Samarth Educational Trust's

Arvind Gavali College of Engineering

Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere.
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PROPOSAL FOR AUTONOMOUS STATUS
A.Y. 2025-26

Name of Document	Particular
Achievements of Faculty Members	List of Faculty Achievements

Annexure No. 22

Dr. Sharad S. Mulik
PRINCIPAL

ARVIND GAVALI COLLEGE OF ENGINEERING EN-6545 SATARA

SAMARTH EDUCATIONAL TRUST
ARVIND GAVALI COLLEGE OF ENGINEERING
Approved by AICTE, New Delhi, Recognized by Govt. of Maha. DTE Mumbai &
Affiliated to MSBTE Mumbai ,Dr. Babasaheb Ambedkar Technological, University Lonere
AICTE ID: 1-4210711 AISHE Code: C-11245 DTE Code: EN-6545 DBATU Code: 6545 MSBTE Code: 1617
NBA Accredited NAAC Accredited
Address : Gat No.247, At.Panmalewadi,
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Website: www.agce.edu.in

Ref. No.: AGCE/Office/2024-25/ **Date:27th Feb. 2025**

ACHIEVEMENTS OF FACULTY MEMBERS

The faculty of Arvind Gavali College of Engineering have demonstrated exceptional academic and research excellence. They have published numerous research papers, filed patents, presented at conferences, authored books, and secured external funding. These achievements showcase their expertise and dedication, enhancing the institution's reputation and research ecosystem, making it an ideal candidate for autonomous status.

Sr No	Activity	No of activities academic year wise					
		2023-24	2022-23	2021-22	2020-21	2019-20	2018-19
1	Number of Research Papers Published in Journals	17	27	08	13	11	07
2	Number of Patents Granted	05	05	02	02	01	
3	Number of Papers Published in National Conferences						
4	Number of Papers Published in International Conferences	01	50		02	34	40
5	Number of Books Authored	02		01	01		
6	Number of Book Chapters Authored		01				
7	Number of New Externally Funded Research Projects Received	31	24	25	21	16	14
8	Funds Received	5.74 Lakhs	11.26 Lakhs	4.98 Lakhs	6.98 Lakhs	4.83 Lakhs	3.10 Lakhs
9	Other Achievements	47	22	17	44	110	02
	All faculty members achievement certificates Link for reference	View	View	View	View	View	View

Note: All faculty achievements documents are attached in the respective y[illegible] link above[illegible]ble for your reference.

ARVIND GAVALI COLLEGE OF ENGINEERING EN-6545 SATARA

Achievements of Faculty Members in 2018 – 19:

https://www.agce.edu.in/files/autonomy/af/2018-2019.pdf

1. Number of Research Papers Published in Journals:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Paper
1	Dr. V. K. Bhosale	Computer Science and Engineering	Research Paper Published	Survey on Beacon-Enabled IEEE 802.15.4 MAC Mechanisms
2	Ms. V. V. Gaikwad	Electrical Engineering	Published Research paper	A Review on D-STATCOM Based Voltage Regulator for Power Quality Improvement in Low Voltage Distribution Grid
3	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Research Paper Published	Earthquake Magnitude Prediction using Neural Networks and AI [UGC CARE]
4	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Research Paper Published	Outdoor Node Localization in WSN for Industry Applications using Machine Learning [UGC CARE]
5	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Research Paper Published	Applications of Wavelets in SAR Image Analysis: An Environmental Perspective [UGC CARE]
6	Dr. V. A. Pharande	Mechanical Engineering	Research Paper Published	Performance Analysis of Waste Cooking Oil Biodiesel and its Blends [UGC CARE]
7	Dr. V. A. Pharande	Mechanical Engineering	Research Paper Published	Experimental Investigation of combined effect of thermal performance of thermosyphone heat pipe using Nano-fluid and its analysis [UGC CARE]

ARVIND GAVALI COLLEGE OF ENGINEERING EN-6545 SATARA

2. Number of Patents Granted: NIL

3. Number of Papers Published in National Conferences: NIL

4. Number of Papers Published in International Conferences:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Paper
1	Mr. H. A. Karande	Computer Science and Engineering	Presented Research Paper in ICIRTE-2018	Online Paper Checker
2	Ms. Shital Chavan	Computer Science and Engineering	Presented Research Paper in ICIRTE-2018	Shortest Distance based Location Finding
3	Dr. B. M. Nayak	Electrical Engineering	Presented Research Paper in ICIRTE-2018	Self-organizing controller for Asynchronous motor drive Speed Control
4	Ms. V. V. Gaikwad	Electrical Engineering	Presented Research Paper in ICIRTE-2018	Harmonic Mitigation and Reactive Power Compensation by Shunt Active Filter using p-q Theory
5	Ms. S. S. Jadhav	Electrical Engineering	Presented Research Paper in ICIRTE-2018	Techno-economic of Energy Production and Net Metering of Grid Connected Rooftop Photovoltaic System in Maharashtra
6	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Wireless Network Control System: Review
7	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Design of Data Logger for Quality Control of Transformer Oil Filtering
8	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Gesture Controlled Speaking Using Microcontroller
9	Mr. D. B. Jagtap	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Smart energy meter
10	Mr. D. B. Jagtap	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Car Post Crash Analysis & Emergency Rescue Alert System (Car Black Box)

11	Mr. D. B. Jagtap	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Automatic Solar Grass Cutter
12	Mr. D. B. Jagtap	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	IoT Security Threats, Attack Scenarios in data protocol: Focus in MQTT
13	Mr. V. C. Khade	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Advanced Footstep Power Generation System
14	Mr. V. C. Khade	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Home security using GSM technique
15	Mr. V. C. Khade	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	IoT Based Patient Health Monitoring System
16	Mr. R. S. Vathare	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Recent Trends, Protocol Scope for Mobile Devices and Research Challenges in Internet of Things
17	Mr. R. S. Vathare	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	IOT Based Home Automation Using Raspberry Pi
18	Mr. R. S. Vathare	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Smart vehicle with smart road side units
19	Ms. A. M. Kamble	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	IoT Based Lab Automation System Using Arduino
20	Ms. S. A. Barge	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2018	Solar Wind Hybrid System with Maximum Power Point Tracking
21	Mr. S. P. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Design And Manufacturing of Drone
22	Mr. S. P. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Robocodex
23	Mr. S. P. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	A Review on Combustion, Performance and Emission Characteristics of Diesel and Biodiesel Fuelled Engine
24	Mr. S. S. Ghadage	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Review on Increasing Heat Transfer by Using Nanofluids in Radiator
25	Mr. S. S. Ghadage	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	To Study the influence of Mexicana Biodiesel, its blends and Ethanol as Additive in Diesel

ARVIND GAWALI COLLEGE OF ENGINEERING EN-6545 SATARA

26	Mr. A. A. Kadam	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Weight Optimization of Butterfly Valve by Redesigning and FEA Analysis
27	Mr. A. A. Kadam	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Design And Development of Six Way Valve
28	Mr. A. V. Kamble	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Design and Optimization of Steering Knuckle with Integrated Spindle
29	Mr. A. V. Kamble	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Design and Development of Automatic Pneumatic Bumper for Four Wheeler
30	Mr. S. M. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Experimental Analysis of Heat Transfer Enhancement by Using Various Insertions of Twisted Tapes
31	Mr. S. M. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Design of Progressive Tool for Mounting Bracket of Fuel Tank
32	Mr. P. B. Bamankar	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Performance & Emission Analysis by Using Biodiesel & Its Blends (Chicken Fat)
33	Mr. P. B. Bamankar	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Performance Study of Electrical Discharge Machining (EDM) Process
34	Mr. P. B. Bamankar	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	An experimental study on performance characteristics Of waste cooking oil blends with diesel in a VCR engine
35	Mr. Pradeep Waghmode	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	A Review on the Thermo Acoustic Refrigeration System
36	Mr. A. S. Kulkarni	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Multi-Objective Optimization of Multi-pass Turning Parameters by Response Surface Methodology
37	Mr. M. V. Matkar	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	A Review Paper on Design and Development of Sheet Bending Machine
38	Mr. M. V. Matkar	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Review On Special Purpose Horizontal Boring Machine
39	Mr. Sandeep Jadhav	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Investigation of process parameter of laser beam [illegible]achine for ferrous and

				non-ferrous material: Review
40	Mr. K. A. Kumavat	Mechanical Engineering	Presented Research Paper in ICIRTE-2018	Study of Effect of Solid Contaminants in the Lubricant for Ball Bearings Vibration Response

5. Number of Books Authored: NIL

6. Number of Book Chapters Authored: NIL

7. Number of New Externally Funded Research Projects Received:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Project
1	Dr. A. V. Gujar	Civil Engineering	Project Sponsored by Dhumal Construction Pvt. Ltd., Satara	Performance Analysis of Bond Slip Prlationaship in R. C. C.
2	Mrs. P. H. Jagdale	Civil Engineering	Project Sponsored by J. W. Infra Pvt. Ltd., Satara	Comparison Between Manual Calculation and Staad Pro Software Calculation of Base Shear
3	Mr. A. A. Jahav	Civil Engineering	Project Sponsored by Niketan Construction Pvt. Ltd., Satara	Improving the Performance of Rural Water Supply in Maharashtra
4	Mr. Basavraj Nelogal	Electrical Engineering	Project Sponsored by	Monitoring and Controlling of Three Phase Motor by using Internet of Things
5	Ms. S. Y. Jadhav	Electrical Engineering	Project Sponsored by Siddheshwar Electricals, Satara	GPS-Based Portable Dual Axis Solar Tracking System Using Astronomical Equation
6	Ms. S. S. Jadhav	Electrical Engineering	Project Sponsored by Siddheshwar Electricals, Satara	Solar Based Automatic Pesticide Sprayer
7	Mr. H. A. Karande	Computer Science and Engineering	Project Sponsored by 3 Star IT Solutions and Services, Satara	Analysing Phishing Attack Using NLP and Machine Learning
8	Mr. H. A. Karande	Computer Science and Engineering	Project Sponsored by Inventive Infotech	Digital Library
9	Mr. P. R. Katre	Computer Science and Engineering	Project Sponsored by QLogical	ERP System for Turn Tech Automation

10	Ms. A. M. Kamble	Electronics and Telecommunication Engineering	Project Sponsored by 3 Star IT Solutions and Services	Automatic Powder Packing Machine
11	Mr. M. V. Matkar	Mechanical Engineering	Project Sponsored by J.B. Plastics & Packaging Solutions	Chiller of Thermoformig Process
12	Mr. Waghmode P. K.	Mechanical Engineering	Project Sponsored by Shree Ganesh Industries	Automatic Indexing Lift based on Geneva Mechanism
13	Mr. Kamble R. R.	Mechanical Engineering	Project Sponsored by Kavade Industries	Automation for making Jaggery Syrup with Groundnut mixing unit
14	Mr. S. R. Jadhav	Mechanical Engineering	Project Sponsored by Ajinkya Enterprises, Satara	Automatic Piston block Grinding Machine

8. Funds Received During This Academic Year:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Project
1	Dr. A. V. Gujar	Civil Engineering	Project Sponsored by Dhumal Construction Pvt. Ltd., Satara	Rs. 25,000/-
2	Mrs. P. H. Jagdale	Civil Engineering	Project Sponsored by J. W. Infra Pvt. Ltd., Satara	Rs. 30,000/-
3	Mr. A. A. Jadhav	Civil Engineering	Project Sponsored by Niketan Construction Pvt. Ltd., Satara	Rs. 20,000/-
4	Mr. Basavraj Nelogal	Electrical Engineering	Project Sponsored by	Rs. 13,000/-
5	Ms. S. Y. Jadhav	Electrical Engineering	Project Sponsored by Siddheshwar Electricals, Satara	Rs. 15,000/-
6	Ms. S. S. Jadhav	Electrical Engineering	Project Sponsored by Siddheshwar Electricals, Satara	Rs. 12,000/-
7	Mr. H. A. Karande	Computer Science and Engineering	Project Sponsored by 3 Star IT Solutions and Services, Satara	Rs. 18,000/-
8	Mr. H. A. Karande	Computer Science and Engineering	Project Sponsored by Inventive Infotech	Rs. 18,000/-
9	Mr. P. R. Katre	Computer Science and Engineering	Project Sponsored by QLogical	Rs. 20,000/-

10	Ms. A. M. Kamble	Electronics and Telecommunication Engineering	Project Sponsored by 3 Star IT Solutions and Services	Rs. 28,000/-
11	Mr. M. V. Matkar	Mechanical Engineering	Project Sponsored by J.B. Plastics & Packaging Solutions	Rs. 38,500/-
12	Mr. Waghmode P. K.	Mechanical Engineering	Project Sponsored by Shree Ganesh Industries	Rs. 24096/-
13	Mr. Kamble R. R.	Mechanical Engineering	Project Sponsored by Kavade Industries	Rs. 27,500/-
14	Mr. S. R. Jadhav	Mechanical Engineering	Project Sponsored by Ajinkya Enterprises, Satara	Rs. 21,000/-

9. Other Achievements:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Project
1	Ms. Shital Chavan	Computer Science and Engineering	Attended One Day Workshop	Attended One Day Workshop on "R"
2	Ms. Shital Chavan	Computer Science and Engineering	Completed AICTE Approved FDP	Completed AICTE Approved FDP on "Foundation Program in ICT for Education"
3	Mr. S. P. Patil	Mechanical Engineering	NPTEL Certification	NPTEL Certification for Introduction to Research

ARVIND GAVALI COLLEGE OF ENGINEERING EN-6545 SATARA

Principal
Principal
Samarth Educational Trust
Arvind Gavali College of Engineering
Panmalewadi, Satara

1. Number of Research Papers Published in Journals

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 6 (2018) pp. 3725-3737

Survey on Beacon-Enabled IEEE 802.15.4 MAC Mechanisms

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Abstract

IEEE 802.15.4 protocol is primarily designed for low rate wireless personal area network (WPAN) with low cost and low power consumption. However, the performance of IEEE 802.15.4 MAC is affected by its limitations such as there is no prioritization in the Guaranteed Time Slot (GTS) allocation procedure. Also, GTS allocations are distributed in first-come-first-serve basis. If allocated devices use GTS slot partially or traffic pattern is not suitable, the wastage of bandwidth will increase. To improve the performance of IEEE 802.15.4 MAC, it is necessary to minimize the power consumption and improve the throughput. In this paper we present the review of existing work of IEEE 802.15.4 MAC and also provide classification of beacon-enabled IEEE 802.15.4 methods based on the performance evaluation. Also, we analyze the work in terms of performance metrics like power consumption, throughput, bandwidth utilization, end-to-end delay, energy efficiency, and quality of service.

Keywords: Wireless Sensor Network (WSN), IEEE 802.15.4, Power consumption, Guaranteed Time Slot (GTS), Energy efficiency, Throughput.

INTRODUCTION

IEEE 802.15 (WPAN) [1] is primarily designed for applications that transmit data over short distances among a private group of participant devices such as PCs, PDAs, wireless printers and storage devices. WPAN requires little or no infrastructure. Wireless personal area network working group (IEEE 802.15) is classified into four task groups: WPAN/Bluetooth (IEEE 802.15.1), coexistence (IEEE 802.15.2) , WPAN high rate (IEEE 802.15.3) and WPAN low rate (IEEE 802.15.4). WPAN low rate (IEEE 802.15.4) is designed for a low data rate up to 250kbps at 2.4GHz band [2]. IEEE 802.15.4 has been deployed in industrial applications, for wireless sensor networks (WSNs) and wireless body area networks (WBANs).

The main objectives of IEEE 802.15.4 protocol are to enable a Low Rate – Wireless Personal Area Network (LR-WPAN) at low cost, with low power consumption among inexpensive devices [2]. The superframe of 802.15.4 has an active and an inactive period, controlled by two parameters – the *Superframe Order (SO)* and *Beacon Order (BO).* Within the active period, devices may transmit data during the Contention Access Period (CAP) or Contention Free Period (CFP). If BO > SO, then the *inactive period* increases. Guaranteed Time Slots (GTSs) allocated during the CFP are used for assigning dedicated time-slots to devices. The devices can use these time slots to transmit periodically generated data without competing for the channel. The number of Guaranteed Time Slots (GTSs) is limited to seven in one *superframe*. In this paper, we review literature which aims to further improve the power consumption [3], [4], throughput [5], [6] , energy efficiency[6],[7], delay [8],[9], and other performance parameters of 802.15.4. We have categorized the different approaches for improving IEEE 802.15.4 protocol according to the mechanism they use for improvement. For example, GTS allocation based schemes [10], [11] provide better GTS bandwidth utilization, improve the throughput, and decrease energy consumption.

The rest of the paper is organized as follows. We present an overview of IEEE 802.15.4 and Zigbee in the next section. Next we classify beacon-enabled IEEE 802.15.4 improvement methods and discuss their performance. After this we analyze the schemes explained in the previous section by considering the performance parameters like power consumption, throughput, bandwidth utilization, end-to-end delay, and energy efficiency. Next we discuss the limitations of the various techniques. We present our concluding remarks in the last section.

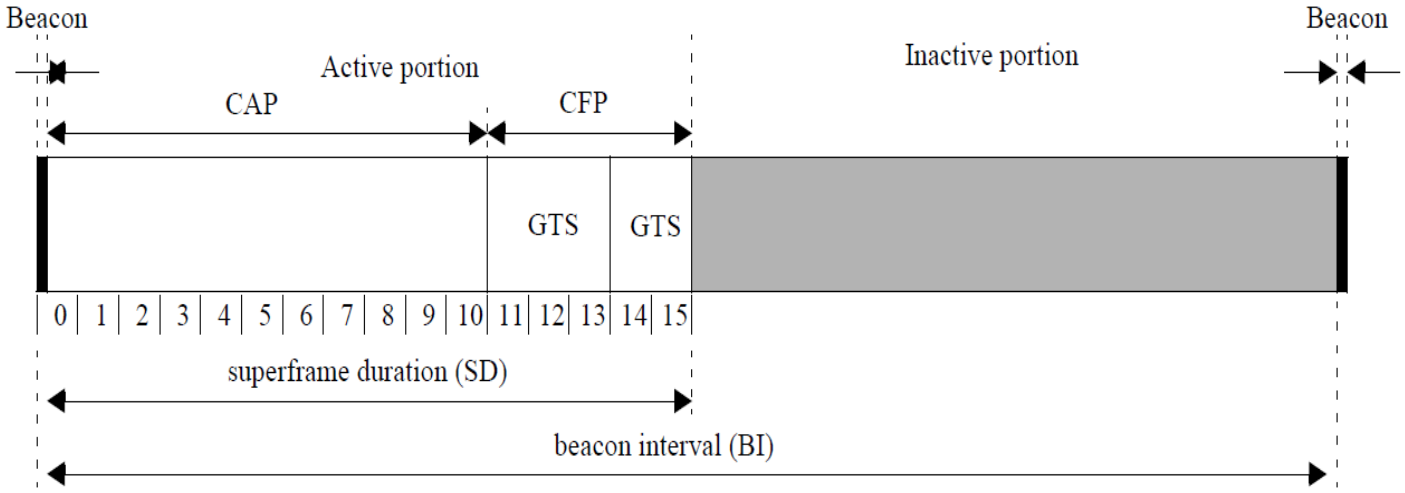

Figure 1: IEEE 802.15.4 Superframe structure

OVERVIEW OF IEEE 802.15.4

In this section we provide an overview of 802.15.4. ZigBee works closely with IEEE 802.15.4 to provide an integrated and complete solution for home automation, industrial control and medical applications. ZigBee technology is developed jointly by ZigBee alliance [12] and the IEEE 802.15.4 group. IEEE 802.15.4 defines the lower layers of the protocol stack, that is, physical layer and MAC sublayer. ZigBee defines the upper layers of the protocol stack from network to application layer.

An 802.15.4 system consists of several components. An 802.15.4 device can act as a *Full Function Device (FFD)* or *Reduced Function Device (RFD)*. FFDs can work in three different modes – as a Personal Area Network (PAN) coordinator, a coordinator, or a device. A Reduced Function Device (RFD) works as an end device and it can only communicate with other FFDs but cannot act as a coordinator. The central controller of the Personal Area Network (PAN) is called the PAN coordinator (PANC). IEEE 802.15.4 protocol uses three network topologies: *star*, *peer-to-peer* and *cluster-tree* topology [2].

In 802.15.4, the medium access is primarily contention based and uses slotted or unslotted CSMA/CA. There are two operational modes, *beacon-enabled* and *non-beacon-enabled*. The beacon-enabled mode is used when support is required for device synchronization and applications with low latency requirements. In the beacon-enabled mode, the PANC sends *beacon frames* periodically after every *Beacon Interval (BI)*. The beacons identify the PAN and help in synchronizing the devices in the PAN. Further, they describe the superframe structure. If synchronization and low latency support is not required then the non-beacon-enabled mode is used. In this paper, we have considered only beacon-enabled mode because this mode is specially suited to provide time guarantees for time sensitive applications.

Figure 1 shows the 802.15.4 MAC-protocol's superframe structure. This superframe consists of an active period (*Superframe Duration (SD)*) and an optional inactive period. The active period is divided into 16 equally sized time slots, during which data transmission is permitted [2].

The active period can be further divided into a *Contention Access Period (CAP)* and an optional *Contention Free Period (CFP)* containing Guaranteed Time Slots (GTSs). The GTSs are allotted to applications to meet application requirements of low latency. PANC allocates GTSs, using the beacon-enabled mode, to the devices that intend to transmit time critical data. The CAP uses slotted CSMA/CA. The superframe structure is defined by two parameters, the *Beacon Order (BO)* and the *Superframe Order (SO)*. BO is used to determine the interval between the beacons or *Beacon Interval (BI)*. The SO is used to determine length of the active portion of the superframe. The values of BO and SO must satisfy the relationship $0<=SO<=BO<=14$. The Beacon Interval (BI) and Superframe Duration (SD) are defined as BI = *a Base Superframe Duration* $*2^{BO}$, and *SD = a Base Superframe Duration* $* 2^{SO}$ for $0<=SO<=14$, where *a Base Superframe Duration (SD)* is the minimum length of the superframe when BO is equal to 0. The IEEE 802.15.4 standard fixes this duration to 960 symbols (1 symbol=4 bits). The duty cycle (DC) for a device is determined by SO and BO and is defined as follows -

$DC=SD/BI$. BI and SD affect the throughput, energy consumption and end-to-end data delivery delay. Smaller duty cycles reduce energy consumption of the nodes, and thus help to improve lifetime of the network, but would lead to a decrease in the network throughput. This is because by reducing duty cycle, packets generated during the inactive period have to wait in the queue for longer period [6].

Each superframe supports up to 7 GTSs. The PANC allocates GTSs to devices when they send a request, if sufficient resources are available in the current superframe. In case sufficient resources are not available, the PANC would defer the GTS allocation, for the device, to the next superframe. Each GTS may contain one or more time slots. Each device may request up to one GTS in the transmit direction and /or

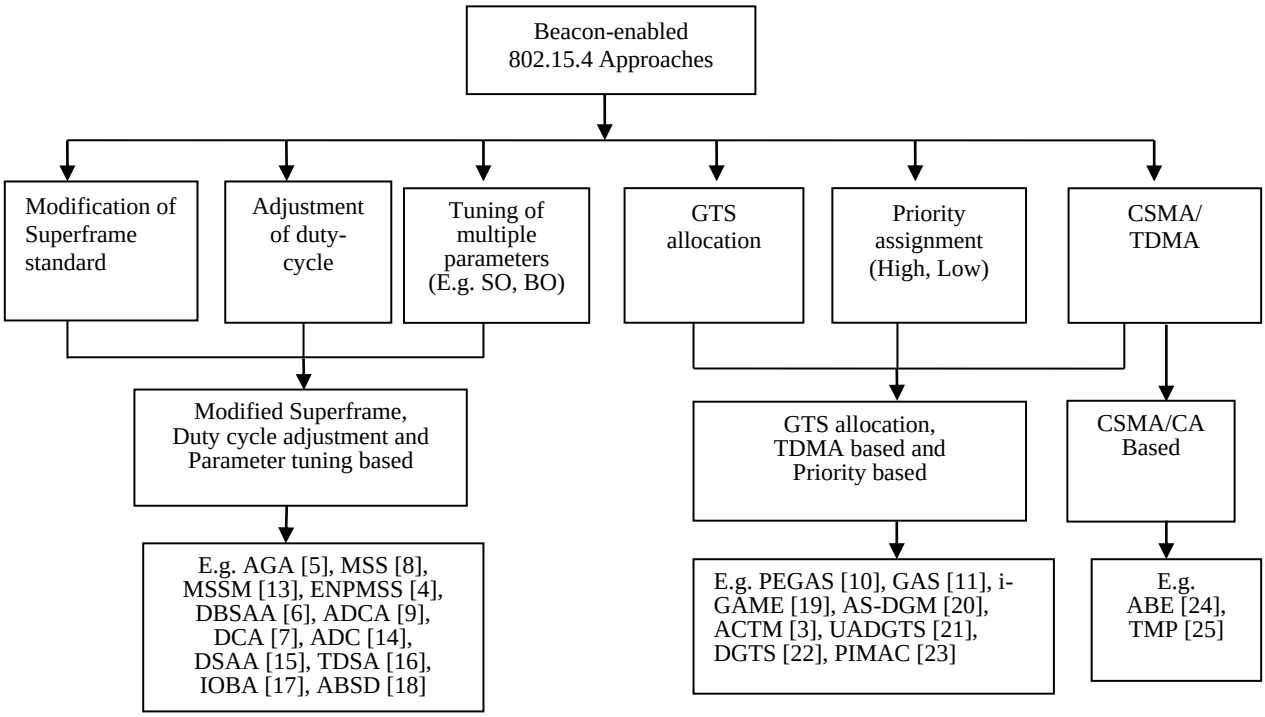

Figure 2: Beacon-enabled IEEE 802.15.4 improvement approaches

one GTS in the receive direction. In case a GTS is not allocated, the device may send the data during the CAP.

In this section, we gave an overview of IEEE 802.15.4 MAC. In the next section, we survey beacon-enabled IEEE 802.15.4 schemes aimed at throughput improvement.

Beacon-Enabled IEEE 802.15.4 Schemes

We classify the schemes which focus on throughput improvement. The schemes that we have surveyed can be categorized as follows: Modification of the standard superframe [5], [8], [13],[4], *adjustment of duty-cycle* [6],[9],[7],[14],[15], *tuning* of multiple parameters[16],[17], [18], GTS allocation[10],[11],[19],[20],

TDMA based [3], priority assignment [21],[22],[23] and CSMA/CA based [24], [25]. Figure 2 shows the classification of the schemes mentioned above.

Modification of the standard superframe is aimed at improving throughput, power consumption and delay. For example, the superframe structure is extended [5] to increase the number of GTSs by increasing the SO value which results in increase in bandwidth utilization. The scheme based on duty cycle minimizes power consumption and improves the throughput of IEEE 802.15.4 MAC protocol. Duty cycle is adjusted by varying SO and BO, that results in decreased energy consumption and power consumption and improved throughput period [6].

Tuning of multiple parameters based scheme precisely selects the values of the parameters like SO, BO, packet size and number of nodes of the IEEE 802.15.4 MAC protocol. By properly selecting SO and BO, superframe is adjusted such that it increases throughput and minimizes energy consumption. GTS allocation based schemes focus on how efficiently GTS can be allocated to the requesting nodes to improve the performance of the IEEE 802.15.4 MAC protocol [10]. CSMA and TDMA based schemes use slotted CSMA/CA and TDMA respectively for improving throughput and energy consumption. The coordinator adaptively divides CAP into slotted CSMA/CA slots and TDMA slots according to node's data queue state and level of collision detected on the network [3]. Priority based schemes assign priority to the nodes for accessing the medium. It also improves throughput and energy consumption[21].

Schemes Based on Modified Superframe, Duty Cycle Adjustment and Parameter Tuning

In this section, we combine schemes in [5],[8],[4][13], [6],[9],[7],[14],[15],[16],[17],[18] based on modification of superframe standard, duty cycle adjustment and parameter tuning because they consist of common parameters of IEEE 802.15.4 protocol such as SO, BO, GTS, SD, BI, packet size, number of nodes. The modification of superframe structure increases number of GTS, and hence results in high energy efficiency and high bandwidth utilization. These schemes have higher duty cycles and hence result in high throughput, high power consumption and low delay. These schemes provide quality of service (QoS) for time sensitive applications.

In duty-cycle based schemes, the PAN coordinator controls the duty cycle to minimize the packet drop, energy consumption and hence increases the throughput, bandwidth utilization and energy efficiency[9]. However, duty-cycle

based schemes result in high end-to-end delay due to large number of nodes transmitting data traffic. These schemes provide support for quality of service for real time applications[14]. Parameter tuning based schemes provide better performance in terms of throughput, energy consumption, power consumption and end-to-end delay by

tuning the multiple parameters like SO, BO ,SD, BI, packet size and number of nodes[17]. These schemes can dynamically adapt heavy traffic. These schemes are application specific and hence they provide good quality of service by enhancing network lifetime.

Yong-Geun *et al.* [5] have proposed the adaptive GTS allocation (AGA) scheme which supports multiple devices and ensures reduction in wastage of channel bandwidth in IEEE 802.15.4 networks. The proposed superframe structure is extended by modifying the necessary fields in beacon frame like 'Superframe Specification field', 'GTS Specification field', 'GTS Direction field', and 'GTS List field'. In this scheme, the length of one slot (SlotD) in CFP is changed according to the category of SO value given in Table 1[5].

From Table 1, the length of a slot in CFP is divided by a constant value called SlotD into seven slots. If value of SO is in the range 0 to 2, the proposed scheme acts as 802.15.4. If value of SO is greater than 3, the length of one slot in CFP is decreased according to SO value (2*(15-FinalCAPSlot)). The FinalCAPSlot shows the last slot number of CAP period. Using their proposed scheme, it is possible to allocate maximum 127 slots in CFP period and bandwidth can be assigned more accurately. After modifying IEEE 802.15.4 superframe structure and minimizing slot length in CFP period through theoretical computations, the authors have shown that their proposed scheme performs better than general IEEE 802.15.4 in terms of efficient bandwidth allocation. The bandwidth utilization is 25% high as compared to IEEE802.15.4 MAC.

Table 1: Changes of SlotD and the number of slots

Category	**The value of SO**	***SlotD_CFP/ SlotD_CAP***	**Maximum available slot numbers in CFP**
Scope 1	0~2	1	15-*FinalCAPSlot*
Scope 2	3~5	1/2	2*(15-*FinalCAPSlot)*
Scope 3	6~8	1/4	4*(15-*FinalCAPSlot)*
Scope 4	9~11	1/8	8*(15-*FinalCAPSlot)*
Scope 5	12~14	1/16	16*(15-*FinalCAPSlot)*

Pradnya Ghare *et al.*[8] have proposed modifications to the MAC superframe structure of existing 802.15.4 (MSS) in order to improve throughput, power consumption and delay. The total superframe length is adjusted by varying the beacon order ($0 \leq BO \leq 14$) and also the active portion in the superframe is adjusted by varying the superframe order ($0 \leq SO \leq 14$). In IEEE 802.15.4 MAC the total slots in the superframe is 16 and the maximum numbers of GTS slots is 7. Using superframe length, duration of the CAP and the number of GTS slots, the authors have computed the appropriate superframe order (SO). The basic idea is to find the appropriate superframe order (SO) that satisfy the requirements. The authors discover the combinations of superframe lengths and slot duration which could support the Body Area Network (BAN) applications. Authors have considered applications like ECG, EEG etc. For these applications, the total superframe length has to be less than 40ms. Their proposed scheme can support high data rate applications (up to 1 Mbps). Also, their proposed scheme may results in reduction in overhead of header since the MAC header is modified for the BAN applications. The modified MAC frame format consists of various fields like Frame Control, Sequence number, Destination (Dst.), Source (Src.). The modified fields are Dst. Address, Dst. PAN address, Src. PAN address and Src. address. The source address field (Src. address) specifies the sensor (that is placed on the body) sending the data and the source PAN address field (Src. PAN address) helps in identifying the person. Through simulations the authors have shown that the higher duty cycle results in increased throughput and reduction in delay. The modified superframe structure supports increased data rate and increased number of leads for a single BAN. Simulation results show improvement in throughput, power consumption and delay as compared to unslotted CSMA-CA mechanism. Throughput of beacon enabled 802.15.4 MAC is below 50 kbps which is lesser as compared to proposed scheme, whereas throughput of proposed scheme is above 200kbps. Their proposed scheme results in lesser power consumption (above =~1mW) and lesser end-to-end delay (=~50msec) as compared to IEEE 802.15.4 (whereas power consumption for IEEE 802.15.4, above 1.2mW and end-to-end delay is 300msec).

Muhammad Babar Rasheed et al. **[**13] have proposed the modified superframe structure of IEEE 802.15.4 based MAC (MSSM) protocol to address the problems of network lifetime and QoS requirements such as delay, energy consumption and throughput. MSSM also improves energy efficiency. The priority guaranteed CSMA/CA mechanism is used in which different priorities are assigned to body nodes by adjusting the data type and size. A wake-up radio based mechanism to control sleep and active nodes of body sensors are used in order to save energy consumption. A discrete time finite state Markov model is used to find node states. This model provides the probability of body nodes in different states along with their transition probabilities. Using this model the probability of final state could be discovered more precisely. The simulation results shows that MSSM is effective as compared to IEEE 802.15.4 protocol with respect to average energy consumption, delay, throughput, and packet drop ratio. MSSM results 40% higher throughput as compared to IEEE 802.15.4.

Z.A.Khan, et.al.[4] have presented the mechanism for handling emergency data (e.g. Electric Cardio-gram (ECG)) alongwith normal data (e.g. body temperature) and periodic data (e.g. data that a doctor needs after some regular intervals of time like video or audio data) by modifying the superframe structure (ENPMSS). CSMA/CA mechanism is used for normal traffic. Periodic traffic is transmitted through TDMA

based time slots. Access point (AP) transmits extra beacon for emergency data. The packet inter-arrival time is included to analyze the energy consumption. Both CSMA/CA and TDMA do not provide any type of emergency data handling mechanism. The type of data is differentiated on the basis of their data rates and packet sizes. Normal data, periodic data and emergency data are assigned normal priority $Data_{normal}$, $Data_{periodic}$ and $Data_{emergency}$ respectively. According to these priorities, nodes and AP take decision during resource allocation and transmission. Body nodes calculates the priority of each data on the basis of equation, Priority= DataType/$\lambda t \times P_{size}$, Where, λt is a traffic generation rate and P_{size} is the length of the data packet generated by the body node. Packet inter-arrival time is also another reason for energy consumption. If inter-arrival time is more than service time, nodes will have to wait due to limited queue size. Hence packet inter-arrival time needs to be adjusted based upon data rate and payload. To avoid queue overflow, service time should be less as compared to packet inter-arrival time. The energy consumption analysis shows that Contention Access Period (CAP) of superframe is not feasible for emergency data due to its extra delay and energy. The proposed protocol performs better as compared to 802.15.4 MAC in terms of throughput, energy consumption and end-to-end delay.

Oliveira *et al.* [6] have introduced the Duty Cycle Self-Adaptation Algorithm (DBSAA) that uses two MAC layer parameters BO and SO for network duty cycle. DBSAA provides more flexibility in duty cycle adaption for increasing the network throughput and decreasing energy consumption and end-to-end delay. DBSAA is designed for 802.15.4 network using beacon-enabled operation mode in a star topology. DBSAA assumes same data rate of all network nodes and does not consider time bound data during event reporting. Also, DBSAA estimates network load based on the number of packets received by the coordinator and number of nodes that sent packets. It is easily performed by the simple measurement made by the coordinator over last N beacon intervals. According to application requirements DBSAA uses two thresholds, the THoccupation and THcollision which describe the traffic behavior. The coordinator maintains the information like number of packets received and number of nodes that sent packets during measurement window. Using this information, the coordinator computes the superframe Occupation Ratio (OR) and Collision Ratio (CR). If OR is smaller than THoccupation, the BO and SO values are not modified. If OR is greater than THoccupation and if SO is smaller than BO, SO is increased which results in increase in packets sent since nodes get more time to send the packets. If CR is less than THcollision, the BO and SO values remains unchanged. Otherwise if SO is smaller than BO, SO is updated. The active period becomes longer and nodes will require less number of slots to send their packets which results in decrease in collisions. Through simulation results the authors have shown that the effect of SO and BO (SO<BO) is better. DBSAA performs better as compared to 802.15.4 MAC and DSAA [15] algorithm in terms of throughput, energy consumption and end-to-end delay. In DBSAA energy drops few seconds earlier (below =~1Joules) than 802.15.4 MAC and DSAA. End-to-end delay is low in DBSAA (below=~1msec) as compared to DSAA (below =~2msec) and IEEE 802.15.4 (below =~4msec).

Hadi Rasouli *et al*. [9] have proposed Adaptive Duty Cycle Algorithm (ADCA) for efficient utilization of network permitting maximum traffic demands. ADCA automatically adjust duty cycle and hence results in minimum energy consumption. ADCA is designed for WSNs using a star topology with a beacon-enabled mode. The coordinator monitors the neighboring nodes and adaptively tunes the BO, SO and BI values which results in increase in network throughput. ADCA adjusts CAP length proportional to the network traffic and ensures decrease in energy consumption and increase in network throughput. The coordinator can increase the network lifetime by appropriately adjusting the duty cycle. The coordinator controls the contention between nodes by determining the collision rates in each superframe and by setting Backoff Exponent (BE). In ADCA, the coordinator selects SO for each superframe based on idle time, throughput of CAP and queue state of nodes. The algorithm works in three cases. In first case, the idle time length is more than half of the CAP length in current superframe. Hence coordinator decrements SO by one unit and selects it as the SO for the next superframe. Due to this, CAP size for the next superframe is halved. It controls the collision rate of the nodes that occurs in each superframe. In the second case, when the idle time length is less than half of the CAP length, then coordinator compares number of received packets and number of awaiting packets during the CAP. If the awaiting packets at PAN coordinator are more than received packets then SO is increased by one. If SO=BO, coordinator decreases the BE value and nodes will be able to send their packets more contentiously and speedy. This prevents dropout of packets and decreases the delay. In case three, when the remained pending packets are less than the numPkt value based on the nodes queueState array, coordinator selects the SO of current superframe as the SO of the next superframe. The numPkt is the maximum number of sent packets in idle time based on CAP Throughput. The queueState array of a node consists of number of pending packets at the end of each cap. For selection of SO, the coordinator compares collision rate with two different thresholds, UPPER and LOWER, to increase the throughput of the network. The UPPER and LOWER thresholds are maximum and minimum of acceptable collision rates in the network. If the collision rate is more than UPPER rate, BE is needed to be increased in order to decrease the collision. If the collision rate is less than LOWER threshold, BE is decreased and contention among the nodes is increased. The coordinator send the values of SO and BE to all nodes. Through simulation results the authors have shown that with respect to energy consumption, network life time and throughput, ADCA performs better as compared to AAOD [9], DSAA [15], DCA [7], AMPE [9] and IEEE 802.15.4. In ADCA, average of per packet energy consumption decreases 50%, 34%, 34%, 31% and 45% as compared to AAOD, DSAA, DCA, AMPE and IEEE 802.15.4 respectively. In ADCA, throughput increases by 81.5%, 39.7%, 52.9%.39.9% and 78.6% as compared to AAOD, DSAA, DCA, AMPE and IEEE 802.15.4 respectively. In ADCA [9], bandwidth

utilization is 43.3% high and delay is low (below 1msec) as compared to IEEE 802.15.4.

