systems architecture are well established in the literature to develop modern arithmetic processors and the use of latest innovations and advanced technologies dedicated to special logic circuits. Specifically multiplier design is critical in signal processing applications of digital system where it requires larger number of multiplications. The multiplication operation is used in digital system for various applications and multipliers are important part of systems like ALUs and DSP processors. The performance [2] of the system depends on the multiplier because they are often called the slowest components. So reduction of delay is important in this research.

Wallace tree multiplier is fast multiplier [3] compared to the available multiplier as they are used carry save addition algorithm for the final product addition. In multipliers if there is a small increase in speed will improve the operating frequency of a digital signal processor. Hence many attempts are done on multipliers to make it faster. When designing a multiplier, huge amount power and delay are generated, to minimize that, adders and compressor [4]are used. The proposed Wallace tree multiplier uses higher order compressors such as 3-2, 5-3 and 7-3 compressors to reduce delay and to achieve high-speed [5]. The higher order compressors are developed by merging binary counter property with compressor property. The design of wallace tree multiplier consist of three essential steps.

1. Generation of partial products
2. Reduction of partial products
3. Addition of reduced partial products to produce final product.

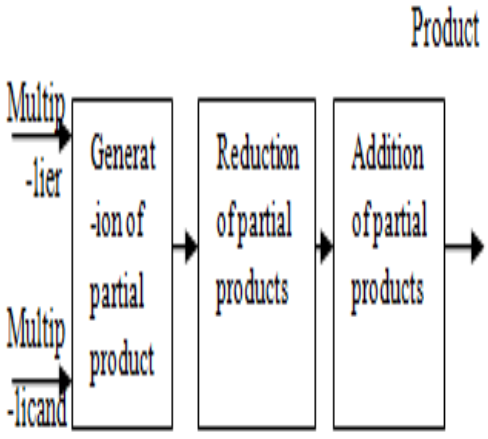



**Fig.1**: Block diagram of Wallace tree multiplier

In multiplier design if speed is not a problem the design complexity can be reduced by adding partial products serially. For high speed multipliers, consider 16 bit partial products are generally added using Wallace tree method. In this approach generated partial products are compressed at each column into two or more bits.

*International Journal of Humanities and Social Science Invention (IJHSSI)*
*ISSN (Online): 2319 – 7722, ISSN (Print): 2319 – 7714*
*www.ijhssi.org ||Volume 8 Issue 05 Ser. II || May 2019 || PP 39-46*

# A Analysis Of Low Power Design Techniques For Last Level Caches Using Way Filter Technique

Dr. Nagesh K N[1], ShashikiranR[2] , Manjunatha M[3]
*1. HOD and Professor Department of ECE, Nagarjuna College of Engineering and Technology, Bangalore*
*2. Assistant Professor Department of ECE,Nagarjuna College of Engineering and Technology, Bangalore.*
*3. IV Sem, M.Tech, Department of ECE, Nagarjuna College of Engineering and Technology, Bangalore.*
*Corresponding Author: Manjunatha M*

***ABSTRACT:*** *Last-level caches (LLCs) help improve performance but suffer from energy overhead because of their large sizes. An effective solution to this problem is to selectively power down several cache ways, which, however, reduces cache associativity and performance and thus limits its effectiveness in reducing energy consumption. To overcome this limitation, we propose a new cache architecture that can logically increase cache associativity of way-powered-down LLCs. Our proposed scheme is designed to be dynamic in activating an appropriate number of cache ways in order to eliminate the need for static profiling to determine an energy-optimized cache configuration. The experimental results show that our proposed dynamic scheme reduces the energy consumption of LLCs by 60% on single- and dual-core systems, respectively, compared with the best performing conventional static cache configuration. The overall system energy consumption including CPU, L3 cache, and DRAM is reduced by 3.64% on Pentium Quad core systems. The project consists of three different tasks: 1) Design - Designing a low-power cache memory (instruction or data) at the abstract level after literature research; 2) Code - Writing a simulation program on top of a simulator (e.g., Simple scalar); and 3) Test - Running a test program to evaluate the low-power cache memory by using performance metrics.*
***Index Terms—*** *Cache, energy, multicore system.*

---

Date of Submission: 06-05-2019 Date of acceptance:21-05-2019

---

## I. INTRODUCTION

Last-level caches (LLCs) play important roles of improving performance and reducing energy consumption by filtering out costly accesses to the memory system. The size of LLC is getting larger to support multicore systems better, which run many programs simultaneously. Thus, the LLC consumes more energy when many cores are involved. A large LLC that exceeds program demand capacity generally increases energy consumption without improving performance. Because programs demand different LLC capacities [1] and SRAM LLCs consume large leakage energy, several techniques have been proposed to reduce leakage energy consumption of LLCs. An effective and natural solution is to selectively power down some LLC ways when LLC capacity exceeds a needed capacity by programs, which eliminates leakage energy consumption in these powered down LLC ways [2]. However, the reduced associativity of way-powered-down LLC decreases performance due to increased LLC conflict misses, which may result in actual increase in energy consumption.way-filtering (WF)-based logical–associative LLC architecture to reduce the energy consumption of LLCs. This architecture logically increases the associativity of LLCs when one to three cache ways are activated, and thus improves performance and reduces energy consumption. To further decrease tag way energy consumption, we utilize a partial tag-based WF scheme. In addition, a sequential logical way accessing and indexing scheme is proposed to support multiple LLC logical way accesses when multiple logical way hits occur in one physical way using the partial tag-based way filter as show in fig below.

Springer Professional

Read first chapter

19 | OriginalPaper | Chapter

# Anomaly Detection in MANET Using Zone Based AODV Routing Protocol

Authors: G. S. Prasanna Lakshmi, Shantakumar B. Patil, Premjyothi Patil

Publisher: Springer Singapore

Published in: Advanced Informatics for Computing Research

## Abstract

Intrusion Detection System (IDS) is a famous approach for finding attacks in anomalies. This system is used for monitoring the attacks happening in mesh or computers. The anomaly intrusion detection technique plays the significant part in the intrusion detection systems to recognize the recent or a novel attacks by identifying any variation from common profile. This research provides the proof for enhancement of anomaly intrusion detection. The introduced method improves the security by using anomaly based intrusion detection process and zone based AODV routing protocol to discover shortest path. First it contains selection of the features for anomaly IDS. Next is essential to identify the novel or recent attacks by achieved decision rules from database.

**Indonesian Journal of Electrical Engineering and Computer Science**
Vol. 7, No. 3, September 2017, pp. 737 ~ 747
DOI: 10.11591/ijeecs.v7.i3.pp737-747


# Crowd Anomaly Detection Using Motion Based Spatio-Temporal Feature Analysis

**Basavaraj G M*[1], Ashok Kusagur[2]**
[1] Department of Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology, Bengaluru, Karnataka, India
[2] Department of Electrical and Electronics Engineering
University B.D.T College of Engineering (UBDTCE), Davanagere, Karnataka, India
*Corresponding author, e-mail: baswaraj832@gmail.com, ashok.kusagur@gmail.com

***Abstract***

*Recently, the demand for surveillance system is increasing in real time application to enhance the security system. These surveillance systems are mainly used in crowded places such as shopping malls, sports stadium etc. In order to support enhance the security system, crowd behavior analysis has been proven a significant technique which is used for crowd monitoring, visual surveillance etc. For crowd behavior analysis, motion analysis is a crucial task which can be achieved with the help of trajectories and tracking of objects. Various approaches have been proposed for crowd behavior analysis which has limitation for densely crowded scenarios, a new object entering the scene etc. In this work, we propose a new approach for abnormal crowd behavior detection. Proposed approach is a motion based spatio-temporal feature analysis technique which is capable of obtaining trajectories of each detected object. We also present a technique to carry out the evaluation of individual object and group of objects by considering relational descriptors based on their environmental context. Finally, a classification is carried out for detection of abnormal or normal crowd behavior by following patch based process. In the results, we have reported that proposed model is able to achieve better performance when compared to existing techniques in terms of classification accuracy, true positive rate, and false positive rate.*

***Keywords****: Spatio-temporal, visual surveillance, crowd behavior analysis, Streamline, Streakline*

***Copyright © 2017 Institute of Advanced Engineering and Science. All rights reserved.***

## 1. Introduction

Recently, video surveillance technology has grown due to its importance for security requirement and detection of events in public places such as streets, shopping malls, subway station etc. Video surveillance system is widely used to monitor the crowd activities during any public events. Automated analysis and detection of anomalies in crowd activities is a challenging issue in video surveillance system. According to the study presented in [1], abnormal activities are determined based on deviation from the normal or abnormal standard. By considering this interpretation, abnormal activities are defined based on the deviation from normal activities. In real-world scenarios such as pedestrian walking, subjects follow neighboring subjects aiming for the same destination. Abnormal crowd activities affect public safety such as an explosion, fire, disasters etc.

This technique of crowd behavior analysis is widely used in real-time applications such as:

(a) Visual surveillance

Crowd behaviors analysis is applicable for various visual surveillance scenarios such as shopping malls, railway stations etc. Conventional methods are not capable of providing better efficiency due to a huge density of the crowd.

(b) Crowd management

This approach is utilized for a mass gathering of a crowd such as sports event, music festival etc. Using this approach, the gathering areas can be analyzed and the crowd can be assisted for movement.

(c) Public space design

Crowd behavior analysis can be used designing public spaces during movement of the crowd in a railway station, shopping malls to increase the safety and efficiency.

*Received May 19, 2017; Revised July 28, 2017; Accepted August 13, 2017*

**Indonesian Journal of Electrical Engineering and Computer Science**
Vol. 7, No. 3, September 2017, pp. 737 ~ 747
DOI: 10.11591/ijeecs.v7.i3.pp737-747


# Crowd Anomaly Detection Using Motion Based Spatio-Temporal Feature Analysis

**Basavaraj G M*[1], Ashok Kusagur[2]**
[1] Department of Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology, Bengaluru, Karnataka, India
[2] Department of Electrical and Electronics Engineering
University B.D.T College of Engineering (UBDTCE), Davanagere, Karnataka, India
*Corresponding author, e-mail: baswaraj832@gmail.com, ashok.kusagur@gmail.com

***Abstract***

*Recently, the demand for surveillance system is increasing in real time application to enhance the security system. These surveillance systems are mainly used in crowded places such as shopping malls, sports stadium etc. In order to support enhance the security system, crowd behavior analysis has been proven a significant technique which is used for crowd monitoring, visual surveillance etc. For crowd behavior analysis, motion analysis is a crucial task which can be achieved with the help of trajectories and tracking of objects. Various approaches have been proposed for crowd behavior analysis which has limitation for densely crowded scenarios, a new object entering the scene etc. In this work, we propose a new approach for abnormal crowd behavior detection. Proposed approach is a motion based spatio-temporal feature analysis technique which is capable of obtaining trajectories of each detected object. We also present a technique to carry out the evaluation of individual object and group of objects by considering relational descriptors based on their environmental context. Finally, a classification is carried out for detection of abnormal or normal crowd behavior by following patch based process. In the results, we have reported that proposed model is able to achieve better performance when compared to existing techniques in terms of classification accuracy, true positive rate, and false positive rate.*

***Keywords****: Spatio-temporal, visual surveillance, crowd behavior analysis, Streamline, Streakline*

***Copyright © 2017 Institute of Advanced Engineering and Science. All rights reserved.***

## 1. Introduction

Recently, video surveillance technology has grown due to its importance for security requirement and detection of events in public places such as streets, shopping malls, subway station etc. Video surveillance system is widely used to monitor the crowd activities during any public events. Automated analysis and detection of anomalies in crowd activities is a challenging issue in video surveillance system. According to the study presented in [1], abnormal activities are determined based on deviation from the normal or abnormal standard. By considering this interpretation, abnormal activities are defined based on the deviation from normal activities. In real-world scenarios such as pedestrian walking, subjects follow neighboring subjects aiming for the same destination. Abnormal crowd activities affect public safety such as an explosion, fire, disasters etc.

This technique of crowd behavior analysis is widely used in real-time applications such as:

(a) Visual surveillance

Crowd behaviors analysis is applicable for various visual surveillance scenarios such as shopping malls, railway stations etc. Conventional methods are not capable of providing better efficiency due to a huge density of the crowd.

(b) Crowd management

This approach is utilized for a mass gathering of a crowd such as sports event, music festival etc. Using this approach, the gathering areas can be analyzed and the crowd can be assisted for movement.

(c) Public space design

Crowd behavior analysis can be used designing public spaces during movement of the crowd in a railway station, shopping malls to increase the safety and efficiency.

*Received May 19, 2017; Revised July 28, 2017; Accepted August 13, 2017*

ISSN No:-2456-2165

# Design and Development of the Fault Tolerance Software for the OBC Subsystem of STUDSAT

Sreevani Nanjuri[1],Professor
Electronics & Communication Engineering Department
Nagarjuna College of Engineering & Technology
Bengaluru, India

Irfan Khan[2],Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering & Technology
Bengaluru, India

Krithika M[3],Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering & Technology
Bengaluru, India

Meghashree L[4],Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering & Technology
Bengaluru, India

Yashwanth P[5],Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering & Technology
Bengaluru, India

**Abstract:- STUDent SATellite (STUDSAT) is India's first Twin - Nano satellite project which aims to demonstrate in-orbit separation, inter-satellite communication and drag-sail mechanism. The mission life of this class of satellites is short mainly due to two reasons. Firstly, the constraints on the volume of the satellite limit the scope of energy capacity which in turn degrades the survivability of the satellite. Also, the adverse and hostile environment in space necessitate the need for space-grade components in the design. Hence there is necessity for a system which can withstand itself in faulty environment and thereby increasing mission life of satellite.**

**In this project we are implementing the Fault Tolerance Software for OBC Sub-system, the complete satellite system is divided into six subsystems out of which, the On Board Computer (OBC) subsystem plays an important role in the functioning of the satellite. Even if there is a malfunction in this system, it might result in failure of the entire mission. So, a fault tolerant design is developed by introducing fault handling methods and redundancy to both software and hardware. The redundancy architecture of the system is implemented at three different levels viz. system level, subsystem level and interface level to improve the reliability of the OBC of the satellite.**

***Keywords:-*** *STM32F407VG Discover Board, CAN ,UART.*

## I. INTRODUCTION

The STUDSAT-2 consists of two Nano satellites (STUDSAT-2A and STUDSAT-2B) each mass less than 5kgs with the dimensions of 30 x 30 x 10 cm. The satellites are separated in the orbit. The satellite STUDSAT-2A shall receive AIS messages from ships and sends the received message, telemetry data to STUDSAT-2B through Inter Satellite Link (ISL). STUDSAT-2A carries AIS system and beacon data relay with ISL facility while STUDSAT2B has beacon data relay system, Drag-Sail and ISL. Along with these payloads, each satellite hosts an On-Board Computer (OBC) subsystem, Attitude Determination and Control System (ADCS) subsystem, Communication subsystem, Command and Data Handling(C&DH) subsystem, Mechanical subsystem and an Electrical Power subsystem (EPS) that are required for a successful space mission. The satellite was designed to send the images and telemetry data to the ground station NASTRAC (Nitte Amateur Satellite Tracking Centre) NASTRAC, the ground station, was also developed at NMIT itself by students, which like the STUDSAT-1, was the first-of-its-kind.

The satellite system of STUDSAT-2 is shared a six sub-system i,e. Structure, Attitude Determination and Control System (ADCS), Electrical Power System (EPS), Command and Data Handling(C&DH), Communication and Payload. The OBC is a special-purpose on board computer, and is different in many respects from the conventional PCs and work stations. An on-board computer designed to monitor and control the real time operations of a satellite. It takes control of the satellite immediately after its launch, and remains in command until the end of the operation life of the satellite. The primary role of the OBC is an autonomous control of all subsystems of the satellite. The OBC consists of complex hardware and software to communicate with the on-board subsystems and the ground station. When the satellite is not in the cone of window of

# Design of Area and Power Efficient Approximate Multipliers for Image Processing

[1]Mr.Sridhar T N, [2]Dr.Premjyoti patil
[1]M.Tech Scholar, [2]Professor
[1]Dept. of ECE
[1]Nagarjuna College of Engineering and Technology,Bengaluru(Autonomous under VTU)

***Abstract :*** In this paper a new design for approximation of multipliers is introduced. Decreasing the design complexity and increasing the power efficiency is the main advantage of approximate computing. This can be achieved by altering the partial products of the multiplier to introduce varying probability terms. For the accumulation of altered partial products based on their probability logic complexity of approximation is varied. Two variants of 16-bt multipliers are utilized in the proposed methodology. By synthesis they can achieve power savings of 72% and 38% respectively, in comparison with exact multiplier and also there is an increase in precision. Decrease in the Mean relative error to low value of 7.6% and 0.02% which are better than the previous works. The evaluation of these multipliers can be done with image processing application and it can be seen that the proposed model achieves highest peak signal to noise ratio.
***IndexTerms*-Multipliers,approximatecomputing,lowpower,erroranalysis,low**

## I. INTRODUCTION

The exact computing is not necessary in some of the applications like data mining and multimedia signal processing because they can tolerate error. By using approximate computing we can reduce the errors. The main components of the approximation computing are the adders and multipliers. In [1], For the digital signal processing application approximate full adders are proposed. They plays a role of accumulating the partial products in multipliers.

## II. LITERATURE SURVEY

In fixed-width multiplier designs the truncation is achieved by decresing the hardware complexity of the multiplier. To compensate the error of quantization introduced by truncated part [2], [3] , the variabl and constant correction term is added.In multipliers the techniques of approximation focus on partial product accumulation ,which is very essential in terms of consumption of power. The implementation of broken array multiplier [4], where the truncation of least significant bits of the input, while to decrese complexity of hardware by partial products formation. In partial product accumulation few adder circuits are saved in proposed multiplier design in [4] is automatically saves area.

In [5], two designs of approximate 4-2 compressors are pre- sented and used in partial product reduction tree of four variants of 8 8 Dadda× multiplier. The major drawback of the proposed compressors in [5] is that they give nonzero output for zero val- ued inputs, which largely affects the mean relative error (MRE) as discussed later. The approximate design proposed in this Paper overcomes the existing drawback. This leads to better precision. In static segment multiplier (SSM) proposed in [6], *m*-bit segments are derived from *n*- bit operands based on leading 1 bit of the operands. Then, *m m* multiplication is performed instead of *n n* mul- tiplication, where *m*<*n*. Partial product perforation (PPP) multiplier in [7] omits *k* successive partial products starting from *j*th position, where *j* [0, *n*-1] and *k*[1, min(*n*-*j*, *n*-1)] of a *n*-bit multiplier. In [8], 2 2 approximate multiplier×based on modifying an entry in the Karnaugh map is proposed and used as a building block to construct 4 4 and 8 8 multipliers. In [9], inaccurate× counter design has been proposed for use in power efficient Wal- lace tree multiplier. A new approximate adder is presented in [10] which is utilized for partial product accumulation of the multiplier. For 16-bit approximate multiplier in [10], 26% of reduction in power is accomplished compared to exact multiplier. Approximationof 8-bit Wallace tree multiplier due to voltage over-scaling (VOS) is discussed in [11]. Lowering supply voltage creates paths failing to meet delay constraints leading to error.

Previous works on logic complexity reduction focus on straight- forward application of approximate adders and compressors to the partial products. In this Paper, the partial products are altered to introduce terms with different probabilities. Probability statistics of the altered partial products are analyzed, which is followed by systematic approximation.

Simplified arithmetic units (half-adder, full-adder, and 4-2 compressor) are proposed for approximation. The arithmetic units are not only reduced in complexity, but care is also taken that error value is maintained low. While systemic approximation helps in achieving better accuracy, reduced logic complexity of approximate arithmetic units consumes less power and area. The proposed multipliers outperforms the existing multiplier designs in terms of area, power, and error, and achieves better peak signal to noise ratio (PSNR) values in image processing application.

Error distance (ED) can be defined as the arithmetic distance between a correct output and approximate output for a given input. In [12], approximate adders are evaluated and normalized ED (NED) is proposed as nearly invariant metric independent of the size of the approximate circuit. Also, traditional error analysis, MRE is found for existing and proposed multiplier designs.

The rest of this Paper is organized as follows. Section II details the proposed architecture. Section III provides extensive result analysis of design and error metrics of the proposed and existing approximate multipliers. The proposed multipliers are utilized in image process- ing application and results are provided in Section IV. Section V concludes this Paper.

# Design of Booth Multiplier using Double Gate MOSFET

Yogeesh K.V.
PG Student
NCET, Bengaluru

Venkateshkumar H.
Associate Professor
NCET, Bengaluru

## ABSTRACT
Double gate MOSFET technology is used wherever low power delay product is desired. It uses to reduce leakage current drain induced barrier lowering effect (DIBL) and other short channel affects. In this work 8×8, Booth Multiplier is analysed in 90nm technology, with one single-gate MOSFET technology and then other using the proposed that is Double-Gate MOSFET technique. Depending on the input patterns, the proposed technique saves 24% in power consumption has observed in proposed circuit. Design and simulations are performed in cadence virtuoso and spectre tools using 90nm technology.

## Keywords
Booth Multiplier, Double Gate, Low power, Power Delay Product (PDP)

## 1. INTRODUCTION
In digital signal processing and various applications, multipliers [1] plays an important role. In advance technology many researchers tried to design multipliers which offer the following specifications such as high speed, low power consumption or less power.

Booth algorithm [2] was invented by Andrew Donald in 1950 while study on crystallography at brickbeck college, Bloomsbury London. Booth used reception desk calculators that shifts faster than adding and formed the algorithm to increasing the speed. Booth multiplication involves two techniques to reduce the delay

1. To reduce the number of partial products.
2. To increase the speed at which partial products are added.

Figure 1.1 shows the architecture [3] of booth multiplier . Radix-2 booth multiplier consists 4 logic blocks namely booth encoder is used for encoding multiplier bits and reduce the number of partial products. Partial product generator is used to generate partial products. (9:4,7:3 & 4:2) compressor adder is used for collecting all the partial products and produce the sum and carry vectors.6T-Transistors adder is to produce final product terms.

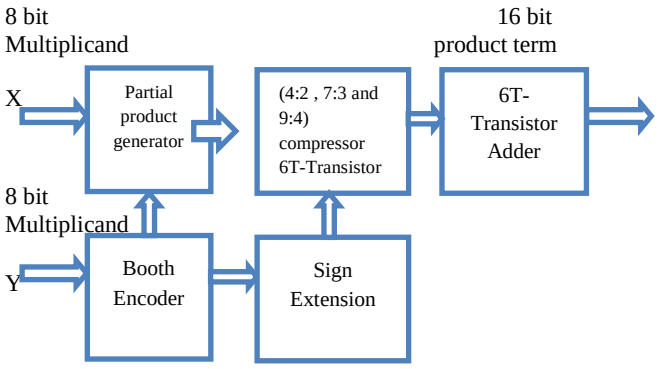



**Figure 1.1 Architecture of Booth Multiplier.**

## 2. LITERATURE REVIEW
The need of designing low power VLSI circuits has been increased abundantly and increase demand of portable device like cellular and mobiles. Further increase more number of devices on chip, scaling of device size is required. Number of problems are facing in scaling of bulk MOSFETS. The problems like leakage current, drain induced barrier effect (DIBL) and other short channel affects (SCE'S) degrade the performance of circuits. Design all the blocks of booth multiplier in both single gate and double gate technique. The proposed double gate technique give better performance compare to single gate MOSFET technique.

## 3. DOUBLE GATE MOSFET TECHNIQUE
Double gate MOSFET [4] technique proposed in 1980. It is used in ultralow power design. DG MOSFETS has drain, source and two gates. The two gates (front & back) electrically coupled together in double gate devices. It reduces has better control over channel conductance and immunity to SCE'S and reduce sub threshold leakage. It operates in two modes such as symmetrical driven (SDDG) and independent driven (IDDG) double gate MOSFET. The below figure 3.1 and 3.2 shows the symbol of double gate MOSFETS and symmetrical mode operation of double gate MOSFETS.

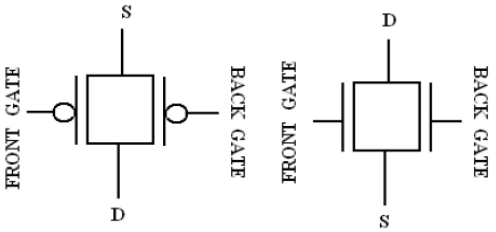



**Figure 3.1 circuit symbols for p-type and n-type of Double Gate MOSFETS.**

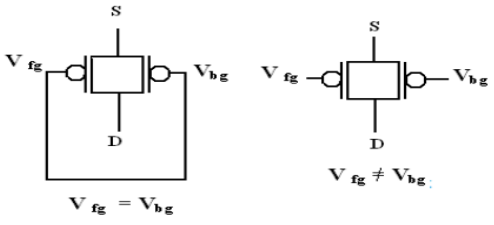



**Figure 3.2 symmetrical and independent driven Double Gate MOSFETS.**

### 3.1. General Double Gate operation
The voltage applied on the gate terminals controls the electric field, determining the amount of current flow through the channel.

The most common operations is to switch both gates simultaneously.

# DSP-IR: Delay Sensitive Protocol for Intelligent Routing with Medium Access Control

A. C. Yogeesh[1(✉)], Shantakumar B. Patil[1], Premajyothi Patil[1], and H. R. Roopashree[2]

[1] Department of Computer Science and Engineering, Nagarjuna College of Engineering and Technology, VTU, Bengaluru, India
yogeeshl3@gmail.com
[2] Publicis Sapient Consulting Pvt. Ltd., Bengaluru, India
roopashree.r@res.christuniversity.in

**Abstract.** The wireless sensor network has been positioned itself from a complete network system to a sub-net of future internet namely Internet of Things, where a communications among anything to anything is possible. The extensible use of wireless sensor network makes it more risky if the security threats are not handled wisely. The conventional methods adopted for securing the WSN vulnerability based attacks introduces delay, which brings congestion in the routing flow as well as influence the quality of service. The proposed DSP-IR is a secure routing algorithm to handle security with delay sensitivity. The DSP-IR framework evaluates MAC protocols including S-MAC, Q-MAC and IH-MAC along with RSA, AES and DSP-IR encrypt process. For all the three combinations performance evaluation is done by simulating the model to know the behavior of residual energy, energy consumption and average packet delay with varying interval of message arrival time and it is found that the proposed IH-MAC with DSP-IR exhibits better performance.

**Keywords:** Wireless sensor network · Secure routing
MAC for sensor network

## 1 Introduction

Wireless Sensor Network (WSN) either as an independent network or sub-net of internet of things (IoT) along with pervasive and ubiquitous future generation applications in Industry 4.0 vision may provision many intelligent applications in the wide variety of domains of IBM vision of smart planet as well as many cyber physical world based any-to-any communication based applications [1]. In future, all these applications will be critical applications, which will be treated as a lifeline. There are two requirements that ensures success of this vision (1) optimal quality of service

© Springer International Publishing AG, part of Springer Nature 2019
R. Silhavy (Ed.): CSOC 2018, AISC 765, pp. 393–402, 2019.
https://doi.org/10.1007/978-3-319-91192-2_39

IJARSCT
ISSN (Online) 2581-9429
ISSN (Print) 2581-XXXX
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 1, February 2021
Impact Factor: 4.819

# FPGA Implementation of 8-Bit Vedic Multiplier for DIT-FFT Application Using Urdhva Tiryagbhyam Sutra

**Rohith S, Kasetty Ram Babu and Chandrashekar M N**
Department of Electronics and Communication Engineering
Nagarjuna College of Engineering and Technology, Bengaluru, Karnataka, India

**Abstract:** *This paper discusses FPGA Implementation of 8-Bit Vedic Multiplier and DIT-FFT Application Using Urdhva Tiryagbhyam Sutra. Initially 8-bit Vedic multiplier performance is compared with existing multiplier such as i) Wallace tree multiplier ii) Array multiplier iii) Booth multiplier. In this work Urdhva Tiryagbhyam (upright and across) Vedic sutra is used for multiplier design which provides better performance and consumes smaller time for computation. In this work, Modified Carry Save Adder (MCSA) is used to compute the sum of partially generated products. Further the multiplier is It reduces the computational delay towards the addition of unfinished products. The proposed design uses the Verilog HDL to develop the algorithm. The XILINX 14.7 software tool is used to simulate and synthesize the code. The proposed design is used for DIT FFT application.*

**Keywords:** Urdhva Tiryagbham, DCT, FFT, Booth Multiplier, Array Multiplier, Wallace Tree Multiplier, MCSA

.