Joseph Jeon *et al.*[7] have proposed Duty-cycle Adaption algorithm (DCA) in which coordinator controls the duty cycle by keeping BO constant and by setting SO adaptively. The PAN coordinator adapts the value of SO based on different metrics including queue size, energy consumption and data rate. Their proposed algorithm is composed of MAC status index (MSID) and a SO decision algorithm at the coordinator. Buffer occupancy and queuing delay are combined to represent MSID in 8 levels. Buffer occupancy is divided into 4 layers and queuing delay is into 3 levels. Each end device has a limited queue size, hence buffer occupancy is important parameter to prevent the packet drop. The end device enters into sleep mode which causes delay for packet transmission called sleep delay. Increase in MSID indicates that the packets are stacked and network is heavily loaded. The coordinator decides the SO value by the delivered MSID and other parameters collected during an active duration. The reserved 7^{th} to 9^{th} bits from the MAC are used for MSID field. The coordinator determines the SO using MSID, number of end devices and number of packets received. If small BO is used, inactive portion becomes small and large number of packets will be transmitted which results in increase in energy consumption. When SO value increases, the packet drop reduces. In DCA [8], the packet drop is low for the SO=0 or SO=1. Through simulation results the authors have shown that DCA controls duty cycle which results in reduction in packet drop and increase in energy efficiency. In DCA throughput is low (=~1Kbps), energy consumption is low (below=~0.2Joules) and end-to-end delay is low (above=~0.2sec) as compared to IEEE 802.15.4.

Shashwat Pathak. *et al.* [14] has investigated the energy optimization in the beacon enabled mode of IEEE 802.15.4. Adjustable duty cycle (ADC) operation is performed by setting two system parameters, Superframe Order (SO) and Beacon Order (BO). The authors have proposed a tele-cardiac patient monitoring system in which they monitored the ECG of cardiac patients. ECG signal is measured by battery operated ECG sensors placed on patient's body. All the sensors send data to a main nurse's Personal Digital Assistant (PDA) and then to Doctor's PDA for monitoring in case of emergency. For faster connection between sensors and nurse's PDA and also to connect Doctor's PDA to nurse's PDA, ZigBee is used. They have considered a typical 200m*200m hospital scenario in which the ECG sensors are connected to the FFD device called nurse's PDA. The PDA or the sink nodes are connected to a central node (Doctor's PDA) which receives all the data from the nurse's PDA. In this scenario, the parameters being varied is Superframe duty cycle which is varied by changing Superframe order (SO) and Beacon order (BO). The optimal duty cycle is carried out by varying load and packet rates. The authors analyzed the energy consumption in transmit mode, receive mode and idle mode. Simulation results show that at lower duty cycle, throughput increases. The average end-to-end delay in ECG transmission increases with increase in duty cycle. The energy consumed in transmits mode increases with increase in duty cycle. The energy consumed in receive mode is less for selected duty cycles. The lower duty cycle performance is better as compared to higher duty cycle and it can further increase the lifetime of the network. The proposed mechanism performs better as compared to 802.15.4 MAC protocol in terms of energy consumption and end-to-end delay.

Lee *et al.* [15] have introduced the dynamic superframe adjustment (DSAA) that adjusts only the SD duration by varying the SO and keeping BO fixed. During high traffic load, the insufficient active period results in decrease in transmission opportunities of devices and increase in collision. DSAA is designed to solve this problem that dynamically adjusts the duty cycle of the superframe according to the channel opportunity and collision ratio observed by the coordinator. The coordinator calculates the superframe occupation and collision rate using number of nodes, the packet length, time required to transmit a packet, number of nodes transmitting packets and number of nodes unsuccessfully transmitting packets. The coordinator compares these values to the threshold of superframe occupation and threshold of collision. Accordingly, the length of the active period for next superframe is adjusted by the coordinator. DSAA can dynamically adjust the value of the SO according to the traffic load of the network. Through simulation results the authors have shown that with respect to goodput (goodput is the rate at which useful data traverses a link), delay and power consumption, DSAA performs better as compared to the IEEE 802.15.4. In DSAA, goodput is better (above 50Kbps) as compared to ECAP [26] (above 25Kbps) and IEEE 802.15.4 (above 25Kbps). Energy consumption in DSAA is lower (below 0.004Joules) than ECAP (above 0.004Joules) and IEEE 802.15.4 (0.005Joules).

Farhad *et al*. [16] have proposed the Traffic Aware Dynamic Superframe Adaption algorithm (TDSA) that adjusts superframe through Beacon Order (BO) and Superframe Order (SO) for increasing throughput and decreasing latency and energy consumption. The algorithm has been designed for star topology in beacon enabled mode of IEEE 802.15.4 network. TDSA consider only CAP period and assume that GTS has not used. TDSA also assume that the PAN coordinator is aware about the nature of traffic delivered by different sensors and different events generated by them. Superframe adjustment refers to the adjustment of both BO and SO for selection of beacon interval and active portion within a beacon interval respectively. The PAN coordinator calculates the expected duration of the active portion based on the data rate requirement of traffic flow. The first step in TDSA is to estimate SO (SO_{Exp}) after the expiry for every BI. SO_{Exp} is the expected length of superframe duration (SD) for next beacon interval (BI). It depends on the required throughput and is calculated on the number of PAN source members and their data rates.Through simulation results the authors have shown that with respect to throughput, energy consumption, packet loss and end-to-end latency, TDSA performs better as compared to IEEE 802.15.4. Average throughput of TDSA is better (above 90kbps) as compared to AMPE (below 85kbps), AAOD (below 90kbps) and IEEE 802.15.4 (below 50kbps). Average energy consumption is low for TDSA (below 0.5%) and IEEE 802.5.4 (below 0.4%) , where as it is high for AMPE (above 0.7%) and, AAOD

(above 0.7%). The end-to-end delay of TDSA is low (below 0.3msec) as compared to IEEE 802.15.4 (above 6msec).

Bo Gao *et al*. [17] have proposed an individual beacon order adaption algorithm (IBOA) for improving performance of IEEE 802.15.4 networks. In IBOA, SO is set to constant value and BO is assigned for each node individually. The coordinator calculates beacon interval (BI) and duty cycle of each node using current value of BO. Both the beacon interval and duty cycle of each node can be changed by BO at the same time. Therefore active portions of the any two different nodes may not begin at the same time and hence reduces competition for accessing the channel. IBOA individually adapts the beacon interval and duty cycle of each node which results in reduction in power consumption, ensures end-to-end delay requirements and increase in throughput. In IOBA, power consumption is high (above 40Mw), throughput is high (above 70 packets/sec) and delay is high (above 5sec) as compared to IEEE 802.15.4.

Thien D Nguyen *et al*. [18] have presented an energy harvesting model to show effectiveness of human body motion based energy. They have proposed an adaptable duty cycle adjustment algorithm ABSD (Adaptive Beacon Order, Superframe Order and Duty cycle) to prolong a WBAN node battery lifetime. Algorithm allows us to adapt the value of duty cycle according to offered load conditions by simultaneously adjusting BO and SO values. By combining these two approaches, the authors have resolved the issue of energy efficiency in an IEEE802.15.4 WBAN under variable traffic conditions. The authors performed their experiments on OPNET as well as MATLAB for analyzing performance of data in WBAN. OPNET based discrete event model was developed to measure the performance of ABSD packet transmission technique. MATLAB model is used to compute battery lifetime by linking energy profile of WBAN nodes with energy scavenging model. Their proposed mechanism performs better in terms of energy efficiency as compared to IEEE802.15.4 protocol.

Schemes based on GTS Allocation, TDMA based and Priority Assignment

In this section we explain the schemes based on TDMA, GTS allocation and Priority assignment. In GTS allocation schemes, the coordinator allocates GTS dynamically to the requested nodes and results in high bandwidth utilization and high throughput. These schemes result in low energy consumption, low power consumption and low end-to-end delay because packet retransmission in CAP is reduced. Hence, they provide support for better quality of service for real time applications. TDMA based schemes can be mainly used for applications with bursty traffic conditions. In these schemes, the part of contention access period (CAP) is dynamically assigned to TDMA for GTS slot allocation. This increases contention free period (CFP) and more number of slots is available for GTS allocation. Therefore large number of packets can be transmitted. Hence, TDMA based schemes result in high bandwidth utilization, high throughput, low energy consumption and low end-to-end delay. In priority assignment schemes, priority is assigned to nodes for accessing the medium. These schemes result in reduction in energy consumption and increase in throughput. However, these schemes require extra power for processing. In these schemes the coordinator dynamically assigns GTS to the devices based on the priority in each superframe and hence results in high throughput and high energy efficiency. These schemes can dynamically adapt to traffic changes and result in low end-to-end delay that provides support for better quality of service for real time applications.

Harun *et al.* [10] have proposed the Partitioned GTS Allocation Scheme (PEGAS) for improving GTS bandwidth utilization, throughput, energy efficiency and latency for IEEE 802.15.4 networks. PEGAS addresses the issues of unsuitable traffic pattern and wastage of bandwidth. The main objective of PEGAS is to decide the precise time for the starting time (GTSstart), the end of the GTS(GTSend) and GTS length (GTSlength) allocation for requested devices by considering the data packet length, SO value and packet arrival rate. Coordinator calculates time of one slot duration, time to transmit one data packet, time to transmit data using packet arrival rate and number of requested slots for each GTS of IEEE 802.15.4 by each device. Coordinator calculates values of GTSend and GTSlength using PEGAS algorithm. In PEGAS, 16^{th} slot is partitioned into smaller slots forming CFP and CAP. In this, seven slots are assigned to CFP and remaining slots are assigned to CAP. The requesting nodes will get one slot out of 16^{th} slot. In case where number of nodes is greater than 7, the nodes for which GTS is not allocated, can transmit data packets in CAP period. PEGAS results in increased in CAP duration and decreased in CFP period which eventually increases bandwidth utilization. Using simulation results the authors have shown that the performance of PEGAS is better than IEEE 802.15.4, with respect to throughput, energy efficiency and latency. In PEGAS [10] power consumption is low (about 3mW), throughput is high (above 100kbps), and energy consumption is low (below 200 micro joule/packet) as compared to IEEE 802.15.4.

Shrestha *et al.* [11] have proposed GTS Allocation Scheme (GAS) for improving reliability and bandwidth utilization in wireless body area networks. It is based on optimization problem to minimize the bandwidth requirements. An optimization problem is the problem of finding the best solution from all feasible solutions. In traditional IEEE 802.15.4 MAC, GTS is allocated in first-come-first-serve basis. It results in wastage of bandwidth due to asymmetric traffic conditions of different sensor nodes. Authors have defined a priority computation method to solve this problem that depends on the packet generation rates of nodes. The nodes check their buffers contents to set their priorities. The nodes use this information with GTS allocation requests and send it to the coordinator. During CAP period, the coordinator collects all GTS requests. GTS allocation is optimized using knapsack problem. A knapsack problem is formulated to obtain optimal GTS allocation for different devices. The coordinator uses a fractional knapsack optimization problem to allocate GTSs according to priority of the nodes. Their proposed scheme performs better as compared to IEEE 802.15.4 with respect to average packet delivery ratio 0.9)

above, end to end delay (=~ 1sec) and packet discard rate (0.05).

Koubaa *et al.*[19] have proposed an implicit GTS allocation scheme (i-GAME) to improve the GTS utilization. This scheme is used to overcome the drawbacks of GTS allocation mechanism in beacon-enabled IEEE 802.15.4. In traditional IEEE 802.15.4, a single GTS is assigned to a requesting node. i-GAME scheme allows multiple nodes to share GTS in a round-robin fashion. The time slots of a shared GTS among several nodes are dynamically allocated to different nodes in each superframe according to a given schedule, which is formed by PAN coordinator. GTS allocation mechanism is based on the traffic of the requesting nodes, their delay requirements and available GTS resources. Nodes send their traffic specifications like maximum amount of bits transmitted, arrival rate and delay requirements to the PAN coordinator. The coordinator uses this information to run admission control algorithm. The algorithm computes the available GTS resources and responds accordingly. Using simulation results the authors have shown that with respect to efficient bandwidth utilization, i-GAME performs better as compared to standard GTS allocation in IEEE 802.15.4. In i-GAME, bandwidth utilization is high (about ~97%) and end-to-end-delay is low (below ~250msec) as compared to IEEE 802.15.4.

Marwa Salayma *et al.* [20] have presented two IEEE 802.15.4 TDMA based techniques namely adaptive sleep IEEE802.15.4 MAC and dynamic GTS IEEE802.15.4 MAC (AS-DGM) to improve WBAN reliability and energy efficiency. In the first technique nodes are allowed to avoid channel deep fade by distributing adaptively their sleep period during their active period according to their channel status. In the second technique, time slots are allocated to nodes dynamically according to their requirements that depend on their link's status. In adaptive sleep IEEE802.15.4 MAC, TDMA based free channel access mechanism is used in which GTS(s) are offered in the contention free period (CFP) which follows CAP(Contention Access Period) in the active period. The nodes send GTS request packets to PAN coordinator (PANc). After receiving this request, PANc acknowledges the node and offers that node a number of GTS(s) according to GTS request. After this GTS request, nodes are scheduled to access the channel. As per the schedule, the node will wake up during its GTS(s) period and try to transmit its packets. If the node fails to receive acknowledgment frame from the PANc, it indicates that its link with the PANc suffers from a deep fade. It will not perform packet retransmission and will shutdown its transceiver if the inactive period is enabled. The node will continue sleeping until the current BI finishes. The node will wake up when the current BI finishes in order to receive the next beacon frame. The other nodes will use the channel according to the schedule. In the second technique of dynamic GTS IEEE802.15.4 MAC, the time slot allocation is dynamic according to nodes' needs. In this assumption is that, WBAN consists of 5 clients/nodes. Each node is allocated 3 time slots when network is created. Those nodes that have slept adaptively during the current BI due to fading can be given extra slots in the next BI. Therefore, they can get enough time to transmit the packets that have been stored in their buffer. These extra slots can be allocated from other nodes whose links have not suffered from fading in the current BI. This technique is suitable for high traffic load networks and emergencies. The nodes having critical or emergent data should be assigned more slots than other nodes with normal data by considering fading in the channel. Their proposed dynamic GTS improves performance of nodes. It consumes much less energy as compared to adaptive sleep and traditional IEEE 802.15.4 MAC at moderate, high and very high data rates.

Gilani *et al.* [3] have proposed an adaptive CSMA/TDMA hybrid MAC (ACTM) protocol to improve throughput and the energy consumption of IEEE 802.15.4 MAC using star topology in a beacon enabled mode. Using simulation results the authors have shown that CSMA-CA does not perform well under high traffic loads. Hence, they introduced the concept of time division multiple access (TDMA) in the CAP of the superframe. The main idea is to add a dynamic TDMA period into CAP of 802.15.4 standard. The coordinator adaptively divides the CAP into slotted CSMA-CA slots and TDMA slots according to nodes' data queue state and level of collisions detected on the network. In GTS specification field, the three bits are GTS Descriptor Count (0-2), the four reserved bits (3-6) represents number of slots belonging to TDMA period. In this way upto 16 slots can be used for TDMA slots. The queue state information of the network nodes can be acquired by using reserved bits in the transmitted frames. The beacon frame GTS descriptor and reserved bits are modified to assign TDMA slots to network nodes. The coordinator assigns TDMA slots to network nodes. It resolves the two main issues of TDMA-based protocols: i) The coordination of nodes and ii) The under-utilization problem in TDMA networks in heavy traffic loads. Number of nodes that take part in the contention can be controlled using TDMA slots in the CAP which results in reduction in collisions, reduction in energy consumption of nodes and increase in throughput. The network coordinator uses greedy algorithm to determine the border between CSMA/CA and TDMA periods. Using simulation results the authors have shown that with respect to throughput, energy consumption and end-to-end delay their proposed protocol performs better as compared to 802.15.4 MAC. In their proposed schemes, throughput is 3.7 times higher, energy consumption is 38% to 70% low and delay is low (below 5sec) as compared to IEEE 802.15.4 MAC protocol.

Hyung Cho *et al.*[21] have introduced utilization-aware dynamic GTS allocation scheme (UADGTS) to improve the throughput of overall network and reduce latency for data transmission. PAN coordinator manages priority of each device. It dynamically assigns GTS to devices based on the priority in each superframe. The authors have introduced *state and utilization factor* for computing priority for each device. The utilization factor is used for calculation of priority. PAN coordinator calculates the value of the utilization factor as the ratio of the amount of data that the device can transmit to PAN coordinator during the assigned GTS in n^{th} superframe to the amount of maximum data that the device can transmit to the PAN coordinator using assigned GTS in a superframe. In every superframe, PAN coordinator dynamically allocates

GTSs to devices in descending order of their priorities that have been calculated before the starting time of the subsequent superframe. In the subsequent superframe, the top seven devices will be assigned GTSs. The state is decided according to property of GTS usage and is used for managements of priority. The PAN coordinator classifies devices based on three states namely non-GTS, GTS-occupation, and GTS-desire states and maintains states of its associated devices. For each state there are three different priority management methods. In non-GTS state, the PAN coordinator does not maintain priority for the device. In GTS-occupation state, PAN coordinator calculates the priority of the device before every starting time of a superframe. In GTS-desire state, PAN coordinator keeps priority of the device for assigning GTS. Through simulation results the authors have shown that with respect to throughput and queuing delay, their proposed scheme performs better as compared to IEEE 802.15.4. Using their scheme, throughput is higher (above =~9Kbps) than IEEE 802.15.4 (above =~6Kbps) and average waiting time is lower (below=~100sec) than IEEE 802.15.4 (above 800sec).

Tuomas Paso *et al.* [22] have introduced a novel dynamic guaranteed time slot (DGTS) allocation scheme that enables effective utilization of the GTS slots in the IEEE 802.15.4 MAC protocol. DGTS addresses the following issues of IEEE 802.15.4 MAC: the maximum number of GTSs is limited to seven in one superframe. GTS allocation without prioritization and first-come-first-serve basis. DGTS adds three additional fields: Type of Service, GTS Buffer Length and Highest Type of Service to the IEEE 802.15.4 MAC frame. The PAN coordinator maintains the list of the GTS buffer lengths of the end devices located inside the PAN. The PAN coordinator updates the list of GTS buffer length after receiving data packet using the information extracted from packet's header. The PAN coordinator checks the list before sending a beacon and executes the DGTS allocation scheme in two phases. In phase 1, the PAN coordinator allocates the GTS slots based on the GTS buffer lengths of the end devices. The end device having largest GTS buffer length is identified and then PAN coordinator calculates the number of GTS slots to be allocated to an end device. In phase 2, the PAN coordinator first checks the value of the Highest Type of Service field from the packets headers. When an end device could not get a GTS slot in phase 1, but it has a packet with a highest priority than packets of other end devices, then PAN coordinator allocates one GTS slot to that respective end device. DGTS guarantees immediate channel access to the highest priority traffic. More number of devices get GTS slot. Using simulation results the authors have shown that throughput is higher (above=~7Kbps) than IEEE 802.15.4 (above=~5Kbps) and delay is higher (above=~ 0.5 sec) than IEEE 802.15.4(above =~0.05sec).

Jardosh *et al.*[23] have introduced explicit priority based channel access mechanism (PIMAC) for beacon enable mode of 802.15.4 MAC. Their proposed mechanism categorizes the nodes as normal nodes and critical nodes. The authors define the normal nodes as the nodes which can transmit the routine information like information of environment monitoring applications and allow delay at certain extent. The authors define critical nodes as the nodes which transmit important information for example detection of monitored phenomenon such as an intruder, high temperature conditions to the coordinator, etc. The critical nodes are considered as high-priority nodes and normal nodes are considered as low-priority nodes. The coordinator includes the priority information in the primary beacon and periodically broadcasts it to all the nodes. The normal nodes are not allowed to contend for the channel during the CAP and hence results in reduction in competition for channel. Hence, using their proposed mechanism, the traffic priority is maintained by giving preference to the critical traffic over regular traffic. Simulation results show that their proposed scheme has higher packet delivery count (below=~3500) as compared to IEEE 802.15.4 (below=~2500) and energy consumption is lower (0.000015Joules) as compared to IEEE 802.15.4(0.00002Joules).

Schemes based on CSMA/CA

In this section we explain the schemes based on CSMA/CA.

Nazim Abdeddaim *et al.*[24] have proposed the model that addresses the issue of optimizing the operation of IEEE 802.15.4 networks. Their proposed model uses the Idle Sense access method for 802.11 and 802.15.4 slotted CSMA/CA using bursty nature of the traffic. By combining these two approaches the authors have formed a model of IEEE 802.15.4 and proposed Adapting contention window (ABE) mechanism. The model is validated and used to derive ABE that adjusts the contention window according to the function of active nodes and varying traffic patterns. The suitable values of SO and BO are considered for simulation. In ABE, the PAN coordinators derive the load of access channel and distribute the values of contention window to the associated devices. Using simulation results, the authors have shown that ABE results in high throughput (above 16Kbps), high packet delivery ratio (0.85) and low end-to-end delay (below 2sec) as compared to standard IEEE 802.15.4 MAC.

Muhammad Sajjad Akbar *et al.* [25] have proposed a tele-medicine protocol (TMP) under IEEE 802.15.4 slotted CSMA/CA with beacon enabled mode for remote patient monitoring systems. TMP combines two optimizations methods namely MAC layer parameter tunning optimization and duty cycle optimization. Their approach consists of three steps. In the first step, network traffic and its transmission time are estimated by considering a network with six to ten biomedical sensor nodes. The idea is to estimate the total required time for the transmission of data of 100kbps. This time is considered to set the superframe duration. In the second step, the channel access and collision probabilities are calculated. End-to-end delay is computed for the slotted CSMA/CA to make TMP protocol reliable with limited latency. It also considers a reasonable reliability in terms of retransmission and channel access attempts. The energy consumption of a node depends on the selection of the duty cycle value. In the third step, the optimized duty cycle value is calculated by considering the superframe duration value of the system. The assumed that the value of the CFP is zero that means CAP represents the complete active period. Authors

have used the MAC layer parameter optimization approach for tunning the MAC layer parameter according to delay and reliability needs of remote patient monitoring systems. The authors compute multiple combinations of performance parameters, backoff exponent (BE) macCSMABackoff and macMaxFrameRetries for slotted CSMA/CA that can fulfill the requirements of medical applications in terms of limited delay(less than 250ms) and reasonable reliability. In TMP delay is reduced by 91%, 87%, 75%, 78%, and 63% compared to AAOD [25], AMPE [25], ADCA [7], DSAA [10], DCA [8] and IEEE 802.15.4 respectively. TMP provides better performance for energy consumption (2.3 Joules/sec) as compared to other protocols.

In this section we have discussed classification of Beacon-Enabled IEEE 802.15.4 schemes based on their performance evaluation. In the next section we present the analysis of the schemes discussed in section 3.

Analysis of Beacon-Enabled IEEE 802.15.4 Schemes

In this section, we provide the analysis of the beacon-enabled IEEE 802.15.4 schemes using various parameters like power consumption, bandwidth utilization, throughput, energy efficiency, end-to-end delay and Quality of Service (QoS). Table 2 shows the analysis of schemes discussed in section 3.

Below Table 2 shows comparison of various beacon enabled schemes of 802.15.4 with 802.15.4 MAC protocol.

Table 2: Comparative analysis of the existing beacon-enabled IEEE 802.15.4 schemes with IEEE 802.15.4 protocol

Mechanism	Power consumption	Bandwidth utilization	Throughput	Energy Consumption	End-to-End delay	Applications
AGA [5]	High	25% high	High	Low	Low	Medical treatment like ECG & EEG.
MSS [8]	Low above=~1mW	High High	High, more than 200 Kbps	Low Low	Low below =~50 msec	Medical purpose e.g. ECG and EEG.
MSSM [13]	High	High	40% High	High	High	Medical treatment
ENPMS [4]	Low	High	High	High	Low	Handling normal, periodic data.and emergency data
DBSAA [6]	Low	High	High upto =~ 250Kbps	Low below =~Joules	Low below =~1 msec	Smart homes & environmental monitoring
ADCA [9]	Low	43.3% High	78.6% High	Low decreases to 45%	Low below =~1 msec	Highly variable traffic conditions
DCA [7]	Low	Low	Low =~1Kbps	Low below =~Joules	Low above =~0.2 sec	Variable network traffic load
ADC [14]	High	High	Low	Low	High	Wireless telemonitoring scenario of cardiac patients
DSAA [15]	Low =~31.3mW	High	NA	Smaller above =~0.004Joules	Low above =~400msec	Networks having high traffic load
TDSA [16]	High	High	High above =~90 Kbps	Low above =~0.% Joules	Low below =~0.3 sec	Variable traffic load
IOBA [17]	High above =~ 40mW	High	High above =~70 packets/sec	NA	High above =~5sec	Low power WSN applications
ABSD [18]	High	Low	NA	Low	Low	Patient monitoring in WBAN
PEGAS [10]	Low =~ 3.0mW	High	High above =~100Kbps	Low below =~200 microjoule/packet	NA	Real time applications

Table 2 Continued…

Mechanism	Power consumption	Bandwidth utilization	Throughput	Energy Consumption	End-to-End delay	Applications
GAS [11]	Low	High	High	NA	=~ 1sec	Data collection in a WBAN sensor networks
i-GAME [19]	Low	High about =~97%	NA	NA	Low below =~250 ms	Real time applications
AS-DGM [20]	Low	High	NA	Low	High	WBAN for E-Health systems
ACTM [3]	High	High	2.3 times High	Low	Low	Real time applications
UADGTS [21]	High	High	High =~ above 9Kbps	NA	Low=~ below 100sec	Variable traffic conditions
DGTS [22]	Low	High	High=~ above 7Kbps	NA	High above=~ 0.5sec	Biomedical sensor applications
PIMAC [23]	Low	High	NA	Low below 0.000015 Joules	Low	Mission critical applications
ABE [24]	Low	High	High above =~16Kbps	NA	Low below=~ 2 sec	Networks with bursty traffic conditions
TMP [25]	Low	High	High	Low	Low	Remote monitoring of medical field

DISCUSSION AND FUTURE WORK

In this section we discuss the limitations of Beacon-Enabled IEEE 802.15.4 mechanisms.

In the modification of Superframe standard schemes in [5],[8],[4][13] the authors have used SO, BO and GTS parameters. The PAN coordinator needs to modify original superframe structure by fine-tuning values of parameters such as SO, BO and GTS. For e.g. the superframe length is adjusted by varying the beacon order ($0 \leq BO \leq 14$) and the active portion in the superframe is increased by varying the superframe order ($0 \leq SO \leq 14$) [8]. In the future work, by using proper design of experiments methods and fine-tuning the parameters of IEEE 802.15.4, accurate parameter values can be determined.

The PAN coordinator needs to perform extra task of processing and analysis due to heavy traffic. For e.g. in DSAA[15]and TDSA[17] as the traffic conditions increases it causes a burden on the PAN coordinator for processing and analysis. In the future work, the algorithms in DSAA[15]and TDSA[17] needs to be modified for multimedia applications. This is because in multimedia applications there is very high load on PAN coordinator.

In GTS allocation schemes [10], [11], [19], [20], there is no proper allocations of GTS. For e.g. in PEGAS [10], the authors have considered SO, GTS and data packet length parameters. PAN coordinator does not use prioritization concept in the GTS allocation procedure. Therefore GTS allocation is not done properly. In the future work, this scheme needs to be designed with fair bandwidth allocation and hence proper utilization of GTS.

In priority based schemes UADGTS [21], DGTS[22] and IEEE 802.15.4 [23], the authors have considered GTS and the number of nodes. In these schemes the PAN coordinator computes priorities of the nodes. This results in processing overhead on PAN coordinator. In the future, a simplified algorithm for scheduling of GTS will reduce the overhead on PAN coordinator.

CONCLUSIONS

In this paper we have provided the classification and discussion of Beacon-Enabled IEEE 802.15.4 methods based on their performance evaluation. We have classified the schemes based on modification of superframe standard, duty-cycle based, tuning the parameters based, GTS allocation scheme based, CSMA/TDMA based and priority based. Also, we have analyzed the performance of these schemes by taking into account the performance metrics like power consumption, throughput, bandwidth utilization, end-to-end delay, energy efficiency and quality of service. The GTS allocation based schemes, priority-based schemes and CSMA/TDMA based schemes provide better quality of service. This is because in GTS allocation based schemes the number of GTS allocations is increased upto 127 slots. These schemes can be used for time sensitive applications. The priority-based schemes assign

priority to the important information for example detection of monitored phenomenon such as an intruder, over regular information like information of environment monitoring applications. The CSMA/TDMA based schemes dynamically assigns the part of contention access period to TDMA for GTS slot allocation. These schemes increase the throughput and reduce the energy consumption of IEEE 802.15.4 MAC. These schemes are suitable for heavy traffic loads using TDMA. Further investigations are needed to improve the performance of IEEE 802.15.4 protocol, by way of GTS priority, scheduling algorithms, appropriate design of experiments for determining correct parameter setting.

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Earthquake Magnitude Prediction using Neural Networks and AI

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***Abstract*:**
The earthquake is one of the most devastating natural disasters that mankind has ever faced; it strikes without warning and causes massive devastation. These earthquakes have a huge impact on millions of people and a lot of property. It is clear that some efforts must be performed in order to be adequately prepared for these earthquakes. For a long time, people have used odd animal behaviour to predict when an earthquake would occur. Many people believe that animals have the ability to detect when an earthquake or tragedy is about to occur, however, this is not a reliable approach to anticipate earthquakes. As a result, in this work, the strong deep learning technique is used. We have taken a step forward in our work by forecasting earthquake magnitude and depth using recent deep learning algorithms such as LSTM and a combination of LSTM-RNN to comprehend the relationship between time-series and earthquakes and generate predictions based on that understanding. We proposed our final model using a combination of LSTM and RNN model, which has the highest accuracy score of 93.8% and also provided a comparative analysis of how it performs in comparison to other Machine Learning Algorithms to predict Magnitude and Depth.

***Keywords*: Earthquake Prediction, Neural Networks, Magnitude, Depth, Time Series Data, LSTM, RNN**

I. INRODUCTION

With 19 major earthquakes, three of which were more than 8.0 magnitude, 2021 was the most seismically active year since 2007. There were a total of 2,476 fatalities, the vast majority of which occurred in Haiti. There were fatalities every month of the year. June had the fewest earthquakes, while August was the most active and deadly. As a result, earthquake forecasting is more critical than ever.

Earthquakes are spatially and temporally linked due to the movement of the crust. As a result, earthquake prediction for a certain location should be based not just on past data from that location, but also on data from a wider area.[1]

There are numerous projects currently underway to prevent such incidents. Some of them make use of weather data, while others make use of satellite imagery, and so on. As the saying goes, "History Repeats Itself," and one of the best ways to predict future earthquakes is to use historical earthquake data.

Several experiments have shown that the method is effective. Because computers are better at making calculations to detect patterns in data, Machine Learning techniques such as Neural Networks are being used to detect earthquakes. To perform these tasks, various types of neural networks such as RNN, LSTM, and other regression models are used.

II. RELATED WORK

Research work in [1], consists of two case studies using one-dimensional and two-dimensional inputs. Accuracy achieved is 63% and 86% on a dataset from USGS 2006-2016 from the targeted area.

A recurrent part employs LSTM to account for time dependencies between earthquakes, and a convolutional part uses convolutional learning to account for spatial dependencies in the Deep NN

model reported in [2]. Based on historical earthquake data from Japan, their model forecasts the events of an earthquake in a span of 10,50 days from an instant where mg>5, losing 2.09103 earthquakes out of 3.11103 and producing 192103 false alarms.

The research given in [3] makes use of a dataset from the USGS NEIC to predict big earthquakes (Magnitude 5.0 or greater). The RBF neural network correctly predicts major earthquakes 92% of the time. With an accuracy of 8%, the BP neural network forecasts major earthquakes. RBF outperforms BP when it comes to predicting major earthquakes.

In [4] the research region's earthquake catalogue from 2000 to 2010 with a Richter magnitude (ML) of 5 and a depth of 300 km was utilised as training data to develop an initial earthquake Richter magnitude (ML) prediction backpropagation neural network (first IEMPBPNN) model with two hidden layers.

The technique provided in [5] uses a BP neural network and an improved PSO (IPSO) algorithm to predict earthquake magnitude from coastal seismic data. The earthquake prediction modelling is built using the BP neural network. The IPSO technique is used to optimise the BP neural network's parameters.

Using a decades dataset earthquake catalogue wher ML=5, depth=300 km and the research published in [6] an IEMPBPNN with couple of hidden layers was considered initially. An EEMPBPNN was developed without the 2000–2010 earthquake catalogue by using the 1990–1999 and 2011–2014 earthquake catalogues as training data (ML = 5, depth 5 300 km), as well as the IEMPBPNN's final weights and biases as initial inputs. The EEMPBPNN lowered its inaccuracy in predicting the ML. Each of the hidden layers contained ten neurons. The ML was predicted using the 2000–2010 catalogue as the outside test and the 2011–2014 catalogue as the interior test by the EEMPBPNN based on the low SDV, MSE, and high correlation coefficients. The ML prediction was highly accurate.

[7] offers a new earthquake magnitude prediction approach based on the composition of a known system whose behavior is dictated by observations from more than two decades of seismic activity and is modelled as a time series using Machine Learning, especially an LSTM cell-based network architecture. The model has a training error of 0.002 and a prediction error of 0.003.

An ANN model has been built in the work presented in [8] to predict earthquakes on seismic dataset obtained from catalogue of Indonesian agency for Meteorological, Climatological, and Geophysics (BMKG) of 1910 to 2017.

[9] Presents a Back-Propagation Neural Network approach using the architectural pattern 3-2-1. The earthquake data used in this study was gathered in Indonesia. The BPNN output value is chosen to determine or predict the likelihood of the next earthquake. The precise results of output value training or testing aid in determining the pattern of point seismic motion.

The technique presented in [10] uses a Back Propagation Algorithm to forecast future earthquake activity in the Himalayas (BPA). The Artificial Neural Network (ANN) is being developed. The Himalayan region and Nepal are expected to see an increase in the number of earthquakes with a maximum magnitude of MW6.5.

[11] The testing accuracy is 81.2 percent for 117 seismic locations, 95 of them forecasted as "earthquake," and 22 of which are incorrectly projected as "non-earthquake." The testing accuracy for 57.7 is 106 non-seismic locations, 45 of them are forecasted as "earthquake" and 61 of which are predicted as "non-earthquake." It proves to be a relatively good prediction in earthquake areas, but an unfavourable prediction in non-seismic areas. The overall accuracy is approximately 69.96%.

Eight machine learning algorithms were tested in work presented in [12], for their ability to differentiate between negative and positive major earthquake events. The research was conducted on a dataset gathered from a California centre that had been collecting inputs for 36 years. Each ML technique produces results that differ from one another. KNN, Random Forest, and MLP perform good by producing the fewest false outputs (FP), whereas SVM, KNN, MLP, and Random Forest correctly classify the greatest number of outputs.

[13] uses a historical dataset acquired from earthquakes in Japan. With the CatBoost Algorithm, the model has a ROC AUC of 0.975 and a PR AUC of 0.0890, whereas without it, the ROC AUC and PR AUC are 0.992 and 0.00911, respectively. The authors believe that historical data can aid in the prediction of three earthquake parameters: occurrence time, epicentre location,

and magnitude of future earthquakes. The model gives more accurate results in locations with more seismic data. In low-seismicity zones, it may not yield reliable findings.

In [14], an ANN model was built to forecast earthquakes five days after an earthquake in a given cluster. For the magnitude threshold of 6 ML, the proposed model performed better. The proposed ANN outperformed all other ANN models when compared to them. As a result, the authors found that the peculiarities of a region's seismic data can lead to distinct ANN models, as well as varied cutoff selections.

III. METHODOLOGY

1. A. DATA COLLECTION

The earthquake dataset has been fetched from the United States Geological Survey(USGS). The dataset contains the characteristics of earthquakes like latitude, longitude, magnitude, depth, date and time of occurrence, recording earth observatory details, the distance of the observatory from the epicenter of the earthquake etc. The data contains a list of earthquakes that occurred from January 2010 to December 2020 with more than 200,000 rows.

Date	Time	Latitude	Longitude	Type	Depth	Magnitude
01-02-1965	13:44:18	19.246	145.616	Earthquake	131.6	6
01-04-1965	11:29:49	1.863	127.352	Earthquake	80	5.8
01-05-1965	18:05:58	-20.579	-173.972	Earthquake	20	6.2
01-08-1965	18:49:43	-59.076	-23.557	Earthquake	15	5.8
01-09-1965	13:32:50	11.938	126.427	Earthquake	15	5.8
01-10-1965	13:36:32	-13.405	166.629	Earthquake	35	6.7
01-12-1965	13:32:25	27.357	87.867	Earthquake	20	5.9
01/15/1965	23:17:42	-13.309	166.212	Earthquake	35	6
01/16/1965	11:32:37	-56.452	-27.043	Earthquake	95	6
01/17/1965	10:43:17	-24.563	178.487	Earthquake	565	5.8
01/17/1965	20:57:41	-6.807	108.988	Earthquake	227.9	5.9
01/24/1965	00:11:17	-2.608	125.952	Earthquake	20	8.2
01/29/1965	09:35:30	54.636	161.703	Earthquake	55	5.5
02-01-1965	05:27:06	-18.697	-177.864	Earthquake	482.9	5.6
02-02-1965	15:56:51	37.523	73.251	Earthquake	15	6
02-04-1965	03:25:00	-51.84	139.741	Earthquake	10	6.1
02-04-1965	05:01:22	51.251	178.715	Earthquake	30.3	8.7

Fig. 1. Dataset

2. B. DATA PREPROCESSING

The data processing step consists of the cleaning of the dataset. We need to eliminate unnecessary redundancy in the data like Null values. The data is visualised using appropriate data visualization tools in order to perform feature extraction on the dataset.