## I. INTRODUCTION

In digital signal processing Multiplication is a very important fundamental arithmetic operation for various applications like Convolution, FFT and digital filters. The performance of the system is decided by time taken to compute the multiplication procedure. In direction to drop the power requirement and time we need a high-speed and competent multiplier. Reducing the area, power and time delay are the major demands for different applications. There are diverse categories of multipliers depends on the prearrangement of the digital components. In DSP systems the multiplier decides the key performance of the system when it placed in critical delay paths. The area optimization, performance and low power consumption is the major domain concern in VLSI Design field.

The multipliers are also used in the designing of processors and ALU the processors speed is depending on the performance of the multiplier. From fast decades many new multiplier architectures have been designed like Booth's multiplier, Array multiplier, Braun multiplier and Wallace tree multipliers etc., in these multiplier algorithms the unfinished products are formed by various steps such as addition, subtraction and many other comparisons to get the actual result. Since in the multiplier design speed is the major criteria, hence these multiplier architectures are not suitable for Digital signal processing (DSP) applications.

Sri BhartiKrishnaTirthaji (1884-1960) anticipated Vedic arithmetic later than his eight years of investigate on Atharva Vedas [5]. The Vedic mathematics is a incredibly attention grabbing field and presenting several successful algorithms that can be useful to a range of engineering branches. The multiplication processes with Urdhva Tiryagbham mathematics algorithm would result into the dropping of computational delay.

In this work, the multiplier utilizes the Urdhva-Tiryakbhyam sutra for multiplication of binary numbers. The major consideration of the design is to improve the speed of multiplier to produce the unfinished products. The unfinished products generated by using Vedic multiplier are subsequently added by MCSA to produce the final product. The estimated multiplier leads to a improved speed and decreases the power utilization by multiplier design.

The rest of the paper is organized as follows. Literature survey is given in Section II. The traditional multiplier design

*Sreevani Nanjuri N Journal of Engineering Research and Application* www.ijera.com
*ISSN : 2248-9622, Vol. 8, Issue 7 (Part -IV) July 2018, pp 04-08*

RESEARCH ARTICLE OPEN ACCESS

# Functional and Assertion Based Verification of Audio Echo Effect Unit

Sreevani Nanjuri N[1] , Nagesh .K.N[2], Yaseen Basha[3]
[1]*Department of ECE, PG Student, NCET, Bengaluru, India,*
[2] *Department of ECE, Professor & Hod, NCET, Bengaluru, India,*
[3]*Department of ECE, Assistant professor, NCET, Bengaluru, India,*
*Corresponding Author: Sreevani Nanjuri N*

**ABSTRACT**
The aspect ratio of MOS (Metal oxide semiconductor) Transistors are scaling down, designer are able to put more circuit with various functionality on a single die. This made design and verification process complex. If we consider today's system on chip (SOC) design, it is impossible to check all possible combination of input on design. To verify complex design successfully various verification techniques are exists. Successful verification is very much required for design signoff. There are various verification techniques like functional verification, equivalence checking, model checking, code and functional coverage, Assertion based verification are employed in verification process. In this paper, the sub modules such as Counter, Subtractor, Multiplexer, Memory unit and a Multiplier is designed and verified. Using these sub modules the top module for audio echo effect unit is designed and verified with test benches (functional). The Assertion based verification is performed on the top module.

**Keywords-:**Audio echo effect unit, Functional Verification, Assertion Based Verification, Verification Approaches.

---

Date of Submission: 11-07-2018 Date of acceptance: 25-07-2018

---

## I. INTRODUCTION

Verification[1] is a procedure used to exhibit that the goal of configuration saved in it's execution. Today, the period of multi-million-gate Application Specific Integrated Circuits (ASIC's), reusable intellectual property (IP) and system on-chip (SoC)[2] plan check expends 70% of outline endeavors. Because of this number of verification architects can be double the quantity of Register Transfer level (RTL) Designers. Verification moment can be lessened through parallelism. Verification time can be decreases through automation.

## II. DIFFERENT TYPES OF FUNCTIONAL VERIFICATION APPROACHES

There are three complementary functional verification approaches.
BLOCK-BOX verification
WHITE-BOX verification
GRAY-BOX verification

### 2.1 BLOCK-BOX Verification

In this confirmation, without any understanding of the real realization of the design the functional verification[1] can be performed. The benefit of block-box verification is that it is independent on any exact implementation whether the implemented in a single ASIC, RTL code. It is hard to observe and control precise features in block-box verification. Critical functions, deep into the design will be complicated to manage and monitor.

### 2.2 WHITE-BOX Approach

This approach has intimate information of the internals of a plan and also has control over it. The advantage of this approach is being able to add any interesting arrangement of states and inputs quickly, or to separate a desired function based on requirement.

### 2.3 GRAY-BOX-Verification

It is understand between White-box verification and block box verification. This means, block- box may not fully use all parts while the white box is not convenient. A gray-box approach commands and notices a plan completely through its top level interfaces (block-box).

## III. FORMAL VERIFICATION

It is a method of verifying whether the design fulfills the specific requirement or not (properties).Formal verification[3] does not remove the requirement to write test-benches. Once you follow what the conclusion points of the formal

*Sreevani Nanjuri N Journal of Engineering Research and Application* www.ijera.com
*ISSN : 2248-9622, Vol. 8, Issue 7 (Part -IV) July 2018, pp 04-08*

RESEARCH ARTICLE OPEN ACCESS

# Functional and Assertion Based Verification of Audio Echo Effect Unit

Sreevani Nanjuri N[1] , Nagesh .K.N[2], Yaseen Basha[3]
[1]*Department of ECE, PG Student, NCET, Bengaluru, India,*
[2] *Department of ECE, Professor & Hod, NCET, Bengaluru, India,*
[3]*Department of ECE, Assistant professor, NCET, Bengaluru, India,*
*Corresponding Author: Sreevani Nanjuri N*

**ABSTRACT**
The aspect ratio of MOS (Metal oxide semiconductor) Transistors are scaling down, designer are able to put more circuit with various functionality on a single die. This made design and verification process complex. If we consider today's system on chip (SOC) design, it is impossible to check all possible combination of input on design. To verify complex design successfully various verification techniques are exists. Successful verification is very much required for design signoff. There are various verification techniques like functional verification, equivalence checking, model checking, code and functional coverage, Assertion based verification are employed in verification process. In this paper, the sub modules such as Counter, Subtractor, Multiplexer, Memory unit and a Multiplier is designed and verified. Using these sub modules the top module for audio echo effect unit is designed and verified with test benches (functional). The Assertion based verification is performed on the top module.

**Keywords-:**Audio echo effect unit, Functional Verification, Assertion Based Verification, Verification Approaches.

---

Date of Submission: 11-07-2018 Date of acceptance: 25-07-2018

---

## I. INTRODUCTION

Verification[1] is a procedure used to exhibit that the goal of configuration saved in it's execution. Today, the period of multi-million-gate Application Specific Integrated Circuits (ASIC's), reusable intellectual property (IP) and system on-chip (SoC)[2] plan check expends 70% of outline endeavors. Because of this number of verification architects can be double the quantity of Register Transfer level (RTL) Designers. Verification moment can be lessened through parallelism. Verification time can be decreases through automation.

## II. DIFFERENT TYPES OF FUNCTIONAL VERIFICATION APPROACHES

There are three complementary functional verification approaches.
BLOCK-BOX verification
WHITE-BOX verification
GRAY-BOX verification

### 2.1 BLOCK-BOX Verification

In this confirmation, without any understanding of the real realization of the design the functional verification[1] can be performed. The benefit of block-box verification is that it is independent on any exact implementation whether the implemented in a single ASIC, RTL code. It is hard to observe and control precise features in block-box verification. Critical functions, deep into the design will be complicated to manage and monitor.

### 2.2 WHITE-BOX Approach

This approach has intimate information of the internals of a plan and also has control over it. The advantage of this approach is being able to add any interesting arrangement of states and inputs quickly, or to separate a desired function based on requirement.

### 2.3 GRAY-BOX-Verification

It is understand between White-box verification and block box verification. This means, block- box may not fully use all parts while the white box is not convenient. A gray-box approach commands and notices a plan completely through its top level interfaces (block-box).

## III. FORMAL VERIFICATION

It is a method of verifying whether the design fulfills the specific requirement or not (properties).Formal verification[3] does not remove the requirement to write test-benches. Once you follow what the conclusion points of the formal

ISSN No:-2456-2165

# GPS Based Vehicle Tracking System via Android Device

Mahesh M R[1],Assistant Professor
Department of Electronics & Communication Engineering
Nagarjuna college of Engineering & Technology
Bengaluru, India

K. Ashok Kumar Reddy[2], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

B.Sreekanth Reddy[3], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

Nuggu Manasa[5], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

C.Soujanya[4], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering and Technology
Bengaluru, India

**Abstract:- Now-a-days, there is a increasing number of vehicle and vehicle thefts has been increasing in large number. It is very difficult to protect the vehicle from the theft to overcome the theft of the vehicle an anti-theft system is designed. vehicle Theft Alert System with Remote Engine Locking mainly aims to reduce vehicle theft to a great extent.**

**This system is an attempt to develop an advanced vehicle security system that identify vehicle theft and can track the details using GPS and GSM Module. Today vehicles are being stolen on a large number and this is the reason why this system is being introduced. To prevent the theft from stealing vehicle. If the vehicle is stolen and detects, this system send SMS to the user and consultative authorities. After which the user is supposed to send back the commands in order to stop the functions of the vehicle. Whenever a person tries to steal a vehicle, the Arduino is being interrupted. The Arduino uses a mechanism to stop the engine. This project using GPS which will also help to find the exact location of the vehicle.**

***Keywords:-*** *GPS, GSM, theft, Arduino and vehicle.*

## I. INTRODUCTION

In the present growing economy, the use of vehicles become enormous. Due to this, thefting of vehicles became large in amount. To prevent this, GPS based vehicle tracking system is introduced. This system can be used in every vehicle because GPS is used in different vehicles like cars, ambulance, school buses and police vehicles. The GPS/GSM based system is used in wide range of applications around the world due to it's use of ease.

Vehicle tracking system is the device used to determine the exact location and intimate the position to the use through an SMS. This system tracks the each vehicle at a given time and it is becoming most popular for people having expensive cars as theft prevention and Retrieval device. This system is mainly used in navy operators for management functions. The main aim is to provide a system that monitor and manage the public transportation system

## II. RELATED WORK

Firstly, in paper Akshatha S.A [1] States the "GPS vehicle Tracing and Monitoring System-a solution for public transportation", the author of this paper provides a solution for tracking and observing the public transport vehicle by the help of raspberry pi and GPS antenna. Raspberry pi processing board with receive the values and gives the result . when a passenger is travelling at that time passenger will provide a different locations to the system. The location information is in the form of source and destination. Those locations are stored in raspberry pi database and raspberry pi process and compare the passenger stored data if the data is not the same then the passenger will get a warning message on LCD display that driver is driving in a wrong direction.

In these paper Amol Dhul, Amol Naikoji , YutikaPatwa, ManaliShilimakar Prof. M. k. Nighot ,[4] states that "Survey Paper on Vehicle Tracking System using GPS ". The author of this paper proposed a GPS based Tracking system to help for finding the address of the vehicle and gives the locations on their mobile devices. The author says that system will provide the exact location of the vehicle along with distance also. The location details of the data is stored in database . that data will be plotted using the google maps on monitoring device .

In these paper Prashant kokane, Prof . Yogesh Throat [5] states that "Review on Accident alert and Vehicle tracking system". The author of this paper mainly discussing about the tracking the vehicles and detect the an accident. Here we are using a automatic detection of a traffic accidents using vibration sensor. When the accident

# *Intelligent Shopping Trolley and Billing System Using Raspberry Pi*

Ms.Sunitha.M[1], Asst. Professor
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India
m.sunitha@ncetmail.com

Vismaya.M [2], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering &Technology
Bengaluru, India
vvismaya2016@gmail.com

Sowmyashree P [3], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India
Sowmyagowda6498@gmail.com

Vaishnavi L M[4], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India
vaishnavimohan98@gmail.com

Pallavi K V [5], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India
pallupallavi90@gmail.com

**********

ISSN No:-2456-2165

# Interactive Humanoid Robot

Dr. Wilferd John Vaz[1], Professor
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

Sareddy Jaswanth Reddy [2], Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

Sushmitha KR[3], Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

Swathi V[4], Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

Rashmi KR[5], Student
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

**Abstract:- Humanoid Robots are built to mimic humans. The navigation problem of robot is solved by decomposing them into a series of small multi-objective optimization problems (MOPs) with corresponding local information, using multi-objective evolutionary algorithms (MOEAs).The humanoid robot can use its control function to stimulate more number of responses to its environment and uses a computing speed of milliseconds to anticipate and react to the movements done by workers at the workplace. For implementing the robotic control and computer vision functions a group of applications are developed in Raspberry Pi using Open CV modules. The Image processing and controlling is done by the processor Raspberry Pi . Various sensors will be embedded to fetch the data from the environment or the user. Required information is conveyed through LCD touchpad.**

**In this paper we are mainly concentrating on SLAM technology for tracking the position of robot and to prepare a map of surroundings, which helps in navigation of a person.**

***Keywords:-*** *Raspberry Pi Microcontroller, Touch Pad, Speaker, Accelerometer and Gyroscope Sensors.*

## I. INTRODUCTION

A humanoid robot is a type of robot built to resemble human body. Humanoid robots generally have a head, two upper limbs, and two lower limbs, though some forms of humanoid robots has only part of the body, for example, from the upper part of waist. Few humanoids just have head designed to replicate human facial expressions through eyes and mouth.

Humanoid robots are developed to perform human based tasks such as personal assistance, through which they are able to assist the old and sick and dangerous or dirty works. Humanoids robots are also capable of doing some procedurally repetitive jobs, such as receptionists and automotive manufacturing company workers. Since they do the repetitive jobs humans can be replaced with the humanoid robots for better accuracy and performance.

## II. RELATED WORK

First, Rainer Stiefelhagen, Hazım Kemal Ekenel, Christian F¨ugen, Petra Gieselmann, Hartwig Holzapfel, Florian Kraft, Kai Nickel, Michael Voit, and Alex Waibel[1]. (IEEE TRANSACTIONS ON ROBOTICS). They developed a natural multimodal humanoid robot interaction system which spontaneously recognizes the speech, process the multimodal dialogues and visual perception of the person who is using the robot. It includes localization of the robot, tracking and identification of the user, identification of sign gestures shown and also recognition of a user's head orientation. This project is defined as human to human robot interaction than human to robot interaction. Multiple algorithms were written for recognition of various different types of speech or dialogues and visual signs given by the user. They also presented several practical experiments on human-to-human robot interaction through speech and gestures.

In Shu-Yin Chiang*, Yi-Quan Jiang, Hsin-Tieh Yang, Chia-Chin WangandYu-ChenLee[2] Department of Information and Telecommunications Engineering, Ming Chuan University, Taiwan, IEEE. They developed a intelligent multifunctional humanoid robot to provide a companion and entertainment to the user, They used Kinect depth image as the visual platform to gain the information from the environment and to perform image processing. Next, the results from the image processing are considered in planning of robotic behavior. They used omnidirectional wheels, motors with high power, FPGA and ARM based tools as motion system, Lower body consists of four omnidirectional wheels in all the directions and upper body is human design. They used the information extracted from Kinect depth image stream to integrate the robot localization system and mapping of the real time environment and avoidance of obstacle. And also Kinect skeleton detection is

ISSN No:-2456-2165

# Live Streaming of Agriculture Market Statistics to the Remote Village Areas Using Amateur Radio

Dr. H.Venkatesh Kumar[1], Professor
Electronics & Communication Engineering Department
Nagarjuna College of Engineering &Technology
Bengaluru, India

K. VENKATA MOHAN REDDY[2], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

B. SAMARASIMHA REDDY[3], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

K. NIRANJAN REDDY[4], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

K. YASWANTH KUMAR REDDY[5], Student
Electronics & Communication Engineering
Nagarjuna College of Engineering & Technology
Bengaluru, India

**Abstract:- Amateur radio is a hobby that encompasses the whole range of communications technology. It has existed since the time Marconi, Hertz and others began their experiments. It is the only hobby that is regulated by the government of every country in the world. To obtain their operating licenses, amateurs are required to pass a written examination in radio regulations and fundamentals of radio technology. More than a 1.5 million persons worldwide are licensed amateurs. Now, after 100 years, amateur radio is at a critical turning point.**

**In this project we are going to implement the concept how ham is useful for farmers who are located in remote areas where other networks may not be reachable. HAM is used to give information like live updates about price of their agriculture yields in their local and near market places or state or national wide price and also giving instructions to them about other agriculture related queries. Hence appropriate decision can be taken at the field itself. The intent is to develop a two way communication to the farmers located in remote areas using HAM radio based transceiver that transmits and receives signals.**

***Keywords:-*** *Trans receiver, mic, antenna.*

## I. INTRODUCTION

In the present technology world we have various different type of updated and updating technologies in communication network. But most of the government relies on HAM RADIO during disasters time. It is not only used for disaster communication but also it used in space station communication and played one of the main key role for communication during world war 1.

In the present days even we may have different communication technologies but all this are not available even at present to most of the people located in remote area. Where most of there livelihood/occupation is agriculture they relies on farming.

But they don't know the present market statistics and what all measure they can take for agriculture growth. Not only that even if any disasters or sever health issues occur in remote areas most of outer world don't know what happens in remote areas and not possible to provide help for them. In this cases by Setting up a HAM radio station to the people in remote areas it is help for them like.

It can be used to assess the needs and gaps in early warning and communications for disaster situations.

It can be used to explore the possibilities for transmitting the live agriculture base price from the market yard to the Remote Areas where internet and mobile networks will not work.

Remote villagers can communicate to the agriculture R&D institutions to share/receive the information about newly implementing methods.

Since HAM operates by authorized person (HAM Licensed Holder).Hence information is more authenticated. Here communication happens through a using battery-operated/12v power supply transceiver.

## II. RELATED WORK

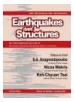
There are various kind of antenna's in which inverted vie antenna and horizontal dipole are similar which are bent towards ground creating an angle 120 or 90 degree between dipole legs with the reason that it can reduce ground foot print of antenna with out any impact on performance it is widely used in areas of limited space.

P. R. Kam, H. E. Price, R. J. Diersing, "Packet radio in the amateur service", IEEE J. Select. Areas Common., vol. SAC-3, pp. 431-439, May 1985.several activities are

Earthquakes and Structures

Volume 10 Issue 1 / Pages.191-209 / 2016 / 2092-7614(pISSN) / 2092-7622(eISSN)

Techno-Press (테크노프레스)



# Seismic force evaluation of RC shear wall buildings as per international codes

DOI QR Code

Jayalekshmi, B.R. (Department of Civil Engineering, National Institute of Technology Karnataka) ;
Chinmayi, H.K. (Department of Civil Engineering, National Institute of Technology Karnataka)

Received : 2013.11.29 Accepted : 2015.10.28 Published : 2016.01.25

https://doi.org/10.12989/eas.2016.10.1.191 Copy Citation KSCI

## Abstract

Seismic codes are the best available guidance on how structures should be designed and constructed to ensure adequate resistance to seismic forces during earthquakes. Seismic provisions of Indian standard code, International building code and European code are applied for buildings with ordinary moment resisting frames and reinforced shear walls at various locations considering the effect of site soil conditions. The study investigates the differences in spectral acceleration coefficient ($S_a/g$), base shear and storey shear obtained following the seismic provisions in different codes in the analysis of these buildings. Study shows that the provision of shear walls at core in low rise buildings and at all the four corners in high rise buildings gives the least value of base shear.

## Keywords

base shear; spectral acceleration coefficient; storey shear; shear wall; natural period; design response spectrum

## References

1. ASCE 41-06 (2007), "Seismic rehabilitation of existing buildings", American Society of Civil Engineers, Virginia, USA.
2. Dogangun, A. (2006), "A comparative study of the design spectra defined by Eurocode 8, UBC, IBC and Turkish Earthquake Code on R/C sample buildings", J. Seismol., 10(3), 335-351. https://doi.org/10.1007/s10950-006-9020-4
3. EC8 (2004), "Eurocode 8: design of structures for earthquake resistance Part 1: general rules, seismic actions and rules for buildings", European Norm, European Committee for Standardisation, Brussels.
4. FEMA-273 (1997), "NEHRP guidelines for the seismic rehabilitation of buildings", Federal Emergency Management Agency, Washington, DC.
5. FEMA-356 (2000), "Prestandard and commentary for the seismic rehabilitation of buildings", Federal Emergency Management Agency, Washington, DC.
6. Ghosh, S.K. and Khuntia, M. (1999), "Impact of seismic design provisions of 2000 IBC: Comparison with 1997UBC", Proceedings of the 68th Annual Convention, Structural Engineers Association of California (SEAOC), Santa Barbra, California, USA.
7. Iervolino, I., Maddaloni, G. and Cosenza, E. (2008), "Eurocode 8 compliant real record sets for seismic analysis of structures", J. Earthq. Eng., 12(1), 54-90. https://doi.org/10.1080/13632460701457173
8. Imashi, N. and Massumi, A. (2011), "A comparative study of the seismic provisions of Iranian seismic code (standard no. 2800) and International building code 2003", Asian J. Civ. Eng., 12(5), 579-596.
9. International Building Code (2012), International Code Council Inc., Falls Church, VA, USA.
10. IS: 13920 (1993), "Ductile detailing of reinforced concrete structures subjected to seismic forces -code of practice", Bureau of Indian Standards, New Delhi, India.

**Structural Engineering and Mechanics**, *Vol. 60, No. 3 (2016) 433-453*
DOI: http://dx.doi.org/10.12989/sem.2016.60.3.433 

# Seismic analysis of shear wall buildings incorporating site specific ground response

B.R. Jayalekshmi[1] and H.K. Chinmayi*[2]

[1]*Department of Civil Engineering, National Institute of Technology Karnataka, Surathkal 575-025, India*
[2]*Department of Civil Engineering, Nagarjuna College of Engineering and Technology, Bangalore 562-164, India*

*(Received August 21, 2015, Revised July 22, 2016, Accepted August 23, 2016)*

**Abstract.** During earthquake, the motion of ground is affected significantly by source characteristics, source-to-site path properties and local site conditions. Due to the influence of local soil conditions different places experience distinctive amplitude of surface ground motion. Ground response analysis of a specific site utilizing the borehole information at different locations is done in present study. The ground motion with the highest peak ground acceleration for this site obtained from the ground response analysis is used in finite element soil-structure interaction analysis of multi-storey shear wall buildings with various positions of shear walls. The variation in seismic response of buildings and advantageous position of shear wall are determined. The study reveals that providing shear wall at the core of buildings at the specific site is advantageous among all shear wall configurations considered.

**Keywords:** ground response analysis; soil-structure interaction; shear wall

## 1. Introduction

Ground responses are essentially influenced by the local soil conditions during earthquakes. The principal components that influence local modifications to the underlying motion are the topography of site and nature of depositional soil (Raju, Ramana *et al*. 2004). Approximation of site-specific dynamic response of a layered soil deposit is pertained to as a site-specific response analysis.

Effect of local soil conditions on intensity of ground shaking is known. The impact of local soil on the 1906 San Francisco earthquake was studied by (Wood 1908, Reid 1910). Later, from recordings of earthquake at sites with different subsurface conditions Gutenberg formulated site-dependent amplification factors. The influence of local site conditions on ground motions have been an area of intense research because the local site effects play a major role in earthquake resistant design of structures.

Site response study of selected sites of New Madrid seismic zone was carried out by Wang, Zeng *et al*. (1996) to study the site effects and strong motion characteristics of the area. New Madrid seismic zone area is susceptible to extreme damage by local site effect due to the thick

*Corresponding author, Associate Professor, E-mail: chinmayi.moorthy@gmail.com

**Copyright © 2016 Techno-Press, Ltd.**
http://www.techno-press.org/?journal=sem&subpage=8 ISSN: 1225-4568 (Print), 1598-6217 (Online)

# Compressive Strength of Concrete with Construction and Demolition Waste and m-SAND using Additives

**DivyaSrinath, Shashishankar A, Ravindra R, Mohiyuddin C S**

***Abstract*: Construction and Demolition wastes(C&D wastes) are generated in all cities of the world due to rapid urbanization. Disposing C & D waste these days is a costly affair, and raises environmental issues. Hence an attempt is made to reuse the demolished concrete as a partial replacement of natural coarse aggregates. Also due to ban of sand mining by local authorities, the cost of natural fine aggregate is very high and itself becoming a scarce material. Hence crushed stone aggregates called manufactured sand (m sand) is used, totally replacing natural fine aggregates. This concept is found to be cost effective, minimizes disposal of C & D wastes, and leads towards Green Building Concepts.**

***Compression test on M40 concrete cubes of size 150mmx150mmx150mm are conducted at end of 7 days and 28days. Mix design for M40 concrete is made in accordance to IS: 10262-2019 with water cement ratio of 0.45 using 53 Grade Ordinary Portland cement. Superplasticizer (LIQUIFIX) is used to enhance workability. Nano Silica (NS)(1.5% by weight of cement),Wollastonite powder(WP)(10%by weight of cement) and Basalt fibres(BF)(1% by weight of cement) are added as additives.***

***It is observed, that compressive strength of 7 days and 28 days cured samples is 25% more with the addition of all three additives compared to samples without additives. Hence the loss of compressive strength obtained by using demolished concrete as aggregates and m sand in concrete is regained with the addition of additives.***

***Index Terms*— Construction & Demolition waste, Concrete, m Sand, Nano Silica, Basalt fibres, Wollastonite powder.**

## I. INTRODUCTION

Globally, Construction & demolition waste is generated every year of the order 2.2 Billion tons per annum and in India it is 10 to 12 million tons per annum, as per the statistics available. Disposing this waste is a very costly affair, and disposing by filling in open grounds, will lead to health problems of the public and raises environmental issues. Hence an attempt is made to reutilize the demolished concrete in concrete, to evaluate its compressive strength, after 7 days and 28 days curing. After assessing the compressive strength at end of 7 day and 28 days, the outcome of the work will enable its applicability of its use in structural elements. Research works carried out by various authors involve Compressive Strength Tests, Flexural Tests, Split Tensile Tests, and Durability Tests, indicate the following facts: Forood Torabian Isfahani et al.[1], mentions that there was a remarkable improvement of compressive strength of 41%, by using Nano silica. Rutuja Mininath Sarade et al.[2], concludes that by adding Nano silica , it reduces carbon dioxide emission and also 20% increase in compressive strength is observed. Renu Mathur et al.[3] in their work states that with the addition of Wollastonite powder, an 28% to 35% increase in compressive strength and an 36% to 42% increase in flexural strength, were observed. Also, reduction in water absorption, drying shrinkage, abrasion loss of concrete, enhancement of durability against sulphate attack and alternate freezing & thawing were observed. Kandula Mohan Krishna Reddy et al.[4] observed an 24% increase in compressive strength , and 14% increase in flexural strength with addition of Wollastonite powder. Tehmina Ayub et al.[5] in his work indicates that with the addition of Basalt fibres the compressive strength, tensile splitting strength and the flexural strength of concrete increased significantly. Nayan Rathod et al.[6] concludes that use of Basalt fibres in concrete has multifold benefits. The benefits of using Basalt fibres are: it is non corrosive, the flexural and compressive strengths increases, and has good thermal resistivity.

## II. METHODOLOGY

As per the IS 10262:2019, for M40 Grade concrete, the proportions by weight of cement/Fine aggregate/coarse aggregate 1:2.56:3.26 is followed, six concrete cubes are cast for Normal Concrete, another six cubes are cast with demolished concrete(50% replacement for natural coarse aggregates), and with m sand (100% replacement for natural fine aggregate), and another six cubes with demolished concrete and m sand with additives Nano silica(1.5% by weight of cement, Basalt fibres (1% by weight of cement and Wollastonite powder(10% by weight of cement) as additives are cast. The percentages of additives are the optimum percentage obtained by experimental tests on compressive strength of cubes tried individually with each additive. Tables 2 to 4 gives the details of optimal percentages of Nano Silica, Basalt fibres and Wollastonite powder.

**Revised Manuscript Received on July 22, 2019.**

**Divya Srinath,** Associate Professor, Department of Civil Engineering,Nagarjuna College of Engineering and Technology, Bangalore.

**Shashishankar A**, Professor, Department of Civil Engineering, AMC College of Engineering, Bangalore.

**Ravindra R,** Associate Professor, Department of Civil Engineering, Rashtreeya Vidyalaya College of Engineering, Bangalore

**Mohiyuddin C S,** Assistant Professor, Department of Civil Engineering, AMC College of Engineering, Bangalore.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 01 | Jan 2020 www.irjet.net p-ISSN: 2395-0072

# Studies on Flexural Strength of Concrete with Demolished Concrete as Coarse Aggregate(Partial Replacement) and Manufactured Sand as Fine Aggregate(Total Replacement) using Admixtures

**Divyasrinath[1], Dr. Shahishankar A[2], Dr.Ravindra R[3], Mohiyuddin C S[4]**

*[1]Ph.D., Scholor in Civil Engineering, Jain University Bengaluru, Karnataka, & Associate Prof., at Nagarjuna College of Engineering and Technology Bengaluru, Karnataka, India.*
*[2]Professor & HOD of Civil Engineering, AMC College of Engineering, Bengaluru, Karnataka, India.*
*[3]Associate Professor in Civil Engineering, Rashtreeya Vidyalaya College of Engineering, Bengaluru, Karnataka, India.*
*[4] Assistant Professor & HOD of Civil Engineering, AMC College of Engineering, Bengaluru, Karnataka, India.*

---

**Abstract -***Flexural Strength is one of the important Engineering Properties of Concrete to be used as a Structural Member in any building. In the research work done demolished concrete is used as a partial replacement(50%) of natural coarse aggregate, and manufactured sand is used as a total replacement(100%) of natural fine aggregate. M40 Grade Concrete was prepared as per IS 10262-2019. Flexural Tests were carried out for Concrete prism beams for Concrete with demolished concrete and m-sand as Coarse and fine aggregates(CA & FA) respectively, and for Concrete prism beams with demolished concrete & m-sand as CA and FA with admixtures Nano Silica/Wollastonite Powder/Basalt Fibres, individually and Collectively. It was observed that there was an increase of Flexural strength by 33% in Concrete prism beams with the addition of all the admixtures Collectively in comparison to the Concrete beams without these admixtures. Thus the tests indicate there is an improvement in the Flexural Strength Properties of Concrete beams with demolished concrete & m-sand as CA & FA, using the three admixtures Collectively.*

***Key Words***: Demolished Concrete 1, Manufactured sand2, Nano Silica3, Wollastonite Powder4,Super plasticizer5,Basalt fibre6,

## 1. INTRODUCTION

*Throughout the world due to some reasons or the other the existing building ownership may change, because of this the existing buildings will be demolished, hence lots of huge quantities of demolished concrete is available.( As per the data available it is 2.2 Billion tons every year throughout the world and in India it is 12 Million tons per annum). Shifting these Construction and Demolition waste to outskirts of a city where the public will not reside is a costly affair, and also natural fine aggregate is scarce and also is very very costly. Hence the demolished concrete is used as a partial replacement(50%)of natural coarse aggregate, and manufactured sand is used as total replacement(100%) of natural fine aggregate in the preparation of M40 Grade Concrete as per IS 10262-2019. Thus when the demolished concrete and manufactured sand are utilized in concrete, it leads to Economical Green Buildings. Also if the Construction and Demolition waste is dumped in open spaces within in layouts it spoils the health of the Citizens and also punishable in some of the states in India.*

**(1)**Divyasrinath et.al,[1], (2019), observed an increase of around 25% increase in the Compressive Strength and 33% increase in the Flexural Strength of Concrete with RCA, using the Additives.(Nano Silica +Wollastonite powder+Basalt fibres).

**(2)**Fathima Irene IA,[2], (2014), has mentioned 14% increase in Compressive Strength for Concrete cubes with Basalt Fibres. The Flexural Strength increased by 54% with Basalt fibres at 4kg/$m^{3,}$ Formation of Cracks was found less in Basalt fibres reinforced concrete, The Ductility characteristics of Basalt fibres showed improvement in comparison to that of brittle failure of plain concrete.

**(3)**Farood Torabian Isfahani et.al [3], (2016) have said that by the incorporation of 1.5% of Nano Silica with w/c ratio 0.55, there was an increase of 6.5% in the Compressive Strength.

**(4)** Hyder Jahim [4], (2010), has said theat Wollastonite powder is effective in modifying the Compressive Strength of Mortor when 5% of it replaces sand as replacement, Wollastonite powder gives good results in Compressive strength of Concrete when mixing 10% of it as sand replacement, Wollastonite powder is a non pozzolonic material, Wollastonite powder can be used as an inert filler in Self Compacting Concrete.

**(5)** Kandula Mohan Krishna Reddy et.al [5],(2016) has told that 23.74% increase was observed in Compressive strength of M35 grade concrete with 10% Wollastonite powder and 10% Silica fume, Flexural strength increased by21.44% with same combination of the additives.

**(6)** Khaleel H Younis et.al[6], (2018), has observed an increase of 22% in the Compressive strength of Concrete with the addition of 1.2% of Nano Silica.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

# Effect of Mass and Stiffness of Vertically Irregular RC Structure

**Rohith R Shenoy[1], Dr. Sridhar R[2], Karthik B.S[3]**

*[1]Student (M.Tech), Department of Civil Engineering, NCET, Bangalore, Karnataka, India*
*[2]Professor, Department of Civil Engineering, SVCE, Bangalore, Karnataka, India*
*[3]Assistant Professor, Department of Civil Engineering, NCET, Bangalore, Karnataka, India*

---

**Abstract -** *Irregular buildings form a large portion of the modern urban infrastructure. In the past, several major earthquakes have exposed the shortcomings in buildings, which had caused them to damage or collapse. This paper is an attempt to evaluate the seismic response of vertically irregular building frames by considering mass and stiffness irregularities of the models with shear wall and compare the results with the bare frame. These irregularities can be avoided by providing shear wall in center of building. In the present paper, response of a G+ 10-storeyed vertically irregular frame to lateral loads is studied by IS-1893-part 1.The soft computing tool and commercial software CSI-ETABS (version 16.20) is used for modeling and analysis. Effects on base shear forces, maximum storey drifts and maximum storey deflection of beams is studied. The buildings has been modelled with a floor area of (25m x 25m) with 5 bays of 5m span along both the directions. Storey height being 3m.*

**Key Words:** Irregular building, Mass and Stiffness Irregularities, Base shear forces, Maximum storey drifts, Maximum storey displacement.

## 1. INTRODUCTION

In the past years, several major earthquakes have exposed the shortcomings in buildings, which had caused them to damage or collapse. It has been found that regular shaped buildings perform better during earthquakes. The structural irregularities cause non-uniform load distribution in various members of a building. There must be a steady path for these inertial forces to be carried from the ground to the building weight locations. A gap in this transmission path results in failure of the structure at that location. The structures having these discontinuities are known as Irregular structures. This may lead to irregular distributions in their mass, stiffness along the height of building. When such buildings are located in a high seismic zone, the structural engineer's role becomes more challenging. Hence, the structural engineer needs to have thorough understanding of the seismic response of irregular structures.

### 1.1 Structural Irregularities

Vertically irregularities are divided into two groups—plan irregularities and vertical irregularities.

Vertically Irregularities are of five types:

1. Stiffness Irregularity –

a) Soft Storey - A soft storey is one in which the lateral stiffness is less than 70% of that in the storey above or less than 80% of the average lateral stiffness of the three storey' s above.

b) Extreme Soft Storey - An extreme soft storey is one in which the lateral stiffness is less than 60% of that in the storey above or less than 70% of the average stiffness of the three storey' s above.

2. Mass Irregularity – Mass irregularity exists when the weight of any storey is more than 200% of that of its adjacent storey.

3. Vertical Geometric Irregularity – When the horizontal dimension of the lateral force resisting system is more than 150% of that in its adjacent storey.

4. In – Plane Discontinuity in Vertical Elements Resisting Lateral Force.

5. Discontinuity in capacity – The storey lateral strength is less than 80% of above storey.

### 1.2 Objectives

To obtain the performances of different stiffness irregularity in multi storey buildings located in severe earthquake zone IV of India, and also identify the most vulnerable building among them.

**1.** To obtain the response of bare frame with no irregularity.

**2.** Seismic response with stiffness irregularity.

a) To obtain the maximum Displacement.
b) To obtain the maximum Drift.
c) To obtain the maximum Storey Shear.
d) Effect of Shear Wall on the structure.

Analysis has been carried out by using CSI-ETABS 2016 (Extended 3D Analysis of Building System) program.

### 1.3 Scope of the Study

1. Only Reinforced Concrete buildings are considered.
2. Only vertical irregularity in Structure was studied.
3. Linear elastic analysis was done on the structures.
4. Column was modeled as fixed to the base.

# BEHAVIOR OF CONCRETE GRADE VARIATION IN TENSION AND COMPRESSION ZONES OF RCC BEAMS

**B S Karthik[1], Dr.H.Eramma[2]& Madhukaran[3]**

*[1]PG Student, M.Tech CADS, [2]Associate Professor, [3]Assistant Professor,*

*Department of Studies in Civil Engineering,*

*University BDT College of Engineering, Davangere, 577004 Karnataka, (India)*

## ABSTRACT

*A beam is a one dimensional (normally horizontal) flexural member which provides support to the slab and vertical walls. In a normal beam (simply supported) two zones generally arise, viz. compression zone at top and tension zone at bottom. As concrete is weak in tension, steel is introduced in the tension zone to take the tension, but as strength of concrete is ignored in tension zone with respect to compression zone. So logically no concrete is required in tension side. But this concrete needs to be provided on tension side to act as strain transferring media to steel and may be called as 'sacrificial concrete'. If this concrete has no tensions more than strain transferring, then why to go for same grade of concrete which is used in upper zone? This is basic question which led to the idea of concrete grade reductioning tension zone for RCC beams to reduce construction cost.*

***Keywords: $M_{20}$, $M_{25}$, Behavior of Partial Beam & Normal Beam, Flexural Member***

## I INTRODUCTION

In the ancient time size of walls are large especially in load bearing structures. With the advances in the science and technology Reinforced Concrete Construction (R.C.C) came in to picture. Initially according to Indian Standard Code of Practice IS456-1978, M15 grade of concrete was also permitted to be use in general construction but according to new revision made in IS 456-2000, lowest grade of concrete which can be used in concreting for construction is M20 for mild environment. With the help of creative sense, imagination, understanding and keen observation of structures in nature, scientific knowledge of various aspects of the structures, many dynamic personalities in civil engineering field are coming with new concepts with the help of which there are lots of finding viz. reduction in the thickness of wall, reduction in the Beam-column sizes etc. But no research or study has been made until now on replacement of sacrificial concrete in case of deep beams. This is also a research area in structural design.

As concrete is weak in tension, to take this tension steel reinforcement is provided at the bottom side of the beam section. As compressive stresses are induced in the zone above the neutral axis, compressive strength of the concrete lying above neutral axis is very important parameter. This induces compressive force in the top zone at a distance of 0.42 $X_U$. ($X_U$ –Neutral axis distance from top of section).



IJATES

# List of Publications

## Journal Publications

1. **Suravi Pal** and Kousik Deb (2021) "Filtration Performance of Geotextile Encasement to Minimize the Clogging of Stone Column during Soil Liquefaction." *Geotextiles and Geomembranes*, Elsevier ( accepted).

2. **Suravi Pal** and Kousik Deb (2020) "Post-Earthquake Reconsolidation Settlement of Stone Column-Treated Liquefiable Sand." *International Journal of Geomechanics*, ASCE, Vol. 20, No. 10, Paper No: 04020183, Page: 1-12.

3. **Suravi Pal** and Kousik Deb (2019) "Effect of Clogging of Stone Column on Drainage Capacity during Soil Liquefaction." *Soils and Foundations*, Journal of the Japanese Geotechnical Society, Elsevier, Vol. 59, No. 1, Page: 196-207.

4. **Suravi Pal** and Kousik Deb (2018) "Effect of Stiffness of Stone Column on Drainage Capacity during Soil Liquefaction." *International Journal of Geomechanics*, ASCE, Vol. 18, No. 3, Paper No: 04018003, Page: 1-11.

## ASCE Geotechnical Special Publication

1. **Suravi Pal** and Kousik Deb (2019) "Effect of Smear, Well Resistance and Stiffness on the Performance of Stone Column during Soil Liquefaction." *Geo-Congress* 2019: *Earthquake Engineering and Soil Dynamics*, ASCE Geotechnical Special Publication (GSP 308), Page: 413-421.

# ANALYSIS OF JUNCTION AND TRAFFIC DATA FOR THE IMPROVEMENT OF THE YELAHANKA POLICE STATION CIRCLE

**MANDEEP B V**

ASSISTANT PROFESSOR, NAGARJUNA COLLEGE OF ENGINEERING AND TECHNOLOGY, BANGALORE

E MAIL: mandeepgowda@gmail.com

**ABSTRACT:** The city growing radially with new towns being constructed has led to high level of traffic which has put the road network under great strain. The government and the concerned agencies such as the Bangalore Development Authority (BDA) have the task of improving the transportation infrastructure to meet the growth of traffic needs. Many schemes of grade separation facilities such as underpass and flyovers at important intersections, traffic signal systems etc. are under implementation.Yelehanka police station junction is one of the major junction. This junction serves as connection for Airport, Hebbal, Doddaballapur and Yelahanka. For Yelahanka and Doddaballapur road users, this is the only major junction which departs towards Airport and Hebbal (other than Judicial layout approach road). Hence, there is a huge flow of traffic inward and outward the junction which needs to be studied and analysed. In this paper the studies are conducted, traffic volume studies Analysis of signals at the junction, Analysis of Traffic volume flow, and spot speed study are conducted at yalahanka police station circle all the data should be entered in different tabular column and graphs should be plotted Considering the route wise traffic volume for the taken 5 days, a flyover can be proposed from NES towards Jakkur and vice-versa as there is no conflict point in this route compared to other routes. A service road should be provided on both sides of the flyover for easy movement of vehicles travelling from NES to Yelahanka Old Town and those travelling from Yelahanka Old Town to NES below the flyover, reducing the congestion rate at the junction.

**Key words:** traffic volume, route wise traffic, signals, dimensions of road.

# LABORATORY STUDIES ON CHEMICAL STABILIZATION OF BLACK COTTON SOIL USING COMMERCIALLY AVAILABLE STABILIZERS

Mandeep B V[1] G Kavitha[2]

[1] **MANDEEP B V**
[1]Assistant Professor, Nagarjuna College of Engineering and Technology, Bangalore
email: mandeepgowda7@gmail.com
[2] Asst Professor, RASTA center for road technology, Bangalore; email: gkavitha@rastaindia.com

**Abstract**

Black cotton soil is often referred as a highly expansive cohesive soil, visibly grey to black in color, found vastly in northern Karnataka region. Due to its high swelling and shrinkage characteristics, it poses huge problem in road construction industry, for use as a construction material or foundation material. Roads constructed over this soil as foundation layer, are prone to excessive cracks, rutting and potholes, because of its unstable nature. Conventional method practiced in site, is to construct subgrade layer by a stronger soil like gravel above the existing weak soil. This practice increases the project cost in terms of material cost, transportation cost, labor cost and machinery cost. If locally available weak material is strengthened using new methods and technologies that are available, total project cost might get reduced. For this to happen, first the engineering properties of stabilized soil have to be checked for its suitability as a subgrade layer. In this work an effort is made to check the engineering properties of stabilized expansive black cotton soil using commercially available chemical stabilizers and to judge its suitability as a construction material based on the results and in accordance with the standards and specifications.

*Keywords: black cotton soil, expansive soil, cohesive soil, swelling, shrinkage, cracks, rutting, potholes, stabilization, chemical stabilizers*

## Introduction

Soil is the most important engineering construction material. It is the foundation material where all the loads from super structure gets transmitted and distributed to a greater depth thus making the super structure to remain intact and safe. In case of pavement structures, design objective is to minimize the stresses on subgrade so that pressure exerted on subgrade is well within its bearing capacity. In case of weak subgrade soil like black cotton soil, pavement crust thickness increases and so does the overall project cost. Even replacing the weaker soil with a stronger material like gravel incurs more cost.

Gravel is the most desirable construction material to be used in subgrade layers because of its high strength, low plasticity, very less shrinkage and swelling characteristics and excellent drainage property. However, not all soils satisfy the requirements for use as a subgrade material. Black cotton(BC) soil is one such material. It is a fine grained soil consisting of more than 50% particles, finer than 75micron sieve and thus having no consistent load bearing skeleton. It is highly compressible which might lead to excessive settlement and the condition is worsened by excessive shrinkage and swelling properties. During monsoons due to increased movement of water, these soils absorb water and its

# Analysis of Junction and Road User Traffic Data, to reduce the Congestion at Tin Factory Junction

**MANDEEP B V**
Assistant professor, Nagarjuna college of Engineering and Technology, Bangalore
E mail: mandeepgowda@gmail.com

***Abstract -- A bus stand along with the steel structure skywalks designed and recommended at Tin factory junction in Bangalore for the reduction of the traffic by 80%. The skywalk is designed keeping all the norms of the traffic engineering and the structural design. After the survey and the personal investigation for 3 months with the people travelling daily, weekly, monthly in different vehicles we found out that everyone had the same problem of the delay at junction. Tin factory is a junction in Bangalore from where everybody travels to the MNC's, as the junction is the through route to K R Puram, Hoskote, Silk board and Bangalore city. Any delay at the junction causes overall wastage and loss to the capital in general and to the country at large. If a bus stop is provided far from the junction point, the buses directly moving to K R Puram will become free and will be able to pass easily. The buses travelling to Hoskote can stop at 1km away from the junction (bus stop shown in the model) so that the passengers getting down and coming in won't disturb the traffic in any ways. According to survey and conclusion it will also decrease the rate of pedestrian accident and reduce their wastage of time of walking and waiting.***

## I. INTRODUCTION

Bangalore city is the capital of the state of Karnataka in southern India and is one of the fastest growing cities of the country and also the world. The city is growing in its stature as a 'cosmopolitan' center and is the leading hub of Information Technology. Owing to factors such as favorable climatic condition, commercial and employment, cultural life, etc., the population of the city has been increasing by alarming proportions. Consequently, apart from increased number of public transport vehicles, there has been a tremendous increase in the number of personalized vehicles such as two-wheelers and motorcars. The city growing radially with new towns being constructed has led to high level of traffic which has put the road network under great strain. The government and the concerned agencies such as the Bangalore Development Authority (BDA) have the task of improving the transportation infrastructure to meet the growth of traffic needs.

 Definition:

"Traffic engineering is the science of measuring traffic and travel, the study of the basic laws relating to traffic flow and generation and application of this knowledge to the professional practice of planning, designing and operating traffic systems to achieve safe and efficient movement of people and goods."

 Scope of Traffic Engineering:

The basic object of traffic engineering is to achieve

- Free and rapid flow of traffic.
- Less number of accidents.
- Less delay at intersections.
- Streamline flow of traffic for less journey time.

The study of traffic engineering may be divided in to 7 sections:

- Traffic characteristics
- Traffic studies and analysis
- Traffic operations-control and regulation
- Planning and analysis
- Geometric design
- Administration and management

 Passenger Car Units (PCUs):

Different classes of vehicles such as cars, vans, buses, trucks, auto rickshaw, motor cycles, pedal cycles, etc., are found to use the common roadway facilities without segregation on most of the roads in developing countries like India. The flow of the traffic with unrestricted mixing of different classes on the roadways forms the heterogeneous traffic flow or the mixed traffic flow.It is common practice to consider the passenger car as the standard vehicle unit to convert the other vehicles classes and the unit

# Effect of Shear Modulus Correlation on Site Response Study

**Anbazhagan P.[1, 2]*, Manohar D.R.[1], Sayed S.R. Moustafa[2, 3] and Nassir S. Al-Arifi[2]**
1. Department of Civil Engineering, Indian Institute of Science, Bangalore, INDIA
2. King Saud University, Riyadh, SAUDI ARABIA
3. National Research Institute of Astronomy and Geophysics (NRIAG), Cairo 11421, EGYPT
*anbazhagan@civil.iisc.ernet.in

***Abstract***

*Site response analysis requires dynamic/shear moduli of subsurface layers. A low strain shear modulus plays a fundamental role in the geotechnical earthquake engineering to estimate the hazard parameters for site response studies and seismic microzonation. Shear modulus is usually obtained from measured shear wave velocity and density or from standard penetration test (SPT) N values using correlation between SPT N and shear modulus. Many shear modulus correlations between N and shear modulus ($G_{max}$) are available in the literature but selected few correlations are repeatedly used to obtain site response parameters. Anbazhagan et al[2,3] presented a detailed review of the available fifteen $G_{max}$ correlations with SPT N and a proposal of new correlation applicable to any region. The objective of this study is to identify the suitable $G_{max}$ correlation for different soil types such as sand, clay and gravel or the mixture of all (sand, clay, gravel, sandy soil) considering recorded ground motion data with soil profile.*

*In this study, sites with earthquake data recorded at the surface, drilled soil profiles along with SPT N values and shear wave velocity are selected from K-NET (Japanese website) data base. Shear wave velocity is used to classify the sites. As bedrock recorded ground motion data is not available for the most of site with SPT N values, ground motion recorded in site class A and B is used as input to understand the response of site class C, D and E. Collected earthquake data consists of moment magnitude (MW) of 5.0 to 9.0 which are recorded at different epicentral distances. Surface ground motion and response spectrum are obtained by considering dynamic properties from 16 $G_{max}$ correlations. The estimated values are compared with surface recorded data of the same event. The study shows that peak ground acceleration (PGA), amplification factor (AF) and average horizontal spectral amplification (AHSA) are obtained from very few $G_{max}$ correlations comparable with recorded values. $G_{max}$ relation giving values close to record data is considered as a suitable correlation for specific soil type.*

**Keywords:** Amplification factor, Shear modulus, SPT N vs $G_{max}$, Peak ground acceleration, Response Spectra, Site response.

## Introduction

Different sites located at a same epicentral distance may have different soil response during earthquake. Site amplification of seismic energy due to soil conditions and damage to built environment was demonstrated by many earthquakes during the last century to the greater extent. The destruction caused by the Guerrero earthquake (1985), Spitak earthquake (1988), Loma Prieta earthquake (1989), Kobe earthquake (1995), Kocaeli earthquake (1999) are important examples of site specific amplification of ground motion. Even at locations far away (100-300 km) from the epicentre this amplification can be significant[5]. The 2001 Gujarat-Bhuj earthquake in India is another example with notable damage at a distance of 250 km from the epicenter.[12,31] These failures resulted from the effect of soil condition on the ground motion that translates to higher amplitude; it also modifies the spectral content and duration of ground motion.

The nature and distribution of earthquake damage are strongly influenced by the response of soils to cyclic loading. Parameters that characterize the response studies are earthquake source, source nature and distance from the source, wave path, geological context, upper soil properties, topography and primary site effects.[1,10] These effects can be quantified by the site response analysis which involves the propagation of earthquake motions from the base rock to ground surface through overlying soil layers. This response is controlled in large part by the mechanical properties of the soil. Soil properties that influence wave propagation and other low-strain phenomena include stiffness, damping, Poisson's ratio and density. Stiffness of soil deposits, represented by shear modulus, is an important property for evaluating the dynamic responses of soil structures at different sites.

Shear modulus is one of the important site parameters which affect site response studies along with the depth of the bedrock and the type of sand or clay[14]. Shear modulus is usually obtained from measured shear wave velocity and density or from standard penetration test (SPT) N values using correlation between SPT N and shear modulus (G). Soil stiffness in the form of SPT N value is a useful parameter and is widely used to estimate amplification of seismic waves. Many regression equations between SPT N and shear modulus were developed considering different

# Small- to Large-Strain Shear Modulus and Damping Ratio of Sand-Tyre Crumb Mixtures

P. Anbazhagan, M.ASCE[1]; and D. R. Manohar, S.M.ASCE[2]

[1]Assistant Professor, Dept. of Civil Engineering, Indian Institute of Science, Bangalore 560012, India. E-mail: anbazhagan@civil.iisc.ernet.in
[2]Research Scholar, Dept. of Civil Engineering, Indian Institute of Science, Bangalore 560012, India. E-mail: manohardr@civil.iisc.ernet.in

**Abstract**: Utilizing rubber tyres in vibration mitigation can be a viable approach of resolving the chronic problems associated with disposal of waste tyres. However, the dynamic properties of sand-tyre crumb mixtures (STCM) are essential for the design of a vibration isolation system. In this study, the dynamic properties of STCM in terms of shear modulus and damping ratio are presented against the shear strain. The modulus and damping ratio of STCM for small to large shear strain were measured using Torsional resonant column tests and cyclic triaxial tests, for two composition of tyre crumbs (50% and 75%) and three different confining pressure (50, 100, and 200 kPa). The results showed that, shear modulus and the damping ratio of the mixtures are strongly influenced by the percentage of rubber inclusion. Shear modulus decreased with an increase in tyre crumb inclusion for all the confining pressure, whereas the damping ratio increases with the increase in rubber content in STCM. For any percentage of tyre crumbs inclusion, the shear modulus increases and damping ratio decrease with increasing confining pressure. These results are useful to understand the dynamic response of STCM and further used in model studies to design a low cost isolation system.