The useful features obtained thus are taken to the next step. Also, the time and date columns in the data could be merged into the timestamp column by converting it into a machine-readable epoch timestamp.

3. C. DATA NORMALISATION

The extracted features from the dataset further need to be normalised. The data contains several features like timestamp, latitude, longitude, magnitude, depth which have various ranges which make the model tend to overfit. To avoid this, we could normalise the dataset between 0-1 or -1 to +1 range, which will impact the model training speed and accuracy as well.

D. DATA VISUALISATION

We used the basemaps to plot all previous earthquakes on the world map to gain insight into which areas are more prone to earthquakes. The blue dots that you see on this graph are the coordinates where past earthquakes occurred. You can see that there are blue dots over the ocean area as well. This is because earthquakes occurred on the sea bed as well. The visualised data is

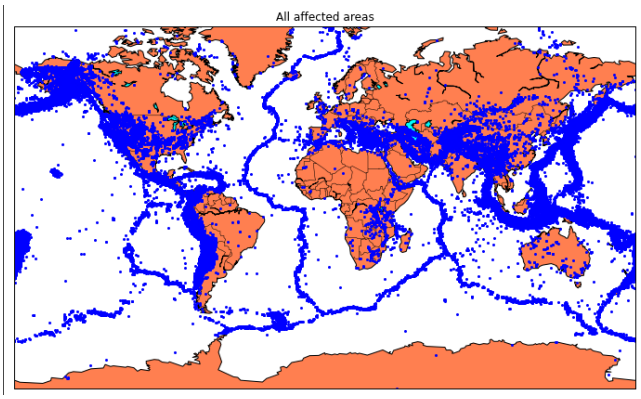

Fig. 2. Plotted data

4. E. MODELLING

Training a machine learning algorithm to predict labels from features or reveal hidden patterns and apply them to real-world problems is the job of modelling.

F. ALGORITHMS

To determine which method is most suited for earthquake magnitude and depth prediction, a list of machine learning algorithms and Deep Neural Networks were employed. Tables 2 and 3 provide the list of algorithms and their results.

The Neural Network model utilised is made up of three hidden layers, with 16, 16, and 2 neurons respectively. In the hidden layers, the Relu activation function is utilised because it introduces non-linearity to the model and may therefore easily back-propagate mistakes. Furthermore, due to

simpler mathematical processes, Relu is less computationally expensive than Sigmoid and Tan-h activation functions. The SGD and Adadelta functions are used as the optimization functions due to their efficiency.

G. EXPERIMENTAL SETUP

Parameter	Quantity
Epochs	50
Batch size	100
Total iterations	50000
Activation Function	Relu
Optimizers	SGD/ADAM

Table 1: Hyper parameters of the system

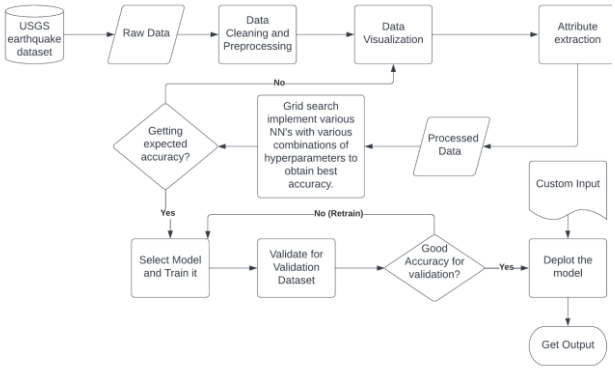

Fig. 3. Block Diagram of Proposed System

H. MODEL EVALUATION AND TRAINING

Checking if the model is ready for deployment is a crucial part of the process. For all of the models we used for comparison analysis, we used GridSearch to discover the optimal parameters..

The tools used for the methodology are:

1. Data Handling and Preprocessing is done with NumPy, Pandas, and Matplotlib.
2. Basemaps for visualisation.
3. Sklearn, Tensorflow are used for classification of models and model evaluation.
4. We have used react js for frontend , flask for backend and deployed our model on Heroku. The Web App is displayed in Fig 4.

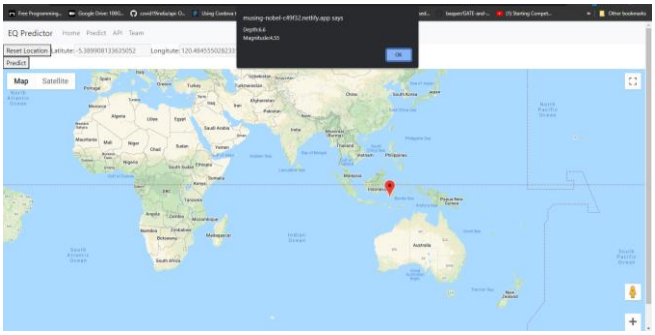

Fig. 4. Web App

IV. RESULT AND ANALYSIS

MODEL	ACCURACY	RMSE
Linear reg	88.3%	0.09
Decision tree	89.5%	0.15
Polynomial reg	90.11%	0.11

Table 2: Prediction Accuracies of Machine Learning Algorithms

Table 2 shows the linear regression result and model comparison. Accuracy is expressed as a percentage and is expressed in r2,rmse.

RMSE stands for root mean square error. It measures how outspread these outliers are. In simple words, they tells us how much data is clustered closely around the line of best fit.

$$\textbf{RMSE} = \sqrt{\overline{(\boldsymbol{f}-\boldsymbol{o})^2}}$$

Where:

- f = forecasts (expected values or unknown results),
- o = observed values (known results).

The coefficient of determination, often known as the R2 score, is used to assess the effectiveness of a linear regression model.

R^2= 1- $\frac{SS_{res}}{SS_{tot}}$

Where,

SSres is the sum of squares of the residual errors.

SStot is the total sum of the errors.

The table 2 shows that polynomial regression performs well in terms of accuracy but fails in terms of RMSE. This issue occurred in other models as well where accuracy is high but RMSE score lies below 0.2. This is because both groups have a lot of overlapping values, making it impossible to distinguish between them, and still false positive values surpass true negative values, it won't make a difference because true positives are way more in amount. Because such an efficient model does not fit the real applications of earthquake prediction, it cannot be applied.

MODEL	TRAINING ACCURACY	TESTING ACCURACY	DROPOUT
LSTM_RNN	91.3	93.8	0.2
LSTM_RNN	91.1	90.5	0.3
LSTM	90.5	93	0.2
LSTM	92.5	90.4	0.3

Table 3: Prediction Accuracies with Neural Networks

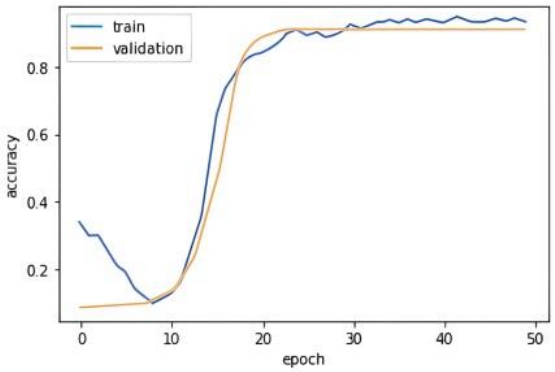

Fig. 5. Training and Validation graph of LSTM plus RNN model

The result and model comparison for NN is given in Table 3.

Units in a neural network that are inactive or dormant (both hidden and exposed) are called "dropouts.".

$E_R = \frac{1}{2}(t - \sum_{i=1}^{n} p_i w_i I_i)^2 + \sum_{i=1}^{n} p_i(1 - p_i) w_i^2 I_i^2$

Training and Testing accuracy is given in terms of training, testing, dropout. From the table, it can be inferred that with low dropout training and testing accuracy are both high but testing accuracy coming more than training shows the model is overfitted and 30%,70% splitting was used as it is getting accuracy of unknown values which should be right theoretically but as we increase dropout and changing split to 50-50 and testing with different dataset we get less accuracy and testing accuracy comes below training which makes the prediction practically possible. Using the NN model makes prediction more efficient than a linear regression model as well as using a boosting technique with it.

V. CONCLUSION AND FUTURE SCOPE

The financial and life losses due to natural calamities like earthquakes, Tsunami and landslides are increasing day to day due to urbanization. Where there hasn't been more population density, the losses were less due to more empty places.

From our research work, it is clear that the LSTM is a good

model for time series data, which is the type of our dataset. Along with that, combining LSTM and RNN together achieves better accuracy.

Future scope of this research work is as follows. Predicting more characteristics of an earthquake like type, impact, destruction caused etc. We can have a tie-up with nearby seismic stations to get the latest data on earthquakes to increase the accuracy of the model. We can add a feature where an API call would be made to get the latest updates of upcoming earthquakes and we can notify our users with the help of push notifications.

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Outdoor Node Localization in WSN for Industry Applications using Machine Learning.

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Abstract: Information of accurate node location is one of the crucial and imperative elements of monitoring data in wireless sensor networks (WSNs). DV-Hop (Distance-Vector Hop) localization algorithm, as a commonly used range-free localization scheme for outdoor industry application, is of practical importance to improve its localization performance. To achieve global optimization, a DV-Hop algorithm based on cyclotomic method together with weighted normalization, also known as CMWN-DV-Hop, is proposed in this paper for any industry application. Hence, the segmentation and weighting factor are introduced and normalized. The effects of various factors on this algorithm are tested, and the data showed that CMWN-DV-Hop has significantly superior performance in various aspects than DV-Hop, CS-DV-Hop, NSGA-II-DV-Hop, and BFO-GSO-DV-Hop. Simultaneously, CMWN-DV-Hop is reliable, practical, and stable.

Keywords: Wireless Sensor Networks (WSN), Cyclotomic Method, Node Localization, DV-Hop Algorithm

1. Introduction

Wireless Sensor Networks (WSN) is an emerging technology and have attracted worldwide interest in research and industries, because of having a large number of applications in various areas such as surveillance, habitat and environmental monitoring, military applications, healthcare, structural monitoring and disaster management (Gui et al., 2020, Kuila et al., 2014]. As a new type of information acquisition system, wireless sensor network has the superiority in high flexibility, fault tolerance, self-control, and rapid deployment. A fundamental and hot topic in WSNs is localization. In recent years, many domestic and foreign scholars have done numerous explorations and studies, which particularly, and as a multitude of relevant algorithms from the literature have been submitted (Zhong et al., 2007, Shang et al., 2003). These algorithms are clearly categorized into two types (Strumberger et al., 2015) range-free and range-based location. Among all these algorithms, a small number of nodes, referred to as anchor nodes, incorporate a GPS module and are configured for discriminating their position (Han et al., 2020). Utilizing these anchor nodes, the remaining unknown nodes can be reckoned. Range-free localization algorithms have low hardware requirements for nodes and are more suitable for large-scale sensor networks, e.g., MSP (Zhong et al., 2007), MDS-MAP (Shang et al., 2003), APIT (Huang et al., 2003), DV-Hop (Niculescu et al. 2003), and so on. Fig. 1 shows the application of WSN localization in transport industry.

Fig. 1. WSN applications in transport industry

DV-Hop location algorithm was proposed by Niculescu et al. 2003. It is a location method of WSNs that directly measures the distance among nodes without additional hardware equipment (Zhang et al., 2016). In terms of implementation, DV-Hop location algorithm only relies on the connectivity of the whole network, so the implementation of DV-Hop location algorithm is relatively simple and the cost of establishing the network is low. However, cumulative errors occur in the hop size estimation stage, resulting in large errors between the expected and actual distances between the known node (a node whose own position is known) and the target node. In the location stage, there is also a certain error between the actual position and the expected position of the target node.

In DV-Hop location algorithm, swarm intelligence optimization algorithm is usually used to reduce the location error of target nodes. Nowadays, swarm intelligence algorithms are commonly used in DV-Hop localization algorithms to optimize algorithms to reduce the target node location error, classical swarm intelligence algorithms such as particle swarm optimization algorithm, genetic algorithm, ant colony optimization algorithm, grey wolf optimization algorithm, bacterial foraging optimization algorithm, and some novel optimization algorithms proposed in recent years, such as the sparrow search algorithm, the squirrel search algorithm, and the butterfly optimization algorithm. Particle swarm optimization is a common algorithm used by researchers to optimize DV-Hop location algorithm. Cai et al., 2018 by adjusting a few particle parameters and extending the target node to the selected known node, the objective function of particle swarm optimization algorithm is established to provide better location accuracy in resource-constrained environment through iteration. However, the increase of parameters will lead to the complexity of operation and increase the complexity of the algorithm. Chen et al., 2013 first found the feasibility region of each target node and determined the initial position velocity of the particle in the feasibility region. Secondly, update the particles in the estimation of particle fitness function. Finally, the optimal position of target nodes can be determined after the iteration is completed by setting the number of iterations. Wang et al., 2019 used the PSO algorithm to further correct the proposed two-dimensional hyperbolic algorithm to determine the location of target nodes. Firstly, find out the survival area of each target node, determine the initial position and velocity of the particles in the feasible area; secondly, estimate the fitness of each particle; and finally obtain the optimal solution through iteration, which is the optimal position of the target node. However, this algorithm does not optimize the PSO algorithm, which will result in slow convergence, the algorithm is easy to fall into a local optimum during the solution process, and the algorithm complexity and space complexity will also increase.

An elaborated DV-Hop based on cyclotomic method together with weighted normalization (CMWN-DV-Hop) is explicitly proposed, in this paper.

The specific organization of the article is as follows. Basic DV-Hop algorithm and some modified DV-Hop algorithms are presented in Section II. In Section III, general overview of DV-Hop algorithm is presented. Section IV introduces the theory of CMWN-DV-Hop, and Section V covers simulation, curve analysis, and capacity evaluation. Section VI draws the conclusions.

2. Related Works

In recent years, a host of scholars conducted in-depth and detailed research on DV-Hop algorithm (Niculescu et al. 2003, Kumar et al. 2013). Diverse improvement schemes were proposed to the ranging errors of the original algorithm, and better progress was achieved.

Considering the uneven distribution of nodes, many scholars optimized phases 1 and 2 of DV-Hop. For example, the literature (Li et al., 2020) optimized the minimum number of hops by increasing *R* and setting two communication radii. A hybrid detection algorithm (HMCS-D) based on anchor quantization of jump count and modified cuckoo searches was proposed in the literature (Yu et al., 2019). The algorithm applied a correcting factor to compensate for the hop count, thus reducing the error caused by incorrectly documenting the minimum hop-count value. Since the localization algorithm ignored packet conflicts (Cui et al., 2019). A MAC-based broadcasting strategy that is protocol sequential was proposed in the literature (Gui et al., 2019).

There are numerous improvements to DV-Hop, focusing predominantly on its Phase 3 improvements (Messous et al., 2019). The IR-DV-Hop proposed a reciprocal location-based in model and utilized polynomial approximation to optimally determine the average hop distance between anchor nodes (Zhou et al., 2019). Recently, as intelligent computing (Cui et al. 2017), it has shown excellent performance on a variety of challenging optimization issues. For instance, an upgraded DV-Hop improvement algorithm based on bacterial foraging optimization was proposed in the literature (Zhou et al., 2019), and the algorithm was a bionic intelligent parallel search algorithm (Qiang et al., 2020). Proposed mechanism has preponderant real-time than DV-Hop. Considering the balance of energy consumption, a hybrid chaotic strategy firefly swarm optimization algorithm based on chaotic variation and chaotic inertia weight update was proposed in the literature (Song et al., 2019).

MC-GSO was employed instead of least squares in the algorithm. Literature (Zhou et al., 2019, Song et al., 2019) detailed the algorithm based on BFO-GSO. A coupled scheme in the light of bacterial foraging algorithm and firefly swarm optimization algorithm was chosen for this improved algorithm. This scheme had tremendous convergence velocity, BFO local retrieval capability. It was well known that localization algorithms for WSNs ought to be mindful of viable application scenarios. For certain complex deployment environments, such as indoor environment coal mine tunnels, canyon terrain, and lake terrain (Farjow et al., 2015), their corresponding node topologies, new characteristic factors need to be considered. Consequently, a multi-objective DV-Hop hinged on NSGA-II was previously proposed in the literature (Wang et al., 2019). Moreover, detailed simulations and evaluations were performed within four application contexts. Various localization methods are used in many industries for efficient operations. Fig. 2 shows the application of WSN localization in industry, where mobile cell antenna acts as sink node and used to receive the signals from various waspmote GPRS node.

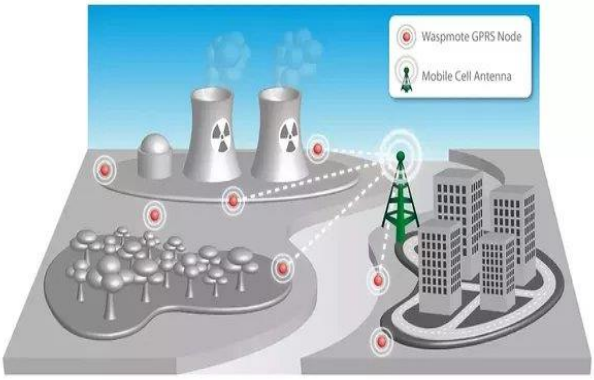


Fig. 2. Localization application in industry

3. Distance Vector Hop Algorithm in Industry Applications

DV-Hop has a similarity to the distance vector procedure in primitively traditional network. Overall, DV-Hop algorithm is divided into three stages. Firstly, the minimum number of hops between the unknown node and the anchor node are calculated (Yu et al., 2012). Secondly, the estimated distance is obtained by

calculating the product of the minimum amount of hops and the average distance per hop (Prashar et al., 2018). And finally, the specific coordinate of the unknown node is calculated based on the triagonal localization mechanism or the great likelihood appraisal method (Yi et al., 2017). The three stages are described in detail below.

First of all, the minimum of hops is determined between the unknown node and each anchor node. The anchor node floods its own information to the neighboring nodes, which includes the whereabouts information of the anchor node and the initial hop count 0 (Liu et al., 2014). Upon receiving a packet of the anchor node, the neighbor node attaches a hop value to the packet (Cao et al., 2019). The hop count value of a folder stored in any node represents the minimum hop count value that occurs between that node and the underlying anchor node (Huang et al., 2021). The packet broadcast by the anchor node is propagated through the network one by one in approximately concentric circles, as shown in Fig. 2.

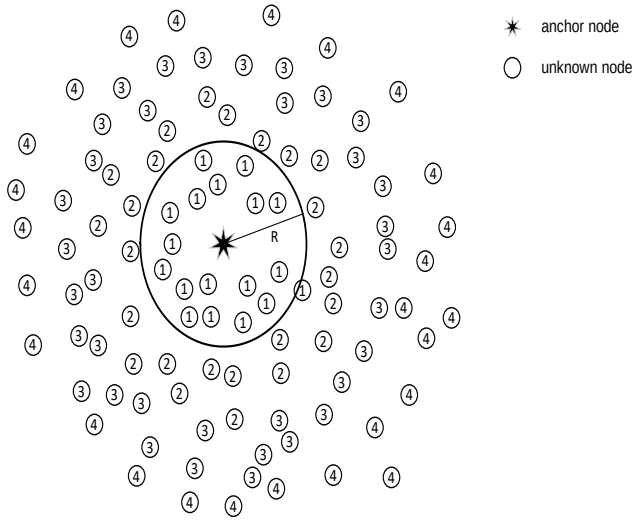


Fig. 3. Propagation process of anchor node broadcast group

Secondly, Accurate and speedy estimation of the factual distance of anchor nodes with respect to unknown nodes. Consequently, given the total number of jumps recorded and the coordinates of the locations of the other anchor nodes, we estimate the average valid distance per jump utilizing Eq. (1).

$$Hopsize_i = \frac{\sum_{i \neq j} \left\| X_i - X_j \right\|_2}{\sum_{i \neq j} Hop_{ij}} \quad (1)$$

where $X_i = [x_i, y_i]^T$, x_i and y_i are the horizontal and vertical coordinates of anchor node, individually. Hop_{ij} is the hop count for the respectively shortest path of anchor nodes i and j (Mehrabi et al., 2020). Subsequently, while the anchor node broadcasts the calculated average distance, each unknown node stores merely the initial average distance it received. In the network with numerous nodes or a wide node deployment, the amount of unnecessary communication between nodes can be reduced by setting time to live for the packets. Consequently, the distance from anchor node i to the unknown node is more precisely obtained (Wang et al., 2019)

$$d_i = h_i \times Hopsize_i \quad (2)$$

where h_i is the minimally hopped number to anchor node i at which d_i is the distance.

Finally, the trilateral localization method or multilateral localization method is an essential mechanism to acquire the fully locational information in more detail. The diagram of the multi-edge positioning method is legibly illustrated in Fig. 4.

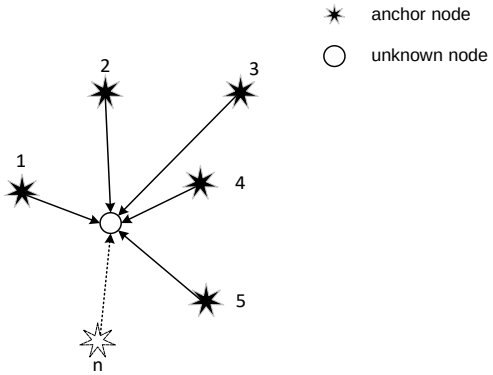


Fig. 4. Multi-edge positioning method diagram

3. Cyclotomic Method: Proposed Technique

The cyclotomic method was first proposed by mathematician Hui Liu, which divides a circle by its inner polygon and utilizes the circumference of the polygon approximately to get the circumference of the circle. The intuitive

presentation in Fig. 5. The unit circle is divided into a square, a pentagon, a hexagon, an octagon, and a decagon. The segmentation factors are 4, 5, 6, 8, and 10, respectively. It can be observed that the larger the segmentation factor is, the closer the circumference of the polygon is to the circumference of the unit circle.

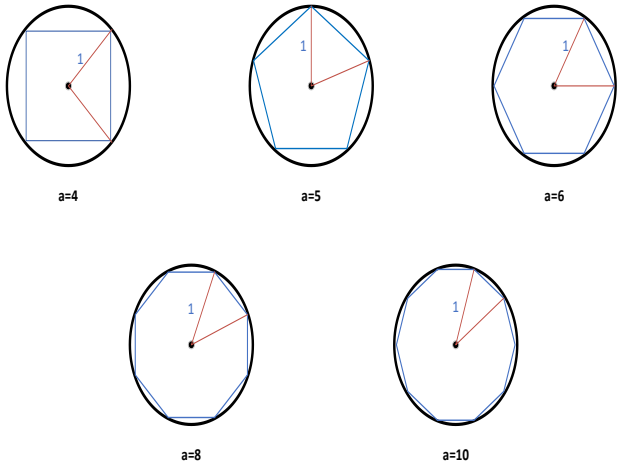


Fig. 5. Cyclotomic method (with unit circle as an example)

We use the cyclotomic method to partition the hop value in the interval [0,1] with the segmentation factor. In this way, the hop numbers between nodes are refined and the overall accuracy is improved.

The segmentation factor is introduced based on the cyclotomic method, and diverse segmentation factors divide the unknown nodes into different groups. For example, when the segmentation factor is 8, the communication range is divided into A ~ H in Fig. 6. Area A is that which the anchor node can receive within a communicative radius used of 0.125R. The hop count of this area node is recorded as 0.125 when making a broadcast. Area B refers to the range where the anchor node can receive packet information when it broadcasts within a communicative radii used of 0.25R. The hop value of unknown nodes in this geographic region is recorded as 0.25; C ~ H and so forth. Based on the round-cutting technique to split the hop count, recording to the minimum number of jumps will make the subsequent calculation of the actual jump distance more accurate and the positioning accuracy will be improved.

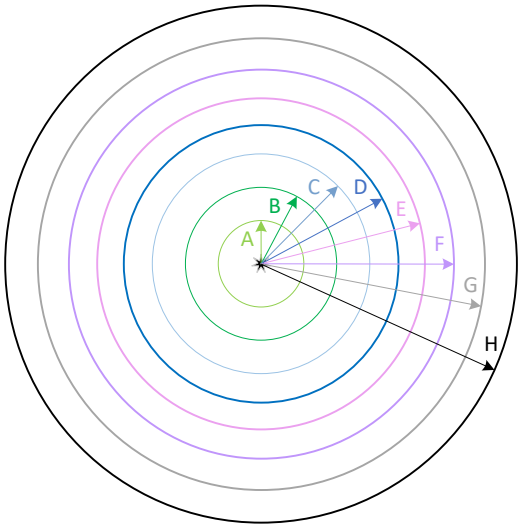


Fig. 6. Schematic diagram of the communication range when the splitting factor a=8

5. Simulation Results

In this section, we selected the square two-dimensional area as the node deployment environment and conducted simulation experiments on MATLAB R2020b. In order to have the relevant performance tested, the following algorithms have been compared.

- DV-Hop
- CS-DV-Hop
- NSGA-II-DV-Hop
- BFO-GSO-DV-Hop
- CMWN-DV-Hop

Considering different deployment environments of wireless sensor networks, experiments were carried out with three factors as variables. Nodes are randomized within a square area, so each set of simulation experiments is run 100 times. The parameter settings for the simulation experiment are given in Table 1. Fig. 7 shows the network deployment diagram with 100 nodes randomly distributed.

Table1. Simulation Parameters

Parameter	Value
Nodes Distribution	Random
Network Size	100*100
Number of Nodes	100
Anchor Node Ratio	20%
Segmentation Factor (a)	2,4,6,10

Communication Radius (R)	25

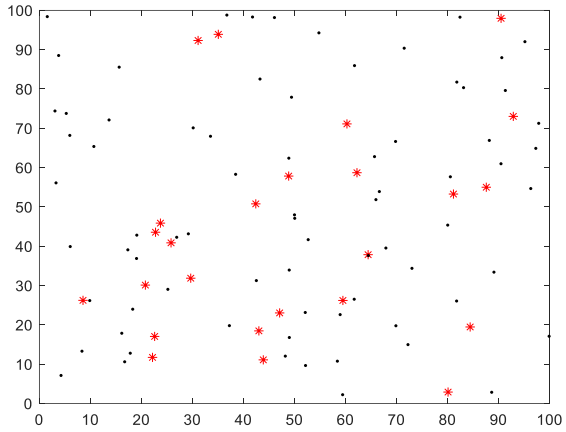


Fig. 7. Schematic of random node deployment

The simulation experiments are conducted based on two evaluations metrics. The first one is the localization error, and the other one is the average localization error. The specific calculation equations are shown below.

$$Localization\ error = \frac{\sum_{i=1}^{N_u} error_i}{N_u} \quad (3)$$

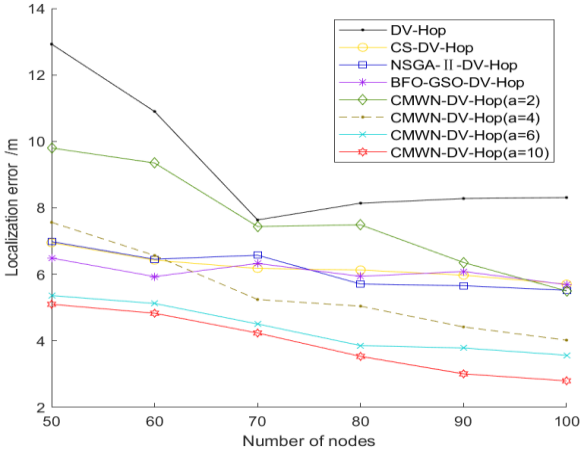
$$Average\ localization\ error = \frac{\sum_{i=1}^{N_u} error_i}{N_u \square R} \times 100\% \quad (4)$$

Where, $error_i = \left\| X_i - X_{i0} \right\|_2$, R indicates the radius of communication. the total count of unknown nodes is represented visually by N_u. The estimated coordinate of node i are $X_i = [x_i, y_i]^T$. $X_{i0} = [x_{i0}, y_{i0}]^T$ denotes the virtual position of unknown node i.

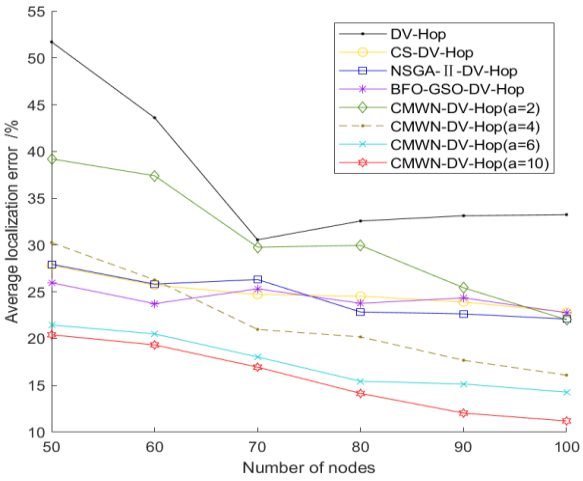
5.1 Effect of amount of nodes

We test the above five algorithms in the case of varying the nodes. R is 25 m and the ratio of anchor nodes is 20% and. Variation of the amount of network nodes from 50 to 100. A comparison of the localization error and the average localization error of five algorithms in Fig. 8.

It can be plainly revealed from Fig. 8 that the localization error and the average localization error show an overall decreasing curve when the nodes are increased. Along with the increase of segmentation factor, the localization error of CMWN-DV-Hop progressively decreases. When the nodes are the same, CMWN-DV-Hop (a = 2) is slightly inferior to the three algorithms including CS-DV-Hop, but evidently outmatches DV-Hop. The two types of errors of CMWN-DV-Hop always reach the lowest when the segmentation factor is 6 and 10, regardless of the number of nodes. Fig. 8 illustrates that CMWN-DV-Hop (a = 2,4,6,10) demonstrates the greatest reduction in mean positioning error by 29.8405%, 56.4544%, 63.6962%, and 68.8126%, in comparison with DV-Hop, respectively.



(a) Localization error



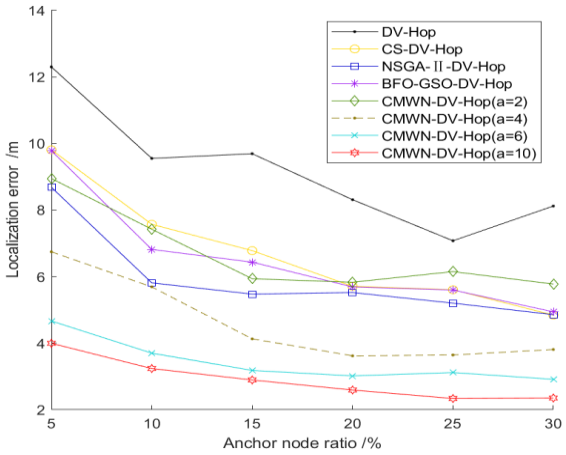
(b) Average localization error

Fig. 8. Comparison of various localization algorithms with different number of nodes.

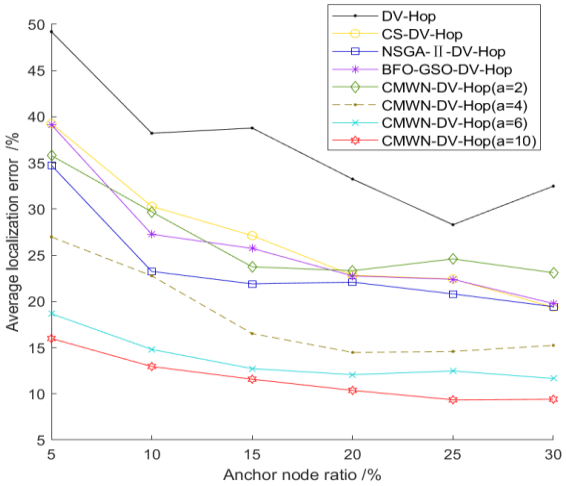
5.2 Effect of anchor node ratio

Test the above localization algorithm with varying ratios of anchor nodes. R is 25 m and the number of nodes is 100. It varies between 5% and 30% for anchor nodes. The curve variations of the two kinds of errors for each

algorithm are plotted in Fig. 9.



(a) Localization error



(b) Average localization error

Fig. 9. Comparison of various localization algorithms with different anchor node ratio.

The two categories of errors for each algorithm, as a whole, follow a decreasing trend as the proportion of anchor nodes increases. The average localization error decreases significantly and gradually with increasing segmentation factor, when CMWN-DV-Hop is utilized. When the anchor node ratios are the same, the performance of CMWN-DV-Hop (a = 2) is comparable to CS-DV-Hop and BFO-GSO-DV-Hop, while significantly superior to DV-Hop. The two categories of errors of CMWN-DV-Hop always reach the lowest when the segmentation factor is 4, 6, and 10, regardless of the anchor node ratio. CMWN-DV-Hop (a = 2,4,6,10) has a maximum reduction in average localization error of 38.7579%, 57.3950%, 67.1837%, and 70.1403%, respectively, in comparison with DV-Hop, when the anchor node ratio varies.

6. Conclusions

In this paper, a localization algorithm is conceptualized derived from the cyclotomic method and weighted normalization, called CMWN-DV-Hop. In the algorithm error sources of each stage of the original DV-Hop is fully considered, and the corresponding improvements are made for the purpose of global optimization. We introduce the segmentation factor based on cyclotomic method. Various effects of amount of sensor nodes have been analysed in the paper to see the influence on the localization accuracy of the DV-Hop localization algorithm. The various localization performances of CMWN-DV-Hop ($a \geq 4$) are significantly superior to those of DV-Hop, as well as CS-DV-Hop, NSGA-II-DV-Hop, and BFO-GSO-DV-Hop. In particular, CMWN-DV-Hop is slightly less sensitized to these three factors and is more suitable for large-scale networks with reliability, practicality, and stability.

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APPLICATIONS OF WAVELETS IN SAR IMAGE ANALYSIS: AN ENVIRONMENTAL PERSPECTIVE

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ABSTRACT

Our research "Applications of Wavelets in SAR image analysis: An environmental perspective " is aimed at investigating an alternative to the conventional roughness characterization. In the main study, damage features from ceramic surface morphology are extracted and evaluated using wavelet methods, as well as damage features from surface contours are extracted and evaluated quantitatively using damage rate and damage mean spacing. A fractal dimension calculation method that was suitable for calculating the ceramic surface was chosen by comparing several fractal dimension calculation techniques, and the fractal method was then employed to characterize the ceramic surface topography as a whole. It is discovered that the vibrational method is more appropriate for calculating the fractal dimension of ceramic surfaces after comparing various methods and further verifying them with measured three-dimensional morphology. The accuracy of the calculation is also investigated, and the results demonstrate the method's reliability. A mathematical model of surface wear and surface sealing was developed based on the fractal theory. A deeper investigation of the model reveals that surfaces with large fractal dimensions have strong sealing properties, whereas surfaces with the best fractal dimensions are the most wear-resistant. The complexity of the surface profile as a whole may be described using the fractal approach.

Keywords: Applications, Wavelets, SAR, image, analysis, environmental, perspective.

I. INTRODUCTION

Ceramics are exceedingly challenging to machine because of their extreme hardness and fragility, as well as their low heat conductivity and wear resistance. Currently, grinding using diamond tools (mostly grinding wheels) is the primary method used to process ceramics [1]. The geometric structure of these rough surfaces is closely connected to numerous surface aspects, such as the following: The treated surface often exhibits textural qualities related to the processing method in addition to broken, scratched, cracked, and other damage. In the mechanical industry, the surface shape processing features have an impact on transmission accuracy as well as the overall system of contact stiffness, contact strength, friction, and wear. Have a significant impact. For example, in the electronics industry, the silicon wafer surface roughness has an increasing impact on the thin film capacitance and thin film resistance in the integrated circuit, affecting the performance and yield of the entire integrated circuit device; in the biomedical manufacturing industry, the surface morphology of artificial joints and other artificial organs will directly affect the flexibility and life of the joints; in the aero spinning industry, the surface roughness of the artificial joints and other artificial organs has an increasing impact.

Additionally, ceramic materials are typically used in high temperature, high pressure, high speed, and heavy load applications, necessitating extremely excellent surface quality. To enhance the surface quality and functionality of machined components, it is crucial to accurately define the surface morphology of ceramics [3].

Wavelet Analysis-Based Texture Analysis of Ceramic Surface Images

In order to estimate and identify edges at various scales, the wavelet transform's local and multiresolution analytic capabilities are superior [11]. It can suppress noise at large scales, pinpoint edges at tiny scales, and smooth the noise while still maintaining the image's edges. Define the two-dimensional smoothing function, use its first-order partial derivatives in the horizontal and vertical directions as the two fundamental wavelets of the image transform, and then define the convolution of the scaling wavelets of the fundamental wavelets in the two directions with the image as the horizontal and vertical components of the wavelet transform, respectively.

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The fundamental difference between the Fourier transform and the wavelet transform is that the fundamental function of the Fourier transform is unique, but the fundamental function of the wavelet transform is not. Using multiple wavelet basis functions to evaluate the same problem will yield different findings because different wavelet bases have varied time-frequency properties. Finding a wavelet foundation appropriate for assessing the ceramic grinding process' surface contour is thus closely tied to the precision of damage extraction. The choosing of wavelets is unclear and challenging due to the diversity of wavelet bases.

Previous researchers have used the trial selection method, which is very blind and time-consuming, and the results are not always reliable. In this paper, the wavelet mathematical properties are combined with the characteristics of ceramic surface contour signals to find the best wavelet basis.