## INTRODUCTION

Dynamic soil properties are important parameters for the analysis and design of structures required to resist dynamic loads such as earthquake shaking, machinery vibrations, blast forces, traffic loading, etc. Each one of the above events subjects the soil-structure system to very different amplitudes and frequencies and requires the soil dynamic properties for a wide range of load amplitudes and frequencies. The mechanical behaviour of soils is determined by effective stresses, void ratio, water content, and several other parameters such as strain level and stress or strain path. All these factors are equally important under either static or dynamic loading conditions. Then the features that distinguish the dynamic from the static problems are the speed of loading and load repetitions. In the analysis of most soil dynamic problems, determination of shear modulus and damping ratio as a function of shear strain

© ASCE

# Energy Absorption Capacity and Shear Strength Characteristics of Waste Tire Crumbs and Sand Mixtures

*P. Anbazhagan, Indian Institute of Science, Bangalore, India*

*D.R. Manohar, Indian Institute of Science, Bangalore, India*

## ABSTRACT

*The primary objective of the study is to estimate the energy absorption (EA) capacity, brittleness index (ductility) and stiffness characteristics of Sand-Tire Crumb Mixtures (STCM) using direct shear test and Unconsolidated Undrained (UU) triaxial test for the effective reuse of waste tire crumbs as isolation materials. The properties considered include, strength and deformation characteristics of a STCM. A relatively uniform sand and readily available tire crumb grouped into four size has been selected to generate STCM. Experimental studies have been carried out on STCM with constant density of 1.54 g/cc. Stress-strain curve obtained from UU test has been used to estimate EA. The experimental results show that peak strength, EA and stiffness increases with increasing percentage of tire crumbs up to 25% and starts decreasing thereafter. Among the tested tire crumb sizes, crumb size IV provide the maximum EA without compromising on strength compared to other tire crumb sizes.*

*Keywords:* *Brittleness Index, Energy Absorption, Sand-Tire Crumb Mixtures, Shear Strength*

## INTRODUCTION

Urban agglomeration and population growth results in increasing automobile industries and in turn increase the disposal of waste products from these industries, including scrap tires (WRAP, 2007; RMA, 2009; RRI, 2009). Most of the wastes generated from automobile industries are reusable without affecting surrounding environment except vehicle tires. On an average, scrap tires are generated one per capita annually in many of the countries (Edil & Bosscher, 1994), particularly in developing countries facing significant disposal problem. It is estimated that, 13.5 million tons of tires (United States 4.4 million tons) are scrapped each year (Genan, 2012). In

DOI: 10.4018/IJGEE.2015010103

Copyright © 2015, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

Taylor & Francis
Taylor & Francis Group

Geomechanics and Geoengineering
An International Journal

ISSN: 1748-6025 (Print) 1748-6033 (Online) Journal homepage: http://www.tandfonline.com/loi/tgeo20

# Influence of size of granulated rubber and tyre chips on the shear strength characteristics of sand–rubber mix

P. Anbazhagan, D. R. Manohar & Divyesh Rohit

**To cite this article:** P. Anbazhagan, D. R. Manohar & Divyesh Rohit (2017) Influence of size of granulated rubber and tyre chips on the shear strength characteristics of sand–rubber mix, Geomechanics and Geoengineering, 12:4, 266-278, DOI: 10.1080/17486025.2016.1222454

**To link to this article:** http://dx.doi.org/10.1080/17486025.2016.1222454

Published online: 26 Aug 2016.

Submit your article to this journal

Article views: 145

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
http://www.tandfonline.com/action/journalInformation?journalCode=tgeo20

**Download by:** [157.49.2.173] **Date:** 15 September 2017, At: 06:02

*Journal of Engg. Research* **Vol. 4 No. (3) September 2016** pp. 18-42

# اختيار ارتباط معامل القص لقيم اختبار الاختراق القياسي بناء على دراسات استجابة الموقع

*****أنبزاجان ب.، *مانوهار د. ر.، *****سيد ش. ر. مصطفي**
**و**ناصر س. ن. العريفي**
*قسم الهندسة المدنية، المعهد الهندي للعلوم، بنغالور، الهند
**قسم الجيولوجيا والجيوفيزياء، كلية العلوم، جامعة الملك سعود، الرياض، المملكة العربية السعودية
***قسم الزلازل، المعهد القومي للبحوث الفلكية والجيوفيزيقية، القاهرة، مصر

## الخلاصة

يلعب معامل القص دورا أساسيا لتقدير معاملات استجابة الأرض في دراسات المنطقة الزلزالي. لا يزال الكثير من دراسات استجابة الموقع تتم باستخدام بيانات اختبار الاختراق القياسي معتبرا الارتباطات القائمة بين قيم اختبار الاختراق القياسي ومعامل القص دون معرفة فعالية ارتباط معامل القص لنوع عمود التربة. إلى حد علمنا، ليس هناك توجيه واضح المعالم بشأن استخدام ارتباط معامل قص مناسب لتقدير تمثيلية صلابة القص لعمود تربة معين في دراسات الاستجابة الأرضية المختلفة. لذلك، في هذه الدراسة قد بذلت محاولة لتحديد علاقة مناسبة لتقدير معامل القص ($G_{max}$) لأنواع مختلفة من التربة، مثل الرمل والطين والحصى أو خليط من كل الثلاثة. لقد تم تجميع واختيار مجموعة من البيانات الزلزالية المسجلة على سطح الارض (تتضمن عمود التربة جنبا إلى جنب مع بيانات اختبار الاختراق القياسي وقيم سرعة موجة القص) من شبكة K-NET اليابانية. لقد تألفت مجموعة البيانات التي تم جمعها من عدد من الزلازل التي سجلت على مسافات مختلفة وذات مقادير لحظية($M_W$) تتراوح قيمها بين 5.0 و 9.0. وقد أجريت دراسات استجابة الموقع غير الخطية من خلال استخدام بيانات الزلازل المسجلة في موقع ذو طبيعة صخرية باعتبارها الحركة الأرضية المدخلة والمساهمة في خصائص التربة كما تم نشرها في موقع بيانات K-NET . وبناء علي ذلك، تم الحصول على الحركة الأرضية السطحية والاستجابة الطيفية وذلك باستخدام قيم ارتباط ($G_{max}$) المختلفة. ولقد تمت مقارنة النتائج المختلفة مع التسجيلات الزمنية السطحية التي سجلت لنفس الزلزال المدخل. وتبين هذه الدراسة أن ذروة التسارع الأرضي (PGA)، أطياف الاستجابة (RS) وعوامل التضخيم الموجية (AF) التي تم الحصول عليها من عدد قليل جدا من ارتباطات ($G_{max}$) قابلة للمقارنة مع قيم (PGA) المسجلة وطيف الاستجابة وعامل التضخيم.

# Selection of shear modulus correlation for SPT N-values based on site response studies

Anbazhagan P.*,**, Manohar D. R.*, Sayed S. R. Moustafa**,*** and Nassir S. N. Al-Arifi**

**Department of Civil Engineering, Indian Institute of Science, Bangalore, India*

***Department of Geology and Geophysics, Faculty of Science, King Saud University, Riyadh, Saudi Arabia*

****Department of Seismology, National Research Institute of Astronomy and Geophysics (NRIAG), Cairo 11421, Egypt*

*Corresponding author: anbazhagan@civil.iisc.ernet.in*

## ABSTRACT

Shear modulus plays a fundamental role in the estimation of the ground response parameters in seismic microzonation studies. A large number of site response studies are still being carried out using SPT data, considering existing correlations between SPT N-values and shear modulus without knowing the effectiveness of the shear modulus correlation for the type of soil column. To the best of our knowledge, there is no clear-cut guideline regarding the use of a suitable shear modulus correlation to estimate representative shear stiffness for a specific soil column in response studies. In this study, therefore, an attempt has been made to identify a suitable correlation for estimating shear modulus ($G_{max}$) for different types of soils, such as sand, clay and gravel or a mixture of all three. Sites with earthquake data recorded at the surface (soil profiles along with SPT N-values and shear wave velocity), are selected from the K-NET (Japanese website) data set. The collected earthquake data consists of moment magnitudes (Mw) ranging from 5.0 to 9.0, which were recorded at different epicentral distances. Nonlinear site response studies have been carried out by considering earthquake data recorded at a rock site as an input ground motion to the soil profiles, as published in the K-NET data site. Surface ground motion and response spectrums were further obtained from different $G_{max}$ correlations and were compared with surface recorded time histories for the same event. This study shows that peak ground acceleration (PGA), response spectrums (RS) and amplification factors (AF) obtained from a very few $G_{max}$ correlations are comparable with the recorded PGA, response spectrum and amplification factor.

**Keywords:** Amplification; correlation; shear modulus; site response; SPT-N-values.

# Low cost damping scheme for low to medium rise buildings using rubber soil mixtures

Anbazhagan Panjamani [i], Manohar Devarahalli Ramegowda [ii] and Divyesh Rohit[iii]

i) Assistant Professor, Department of Civil Engineering, Indian Institute of Science, Bangalore 560012, India.
ii) Ph.D Student, Department of Civil Engineering, Indian Institute of Science, Bangalore 560012, India.
ii) Project Associate, Department of Civil Engineering, Indian Institute of Science, Bangalore 560012, India.

## ABSTRACT

This study proposes to develop a low cost damping scheme using soil and waste tyre crumb mixture for low to moderate rise buildings. The proposed study consists of two parts, first characterizing soil and waste tyre mixtures and finding out the optimal size of tyre crumbs. The second part is to design the isolation system for low to moderate rise buildings and determine optimum dimension of the system. In the first part, a series of Unconsolidated Undrained triaxial test and large scale direct shear test have been carried out to select the optimum size of tyre crumbs from seven different crumb sizes. The Rubber Soil Mixtures (RSM) sample that provides higher shear strength, energy absorption capacity and stiffness is considered as the optimal size and further used in numerical simulations. In the second part, to analyze the damping effect of RSM, extensive numerical simulations have been carried out on the soil-foundation-structure system with varying thickness of RSM around isolated footing, varying percentage of rubber in RSM and input time history. The reduction in shaking level in terms of acceleration and inter storey drift, at different floor level with the use of RSM can be reduced by 40 to 50%.

**Keywords:** Rubber soil mixtures, numerical simulation, shear strength, seismic isolation

## 1 INTRODUCTION

A conventional earthquake resistance technology involves advancing the lateral strength, stiffness and inelastic deformation potential. Since the past century advanced earthquake resistance techniques are being developed not only to strengthen the structure, but also to reduce vibrations caused by earthquake generated forces to structures. Vibration reducing techniques involve the application of external devices among which base isolation systems in which rubber is substantially used as an essential element that has been principally suitable for earthquake resistance of low-to-medium-rise buildings (Ganeriwala, 1995). Hence, base isolation is considered the most effective tool for seismic isolation, considering passive devices for earthquake damping. Nevertheless, due to expensive implementation, these seismic isolation techniques are limited to only important structures. Considering its cost of implementation, particularly in developing countries, an effective seismic isolation technique cannot be afforded by a common man. Therefore, in this study a favorable and low cost seismic damping system has been suggested by providing a rubber-soil mixture (RSM) around the foundation of the structures to damp the vibrations due to seismic excitation. Any innovative system can be widely adopted in developing countries, if it is a cost effective technology (Tsang, 2008; Tsang et al., 2012). The main purpose of this study is to examine the vibration reduction due to new damping system. This study focused on understanding the damping reduction for a typical three storey building with isolated footings as these types of foundation are the most widely used in India.

The volume of scrap (waste) tyres, an undesired urban waste, is increasing every year. On an average, scrap tyres are generated one per capita annually in many of the countries (Edil & Bosscher, 1994), in particular developed countries, resulting in significant disposal problems. Utilization of rubber from scrap tyres has become one of the potential areas of research worldwide due to the unacceptable current disposal and stocking method of waste tyres. Many geotechnical applications were proposed for beneficial ways of recycling scrap tyres, of these major applications are its usage as a fill material in highway construction. Several studies are also available on the use of rubber/rubber sand mixtures as a novel application for seismic disaster mitigation for retaining wall and waterfront structures (Hazarika et al., 2008; Hazarika 2008). Reuse of scrap tyres would not only provide a way of disposing them, but also helps to solve some economic and technical problems for the sustainable environment. The use of waste tyres in geotechnical application may be feasible with a better understanding of the behavior of RSM. However the limited study was carried out to estimate

Geotextiles and Geomembranes 49 (2021) 910–920

Contents lists available at ScienceDirect

Geotextiles and Geomembranes

journal homepage: www.elsevier.com/locate/geotexmem

# Shear strength characteristics of geosynthetic reinforced rubber-sand mixtures

D.R. Manohar, P. Anbazhagan [1,*]

*Department of Civil Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India*

ARTICLE INFO

*Keywords:*
Geosynthetics
Brittleness index
Energy absorption
Triaxial test
Shear strength

ABSTRACT

Shear strength characteristics of the geosynthetic-reinforced rubber-sand mixture (RSM) has been investigated by conducting Unconsolidated Undrained (UU) triaxial test. In the first part, a series of UU triaxial tests have been carried out to know the size effect of granulated rubber/tyre chips from seven different rubber sizes. RSM sample that provides higher strength, energy absorption capacity and stiffness is considered as the optimal size and has been used in the investigation on geosynthetic-reinforced RSM. In the second part, shear strength characteristics of geosynthetic-reinforced RSM has been investigated by varying proportions of rubber content (50% and 75% rubber by volume), type of geosynthetic (geotextile, geogrid and geonets), number of geosynthetics (1–4) layers, geosynthetic arrangement and confining pressure. The results demonstrate that RSM reinforced with geosynthetic has enhanced peak strength, failure strength and corresponding axial strain at failure. Fifty percent RSM reinforced by geotextile and 75% RSM reinforced by geonets with 4 layers of reinforcement, led to a maximum increase in shear strength. The strength and energy absorption capacity are doubled for the reinforced RSM's, and reduced the brittleness index values as close to zero, which depends on the type, number of layers and arrangement of geosynthetic.

## 1. Introduction

Natural and man-made vibrations are undesirable for structures, as structural stability, durability, and performance are affected considerably. Vibrations which are transmitted through the ground can cause excessive stresses in the structures, resulting in a collapse of structures accompanied by disastrous physical and economic consequences (Hazarika et al., 2008; Kirzhner et al., 2006). Backmann and Ammann (1987) have proposed the limits on allowed levels of vibrations tolerated by structures and machines from different regulations. Vibration reduction can be attained either by increasing the damping capacity or by increasing stiffness of the structure and the construction materials. Rubber is commonly used as a vibration-damping material due to its viscoelasticity (Ganeriwala, 1995; Tsang, 2008; Tsang et al., 2012). The damping properties of the granulated rubber/tyre chips derived from the waste tyres are yet to be exploited to use them effectively in common civil engineering applications. Scrap tyre derived recycled products (such as granulated rubber, tyre chips and tyre shreds) has been called "smart-geomaterial," due to their good permeability, high strength, compressibility, and the absence of strain localization (Hazarika et al., 2008a; Sheikh et al., 2013).

One promising approach in waste tyre utilization is vibration reduction and seismic isolation of building taking into account the high damping behaviour in rubber (Hazarika, 2008; Hazarika et al., 2008b; Senetakis et al., 2012; Tsang, 2008; Tsang et al., 2012). However, systematic studies of using RSM as vibration isolation materials are limited. Anbazhagan et al. (2017) concluded that parameters influencing shear strength and compressibility characteristics of RSM were rubber size, unit weight of RSM, rubber content, aspect ratio and confining pressure. Waste tyres are mixed with sand and used in geotechnical applications in order to overcome the potential problem such as spontaneous combustion and compressibility (Bosscher et al., 1997). Bosscher et al. (1997) reported that the compressibility of tyre chips could be reduced significantly by adding 30–40% sand by volume. For higher rubber content in RSM, shear strength of RSM reduces when compared to soil. In order to overcome this, geosynthetic is placed within RSM to increase vertical confinement of the system. The main role of reinforcement is to improve the engineering properties of soil. Geogrid and geotextile have been

* Corresponding author. Department of Civil Engineering, Indian Institute of Science, Bangalore, 560 012, India.
*E-mail addresses:* anbazhagan@iisc.ac.in, anbazhagan2005@gmail.com (P. Anbazhagan).
[1] http://civil.iisc.ernet.in/~anbazhagan/.

https://doi.org/10.1016/j.geotexmem.2020.12.015
Received 4 March 2020; Received in revised form 31 December 2020; Accepted 31 December 2020
Available online 21 January 2021
0266-1144/© 2021 Elsevier Ltd. All rights reserved.

Author's Accepted Manuscript

# Assessing the performance of molarity and alkaline activator ratio on engineering properties of self-compacting alkaline activated concrete at ambient temperature

Nagaraj. V. K, D.L. Venkatesh Babu


www.elsevier.com/locate/jobe

PII: S2352-7102(17)30843-4
DOI: https://doi.org/10.1016/j.jobe.2018.07.005
Reference: JOBE529

To appear in: *Journal of Building Engineering*

Received date: 31 December 2017
Revised date: 25 June 2018
Accepted date: 5 July 2018

Cite this article as: Nagaraj. V. K and D.L. Venkatesh Babu, Assessing the performance of molarity and alkaline activator ratio on engineering properties of self-compacting alkaline activated concrete at ambient temperature, *Journal of Building Engineering,* https://doi.org/10.1016/j.jobe.2018.07.005

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Asian Journal of Civil Engineering
https://doi.org/10.1007/s42107-018-0081-9

ORIGINAL PAPER

# Formulation and performance evaluation of alkali-activated self-compacting concrete

**V. K. Nagaraj**[1] · **D. L. Venkatesh Babu**[1]

Received: 7 May 2018 / Accepted: 6 September 2018
© Springer Nature Switzerland AG 2018

**Abstract**
Extensive quantities of fly ash and ground granulated blast furnace slag are produced by power-generation plants and steel manufacturing industries. These superfluous by-products, instead of being left as waste, are used for producing alkali-activated self-compacting concrete, generally known as self-compacting geopolymer concrete. Geopolymer technology has shown its potential in completely eradicating Portland cement for producing concrete. The current study present the executability of developing free flow geopolymer concrete with diverse consequences of substitution of fly ash by ground granulated blast furnace slag (0%, 50% and 100%) and alkaline activator to cementitious binder ratio (0.1, 0.3, and 0.5) on fresh properties, strength development and durability properties. Various tests such as volume stability, sorptivity, water permeability, rapid chloride penetration, sulphate attack and acid attack were evaluated. The results concluded that partial to complete replacement of fly ash by ground granulated blast furnace slag not only eliminated the requirement for elevated curing treatment, but also improved the compressive strength and volume stability, whereas the alkaline activator to cementitious binder ratio effectively influenced the durability and strength development of self-compacting geopolymer concrete to a greater degree. Also, there was no remarkable enhancement in various properties with the use of high-range water-reducing chemical admixtures on the mix. A dominant parameter in deciding the potential adaptation of self-compacting geopolymer concrete in the construction sector is its durability parameters. The durability characteristics were evaluated in detail by activating the source products with a combined mixture of 10 M sodium hydroxide solution and sodium silicate with an alkaline activator ratio of 4.

**Keywords** Low calcium fly ash · Ground granulated blast furnace slag · Fresh properties · Strength development · Volume stability and durability properties

## Introduction

Clinker production involves intensively high energy and also emission of anthropogenic carbon dioxide ($CO_2$). The production of ordinary Portland cement (OPC) consumes 4–8 MJ of fossil fuel energy per kilogram (Swamy, 1998), and calcification of calcium carbonate ($CaCO_3$) to produce 1 T of OPC releases approximately 1 T of $CO_2$ (Law, et al., 2015). The cement industries produce about 5–8% of greenhouse gas ($CO_2$) by consuming 5% of the available natural resources (Turner and Collins, 2013). Due to high consumption of limestone-based raw materials, the cement and concrete industries may suffer from future shortage: more than 3 billion tons of limestone is required per year for clinker production (Schneider, et al., 2011). From the past three decades to the present day, voluminous research in concrete technology has been carried out to reduce global warming caused by emission of greenhouse gas by cement manufacturing industries. In this respect, the geopolymer technology, a zero cement binder, was one of the noteworthy breakthroughs (Davidovits, 1991) and considered the most promising technique. This technology, considered as promising, was introduced by J. Davidovits. It uses relatively new class of amorphous inorganic materials derived by activating waste aluminosilicate source materials by high alkaline solution such as sodium hydroxide (NaOH) or potassium hydroxide (KOH) and potassium silicate ($K_2SiO_3$) or sodium

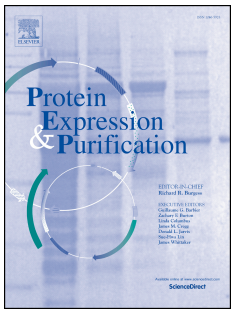
✉ V. K. Nagaraj
theconcretepeddler@gmail.com

✉ D. L. Venkatesh Babu
drdlvbabu@gmail.com

[1] Civil Engineering Department, ACS College Of Engineering, Bengaluru, Karnataka, India

Published online: 21 September 2018

# Accepted Manuscript




An efficient production of hybrid recombinant protein comprising non-structural proteins (NS 1 & NS 3) of bluetongue virus in prokaryotic expression system

Nihar Nalini Mohanty, Sathish Bhadravathi Shivachandra, Sanchay Kumar Biswas, Vijay Nagaraj, J.B. Thaslim, D. Narendra Babu, R. Yogisharadhya, Divakar Hemadri

PII: S1046-5928(18)30398-X

DOI: 10.1016/j.pep.2018.09.005

Reference: YPREP 5326

To appear in: *Protein Expression and Purification*

Received Date: 20 July 2018

Revised Date: 31 August 2018

Accepted Date: 10 September 2018

Please cite this article as: N.N. Mohanty, S.B. Shivachandra, S.K. Biswas, V. Nagaraj, J.B. Thaslim, D. Narendra Babu, R. Yogisharadhya, D. Hemadri, An efficient production of hybrid recombinant protein comprising non-structural proteins (NS 1 & NS 3) of bluetongue virus in prokaryotic expression system, *Protein Expression and Purification* (2018), doi: 10.1016/j.pep.2018.09.005.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

# An efficient production of hybrid recombinant protein comprising non-structural proteins (NS 1 & NS 3) of bluetongue virus in prokaryotic expression system.

**Nihar Nalini Mohanty, Sathish Bhadravathi Shivachandra, Sanchay Kumar Biswas[§], Vijay Nagaraj, Thaslim J B, Narendra Babu D, Yogisharadhya R, Divakar Hemadri***

*ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), Yelahanka, Bengaluru-560064, Karnataka, India.*

[§]*Division of Virology, ICAR-IVRI, Mukteswar-Kumaon, Nainital-263138, Uttarakhand, India*

[*]Corresponding author:

Phone: +91-080-23093100/133 (Office);

Fax: +91-080-23093222; E-mail addresses:divakar.hemadri@gmail.com (D. Hemadri)

ACCEPTED MANUSCRIPT

Energy and Buildings 80 (2014) 247–259

Contents lists available at ScienceDirect

Energy and Buildings

journal homepage: www.elsevier.com/locate/enbuild

# A case study on life cycle energy use of residential building in Southern India

Pinky Devi L., Sivakumar Palaniappan*

*Building Technology and Construction Management Division, Department of Civil Engineering, Indian Institute of Technology Madras, Chennai 600036, India*

ARTICLE INFO

*Article history:*
Received 4 February 2014
Received in revised form 17 May 2014
Accepted 24 May 2014
Available online 2 June 2014

*Keywords:*
Life cycle energy
Embodied energy
Residential homes
Residential apartments
On-site construction processes

ABSTRACT

The life cycle energy of a building consists of construction energy, operational energy and demolition energy. Construction refers to initial construction as well as recurring maintenance and repair work. Initial construction represents manufacturing of construction materials, transportation and site related on-site construction processes. Only a few studies focused on life cycle energy use of Indian residential buildings. However, the energy use due to on-site construction processes is either ignored or not modelled with adequate level of detail at present. This paper presents a case study on life cycle energy analysis of a residential development consisting of 96 identical apartment-type homes located in Southern India. Energy use due to transportation of materials and construction equipment use at site are quantified. Sensitivity analysis is carried out to study the influence of building service life and monthly electricity use per home on the relative significance of construction energy and operational energy. The construction energy is found to be a significant component of life cycle energy of residential buildings with partial or no air-conditioning. Further, reduced building service life period and increased energy efficiency achieved in the operational phase makes the construction energy as important as the operational energy with respect to life cycle.

© 2014 Elsevier B.V. All rights reserved.

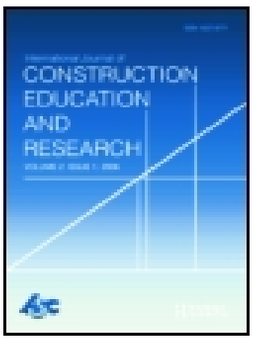
## 1. Introduction

The construction industry is a major consumer of natural resources such as materials, energy, land and water. Buildings use 40% of energy and generate 33% of green house gas emissions globally considering both developed and developing countries [1]. In India, the construction industry solely contributes to about 24% of $CO_2$ emissions of all the sectors [2]. There is a dire need to modify the construction industry practices so that the resulting environmental impacts could be reduced [3]. True progress towards sustainable built environment requires a life cycle thinking approach i.e. a holistic evaluation of all phases of a building life cycle [4,5]. The building life cycle consists of four major phases namely production, on-site construction, use or operation and end-of-life. The life cycle energy of a building is the aggregate of (i) initial embodied energy, (ii) recurring embodied energy, (iii) operating energy and (iv) demolition energy. Initial embodied energy is the energy used during the production phase (indirect energy) and the on-site construction phase (direct energy). Energy used during the production phase is based upon mining of raw materials, transportation, processing and manufacturing of construction materials. On-site construction refers to the final installation/erection of the building at the construction site. Energy used for on-site construction processes is based upon the transportation of human, material and equipment resources to site, use of construction equipment at site and energy used for operating temporary site facilities. Operational energy is the energy required for building operation during its service life. It refers to lighting, heating, cooling, and ventilation. Recurring embodied energy is the energy required for maintenance, repair, replacement and refurbishment during the entire building service life. Demolition energy refers to demolition/deconstruction, transportation of waste and land filling.

Initiatives towards sustainable built environment have mainly focused upon reducing the operational energy use through advanced building envelope materials and high performing equipment thereby increasing the significance of embodied energy [6–8]. The significance of construction energy (i.e. materials and on-site construction) increases as the energy efficiency of the operational phase reaches a threshold. The construction energy is expected to be a significant component of life cycle energy for naturally ventilated or partially air-conditioned residential buildings.

* Corresponding author. Tel.: +91 44 22574258; fax: +91 44 22574252.
*E-mail addresses:* sp@iitm.ac.in, sivakumar.palaniappan@gmail.com (S. Palaniappan).

http://dx.doi.org/10.1016/j.enbuild.2014.05.034
0378-7788/© 2014 Elsevier B.V. All rights reserved.



International Journal of Construction Education and Research

ISSN: 1557-8771 (Print) 1550-3984 (Online) Journal homepage: http://www.tandfonline.com/loi/uice20

# Life cycle energy analysis of a low-cost house in India

L. Pinky Devi & Sivakumar Palaniappan

**To cite this article:** L. Pinky Devi & Sivakumar Palaniappan (2018): Life cycle energy analysis of a low-cost house in India, International Journal of Construction Education and Research, DOI: 10.1080/15578771.2018.1476935

**To link to this article:** https://doi.org/10.1080/15578771.2018.1476935

Published online: 30 May 2018.

Submit your article to this journal

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
http://www.tandfonline.com/action/journalInformation?journalCode=uice20

INTERNATIONAL JOURNAL OF CONSTRUCTION EDUCATION AND RESEARCH
https://doi.org/10.1080/15578771.2018.1476935

Routledge
Taylor & Francis Group

Check for updates

# Life cycle energy analysis of a low-cost house in India

L. Pinky Devi[a] and Sivakumar Palaniappan[b]

[a]Department of Civil Engineering, Nagarjuna College of Engineering and Technology, Bengaluru, India; [b]Department of Civil Engineering, Indian Institute of Technology Madras, Chennai, India

**ABSTRACT**

There is tremendous focus in the construction industry to quantify and minimize energy footprint, carbon footprint, material footprint and water footprint and undertake initiatives toward a sustainable built environment. The Economically Weaker Section (EWS)-type residential buildings represent 82% of India's total housing shortage. It is aimed to meet this housing need by 2022 through the scheme 'Housing for All'. There is huge demand for materials and energy at the aggregate level and the need for conserving them during the planning, design, construction and operation of residential buildings. This article presents a case study on life cycle energy analysis of a residential building constructed for EWS community in Southern India. Cement, brick and rebar represent more than 3/4th of the total embodied energy of building materials. The structural frame and the building envelope are identified as major hotspots of the total initial embodied energy. The life cycle energy is found to be 0.46 GJ/m$^2$/year for 50 years' service life. The influence of operation energy and the building service life on the relative significance of construction energy is evaluated. The construction energy represents 29–62% of the life cycle energy for 50 years' service life.