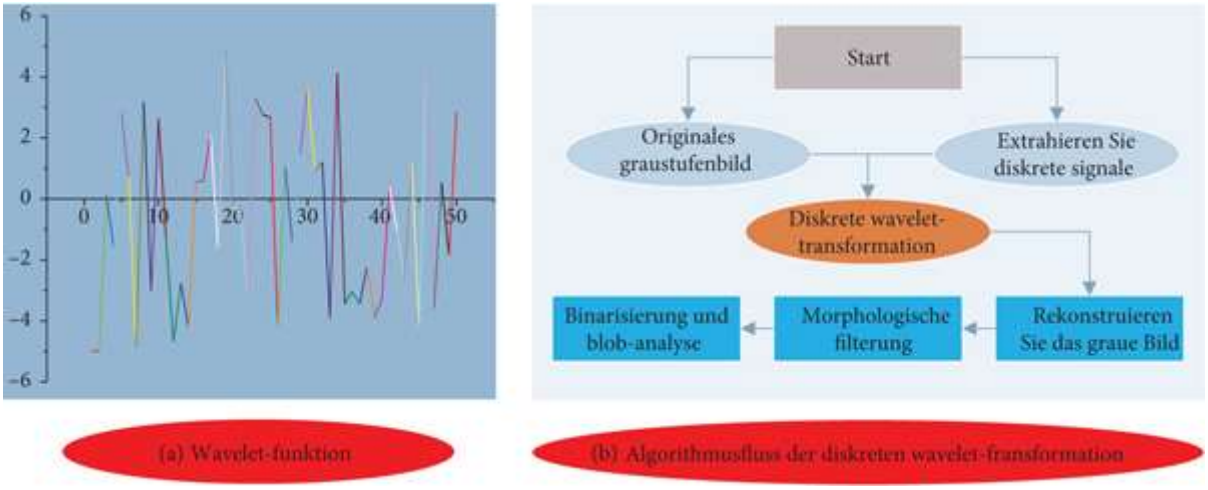

Figure 1 : Wavelet analysis algorithm flow

Ceramic Surface Image Texture Feature Analysis System Design

The Talysurf-i120 profiler serves as the hardware component of the ceramic surface measurement and processing system. The software component is an algorithm based on wavelet and fractal theories that is integrated with a visual interface with the aid of the Matlab GUI module, enabling the evaluation of the machined surface topography while lowering evaluation complexity and enhancing evaluation effectiveness. This lessens complexity and boosts assessment efficiency. Following is a synopsis of the full measuring and assessment process: Prepare ceramic samples, then use a Talysurf-i120 profiler to measure their surface and Tallyman to output the raw profile data. Talysurf's built-in post-processing program, Gold, is used to (i) analyze and process the exported data, (iii) determine the evaluation parameters, and (iv) assess the surface profile using the determined evaluation parameters. The resulting evaluation parameters may be utilized to guide the machining process and forecast the performance of the ceramic grinding surface, allowing for the optimization of the machining process. The overall structure is depicted in Figure 2(a), and by further refining the general structure diagram, the system framework for the surface measuring system indicated in Figure 2(b) may be achieved.

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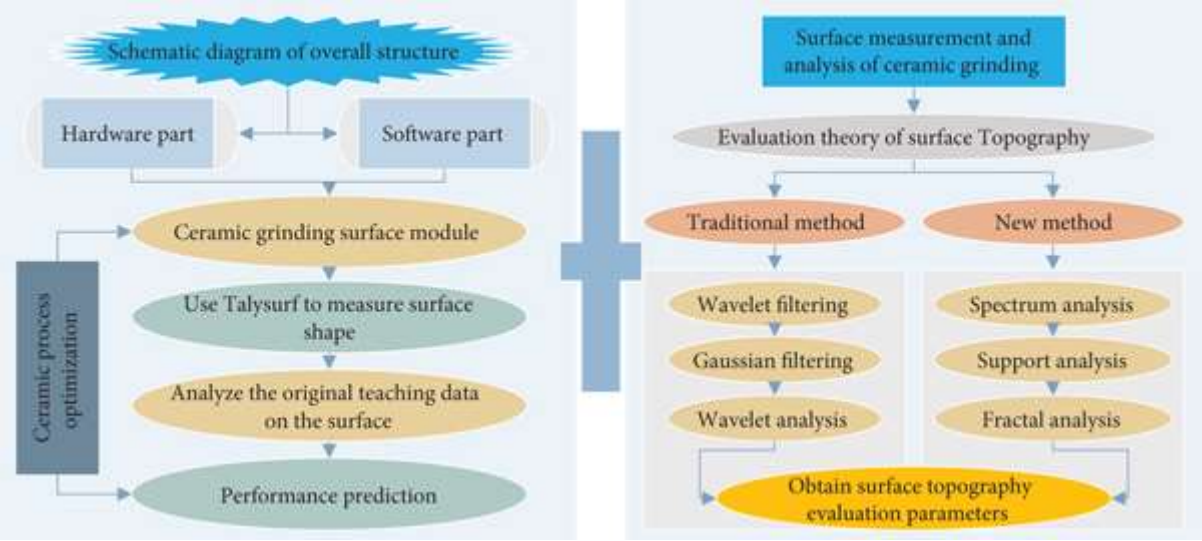

Figure 2 : Schematic diagram of the general structure and the system framework of the surface measurement system

In this research, a software system based on wavelet analysis for image recognition of ceramic surface image textures is created in order to perform automatic image texture detection on ceramic surfaces and to expand the detection to other image textures in the future. The software interface is created using Qt, while the image processing and identification algorithms are created using the C++ language and Visual Studio development environment. The development of the software system is based on the concept of modules, and each interactive module, including the interface dialog box and algorithm module, is independent from the others. Pulling and dragging may be used to combine the necessary image processing operators with additional picture capture and communication modules to create the image texture analysis project.

II. ANALYSIS OF RESULTS

The experiments on the wavelet analysis-based crack detection method and the LDGV-based detection method, respectively, used four feature combinations, including feature combinations 2, 5, 11, and 12. Figure 3 displays the algorithm runtimes for these four feature combinations. The outcomes of the experiment are examined. First, it can be said that the LDGV approach outperforms the wavelet method in the end-face identification of the magnetic ring. The LDGV approach outperforms the wavelet method in identifying various fractures. The two vary mostly in the subdivision index of TP, and the LDGV method has a lower leakage detection rate.

The greater leak identification rate of the wavelet approach shows that the fixed wavelet function's adaptability to changing cracks is weak, and the wavelet function may be adjusted adaptively according to the particular image to increase the wavelet method's recognition rate. Second, the wavelet approach and the LDGV method respond differently to grayscale characteristics. Grayscale features do not significantly affect the recognition rate for the wavelet method, but they significantly lower it for the LDGV method. This suggests that the grayscale features are not suitable for the LDGV method because they tend to confuse the crack features and interference features extracted by LDGV.

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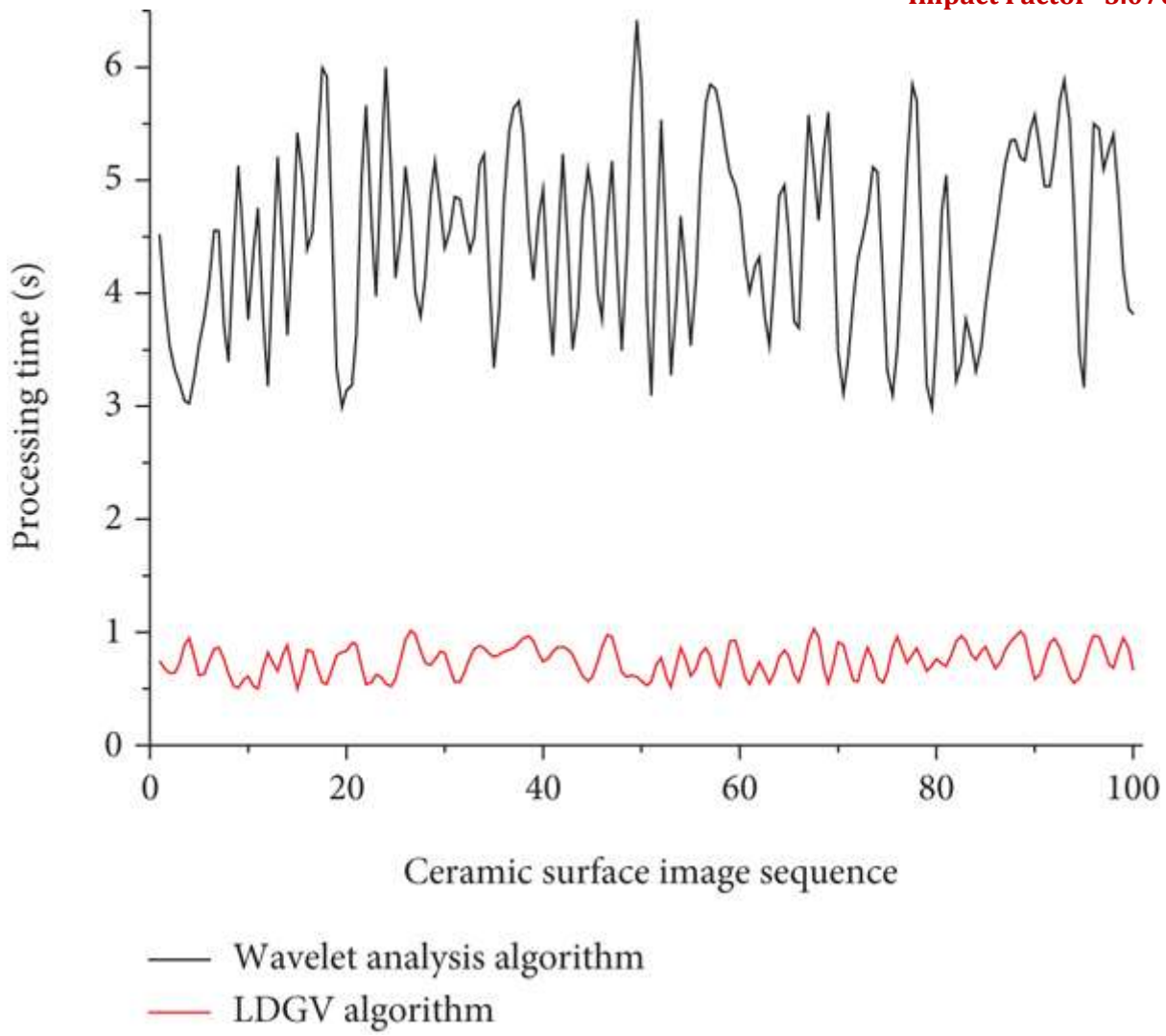

Figure 4 :Running time of magnetic ring inner wall inspection for both methods

III. CONCLUSION

Currently, the classic roughness index is used to characterize ceramic grinding processing surfaces. Even if the roughness values for metal and ceramic surfaces are the same, there are significant variances between them since ceramics are hard and brittle materials and the machined surfaces are susceptible to residual flaws such cracks, pits, and crushing. In order to supplement the conventional characterisation methods for ceramic materials, this research investigates additional characterization techniques. The characterisation of ceramic surface damage and its surface function are the main topics of this research. The main research topics cover wavelet analysis' extraction of damage features visible in the surface contour and quantitative assessment of the damage, choice of an appropriate method for calculating the fractal dimension of a ceramic surface based on that surface's contour, validation using the measured 3D model and fitting, study of sealing and wear based on fractal theory, and study of the fractal dimension by spectral analysis. The ceramic grinding surface feature measurement and analysis system was improved. The fractal theory was used to study the seal and wear, the spectral analysis was used to study the periodic components and their frequency components in the surface profile, and the support length rate was used to study the support of the surface profile.

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Performance Analysis of Waste Cooking Oil Biodiesel and its Blends

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Abstract: Now days to fulfill the energy requirement there have been growing interest in alternative fuels like vegetable oil, biodiesel, biogas, LPG, CNG to provide suitable alternative fuel to diesel oil for internal combustion engine. Vegetable oil or cooking oil due to their agricultural origins and less carbon contain as compare to mineral diesel are produce less emission. In India massive wastage of cooking oil in big restaurants, household, food processing industry, packing industry because of this are not reutilized and ultimately get waste. For utilization purpose of these waste cooking oil and producing alternative fuel to traditional mineral diesel fuel. In present paper production and experimental study is carried out in I.C. engine laboratory on single cylinder four stroke computerized VCR engine. The analysis of chemical and physical property, performance and emission characteristic of pure diesel with waste cooking oil – diesel with various blends. All measurement is recorded for compression ratio 14, 16, 17.5 with varying load ideal to 12Kw.This report describes the current alternative fuel technology and their impacts and global warming and unbars air quantity. The performance parameter was found to be very close to that of mineral diesel. The better than mineral diesel for some specific blending ratio under certain blends.

Index Terms **- Biodiesel, Performance, VCR Engine, LPG, CNG.**

I. INTRODUCTION

Biodiesel is derived from vegetable oils and hence is a renewable fuel. Gasoline and diesel come in the category of non-renewable fuel and will last for a limited period of time. These non- renewable fuels also emit pollutants in the form of oxides of nitrogen, oxides of sulphur, carbon dioxide, carbon monoxide, lead, hydrocarbons, etc. during their processing and use. A renewable fuel such as biodiesel, with lesser exhaust emissions, is the need of the day. Hence, researchers and scientific community worldwide have focused on development of biodiesel and the optimization of the processes to meet the standards and specifications needed for the fuel to be used commercially without compromising on the durability of engine parts. The interest in the use of renewable fuel started with the direct use of vegetable oils as a substitute for diesel. Biodiesel, a diesel fuel which can be made from verity of oils, fats and greases it can provide an additional market for vegetable oil and animal fats.

Biodiesel produces less air pollution(exhaust emissions)than diesel made from fossil fuels. A 1998 study by the USDA and US DOE found that using pure biodiesel in urban buses "result in substantial reduction in life cycle emission of total particulate matter, carbon monoxide and sulphur oxide(32%,35%and8% reductions respectively, relative to petroleum diesel's life cycle).

II. LITERATURE SURVE

K. NanthaGopal[1] et al.used usual transesterification processbiodiesel from Waste Cooking Oil (WCO) can be prepared economically. It was observed that the WCO biodiesel has similar characteristics to that of diesel. In the case of WCO biodiesel blends it was observed that brake thermal efficiency, carbon monoxide, unburned hydrocarbon and smoke opacity were lower than diesel.Compared to that of conventional diesel combustion characteristics of all biodiesel blends showed similar trends.

Enrico Mattarelli[2] et al. founded that the influence of rape- seed biodiesel in the fuel blend is not constant at each operating condition. Full load performance tends to drop as the biodiesel content increases, wherever soot emission goes down. They observed maximum improvement in terms of soot concentration was 37.5%, at 1200 rpm. According to combustion analysis it was revealed that the main differences among the fuels occur in the first phase of combustion: the burn rate was slower for biodiesel blends at low speeds, and faster at high.

Shou-HengLiu[3] et al. investigated that the development of biodiesels was being driven by the need for reducing emissions from diesel engines without modifying engines and for saving energy. They observed that the ultra-low sulfur diesel (ULSD)/ WCOB blends had lower PM, HC, and CO emissions but higher CO2 and NOx emissions when comparedwith that of ULSD. They were decreased PAHs by 14.1%–53.3%, PM by 6.80%–15.1%, HC by 6.76%–23.5%, and CO by 0.962%–8.65% but increase CO2 by 0.318–1.43% and NOx by 0.384–1.15% by Using ULSD/WCOB blends instead of ULSD.

BelachewTesfa[4] et al. carried out experimental work on a four-cylinder, four-stroke, direct injection (DI) and turbocharged diesel engine by using biodiesel made from waste oil, rapeseed oil, corn oil and comparing them to normal diesel. Detailed analyses were carried out on major regulated emissions such as NOx, CO, CO2, and THC. As compared to diesel fuel at various operating conditions the emissions of the CI engine running on neat biodiesel (B100) were reduced by up to 15%, 40% and 30% for CO, CO2 and THC emissions respectively.

BhabaniPrasannaPattanaik[5] et al. studied about the production of Rice bran oil biodiesel (RBOBD), study of its characteristics and potential as a substitute for Diesel fuel in CI engines.On volume basis various proportions of RBOME and Diesel were prepared & used as fuels in a four stroke single cylinder direct injection Diesel engine to study the performance and emission characteristics of these fuels. They obtained that the 49% reduction in smoke, 35% reduction in HC and 37% reduction in CO emissions for the blends whereas the brake power and BTE were reduced by 2.4% and 3.2% respectively with 4.3% increase in the SFC. G Lakshmi NarayanaRao[6] et al. disposed used vegetable oils from restaurants in large quantities. They were analysed the combustion, performance and emission characteristics of Used Cooking oil Methyl Ester (UCME) and its blends with diesel oil in a direct injection C.I. engine. A significant improvement in reduction of particulates, carbon monoxide and unburnt hydrocarbons was observed compared to diesel with minor decrease in thermal efficiency. They were used transesterified used cooking oil and its blends as fuel for diesel engines will reduce dependence on fossil fuels and also decrease considerably the environmental pollution.

T.ShanmugaVadivel[7] et al.manufactured biodiesel from plant oil whichwas relatively easy and possesses many environment benefits. Biodiesel was derived from waste cooking oil produced in large quantities in public eateries which makes biodiesel all the

more attractive. The performance, emission and combustion characteristics analyzedin the single cylinder water cooled DI diesel with the sole fuel. .At maximum load in case of palm oil the maximum brake thermal efficiency is 28%.

SirivellaVijayaBhaskar[8] et al. revealed that the transesterification process was a most appropriate and distinctive method used for preparation of biodiesels from plants and animal fats.As compared to neat diesel it has been unveiled that the biodiesels typically causes the reduction in engine torque and power, but the lower smoke emissions, carbon dioxide, carbon monoxide, pollutionwith a minor increased in NOx emissions. They were focussed on evaluating the effect of fish oil methyl ester (FOME) on characteristics of CIDI engine.

UmeshT[9] et al. investigated experimentally the performance and exhaust emission characteristics of a diesel engine when fuelled with diesel and methyl esters of rice bran oil in various proportions. Their study resulted that the performance characteristics of B-20 blend was superior to all other blends of fuels. As blending percentage increased emission levels of HC, NOx, & CO2 decreased as per emission test. They were observed that without any major modifications the rice bran methyl ester can be used in C.I. engine.

III. METHODOLOGY

A. *Transesterification*

The major component of vegetable oil is triglycerides. When the triglycerides react with alcohol in presence of base catalyst, this is called "transesterification" in this reaction triglyceride are converted in to diglyceride, monoglyceride and finally converted in to glycerol. The process is explain in diagram:

1) *Preprocessing*: The cooking oil collect form the market and restaurants have various impurities and carbon and water contain to remove this impurities preprocessing is done. Here Filtration, Demoisture, Neutralization process is done.
2) *Transesterification Process:* Here the reaction of triglyceride with the methanol in the presence of catalyst is done in reactor. The methanol is used as solvent where the Sodium methoxide as a catalyst, the reaction temperature is maintain at 60o and stirring speed is 250rpm constant to get the best result. This reaction continuous for 1 hr. during this period the methanol reacts with the triglyceride to form methyl ester and glycerol as a byproduct.
3) *Separation:* After completion of process the mixtures is settled in the settling jar for 18hrs. So get the better separation of glycerol and ester.
4) *Washing and post processing:* After the separation process we get the ester with the amount of glycerol to remove the all contains of glycerol the washing with warm water is done and after washing heating above the $100^{o}$is done to remove the water contain. After all these process we get the biodiesel as a final product. This biodiesel is mix with the diesel in the percentage of diesel fuel to get the blends of biodiesel.

B. *Setup and Specification*

The experimental test rig consists of a variable compression ratio engine, eddy current dynamometer as loading system, fuel supply system for both Diesel oil and biodiesel supply, water cooling system, lubrication system and various sensors and instruments integrated with computerized data acquisition system for online measurement of load, air and fuel flow rate, exhaust emissions and smoke opacity. Following fig. gives the information about experimental test rig.

Table 1 Engine Specification

Product	VCR engine test setup 1 cylinder, 4 stroke diesel
Engine	Make Kirloskar, type 1 cylinder 4 stroke diesel, water cooled, power 3.5KW at 1500rpm, stroke110mm, bore87.5mm, 661cc, CR 17.5, modified to VCR engine CR 12 to 18
Dynamometer	Type eddy current, water cooled
Propeller shaft	With universal joints
Fuel tank	Capacity 15 lit with glass fuel metering column
Calorimeter	Pipe in pipe
Piezosensor	Range 5000 PSI with low noise cable
Crank angle sensor	Resolution 1^{o}, speed 5500 RPM with TDC pulse
Temperature Sensors	Type RTD, PT 100 and thermocouple type K
Temperature transmitter	Type 2 wire, input RTD PT 100, range 0 to 100 Deg. C output 4 to 20 MA, input thermocouple
Load indicator	Digital, range 0 to 50 Kg supply 230 VAC
Load sensors	Load cell, type strain gauge, range 0 to 50 Kg
Fuel flow transmitter	DP transmitter, range 0 to 500mm WC
Air flow transmitter	Pressure transmitter range 0 to 250mm WC
Rota meter	Engine cooling 40 to 400LPH, calorimeter 25 to 250 LPH
Overall Dimensions	W2000 X D 2500 X H 1500 mm
Optional	Computerized diesel injection pressure measurement.

IV. RESULT AND DISCUSSION

All the following result are taken on the 1 cylinder 4 stroke computerized VCR engine for all blends with varying load form 0 to 12 Kg. and compression ratio 14, 16, 17.5. Other specification of test setup are given in table

A. Load VS Break Power

Table 2 For CR 14

% of Blend	Load				
	0	4	8	12	
0	0.1	1.17	2.35	3.45	BP
6	0.09	1.19	2.33	3.46	
12	0.085	1.2	2.34	3.48	
18	0.14	1.21	2.35	3.52	
24	0.12	1.21	2.35	3.47	
30	0.09	1.22	2.34	3.46	
36	0.06	1.23	2.37	3.44	

Table 3 For CR 16

% of Blend	Load				
	0	4	8	12	
0	0.04	1.2	2.43	3.46	BP
6	0.06	1.26	2.36	3.43	
12	0.08	1.22	2.33	3.48	
18	0.1	1.2	2.33	3.52	
24	0.09	1.22	2.34	3.51	
30	0.1	1.24	2.35	3.52	
36	0.05	1.19	2.36	3.5	

Table 4 For CR 17.5

% of Blend	Load				
	0	4	8	12	
0	0.11	1.19	2.35	3.49	BP
6	0.06	1.23	2.36	3.44	
12	0.07	1.22	2.37	3.47	
18	0.08	1.21	2.35	3.49	
24	0.1	1.22	2.38	3.48	
30	0.12	1.22	2.39	3.47	
36	0.07	1.21	2.34	3.5	

Table 2 to Table 4 shows the comparison of load and brake power. By comparing these it is found that there are little variations between pure diesel (0%) and blends. By comparing pure diesel and 36% blend, it shows approximately same brake power through all the compression ratio.

B. Load VS Break Thermal Efficiency

Table 5 For CR 14

% of Blend	Load				
	0	4	8	12	
0	1.64	15.47	23.81	23.73	BTE
6	1.48	15.82	23.64	24.81	
12	1.82	15.64	22.38	23.38	
18	2.2	14.92	21.3	22.44	
24	1.38	14.32	21.24	22.6	
30	1.21	14.02	21.18	22.03	
36	1.06	15.1	21.48	23.69	

Table 6 For CR 16

% of Blend	Load				
	0	4	8	12	
0	1.27	18.73	24.6	24.56	BTE
6	1.29	18.03	23.85	24.58	
12	1.38	17.82	22.18	24.32	
18	1.83	15.89	22.3	25.25	
24	1.84	15.58	22.42	24.28	
30	1.84	15.28	22.47	23.32	
36	1.11	18.68	22.59	23.14	

Table 7 For CR 17.5

% of Blend	Load				
	0	4	8	12	
0	2.71	17.04	25.28	28.57	BTE
6	1.38	17.71	25.37	26.95	
12	1.54	17.52	24.42	26.98	
18	1.66	17.4	23.83	25.01	
24	1.82	16.38	22.12	24.82	
30	2.22	15.01	22.81	23.86	
36	1.45	16.06	23.73	25.11	

The variation of break thermal efficiency with load and blends as shown in Table 5 to Table 7. The break thermal efficiency is found to be same as comparing with diesel. By taking pure diesel and 36% blend it is found that break thermal efficiency of blended diesel is lower than pure diesel for every load. This is because of fuel properties such as viscosity and density.

C. Load VS Indicated Power

Table 8 For CR 14

% of Blend	Load				
	0	4	8	12	
0	2.08	3.98	5.18	6.01	IP
6	2.12	3.89	4.78	5.99	
12	2.58	3.92	5.12	6.04	
18	3.11	4.23	5.42	6.19	
24	2.62	4.08	4.38	5.98	
30	1.8	4	4.93	5.93	
36	2.42	3.76	4.88	5.81	

Table 9 For CR 16

% of Blend	Load				
	0	4	8	12	
0	2.3	3.78	4.96	6.06	IP
6	2.58	3.84	4.89	6.1	
12	2.64	4.08	4.94	6.18	
18	2.79	4.26	5.14	6.24	
24	2.76	4.27	5.13	6.26	
30	2.74	4.28	5.12	6.28	
36	2.53	3.8	5.06	5.98	

Table 10 For CR 17.5

% of Blend	Load				
	0	4	8	12	
0	2.55	3.86	5.16	6.09	IP
6	2.74	1.08	5.16	5.88	
12	2.68	1.12	5.14	5.94	
18	2.65	4.17	5.08	6.01	
24	2.82	4.17	5.28	5.98	
30	3.29	4.18	5.39	6.34	
36	2.76	3.96	4.93	6.05	

The variation indicated power with load and blends as shown from Table 8 to Table 10. It is observed that from 0% to 24% the indicated power slightly changes and further it fluctuate more.

D. Load VS Mechanical Efficiency

Table 11 For CR 14

% of Blend	Load				
	0	4	8	12	
0	5.04	29.36	45.42	57.32	MEff
6	4.45	30.69	48.81	57.78	
12	4.48	29.46	46.38	57.96	
18	4.51	28.66	43.37	56.84	
24	4.82	29.28	46.72	57.48	
30	5.06	30.58	47.42	58.27	
36	2.55	32.64	48.58	59.24	

Table 12 For CR 16

% of Blend	Load				
	0	4	8	12	
0	1.93	31.69	49.03	57.02	MEff
6	2.33	32.73	48.13	56.18	
12	2.82	29.84	47.38	56.32	
18	3.43	28.21	45.4	56.43	
24	3.48	28.65	45.62	56.64	
30	3.51	29.03	45.86	56.13	
36	2.05	31.41	46.65	58.48	

Table 13 For CR 17.5

% of Blend	Load				
	0	4	8	12	
0	4.31	30.81	45.59	57.2	MEff
6	2.35	30.27	45.7	58.57	
12	2.58	30.08	46.22	58.36	
18	2.92	29.11	46.36	58.04	
24	3.18	29.18	46.76	57.65	
30	3.53	29.2	44.22	57.7	
36	2.45	30.6	47.53	57.93	

The variation mechanical efficiency with load and blends as shown from Table 11 to Table 13. It is observed that the mechanical efficiency at 0 load and at 12 kg load is nearly approximate same at all but it get fluctuate at load 4kg and at load 8kg.

E. Load VS Volumetric Efficiency

Table 14 For CR 14

% of Blend	Load				
	0	4	8	12	
0	81.06	81.32	80.36	78.41	VEff
6	79.25	78.55	77.14	75.41	
12	80.12	79.62	78.62	76.64	
18	80.76	80.13	78.78	77.36	
24	79.65	79.36	78.79	77.26	
30	78.72	79.72	78.81	77.02	
36	78.29	78.23	77.13	75.38	

Table 15 For CR 16

% of Blend	Load				
	0	4	8	12	
0	78.77	79.76	79.35	77.82	VEff
6	76.42	77.38	78.43	78.76	
12	77.36	77.64	78.64	79.54	
18	77.53	78.75	79.72	80.02	
24	77.08	78.68	79.64	79.45	
30	76.82	78.46	79.56	79.68	
36	75.75	77.4	78.51	78.54	

Table 16 For CR 17.5

% of Blend	Load				
	0	4	8	12	
0	80.64	80.42	79.74	78.73	VEff
6	78.04	78.14	76.96	75.58	
12	79.12	79.06	77.54	76.54	
18	79.34	79.28	78.25	77.49	
24	79.18	79.34	78.68	77.79	
30	79.2	79.55	78.7	77.95	
36	79.17	78.77	77.81	76.65	

The variation volumetric efficiency with load and blends as shown from Table 14 to Table 16. It is observed that the pure biodiesel has highest volumetric efficiency than blended biodiesel.

F. Load VS Specific Fuel Consumption

Table 17 For CR 14

% of Blend	Load				
	0	4	8	12	
0	5.22	0.55	0.4	0.36	SFC
6	5.8	0.54	0.36	0.35	
12	6.12	0.56	0.38	0.36	
18	3.9	0.57	0.4	0.38	
24	5.18	0.58	0.4	0.38	
30	7.11	0.61	0.4	0.39	
36	8.06	0.57	0.4	0.36	

Table 18 For CR 16

% of Blend	Load				
	0	4	8	12	
0	6.74	0.46	0.35	0.17	SFC
6	6.63	0.48	0.36	0.35	
12	5.45	0.52	0.37	0.34	
18	4.67	0.54	0.38	0.34	
24	4.66	0.55	0.38	0.36	
30	4.66	0.56	0.38	0.37	
36	7.7	0.46	0.38	0.37	

Table 19 For CR 17.5

% of Blend	Load				
	0	4	8	12	
0	3.16	0.5	0.34	0.3	SFC
6	6.19	0.48	0.34	0.32	
12	6.12	0.48	0.35	0.33	
18	5.15	0.49	0.36	0.34	
24	4.36	0.55	0.37	0.35	
30	3.86	0.57	0.38	0.36	
36	5.9	0.53	0.36	0.34	

The variation break specific fuel consumption against load and blends as shown from Table 17 to Table 19. It is observed that break specific fuel consumption is same as blending biodiesel excluding at 0 load.

V. RESULT AND DISCUSSION

The properties like Break power ,break thermal efficiency, indicated power and mechanical efficiency of each blends are nearer to the properties of diesel fuel. In these B06, B12, B18, B24 has their properties very closer to pure diesel and here it is concluded that up to 24% blended biodiesel, no necessary of any modifications required. The performance of engine by using biodiesel is quite same as pure diesel. Waste vegetable oil was found to be safe and efficient alternative fuel. The present experimental studies support the fact that vegetable oil can be successfully used as biodiesel. The fuel consumption increases as the biodiesel content in the fuel rises due to its lower heating power. Nevertheless, it should be noted that the biodiesel maintains approximately the same engine efficiency at that obtained with diesel fuel.

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"EXPERIMENTAL INVESTIGATION OF COMBINED EFFECT OF THERMAL PERFORMANCE OF THERMOSYPHON HEAT PIPE USING NANO-FLUID AND IT'S ANALYSIS."

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Abstract— **In this research the combined effect of using multiwalled carbon nanotubes nanofluid and inclination angle on heat transfer through thermosyphon heat pipe is investigated. The thermosyphon heat pipe is made up of straight copper pipe. Base fluid inside thermosyphon heat pipe is water and MWCNT nanofluid. Also concentration level of nanoparticles in nanofluid is varied as 0.05% Wt, 0.1% Wt and 0.15% Wt. The results show that thermal performances are enhanced in case of nanofluid than that of water. By charging nanofluid into thermosyphon heat pipe, thermal performance is enhanced by reducing thermal resistance, as temperature gradient along length is decreased.**

Keywords— CNT, MWCNT, Nanofluid, nanoparticles, Thermosyphon heat pipe.

1. INTRODUCTION

I. The investigation of thermosyphon heat pipes and their applications into thermal engineering are known for years, being used in various applications, such as heat exchangers, electronics cooling, chemical engineering, waste heat recovery, power generation, air conditioning systems, water heater, and solar collectors. thermosyphon heat pipes are passive heat transfer devices with high effective thermal conductivity. The effective coefficient of thermal conductivity of a thermosyphon heat pipe can be orders of magnitude higher than that of highly conductive solid materials, such as copper.

II. Common fluids such as water, ethylene glycol, and heat transfer oil play an important role in many industrial processes such as power generation, heating or cooling processes, chemical processes, and microelectronics. However, these fluids have relatively low thermal conductivity and thus cannot reach high heat exchange rates in thermal engineering devices. A way to overcome this barrier is using ultra-fine solid particles suspended in common fluids to improve their thermal conductivity. The suspension of nano-sized particles (1–100 nm) in a conventional base fluid is called a nanofluid [2]. In recent years, many researchers have investigated the effects of nanofluids on the enhancement of heat transfer in thermal engineering devices, both experimentally and theoretically. Researchers have also applied a variety of preparation methods, characteristics, and different models used for the calculation of thermophysical properties of nanofluids (i.e., thermal conductivity, viscosity, density, specific heat capacity).

III. Murshed, K.C. Leong et al. [1] reviewed various thermophysical properties such as thermal conductivity, thermal diffusivity, and viscosity. They also studied theoretical mechanism for the enhanced thermal conductivity of nanofluids. They got the thermal conductivity of various nano particles and their comparative performance. Maryam Shafahiet et al [2] studied effect of al2o3, cuo and tio2 nanofluids on the performance of heat pipe. They reported the substantial changes in heat pipe thermal resistance, temperature distribution, and maximum capillary heat transfer of the heat pipe is observed when using a nanofluid. The nanoparticles within the liquid enhance the thermal performance of the heat pipe by reducing the thermal resistance while enhancing the maximum heat load which it can carry. He found that smaller particles have a more pronounced effect on the temperature gradient along the heat pipe. Also existence of an optimum mass concentration for nanoparticles in maximizing the heat transfer limit is established. Gabriela Huminic et al [3] studied experimentally the effect of iron oxide nanoparticles on the performance of thermosyphon heat pipe. While experimentation studied the temperature distribution and compare the heat transfer rate of the thermosyphon heat pipe with nanofluid and with DI-water. He also tested various concentration levels of nanoparticles. Result shows that thermal performance increases with increase in particle concentration. Mostafa Keshavarz Moraveji et al [4] studied the effect of using aluminum oxide nanofluid on the thermal efficiency enhancement of a heat pipe on the different operating state was investigated the tested concentration levels of nanofluid are 0%, 1% and 3%wt. results show that by charging the nanofluid to the heat pipe, thermal performance is enhanced by reducing the thermal resistance and wall temperature difference. The thermal efficiency of heat pipe charged with nanofluid is compared with pure water. Matthias H. Buschmann et al [5] reviewed the application of nanofluid in thermosyphons, heat pipes, and oscillating heat pipes. He found that pipes performance effects which are related to filling ratio, inclination angle, and operation temperature seem to be similar to those for classical working fluids. Decrease of the thermal resistance or an increase of the efficiency with increasing concentration, but also a reversing of this trend if a certain optimal concentration is exceeded. The main mechanism responsible for the improved thermal performance seems to be a porous layer built from nanoparticles on the evaporator

surface. Additional positive effects may follow from the changed thermophysical properties of the working fluid. Paisarn Naphon et al [6] he found that effects of % charge amount of working fluid, heat pipe tilt angle and % nanoparticles volume concentrations on the thermal efficiency of heat pipe are considered. The nanoparticles have a significant effect on the enhancement of thermal efficiency of heat pipe. The thermal efficiency of heat pipe with the nanofluids is compared with that the based fluid.

2. EXPERIMENTS.

Nanofluid preparation:

The test on MWCNT was obtained by dispersing MWCNT particles in DI water. The MWCNT nanoparticales with mean size of about outer diameter 10-15 nm, length 10-30 micro m, purity 97% are used for experimentation prepose, which were prepared by M/S Global nanotechnology by vapour decomposition method. And carried out the fictionalization process to remove the carboxyl group (COOH) by acid treatment [10]

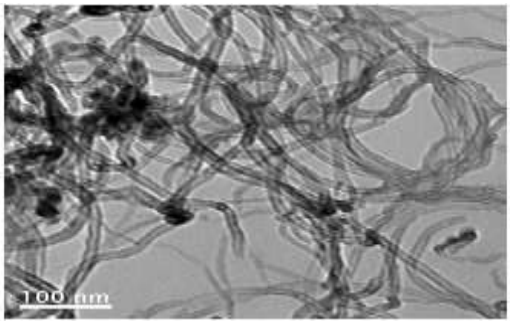

fig 2. TEM image of MWCNT .

The nanofluid is formed for three different weight percent (0.05Wt%, 0.1 Wt%, 0.15 Wt %) by the processes as follows

I. Take the required weight of DI water and surfactant that is Gum Arabic used in this case.

II. Mix the above mixture and stir it for 5 min.

III. Now take the nanoparticles in above mixture.

IV. This mixture is now sonicated in utrasonication bath for 40 min. For uniform dispersion, sonication was followed by 5 min. of magnetic stirring.

The fluid preparation is carried out at research lab of YSPM's Yashoda College of Pharmacy, Satara.

Experimental setup:

The prepared nanofluid is charged in the thermosiphon heat pipe at Golden star heat pipe pune. In present research four thermosiphon heat pipes are manufactured one containing DI water as base fluid, second containing nanofluid having concentration 0.05 Wt%, third containing nanofluid having concentration

0.1 Wt% and fourth containing nanofluid having concentration 0.15 Wt%. This thermosiphon heat pipes were tested on the setup shown below

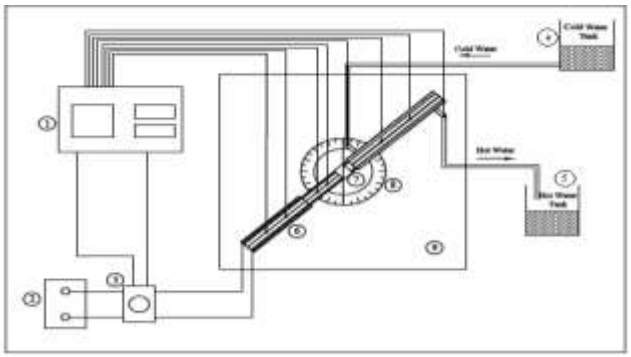

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Fig.2 (a) Experimental set up for thermosyphon heat pipe testing

1. Control panal, 2. Eectric supply, 3. Dimerstst, 4.Water tank, 5. Hot water tank, 6. Thermosyphon heat pipe, 7.Angle variation arrangement 8.Angular scale 9.Supporting plate.

The heat input applied at evaporator end in the step of 25W, 50W, 75W and 100W, first start the cooling water flow in the water jacket at condenser end and heat input supplied at evaporator with band heater and care was taken to achieve steady state at evaporator end. The testing is carried out for 15°, 30°, 45°, 60° and 75°

3. MATHEMATICAL EQUATIONS.

The overall thermal resistance of circular heat pipe is calculate by equation-

$$R_{th} = \frac{T_e - T_c}{Q_{in}} \quad \ldots\ldots\ldots (1)$$

Where,

T_e and T_c are the average wall temperatures of evaporator and condenser section and can be determined by following equations

$$T_e = \frac{1}{n}\sum_{i=0}^{n} Ti \quad \ldots\ldots (2)$$

$$T_c = \frac{1}{m}\sum_{i=0}^{m} Ti \quad \ldots\ldots (3)$$

$$\text{Thermal resistance ratio} = \frac{R_{water} - R_{nanofluid}}{R_{water}} \quad \ldots (4)$$

Thermal efficiency is the ratio of heat input to heat output. The heat input is taken from electric supply, and heat out put is calculated from cooling effect at condenser section.

$$\text{Thermal efficiency} = \frac{Q_{in}}{Q_{out}}$$

$$\eta_{th} = \frac{Q_{in}}{m \times cp \times \Delta T} \times 100 \quad \ldots\ldots\ldots\ldots (5)$$

Where,

Q_{in}= Heat input in Watts.

m = Mass flow rate of cooling water (3 Kg/hr).

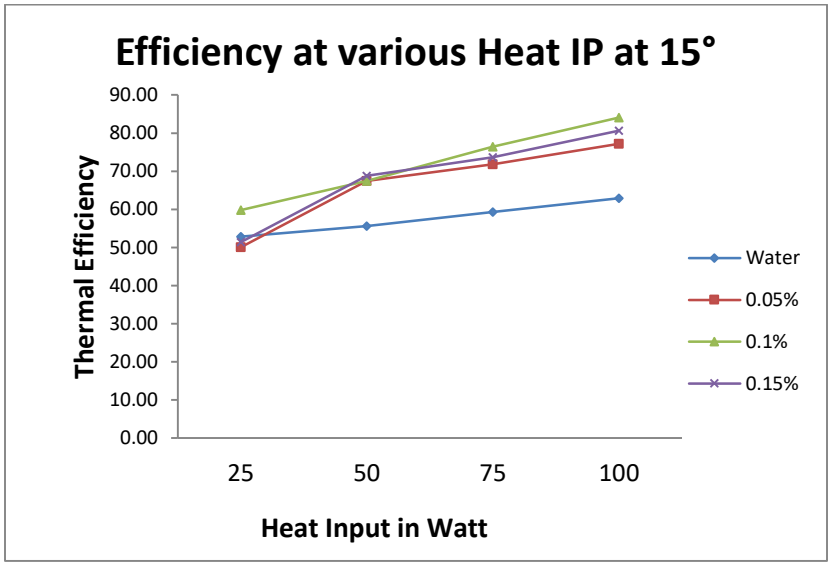
C_p= Specific heat of cooling water. (4187 J/KJ.K)

ΔT = Inlet and outlet cooling water temperature difference.

4 .RESULT AND DISCUSSION

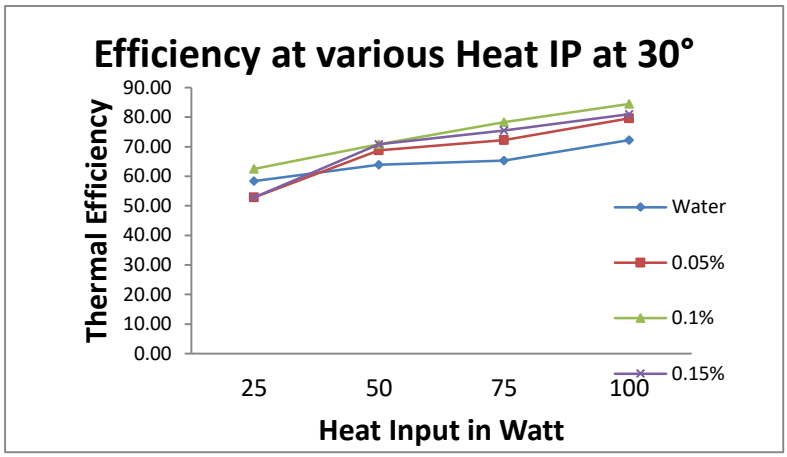
4.1Thermal Efficiency of Thermosyphon Heat Pipe at Various Tilt Angles: the heat input is given in the steps of 25 W, 50 W, 75 W and 100 W the thermal efficiency for different angles and thermosyphon heat pipe with different base fluid are as follow.

4.1.1Thermal efficiency Vs Heat input at 15° tilt angle.



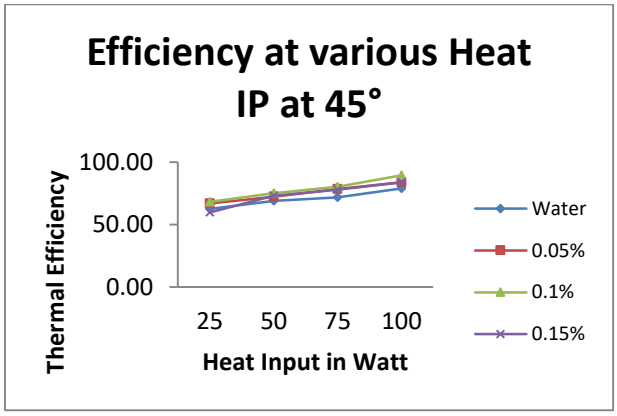
Graph no.4.1.1. Efficiency Vs Heat Input at 15° tilt angle.

4.1.2Thermal efficiency Vs Heat input at 30° tilt angle.



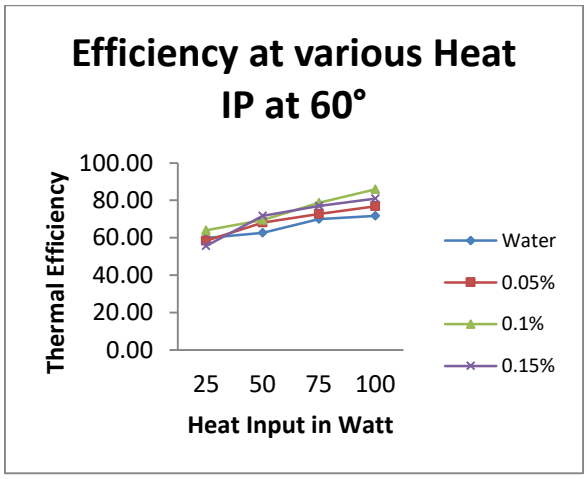
Graph no.4.1.2. Efficiency Vs Heat Input at 30° tilt angle.

4.1.3Thermal efficiency Vs Heat input at 45° tilt angle.



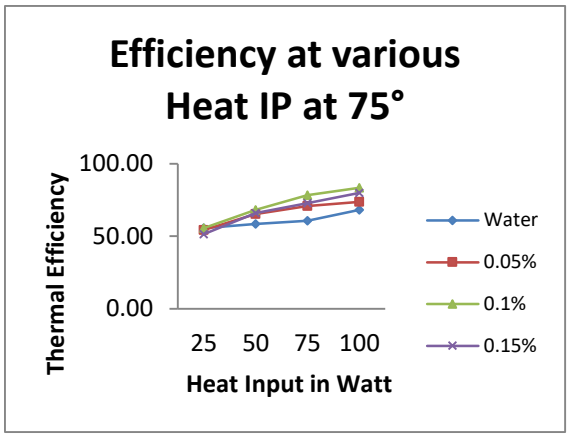
Graph. No. 4.1.3. Efficiency Vs Heat Input at 45° tilt angle.

4.1.4Thermal efficiency Vs Heat input at 60° tilt angle.

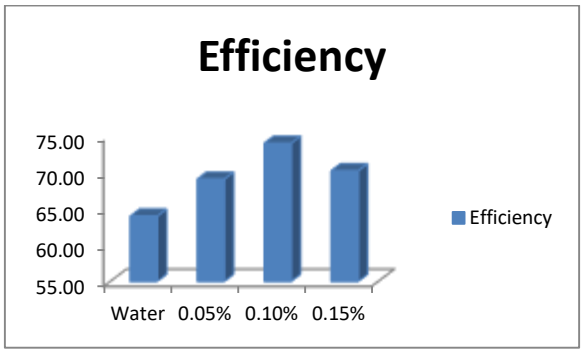


Graph no.4.1.4 efficiency Vs Heat Input at 60° tilt angle.

4.1.5Thermal efficiency Vs Heat input at 75° tilt angle.



Graph no.4.1.5 (a). Efficiency Vs Heat Input at 75° tilt angle.

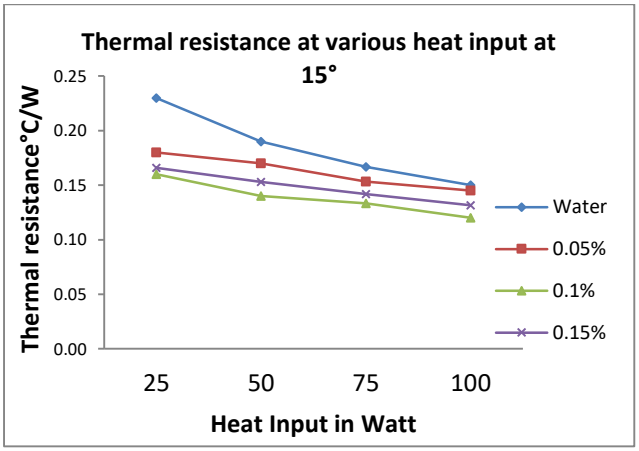


Graph no.4.1.5 (b). Average efficiency for thermosyphon heat pipe congaing different base fluids.

The graph shows average efficiency of thermosyphon heat pipe base fluid as 0.10 Wt% nanofluid is having average efficiency higher than that of all other thermosyphon heat pipe. Thermosyphon heat pipe with MWCNT 0.10 W% nanofluid as base fluid is having around 10.03% maximum efficiency than that of thermosyphon heat pipe with water as base fluid. That indicates heat carting capacity of thermosyphon heat pipe is increases due to the MWCNT nanofuid

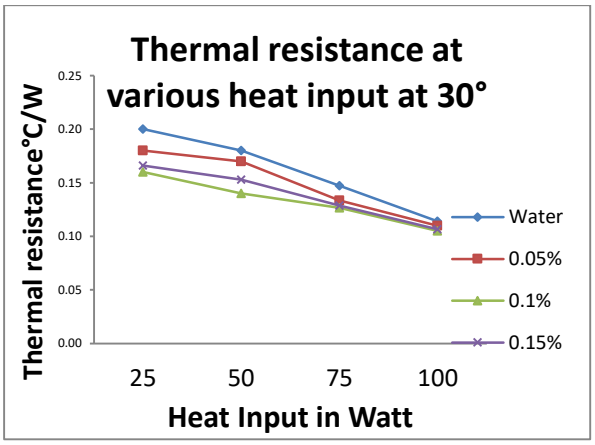
4.2Thermal Resistance of Thermosyphon Heat Pipe at Various Tilt Angles: the heat input is given in the steps of 25 W, 50 W, 75 W and 100 W the thermal resistance for different angles and thermosyphon heat pipe with different base fluid are as follow.

4.2.1Thermal Resistance Vs Heat Input for 15° Tilt Angle:



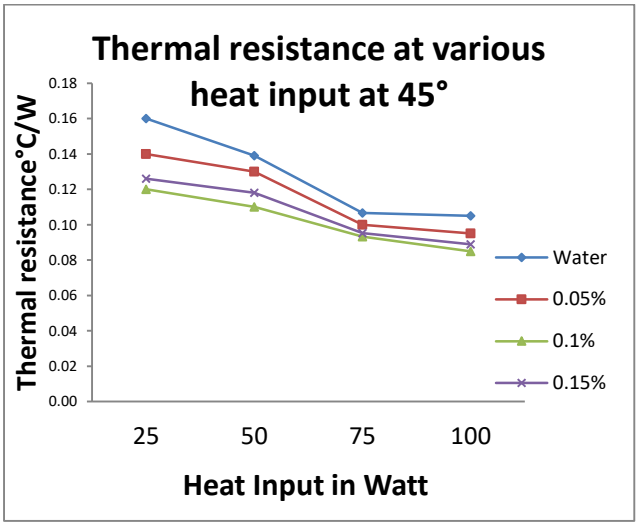
Graph no.4.2.1. Thermal resistance Vs Heat input at 15° tilt angle.

4.2.2Thermal Resistance Vs Heat Input for 30° Tilt Angle:



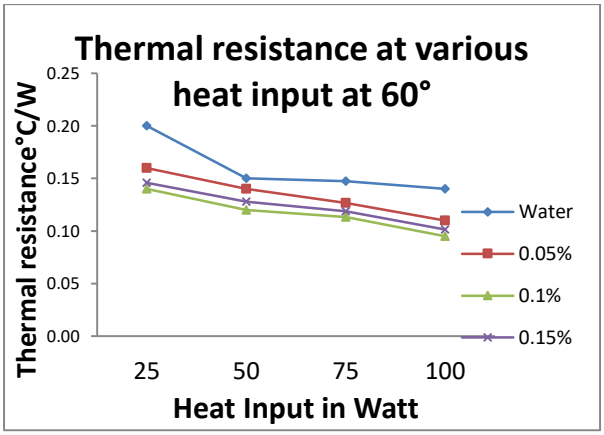
Graph no. 4.2.2. Thermal resistance Vs Heat input at 30° tilt angle.

4.2.3Thermal Resistance Vs Heat Input for 45° Tilt Angle:



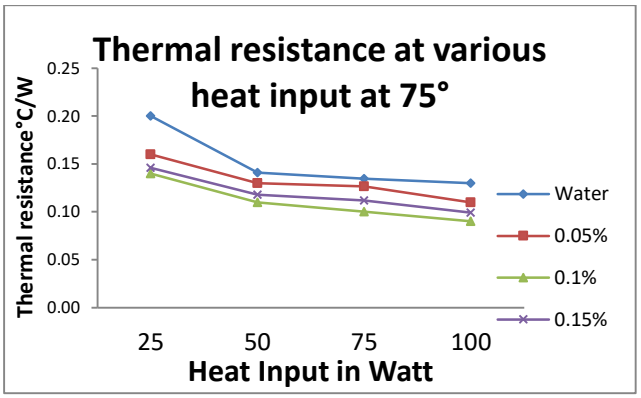
Graph no.4.2.3. Thermal resistance Vs Heat input at 45° tilt angle.

4.2.4 Thermal Resistance Vs Heat Input for 60° Tilt Angle:



Graph no.4.2.4. Thermal resistance Vs Heat input at 60° tilt angle.

4.2.5Thermal Resistance Vs Heat Input for 75° Tilt Angle:



Graph no.4.2.5 (a). Thermal resistance Vs Heat input at 75° tilt angle

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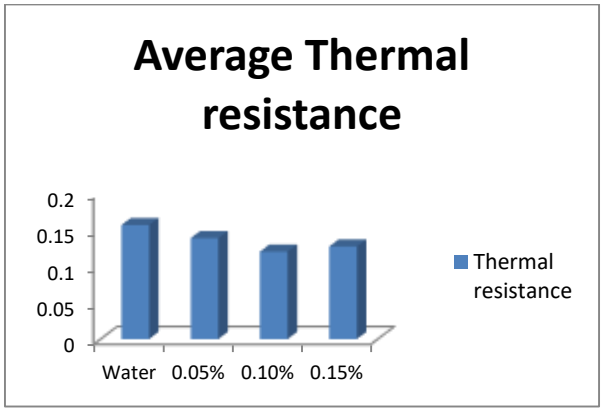

Graph no.4.2.5(b). Average thermal resistance of all angles and heat input.

The graph no. 12 shows average thermal resistance of all angles and heat input. From this it is clear that MWCNT 0.10 Wt% particle concentration has less thermal resistance than all others. maximum thermal resistance difference is observed to be 0.0365 W/°C between the thermosyphon heat pipe with base fluid water and thermosyphon heat pipe with 0.10 Wt% MWCNT concentration nanofluid.

From Graph. no. 7 to 11 it is seen that thermal resistance for all angles thermal resistance decreases with increase in heat input. The nanoparticle added to nanofluid also gives decreased thermal resistance than that of water, but the resistance decreases with increases in particle concentration from 0.05 Wt% to 0.10 Wt% and further increases with increase in particle concentration from 0.10 Wt% to 0.15 Wt%. This is the main cause for the increasing thermal performance of thermosyphon heat pipe. It observed that thermal resistance at 15°, 30°, 45°, 60° and 75°. But at 45° inclination angle value of thermal resistance is minimum.

5. CONCLUSIONS.

In the present work, an experimental study has been conducted to evaluations of effect of MWCNT nanoparticle concentration and inclination angle of thermosyphon heat pipe optimum heat transfer. The points concluded are as bellow.

- Experimental results shows thermal resistance of thermosyphon heat pipe is less in case of nanofuid as a base fluid than that of water as base fluid.
- Thermal resistance of thermosyphon containing nanofluids decreases with increase in particle concentration up to certain limit after that thermal resistance increase.
- For MWCNT nanoparticles optimum value of concentration of nanoparticle is 0.10 Wt%.
- Also the thermal resistance decreases with increase in tilt angle up to 45° angle after that thermal resistance start decreases though tilt angle increased.

6.ACKNOWLEDGMENT.

I acknowledge with thanks, the assistance provided by departmental staff, central library. I find myself spellbound to acknowledge thanks to my father and mother for their silent support, patience, encouragement and affection without which this work would never have been possible and I thank all my colleagues for their valuable co-operation and coordination which was available time to time.

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4. Number of Papers Published in International Conferences

Online Paper Checker

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Abstract

OPC system is experiment level of project. This system works completely on trial and error basis. It is mainly focused on managing the University type Exams containing descriptive Question. In this System admin is present. It has its own ID and Password. It manages all teachers details and according to that provide Model Answer Paper and Student exam sheet. Teacher will enter to their System through its ID and Password and check student Answer Sheet manually. Here some facilities provided by the System's are Comment Box, Automatic Calculation of Marks. By using this app there will be lower human interference so that the possibility of mistake occurrence will be reduced hence it will ensure better security.

Keywords: Authorization, security, Accuracy, Descriptive

Introduction

"Online Paper Checker" system is experimental level of project. This System works completely on trial and error basis. Today's paper checking system is manually so our aim is to develop such a system that will recover the problem caused by manual system such as mistakes in data entry , calculation of marks etc. It is mainly focused on managing university type exams containing descriptive questions. Every semester, the university conducts different examinations in various faculties. Every semester examiners, followed by moderators, evaluate answer booklets manually. But the university owing to several constraints and human interface has been trouble meeting the deadlines for the past decade. So our aim is to develop an app that will recover these problems. In our app the answer sheets of the university examinations for all courses will be scanned. Examiners will be given a user ID and password, which will allow them to access the papers and evaluate them on the screen itself. On our app screen there will be two tabs available, one represent model answer paper and another is student paper which we have to check. So that answer will be checked clearly. Due to this app there will be saving in postage transportation and stationary.

In today's paper checking the main problem is correct calculation of total marks. In our app this problem will be avoided as there is automatic calculation of marks given to each answer will be carried out. Also examiner should not go to next page unless he checks previous page. If there is any blank page in answer sheet then it will be tagged by seen notation otherwise examiner should not go to the forward. If any student writes answer point wise and clearly then during giving marks that point will be underlined by examiner. Also if any student write answer other than the requirement of the answer then at that point question mark will be given by the examiner also some student write answer of extra question if time remains it also checked by examiner in that, the answer which has greatest marks then it will be accessd in total marks. By using this app there will be lower human interference so that the possibility of mistake occurrence will be reduced hence it will ensure better security. According to the officials, since the papers are scanned there will be no physical copies lying with the examiners. Papers will be sealed as soon as they are checked, ensuring increased efficiency and transparency.

Methodology:

System will work follows-

Step1- Scan student answer-sheet.
Step2- Convert it into PDF format.
Step3- Admin login.
Step4- Authentication of Admin done successfully it Will allow to register new teacher ,upload Model answer-sheet, upload student answer-sheet.
Step5-Teacher enter into the system through user id and Password.
Step6-Teacher will see two tabs in the system, one for Student answer sheet and another for model Answer sheet.
Step7- Teacher will compare model answer-sheet with student answer paper and according to that give marks.
Step8- After checking all questions result will be Display.

Proposed System

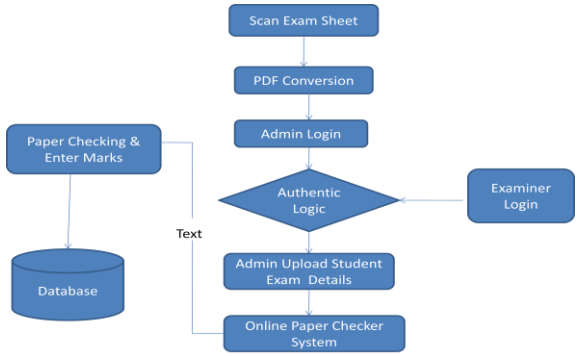

Figure 1: System Architecture

In proposed system seeks to evaluate the descriptive answer to a question. It will evaluate the marks to question according to teacher judgement. In this system admin and teacher authenticated by its user id and password. Authentication of admin is done it will enter into the system and done his task such as new teacher registration , upload model paper, upload student answer sheet etc. Authentication of teacher is done it will enter into the system . According to model paper it checks student answer sheet and give marks. After checking answer sheet result will accessd automatically, At finally student mark sheet generated.

Results:

In this project it have two login first of admin and second one is teacher .When admin authentication is done admin can done new teacher registration, student answer sheet upload and upload model paper. Teacher enter into the System through user-id and password and compare answer from model answer paper to student answer sheet . According to that give marks .At finally student mark sheet is generated.

Conclusion:

In colleges, universities and various other educational institutes' examinations play a very vital role. Many educational institutes conduct online examinations. But, these exams only include multiple-choice questions. Thus descriptive answers must be involved in online examinations. The proposed system attempts to access the descriptive answer. The proposed system accesss the student's answer based on the comparison of student answer sheet with model paper. By judging against the model answer and the student's answer marks are allocated to the student. Highest marks are gained if the student writes all the questions declared in the model answer. As compare to existing system the proposed system provide better working and give extra facilities such as comment box. Thus the proposed system could be of great effectiveness to the educational institutes.

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Shortest Distance based Location Finding

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***Abstract*—** An accident can be happen anywhere in day to day life and that accident is minor or major. Major accidents can affect to the human`s biological system in dangerous way. In that situation instant help is very important in minimum time. In this paper, the android application is defined to provide emergency help in minimum time, as per giving the shortest way to the exact nearest hospital from the accident`s location. This application uses the Google map API and its service. It uses navigation system to provide exact shortest hospital`s path and provide the emergency help.

***Keywords*—**Android, Google Maps API, Navigation System, Shortest Path.

I. INTRODUCTION

Now days the number of road accidents are increasing all over the world. A large number of deaths are caused by accidents. There are number of reasons behind the death during the accidents, but one of the reasons behind the death can be if immediate help is not get provided at accident' s emergency condition. So we are developing Android application which gives emergency help in different concerns which contains medical help as well as other properties. So we can save human being' s life. As per consideration of Android platform, android applications are easy to use and it provides better graphical user interface also [1].

In today' s fast paced world everyone is having smartphone. Smartphone gives us different functions which are useful in daily life and make people smarter. And android technology making more reliable and functional to the smart phones. [2] Now a days India is growing towards Atomization. So android technology is making human' s work more easily and fast. So proposed application finds the exact shortest path from user' s current location to the nearest hospital. For that it uses Google map API.

In accidental condition one can require urgent money also; this application also provides the exact nearest ATM by giving shortest path. Accidents can be minor or major. In the major type of accidents registration of the police case is essential, proposed application also gives the nearest police station as well as it gives the notification, one can directly call to police. This application also provides the list of near by hospitals, ATMs and police station. This application also suggests the route from user' s current location to the selected destination. One of the main characteristic of the application is that it reduces the time complexity; we can provide emergency help in minimum time. Another important feature of this application is that one can use this application all over the world at any location at any time; this application is not limited for any specific region. This application is useful for providing help to save human' s life in accidental condition.

II. LITERATURE SERVAY

[1] Dagade Ajay U, Desai Arati S, Mule Ashwini S, PatilPratiksha D, Prof. Gavade R.K. May 2017

In this paper " Messwala.com" application is developed to give centralized collection of mess in a single application. Also the function provided for the find nearest location of mess via Google Map API. Therefore this function provides the smart way to find out nearest location within a particular area, so this application is works as smart application.

This application provides the online data fetching facility due to this we can able to see more data about mess as well as we can able to view these data offline. This application also provides facility to mess owner to update their data based on their own choice.

[2] Ms.T.Premamala,K.Anitha, K.U.Abinaya, J.Infant Alfred March 2017

This paper introduces an Android based application for identifying a caller when a call is received from registered users. This application mainly focuses on the requirements of neglecting calls from non -registered users.

The application provides a means of identifying the caller of a particular student. With the help of this system the wardens can get rid of fake calls from other numbers claiming to be as parents of the student, as the phone numbers of the parents are already registered in the server by students and also admin will manage accounts of student batch once they join or leave hostel

[3]Saif Ahmed, Jawed Ahmed January 2017

In this paper, they have used an algorithm to remedy the MST hassle and we have parallelized it with the assist of Open MP API, they have got implemented the parallelized algorithm to resolve community routing problem with respect to its objective feature. The result of analysis shows that there is an improvement in performance when algorithm is executed in parallel environment provided by Open MP.

[4]P.Aruna, M.Sharmila Begum D.Maghesh Kumar Maniammai University Sept 2016

In this paper, an android application system called " Alumni Smart Connect" is proposed to develop an effective mobile user interface design to connect and collaborate former students of institution. This paper discusses mobile application user interface for the Group of former students in and Institution. This Mobile application is developed with familiar user interface elements, which facilitate easy to access, understand and select various options.

[5]G R Bamnote, KarishmaTalan May 2015

In this paper they evaluate the shortest path problem; A * (Star) algorithm; Minimum weight node first Principle, efficiency evaluation. With the A Star search algorithm it is possible to find the shortest path from one point to another on a map.

Sr. No	Application Name	Advantage	Disadvantage
1	Hospital ATM Finder	1.Easily find out nearest hospital and ATM 2.show the route 3. It is simple app easy to understand.	1. At a time one content show either hospital or atm. 2. It does not show list of hospital.
2	Hospital Finder	1.Hospital finder provides you the Listing of around you. 3. You can save the hospital. 4. it provide the range by kilo meter	1.this application is limited for particular area 2 it required high speed internet. 3. It does not show nearest hospital. Hospital. Show the hospital rage wise.
3	Nearest Hospitals	1.find route on ap 2.Get current location to selected hospital 3.Share application link to the friends	1. List show randomly. Does not show any order. 2.medicals are show in hospital list 3.
4	Nearby Hospitals	1.share place to your family and friend 2.User can able to enter from/input place find to hospitals 3.It provide list of hospital	1. Does not show nearest hospital. 2 it required to enter name of hospital 3. It does not show current location.
5	Nearby places	1. It works all over the world. 2.Automaticaly find your location and show it on map 3. Find distance of searched location from your current position.	1. medicals are show in hospital list 2. It does not show nearest place on map. List of place show on list

III. PROPOSED WORK

In this project work we use different Google services and Map API that are as follows:

User Location API:

We are using different methods in this project to define the map fragments and also define the user location:

Location Manager: It is used to provide the location service to the application for defining the location.

Location provider: It is used to provide the location of the user from its current device location.

Location listener: It is used to define the location of the user after changing its latitude and longitude from the previous location.

Google Map API:

Google map API provides us the location services to reach to the destination within the time. API key will required to fetch all these things from the Google. In our " Lifeline" application we define route towards the nearest hospital from the current location of the user. In this application we additionally define the ATM and police station nearest from the user.

In our mobile device we use the Google Map application, but in emergency situation we cannot define all these three location at a time in the map so solution on that we dev

In our dologies to find the nea

1
2 t location of the
3 g hospitalFinder
4 format in XML
5 n the JSON file.
6
7 the destination
8

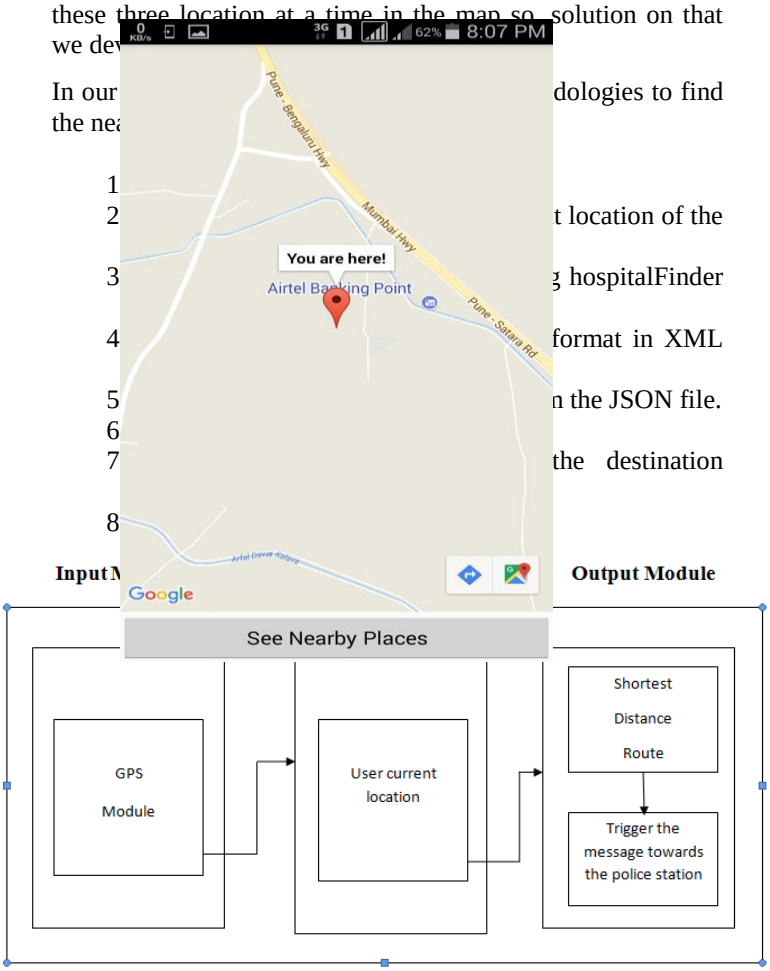


Fig.1. System Architecture

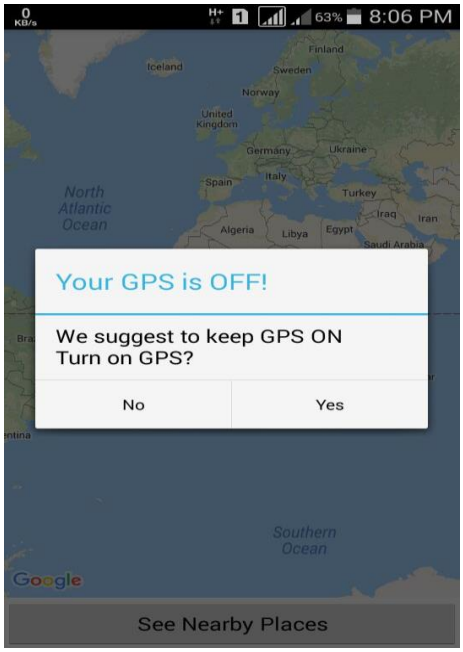
In fig 1. There are 3 modules in the system on which system can work.

1) Input module: This module can define GPS module can define to the user to find out the current location of the user. It define the latitude and longitude of the user`s location.

2) Process module: In this module the GPS can fetch the location of the user and display the location on the map of the application.

3) Output module: This module can display the nearest hospital from the current user location and also when you turn on this application it simply show the trigger call to police station on the notification bar.

VI. RESULTS




10:44 AM
Vijaya Bank ATM
Axis Bank ATM
Maharashtra Bank ATM Centre
IndusInd Bank ATM - Satara
Axis Bank ATM
भारतीय स्टेट बँक एटीएम
State Bank Of India ATM
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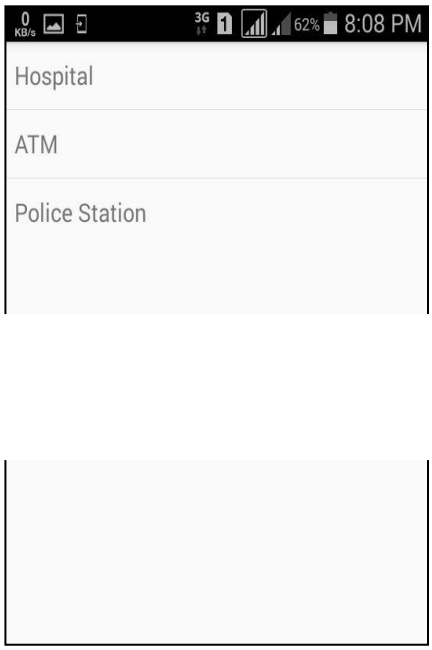
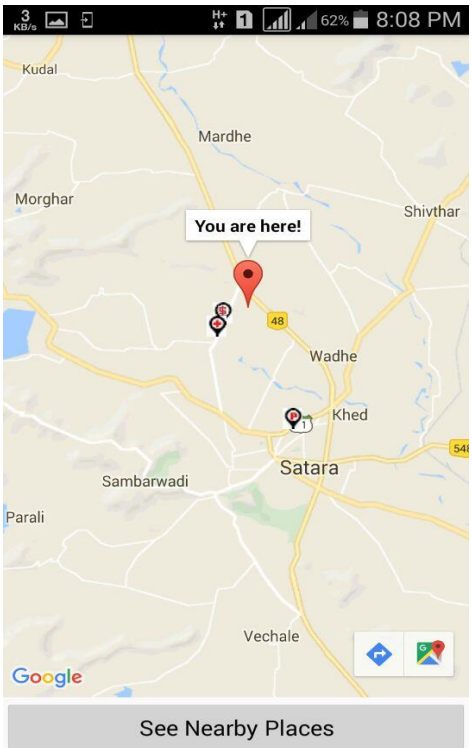
Union Bank ATM
State Bank Of India ATM
IDBI Bank ATM


8:08 PM
Hospital
ATM
Police Station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48
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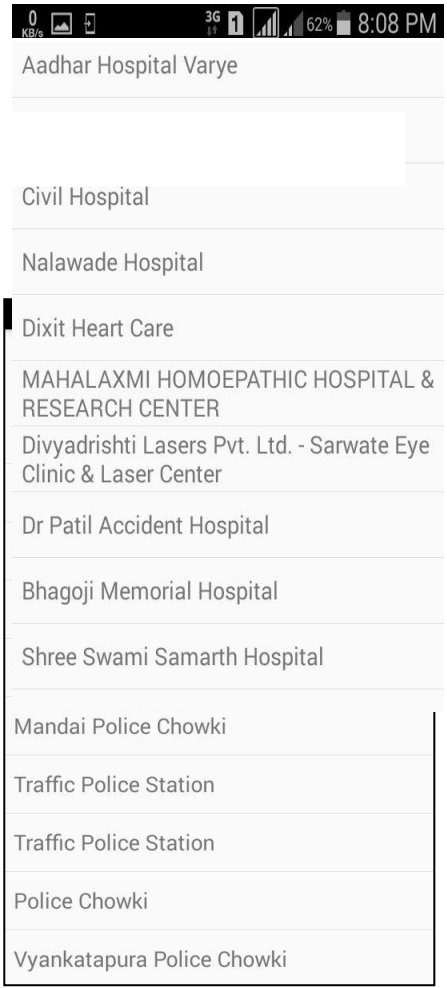
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Dr Patil Accident Hospital
Bhagoji Memorial Hospital
Shree Swami Samarth Hospital
Mandai Police Chowki
Traffic Police Station
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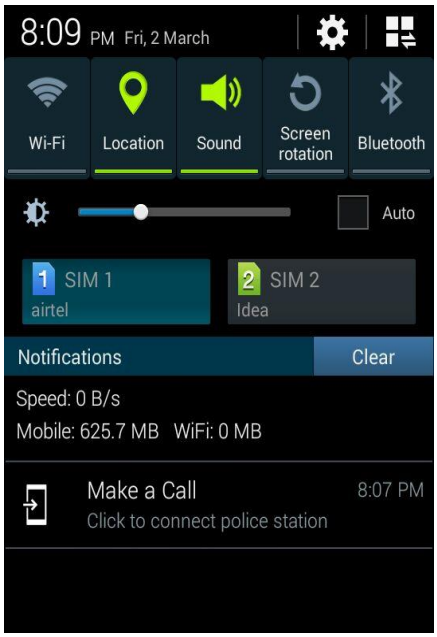
Police Chowki
Vyankatapura Police Chowki



V. CONCLUSION

In this project work we developed an android application to provide an emergency help to injured person in minimum time to save their life along with nearest hospital, ATM and police station.

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Self-organizing controller for Asynchronous motor drive Speed Control

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***Abstract*—The development of modern control theory, the general techniques of controller design is gradually replaced by artificial intelligence software technique be widely used. Artificial intelligent contains hard computation and soft computation.**

Comparatively speaking, artificial intelligence software technique has more easy operation and better performance. The intelligent control of electric drive system has attracted much attention at present. Artificial intelligent has found high application in most nonlinear systems same as motors drive. Because it has intelligence like human but there are no sentimental against human like angriness and… Artificial intelligent is used for various points like approximation, control, and monitoring. Because artificial intelligent techniques can use as controller for any system without requirement to system mathematical model, it has been used in electrical drive control.

Keywords— Artificial intelligent, electrical motor, intelligent drive and control.

I. INTRODUCTION

Induction motors require low maintenance, good pf and are robust, have many applications in industry. Along with industry progress, it indicates requirement to progresses drive with high performance. DC motors are control abler than AC motors but they require much cost. In addition, in equal power, DC motors have higher volume and weight. Main variations in semiconductors, converters topology, analyze technique and simulation of electrical machines drive and newer control technique have had role in this progress.