**KEYWORDS**

Embodied energy; life cycle energy analysis; low-cost house; operation energy; residential building

## Introduction

The built environment uses approximately 40% of the total energy produced in the world and is responsible for ⅓rd of all carbon dioxide emissions (United Nations, 2010). The building life cycle consists of a number of phases such as the manufacturing of building materials, on-site construction, building operation, maintenance and demolition. Among these phases, the building operation uses about 90% of the total life cycle energy. However, some studies find that the construction energy used for materials and on-site construction is as high as 40% for buildings that are naturally ventilated or partially air-conditioned (Devi & Palaniappan, 2014; Varun, Aashish, Shree, & Nautiyal, 2012). This highlights the significance of construction energy with respect to the building life cycle. After achieving the energy efficiency in building operation, the next focus of improvement would be the construction phase (Cole, 1999; Cole & Kernan, 1996). The construction phase consists of manufacturing of materials and on-site construction processes. Although the on-site construction-related impacts are assumed to be negligible or approximated in several studies, they are expected to be significant at the aggregate level (Bilec, Ries, Matthews,

**CONTACT** Sivakumar Palaniappan sp@iitm.ac.in

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/uice.

© 2018 Associated Schools of Construction

# A Framework for the Assessment of Energy Use of High-Rise Building Construction Processes

L. Pinky Devi and Sivakumar Palaniappan
Building Technology and Construction Management, Dept. of Civil Engineering, Indian Institute of Technology Madras, Chennai 600 036, India.
E-mail: sp@iitm.ac.in

Downloaded from ascelibrary.org by University of Technology, Sydney on 07/26/16. Copyright ASCE. For personal use only; all rights reserved.

## Abstract

The energy use for materials and on-site construction assumes significance after we reach a threshold regarding building operational energy efficiency. Integration of energy use and emissions into construction planning and monitoring tools will enable planners to evaluate alternate construction schedules based on time, cost, productivity, and environment. Such integration requires a systematic understanding of technological and operational parameters that influence the construction processes. This study presents a conceptual framework to assess the energy use and emissions of on-site construction processes of high-rise buildings. Five major work items namely earthmoving, concreting, formwork, rebar bending and cutting, and masonry work are considered. Based on this, a generic framework is presented for integrating sustainability metrics into construction project planning.

## INTRODUCTION

The four major phases of a building life cycle are the production of building materials, on-site construction, operation and end-of-service life. Although the building operational energy is the major component of the total life cycle energy, the energy use due to production of materials and on-site construction gains significance as the energy efficiency of building operation reaches a threshold (Cole, 1999; Guggemos and Horvath, 2005; Bilec, 2006). After achieving the energy efficiency in building operation, the next focus of improvement is the construction phase (Cole, 1999). The construction phase related impacts could be significant at the aggregate level (Bilec et al. 2006; Guggemos and Horvath, 2006). Holistic evaluation of building performance requires the quantification of construction phase related energy use (Guggemos and Horvath, 2005). The energy use for production of materials and on-site construction is as important as the building operational energy for buildings with partial or no-air conditioning (Pinky and Palaniappan, 2014).

Studies have been carried out to assess the energy use and emissions of on-site construction processes. Equipment use contributes to about 50% of the total environmental effects during the construction of structural frames (Guggemos and Horvath, 2006). The application of process LCA, EIO-LCA and Hybrid LCA has been reported (Guggemos and Horvath, 2006; Bilec et al., 2010). It is found that the particulate matter emissions are significant during the construction phase due to vehicles and equipment movement and earth moving activities. The energy use for manufacturing building materials is a major component of the construction phase (Hong et al. 2014). The study of construction phase of a commercial building located in Hong Kong indicates that the materials, equipment use, and transportation account for 82%, 9%, and 8% of the total greenhouse gas emissions (Yan et al., 2010). Tools

© ASCE

# L.PINKY DEVI

NCET

Construction Management
Sustainable Construction

| | All | Since 2016 |
|---|---|---|
| Citations | 77 | 71 |
| h-index | 3 | 3 |
| i10-index | 2 | 2 |

| TITLE | CITED BY | YEAR |
|---|---|---|
| A case study on life cycle energy use of residential building in Southern India<br>P Devi, S Palaniappan<br>Energy and Buildings 80, 247-259 | 58 | 2014 |
| A study on energy use for excavation and transport of soil during building construction<br>LP Devi, S Palaniappan<br>Journal of cleaner production 164, 543-556 | 13 | 2017 |
| Life cycle energy analysis of a low-cost house in India<br>L Pinky Devi, S Palaniappan<br>International Journal of Construction Education and Research 15 (4), 256-275 | 6 | 2019 |
| A Framework for the Assessment of Energy Use of High-Rise Building Construction Processes<br>L Pinky Devi, S Palaniappan<br>Construction Research Congress 2016, 1010-1019 | | |

Gmail **Pinky L <pinkydevi@gmail.com>**

# Fwd: Acceptance of Paper for ICCRIP - 2019

**mohd hussain** <mohdhussain393@gmail.com> Tue, Nov 19, 2019 at 8:10 PM
To: pinkydevi@gmail.com

---------- Forwarded message ---------
From: <conference@nicmar.ac.in>
Date: Tue, 19 Nov, 2019, 2:22 PM
Subject: Acceptance of Paper for ICCRIP - 2019
To: <mohdhussain393@gmail.com>

Dear Author/s,

Greetings!

I am pleased to inform you that your paper titled **'Implementation of lean concepts in concreting work'** has been accepted for presentation in the 'International Conference on Construction, Real Estate, Infrastructure and Project Management (ICCRIP– 2019)' to be held during **'December 13 & 14, 2019'** at National Institute of Construction Management and Research (NICMAR), Pune. Please complete your registration for the conference through the online portal by paying the conference registration fees. The last date of registration is **'November 24, 2019'** .

You are also requested to upload the following by using your login details on or before **November 20, 2019**.

1.Copyright form in PDF format
2.PPT of your paper/s

**Note:** A link to upload copyright form and PPT will be made available upon successful payment of Registration Fee.

In the conference for paper presentation purpose, you will be given total 20 minutes, out of which 15 minutes will be given for the presentation of your paper and another 5 minutes for discussion.

For any further information, you may visit our website www.nicmar.ac.in. OR email to conference@nicmar.ac.in

Thank you and we look forward to having you with us at ICCRIP – 2019.

With Regards,

Dr. Jonardan Koner
Conference Convener, ICCRIP – 2019
Professor and Dean- Research & Publications,
NICMAR, Pune

--
This message has been scanned for viruses and

# Implementation of Lean Concepts in Concreting Work

Author 1 Name: Mohammed Hussain Shariff R
Department: Civil Engineering
University/Institution/Organization: Nagarjuna College of Engineering and Technology
Town/City: Bangalore
Country: India

Author 2 Name: Meghana S
Department: Civil Engineering
University/Institution/Organization: Nagarjuna College of Engineering and Technology
Town/City: Bangalore
Country: India

Author 3 Name: Dr. L Pinky Devi
Department: Civil Engineering
University/Institution/Organization: Nagarjuna College of Engineering and Technology
Town/City: Bangalore
Country: India

**Corresponding author:** Mohammed Hussain Shariff R
**Corresponding Author's Email:** mohdhussain393@gmail.com
**Alternate Email:** pinkydevi@gmail.com

**Abstract**

Construction industry is one among the prominent sectors which is growing worldwide. To improve the performance of the construction industry, the new technologies are being adopted. Implementations of new technologies are deviating from traditional to modern approach. One of the modern approaches which is gaining acceptance worldwide is lean construction. Lean construction is a new concept to minimize the waste and to increase the value of the end product. Lean also plays an important role in reduction of various factors like time, cost and energy. There are different lean tools and methodologies that can be implemented in construction site. One such methodology is value stream mapping (VSM). Value stream mapping helps in analysing the current state of any process by identifying the waste and improvising it in the future state. Two case studies A and B are selected for the implementation of lean methodology. In both the case studies initial data for the various factors like time and cost for the construction process of columns, beams and slab for the current state is analysed. The non-value added activities for the construction of columns, beams and slab in the current state are identified. Future value stream mapping is carried for both case studies. From the case studies the comparison is made between current and future

Journal of Cleaner Production 164 (2017) 543–556

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

# A study on energy use for excavation and transport of soil during building construction

L. Pinky Devi, Sivakumar Palaniappan*

*Building Technology and Construction Management, Department of Civil Engineering, Indian Institute of Technology Madras, Chennai 600036, India*

ARTICLE INFO

*Article history:*
Received 21 February 2016
Received in revised form
22 April 2017
Accepted 23 June 2017
Available online 24 June 2017

*Keywords:*
Buildings
Embodied energy
On-site construction
Earthmoving
Excavation
Transport
Construction planning

ABSTRACT

The building life cycle consists of production, on-site construction, operation and demolition phases. The energy use due to construction (i.e. materials and on-site construction) represents a significant component of life cycle energy in case of naturally ventilated or partially air-conditioned buildings. Earthmoving is one of the major parts of construction processes and it involves the use of heavy equipment. This study presents the influence of technological, operational and site related parameters on the performance of earthmoving operations using five case studies. The energy use due to 'excavation' and 'excavation and transport of soil' is in the range of 14–89 MJ/cu.m. and 19–135 MJ/cu.m. respectively. The choice of equipment selection and its influence on the time (duration), cost, energy use and emissions of earthmoving operations are presented using trade-off analysis. It is observed that the cost of transporting soil could be higher than the excavation cost if the truck is not utilized effectively. A procedure for incorporating sustainability metrics into earthmoving operations during the planning phase is presented. The practical application of this work in industry practice is also demonstrated. The findings are expected to be useful for construction planners in decision making including sustainability metrics.
© 2017 Elsevier Ltd. All rights reserved.

## 1. Introduction

The construction industry uses about 40% of the total energy consumed in the world (Economy Watch, 2010). This would be higher in developing nations due to rapid urbanization and infrastructure development. Buildings in both developing and developed nations account for 40% of the global energy used and 1/3 of the global greenhouse gas emissions (UNEP, 2009). The building sector globally contributes to 33% of the final fuel and power consumption and generates 8.1 Giga tons of $CO_2$ per year (Jennings et al., 2011). The Fourth Assessment Report of the Inter-Governmental Panel on Climate Change (IPCC) states that the building-related Greenhouse Gas (GHG) emissions is around 8.6 million metric tons of $CO_2$(e) in the year 2004 (Levine et al., 2007; Metz et al., 2007). It is estimated that the carbon dioxide emissions increased at the rate of 2.5% per year for commercial buildings and 1.7% per year for residential buildings during the period 1971 to 2004 (Levine et al., 2007; Metz et al., 2007).

The construction industry represents the second largest economic activity and 8% of nation's Gross Domestic Product in India. It is projected that around 70% of the future building stock will be constructed during the period 2011 to 2030 (Planning Commission, 2014). India ranks third globally both in terms of the fuel and power use (Jennings et al., 2011).

Several studies were carried out to determine the life cycle energy use in buildings (Buchanan and Honey, 1994; Fay et al., 2000; Mithraratne and Vale, 2004; Utama and Gheewala, 2008; Ramesh et al., 2012; Varun et al., 2012; Chang et al., 2013; Bastos et al., 2014; Stephan and Stephan, 2016; Hong et al., 2016). However, studies carried out earlier related to building energy use, do not provide an accurate quantification of energy use and emissions of on-site construction processes (Buchanan and Honey, 1994; Fay et al., 2000; Mithraratne and Vale, 2004; Ramesh et al., 2012). This is due to the fact that the operational phase represents 80–90% of the building life cycle energy in many cases. The energy use due to materials and on-site construction gains significance with respect to life cycle energy as the energy efficiency of building operation reaches a threshold (Cole, 1999; Guggemos and Horvath, 2005; Bilec et al., 2006). It is reported that the on-site construction related impacts could be significant at the aggregate level, for example, at the spatial or temporal levels (Guggemos and Horvath, 2005; Bilec et al., 2006). After achieving energy efficiency in

* Corresponding author.
*E-mail address:* sp@iitm.ac.in (S. Palaniappan).

http://dx.doi.org/10.1016/j.jclepro.2017.06.208
0959-6526/© 2017 Elsevier Ltd. All rights reserved.

https://doi.org/10.15623/ijret.2018.0703005 Received: 13-01-2018, Accepted: 24-02-2018, Published: 16-03-2018

# EXPERIMENTAL STUDIES ON BEHAVIOUR OF FERROCONCRETE BEAMS

**Manasa B[1], Sowmyashree T[2], Sharath Babu Khedagi[3]**

*[1]PG Student, Department of Civil Engineering, Vijaya Vittala Institute of Technology, Karnataka, India*
*[2]Assistant Professor, Civil Engineering Department, Vijaya Vittala Institute of Technology, Karnataka*
*[3]Assistant Professor, Civil Engineering Department, Vijaya Vittala Institute of Technology, Karnataka*

## Abstract

*Ferroconcrete is a new generation type of concrete and it is an alternative material for a light weight structural elements. Ferroconcrete consists of cement, jelly chips, mesh and water. This work deals with an experimental study on behavior of ferroconcrete beams. Mix proportions 1:3 i.e. cement: jelly chips with water-cement ratio 0.45 were selected. The overall dimensions of beam are 150X150X2000mm and it is reinforced with compressive strength of about 16.32MPa was obtained at 28days for mix proportion of 1:3 and water-cement ratio of 0.45. Flexural and Impact strength test was conducted. The cracks are due to loading and failure cracks developed due to ultimate load. Flexure strength of produced specimens was 13.6N/mm² and it has good enough to take impact energy of 6415Joules.*

***Keywords:*** *Ferroconcrete, Jelly chips, GI Mesh, Skeleton Steel, Water-cement ratio, Compressive strength, Flexural Strength, Impact Energy.*

----------***----------

## 1. INTRODUCTION

Concrete is a primary material used in construction around the world and most useful in civil engineering works. It extensively used in light of fact that it offers strength and durability at a reasonable cost. It is a man made product which made up of cement, aggregates, water and admixtures. Now a day's ferrocement is most significantly used in a construction of light weight elements. In ferroconcrete constituent material sand is replaced by jelly chips. Ferroconcrete is generally misunderstood to be a new type of cement. The definition of ferroconcrete is "A highly versatile form of reinforced concrete made up of galvanized iron mesh, cement, jelly and water in which closely spaced mesh are layers by layer impregnated with high strength cement and jelly mix". In this investigation sand is replaced by jelly chips and attempt is made to design the ferroconcrete beams and cast them to carry out Flexural and Impact test to study behavior of bending and stresses developed in the beams. The ingredients required for ferroconcrete are easily available in every part of our country, and as such it can be very easily moulded or cast in any shape or form and has been used as construction material by architects and engineers for seeking their dreams coming true whenever the other materials deceived.

### 1.1 Review of Literature

As per Shang Shouping, Zeng Linghong, Peng Hui and Fang Ping [1] study, that ferrocement technology is an efficient method of beam strengthening. The bending behavior of beams strengthened by ferrocement thin plates reinforced with steel wire mesh was experimentally investigated. The results show that ferrocement can obviously increase the load bearing capacity and resisting capacity and improve the bending stiffness of beam. As per Antonine E. Naaman and Surendra P. Shah [2] study, it is to better understand ferroconcrete as an engineering material and predict its design properties. In this they have studied effects of types, sizes, volume of wire mesh on ferroconcrete in uni-axial tension, they observed that ultimate strength of ferroconcrete is that of mesh, and found that modulus of elasticity can be predict from those mortar mesh. Despite the fact that many researchers have been done on ferrocement beams. There is no research work done on ferroconcrete beam. Based on experimental work, it can be presume that jelly chips can be used in place of sand, so compressive strength and impact energy have been improved. In these reviews they discussed that by increasing the number of mesh layers, increases ductility of the ferroconcrete elements also ferroconcrete are good seismic and more economy as compared to conventional concrete. The researches on ferroconcrete beams are still under investigation.

### 1.2 Objectives of Study

The goal of this study is to access to solve the problems due to huge requirement of raw material in nature for the manufacturing of conventional building material and also reduces hazards caused by wastes of industries on the environment. The finding of alternatives low cost and environmental sustainable building materials from industrial residue is a best economic way to overcome from problems and hazards. Importance must be given to cheap, locally available and environmental friendly building materials and

# Risk Management for a Construction Project – A Case Study

**Sharath Babu Khedagi[1] Aravind Sagar B.[2] Sowmyashree T.[3]**
[1,2,3]Assistant Professor
[1]VVIT. Bangalore, India [2]RASTA – VTU Extension Centre, Bangalore, India [3]JAIN Institute of Technology. Davangere, India

*Abstract*— All categories of any organizations may face few internal and external factors that may make it uncertain to achieve their objectives or goals. This uncertainty is called Risk. A guide to the project management body of knowledge (PMBOK guide) defines project risk management as "The process of conducting risk management planning, identification, analysis, response planning, and monitoring and control on a project". The main objective of this study is to illustrate application of risk management process in construction project. To achieve this, a case study is chosen in Bangalore which is a residential villa project. A review of literature and experts advice gave opportunity to prepare a risk breakdown structure which has 9 risk categories that result from 39 risk factors which are generally faced in construction projects. Further questionnaire survey played important role in identifying and analysing the risks faced in the case study. And the results of case study conclude with list of risk factors which were majorly affecting the project and their analysis. And a proper recommendation is suggested for the research work carried out.

***Key words:*** Risk Management, Construction

## I. INTRODUCTION

Risk management is defined as "Systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring and reviewing risk".

A typical risk management has the following key steps:

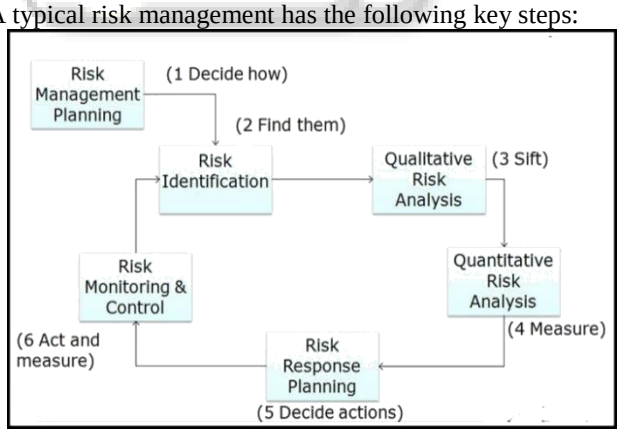



Fig. 1. Risk Management Process

1) Risk Management Planning
2) Risk Identification
3) Risk Analysis – Qualitative and Quantitative Analysis
4) Risk Response
5) Risk Monitoring and Control

### *A. Risk Management Planning*

This planning describes how an organization conducts risk management activities for a project. Planning meetings and analysis are the techniques which help to prepare a risk management plan. Project scope statement, cost management plan, schedule management plan etc. may be considered as inputs to prepare risk management plan

### *B. Risk Identification*

The main objective of Risk identification is that, it gives an opportunity to identify potential risks. Hence this is the crucial step in risk management process. Several tools and techniques are there for risk identification. But the project team should use the one that they are familiar with and effective.

The following are the various techniques through which risk identification can be done.

*1) Documentation Review*
*2) Information Gathering Techniques*
- Brainstorming
- Delphi Technique
- Interview
- Expert Judgement
- SWOT Analysis
- Root Cause Analysis
- Questionnaire Survey

*3) Checklists*
*4) Diagramming Techniques*

### *C. Risk Analysis or Assesment*

Once the risks have been identified or documented, the further question is on how to analyze them. The inputs for this risk assessment process will be risk register and risk management plan.

There two types of risk analysis are as follows:

1) Qualitative Risk Analysis
2) Quantitative Risk Analysis

Qualitative analysis is done to rate the potential risk on scale of low to high. As the name says the quality or nature of the risks is mentioned here i.e. low risk, moderate risk or high risk.

When it comes to quantitative analysis the value of a risk in terms of impact on project objectives is determined (impact in terms of cost or delay).

Example – A risk 'x' causes Rs.y impact on cost and z hour impact on time.

*1) Qualitative Risk Analysis*

The likelihood of occurrence or say probability of occurrence of a risk and the impact of that risk are the two important terminologies here. The probability and impact are evaluated during the interview or meeting. An explanation to satisfy their answers will also be recovered. There after a probability impact matrix will be prepared

The P-I matrix (probability and impact matrix) combines the probability of occurrence and impact scaling and gives a specific ratings to the risks.

The P-I matrix given in PMBOK is illustrated below

All rights reserved by www.ijsrd.com 

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

*Visit: www.ijirset.com*

**Vol. 7, Issue 3, March 2018**

# Study on the Degradation of Concrete by Chloride Diffusion

Shankar Badakundri[1], Sujith S K [2], Karabasappa [3]

P.G. Student, Department of Structural Engineering, Nagarjuan Engineering College, Banglore, India[1]

Asst Professor, Department of Computer Engineering, Nagarjuan Engineering College, Banglore, India[2]

P.G. Student, Department of Structural Engineering, Nagarjuan Engineering College, Banglore, India[3]

**ABSTRACT**: Chloride ions and other aggressive substances penetrate through concrete via different mechanisms depending on the driving force involved. Diffusion, permeability and absorption are the most well-known chloride transport mechanisms through concrete. The fresh state of concrete and the service environment determine the driving force and thus the mechanisms by which chloride penetrates into concrete. In saturated concrete which is continuously immersed in an aqueous solution, chloride transport occurs by diffusion through the pore solution. Movement into and through unsaturated concrete, a common state for concrete with surfaces exposed to the atmosphere, is largely controlled by absorption through the capillary pore system and diffusion of chlorides through pore solution. In highway structures and bridges, concrete is subjected to intermittent wetting events due to rain or condensation and dries out in between these wetting events. The most important and costly deterioration mechanism affecting the reinforced concrete structures is the corrosion of steel reinforcement. Liquid in the pores evaporates progressively from the surface. In this situation, the most likely scenario is that chloride will enter the concrete initially by absorption and produce a reservoir of chloride ions a relatively short distance from the concrete surface from which diffusion can occur. If the concrete dries out to a greater depth, subsequent wettings carry the chlorides deeper into the concrete. Thus it would appear that absorption and diffusion are important transport mechanisms associated with chloride ingress in highway structures and bridges and marine structures However, before discussing these two mechanisms of chloride ingress in detail, the following gives a brief description of permeability which is necessary for an understanding of the theory of absorption. Chloride penetration using ASTM C 1202 &AASTHO T277 (Standard Test Method for of Concretes Ability to Resist Chloride Ion Penetration).

**KEYWORDS**: Diffusion, Chloride penetration, concrete mix design, concrete pumping, curing, finishing, permeability, salt-ponding, temperature control, correlation, coulomb

## I. INTRODUCTION

Concrete is one of the most widely used construction materials in the world. It is a versatile and economical material that generally performs its intended use well over its service life. The most important and costly deterioration mechanism affecting the reinforced concrete structures is the corrosion of steel reinforcement. In good quality concrete reinforcement steel is unlikely to corrode even if sufficient moisture and oxygen are available due to formation of a protective oxide film (passive film) in the highly alkaline environment However, this passive film can be disrupted and corrosion initiated by carbonation, due to the penetration of carbon dioxide into the concrete, which lowers the alkalinity of the environment or by the presence of high concentrations of aggressive ions, mainly chlorides.

The transport of chloride ions through concrete has very severe ramifications on the service life of reinforced concrete structures, not because of its effect on the concrete, but because of its effect on the reinforcing steel.

In a high alkaline environment, such as concrete, a passive layer is formed on the surface of reinforcing steel. This layer is a very dense, slowly reacting corrosion product that essentially prevents further corrosion of the steel bars. However, this layer can be broken down in one of two ways, carbonation or chloride attack. Carbonation lowers the $p^H$

# Effect of Stiffness of Stone Column on Drainage Capacity during Soil Liquefaction

Suravi Pal[1] and Kousik Deb[2]

**Abstract:** Among the most used ground improvement techniques is the mitigation of soil liquefaction by installation of stone columns. To minimize soil liquefaction, the area ratio of the stone columns should be evaluated properly. The available solutions for determining the area ratio of stone columns were developed without consideration of the effects of the stiffness of the columns. However, stone columns have a larger drained elastic modulus than the surrounding soil. The aim of the present paper is to provide a simplified solution for determining the drainage capacity of stone columns during soil liquefaction considering stiffness and limited permeability of the stone columns. Equal strain condition is considered at all depths, i.e., the same vertical deformation of the stone column and surrounding soil is considered at all depths. The present solution shows that the susceptibility of soil liquefaction increases due to the reduction of the stiffness and permeability of the stone column. It is also observed that the maximum pore water pressure ratio decreases by 20–60% due to the stiffness effect of the stone column. Design charts are presented based on the results of the developed solution. Charts can be used to determine the area ratio of the stone columns. Through the presentation of a design example, the present solution is compared with available design methods and the variances between these methods are discussed. **DOI: 10.1061/(ASCE)GM.1943-5622.0001108.** *© 2018 American Society of Civil Engineers.*

**Author keywords:** Liquefaction; Drainage capacity; Stone column; Limited permeability; Stiffness.

## Introduction

The liquefaction of saturated sand during earthquakes is a cause of major damage to civil engineering structures such as buildings, slopes, retaining structures, and earth embankments. To minimize liquefaction-related damage, various ground-improvement methods, such as the compaction of loose sands, replacement of liquefiable soil, grouting and chemical stabilization, application of surcharges, and drainage using stone column are used (Mitchell 2008). Among these techniques, the most popular and common technique is the installation of stone columns. Yoshimi and Kuwabara (1973) first introduced stone columsn for mitigation of liquefaction hazards. Stone columns improve liquefiable soil by virtue of their high permeability, strength, and stiffness. A considerable amount of research has been completed on the performance of stone columns in the mitigation of soil liquefaction. Seed and Booker (1977) proposed an analytical model to design stone columns for liquefaction mitigation by assuming the infinite permeability of the column. Nondimensional charts have been proposed to determine the spacing of stone columns. Sasaki and Taniguchi (1982) carried out large-scale model tests to determine the effective area of the stone columns to minimize liquefaction. Yang and Ko (1998) found that the tendency for the liquefaction of soil is greater at points far from the drain (see Ben Salem et al. 2016). Millea (1990) stated that the primary mechanism of stone columns for improvement of the liquefiable zone is the stiffening of the ground and drainage ability is a secondary benefit.

The improvement and densification of the soil due to installation of stone columns by vibroreplacement and vibrocompaction method are also examined (Tsukamoto et al. 2000; Guetif et al. 2007; Choobbasti et al. 2011 and Frikha et al. 2013). Baez and Martin (1992, 1993) concluded that the cost of liquefiable ground modification program can be reduced by including densification and drainage. It has also been suggested that the liquefaction of soil can be minimized by reducing the seismic shear stress experienced by the soil during earthquakes. Baez and Martin (1993) evaluated the distribution of seismic shear stress according to the stiffness of the individual materials (stone columns and surrounding soil). Priebe (1989) concluded that stone columns can mitigate liquefaction potential by seismic shear stress redistribution [see Adalier and Elgamal (2004)]. Elias et al. (2001) stated that stone columns reduce the susceptibility of soil liquefaction by increasing the density of the liquefiable soil, providing drainage and introducing a stiff element that can carry higher seismic shear stress during an earthquake. Thevanayagam et al. (2006) presented an energy-based approach for the analysis of the densification of sand deposits using dynamic compaction and vibro stone column for the mitigation of liquefaction of loose and non plastic silty sand. Design charts and design guidelines have been presented to quantify the post densification of soil. To consider densification effects, Sujatha (1998) suggested linear and exponential variation of the stiffness of soil with distance. Murali Krishna and Madhav (2008) and Ben Salem et al. (2016) included densification effects in the developed mathematical models by considering the reduced permeability of soil around the column. However, most such studies have been done without considering the limited permeability of stone columns.

Studies show that the well resistance or limited permeability of stone columns (due to the intrusion of fine grained soil into gravel during the construction) may influence their drainage capacity (Barksdale 1987; Han and Ye 2002). Onoue et al. (1987) performed a series of in situ tests and concluded that the effects of the limited

[1]Research Scholar, Dept. of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur 721302, India. E-mail: suravipal1974@gmail.com

[2]Associate Professor, Dept. of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur 721302, India (corresponding author). E-mail: kousik@civil.iitkgp.ernet.in

Note. This manuscript was submitted on February 23, 2017; approved on October 10, 2017; published online on January 5, 2018. Discussion period open until June 5, 2018; separate discussions must be submitted for individual papers. This paper is part of the ***International Journal of Geomechanics***, © ASCE, ISSN 1532-3641.

Downloaded from ascelibrary.org by Indian Inst Of Technology Library, Kharagpur on 01/07/18. Copyright ASCE. For personal use only; all rights reserved.

HOSTED BY

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

Soils and Foundations 59 (2019) 196–207

SOILS AND FOUNDATIONS

www.elsevier.com/locate/sandf

# Effect of clogging of stone column on drainage capacity during soil liquefaction

Suravi Pal, Kousik Deb *

*Department of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur 721302, India*

Received 16 December 2017; received in revised form 18 September 2018; accepted 23 October 2018
Available online 4 January 2019

**Abstract**

Stone columns act as vertical drains, and due to their high permeability, allow for the quick dissipation of earthquake induced excess pore water pressure. When water flows through a loose sandy soil, it washes away fine soil particles. The fine sand particles get detached when the hydrodynamic force applied on the soil particles breaks the inter particle bonds between soil grains. These detached soil particles are then migrated by the seepage water. Based on the concentration of the soil particles in the seepage water, these may be captured at the pore constriction of gravels during the flow of water through the stone column. Thus, the clogging of stone column initiates which reduces of the permeability of column. The rate of dissipation of pore water pressure during earthquake is affected due to the clogging of column. In this paper, a mathematical model is proposed to determine the rate of dissipation of pore water pressure of stone column-reinforced ground by considering the clogging effect of column. The result obtained from the proposed model is verified with the available in-situ experimental data. A parametric study is also performed to investigate the effect of different parameters of the proposed model on the clogging of stone column. It is observed that when the permeability ratio, compressibility ratio and area ratio decrease, the possibility of clogging increases. The peak value of the excess pore water pressure ratio can increase up to around 50% due to clogging.
© 2019 Production and hosting by Elsevier B.V. on behalf of The Japanese Geotechnical Society.

*Keywords:* Liquefaction; Drainage capacity; Clogging; Stone column; Capture rate; Release rate

## 1. Introduction

Soil liquefaction is a major seismic hazard that results in serious damage to infrastructure. A common method to minimize the risk of liquefaction is to install stone columns in the ground. Stone columns provide a drainage path because of their high permeability. Hence, the excess pore water pressure generated in the soil deposits during an earthquake cannot reach objectionable values. As water flows through sandy soil, the fine soil particles are detached by hydrodynamic force and are carried away with seepage water. The migration of these fine sand particles from soil to the pore of gravels causes the clogging in the stone columns. The clogging of stone column results in a reduction in the permeability of the columns. Thus, the efficiency of stone columns as a drainage path is reduced, and the rate of dissipation of pore water pressure is thus affected.

Several approaches are proposed to determine the drainage capacity of stone columns during liquefaction. Seed and Booker (1977) assumed an infinite permeability of stone columns and constant permeability and compressibility of the surrounding soil for determining the drainage capacity of the columns. On the basis of in-situ experimental results, Onoue et al. (1987) reported that well resistance (limited permeability of column) has a significant influence on the drainage capacity of columns. Onoue (1988)

Peer review under responsibility of The Japanese Geotechnical Society.
* Corresponding author.
*E-mail address:* kousik@civil.iitkgp.ac.in (K. Deb).

https://doi.org/10.1016/j.sandf.2018.10.005
0038-0806/© 2019 Production and hosting by Elsevier B.V. on behalf of The Japanese Geotechnical Society.

Check for updates

# Postearthquake Reconsolidation Settlement of Stone Column-Treated Liquefiable Sand

Suravi Pal[1] and Kousik Deb[2]

Downloaded from ascelibrary.org by Indian Institute of Technology Kharagpur on 02/12/21. Copyright ASCE. For personal use only; all rights reserved.

**Abstract:** Stone column is a convenient technique employed to enhance the liquefaction resistance of sandy soil subjected to seismic loading. After the end of an earthquake, the pore water pressures that generated during the earthquake commence to discharge through the stone column, which causes the progressive settlement of the soil surface. In the present paper, a generalized mathematical model is proposed to evaluate the postearthquake settlement of the stone column-treated liquefiable sand surface by adopting different factors such as well resistance, stiffness, smear, and clogging. The well-resistance effect is incorporated by taking into consideration the finite permeability of the column. The effect of stiffness is introduced by considering the difference between the volumetric compressibility of the stone column and soil. The parabolic distribution pattern of the radial permeability and compressibility of the soil within the smear zone are considered in order to quantify the smear effect that occurs during the construction of the column. The clogging effect of the stone column responsible for the gradual decrease in the permeability of the column due to the movement of fines into the pores of the column during dissipation of the pore pressure is also considered in the analysis. The model is verified by comparing its results with the existing field experimental data. It is observed that the postearthquake settlement of the soil is not significantly affected due to the change in the compressibility of the smeared soil. However, the permeability of the smeared soil significantly influences the postearthquake settlement. The rate of settlement significantly decreases because of the clogging of the stone column. **DOI: 10.1061/(ASCE)GM.1943-5622.0001818**. *© 2020 American Society of Civil Engineers*.

**Author keywords:** Clogging; Mathematical model; Liquefiable saturated sand; Postearthquake reconsolidation settlement; Smear effect; Stone column; Unit cell model.

## Introduction

During an earthquake, liquefaction may occur in loose saturated sandy soil due to the development of excess pore water pressures. To improve the drainage condition of the sand and to minimize the soil liquefaction, stone columns are used. When the earthquake is over, the earthquake-generated excess pore pressures dissipate and water flows toward the stone column. The pore pressure dissipation process after the end of earthquake is termed "reconsolidation." The postearthquake settlement is essentially the vertical deformation of the soil surface caused by the reconsolidation of soil (Zhang et al. 2002). The determination of the postearthquake reconsolidation settlement is necessary to assess the response of the civil engineering structures constructed on the stone column-treated liquefiable sand.

Numerous approaches have been suggested to evaluate the liquefaction-induced settlement of the soil through analytical and numerical models as well as laboratory testing. Field tests like the standard penetration test (SPT) and cone penetration test (CPT) are also used to calculate the liquefaction-induced settlement of the ground (Tokimatsu and Seed 1987; Zhang et al. 2002; Juang et al. 2013). Based on the centrifuge test, Kutter et al. (2004) presented the effect of thickness and relative density of sand layer on liquefaction-induced settlement of the ground. Dashti et al. (2010) performed a centrifuge test to evaluate the mechanism of soil liquefaction-induced settlement of buildings. Tsukamoto et al. (2012) performed large shake table tests to study the earthquake-induced settlement of structures resting on the surface of saturated sand. Bertalot and Brennan (2015) studied the effect of initial stress distribution on liquefaction-induced settlement of shallow foundation. Kim et al. (2016) examined the liquefaction-induced settlement of nonplastic silty sand ground. Adamidis and Madabhushi (2016) proposed an analytical approach to estimate the postliquefaction settlement of the soil using the Terzaghi's (1943) one-dimensional consolidation equation. Ashour and Helal (2017) proposed a methodology for predicting the preliquefaction and postliquefaction response of axially loaded piles in sandy soil. Ayoubi and Pak (2017) estimated the liquefaction-induced settlement of shallow foundation resting on a two-layered soil system. Based on centrifuge experiments, Mehrzad et al. (2018) investigated the influence of the extent of soil liquefaction on settlement of shallow foundation during and after the earthquake.

The liquefaction-induced settlement can be reduced by improving the ground. Tokimatsu et al. (1996) showed that the settlement of the vertical drain-improved ground is less than half of the settlement of the unimproved ground. Rollins et al. (2003) and Howell et al. (2012) evaluated the settlement response of liquefiable ground treated with prefabricated vertical drain (PVD). Lopez-Caballero et al. (2016) suggested the preloading technique for minimizing the liquefaction-induced settlements of sandy soil. Bhatnagar et al. (2016) presented the results of numerical modeling of an embankment resting on liquefiable sand. The soil-column is found to be an efficient remedial measure in limiting the displacement

[1]Research Scholar, Dept. of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur 721302, India. Email: suravipal1974@gmail.com

[2]Associate Professor, Dept. of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur 721302, India (corresponding author). Email: kousik@civil.iitkgp.ac.in

Note. This manuscript was submitted on November 12, 2019; approved on June 4, 2020; published online on August 6, 2020. Discussion period open until January 6, 2021; separate discussions must be submitted for individual papers. This paper is part of the ***International Journal of Geomechanics***, © ASCE, ISSN 1532-3641.

Geotextiles and Geomembranes xxx (xxxx) xxx

Contents lists available at ScienceDirect

Geotextiles and Geomembranes

journal homepage: www.elsevier.com/locate/geotexmem

# Filtration performance of geotextile encasement to minimize the clogging of stone column during soil liquefaction

Suravi Pal, Kousik Deb *

*Department of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur, 721302, India*

ARTICLE INFO

*Keywords:*
Liquefaction
Stone column
Geotextile encasement
Clogging

ABSTRACT

Stone columns, which are frequently employed to stabilize the liquefiable soil, are susceptible to accumulation of soil particles. The progressive accumulation of the soil particles causes clogging of the stone column which decreases its drainage capacity. The stone column can be encased with geotextile to sustain its long term drainage function. The encasement prevents the movement of the soil particles into the stone pores. In the present paper, a mathematical model is presented to assess the filtration performance of the geotextile encasement to prevent the clogging. The filtration capacity of the geotextile is related to its maximum pore size, porosity and soil characteristics. It is observed that the encased stone column dissipates the excess pore pressure at a faster rate compared to the stone column without encasement. The peak maximum excess pore water pressure ($U_{max}$) is not significantly affected due to selection of the opening size of the geotextiles for single earthquake. However, the opening size can significantly affect the peak $U_{max}$ value for multiple earthquakes. Depending on the capture coefficient of the stone column, the clogging can be fully prevented for higher hydraulic gradient if geotextile with maximum opening size in between $D_{10}$ to $D_5$ is used as encasement.

## 1. Introduction

The installation of stone column is a convenient liquefaction mitigation method which can shorten the drainage path and pore water pressure dissipation time of the improved ground (Mitchell and Wentz, 1991). Seed and Booker (1977) developed the first analytical model for stabilizing the liquefiable soil using stone column. Onoue (1988) and Pal and Deb (2018) extended the model proposed by Seed and Booker (1977) considering the effect of well resistance and stiffness of the stone column, respectively. The installation process of the stone column creates a smear zone around it where the radial permeability of the soil decreases due to alteration of the soil structure. The reduction of the radial permeability of the soil can prolong the pore water pressure dissipation time (Weber et al., 2010). The smear effect is relevant immediately after the construction of the stone column and cannot be eliminated during the service period of the column (Weber et al., 2010). Hansbo (1981) characterized the smear zone adopting a reduced but constant radial permeability of the smeared soil. However, large scale consolidation experiments performed by Onoue et al. (1991) showed a nonlinear reduction in the radial permeability towards the stone column within the smear zone (See Weber et al., 2010). A number of theoretical approaches have been developed for stabilizing the liquefiable soil using stone column by incorporating different types of nonlinear variations of the radial permeability within the smeared soil (Murali Krishna and Madhav, 2008; Ben Salem et al., 2016; Pal and Deb, 2019b). Murali Krishna et al. (2014) proposed a model for stone column-improved saturated loose sand subjected to seismic loadings considering densification and soil fabric evolution effect.

Field studies (Onoue et al., 1987; Rollin et al., 2004) indicated that the performance of the stone column decreases due to deposition of the soil particles within the pore spaces of the column. During the pore water pressure dissipation through stone column, the fine soil particles are detached from the pore chamber by hydrodynamic or colloidal force (Khilar and Fogler, 1998). However, the hydrodynamic force is dominant for particle size (sand, silt) larger than 10 μm or velocity greater than 0.01 m/s (Khilar and Fogler, 1998). The detached soil particles move along with the water and entrap at the pore constriction of the stone column and with time continue to accumulate in the column pores. The accumulated mass of the entrapped soil particles initiates the clogging in the stone column and the drainage capacity of the column is reduced. The problem of clogging is more acute when the high excess pore water pressure is developed within the stone column-treated

* Corresponding author.
*E-mail address:* kousik@civil.iitkgp.ac.in (K. Deb).

https://doi.org/10.1016/j.geotexmem.2020.12.008
Received 22 June 2020; Received in revised form 11 December 2020; Accepted 16 December 2020
0266-1144/© 2020 Elsevier Ltd. All rights reserved.

# Effect of Smear, Well Resistance, and Stiffness on the Performance of Stone Column during Soil Liquefaction

Suravi Pal[1] and Kousik Deb, Ph.D.[2]

[1]Research Scholar, Dept. of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur City 721302. E-mail: suravipal1974@gmail.com
[2]Associate Professor, Dept. of Civil Engineering Indian Institute of Technology Kharagpur, Kharagpur City 721302. E-mail: kousik@civil.iitkgp.ac.in

Downloaded from ascelibrary.org by Newcastle University on 03/27/19. Copyright ASCE. For personal use only; all rights reserved.

## ABSTRACT

During earthquakes, many structures fail due to the liquefaction of saturated sand or silt. Installation of the stone column is one of the most adopted ground improvement methods used to minimize the damage caused by soil liquefaction. During the installation of the stone column, the permeability of the soil at the vicinity of the column may reduce due to densification. The available analytical solutions to determine the performance of stone columns are developed based on the infinite permeability of the stone columns and without considering the stiffness of columns. Thus, in this paper, an approach has been presented to evaluate the generation and dissipation of excess pore water pressure considering smear effect, well resistance, and stiffness of stone column. The effects of various important parameters of smear zone and stone column on the mitigation of soil liquefaction are evaluated and demonstrated in the results. Obtained results demonstrate that the reduction of the permeability of smear zone increases the pore pressure ratio by around 20% and reduction of the permeability of stone column further increases the peak value of excess pore pressure ratio by 18% to 71%. It is also observed that due to increase in compressibility ratio, the peak value of excess pore pressure ratio is decreased.

## INTRODUCTION

Earthquake induced liquefaction is one of the major causes of damage to facilities and infrastructures. Although, there are various ground improvement methods available to mitigate the liquefaction hazard, the stone columns are preferred due to its technical practicability and cost effectiveness based on the site conditions and depth of treatment. The pioneering work on stone column as a method for mitigating soil liquefaction is presented by Seed and Booker (1977). Till date, a number of studies (Seed and Booker, 1977; Murali Krishna and Madhav, 2008; and Ben Salem et al., 2016) are carried out to determine the effectiveness of stone column in reducing the possibility of liquefaction. However, almost all the previous studies mentioned earlier ignored two important factors. The first factor is the finite permeability of stone column. Most of the previous studies mentioned earlier considered the infinite permeability of the stone column. However, in practice, the limited permeability of column greatly influences the performance of column. Onoue (1987) reported that the well resistance (limited permeability) of stone column cannot be ignored even if the permeability coefficient of column is more than 400 times of the surrounding soils. The second factor is the larger elastic modulus of stone column compared to the surrounding soil. The typical elastic modulus ratios of stone column to sandy soil range from 4 to 20. Han and Ye (2002) reported that the stiffness difference between column and soil should be considered to determine the drainage capacity of stone column. Pal and Deb (2018) proposed a simplified solution for determining the drainage capacity of stone columns during soil liquefaction considering stiffness and limited permeability of the stone columns and it

© ASCE

# Evaluation of Fiber Type and Water-Binder Ratio Influence on Concrete Properties

**Shashi Kumara S. R., D.L. Venkatesh Babu, B.C. Udayashankar, Bharath S.**

***Abstract*: This paper enumerates the experimental study on workability and strength properties of concrete containing different dosage of polypropylene fiber from 0.1% to 0.6% and 1.0% to 3.5% of steel fiber. Water - binder ratio, fiber type and fiber dosage influence on flow behaviour, compressive strength, flexural strength and brittleness ratio were analysed. Experimental results were substantiated by linear regression analysis considering 95% confidence level. Reference mixes with 0.34 and 0.36 water- binder were prepared for results comparison with polypropylene and steel fiber reinforced concretes. Test results showed comparatively higher workability reduction in polypropylene fiber reinforced concrete. Compressive strength test results of fiber reinforced concrete indicted an optimum fiber content of 0.30% of polypropylene fiber and 2.50% of steel fiber. Steel fiber reinforced concrete displayed continuous increase in flexural strength with 44.46% average increase. Brittleness ratio, which was the ratio of flexural strength and compressive strength showed maximum value of 0.24 for concrete with 3.5 % steel fiber and 0.36 w/B ratio. Linear regression analysis revealed good correlation of flow properties with w/B ratio irrespective of fiber type. Though the compressive strength had low correlation with fiber type and w/B ratio, steel fiber reinforced concrete indicated up to 0.987 coefficient of determination with flexural strength.***

***Keywords* : *Brittleness ratio, fiber reinforced concrete, flow properties, linear regression analysis.***

## I. INTRODUCTION

In 21st centaury the concrete is one of the most widely used construction material due to its usage in all type of infrastructural projects. Decade's prior developed concrete is represented as conventional concrete in the present scenario and a step ahead concrete is being emerged as application oriented construction material. The fiber reinforced concrete (FRC) is one among those due to its immense benefit towards serviceability and durability aspects of concrete structures. Fibers in plain concrete withstand the tensile stress developed and prevent the development of microcracks. The production of FRC is intricate and multidimensional with varied grades of material and selection of fiber content. Many fibers are available in the market: polyvinyl fiber, carbon fiber, basalt fiber are successful in imparting one or other required performances in concrete. The studies show that the fresh property and mechanical behaviour of concrete are mainly influenced by fiber amount, fiber geometry, fiber orientation, fiber dispersion, concrete matrix mix design and concrete placement. The fiber amount and the concrete matrix mix design are two vital parameters which can be engineered in contrast to other crucial factors.

Concrete with fibers are tends to reduce the workability. Reduced V-B time and slump were observed for concrete with 0.05%, 0.10% and 0.20% of polypropylene fiber [1]. Steel fiber reinforced concrete with 0.0%, 0.5% and 1.0% fiber dosages, displayed a slump values of 12cm, 10cm and 7 cm [2]. Fiber reinforced concrete exhibited better results for all ranges of workability [3]. Good correlation was exist between slump test and flow table test and a linear regression correlation was exist between them with a correlation coefficient of 0.88 [4]

Considerable amount of works were carried on optimization of fiber type and content based on specific performance. Polypropylene fiber amount in lightweight high-strength concrete was optimized to prevent spalling when exposed to hydrocarbon fire [5]. Varied polypropylene fiber dosage considered in design of fiber reinforced mortar mixes to control the plastic shrinkage cracks [6]. [7] Fiber fractions of 0.05%, 0.1%, 0.2% and 0.3% were considered to analyze the compressive strength, toughness and impact resistance of polypropylene fiber reinforced concrete. The pre-cast fiber reinforced concrete elements are also characterised based on the performances in different tests. [8] Durability, micro- structural analysis and strength test results were utilized for characterization of polypropylene fiber reinforced concrete sleeper. Influences of polypropylene fiber on plaster mortars were analyzed based on strength test results. Among considered fiber dosage of 1.0 kg/m3, 1.5 kg/m3, 2.0 kg/m3 and 3.0 kg/m3, the specimens with 1.5 kg/m3 exhibited enhanced compressive and flexural tensile strength compared with controlled concrete and other fiber reinforced concrete specimens [9]. Concrete with polypropylene fiber contents of 2 kg/m3 and 3 kg/m3 indicated reduced compressive and splitting tensile strength losses at temperature higher than 200°C [10]. Among considered different fiber contents, 0.1% of polypropylene fiber displayed beneficial performances by improving tensile strength by 39% and reducing shrinkage cracks by 50% [11]. The flexural strength and brittleness index of the 1% polypropylene fiber reinforced concrete was increased up to 54% and 145% [12].The improvement in failure load, reduction in number of cracks and width of cracks clearly indicated beam specimens with 1.0 % of synthetic fiber performed better compared to 0.5% specimens [13].

**Revised Manuscript Received on October 30, 2019.**

**Shashi Kumara S.R.**, Department of Civil Engineering, JSS Academy of Technical Education, Bangalore, India, shashikumarsr@jssareb.ac.in

**D.L. Venkatesh Babu**, Department of Civil Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India, drdlvbabu@gmail.com

**B.C. Udayashankar,** Department of Civil Engineering, R V College of Engineering, Bangalore, India, udayashankar@rvce.edu.in

**Bharath S.** Department of Civil Engineering, Nagarjuna College of Engineering and Technology, Bangalore, India, bharath.ncet13819@gmail.com

# Fresh, Strength and Durability Characteristics of Binary and Ternary Blended Self Compacting Concrete

**Abdul Razak B. H., D. L. Venkatesh Babu**

***Abstract:*** ***Mineral admixtures being the economical alternatives to Ordinary Portland Cement (OPC) for various normal and special concretes induce desirable properties to concrete such as higher flow, low heat of hydration, higher strength gain and enhanced durability. Ground granulated blast furnace slag(GGBFS) being one of the largely used mineral admixture alongside Fly Ash as supplementary cementitious material in concrete contributes to enhanced durability properties and low heat of hydration. Various replacement percentages of GGBS at 30%, 40%, 50% and 60% are used in binary blended Self compacting concrete(SCC) in the present study. At 40% replacement level, SCC exhibited improved workability, strength and durability properties. Alccofine(Ultrafine GGBS) used in ternary blended SCC enhanced early strength gain without affecting workability of SCC to a significant extent.***

***Keywords : Ground granulated blast furnace slag(GGBFS), Alccofine, Ordinary Portland cement(OPC).***

## I. INTRODUCTION

With the advancement in construction sector and requirement of structures with high load carrying capacity yet slender structural elements, conjusted reinforcement has become inevitable over the decades. Self compacting concrete(SCC) being more suitable for such situations, it has gained higher importance. Replacing Ordinary Portland cement(OPC) with different mineral admixtures which serve the purpose of lower cost, lower hydration heat and enhanced durability properties [10] without sacrificing concrete strength. Mineral admixtures such as Fly Ash (FA) and GGBS are being extensively used at higher replacement to OPC for the production of various types of concrete. However mineral admixtures such as Silica Fume and Micro silica, Ultra fine GGBS(Alccofine) are among the alternatives for OPC more commonly used in ternary blended mixes to improve initial strength gain of concrete(2). GGBS and Alccofine being the low cost mineral admixtures largely available in market are used for the present study. The present study deals with the workability, hardened properties and durability properties of Self compacting blended concrete with usage of GGBS and Alccofine (Ultra fine GGBFS) as partial replacement to OPC in producing Self compacting concrete.

**Revised Manuscript Received on December 15, 2019.**

**Prof. Abdul Razak B. H.,** Pursuing Ph.D, Construction Materials, Visvesvaraya Technological University, Belgaum (Karnataka) India.

**Dr. D. L. Venkatesh Babu,** HOD, Department of Civil engineering, Nagarjuna College of Engineering and Technology, Bangalore (Karnataka) India.

## II. LITERATURE SURVEY

Previous studies on blended concretes have been done using various mineral admixtures such as GGBS, Fly Ash in higher proportion and Silica Fume, Alccofine, Metakaoline mostly in ternary mixes. Some studies were conducted using fibers in the blended concretes [1].

The following observations were made in the previous studies.

- SCC made with Fly ash and Alccofine with addition of steel fibers at Alccofine content at 10% showed better strength compared with mixes with different proportion of Alccofine [1],[2],[5]. There was also improvement in durability properties of such SCC [1].
- Metakaoline being used as a mineral admixture exhibited optimum fresh properties at a replacement level of 10% [3]. Furthermore it reduced the crack width in concrete as observed in Scanned Electron Microscope (SEM) analysis[3].
- Micronized Calcite used in SCC with Low lime Fly Ash and GGBS as partial replacement for total aggregates enhancedSCCs' flowability, ability to pass and viscosity.T he replacement levels were at 5% and 10% of total aggregates[4].
- Fly Ash and GGBFS when used in SCC showed enhanced results with respect to Workability, hardened and durability of concrete compared to other supplementary cementitious materials basalt powder and marble powder. At a replacement level above 40%, concretes with GGBFS showed improved resistance to chloride ion penetration [6],[7].
- Silica fume when used in ternary blended concretes improves strength of concrete in comparison with binary blended concretes with OPC and GGBS [7].
- Concrete made without compaction such as SCC shows improved carbonation and sorptivity coefficient compared with compacted specimens [8].
- Sorptivity coeffients of low strength concretes depend mainly on curing condition [9].

## III. MATERIALS AND EXPERIMENTAL WORK

### 3.1Materials used in the study

Binder: OPC 53 Grade, GGBFS, Alccofinen Coarse Aggregates: 12.5 mm graded b Fine Aggregates:

Asian Journal of Civil Engineering
https://doi.org/10.1007/s42107-018-0081-9

ORIGINAL PAPER

# Formulation and performance evaluation of alkali-activated self-compacting concrete

**V. K. Nagaraj**[1] · **D. L. Venkatesh Babu**[1]

Received: 7 May 2018 / Accepted: 6 September 2018
© Springer Nature Switzerland AG 2018

**Abstract**
Extensive quantities of fly ash and ground granulated blast furnace slag are produced by power-generation plants and steel manufacturing industries. These superfluous by-products, instead of being left as waste, are used for producing alkali-activated self-compacting concrete, generally known as self-compacting geopolymer concrete. Geopolymer technology has shown its potential in completely eradicating Portland cement for producing concrete. The current study present the executability of developing free flow geopolymer concrete with diverse consequences of substitution of fly ash by ground granulated blast furnace slag (0%, 50% and 100%) and alkaline activator to cementitious binder ratio (0.1, 0.3, and 0.5) on fresh properties, strength development and durability properties. Various tests such as volume stability, sorptivity, water permeability, rapid chloride penetration, sulphate attack and acid attack were evaluated. The results concluded that partial to complete replacement of fly ash by ground granulated blast furnace slag not only eliminated the requirement for elevated curing treatment, but also improved the compressive strength and volume stability, whereas the alkaline activator to cementitious binder ratio effectively influenced the durability and strength development of self-compacting geopolymer concrete to a greater degree. Also, there was no remarkable enhancement in various properties with the use of high-range water-reducing chemical admixtures on the mix. A dominant parameter in deciding the potential adaptation of self-compacting geopolymer concrete in the construction sector is its durability parameters. The durability characteristics were evaluated in detail by activating the source products with a combined mixture of 10 M sodium hydroxide solution and sodium silicate with an alkaline activator ratio of 4.