Intelligence control is a new stage of the development of the automatic control science. At present, the research and application of intelligence control have developed in many fields. At the same time, its development brings new ideas and new methods for the control strategy of electric drive system [1]. This leads to more advanced control methods to meet the real demand. The conventional control methods have the following difficulties

a) It is basis on mathematical accurate model of system that usual it is not known [2, 3].

b) Drives are nonlinear systems and Classical control performance with this system decrease [3, 4].

c) Variation of machine parameters (especially in vector control [2]) by load disturbance [4], motor saturation [3, 4] or thermal variations [3] does not cause expectation performance [3, 4].

d) Classical linear control shows high performance only for one unique act point [3].

e) With choose improperly coefficient, classical control cannot receive acceptable result and suitable choose for constant coefficient in especial application condition with set point varying, necessarily is not optimum [5].

To implement conventional control, the model of the controlled system must be known. The usual method of computation of mathematical model of a system is difficult. When there are system parameter variations or environmental disturbance, the behavior of the system is not satisfactory. Usually classical control is used in electrical motor drives. The classical controller designed for high performance increases the complexity of the design and hence the cost.

Advanced control based on artificial intelligent technique is called intelligent control [2, 6] that is known with "automatic control", "adaptive

control" or "self organizing control" [2]. In addition, simplicity in implementation, noise influences cancellation elimination, system disturbance elimination and parameter variation decreasing.

Advantages of Intelligent Control System

Artificial intelligent control system should adopt different control method according to different control. Nerve control, fuzzy control, neural network control and genetic algorithm can be seen as a family of nonlinear function approximator. These approximators can provide more accurate results and have more advantages than the conventional function estimator.

The specific model of control object will be needed in the control with the traditional function estimator; this is a big limitation, because it is very hard to get the exact dynamical equation of state in many occasions for human. But the limitation can not affect the artificial intelligent control systems which do not need the model of control object.

Artificial intelligent controller can be divided into three classes supervised, unsupervised and reinforcement learning controller. The topology structure and learning algorithm of traditional supervised learning neural network controller have become fixed and unchangeable, this point must give more limitations to controller with this structure that the computation time is more long and the computation effect is not good well. Applying neural network and cut-and-try method can avoid these errors in order to increase learning rate.

II. Fuzzy Control

Advanced control based on artificial intelligence technique is called intelligent control. Every system with artificial intelligence is called self-organizing system. On the 80th decade the production of electronic circuits and microprocessors with high computation ability and operating speed has grown very fast. The high power, high speed and low cost modern processors like DSP, FPGA and ASIC IC's along with power technique switches like IGBT made the intelligent control to be used widely in electrical drives.

Intelligent control, act better than conventional adaptive controls. Artificial intelligent techniques divide two groups:

hard computation and soft computation [5]. Expert system belongs to hard computation which has been the first artificial

intelligent technique. In recent two decades, soft computation is used widely in electrical drives. They are,

1. Artificial Neural Network (ANN)
2. Fuzzy Logic Set (FLS)
3. Fuzzy-Neural Network (FNN)
4. Genetic Algorithm Based system (GAB)
5. Genetic Algorithm Assisted system (GAA)

Neural networks and fuzzy logic technique are quite different, and yet with unique capabilities useful in information processing by specifying mathematical relationships among numerous variables in a complex system, performing mappings with degree of imprecision, control of nonlinear system to a degree not possible with conventional linear systems. Fuzzy logic is a technique to embody human-like thinking into a control system. A fuzzy controller can be designed to emulate human deductive thinking, that is, the process people use to infer conclusions from what they know. Fuzzy control has been primarily applied to the control of processes through fuzzy linguistic descriptions. Fuzzy control system consists of four blocks as shown in Fig. 1.

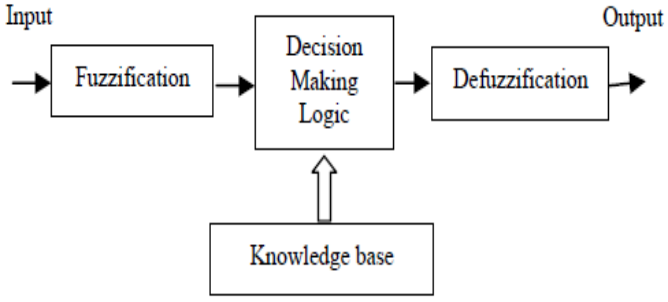


Fig. 1 Fuzzy Control System

This paper deals about the sandwich of artificial intelligence technique particularly fuzzy logic in the speed control of Induction motor. The Section II describes the block diagram of 3Φ IM drive along with fuzzy controller. Section III describes the implementation of maximum torque generation under field oriented control using fuzzy logic

controller. Section V Simulation results are given to demonstrate the advantage of proposed scheme is described in Section VI. Conclusion and reference studies are mentioned in the last section.

III. Block diagram of implemented circuit

Block diagram of implemented drive has shown in figure (2). Using fuzzy logic principles in induction motor speed control has described in [6]. Figure (2) shows block diagram of PI fuzzy logic controller [3, 7]. Speed error ($\Delta\omega 1 = \omega i - \omega f1$) is calculated with comparison between reference speed command and speed signal feedback. Speed error and speed error changing are fuzzy controller inputs, so much speed error ($\Delta(\Delta\omega) = \Delta\omega 2 - \Delta\omega 1$) changing be calculated.

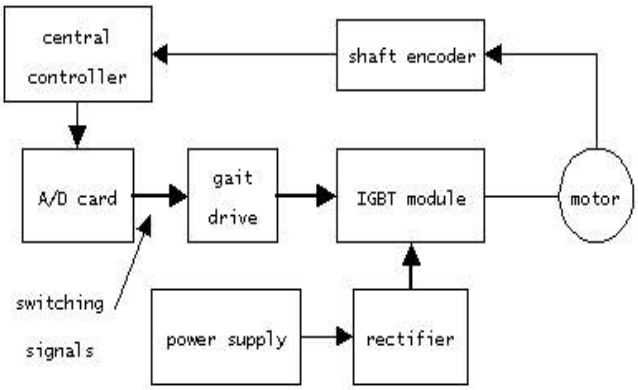


Fig. 2 Block diagram of implemented drive

IV. IMPLEMENTATION OF FUZZY LOGIC CONTROLLER

To obtain fuzzy based model of the motor, the training system derives information from two main sources,

a. The static flux linkage curves of the motor, which provides important information about the electromagnetic characteristics of the motor

b. The dynamic real time operating waveforms of the motor, which can include real-time operating effects, such as mutual coupling between phases, temperature variations, eddy currents and skin effects.

During the training phase, each input-output data pair, which consists of a crisp numerical value of measured flux linkage, current, angle and voltage is used to generate the fuzzy rules.

Input variables require be normalized which range of membership functions specify them, in figure (3) normalization factors have shown with K1 and K2. Suitable normalization has direct influence in algorithm optimality and faster response

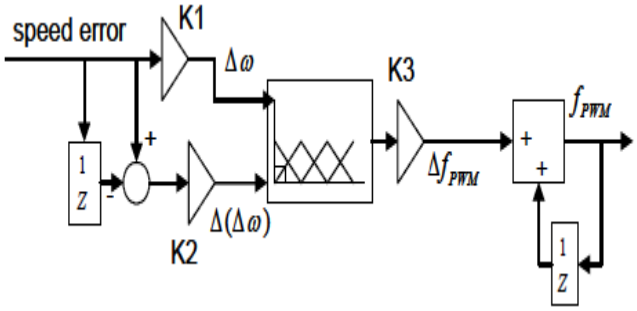
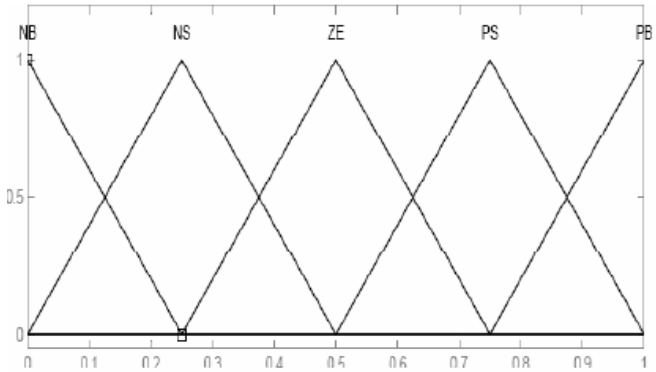
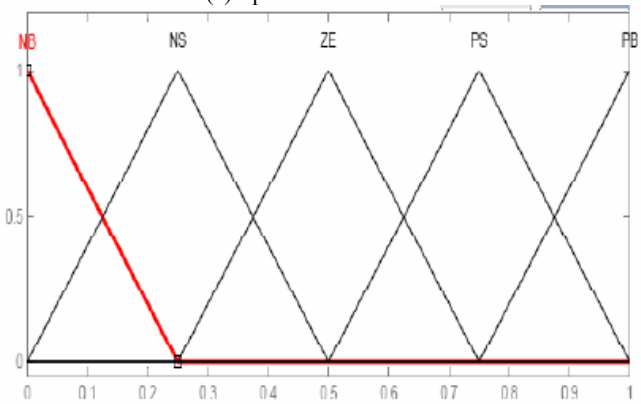


Fig. 3 Fuzzy PI controller

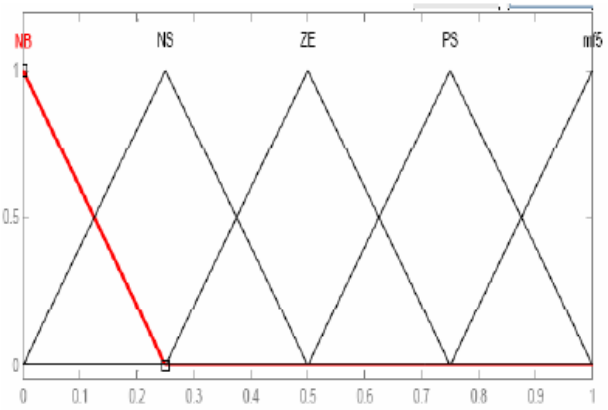
To determine a fuzzy rule from each input-output data pair, the first step is to find the degree of each data value in every membership region of its corresponding fuzzy domain. The variable is then assigned to the region with the maximum degree. When each new rule is generated from the input-output data pairs, a rule degree or truth is assigned to that rule, where this rule degree is defined as the degree of confidence that the rule does in fact correlate to the function relating voltage and current to angle. In the developed method a degree is assigned which is the product of the membership function degree of each variable in its respective region. Every training data set produces a corresponding fuzzy rule that is stored in the fuzzy rule base. Therefore, as each input output data pair is processed, rules are generated. A fuzzy rule or knowledge base is in the form of two dimensional table, which can be looked up by the fuzzy reasoning mechanism. Speed error is calculated with comparison between reference speed and speed signal feedback. Speed error and speed error changing are fuzzy controller inputs. Input variables are normalized with a range of membership functions specified and the normalization factors are named as K1 and K2. Suitable normalization has direct influence in algorithm optimality and faster response. Refer Fig. 2. Fig. 4 shows normalized membership functions for input and output variables. A fuzzy logic controller operation is based on the rules formed.



(a)Input Variable “K1”



(b)Input Variable “K2”



(c) Out-put Membership functions

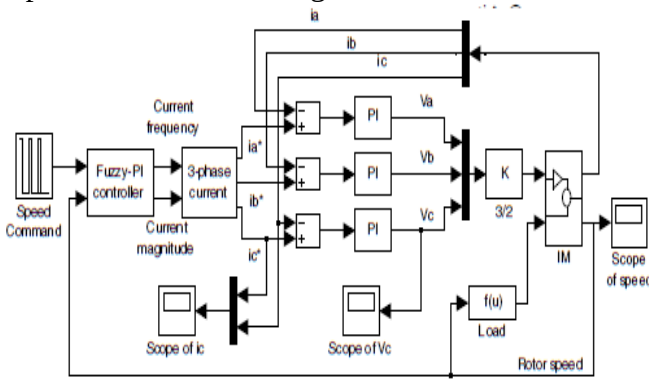
Fig 4 (a) Membership function for input variable K1 (b) Membership
function for input variable K2 (c) Membership function for output variable

Table1
FUZZY CONTROLLER OPERATION

e \ Δe	NS	NM	NS	ZE	PS	PM	PB
Output							
NB	NB	NB	NM	NM	NS	NS	ZE
NM	NB	NM	NM	NS	NS	ZE	PS
NS	NM	NM	NS	NS	ZE	PS	PS
ZE	NM	NS	NS	ZE	PS	PS	PM
PS	NS	NS	ZE	PS	PS	PM	PM
PM	NS	ZE	PS	PS	PM	PM	PB
PB	ZE	PS	PS	PM	PM	PB	PB

V. RESULTS

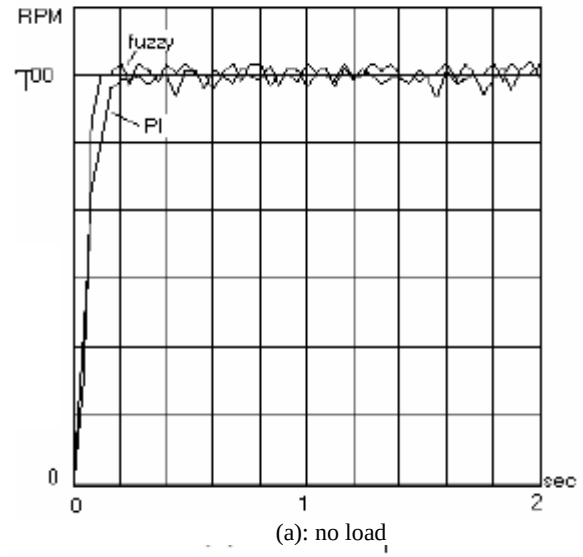
Fuzzy Controller results: Input variables are required to be normalized with ranges of membership functions specified. Suitable normalization has direct influence in algorithm and results in optimality and faster response. The fuzzy logic controller operation is based on the control operation shown in Table I. Following figure represents simulated diagram.



For evaluation of implemented drive, different responses of drive are presented. Sampling time and interrupt time are 2ms and 20us respectively.

Step response of for 600 rpm reference speed with no load and full load condition has represented respectively in figure (7-a) and (7-b). Responses have drawn for 2 sec that motor speed is according to RPM. These responses is compared a driver responses with classical controller. In figures, driver responses with fuzzy controller are specified "FUZZY" and classical controller is represented "PI". In full load, driver response has almost

similar trajectory with classical and fuzzy controller. Rise time nearly is 0.1 sec also in responses has be seen no overshoot. In no load, driver with fuzzy controller has response faster than classical controller response. Driver with fuzzy controller has almost received to reference speed at 0.1 sec, as this time in classical controller s nearly 0.15 sec. driver responses have not any overshoot. Steady state error is %5 for each response. Few speed subsidence in steady state shows that motor flux has been fixed, comparison with no load condition. Because with load changing motor speed has not changed much and speed regulation is nearly suitable.



(a): no load

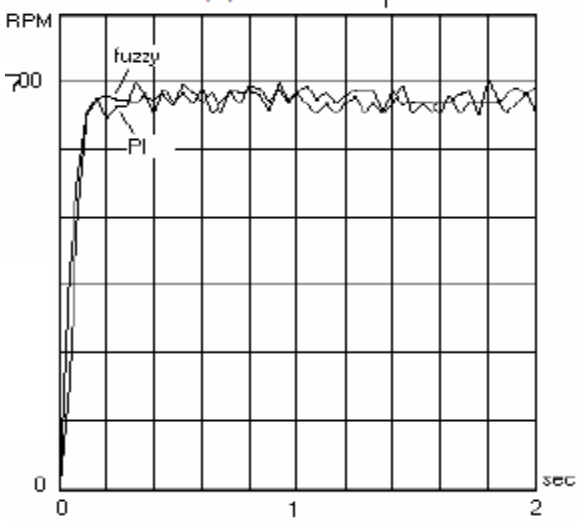


Fig. 7 Step response
(b): full load

VI. CONCLUSION

A new FLC that improve the performance of Induction Motor speed drives has been proposed. This speed controller gives maximum torque over the entire speed range. The method uses the new linguistic rule table in Fuzzy knowledge based controller to adjust the motor control speed, and this FLC can achieve a good system performance of the Induction Motor scalar drive, and it is possible to implement a PI Fuzzy logic controller instead the traditional PI controller. The proposed speed control system can be useful for the variable speed drive system.

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Harmonic Mitigation and Reactive Power Compensation by Shunt Active Filter using p-q Theory

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Abstract— With the widespread use of power electronics devices such as rectifier, inverter etc. in power system causes serious problem relating to power quality. One of such problem is generation of current and voltage harmonics causing distortion of load waveform, voltage fluctuation, voltage dip, heating of equipment etc. Also presence of non-linear loads such as UPS, SMPS, speed drives etc. causes the generation of current harmonics in power system. They draw reactive power components of current from the AC mains, hence causing disturbance in supply current waveform.
Thus to avoid the consequences of harmonics we have to compensate the harmonic component in power utility system. Among various method used, one of the effective method to reduce harmonic in power system is the use of Shunt Active Power Filter (SAPF). Active filters are popular due to its smaller size and weight in contrast to passive filter. In this paper, work is done on shunt active power filter (SAPF) using P-Q theory for current harmonic mitigation and reactive power compensation. Here the simulation as well as its parameters, with or without active filter is well presented. We commence the paper with power quality issues then better understanding of PQ theory, simulation circuits, results, comparison and finally ended with conclusion. An effort is made to achieve THD value of source current below 5% to meet the required IEEE standards.

Keywords—*Power quality, Active filter, PQ theory, Non linear load, THD, Reactive Power Compensation, MATLAB Simulation*

I. INTRODUCTION

At present high technology environment non-linear loads are increasingly common. Because of this change in the load structure, power quality and harmonics mitigation have become a major topic in this decade. Problems caused by harmonics are resulting in higher operations costs, and may also lead to reduced product quality and production output.

Harmonic frequencies in the system are the root cause of power quality problems. Basically, Harmonics is defined as the sinusoidal part of the quantity having a frequency that is the integral multiple of the fundamental frequency [1]. This harmonics is generated by several non-linear loads, will travel back to the source up to the point of common coupling and will adversely affect other equipments.

Earlier, passive filters were used as harmonic elimination technique due to their cheaper cost and ease of operation. But they face some major drawbacks of specific harmonic elimination, detuning, large size, series/parallel resonance, etc. To outlive those difficulties, a technique named Active filters was developed. They provide compensation for several current harmonics, reactive power, voltage flicker, voltage sags, etc. On the basis of the connection with the power system, active filters are classified as Shunt Active Power Filter, Series Active Power Filter & Hybrid Active Power Filter.

Shunt active filters are preferred for current harmonic removal .Other than that, they also posses additional ability of reactive power compensation.

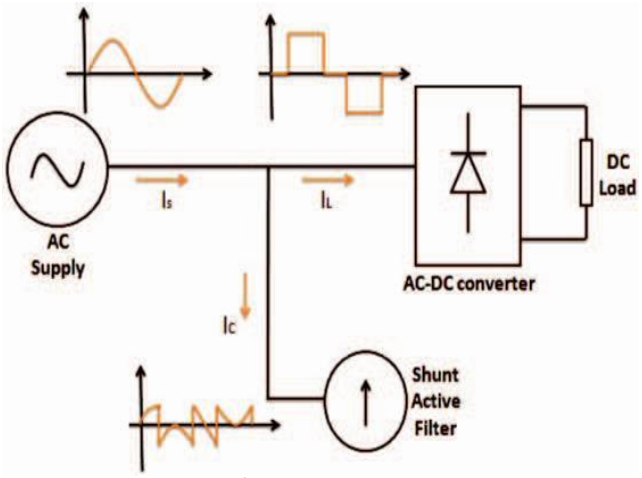

Fig. 1. Basic block diagram of SAPF

Fig.1 shows the basic block diagram of Shunt Active Filter for harmonic compensation. A three phase source is feeding the non-linear load with the APF connected in parallel. IS is the source current, IL is load current & IC is compensating current. It injects harmonic current that is equal in magnitude to the load harmonic current but having 180 phase shift to cancel out the load current harmonics and the source current will be sinusoidal.

The present study is based on the Shunt active power filter. Design based strategy is done to eliminate several dominant order current harmonics from the system caused by the 3-phase uncontrolled bridge rectifier with inductive load. This paper based on the comparative analysis based on Total Harmonic Distortion (% THD) and Reactive power for the system without APF and the system with APF.

II TOPOLOGY

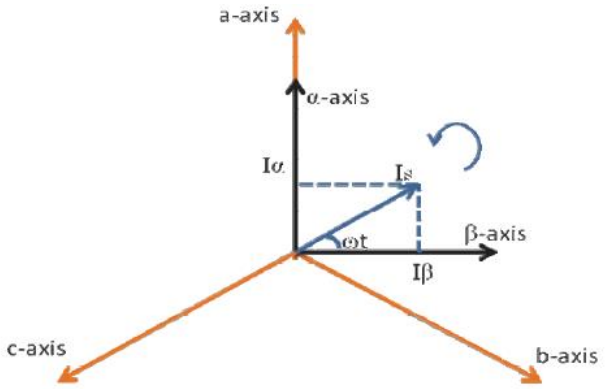

Fig. 2. Vector diagram for abc & αβ axis

Fig 2 shows graphical representation of abc to αβ axis called as Clarke Transformation and αβ to abc called as Inverse Clarke Transformation.

Instantaneous values of voltage and current referred to the abc axes are transformed into the αβ stationary axes, or vice versa. a, b and c axis are shifted by 120 from each other while α and β axes are perpendicular to each other. α axis is parallel to the 'a' axis. Direction of β axis is chosen in such a way that if voltage and current vectors rotates in abc sequence on the abc coordinates, they would rotate in the αβ sequence on the αβ coordinates. [3]

A. *P-Q Theory*

In 1983, Akagi [3] proposed the generalized theory of the instantaneous reactive power in ac networks. It is also known as instantaneous reactive power theory, or p-q theory.

P-Q theory defines the instantaneous real and imaginary power is a powerful tool, not only used for harmonic mitigation but also for reactive power compensation. It also deals with power flow control in a transmission line. [6]

This theory is valid for three phase three wire, three phases four wire as well as single phase networks. The first step in p-q theory is an algebraic transformation of the three-phase Voltages and currents from a-b-c coordinate to the α-β-0 Coordinate.

vectors are transformed into _-_ coordinates as follows

The relation between load current & voltage of three phase power system and the orthogonal coordinates (α-β-0) system are expressed by Clarke's transformation which is shown by the following equations (1) & (2)

$$\begin{bmatrix} V0 \\ V\alpha \\ V\beta \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} Va \\ Vb \\ Vc \end{bmatrix} \quad (1)$$

$$\begin{bmatrix} I0 \\ I\alpha \\ I\beta \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} Ia \\ Ib \\ Ic \end{bmatrix} \quad (2)$$

In orthogonal co-ordinate system instantaneous power can be found out by simply multiplying the instantaneous current with their corresponding instantaneous voltage. Here the 3 phase coordinate system (a-b-c) is mutually orthogonal is nature, so we can found out instantaneous power as in the form of equation (3)

$$p = VaIa + VbIb + VcIc \quad (3)$$

From above equations, the instantaneous active and reactive power in matrix form can be rewritten as

$$\begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} V\alpha & V\beta \\ V\beta & -V\alpha \end{bmatrix} \begin{bmatrix} I\alpha \\ I\beta \end{bmatrix} \quad (4)$$

The instantaneous reactive power produces an opposing vector with 180 degree phase shift in order to cancel the harmonic component in the line current. From the above equations, yield equation (5)

$$\begin{bmatrix} I\alpha \\ I\beta \end{bmatrix} = \frac{1}{V\alpha^2 + V\beta^2} \begin{bmatrix} V\alpha & V\beta \\ V\beta & -V\alpha \end{bmatrix} \begin{bmatrix} -Po + Ploss \\ q \end{bmatrix} \quad (5)$$

After finding the α-β reference current, the compensating current for each phase can be derived by using the inverse Clarke transformations as shown in equation (6)

$$\begin{bmatrix} Ia \\ Ib \\ Ic \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} \frac{1}{\sqrt{2}} & 1 & 0 \\ \frac{1}{\sqrt{2}} & \frac{1}{2} & \frac{\sqrt{3}}{2} \\ \frac{1}{\sqrt{2}} & -\frac{1}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix} \begin{bmatrix} I0 \\ I\alpha \\ I\beta \end{bmatrix} \quad (6)$$

The reference compensating currents obtained from equation (5) are compared with the actual compensating current generated at the inverter output and the error signals obtained are used to generate the gating pulses for the 3-phase inverter.

These equations are used to carry out the simulation of SAPF with the help of embedded function block.

III. MATLAB SIMULATION

Fig.3 shows MATLAB simulation of a basic 3-phase rectifier load without any filter. Here, the load considered is of RL type.

A. Simulation Circuit W/o Filter

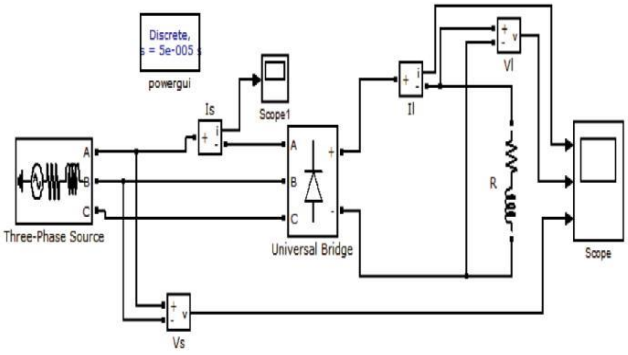

Fig. 3. Simulation circuit for RL load Without SAPF

Parameters: R= 100Ÿ
L= 100mH
A THD result of source current is 30.39% as shown below. This is far beyond the permissible limit of IEEE standard. So it is needed to compensate.

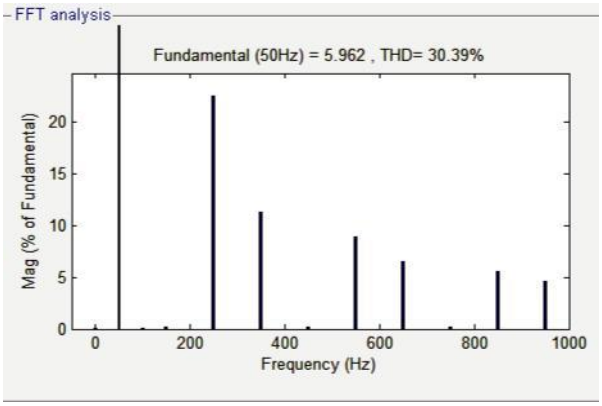

Fig.4. THD without SAPF

Fig. 5 shows source current which is highly distorted and non sinusoidal waveform so SAPF is employed as a closed loop system.

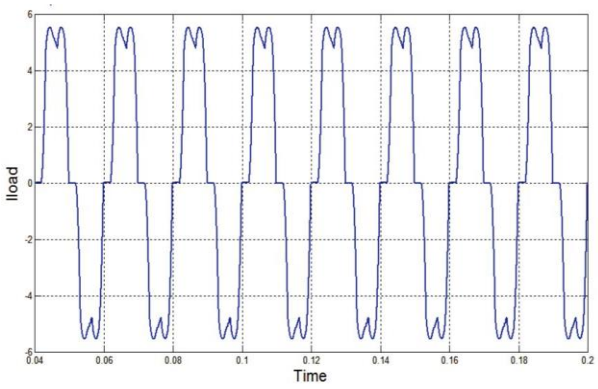

Fig.5. Input current waveform without SAPF

B. Simulation Circuit with Filter

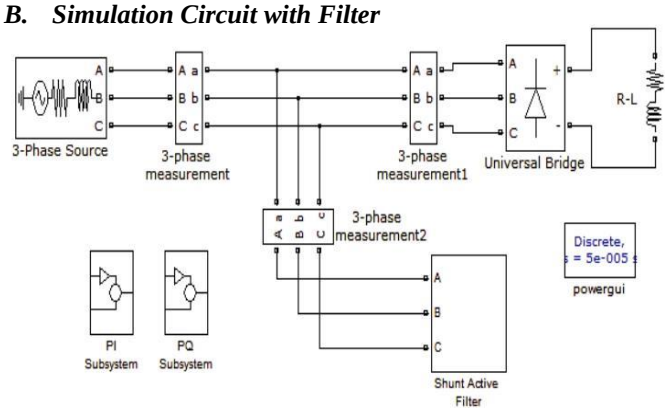

Fig. 6. Simulation circuit with SAPF

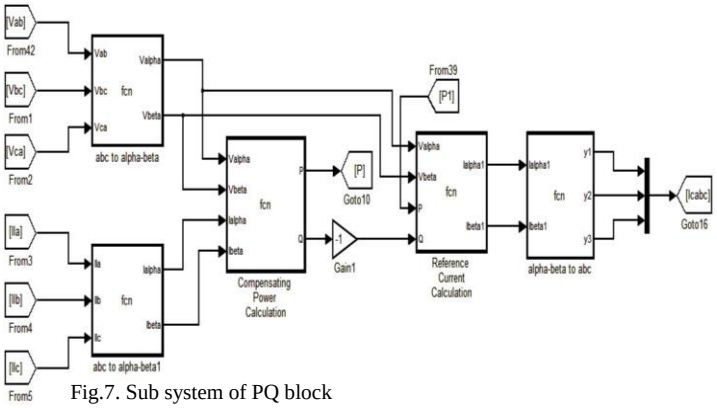

Fig.7. Sub system of PQ block

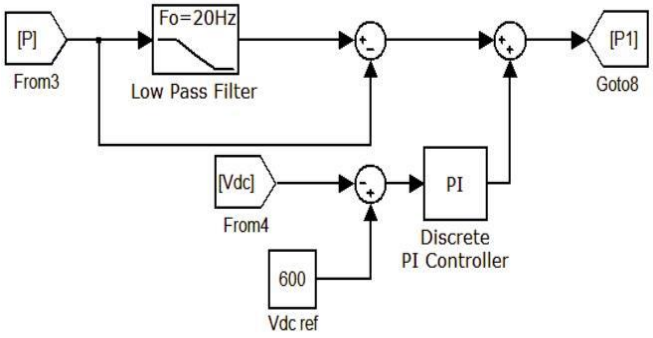

Fig.8. Sub system of PI Controller block

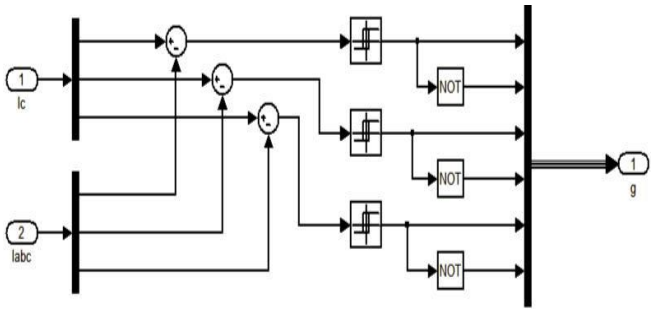

Fig. 9. Sub system of Hysteresis current control block

Fig 6 shows complete MATLAB simulation circuit for the system with Shunt Active Power Filter. Three phase supply is connected to the RL load through Universal bridge rectifier.

It consists of four functional blocks.

1. *Instantaneous power calculation block:*
   Instantaneous power of the non-linear load is calculated by using this block. The output will be the Instantaneous active and reactive power.
2. *Power- Compensating Selection block:*
   It establishes the performance of Shunt Active Filter. It decides the part of the real and imaginary power of the load that should be compensated by the filter.
3. *Dc voltage Regulator block:*
   It regulates the additional quantity of real power characterized by P_{loss} that leads to the supplementary flow of power to the capacitor to maintain its voltage around preset reference value.
4. *Current reference calculation block:*
   These P_{loss} and P_{ac}, along with q_c are passed through the current reference calculation block. It determines the instantaneous compensating current references from the compensating powers and voltages. These reference currents obtained will be in αβ frame. They are transformed to abc frame using Inverse Clarke transformation.

Fig 7 shows subsystem of P-Q theory. Equations (1) - (6) are programmed using EMBEDDED function block and connecting them in proper sequence will provide us with the reference current.

As P= Pdc + Pac. Total power consists of 2 components i.e., Pdc & Pac. As shown in fig.8, 2nd order filters having cutoff frequency of 20 Hz is used to separate the dc component (average) of the total power. Hence only oscillating component remains at the output. Now, Output of PI controller is added with oscillating component of the total power, which is output of filter. And then it is given to current reference calculation block which is shown in fig.9.

Fig.9 comprises of Hysteresis current control block. Comparison of two current is done in this block. Generated compensating current of the filter are monitored instantaneously and compared to the reference currents generated by the control scheme. It determines the switching pattern of the Shunt active filter. Hysteresis band is of 0.04 A. After comparing two currents, pulses are generated and it is given to inverter.

Parameter	Value
Supply	415V, 50Hz
Source Impedance	R= 0.1 , L = 0.15mH
Filter Inductance (Ls)	15mH
Load(R-L)	R= 60 , L=20 mH
Kp , Ki	0.2 , 1.5
Capacitor voltage Cdc	35μF

IV. RESULT

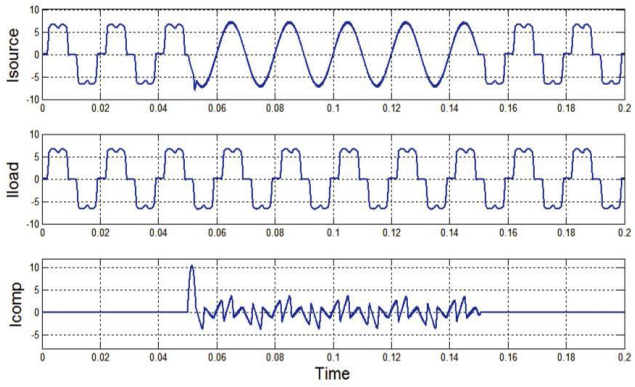

Fig. 10. Source current, Load current and Compensating Current

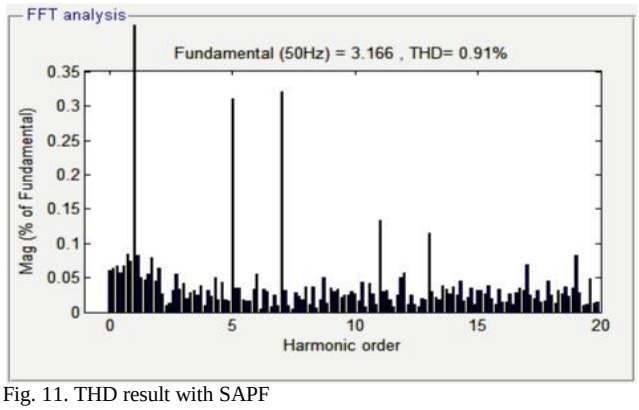

Fig. 11. THD result with SAPF

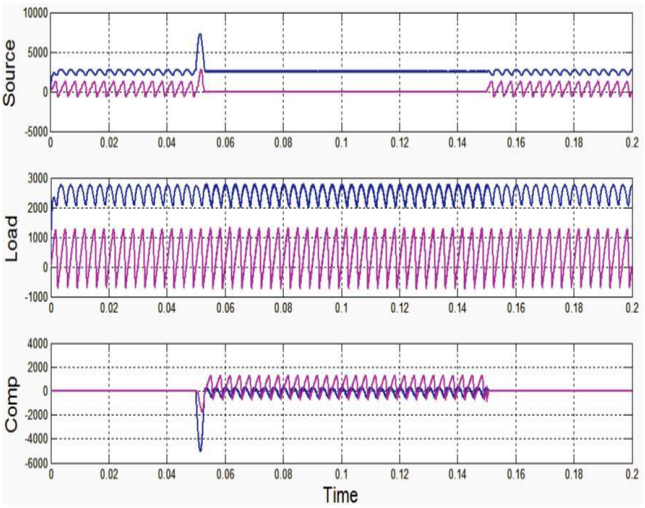

Fig. 12. Active & Reactive Power of Source, Load and Filter

Fig.10 shows the source current, load current and compensating current for the system containing SAPF. 3-phase breaker is connected to the filter. Breaker will start at 0.05 seconds and will remain 'ON' till 0.15 seconds. Meanwhile, it is observed that the effectiveness of Active filter will make the supply current sinusoidal with THD reduced from 30.39% to 0.91% as shown in Fig. 11. Thus, THD lies within the specified IEEE standards.

Active Filter also compensated for the reactive power of the supply. From Fig.12 it is seen that when breaker is in OFF position, the reactive power demand of the load is supplied by the source but in its ON position i.e. from 0.05 sec to 0.15 sec, the reactive power is supplied by filter and the source supplies only the active power to the system.

V. COMPARISON

The comparison based on the connection of the filter Is shown in Table I. Value of THD is decreased from 30.39% to 0.91%. Even the Reactive power supplied by source is totally compensated after the participation of SAPF. In addition the additional advantage that active filter provides to the system is the elimination of the active power oscillations and hence providing constant instantaneous active power from the supply.

TABLE I

Quantity	Without SAPF	With SAPF
THD (%)	30.39	0.91
Reactive Power (Var)	28	0

VI. CONCLUSION

This is the only method when the loads may be balanced/ unbalanced, linear/non-linear and any distortion the source current must be sinusoidal. Because of this we can preferred this proposed approach method. The AF is observed to eliminate the harmonic and reactive components of load current resulting in sinusoidal and unity power-factor source currents. It is observed that the source current remains below the load current even during transient conditions. The AF enhances the system efficiency because the source need not process the harmonic and reactive power demanded by the load. So, the active filter controller is based on the p-q theory, which proved to be a powerful tool.

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Techno-economic of Energy Production and Net Metering of Grid Connected Rooftop Photovoltaic System in Maharashtra

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Abstract

Ministry of Renewable Energy, Government of India in the year 2015, revised the target of solar power generation to 100 GW under National Solar Mission. But out of this 100 GW, target of power of generation completed through grid connected rooftop photovoltaic power plants is 40 GW till the end of the financial year 2021-22. A large number of rooftop systems are being installed for achieving this ambitious target of 40 GW. This paper discusses the guiding principle and technical specifications of various components of grid connected rooftop photovoltaic systems that are specified by Maharashtra Renewable Energy Corporation Ltd for projects being implemented in Maharashtra state of India. Mumbai is located in the equatorial region and receives an annual average 5.35 KWh/m2/day solar radiation. This paper evaluates the optimum design of particular PV modules for lowest payback period. The 3.3 kW building integrated PV system (PBIV) on the rooftop of terrace house located at Mumbai, Maharashtra with a longitude 72.85 and latitude 19.05. This paper discusses four types of PV modules using simulation design through the PVsyst software to identify the total energy yield produced by the numerous modules. The life cycle cost (LCC), liveliest cost of energy (LCOE) and payback period is calculated to identify the economic value of PV module selection. The study concluded that LCOE is between RM0.2400 to RM0.3186 per kWh, payback period of each PV module selection varies between 10.8 to 14.8 years and the annual saving is RM1180.75 to RM1294.75 with Net Energy Metering incentive.