**Keywords** Low calcium fly ash · Ground granulated blast furnace slag · Fresh properties · Strength development · Volume stability and durability properties

## Introduction

Clinker production involves intensively high energy and also emission of anthropogenic carbon dioxide ($CO_2$). The production of ordinary Portland cement (OPC) consumes 4–8 MJ of fossil fuel energy per kilogram (Swamy, 1998), and calcification of calcium carbonate ($CaCO_3$) to produce 1 T of OPC releases approximately 1 T of $CO_2$ (Law, et al., 2015). The cement industries produce about 5–8% of greenhouse gas ($CO_2$) by consuming 5% of the available natural resources (Turner and Collins, 2013). Due to high consumption of limestone-based raw materials, the cement and concrete industries may suffer from future shortage: more than 3 billion tons of limestone is required per year for clinker production (Schneider, et al., 2011). From the past three decades to the present day, voluminous research in concrete technology has been carried out to reduce global warming caused by emission of greenhouse gas by cement manufacturing industries. In this respect, the geopolymer technology, a zero cement binder, was one of the noteworthy breakthroughs (Davidovits, 1991) and considered the most promising technique. This technology, considered as promising, was introduced by J. Davidovits. It uses relatively new class of amorphous inorganic materials derived by activating waste aluminosilicate source materials by high alkaline solution such as sodium hydroxide (NaOH) or potassium hydroxide (KOH) and potassium silicate ($K_2SiO_3$) or sodium

✉ V. K. Nagaraj
theconcretepeddler@gmail.com

✉ D. L. Venkatesh Babu
drdlvbabu@gmail.com

[1] Civil Engineering Department, ACS College Of Engineering, Bengaluru, Karnataka, India

Published online: 21 September 2018

Arab J Sci Eng (2014) 39:6959–6967
DOI 10.1007/s13369-014-1273-6

RESEARCH ARTICLE - CIVIL ENGINEERING

# Behaviour of Hybrid Fibre-Reinforced Concrete Frames with Infills Against Lateral Reversed Loads

**K. Ramadevi · D. L. Venkatesh Babu · R. Venkatasubramani**

Received: 14 April 2013 / Accepted: 30 November 2013 / Published online: 18 July 2014
© King Fahd University of Petroleum and Minerals 2014

**Abstract** Infilled frame construction represents a common type of construction in urban areas. The frames carry gravity loads and earthquake loads while the infills provide a building envelope and or internal partitioning. In several moderate earthquakes, buildings with infills have shown excellent performance even though many such buildings were not designed and detailed for earthquake forces. It is seen that the masonry infills contribute significant lateral stiffness, strength, overall ductility and energy dissipation capacity during moderate earthquakes. By providing fibres in the critical zones, it is possible to improve the performance of the frames against lateral loading. Hence, an attempt is made by using hybrid fibres (a combination of Polyolefin and Steel fibres) in the joints of the frames in various proportions and to determine the behaviour of the hybrid fibre-reinforced concrete (HFRC) frames under lateral reversed load. The percentages of fibres used are 0, 0.75, 1.5 and 2 %. This research work presents the experimental results of RC frames and HFRC frames and also the comparison of the same using ANSYS.

**Keywords** Masonry infill · Polyolefin fibre · Steel fibre · HFRC frames · Lateral reversed load

**الخلاصة**

يمثل بناء إطار الإرتداد نوعا شائعا من البناء في المناطق الحضرية ، حيث إن هذه الأطر تحمل أحمال الجاذبية والأحمال الزلزالية في حين أن الارتدادت توفر غلافا للمبنى و/ أو تقسيما داخليا. وفي العديد من الزلازل المعتدلة أظهرت المباني مع ارتدادات أداء ممتازا بالرغم من أن العديد من هذه المباني لم تكن مصممة ومفصلة لقوى الزلزال. وينظر أن تسهم ارتدادات البناء بشكل كبير في الصلابة الجانبية، والقوة ، وقدرة تبديد الطاقة الشاملة خلال الزلازل المعتدلة. ومن خلال توفير الألياف في المناطق الحرجة ، فمن الممكن تحسين أداء الأطر ضد التحميل الجانبي. ولذلك تم إجراء محاولة باستخدام الألياف المختلطة (مزيج من البولي أوليفين و ألياف الفولاذ) في مفاصل أطر بنسب مختلفة وتحديد السلوك من أطر الخرسانة المسلحة بالألياف الهجينة تحت حمل جانبي معكوس. والنسب المئوية للألياف المستخدمة هي 0٪، 0.75 ٪ ، 1.5 ٪ ، و 2 ٪. ويعرض هذا العمل البحثي النتائج التجريبية من أطر الخرسانة المسلحة وأطر الخرسانة المسلحة بالألياف الهجينة ، وكذلك المقارنة بينهما باستخدام برمجية أنسيس.

## 1 Introduction

The use of fibres in concrete is not a new concept. Asbestos fibres, straw and horsehair were used in olden days. Also the use of hybrid/composite fibres came into being in the 1950s. Fibre-reinforced concrete is concrete containing fibrous material which increases its structural integrity. The performance of conventional concrete is enhanced by the addition of fibres in concrete. FRC contains short discrete fibres that are uniformly distributed and randomly oriented. Fibres include steel fibres, glass fibres, synthetic fibres and natural fibres—each of which lends varying properties to the concrete. In addition, the character of fibre-reinforced con-

K. Ramadevi (✉)
Department of Civil Engineering, Kumaraguru College of Technology, Coimbatore 641 049, India
e-mail: ramadharans@gmail.com

D. L. Venkatesh Babu
Department of Civil Engineering, JSS Academy of Technical Education, Bangalore 560 060, India
e-mail: vbkcm@rediffmail.com

R. Venkatasubramani
Department of Civil Engineering, Sri Krishna College of Technology, Coimbatore 641 042, India
e-mail: rvs_vlb@yahoo.com

ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/265799089

# Pushover Analysis of Existing Reinforced Concrete Framed Structures

**Article** · February 2012

CITATIONS
15

READS
1,858

**2 authors**, including:

D. L. Venkatesh Babu
Nagarjuna College of Engineering & Technology
**24** PUBLICATIONS **194** CITATIONS

SEE PROFILE

**Some of the authors of this publication are also working on these related projects:**




First articelBase Isolation Techniquea View project

All content following this page was uploaded by D. L. Venkatesh Babu on 30 September 2015.

The user has requested enhancement of the downloaded file.

European Journal of Scientific Research
ISSN 1450-216X Vol.71 No.2 (2012), pp. 195-202
© EuroJournals Publishing, Inc. 2012
http://www.europeanjournalofscientificresearch.com

# Pushover Analysis of Existing Reinforced Concrete Framed Structures

**A. Vijayakumar**
*Assistant Professor, Department of Civil Engineering*
*Jansons Institute of Technology, Coimbatore, Tamilnadu, India*
E-mail: vijayakumarkct@gmail.com

**D. L. Venkatesh Babu**
*Principal, United Institute of Technology*
*Coimbatore, Tamilnadu, India*

**Abstract**

The existing building can become seismically deficient since seismic code requirements are constantly upgraded and advancement in engineering knowledge. Further Indian buildings built over past two decades are seismically deficient because of lack of awareness regarding seismic behavior of structures. This paper aims to evaluate the zone – III selected existing reinforced concrete building to conduct the non-linear static analysis (Pushover Analysis). The pushover analysis shows the pushover curves, capacity spectrum, plastic hinges and performance level of the existing building. The non-linear static analysis gives better understanding and more accurate seismic performance of buildings as progression of damage or failure can be traced.

**Keywords:** Existing Reinforced Concrete building, Seismic zone, Pushover Analysis, capacity spectrum.

## 1. Introduction

Most of the existing buildings are in seismically active zones and are designed for gravity loads only. A large number of existing buildings in zone-III is need seismic evaluation due to various reasons such as, noncompliance with the codal requirements, updating of codes, design practice and change the use of the building. However, the existing structure in the earthquake region Zone III has to be provided by some rehabilitation to sustain the expected performance level. Before rehabilitation work, it is necessary to understand the capacity of the existing building to check if it meets the intended performance level.

The analytical techniques proposed in [1, 2] simplified Nonlinear analysis procedure (pushover analysis) to determine the displacements demand imposed on the building expected to yield. The Nonlinear static procedure in these documents is based on the capacity spectrum method, and assumes that the lateral force distribution for the pushover analysis and the conversion of the results of the capacity diagram is based only on the fundamental vibration mode of the elastic structure. This paper [3] described SAP2000 is used in performing a pushover analysis of a simple three dimensional building. SAP2000 is a state-of-the-art, general purpose, and three dimensional structural analysis programs. SAP2000 has static pushover analysis capabilities which are fully integrated into the

ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/278730606

# Behaviour of hybrid fiber reinforced concrete slabs in frames under static loading

**Article** *in* Ecology, Environment and Conservation · November 2012

CITATIONS
0

READS
410

**1 author:**

Rama Dharan
Kumaraguru College of Technology
**21** PUBLICATIONS **153** CITATIONS

SEE PROFILE

All content following this page was uploaded by Rama Dharan on 20 June 2015.

The user has requested enhancement of the downloaded file.

*Eco. Env. & Cons. 18 (4) : 2012; pp. (975-979)*
*Copyright@ EM International*
*ISSN 0971–765X*

# Behaviour of hybrid fiber reinforced concrete slabs in frames under static loading

**Ms. K. Ramadevi[1] and D.L. Venkatesh Babu[2]**

***[1]Department of Civil Engineering, Kumaraguru College of Technology, Coimbatore, PIN 641 049 Tamilnadu, India***
***[2]United Institute of Technology, Coimbatore, PIN 641 020, Tamilnadu, India***

(Received 1 November 2012: accepted November 30, 2012)

**ABSTRACT**

The performance of conventional concrete is enhanced by the addition of fibres in concrete. In this paper the behaviour of RC slab structures by using Hybrid Fibre (steel and polyolefin) Reinforced Concrete (HFRC) was determined. The mix design was done for M25 grade concrete as per IS: 10262: 2009. The various percentages of fibres ranging from 0.50% to 3% by weight of cement were used in the investigations. The HFRC specimens like cubes, cylinders, prism with hybrid fibres of the various percentages were casted, cured and tested for 28 day strength. The compressive strength, split tensile strength and flexural strength of the HFRC specimen were obtained and compared with control specimens. Simply supported one-way slab specimens were casted with hybrid fibre dosages of 0.75%, 1.5%, 2%, and 3% and the slabs were subjected to two static line loads at third points of the slab by hydraulic jacks. Totally five slabs were casted and tested including control slab specimen. The ultimate flexural load of the HFRC slab specimens were determined and compared with that of the control slab specimens. The test results show that use of Hybrid Fibre reinforced concrete improves flexural performance of the slabs under static loading.

***Key words :*** *Polyolefin fibre, Steel fibre, HFRC, Two point load, Displacement ductility*

## Introduction

Reinforced Concrete is the widely used construction material. The strength of concrete can be improved by adding fibres of different materials and volume. The most widely used stiff fibre is steel. Low volume fractions of fibres (less than 1%) are used to reduce shrinkage cracking. Moderate volume fractions (between 1% to 2%) increase flexural strength, fracture toughness and impact resistance. High volume fractions (greater than 2%) lead to strain hardening of the composites. The shape and length of the fibres also play a role in the effectiveness of fibres in improving the properties of the concrete.

Hybrid Fiber Reinforced Concrete (HFRC) is the one in which more than one or two types of fibers are used in concrete. The concrete involves steel fibres of different lengths or a combination of steel and synthetic fibres in different volume fractions. The use of optimized combinations of two or more types of fibres in the same concrete mixture can produce a composite with better engineering properties than that of individual fibres.

From the review of existing literature on hybrid fibre reinforced concrete slabs, it is found that research in this field with steel-steel and Steel-Polypropylene combinations has recently been frequent. And it is seen that the researches with the combination of Steel-Polyolefin fibres is only a few and this is covered in this present research work which would lead to a better understanding of the mechanical and the flexural behaviour of this concrete.

### Present study

Since most of the research works on hybrid fibre re-

***Corresponding authors:** e-mail: ramadharans@gmail.com; vbkcm@rediffmail.com
[2]Professor & Head, JSS Academy of Technical Education, Bangalore, Pin-560060, India

Sponsored By

GLOBAL CONFERENCE ON
ADVANCED SMART & SUSTAINABLE TECHNOLOGIES IN ENGINEERING

# GCASSTE-2020

Organized by

**MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING**

*(An ISO 9001:2015 Certified Institution, Accredited by NAAC)*

*(A Unit of Rajalaxmi Education Trust®, Mangalore)*

# PAPER PRESENTATION CERTIFICATE

This is to certify that **Vidyashree M** has presented a paper entitled ***Experimental Studies on Structural Characteristics of Solid Concrete Block Masonry with Partial Replacement of Sand by Quarry Dust in Mortar*** in the Global Conference on Advanced Smart & Sustainable Technologies in Engineering held at MITE, Moodabidri, India on January 30th & 31st, 2020.

**Dr. Rajashekar C. R**
**Co-ordinator**

**Dr. G L Easwara Prasad**
**Principal**

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

# Treatment of Municipal Landfill Leachate Mixed With Reverse Osmosis Reject Water Using Papaya Seeds as a Coagulant

**Rupesh Khadga Yadav[1], Jagath K.E[2], Harshith Kumar D.R[3], Shivakumar K.R[4], Vidyashree M.G[5]**

[1,2,3,4] *Student at RGIT College, Civil Engineering Department, Bangaluru.*
[5]*Assistant Professor at RGIT College, Civil Engineering Department, Bangaluru.*

---

**Abstract -** *All waste water contains the high characteristics of Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Turbidity, total suspended solids, total dissolved solids and different other waste particles. Coagulation processes are used to separate these kinds of parameters from the waste water. The particles vary considerably in source, composition charge, particle size, shape, and density. The jar test treatability studies have been conducted to know the optimum dosage of papaya seeds powder on the treatment of leachate mixed with reverse osmosis reject water. The optimum dosage of coagulant gives the removal efficiency of 68%, 63%, 64%, 58% and 54% of COD, BOD, Turbidity, TSS and TDS respectively.*

***Key Words***: Coagulation, papaya seeds powder, Reverse osmosis reject water, leachate.

## 1. INTRODUCTION

Generation of solid waste is inevitable in the daily activities of humans and animals. A landfill is a site for the disposal of waste materials by burial and is the oldest form of solid waste treatment. Historically, landfills have been the most common method of organized waste disposal and remains so in many places around the world. Generally municipal solid waste is disposed of in low laying areas without taking any precautionary measures. Therefore, municipal solid waste is one of the major environmental problems of Indian issues. Solid waste management involves activities like generation, storage, collection, transfer and transport, processing and disposal of solid waste. But, in most cities, the Municipal solid waste management (MSWM) system consists of waste generation, collection, transportation and disposal. Management of MSW requires proper maintenance, basic facility and upgrading of all the activities (Ayub et al., 2011). Conventionally, landfill is designed to contain or store the waste so that exposure to human and environment can be reduced. In most of the countries municipal solid waste is dumped in a non-regulated landfill and the generated methane is emitted to the environment without any precautionary measures. When methane is emitted to the environment, it has a global warming potentially which pollutes the environment. Sanitary landfills can provide better solutions then open dumping of waste for reducing many of the problems, still there is a potential for improvement. Some of the modern regulated landfills attempt to capture and utilize landfill biogas, a renewable energy source, to generate electricity or heat (Ayub and Khan, 2011). At present, Reverse osmosis (RO) reject water technology has been applied in the wastewater treatment for sea water desalination, urban wastewater treatment, chemical industry, electric power, metallurgy and other industries, but the actual producing water rate in the RO process is only about 50%, so it still faces serious discharge problems of rejected water (Zhao et al., 2005). It is very meaningful to develop high-effective rejected water treatment process to compensate the deficiencies of RO and realize water saving and wastewater reducing (Reddy et al., 2007 and Wang et al., 2003).

## 2. PREPARATION OF PAPAYA SEEDS POWDER

About 500 gm of papaya seeds were collected from household sector and after that it was dried for about 2 – 3 days in sunlight. After that it was obtained in powder form by blending with the help of domestic blender.

## 3. METHODOLOGY

The jar test procedures were adopted for different dilution of leachate mixed with RO reject water, which was taken in a beaker (1000mL). After adding appropriate volume of the papaya seeds powder solution, the wastewater was mixed at 100 rpm for 2 min and 40 rpm for 30 minutes and settled for 30 minutes. Then the top layer of water in each beaker was collected with a Pasteur pipette and measured in terms of COD, BOD, Turbidity, TSS and TDS. The jar testing apparatus containers were filled with sample waste water. One container was used as a control while the other 5 containers were adjusted depending on what conditions are being tested. Different dosage papaya seeds powder was prepared for treatment of different dilution of waste water.

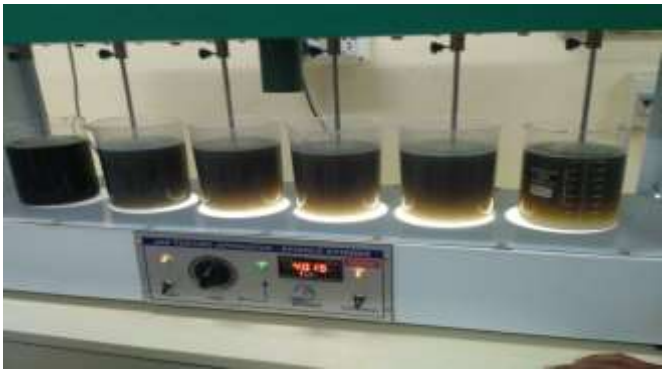


**Figure 1**: Coagulation Experiment in Standard Jar Set up for diluted samples.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

# Treatment of Landfill Leachate Mixed with Reverse Osmosis Reject Water using PAC (Poly Aluminum Chloride) as a Coagulant

**Harshith kumar D.R[1], Rupesh khadga yadav[2], Jagath K.E[3], Shivakumar K.R[4], & Vidyashree M.G[5]**

[1,2,3,4] *Student at RGIT College, Bangaluru, Karnataka, India*
[5]*Assisstant professor at RGIT College, Bangaluru, Karnataka, India.*

---

**Abstract -** *All waste water contains the high characteristics of Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Turbidity, total suspended solids, total dissolved solids and different other waste particles. Coagulation processes are used to separate these kinds of parameters from the waste water. The particles vary considerably in source, composition charge, particle size, shape, and density. The jar test treatability studies have been conducted to know the optimum dosage of poly aluminum chloride on the treatment of leachate mixed with reverse osmosis reject water. The optimum dosage of coagulant gives the removal efficiency of 85%, 71%, 75%, 77% and 73% of COD, BOD, Turbidity, TSS and TDS respectively.*

***Key Words***: Coagulation, PAC, Reverse osmosis reject water, leachate.

## 1. INTRODUCTION

Generation of solid waste is inevitable in the daily activities of humans and animals. A landfill is a site for the disposal of waste materials by burial and is the oldest form of solid waste treatment. Historically, landfills have been the most common method of organized waste disposal and remains so in many places around the world. Generally municipal solid waste is disposed of in low laying areas without taking any precautionary measures. Therefore, municipal solid waste is one of the major environmental problems of Indian issues. Solid waste management involves activities like generation, storage, collection, transfer and transport, processing and disposal of solid waste. But, in most cities, the Municipal solid waste management (MSWM) system consists of waste generation, collection, transportation and disposal. Management of MSW requires proper maintenance, basic facility and upgrading of all the activities (Ayub et al., 2011). Conventionally, landfill is designed to contain or store the waste so that exposure to human and environment can be reduced. In most of the countries municipal solid waste is dumped in a non-regulated landfill and the generated methane is emitted to the environment without any precautionary measures. When methane is emitted to the environment, it has a global warming potentially which pollutes the environment. Sanitary landfills can provide better solutions then open dumping of waste for reducing many of the problems, still there is a potential for improvement. Some of the modern regulated landfills attempt to capture and utilize landfill biogas, a renewable energy source, to generate electricity or heat (Ayub and Khan, 2011). At present, Reverse osmosis (RO) reject water technology has been applied in the wastewater treatment for sea water desalination, urban wastewater treatment, chemical industry, electric power, metallurgy and other industries, but the actual producing water rate in the RO process is only about 50%, so it still faces serious discharge problems of rejected water (Zhao et al., 2005). It is very meaningful to develop high-effective rejected water treatment process to compensate the deficiencies of RO and realize water saving and wastewater reducing (Reddy et al., 2007 and Wang et al., 2003).

## 2. MATERIAL AND METHODOLOGY

### 2.1 Sample Collection

Samples were collected from the open dump site landfill located at Multi Sector General Permit (MSGP) Bengaluru, Karnataka and the leachate are mixed with reverse osmosis (RO) reject water which were collected from the Penta pure (RO) system Hebbal, Bengaluru, Karnataka.

### 2.2 Poly Aluminum chloride

241.3g of PAC was weighed by using weighing balance and it was dissolved in 1000 ml distilled water resulting in 1 normal solution.

### 2.3 Methodology

The jar test procedures were adopted for different dilution of leachate mixed with RO reject water, which was taken in a beaker (1000mL). After adding appropriate volume of the poly aluminum chloride solution, the water was mixed at 100 rpm for 2 min and 40 rpm for 30 minutes and settled for 30 minutes. Then the top layer of water in each beaker was collected with a Pasteur pipette and measured in terms of COD, BOD, Turbidity, TSS and TDS. The jar testing apparatus containers were filled with sample waste water. One container was used as a control while the other 5 containers were adjusted depending on what conditions are being tested. Different dosage poly aluminum chloride was prepared for treatment of different dilution of waste water.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 10 | Oct -2017 www.irjet.net p-ISSN: 2395-0072

# Biosynthesis of Silver Nanoparticles using Plants and its application on the treatment of textile mill wastewater

**Vidyashree M. G[1], Thanushree M.S[2]**

[1]*M.Tech Scholar, Department of Environmental Engineering, Sri Jayachamarajendra College of Engineering, Mysuru – 570006, Karnataka, India.*
[2]*Assisstant professor, Department of Environmental Engineering, SriJayachamarajendra College of Engineering, Mysuru – 570006, Karnataka, India.*

---

**Abstract** – Textile mill wastewater not only consumes large volume of water but also generate an equally alarming quantity of toxic dye rich waste water. This wastewater if treated efficiently may be further reused for domestic and industrial purposes. Hence it is essential to develop, a cost effective and environmentally friendly technique for adsorption of toxic dyes from textile effluents. Firstly, neem (*Azadirachta indica*), mango (*Mangifera indica*), lemon (*Citrus limon*) and combination of all the three leaves (1 ml) were used for the green synthesis of silver nanoparticles (AgNPs). The AgNPs were characterized using SEM analysis and the particles were within the size of $10^{-9}$ nm. These AgNPs were further utilized for the treatment of textile mill wastewater to remove the colour and COD (chemical oxygen demand). The silver nanoparticles synthesised by neem, mango, lemon and combination of all the leaves could able to remove 97, 92, 91, 93 % of colour and 49, 47, 46, and 43 % of COD from the textile mill wastewater respectively within a time period of 15, 50, 60 and 30 minutes. Various isotherms and kinetics were applied to know the capacity and intensity of adsorbents out of which Freundlich isotherm was found to be the best fit for the silver nanoparticles which were used for the removal of colour and COD from textile mill wastewater. Pseudo – second order kinetics provided a good correlation for the adsorption of dyes and COD from textile mill wastewater using silver nanoparticles as an adsorbent. The plots of Dubinin – Radushkevich isotherm it is indicated that the adsorption is physical adsorption and Liquid diffusion model holds good or rate controlling step for the adsorption of colour from textile mill wastewater. The synthesised silver nanoparticles showed effective antimicrobial activity against bacteria like *Esecherisia – coli* (gram negative) and *Streptococcus* (gram positive).

**Key Words: Biosynthesis, Silver Nanoparticles, Antimicrobial Activity.**

## 1 INTRODUCTION

Industrial revolution for fulfilling the demands of increasing population during production, results in the pollution of water, air and soil (1). The discharge of pollutants from various industries poses threat to the surrounding environment. The industries like textile and paper large quantities of water and produces huge volume of wastewater from different types of dyes and finishing process (1). Different types of dyes are used in paper, leather, textile, cosmetics industry (1). Among all dyes, azo dyes are largest and most versatile class of dyes and are widely used in textile industries (1). More than 2000 structurally different azo dyes are currently in use (1). These dyes account for approximately 60 – 70 % of all dyes used in food and textile manufacture. Several physic – chemical methods such as adsorption, chemical treatment and ion pair extractions have been adopted and proven to be costly while producing large amounts of sludge and thus they also lead to second pollution (1). To overcome such problems research has been moving toward biological methods as these methods are eco – friendly and cost effective (1). The application of nanotechnology will enhance the bioremediation (1).

Nowadays, nanotechnology is regarded as a distinct field of research in modern science and technology with multidirectional applications (2). Useful application of nanotechnology in medicinal purposes is currently one of the most fascinating areas of research, metallic nanoparticles have also been receiving considerable interest in biomedical applications (2). Silver nanoparticles in particular, are finding applications to the researchers as tools for antibacterial and antifungal, anti – inflammatory, wound healing, radio – imaging, retinal neovascularization, antiviral and anti – oxidant agents, and also as novel cancer therapeutics, capitalizing on their unique properties to enhance potential therapeutic efficacy (2). Nanoparticles are known as particles with a size smaller than 100 nm (3). Many methods are adopted for nanoparticles synthesis like physical, chemical, and biological methods (3). Biological method of synthesis of silver nanoparticles was achieved by using bacteria, fungi, algae and plants (3). The use of plants as the production assembly of silver nanoparticles has drawn attention, because of its rapid, eco – friendly, non – pathogenic, economical protocol and providing reduction and stabilization of silver ions by combination of bio molecules such as proteins, amino acids, enzymes, polysaccharides, alkaloids, tannis phenolic, saponins, terpinoids and vitamins which are already established in

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 10 | Oct -2017 www.irjet.net p-ISSN: 2395-0072

# Biosynthesis of Silver Nanoparticles using Plants

**Vidyashree M. G[1], Thanushree M.S[2]**

[1]*M. Tech Scholar, Department of Environmental Engineering, Sri Jayachamarajendra College of Engineering, Mysuru – 570006, Karnataka, India.*
[2]*Assisstant professor, Department of Environmental Engineering, SriJayachamarajendra College of Engineering, Mysuru – 570006, Karnataka, India.*

---

**Abstract** – In the present work attempt has been made to synthesise the silver nanoparticles using neem (*Azardirachta indica*), mango (*Mangifera indica*), lemon (*Citrus limon*) and combination of all the three leaves. It is an easy, eco-friendly and cost effective method for the synthesis of silver nanoparticles (AgNPs) and to evaluate its antimicrobial activity. Bio synthesised silver nanoparticles were characterized by using UV – Visible spectrophotometer and scanning electron micrograph (SEM) and it shows the maximum absorbance peak at 420 nm in UV – Visible spectrophotometer. Antimicrobial activity of silver nanoparticles were also studied against *Escherichia coli* (*E. coli*, gram negative) and *Streptococcus aureus* (*S. aureus*, gram positive), and it showed the good antimicrobial activity towards both the bacteria.

***Key Words***: Biosynthesis, Silver Nanoparticles, Antimicrobial Activity.

## 1 INTRODUCTION

Nowadays, nanotechnology is regarded as a distinct field of research in modern science and technology with multidirectional applications (1). Useful application of nanotechnology in medicinal purposes is currently one of the most fascinating areas of research, metallic nanoparticles have also been receiving considerable interest in biomedical applications (1). Silver nanoparticles in particular, are finding applications to the researchers as tools for antibacterial and antifungal, anti – inflammatory, wound healing, radio – imaging, retinal neovascularization, antiviral and anti – oxidant agents, and also as novel cancer therapeutics, capitalizing on their unique properties to enhance potential therapeutic efficacy (1). Nanoparticles are known as particles with a size smaller than 100 nm (3). Many methods are adopted for nanoparticles synthesis like physical, chemical, and biological methods (3). Biological method of synthesis of silver nanoparticles was achieved by using bacteria, fungi, algae and plants (3). The use of plants as the production assembly of silver nanoparticles has drawn attention, because of its rapid, eco – friendly, non – pathogenic, economical protocol and providing reduction and stabilization of silver ions by combination of bio molecules such as proteins, amino acids, enzymes, polysaccharides, alkaloids, tannis phenolic, saponins, terpinoids and vitamins which are already established in the plant extract having medicinal values and are environmental benign, yet chemically complex structure (4) and these helps in the reduction of silver ions to silver nanoparticles and act as capping and stabilizing agent (3).

## 2 MATERIALS AND METHODOLOGY

### 2.1 Synthesis of Silver Nanoparticles by Using Plants

Different leaves of plants (neem, mango and lemon) was used for the synthesis of silver nanoparticles. Fresh leaves were collected from JSS University. The leaves were cleaned with running water followed by distilled water to remove the debris and other contaminants from the leaves. About 100 gm of leaves were weighed and grinded well, then the grinded leaves were filtered by using what man's filter paper which is of grade 1 and the obtained filtrate was boiled for about 10 – 15 minutes to get the plant extract. The plant extract was filtered again to remove the solid part in the extract. About 1 ml of plant extract was taken and it was added to 50 ml of 1mM silver nitrate solution to get or to synthesise the silver nanoparticles. The change in colour from light yellow to dark brown or reddish brown indicates the synthesis of silver nanoparticles (reduction of $Ag^+$ ion to $Ag^0$).

### 2.2 Preparation of Adsorbent by Combination of Leaves

Combination of three leaves were used for the synthesis of silver nanoparticles. Fresh leaves of neem, mango and lemon were collected from the JSS University. All the three leaves were washed thoroughly with the distilled water to remove the debris and other organic contaminants. About 100 gm of leaves were weighed with the help of weighing balance and the weighed leaves were grinded with the help of domestic grinder and the grinded leaves were filtered by using by using whatsman filter paper of grade one. The filtrate was boiled for about 10 – 15 minutes to get the plant extract. The obtained extract was filtered again so has to remove the solid part from the extract. About 1 ml of combination

# REPLACEMENT OF FINE AGGREGATE BY USING LEACHATE SLUDGE IN CONCRETE

**Rupesh Khadga Yadav[1], Jagath K.E[2], Harshith Kumar D.R[3], Shivakumar K.R[4], Vidyashree M.G[5]**

*[1,2,3,4] Student at RGIT College, Civil engineering department, Bangaluru.*
*[5]Assistant professor at RGIT college, Civil engineering department, Bangaluru.*

---

**Abstract -** *The idea of using sludge gives a platform to use it as an alternative source for the replacement of fine aggregate. In this project concrete was tested with w/c ratio of 0.5. Fine aggregate are partially replaced by using sludge with different percentage such as 5%, 10%, 15% and 20%. Chemical composition of the sludge was found by using SEM and EDX test. The mechanical properties of the sludge such as compressive strength, split tensile strength and flexural strength were tested for 7, 14 and 28 days. This experimentation holds good strength till 20% of partial replacement with sludge in fine aggregate. The strengths were decreased when replacement of fine aggregate reaches above 20%.*

***Key Words***: *Sludge, fine aggregate, Cement, SEM, EXD, Compressive strength, Split tensile strength, Flexural strength.*

## 1. INTRODUCTION

Sludge is a by-product that is obtained from the wastewater treatment plant. Disposal of the waste become a serious issue for the society todays. Due to the huge emerging of such waste cause serious problem in designing and operation of the treatment plant resulting pollution in the society. The production of the sludge from the waste treatment plant is increasing day by day around the world. Sludge has a disposal problem in order to reuse and reduce. Hence the test is conducted to reduce the sludge by partially replacing the fine aggregate. The characteristic of the sludge differs for different region and the method of treatment. Sludge is formed after various steps like stabilization, composting, anaerobic decomposition, dewatering and sedimentation. These sludge contain maximum amount of nitrogen, zinc, dry solids, organic material heavy metals etc. hence probably can be used for agricultural purpose (Srinivasan et al., 2016).

At the sewage treatment plant, the sewage sludge was sun dried in the sludge bed (Bharat et al., 2016). In India there are many industries which produce large amount of effluent treatment plant sludge in every year which leads to increasing problem in disposal and environment degradation due to continuous exploitation and depletion of natural resources. Since the land is limited another methods are to be subjected for the treatment of waste sludge (Sreehari et al.,2015).

The sludge pass through 4.75mm IS sieve complexly and retain in 90micron IS sieve similar to that of fine aggregate.The concrete was produced by sludge using M20 grade as per IS 10262:2009 OPC 43 grade cement was used and the water cement ratio is taken as 0.5. The concrete was hand mixed on water-tight, non-absorbent platform with a shovel, trowel and necessary equipment's. The color of the concrete was found uniform. The slump was measured in mm, it was found that the slump is true slump. Further the Compression, Split tensile and Flexural test are carried out to know the strength of different percentage of replacement of fine aggregate by sludge.

## 2. MATERIALS USED

### 2.1 CEMENT

Cement is a good bonding material which having both the cohesive and adhesive properties. Cement used in experiment is ordinary Portland cement (OPC) of grade 43 conforming IS 10262:2009. Various lab test were conducted on cement to determine specific gravity, fineness, standard, initial and final setting time. Specific gravity of cement is 3.1.

### 2.2 WATER

Mostly portable water should be used which is free from the impurities.

### 2.3 COARSE AGGREGATE

The size of coarse aggregate should be 12.5 – 20 mm. It should pass through 20mm sieve and retained on 12.5mm sieve. Specific gravity of coarse aggregate is 2.6.

### 2.4 FINE AGGREGATE

River sand was used as a fine aggregate of specific gravity 2.61. It should pass through 4.7mm sieve and retained on 150micron.

### 2.5 SLUDGE

It was obtained from wastewater treatment plant of having specific gravity 1.4.

## 3. METHODOLOGY

The concrete was developed by replacing the fine aggregate with 5%, 10%, 15% and 20% of sludge, using M20 grade as per IS 10262:2009. Grade of cement used is OPC 43 grade. Water cement ratio taken is 0.5. The concrete batch was hand mixed water tight, non-absorbent platform with shovel, scoop and other required necessary equipment. Then the mixed concrete was placed

ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/321348399

# Effect of Mixed Microbial Culture, Mediator, Different Electrode Configuration and Wastewater Dilution on Power Generation in a Double Chambered Microbial Fuel Cell

**Research** · November 2017

DOI: 10.13140/RG.2.2.35466.16320

CITATIONS
0

READS
82

**4 authors**, including:

Shobhan Majumder
Sri Jayachamarajendra College of Engineering
**14** PUBLICATIONS **5** CITATIONS

SEE PROFILE

**Some of the authors of this publication are also working on these related projects:**



Air Pollution dispersion modeling View project



Microbial Fuel Cell View project

All content following this page was uploaded by Shobhan Majumder on 29 November 2017.

The user has requested enhancement of the downloaded file.

International Journal of Chemical Sciences and Applications
ISSN 0976-2590, Online ISSN 2278 – 6015
Vol 6, Issue2, 2015, pp 42-55
http://www.bipublication.com

**Research Article**

# Effect of Mixed Microbial Culture, Mediator, Different Electrode Configuration and Wastewater Dilution on Power Generation in a Double Chambered Microbial Fuel Cell

**Shobhan Majumder, Prakruthi, H., Vidyashree, M. G.,**

**Priyanka Sarabi, Abhilash Radder and Mahadeva Swamy, M.**

Department of Environmental Engineering,
Sri Jayachamarajendra College of Engineering, Mysuru, India – 570 006
Corresponding author(s): sadaoptimus@gmail.com, mmswamy_20@yahoo.com

[Received-22/05/2015, Accepted-11/06/2015, Published-07/08/2015]

## ABSTRACT

Microbial fuel cell (MFC) is a device generally converts the biochemical energy present in the substrate to electrical energy through degradation of substrate in the absence of oxygen. Various experiments have been conducted to generate electricity using double chambered MFC (DC-MFC) reactor due to its simple construction, mechanism and maintenance compared to single chambered MFC (SC-MFC) reactor. In the present study an attempt has been made to develop a low-cost DC-MFC to generate power from distillery as well as sugar industrial wastewaters using different electrode configurations. Effect of mixed microbial culture, mediators, electrode configuration and varied dilution on power generation has been carried out.The maximum voltage was found to be 1000 mV in the presence of PS and RFS as inoculum using sugar wastewaters, however, a maximum voltage and current of 860 mV and 9.1 mA, respectively, were noticed when distillery wastewaters were used as substrate with phosphate buffer. Experimental results using multi carbon rod electrode assembly with raw distillery wastewaters showed a maximum voltage and current of 870 mV and 10.1 mA, respectively, however, with 20 % dilution of sugar wastewater yielded a maximum voltage and current of 1180 mV and 1.4 mA, respectively. Constructions of MFC reactor was found to be low cost with agar salt bridge when compared with Nafion membranes.

**Keywords:** Microbial fuel cell, mixed culture, mediator, electrode configuration, dilution, voltage, current.

## [I] INTRODUCTION

The non-renewable resources of energy is depleting at a faster rate in the current scenario [1]. Hence, there is the search for high efficient energy transformations and ways to utilize the alternate renewable energy sources. Microbial fuel cells (MFCs) employ microbes to generate electricity from biochemical energy produced during metabolism of organic substrates. MFC consists of anode and cathode connected by an external circuit and separated by proton exchange membrane (PEM) [2]. In anode chamber, organic matter present in the substrate will be degraded bymicrobes and generates electrons ($e^-$) and protons ($H^+$) in the absence of

**Cite this Article:** Shobhan Majumder, Prakruthi, H., Vidyashree, M. G., Priyanka Sarabi, Abhilash Radder and Mahadeva Swamy, M, 2015. Effect of Mixed Microbial Culture, Mediator, Different Electrode Configuration and Wastewater Dilution on Power Generation in a Double Chambered Microbial Fuel Cell, International Journal of Chemical Sciences and Applications, 6(2), 42-55

**International Journal of Civil Engineering and Technology (IJCIET)**
Volume 10, Issue 06, June 2019, pp. 508-512, Article ID: IJCIET_10_06_048
Available online at http://www.iaeme.com/ijciet/issues.asp?JType=IJCIET&VType=10&IType=6
ISSN Print: 0976-6308 and ISSN Online: 0976-6316
© **IAEME** Publication

# URBAN FLOOD MANAGEMENT AND MONITORING IN VRISHABHAVATHI VALLEY

**D H Yashasvini**
Assistant Professor, Civil Engineering Department, SVCE, Bangalore, Karnataka, India

**Priyanka S**
Assistant Professor, Civil Engineering Department, SVCE, Bangalore, Karnataka, India

**Vidyashree**
Assistant Professor, Civil Engineering Department, SVCE, Bangalore, Karnataka, India

**Vinutha S**
Assistant Professor, Civil Engineering Department, AIEMS, Bidadi, Karnataka, India

**ABSTRACT**

*Urban flood is mostly seen in urban areas. They may be due to heavy rainfall, adverse topographical conditions and anthropogenic factors, lead to destruction of drainage, damage to buildings, and even loss of life and property. Now in order to control such problems, systematic urban flood studies are necessary. This study is focused on the mapping and spatial analysis of urban flood vulnerability in Vrishabhavathi valley watershed, Bengaluru using Analytical Hierarchy Process (AHP), GIS and remote sensing techniques. Few causative factors for flooding considered are rainfall, slope, drainage density, land use, building density, road density, non-existing natural drainage and non-existing Lake. The thematic map of these factors was converted into raster maps. Numerical weight and ranking scores will be assigned to each element factor according to fundamental scale of AHP technique. Urban Flood Vulnerability Zone (UFVZ) map is computed using weighted overlay analysis of GIS technique and classified into five categories, viz., very low, low, moderate, high and very high flood zone classes. UFVZ map was compared with the flood prone locations exist in Bengaluru city to assess the accuracy of result. The plot of flood prone locations on flood vulnerability zone map evident that, 50% of flood prone locations found under moderate flood vulnerability zone. This result depicts the fact that, urban flood vulnerability is highly influenced by anthropogenic factors than natural factors in urban environmental study area. The predicted flood vulnerability zones are found to be in good agreement with known flood prone locations.*

**Key words:** AHP technique, Geographic information system, Remote sensing, Urban flood.

INTERNATIONAL JOURNAL OF
Psychosocial Rehabilitation
website : www.psychosocial.com/
+91 98840 78453 +91 98840 78453

# Acceptance Letter

Dear Author(s): Ganesha Mogaveera , Vidyashree.M, Umesh S S, Sherman Jain

| | |
|---|---|
| Paper ID : | IJPR -2346 |
| Paper Title : | EXPERIMENTAL STUDIES ON STRUCTURAL CHARECTERISTICS OF SOLID CONCRETE BLOCK MASONRY WITH PARTIAL REPLACEMENT OF SAND BY QUARRY DUST IN MORTAR |

This is to enlighten you that above manuscript reviewed and appraised by the review committee members of IFERP and it is accepted for the purpose of publication in the **"International Journal of Psychosocial Rehabilitation"** that will be available at https://www.psychosocial.com/.

You have to send following documents at jayaprakash@mite.ac.in before 15th March 2020:

**Proof of Registration/Payment - Scanned | Online Received Email**

**Note:**

1. Above manuscript will be published on or before 30 April, 2020.
2. International Journal of Psychosocial Rehabilitation is a SCOPUS Indexed Journal.
3. Author(s) will receive Publication information and Published Paper link through IFERP.
4. You may see more about the journal at: https://www.psychosocial.com/
5. You will receive Volume/ Issue information of your paper very soon.
6. Publication fee (7500) should be paid in favour of "Chief-Coordinator MITE Seminar & Workshops" payable at Vijaya Bank, Moodabidri Branch through RTGS/NEFT to the following account:

| | |
|---|---|
| A/c Number | : 114901011001148 |
| A/c Name | : Chief-Coordinator MITE Seminar & Workshops |
| Name of the Bank | : Vijaya Bank |
| Branch | : Moodabidri |
| IFS Code | : VIJB0001149 |
| Swift Code | : VIJBINBBMLR |
| Bank Telephone no. | : 08258-237452 |
| Postal/Zip Code | : 574225 |
| State | : Karnataka |
| Country | : India |

INSTITUTE FOR ENGINEERING RESEARCH AND PUBLICATION IFERP

**Executive Chairman**

Hindawi Publishing Corporation
Advances in Civil Engineering
Volume 2016, Article ID 5642523, 10 pages
http://dx.doi.org/10.1155/2016/5642523

*Research Article*

# GIS Based Approach for Vulnerability Assessment of the Karnataka Coast, India

**Akshaya Beluru Jana and Arkal Vittal Hegde**

*Department of Applied Mechanics and Hydraulics, NITK, Surathkal, Mangaluru 575025, India*

Correspondence should be addressed to Akshaya Beluru Jana; aksh.jana@gmail.com

Received 16 November 2015; Accepted 17 April 2016

Academic Editor: Kirk Hatfield

Copyright © 2016 A. Beluru Jana and A. V. Hegde. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

The coastal zones are highly resourceful and dynamic. In recent times, increased events of tropical cyclones and the devastating impact of the December 2004 tsunami have brought forth the importance of assessing the vulnerability of the coast to hazard-induced flooding and inundation in coastal areas. This study intends to develop coastal vulnerability index (CVI) for the administrative units, known as *talukas* of the Karnataka state. Seven physical and geologic risk variables characterizing the vulnerability of the coast, including rate of relative sea level change, historical shoreline change, coastal slope, coastal regional elevation, mean tidal range, and significant wave height derived using conventional and remotely sensed data, along with one socioeconomic parameter "population," were used in the study. A total of 298 km of shoreline are ranked in the study. It was observed that about 68.65 km of the shoreline is under very high vulnerable category and 79.26 km of shoreline is under high vulnerable category. Of the remaining shoreline, 59.14 km and 91.04 km are of moderate and low vulnerable categories, respectively.

## 1. Introduction

Significant changes in environmental and physical processes have been observed in coastal areas as a result of intensive urbanization and tourism [1]. It has been estimated that human population of around 600 million would inhabit coastal flood plains by the year 2100 [2]. Additionally, coastal ecosystem is being subjected to frequent events of hazards such as storms, associated waves and storm surges, tsunamis, river flooding, shoreline erosion, and the influx of biohazards like algal blooms and pollutants [3]. Further, global climate change and the threat of accelerated sea level rise have aggravated the already existing high risks of storm surges, severe waves, and tsunamis [3].

Indian main land has a coastline of about 5,400 km and around 250 million people live within 50 km of the coastline of India [4]. In spite of the various policies and regulatory frameworks, India's coastal and marine ecosystems are under threat due to multiple stresses [5]. The event of December 2004 tsunami brought about importance for scientific study of the natural hazards and coastal processes of the Indian coast [6].

Mitigating the effects of potential disasters and having the appropriate infrastructure in place for the response require a detailed knowledge about vulnerability of the places to a wide range of hazards [7]. Since vulnerability may be associated with natural or social hazards or sometimes a combination of both, various dimensions involving a hazard must be taken into account to effectively carry out a vulnerability assessment [8]. Various coastal vulnerability assessment methods were developed for managing the coasts which include inundation maps, common methodology (IPCC), and computer aided models. Coastal vulnerability index (CVI) developed by Thieler and Hammar-Klose [9–11] is one of the accepted and most commonly used indices for calculating the vulnerability towards the coastal erosion and sea level rise. The majority of the studies using CVI have categorized the vulnerability of different coastal environments relatively, using basic information on coastal geomorphology, rate of sea level rise, past shoreline evolution, coastal slope, mean tidal range, and mean wave height and acknowledged that inclusion of demographic and economic variables may result in a useful and more comprehensive index [12]. Subsequent studies did

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

# Experiment on Strength Properties of High Performance Concrete with the Incorporation of Activated Fly Ash

**Rohini Devoor[1], Chaitra D M[2], Yashwanth N[3]**

*[1]M. Tech Student, Dept. of Structural Engineering, NCET, Bengaluru*
*Assistant Professor, Dept. of Civil Engineering, NCET, Bengaluru*
*[3]M. Tech Student, Dept. of Structural Engineering, NCET, Bengaluru*

---

**Abstract -** *Every year more than 90 million tons of fly ash is produced in India. Out of which only 10 to 15% is being utilized. In order to increase its percentage of utilization, an extensive investigation was carried out to use it in concrete. Fly ash is an ultrafine powder which is collected as a by-product of the silicon and ferrosilicon alloy production. Activation of fly ash is done by two ways, i.e. chemical activation and thermal activation. The main objective of this study was to determine the optimum percentage dosage of activated fly ash to replace cement in order to improve the strength properties of high performance concrete. This paper presents the results of an experimental investigation dealing with concrete with incorporation of activated fly ash. Ordinary Portland Cement was replaced with three percentages i.e., 10%, 20% and 30% of activated fly ash. To fulfill this objective comparison between conventional concrete and high-performance concrete containing different levels of activated fly ash like 10%, 20% and 30% content was conducted. Various tests were performed to check the properties of fresh concrete for such as slump test, air content, compressive test, split tensile test. The test results were studied to find the optimum dosage of activated fly ash required in concrete and found out that the chemically activated fly ash concrete mix achieves higher strength when compared to thermally activated fly ash.*

***Key Words:*** **Activation, Chemical, Thermal, Fly ash, Strength**

## 1. INTRODUCTION

Cement is the most cost and energy efficient component of concrete. The unit cost of concrete can be reduced by replacing partially of cement with activated fly ash. Fly ash is the by-product of the combustion of silicon and ferrosilicon alloy are collected by mechanical and electrostatic separators from the fuel gases of power plants. The disposal of fly ash as a waste material causes severe hazardous issues for environment. The utilization of fly ash instead of dumping it as a waste material can be partly used as partial replacement of cement. Fly ash has several benefits to be considered in construction field such as lower water demand, reduced bleeding and lower evolution of heat. It is been used widely in large concrete applications to control expansion due to heat of hydration and also to reduce cracking at early stages. High volume fly ash concrete usually contains more than 50% fly ash by mass of total cementitious materials. Many inventors have used high volumes of Class C and Class F fly ash in concrete [1].

Researchers have found that Fly ash is one of the best pozzolanic material which when replaced in partial of cement improves durability and long term strength due to presence of fine spherical shape particles. And noticed that 15 to 25% of Fly ash replacement have good effect on the tensile strength of concrete. They have also indicated that though the initial strength of Fly ash concrete may be low, with age the strength is comparable for better compressive strength, heat of hydration and chloride diffusivity of concrete [2].

There are several ways by which activation of Fly ash can be done. Numerous investigators have performed chemical activation process to activate fly ash. Another common method used by investigator to improve early age strengths is the use of chemical admixture. Many commonly available admixtures have the property to accelerate the hydration of concrete, which reduces water and super plasticizer at the same time. The reduction of water in the concrete due to the addition of super plasticizer helps in improving the strength. The chemical activators used are sodium sulphate, calcium sulphate and sodium hydroxide [3].

Fly ash has exhibited several advantages which can be used in construction site. It has several properties like cold weather resistance, gaining higher strength, used as an admixture, as substitution for cement, as a non-shrink material, produces denser concrete, smoother surface, lower water/cement ratio, reduces cracking in concrete, permeability, bleeding and reduces heat of hydration. In geotechnical industry fly ash is involved in several applications such as in brick material, soil stabilization, fillings for embankment, backfill material, sub base and pavement construction [4]. The following article deals with various activation techniques to accelerate the reactivity of Fly ash in concrete. Latterly a comparative assessment of these methods by considering the compressive strength of concrete.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

# Study on Performance of Activated Fly Ash and Silica Fume in High Performance Concrete

**Yashwanth N[1], Chaitra D M[2], Rohini Devoor[3]**

[1]*M. Tech Student, Dept. of Structural Engineering, NCET, Bengaluru.*
[2]*Assistant Professor, Dept. of Civil Engineering, NCET, Bengaluru.*
[3]*M. Tech Student, Dept. of Structural Engineering, NCET, Bengaluru.*

---

**Abstract -** *Concrete in the sense a material which can resist large amount of compressive stresses. This property of concrete has multiplied its use in various construction activities. The conventional concrete has been modified by incorporating supplementary materials of the basic ingredients of the concrete. The main objective of doing so is to enhance the strength development by accelerating the hydration process and to increase the performance & durability of the concrete in its fresh and harden state. In this study an attempt is made to enhance the above-mentioned properties of concrete by adopting fly ash and silica fume as partial supplements of cement. The chemical and thermal activation of fly ash is done to increase the involvement to fly ash particles in the hydration process at early age of curing. Three concrete mixes were prepared by partially replacing the cement by silica fume and fly ash at 5% SF & 10% FA in Mix I, 7% SF & 20% FA in Mix II and 9% SF & 30% FA in Mix III. The slump cone test was performed to check the workability and compressive strength test was conducted to determine the strength. The results show that the chemically activated fly ash concrete mix develops higher strength.*

***Key Words***: Thermal activation, Chemical activation, Silica fume (SF) and Fly ash (FA).

## 1. INTRODUCTION

Concrete is one of the most abundantly used composite construction material on this green planet, earth. Among variety of concretes available, High-Performance Concrete is the one, which is widely used, is all type of construction activities. The idea of high strength and better durability of concrete can only be achieved by reducing the porosity, in homogeneity, micro cracks and transition zones [1]. Any concrete, which develops higher strength at the early age of curing and have long lasting durability could be called as High-Performance Concrete (HPC). In order to achieve the high performance, the concrete has to be blended with such a material so that after setting concrete transforms in to a nonporous solid material. This is achieved only by incorporating the mineral admixtures. Coal Fly ash and Silica fume are the mineral admixtures produced as an industrial waste product that can be used in the concrete as a partial replacement of cement to manufacture HPC.

India is the second largest coal consumer in the world. The 70% of the total coal consumption in the country accounts for power generation [2]. As industries grow, power consumption is going to increase and results in consumption of huge quantity of coal. The ash that flew away during the combustion of coal is captured by electrostatic precipitators or other filtration equipment is termed as Fly ash. It is the solid waste produced by the industries. The fly ash has as particle size in between 0.5 μm to 300 μm and contains substantial amounts of silicon dioxide, aluminium oxide and calcium oxide. The major constituents of the fly ash help to use it as a replacement for cement. By using the fly ash in concrete manufacture will help in the solid waste management and reducing environmental impacts.

Silica Fume is the by-product resulting from reduction of quartz with coal in an electric arc furnace in the manufacture of silicon or ferrosilicon alloy. Silica Fume consists of ninety percent of silica fume with remaining portion as carbon, sulphur, oxides of aluminium, iron, calcium, magnesium, sodium and potassium. Particle size of silica fume is in between 0.1μm to 0.2μm with surface area of 30,000 $m^2/kg$ [3]. Because of its composition Silica Fume can be used as artificial pozzolanic admixture to obtain high strength of concrete. When both Fly ash and Silica Fume are used for partial replacement of cement at different percentages concrete with high early strength and long-lasting durability is obtained.

## 2. Objectives

- Activation of fly ash by means of thermal and chemical methods.
- To investigate the fresh concrete properties of high-performance concrete through workability test for different proportions of silica fume.
- To observe the influence of silica fume and activated fly ash on hardened concrete properties such as compressive strength etc. under different curing conditions.
- To arrive at optimum dosage of silica fume and fly ash in HPC.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

# PERFORMANCE AND STRENGTH EVALUATION OF CONCRETE BY USING ALCCOFINE AND SLAG SAND

**MAMATHA M K[1], CHAYA S[2]**

*[1]M. Tech Student, Dept. of Structural Engineering, NCET, Bengaluru.*
*[2]Assistant Professor, Dept. of Civil Engineering, NCET, Bengaluru.*

---

**Abstract -** *There have been enormous researches going on the use and utilization of industrial, agricultural and thermoelectric plant residues in the production of concrete. There has been increase in the consumption of mineral admixture by cement and concrete industries. This rate is expected to increase day by day. This paper presents the experimental investigation done on strength properties of concrete using "Alccofine and Slag sand". The main objective of this work is to analyze the situation and behavior of M40 grade concrete with 0.36 w/c. Here compressive strength, split tensile strength and flexural strength tests were carried out with different percentage of alccofine with cement as 2.5%, 5%, 7.5%, 10% and constant percentage of slag sand with fine aggregate as 40%. From experimental work and results it can be accomplished that the 40% is ideal percentage replacement of fine aggregate by slag sand.*

***Key Words***: Alccofine, Slag sand, Compressive strength, Split tensile strength, Flexural strength.

## 1. INTRODUCTION

For the construction of any structure, Concrete is the main material. Good strength concrete has been widely used in civil engineering structures to reduce the size of structural elements i.e. beams and columns of high rise buildings. The main ingredient to produce concrete is Portland cement. To produce 1 ton of cement, about 1.6 tons of raw materials are required and the time taken to form the lime stone is much longer than the rate at which humans use it. But the demand of concrete is increasing day by day for its ease of preparing and fabricating in all sorts of convenient shapes. So to overcome this problem, the concrete to be used should be environmental friendly.

Slag sand is a volcanic rock look alike, grayish to black colored by-product obtained during the steel manufacturing process. Thousands of tons of industrial slag sand is generated each year in India and more than 90 % of which is disposed in landfills posing a threat to our environment. Alccofine, a product of Ambuja Cements Ltd, one of the leading cement companies in the Indian cement industry; is a slag based supplementary cementations material (SCM) containing high glass content with high reactivity and ultra fineness [1].

One of the suggestions in the forefront has been the sourcing, development and use of alternative, non-conventional local construction materials including the possibility of using some agricultural wastes as construction materials. Improved quality of concrete will only perform better if concrete improves workability, durability, flow ability and resistance to chemical attack corrosion and reduce w/c ratio, heat of hydration and segregation mainly. For the fulfillment of above properties waste produced from the steel and other industries are used for effective and efficient strength and durability of concrete. There are many waste products which are generated from industries and factories, dumped openly which cause environmental problems and also spread disease. These waste products can be recycled in useful way to save the environment. In present days some waste material are used to produce efficient and effective concrete as blending material or mineral admixture. Most common and known blending materials or mineral admixture used in concrete production industries are marble powder, silica fume, fly ash, ground granulated blast furnace slag and new by product admixtures Alccofine which is glass based. This is due to the fact that recycling of industrial wastes as blending materials has technical, economical and environmental benefits. Containing mineral admixtures within pozzolanic concretes are used extensively throughout the world for their good performance and ecological and economic reason and the applications of such concretes are increasing day by day due their superior structural performance, environmental friendliness and energy conserving implications [2].

The advancement of concrete technology can reduce the usage of natural resources. They have forced to focus on recovery, recycling of natural resources and find other alternatives. The use of the replacement materials secures cost reduction, energy savings, arguably superior products, and fewer hazards in the environment.

## 2. Objectives

a. To characterize the physical properties of alccofine and slag sand.
b. To arrive at optimum mix proportions of the Concrete containing alccofine and slag sand.
c. To determine strength by adding admixtures in it.
d. To determine the compressive strength and split tensile strength and flexural strength of concrete for 7,14 and 28 days of curing.