Keywords—Photovoltaic, PV Module, Net Metering, LCOE, Payback Net metering; rooftop photovoltaic
System;

I. INTRODUCTION

Ministry of New and Renewable Energy (MNRE) of Government of India in year 2015 revised the target of solar power generation to 100 GW under National Solar Mission. This targeted goal is to be achieved till the end of financial year 2021-2022. It was also decided that out of 100 GW, 40 GW of solar power will be generated through grid connected rooftop photovoltaic (RTPV) systems. For achieving this ambitious target, a large number of grid connected RTPV systems will be installed [1]. The electricity energy production by rooftop photovoltaic (RTPV) System becomes more popular in Maharashtra after the implementation of the Renewable Energy Act 2011. It doesn't require a separate land space or area. It is flexible to install on the roof of the house or commercial complex. This paper discusses the net metering circuit arrangements and estimates the energy production of a RTPV system using PV modules software tools at Mumbai location in Maharashtra state of India. This act familiarized the feed in tariff (FiT) (which took effect from June 2011 to October 2016) and net energy metering (NEM) (which took effect in November 2016 & onwards) to encourage consumers to generate electricity from PV.

The FiT rate offered up to RM1.78 per kWh energy produced by PV on 2012 and was reduced to RM1.0879 for installed capacities below 4 kWp whereas NEM offered RM0.310 for every kWh energy exported at the low voltage (below 1kV) and RM0.238 at medium voltage (1kV to 50kV) [2]. Maharashtra is located at the equatorial region and has Peak sun hours approximately six hours a day [3]. Therefore, solar energy has a massive potential as a main source for renewable energy. Economic analysis is essential to optimize energy production with a reference [4] conducted a comparison of FiT and NEM implementation for commercial buildings. Reference [5] calculated the effect of solar radiation and temperature for PV energy production, reference [6] concentrated on energy production between multicrystalline and thin film PV modules while reference [7] is compared the performance of PV module between HIT and c-Si mono-crystalline. Presently, four types of PV modules can be found in the market, including mono-crystalline, multicrystalline, heterojunction with superfluous thin layer (HIT) and thin film. Reference [6] concluded that thin film PV module performance was not affected significantly by the increase in temperature and decrease in radiation as compare with multicrystalline PV module while the researcher [7] found that the HIT PV module can convert 14.8% the solar energy to electricity compared with c-Si can convert 11.69% the solar energy to electricity.

This paper is present an economic assessment of the PV energy yield and installation cost of the four types of PV modules. The LCC, LCOE and payback period were calculated to identify the best PV module installed in Mumbai under the NEM incentive scheme.

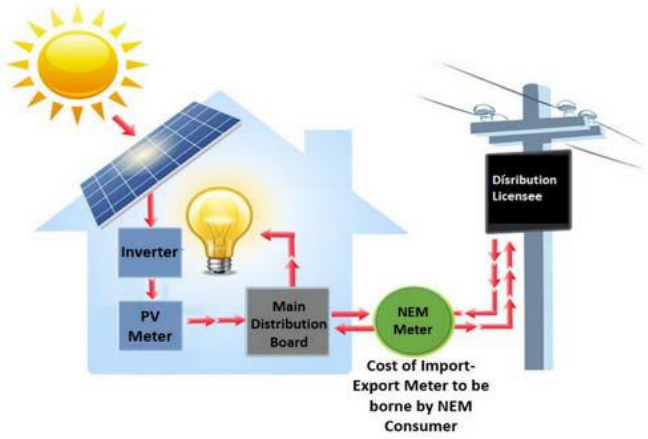

Fig. 1. Net Metering Concept [3]

II. NET ENERGY METERING

NEM is an incentive scheme that consumers are encourages to generate electricity from solar PV. The Maharashtra government planned for a project of 500 MW capacity from November 2016 to 2020. Within this period, 100 MW capacity is the limit per year. The quota is to be divided into three categories including 10% for domestic and 45% for commercial and industrial consumer respectively [3]. The concept of NEM is shown in Fig. 1, where energy produced by solar PV modules is consumed by consumers and the excess energy is exported to the grid. The PV module systems can be installed in available rooftops or car porch only within their own premises.

III. SYSTEM CONFIGURATION

A. Resources of Solar Energy

The electricity produced from PV depends on solar irradiance, cell temperature and types of PV modules [8]. For this study, solar irradiance and temperature were taken from Metoernom 7.1 by using PVSyst software. Fig. 2 shows the monthly average solar radiation and temperature in Mumbai

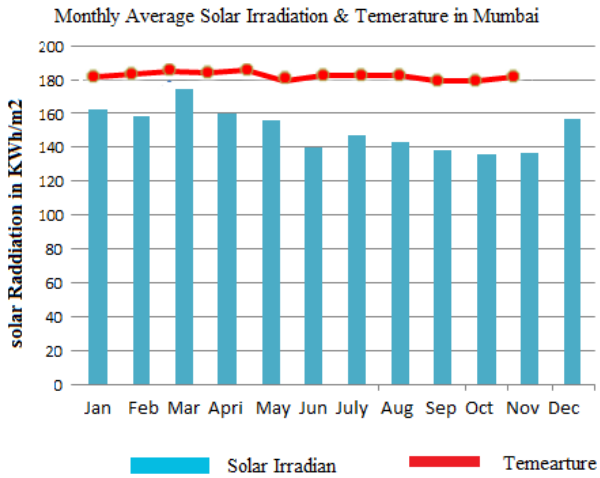

Fig. 2. Monthly Average Solar Radiation and Temperature in Mumbai [9]

Table 1: Residential load [10]

Load	Power, W	Quantity	Daily Usage, h	Energy, kWh
Refrigerator	50	1	24	1.2
Television	60	1	6	0.36
Washing Machine	300	1	2	0.6
Air Conditioning	746	1	7	5.222
Rice Cooker	300	1	1	0.3
Iron	800	1	0.5	0.4
Ceiling Fan	60	2	6	0.72
Table Fan	25	1	2	0.05
Fluorescent Lamp1	20	1	12	0.24
Fluorescent Lamp2	40	7	6	1.68
Total				10.772

B. Load Demand

Table 1 displays the typical residential load in Mumbai. The daily average load consumption in the residential area is 10.772 kWh and the monthly average load consumption is 323.16 kWh.

C. System Component

The system model of the Building Integrated Grid Connected photovoltaic PV Module (BIPV) for residential area is illustrated in Fig. 3. This system consists of a PV array, inverter, national grid and AC load. Electricity energy generated by the PV array will supply to the AC load. At low load demand, excess energy will be exported to the national grid while at a low energy production, the national grid will supply energy to the AC load.

- PV Modules

The technical specification of four types of PV modules is given in Table II.

- Inverter

The inverted selected for this design is SMA Sunny Boy 3800 which has a maximum input DC power of 3820 W and maximum output AC power of 3300W with 95.2% efficiency [9].

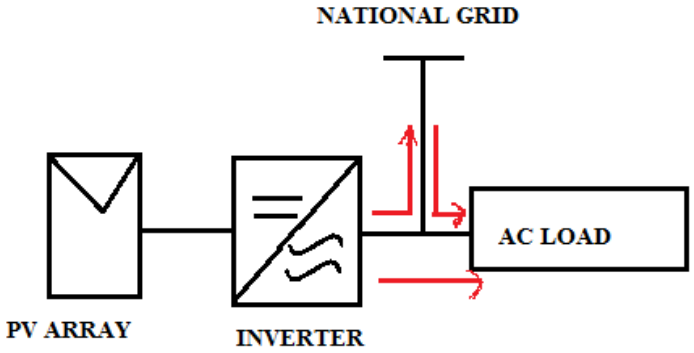

Fig. 3. Schematic Diagram of Building Integrated PV System

Table 2: Technical specification of selected pv modules [9]

Type of PV Module	Brand	Rated Power per module	Temperature Coefficient Factor, %/°C	Efficiency, %
Mono-crystalline	Sharp	280	-0.39	17.12
Multi-crystalline	Canadian	260	-0.41	15.90
HIT	Panasonic	235	-0.30	18.75
Thin Film	First Solar	120	-0.27	16.60

B. SYSTEM DESIGN

A. Load Demand Estimation

Daily average load profile of residential Consumer is shown in Fig. 4. The figure shows that the demand is higher at night than during the day. The reason for this difference is that during the day (between 8am to 5pm) most residential consumer are either at work or school. After 6pm, consumers return home and start using electrical appliances such as television, lamp, Fan, Mobile chargers and air conditioning machines.

B. PV Generator

Electricity generated by the PV module depends on the rated power from PV module, peak sun hour (PSH), efficiency of PV module, inverter and cable losses as shown in Eq. 1 to 4 [10-12]

$$P_{PV}(t) = P_{PV\_mod}(T)\ x\ \eta_{PV}\ x\ \eta_{inv}\ x \eta_{cable}\ x\ PSH(t) \quad (1)$$

$$P_{PV\_mod}(T) = P_{PV\_rated}\ x[1 + f_{temp}] \quad (2)$$

$$PSH = \frac{G(t)}{1kW/m^2} \quad (3)$$

$$f_{temp} = 1 + \left(\frac{\gamma_{temp\_stc}}{100}\right) x\left(T_{cell} - T_{STC}\right) \quad (4)$$

Whereas γtemp_stc is the temperature coefficient factor of PV module, PSH is peak sun hour, ftemp is frequency of temperature. Tcell is the cell temperature, ηPV, ηcable, ηinv is the efficiency of PV module, Cable, Inverter respectively, and Tstc is temperature at standard test condition, 25ºC.

C. Inverter

In selecting the inverter, it should be more than 80% of the PV output and less than 120% of the PV output as shown in Eq. 5 [13]. The percentages are used to protect the inverter at high voltage and high current.

$$0.8\,P_{inv\_DC} \langle P_{inv\_DC} \langle 1.2\,P_{inv\_DC} \quad (5)$$

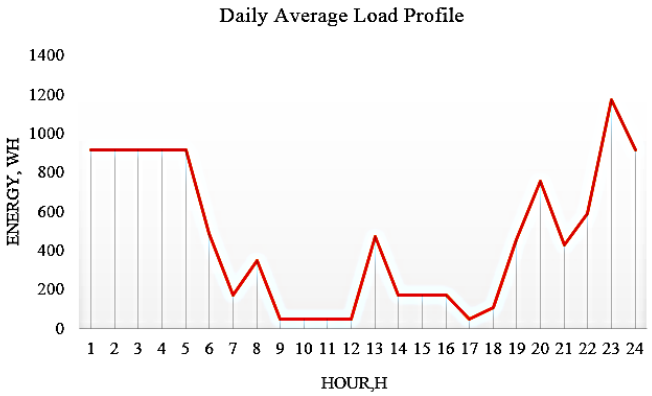

Fig. 4. Daily Average Load Profile

D. System Component Price

The price of the PV module, the inverter and the balance of system including installation costs [10,14] are shown in Table III with the currency rate as 1US$ = MYR4.27 [15].

IV. ECONOMIC ANALYSIS

A. Life Cycle Cost

Life cycle cost is refers to the sum of system cost for a certain period and consists of the cost of installation, maintenance, replacement and salvage. Eq. 6 to 10 [6, 16] show the calculation of LCC.

$$LCC = C_{int} + C_{rep} + C_{OM} - C_{sal} \quad (6)$$

$$C_{int} = C_{pv} + C_{inv} + C_{install} \quad (7)$$

$$C_{rep} = C_{rep\_pv} + C_{rep\_inv} \quad (8)$$

$$C_{rep\_inv} = C_{inv}\left(\frac{1}{1+r}\right)^n \quad (9)$$

$$\sum_{1}^{n} C_{OM} = C_{OM}\left(\frac{(1+i)^n - 1}{i(1+i)^n}\right) \quad (10)$$

where Cint is the initial cost for PV system composed of the cost of PV array, Cpv, cost of inverter Cinv, and cost of balance of system and installation, Cinstall. The replacement cost is refers to the total replacement cost of PV and inverter. The lifetime of PV is 25 years while the lifetime of inverter is 10 years [10]. COM presents the annual maintenance cost of the system that considers 1% of the total initial cost [17], and Csal refers to the value of the salvage at the end of system life which is estimated to be 20% of the initial cost [16], n is the time period, and r is the market interest rate set as 4.6% [17].

TABLE 3: System Component Prices

Component	Price, RM/Wp
PV Module – Mono-crystalline	2.6901
PV Module – Multi-crystalline	2.3741
PV Module – HIT	4.9105
PV Module – Thin Film	2.9036
Inverter	0.8967
Support Structure & Installation Cost	4.00

B. Liveliest Cost of Energy (LCOE)
Liveliest cost of energy consists of the life cycle cost over total energy produce for certain period. Eq. 11 shows the calculation of LCOE [6].

$$LCOE = \frac{LCC}{\sum_{1}^{n} E_{ann}} \quad (11)$$

Where Eann is the total electrical energy produced for a certain period.

C. Electricity Billing
The electricity billing can be calculated as in Eq. 12 -13 [4].

$$C_{bill} = (C_{usage} - C_{ICPT}) \, x \, C_{gst} + C_{re\_fund} \quad (12)$$

$$C_{usage} = E_{usage} \; x \; Rate \quad (13)$$

where Cusage is the cost of electricity tariff and Eusage is the electricity consumption of consumers. For domestic consumers the electricity tariff rate is shown in Table IV[18]. Imbalance Cost Pass-Through Tariff Rebate (ICPT), CICPT is refers to the tariff rebate applicable to all customers except for domestic customers with monthly consumption of 300 kWh (RM 77.00) and below. For period of June to December 2017, the CICPT tariff rebate is RM 0.0152 per kWh. Goods and Services Tax (GST), Cgst is charged 6% for each domestic consumer with monthly consumption of more than 300 kWh. Under the Renewable Energy Act 2011, renewable energy fund, Cre-fund will be charged 1.6% for consumer over 300 kWh [1]. Electricity billing for net metering is calculated as in Eq. 14 [1].

$$C_{net\_bill} = C_{bill} - (E_{exp} \, x \, C_{disp} - C_{net\_gst}) \quad (14)$$

Where Eexp is energy exported to the grid and Cdisp is the displaced cost. The Cdisp is set at RM0.310 and will be reduced for 1± % of each tariff rate revision [1].

TABLE 4: Electricity Tariff Rate For Domestic Consumer

Energy	Rate (cent/kWh)
First 200 kWh (1-200 kWh)	21.80
Next 100 kWh (201-300 kWh)	33.40
Next 300 kWh (301-600 kWh)	51.60
Next 300 kWh (601-900 kWh)	54.60
Next kWh (900 onwards)	57.10

D. Payback Period
Payback period refers to the period for recovery of the investment cost. Eq. 15 describes this period as follows [4].

$$T_{payback} = \frac{C_{int}}{(C_{bill} - C_{net\_bill}) \, x 12} \quad (15)$$

where Tpayback is the payback period, Cint is the total initial cost,.Cbill is the electricity billing without install the PV and Cnet_bill is electricity billing for net metering
.

RESULTS AND ANALYSIS

System Sizing
Table V shows the technical data of PV system design using the PVSyst software.

B. Energy Produced
The monthly average energy produced by the four types of PV modules is shown in Fig. 5. Energy production is linear with the solar radiation received for each year. The annual energy yield of the thin film module generated the highest energy at 5179.0 kWh followed by multi-crystalline (4999.6 kWh), mono-crystalline (4749.3 kWh) and HIT (4723.0 kWh).

TABLE V. TECHNICAL DATA OF PV DESIGN

	PV Modules				Inverter
Type	*Mono-crystalline*	*Multi-crystalline*	*HIT*	*Thin Film*	
Model	NU-RJ280	CS6K-260P	VBHN240 SE10	FS-4120A	Sunny Boy 3800 U-208
Brand	Sharp	Canadian Solar	Panasonic	First Solar	SMA
Rated Power, W	3360	3380	3360	3360	4040 (DC) 3300 (AC)
Rated Voltage, V	333	354	287	263	200 ~ 500
Rated Current, I	9.0	8.6	11	12	20
Number of String	1	1	2	4	-
Number of Module per String	12	13	7	7	-
Total Module	12	13	14	28	-
Efficiency	-	-	-	-	95.6%

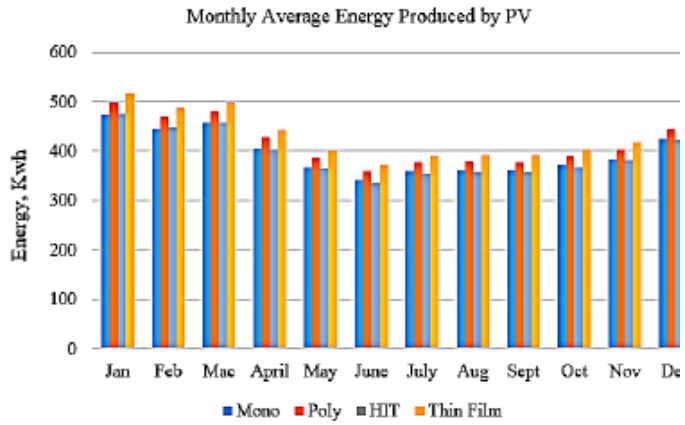

Fig. 5. Monthly Average Energy Produced

C. Economic Analysis

Based on the results in Fig. 5, the life cycle cost (LCC), levelised cost of energy (LCOE), annual billing cost, annual saving and payback period are calculated and shown in Table 5.

The results indicate that the lowest LCC of PV module is multi-crystalline (RM 26427.40), followed by monocrystalline (RM 27174.77), thin film (RM27748.66) and HIT (RM33143.21). The lowest LCOE uses multi-crystalline which had RM0.24 per kWh compared with the other PV modules. By using the NEM incentive scheme, the installer can save up to RM1294.75 annually.

TABLE 5: Economic Analysis

	Without PV	Mono-crystalline	Multi-crystalline	HIT	Thin Film
LCC, RM		27174.77	26427.40	33143.21	27748.66
LCOE, RM/kWh		0.2598	0.2400	0.3186	0.2433
Annual Billing Cost, RM	1016.76	-171.39	-126.83	-176.07	-94.90
Annual Saving, RM		1187.33	1249.90	1180.75	1294.75
Payback Period, year		11.5	10.8	14.8	11.3

VII. CONCLUSION

The selection of PV module can have a considerable effect on total installation costs and annual saving under the NEM incentive. Although the HIT module has the highest efficiency compared with other PV modules, LCOE and payback period had similar values as compared with the others. The best PV module for installing in the BIPV system in Mumbai and can yield optimum payback period is multi-crystalline, with an LCOE of RM0.2400 per kWh and 10.8 years payback period although it has the lowest module efficiency. No computation intensive optimization problems are required, making it light and easy to implement in a relatively simple charge controller.

This paper has many no. of applications in which solar rooftop photovoltaic PV module installation with domestic usage, Apartments, .hospitals, Educational institute, and Government offices

Solar rooftop photovoltaic PV module system has following large no. of advantages:

- Required Electricity is produced by own self.
- Terrace of building is easily available which used for Solar PV system installation.
- Distribution grid connection through Net Meter.
- Calculation of supply and consumed electricity units through Net Metering
- 25 years continued electricity production.
- No battery so, No maintenance.
- Government Subsidy.

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Wireless Network Control System : Review

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Abstract
A Wireless Networked Control Systems review is presented. It begins with a brief history about NCS (Networked Control Systems), recognizing the fundamentals, its ad- vantages over other classical control systems, and the protocols that can be used to do control over the wireless network.
Keywords: Networked Control systems (NCS), Wireless Networked Control Systems (WNCS), Network Scheduling, Delays.

Introduction
The control systems have a connection with the communication systems, and how it can keep a controlled system. The communications can be represented for the interconnection between the different cities in a country, areal connection routes between countries, power distribution lines, among others. Networked control systems arise from the need to cover troubles with different alternatives of a specific network system. It converges to the necessity of to relate the feedback control systems theory with theories about network control systems and the diverse methods that it uses. Networked control systems (NCSs) have been one of the main research focuses in academia as well as in industry for many decades and have become a multidisciplinary area. With these growing research trends, it is important to consolidate the latest knowledge and information to keep up with the research needs.

The advent of communication networks, however, introduced the concept of remotely controlling a system, which gave birth to networked control systems (NCS). The classical definition of NCS can be as follows: When a traditional feedback control system is closed via a communication channel, which may be shared with other nodes outside the control system, then the control system is called an NCS [15]. An NCS can also be defined as a feedback control system wherein the control loops are closed through a real-time network. The defining feature of an NCS is that information (reference input, plant output, control input, etc.) is exchanged using a network among control system components (sensors, controllers, actuators, etc., see Figure 1).

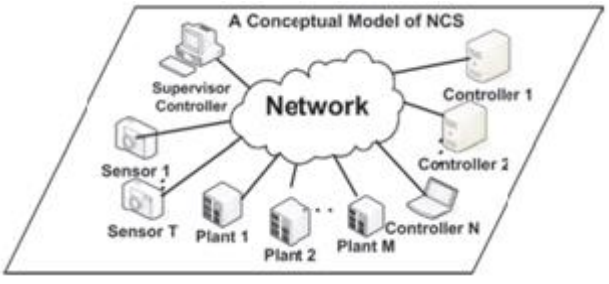

Figure 1: Typical Networked control system

Advantages and Applications of Control over Network
For many years now, data networking technologies have been widely applied in industrial and military control applications. These applications include manufacturing plants, automobiles, and aircraft. Connecting the control system components in these applications, such as sensors, controllers, and actuators, via a network can effectively reduce the complexity of systems, with nominal economical investments. Furthermore, network controllers allow data to be shared efficiently. It is easy to fuse the global information to take intelligent decisions over a large physical space. They eliminate unnecessary wiring. It is easy to add more sensors, actuators and controllers with very little cost and without heavy structural changes to the whole system. Most importantly, they connect cyber space to physical space making task execution from a distance easily accessible. These systems are becoming more realizable today and have a lot of potential applications [16, 20], including space explorations, terrestrial exploration, factory automation, remote diagnostics and troubleshooting, hazardous environments, experimental facilities, domestic robots, automobiles, aircraft, manufacturing plant monitoring, nursing homes or hospitals, tele-robotics and tele-operation, just to name a few.

NCS Categories and NCS Components

Generally speaking, the two major types of control systems that utilize communication networks are (1) shared network control systems and (2) remote control systems. Using shared-network resources to transfer measurements, from sensors to controllers and control signals from controllers to actuators, can greatly reduce the complexity of connections. This method, as shown in Figure 2, is systematic and structured, provides more flexibility in installation, and eases maintenance and troubleshooting. Furthermore, networks enable communication among control loops. This feature is extremely useful when a control loop exchanges information with other control loops to perform more sophisticated controls, such as fault accommodation and control. Similar structures for network-based control have been applied to automobiles and industrial plants. On the other hand, a remote control system can be thought of as a system controlled by a controller located far away from it. This is sometimes referred to as tele-operation control. Remote data acquisition systems and remote monitoring systems can also be included in this class of systems. The place where a central controller is installed is typically called a “local site,” while the place where the plant is located is called a “remote site.” There are two general approaches to design an NCS. The first approach is to have several subsystems form a hierarchical structure, in which each of the subsystems contains a sensor, an actuator, and a controller

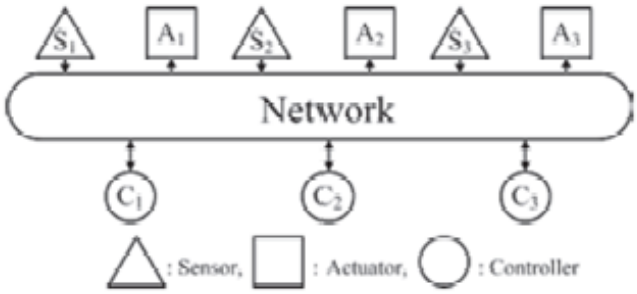

Figure 2: Shared network connections

by itself as depicted in Figure 3. These system components are attached to the same control plant. In this case, a subsystem controller receives a set point from the central controller CM. The subsystem then tries to satisfy this set point by itself. The sensor data or status signal is transmitted back via a network to the central controller. The second approach of networked control is the direct structure, as shown in Figure 4 This structure has a sensor and an actuator of a control loop connected directly to a network.

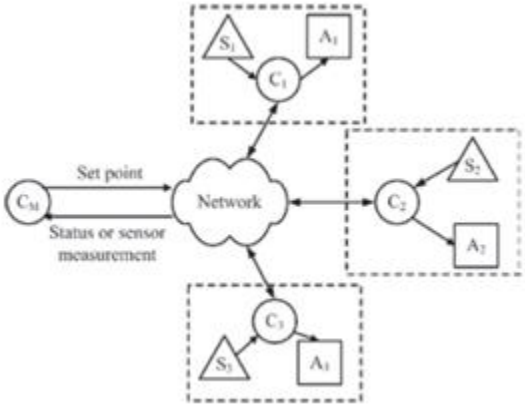

Figure 3: Data transfer of hierarchical structure

In this case, a sensor and an actuator are attached to a plant, while a controller is separated from the plant by a network connection. Both the hierarchical and direct structures have their own pros and cons. Many networked control systems are a hybrid of the two structures. For example, the remote teaching lab is an example that uses both structures [7], [10]. Networked control applications can be divided into two categories: (1) time-critical/time-sensitive applications and (2) time-delay-insensitive applications. In time-delay-sensitive applications, time is critical, i.e., if the delay time exceeds the specified tolerable time limit, the plant or the device can either be damaged or produce inferior performance. An example of time-

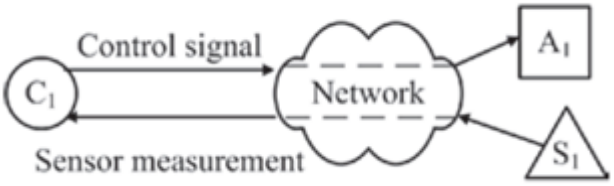

Figure 4: Data transfer of direct structure

delay- sensitive applications is tele-operation via networks for fire-fighting operations, undersea operations, and automated highway driving. On the other hand, time-delay insensitive applications are tasks or programs that run in real time but whose deadlines are not critical. Examples of these applications are e-mail, ftp, DNS, and http. Due to the advance of the wireless communications the idea was reaching to the network control [24]. Within NCS there are some kinds of communications:

- **CAN:** It is a communication protocol designed for applications that require high data integrity and data rates to 1 Mb/s.
- **Ethernet:** It is a good alternative due to low cost network components and compatibility with existing Ethernet infrastructure, but it is affected when the size of the NCS increases. The cost, installation time required for the maintenance, and the large number of cables typically requires in this environment are drawbacks.
- **Wireless NCS (WNCS):** It has evolved by the necessity of mobile operations, flexible installations, and rapid deployment for many applications. When wireless systems are included, the reliability and the time are more difficult to satisfy, because the harmful properties of the radio channels. The majority of control systems assume that the data collected are accurate, timely, and lossless. Those are challenges of WNCS.

The difference with the network control is that the control is remote by microcontroller, and the information can be sent reliably through the shared digital networks, even wire- less connections. In the distribution systems on a wireless network, different sensors can have different locations and its measurements need to be encoded and sent one by one over the different links of wireless networks.

Basic concepts

NCS are systems in which I/O information is exchanged with the system components through a shared communications medium, as shown in Figure 5. Actuators, sensors, and controllers share the information through the network media. The main feature of a NCS is providing a communication

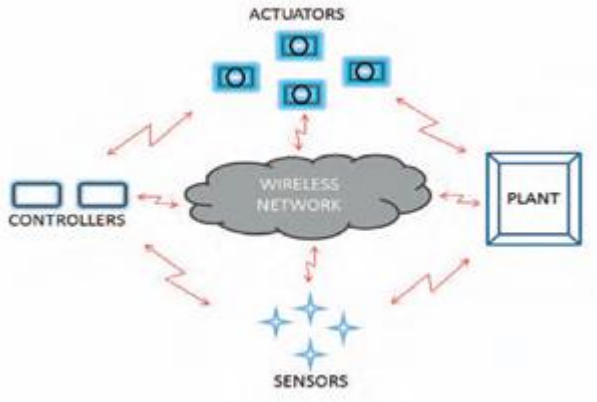

Figure 5: Typical design of an NCS

system appropriated to obtain real-time data. There must be taken into account the network protocol, congestion, routing, and ensure efficient communication data. Also, the networked control is used to design control strategies to minimize problems that might found respect the network performance, delays and parameters that affect system performance [8].

Multiple closed-loop control systems could coexist over the same network. The purpose is that I/O information be exchanged with system components, through of shared communication environment. The rise of new technologies implies that the long distance control in remote locations make necessary the implementation of control systems over wireless communication networks.

A. Wireless Technologies

In wireless communication industry the main standards used are: WLAN 802.11, WPAN Bluetooth 802.15.1, and Zig Bee 802.15.4. These protocols work in the 2.4GHz ISM band, and might coexist in current industrial deployments. The Table I illustrates the key features of these standards.

Table 1

Comparison of wireless technologies

Characteristic	Bluetooth/ IEEE 802.15.1	ZigBee/ IEEE 802.15.4	WLAN/ IEEE 802.11a/b/g
Range	10 (50-100m)	10m	50-100m
Data rate	723 Kbit/s	125 Kbit/s	30.6 Mbit/s (Ethernet), 2.6 Mbit/s (60 bytes payload)
Number of devices for network	2 to 65000	7	40
Power consumption	low	very low	medium
Periodic data	yes (depending on polling algorithm)	yes	DCF: no; PCF: yes (with some jitter); HCF: yes
Transmissions	yes	yes	yes
FEC	available	no	no

1) Control architecture on the network: The wireless network connections use compatible protocols for data transmissions as TCP/IP. It is a connection-oriented protocol, ensuring the delivery of information between nodes, as it handles an algorithm that allows for retransmissions of packets lost during data transfer. UDP is a connectionless-oriented protocol, but there are no provisions for retransmission and the data are not received. This protocol is preferred for networked control in communications of small sampled data packets, because retransmitting lost data allow frequent and Consistent transfer data keeping the system synchronized and low maintenance.

2)Synchronization in the control loop : An approach of synchronization control loop is clock-driven and event-driven. The nodes sensor/actuator is clock-driven and controller is event-driven, or might be handled according to sys- tem. In this method, communication between sensor/actuator and controller is periodic according to sample time. In case of packet loss, the controller waits the next control signal, i.e., it has the ability to take control actions as soon as feedback is available. Until it receives data, the controller action is taken as zero until the next time interval [5]. See Figure 6.

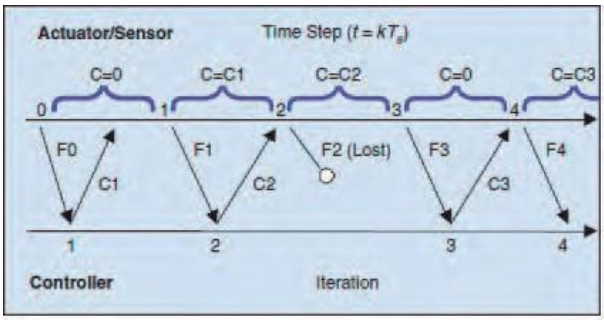

Figure 6 : Time and synchronization diagram .

3)Wireless network problems: The problems in networks wireless are presented by the conditions of transmission media. Due to this, control systems are focused on security network, robustness, and efficiency. It is necessary to implement control strategies according to these needs. The interference is one of the main problems [11]. Because they are free bands can be used by multiple devices, the interference can be generated by a single WNCS devices with other applications. So, should be considered in that channel is working and how far are the neighboring networks; this can be produced by small-scale effects, i.e., devices of the same WNCS, or large- scale effects, i.e., devices of others applications. WNCS also are affected by signal attenuation, obstacles in the radio-path, reflections, propagation delays, fading, and phase shift. Also, system delays (sensor/controller delay and controller/actuator delay) occur while data exchange on devices connected to the shared medium [3]. In networked case, some packets suffer delays and may be lost during transmission or be discarded. To avoid this, it is important that the work channels, distance with neighbors, and capability devices, among others features should be considered to obtain good network performance [20].

B. Networked delays

NCS has limitations of flexibility and mobility because the network is wired. WNCS is an alternative to solve those problems; due it has simple configuration and shared network to access media. Depending on the type of software and hardware on the network, there are three models of networked delays: Constant delays, Random delays, Random delays with Markov chains.

By these models with others complements might be design appropriate delays for specific system.

1) Constant delays: The simplest model of the network delay generates cycles of constant control for all network transfer. These delays are efficient if the time-scale in the process is much larger than the delay introduced by the communication. Otherwise, it could be affecting the stability and efficient of the system because data accumulate are not processed and wrong conclusions can be drawn regarding system information [15].

2)Random delays: Random delays could be applied by operation when network is inactive. If messages are pending to be sent, delay might include transmission of the waiting messages. Also retransmissions can be needed in case of errors, and can include a random wait to avoid a collision at the next try. As nodes are not synchronized with each other, accumulated data send, resulting in the randomness delays to obtain the information. This randomness makes the model delays take the form of probabilistic distribution [15].

3) Markov chains: It is a statistical model that describes a probabilistic distribution over an infinite number of possible sequences. The system has unknown parameters that can represent the loading on the network and lead to delays induced by the same network. These are determined from observable parameters, each state emits observable parameters according to emission probabilities, and the states are interconnected by the transition probability of states. Given an initial state, sequences of states are generated by passing from one state to another by the probabilities of transition to a final state. Each state issues according to observations indicating the probability distribution of emission, creating a sequence of observations so that the value of the hidden variable at time t only depends on the value of the hidden variable at time (t 1) and this is called the Markov property, just as the value of the variable observed in a single moment depends on the value of the hidden variable [25],[20].

C. IEEE 802.11 Protocol

An important feature to consider when the control is implemented over a WLAN (Wireless Local Area Network) is the real time control, due to the data packets between controllers. Sensors and actuators must to transmit periodically, minimizing any loss or error in the transmission. Although the IEEE 802.11 protocol was not designed to WNCS applications, its implementation can be useful on the network control when sets the DCF (Distributed Control Function). In this protocol, the decision of which station can transmit is taken between the nodes of the WLAN. Before transmission, every station must check the channel status to avoid collisions. If the channel is idle in a specific time, the station can transmit in an interval of random back off time. The receiver checks the CRC and sends an ACK message to the transmitter. When it receives the ACK, there is a successful transmission; if the transmitter doesn't receive the ACK, it has to transmit the frame after a random back off delay until the ACK is received [6].

D. IEEE 802.15.4 Protocol

ZigBee is a high level standard based on IEEE 802.15.4 that works in Wireless Personal Area Networks (WPAN). It defines the physical and medium access control layers of wireless networks with low rates of data transmission. ZigBee is designed for low speed, because the channel bandwidth in the 2.4GHz is 250Kbps. It emphasizes the cost of communication with nearby nodes without a complex infrastructure for low power consumption.

A primary requirement of the IEEE 802.15.4 applications is the long battery life. When ZigBee is used for Wireless Networks, sensors and controllers don't need a large band-width due to the low latency and low power consumption with long battery life. That is because it can work in active mode (transmit/receive) or sleep mode. In RTC (Real Time Control) the packets should be small due to short transmission time. The packets are sent continuously, so is acceptable the loss packet and the retransmissions are not required [23].

This protocol is an alternative to set the control over the network. It proposes three ways of working, beacon-enable mode, non beacon-enable mode and beacon-enable mode with GTS (Guaranteed Time Slot). There are models for GTS that make different functions, including some models to as-sign the number of GTSs, the application mode of Markov's chain to study the behavior of the device assignation of GTS [18],[10],[7],[20].

E. Wireless HART

Industrial environments are harsher for wireless applications in terms of interferences and obstacles than office environment. Wireless HART is a secure and TDMA based wire- less mesh networking technology operating in the 2.4GHz ISM radio band, specifically aimed at wireless instrumentation for the factory automation industry [22]. Wireless HART is based on the IEEE 802.15.4, and Wireless HART instruments use a pseudo-random channel hopping sequence to reduce the chance of interference with other networks, such as IEEE802.11b/g (Wi-Fi) which operates in the same ISM frequency band. Using techniques such as channel hopping, time division multiple access, low power, mesh networking, and direct sequence spread spectrum coding allow a Wireless HART network to maintain high data reliability and at the same time minimize, if not eliminate, any effect it has on other overlapping networks [1][20]. Wireless HART is compatible only with HART devices.

F. ISA100

Like Wireless HART, ISA100 is based on the IEEE 802.15.4, and is intended to provide reliable and secure wireless operation for non-critical monitoring, supervisory control, and alerting. Key features are low power consumption, robustness against interference, and interoperability with other devices [13]. ISA100.11a has the ability to support different protocols through a single wireless infrastructure and is a TDMA based wireless mesh network too.

ISA100.11a standard supports many applications with security requirements [19], and addresses wireless sensor net- works in the operating plant environment. Also, ISA100.11a allows the flexibility and scalability, and allows addresses coexistence with other wireless devices, such as mobile phones and other devices based in other relevant standards [2][13].

The main feature of Wireless HART and ISA100 is the channel hopping. Transmissions are scheduled on 1 of the 15 logical channels, which are mapped onto the physical channel by a channel hopping sequence, and the transmission scheduling is organized into multiple super frames [20]. Wireless HART use super frames with a specific time slot and a specific channel, while ISA100 uses different super frames that can use different time slot lengths [20]. Otherwise, a feature of ZigBee and ISA100 is the low energy consumption and use routers to optimize battery consumption, but also investigates the use of alternative energy to avoid the shutdown of the nodes.

G. WISA Network Topology

ABB introduces WISA, a wireless communication system which uses magnetic fields and coils to create a wireless power source for the SAs [14]. Base stations communicate with local SAs wirelessly with a star connection [26]. WISA uses TDMA/FDD/FH for multiple access purposes. The downlink is used to establish frame and slot synchronization, with acknowledgements and control data. Uplink only occurs when sensors have data to send [26]. This is a one way communication, from sensor to controller, then from controller to actuator, with the reverse being acknowledgements. Telegrams received by the base station are acknowledged. In case of a missing acknowledgement, the device will retransmit the telegram, via an automatic repeat request (ARQ). All design parameters guarantee that packets are received within a deadline of 20ms from sensor to controller and 20ms from controller to actuator, on the air interface [26].WISA like Wi-Fi , Bluetooth and Zigbee operate in the 2.4GHz frequency range [27, 28]. A typical factory floor environment contains many sources of noise such as mechanical vibrations, welding equipment, noise from the 2.4GHz and GSM frequency range [29]. After significant amounts of testing, it was found that the noise produced by welding equipment, one of the main sources of electromagnetic interference (EMI), fades out above 1GHz. Such noise produces frequencies up to 1800MHz, far from the 2.4GHz operating band. The effect of such interference was studied on GSM 900/1800 and WISA. The study proved the

immunity of 2.4GHz band, including WISA, to interference from sources other than the 2.4GHz band [29].

H. Wi-fi

A Wireless Networked Control System is introduced which uses the IEEE 802.11b protocol without modifications for node communication with minimal cabling and off-the-shelf equipment. The system model is a 9m2 work cell with 60 sensors and actuators (SAs) as well as 1 controller. The SAs communicate via access points (APs) with the controller. The model was subjected to the harshest form of noise, from the 2.4GHz band, in the form of a laptop communicating with the controller, using a heavy FTP application. The model was tested with a single laptop and then two laptops, in the most interfering positions. A statistical confidence analysis is performed due to the existence of randomness because of Wi-Fi's use of the binary exponential back-off (BEB) technique to avoid packet collisions. The results of the study showed that with a confidence of 95%, the maximum end-to-end delay from sensor to controller was 2.05ms and from controller to actuator was 14.80ms in the presence of noise with zero packet loss (compared to the 20ms delay per air-interface for the ABB system) [30].

Conclusions

This paper presents a brief analysis of the principal characteristic of the NCS, their general aspects and the different problems in a WNCS. Also, it is shown the techniques used to apply delays on the network and make it controllable, and it is described some of the protocols used in the WNCS.

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DESIGN OF DATA LOGGER FOR QUALITY CONTROL OF TRANSFORMER OIL FILTERING MACHINE

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Abstract-*The proper working of the transformer is totally depends on the transformer oil. The quality of the transformer oil is maintained by purifying the transformer oil in high vacuum transformer oil filtration machine. So that the basic idea behind this project is to monitor the different parameters of the transformer oil such as temperature, flow rate, vacuum, moisture etc. Also this system provides data logging facility. All the measurements are stored in SD card in the form of excel sheet.*

Keywords: Filtration machine, Temperature, Flow rate, Vacuum, Data logger.

Introduction

This project is an innovative idea which can be developed and implemented for high vacuum transformer oil filtering machine. In our day to day life it is impossible to live without electricity. Transformer used in electric power distribution is the one of the most costly component. When the transformer failure occurs it leads to huge repairing cost and it is too expensive to replace the transformers regularly. All the load bearing transformers are filled with insulating oil i.e. transformer oil that performs very important role to increase life time of the transformers. The different contaminants present in the transformer oil like moisture, sludge, dissolved gases etc reduces the efficiency and life time of the transformers. So that to increase the efficiency of the transformer the transformer oil quality must be maintained as per the standard specifications. The quality of the transformer oil is maintained by filtering the transformer oil in the high vacuum transformer oil filtration machine. It consists of inlet pump, filters, heaters, degassing and dehydration chamber, discharge pump, vacuum pump. [1]

Previously to monitor these parameters of the transformer oil separate person is assigned and it is difficult for that person to work in such risky environment. Hence in our project we are going to design the system that will monitor the parameters of the transformer oil without any human intervention in the system. The parameters of the transformer oil like temperature, flow rate, vacuum and moisture are measured and displayed on the display. The measured data from each sensor is stored in the storage device i.e. Data logger. Data logger is the electronic device used to keep the record of the measured values.

Materials and Methods

The design of the Transformer oil monitoring system consist of various steps, vise selection of proper sensors to sense physical parameters, design of signal conditioning circuit which support digital logic device, selection of controller and display unit.

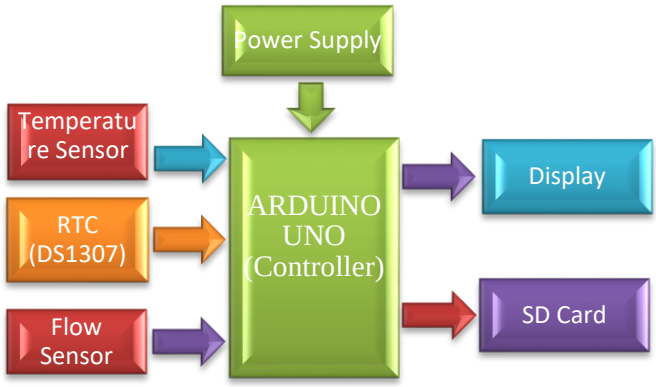

Fig 1: Block Diagram of Data logger for monitoring the parameters of the transformer oil filtering machine

The functional block diagram of Data logger for monitoring the parameters of the transformer oil filtering machine is shown in the fig.1.The whole system is designed around the Arduino Uno microcontroller. It consists of on chip peripherals like ADC, EEPROM, Flash Memory Timer which helps to reduce the cost and increase the efficiency and reliability of the system.

The sensor senses the physical parameters in this case temperature and flow. The analog output of the sensor is given to the on chip ADC. ADC covert this analog input to the digital word which is suitable for the further processing. The device also acts as a data logger, with the help of RTC interfaced to microcontroller. The current time for data-logging purpose is provided by the time- base circuit i.e. RTC. The SD card is used to store the parameters and then given to the PC or Laptop for the permanent storage.

Arduino Microcontroller:

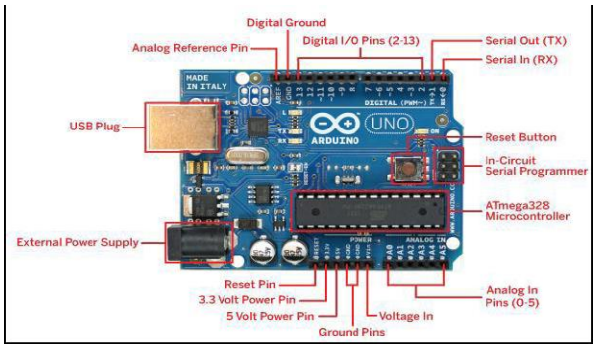

Fig 2: Arduino ATmega328 board

The Arduino is a programmable controller for prototyping electromechanical devices is shown in Figure.2. It has 6 analog input pins, labeled as A0 to A5; each pin provides 10 bits of resolution. Also it has 14 digital Input / output pins of which 6 can be used as PWM outputs. The Arduino includes a Wire library to simplify use of the I2C bus. Software serial library allows serial communication on any of the Uno's digital pins. 3, 4

The Arduino also supports I2C is two wire interface and SPI communication. All needed to support is available on the single chip. The power is given to board by simply connecting Arduino to a computer with a USB cable or powers it with AC-to-DC adapter or battery to get started. It consist of a 16 Mega Hz ceramic Resonator, a USB connection, a power jack, an in-circuit serial programmer (ICSP) header and a reset button as shown in figure.3,4

The features of ATmega328

1. 5Vlt Operating Voltage
2. 6-20Vlt Input Voltage
3. 14 Digital I/O Pins of which provide 6 PWM output
4. 32 bit inbuilt Flash Memory
5. 2KB SRAM
6. 1KB EEPROM
7. 16 MHz Clock Speed.

Temperature sensor

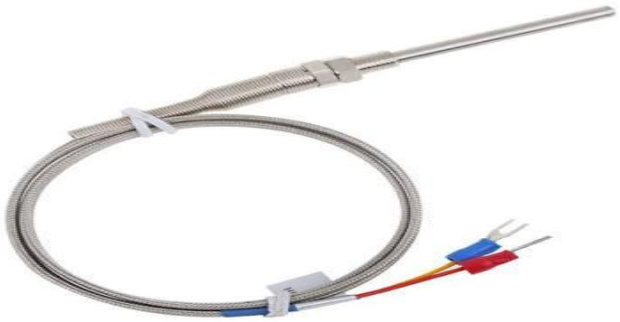

Fig 3: Thermocouple

The most commonly used temperature sensor for the industrial applications is the thermocouple. It is made by joining two dissimilar metals at one end. When two dissimilar metals are joined together the new device is formed called as thermocouple. The one end is called as the Hot Junction and other end of these metals is referred to as the Cold End or Cold Junction. The cold junction actually formed at the last point of thermocouple material. Particular combinations of metals must be used to make up the thermocouple pairs. In this case the thermocouple used is the J-type and the combination of metals is iron and constantan.

The difference in temperature between hot junction and cold junction, results in a small voltage at its output. This output voltage is referred to as an EMF (electro-motive force) and can be measured and used to indicate temperature. The voltage created by a thermocouple is very small and is measured in terms of mill volts (one milli volt is equal to one thousand of a volt). In case of, the human body voltage created is larger signal than a thermocouple. The output of the thermocouple is given to the Arduino by using separate signal conditioning circuit which consist of IC MAX6675 that gives digital output.

MAX6675:

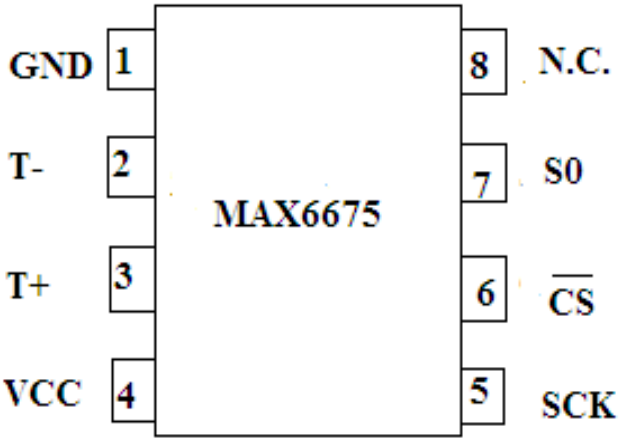

Fig 4: Pin Configuration

Table 1. Pin Description

PIN	NAME	FUNCTION
1	GND	Ground
2	T-	Alumel Lead of Type-J Thermocouple. Should be connected to ground externally.
3	T+	Chromel Lead of Type-J Thermocouple
4	VCC	Positive Supply. Bypass with a 0.1µF capacitor to GND.
5	SCK	Serial Clock Input
6	CS	Chip Select. Set CS low to enable the serial interface.
7	SO	Serial Data Output
8	N.C.	No Connection

Flow Meter:

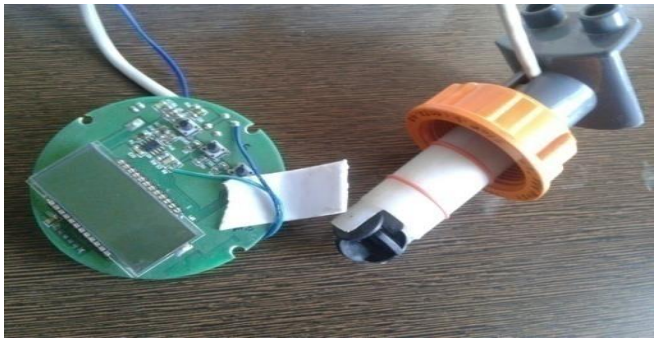

Fig 5: Flow Meter

Flow meters are used in transformer oil filtration machine to indicate the rate of flow of the oil. We can control the rate of flow if we are equipped with a flow control valve. The principle of the flow meter is a particular kind of Rota meters, based on the variable area principle. It provides a simple, precise and economical means of indicating flow rates in filtration machine. This principle consists of three basic elements: tapered flow tube, float, and a measurement scale. The basic working principle of the flow meter is based on the electromagnetism. When the oil passes through the float the metal wheel starts rotating. The metal wheels cut the magnetic flux which is generated by the coil. That results in a generation of EMF in the coil proportional to the speed of the metal wheels.

In operation, the Rota meter is positioned vertically in the fluid system with the smallest diameter end of the tapered flow tube at the bottom. This is the fluid inlet. The float is cylindrical in shape, which is located inside the flow tube, and is engineered so that its diameters nearly identical to the flow tube's inlet diameter.

Real Time Clock (RTC-DS1307):

The DS1307 serial real-time clock (RTC) is a low-power consumption, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address bits and data bits are transmitted serially through an I2C, bidirectional bus. The RTC provides seconds, minutes, hours, day, date, month, and year information. The month end date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock of the RTC operates in either the 24- hour or 12-hour format with AM/PM indicator. The DS1307 has a inbuilt power-sense circuit that detects power failures and automatically switches to the battery supply.

Data Logging

The data logger is an important device to collect and analyze experimental data, having the ability to present real time analysis with sensors and probes able to respond to parameters that are beyond the normal range available from the most traditional equipment. The type of information recorded is determined by the user i.e. whether temperature, humidity, pressure is to be recorded, therefore it can automatically measures electrical output from any type of transducer or sensor and log the value. [2]

A data logger works with sensors to convert physical phenomena and stimuli into electronic signals such as voltage or current. These electronic signals are then converted into binary data. The binary data is then easily analyzed by software and stored on memory for post process analysis. [2]

Software Description

The firmware for the controller is written in the C language. Arduino IDE is the software used for the controller programming.

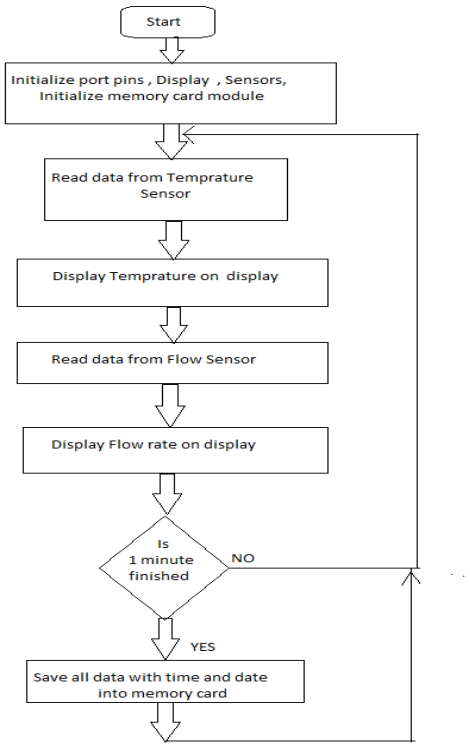

Fig. 6: Data Flow Diagram of the system

Results Display

Fig 7: Temperature and Flow Rate

Table 2: Data Collection

Data Logging File	Column1	Column2	Column3
Date	Time	Temp(F)	FLOW
07/03/2018	13:46:42	32.5	0
07/03/2018	13:47:42	32.25	32
07/03/2018	13:48:43	37.25	19
07/03/2018	13:49:43	36.25	0
07/03/2018	13:50:43	36.25	30
07/03/2018	13:51:44	36	27
07/03/2018	13:52:44	35.75	41
07/03/2018	13:53:45	36	30
07/03/2018	13:54:45	36.25	33

Conclusion

The designed system can be useful for studying the behavior of the Industrial, Medical and home processes applications having multiple parameters to monitor. Though the presented system employs SD card to store the parameters in the form of excel sheet. This Excel sheet can be stored in the personal computer or the laptop for the permanent storage.

Future Scope

In remote places proposed system can also implemented by using wireless technology like Bluetooth and Zigbee. Graphical representation of the logged data is also possible by using specific application.

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Gesture Controlled Speaking Using Microcontroller

Aurthor 1

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Abstract

It is serious problem for dumb or deaf peoples for communication. Dumb and deaf people face difficulties in communication with normal human beings. The main motive of our project is to make possible the communication between dumb or deaf people and normal people. The system that we create is used as a sound recognition system with the Microcontroller AT89C51 and audio recorder which provides deaf person to understand their requirement to the normal person & they can easily understand their problems with the help of this system

Key words

Flex sensor, Accelerometer Sensor, AT89C51, APR33A3 (speaker), 16*2 LCD Display.

1. Introduction

In today's life, it is major problem for deaf and dumb people for communication. Deaf and dumb people have lot of difficulties in communication to normal person. So for communicating to each other, both have understanding about sign language. Here, we discover Indian Sign Language using one hand. For making this, Flex sensor glove is used. This project is microcontroller based system that is designed to provide the communication among the dumb, deaf and blind communities and also their communication with the normal person.

This system is work as a "smart device". In this project, microcontroller and sensors based system is presented. This project has basically a data glove and a microcontroller based system. Data glove can detect movements of a hand and microcontroller based system done conversion of some specified movements into human understandable voice. The data glove has two types of sensors: The flex sensors as bend sensor and accelerometers as tilt sensors.

The building block of this system are :

1. AT89C51 microcontroller
2. LCD
3. Flex sensor
4. Accelerometer sensor
5. Battery
6. Speaker

2.Methods

The system is used for this identify gesture for this we require flex sensor, accelerometer & a Microcontroller. This sensor are based on the use of sign symbols. AT89C51 is used as the Microcontroller.

AT89C51

The controller which we used is the AT89C51. Microcontroller 89C51 is manufactured by Atmel. [1] AT89C51 – Microcontroller 89C51 has 4 different ports. Port 0 is 8-bit port open drain bidirectional I/O port & port 1, 2, 3 is 8-bit bidirectional I/O port having their own internal pull-ups. Microcontroller 89C51 is 40 pin IC & the Flash memory is 4KB.

Flex sensor

Flex sensor is used to measure & capture the movement of the fingers. The range of the flex sensor is approximately 45kohm to 125 k ohms. [2] Flex sensor are used to the sensing the movement of finger. Flex sensor are resistive device that are the used to detect bending or flexing. A simple flex sensor is 2.2 in length.

Figure1.Flex sensor 2.2”

Accelerometer sensor

Accelerometer sensor can measure static or dynamic acceleration in 3 axis. Accelerometer sensor are used in the direction of the angle x, y, z axis. [2] Accelerometer sensor have the standard value is 1.69v. Accelerometer sensor which gives an analog data while moving in x, y direction depends only on sensor type. The ADXL335 is a small sensor.[3]

LCD

LCD display Liquid Crystal Display is 16*2 Alphanumeric display. These LCD16*2 it can display 16 characters per line & 2 such lines.[3] In this LCD each character is displayed in 5*7 pixel matrix. LCD 16*2 has 2 registers are used – command & data registers. The command register stores the command instruction & the data register stores the data that should be displayed on the LCD board. The data is the ASCII value that showed on the LCD.

3. Block diagram:

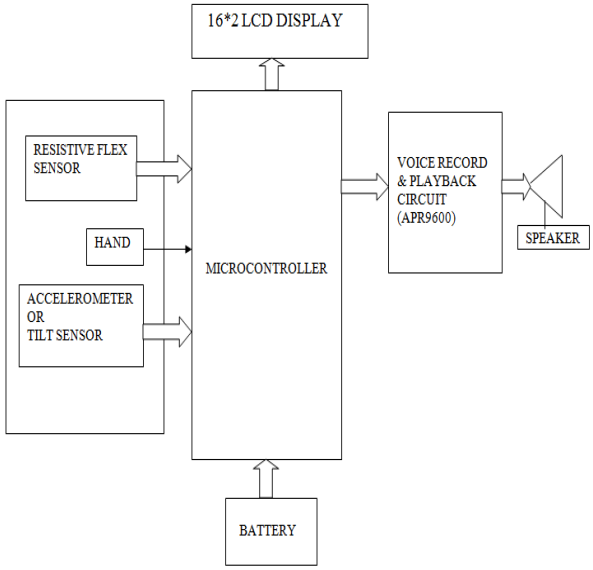


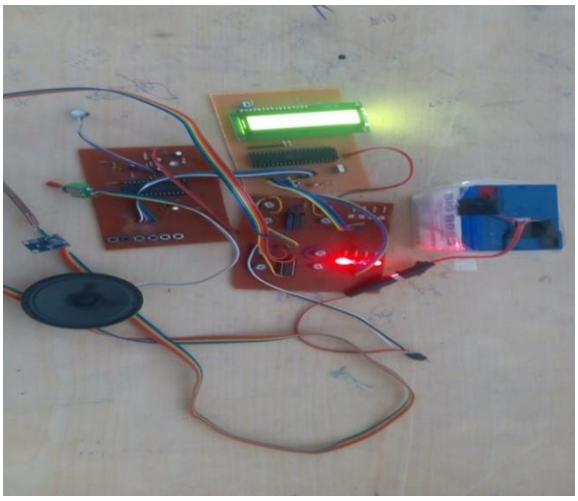
Figure2. Block diagram of the system

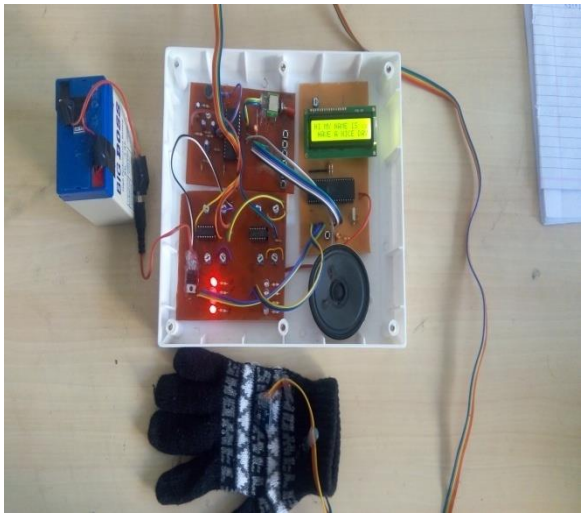
Discussion

The main motive of this paper is to show a simple solution for the communication problem of hearing and speech disabled people while interacting with normal people. It consist of the microcontroller interfaced flex sensors, accelerometer etc. flex sensor are resistive devices that can be used to detect bending or flexing. Flex Sensor compare the data with the data that is already present in the microcontroller. Accelerometer are used the sensor is direction are measured [x, y, z]. Accelerometer Sensor used to the measure the angle. Accelerometer sensor can measure static or dynamic acceleration in all 3 axes. Conclusion is showed on LCD display and also voice result is achieved from IC of voice recorder.

Result

.





This project has low cost, efficient use and portable. This project also uses simple technique for proper understanding. Deaf and dumb people can communicate with the normal people by using this system. [1] This project is helpful for various fields such as Robotics, Biometrics, Automation of industries.

Conclusion

The main motive of this project is proper communication between deaf or dumb & normal people has to be done. the project discover a translational device for deaf people using glove technology. This system is discover to improve lifestyle of dumb or deaf people .This project is effective due to use of Microcontroller.

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Smart energy meter

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Abstract- Normally we see that the person is standing in front of electricity meter and take reading by capturing image. The person handover bill to the user every month. The drowback is the person has to go area to area for collecting information and also to handover bills. Mostly error occur like extra billing, even through the bills are paid. To overcome this drowback we came up with an new idea to eliminate third party. We have an idea of smart energy meter, implemented by using wireless and Ardiuno. Ardiuno is energy efficient and has two UARTS. Here the house hold energy meter is not replaced ,but we modify in installed meter. We have used GSM module for SMS, also we used bluetooth on mobile app.

Keywords- Ardiuno UNO, GSM module, Bluetooth, Energy meter, 16*2 LCD display.

1. Introduction

Without electricity nothing is possible, so it is very important to save electricity and use it properly. So we can help our next generation for their life. In each and every equipment electricity is important like to rotate fan it is required to charge cell phone it is required. That's why it is veryimportant to reduce misuse of electricity and try to use natural energy. But each and every situation natural energy is not suitable so that there is need of electricity.

The advantages these electric metering system offers make it a more accurate measuring device than the conventional electro-mechanical meter reading system being used in developing countries like India. AMRs capacity to automatically transmit data real time increases the reliability of this metering system, unlike electromechanical meters which occasionally make use of previous readings as a basis of the consumer's current billing. It also puts consumers at a disadvantage as the accuracy of power consumption readings is being compromised.

2. Materials and Methods

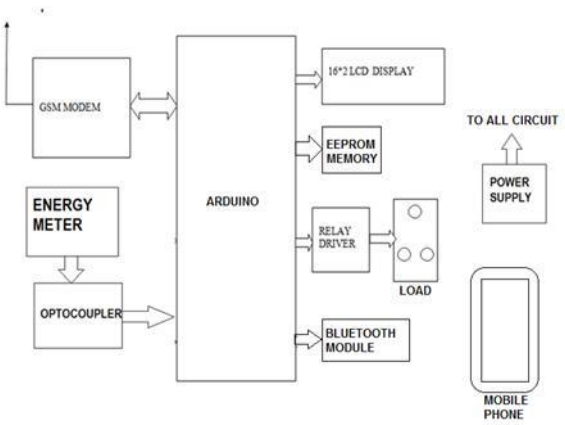

Fig 1: Block Diagram Of Smart Energy Meter

Discussion

This paper is present a solution to overcome the billing problem and human error. LCD is used to display unit and pulses and also operation of load. Ardiuno is a controller thrugh which we control all operation. Relay operate as a switch. Transformer used is stepdown. Converts into 12 volt rectifier circuit is used. Optocoupler is used to sense the pulses. GSm module is used for sending message and operation of the load and also detection of the load status and to get reply. Blutooth helps the person to get reading of meter without taking image on a mobile app.

2.1 Arduino Microcontroller:

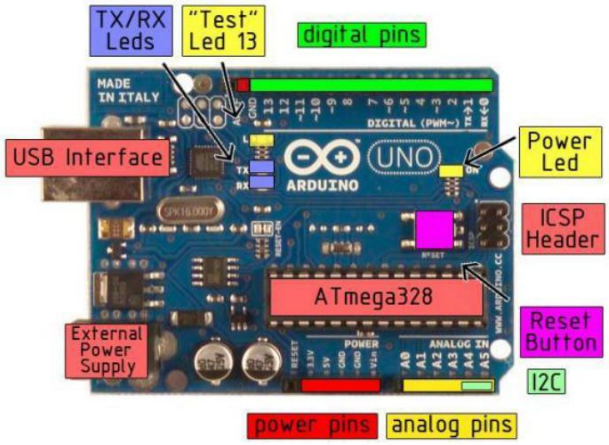

Fig 2: Arduino ATmega328 board

The ArduinoUno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.[1]

2.2 Bluetooth

Fig 3: Serial Port Bluetooth Module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4 GHz radio transceiver and baseband.[2]

2.3 RELAY

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage.[1]

Fig 4: Relay

2.4 16*2 LCD

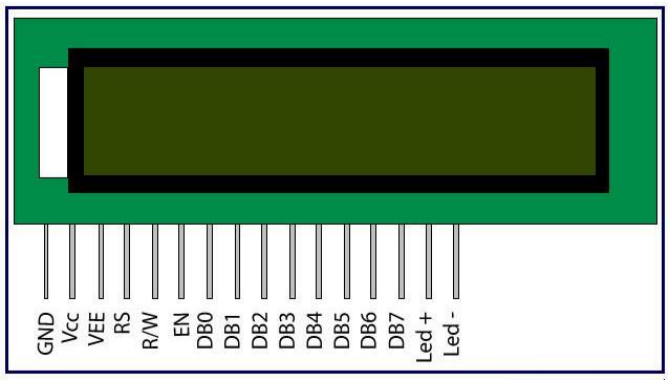

Fig 5: 16*2 LCD Display

Liquid Crystal Displays (LCD)

An LCD is a small low cost display. It is easy to interface with a micro-controller because of an embedded controller(the black blob on the back of the board). This controller is standard across many displays (HD 44780).[3]

Features

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

2.5 GSM/GPRS Modem

Fig 6: GSM Module

This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232. Supports features like Voice, Data/Fax, SMS,GPRS and integrated TCP/IP stack.[3]

3. Working Model-

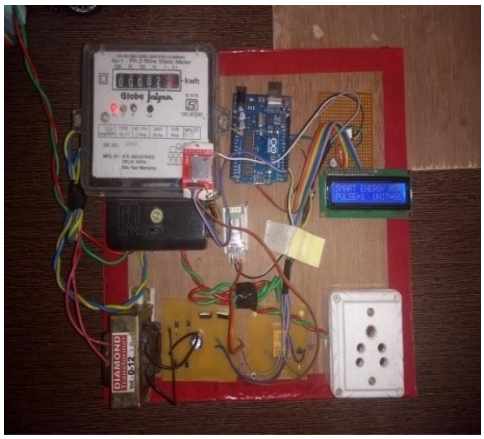

Fig 7: Experimental Setup

4. Results-

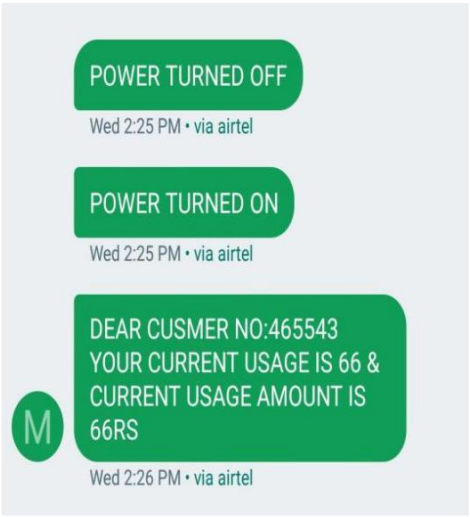

Fig 8: Final Result

5. Conclusion-

An attempt has been made to make a practical model of 'Smart Energy Meter.' The propagated model is used to calculate the energy consumption of the household, and even make the energy unit reading to be handy. Hence it reduces the wastage of energy and bring awareness among all. Even it will deduct the manual intervention.

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Car Post Crash Analysis & Emergency Rescue Alert System (Car Black Box)

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Abstract- The main purpose of this paper is to reduce the time to arrive for an ambulance at the crash location in the event of an accident and victims for emergency services. To develop a prototype of the Car Black Box System (CBBS) that can be placed into any car all over the world. This prototype can be designed with less number of circuits. The CBBS can constructing security of Car and improving the treatment of crash victims. Also enhancing road status in order to decrease the people death rate.

Keywords- Arduino (UNO), GPS, GSM, Impact sensor, water sensor, temperature sensor, accelerometer

1. Introduction:

The main aim of our research is to reduce time between accident location and ambulance for emergency services.
There Objectives includes
i] Collect GPS data and send with the help of aim instantly.
ii] Also for high temperature Vehicle in to the water ,road collision types such as angle or side impact, & rear end collision.
We know that millions of the people die's because of transportation related accidents and this is the unavoidable issue in the world.
Hence to get immediate information about the accidental area
Above the objective plays the vital role. The project is named as 'Black Box' play role in motor vehicle investigation and reduces time to find accidental location for rescue services.
The project include mainly about safety contains various type of sensor which reports about the vehicle crashes and also provide post crash analysis using the sensors recording of images which reduces time for rescue to arrive at the crash location which is obtained with the help of GPS and GSM.[1]

2. Materials and Methods:

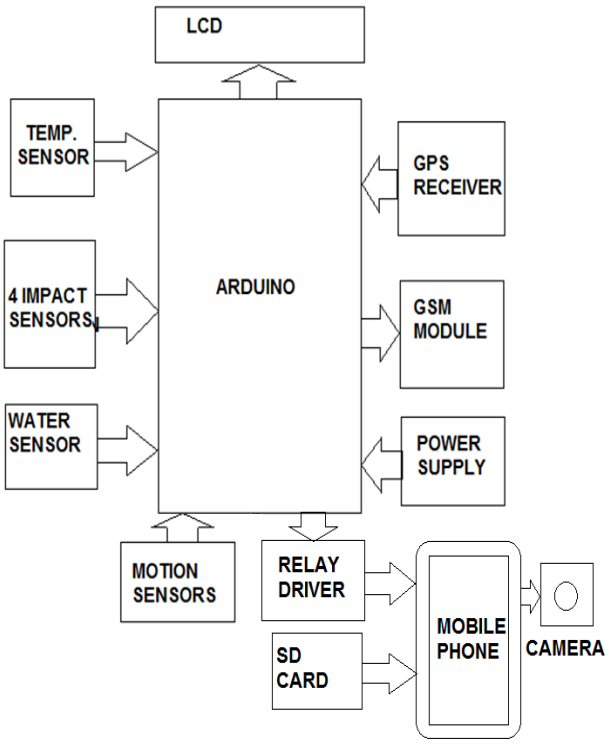

Fig 1: Block Diagram Of Car Post Crash Analysis & Emergency Rescue Alert System

Working-

In this project 4 impact sensors are used if car got in accident from any of four sides these sensors will detect this impact and give signal to controller about accident then controller will immediately give signal to relay driver circuit. This relay driver circuit is connected to mobile phone headphone volume button, hence when relay driver operate then it gives signal to mobile phone which will click photos immediately. These photos get stored into the SD card.

We have included water sensor in this project so in

an accident if car gets into water then water sensor detects this and send this signal to controller then controller again take photos.

If car has an accident by either of any way stated above then controller will take photos as stated above also we have temperature sensor in this system controller will read data from temp sensor and save this data. In case of accident controller will read status of impact sensor, water sensor, temp sensor & motion sensor (which will give information about tilt of car), also controller will gets current position details of car using GPS modem and send this data to an specified mobile nos. using GSM modem.

All this data is displayed into 16x2 LCD display.

2.1 Arduino Microcontroller:

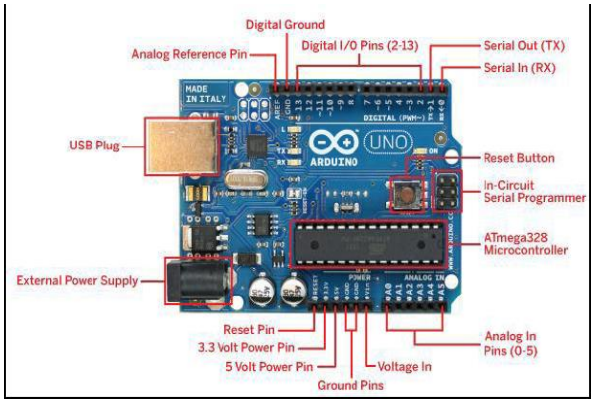

Fig 2: Arduino ATmega328 board

The Arduino Uno is a microcontroller Board based on the ATmega328. The Arduino ATmega328 is a programmable controller for prototyping electromechanical devices is shown in Figure.2. It has 14 digital Input/output pins, 6 analog pins(A0 to A5),16 MHz ceramic resonator, USB connection, Power jack, ICSP header, and Reset button. The ATmega328 also supports I2C which is two wire interface and SPI communication.

2.1.1 The features of ATmega328

1. 5V Operating Voltage
2. 6-20V Input Voltage
3. 20MHz Maximum Operating Frequency
4. 32KB Flash Memory
5. 2KB SRAM
6. 1KB EEPROM
7. 16 MHz Clock Speed.
8. 6 Analog Input.

2.2 Temperature sensor:LM35

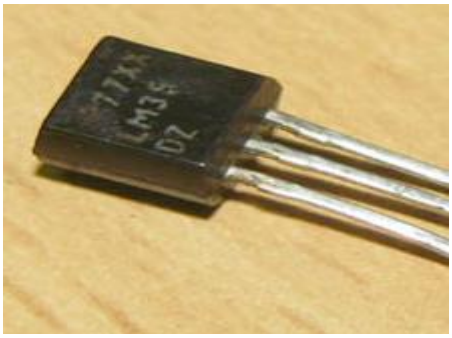

Fig 3: LM35 Temperature Sensor

The operating temperature range is from -55°C to 150°C. [2]The output voltage varies by 10mV in response to every ⁰ C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/ ⁰C.

It is calibrated in Celsius, suitable for remote applications. LM35 operates from 4 to 30 volts. [2] Its main application is detection of heat, so it is used as temperature sensor.

2.3 Impact sensors:

We are going to use push to on sensors to detect impact into the car from 4 sides. [1]

2.4 Motion sensor:

Accelerometer sensor can measure static(earth gravity) or dynamic acceleration in all three axis. Application of the sensor is in various fields and many applications can be developed using this sensor. Accelerometer sensor measures level of acceleration where it is mounted this enable us to measure acceleration/deceleration of object like car or robot, or tilt of a platform with respected to earth axis, or vibration produced by machines. Sensor provides 0G output which detect linear free fall. Sensitivity can be adjusted in two ranges. Acceleration is a vector force which has direction and measured in meters per second. Earth produces gravitational acceleration on all objects on earth. By monitoring the three axis acceleration one can measure the level of tilt of any platform. [1]

2.5 Water sensor:

Water sensor consists of resistive type copper material. When there is no water on this sensor then it will have high resistance. When there is water on this sensor then resistance of this sensor will reduce as per the amount of water. Using this sensor we will water into the car. [3]

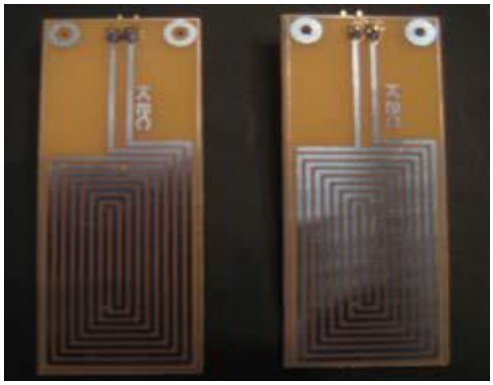

Fig 4: Water Sensor

2.6 16*2 LCD:

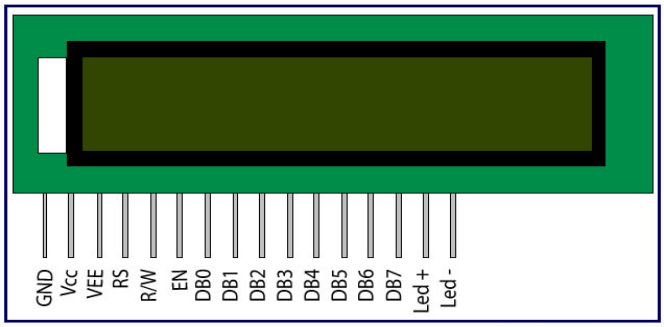

Fig 5: 16*2 LCD Display

The LCD is a 16 character x 2 lines module. Internally it is 40 characters x 2 lines. Line 1 ranges from H'00'to H'27' and Line 2 ranges from H'40' to H'67'. When the LCD board is turned on, data can only be sent to it after 30ms, this is the time taken for the LCD to initialize.LCD is a small low cost display. It is easy to interface with a micro-controller because of an embedded controller. [2]

2.7 GPS:

Fig 6: GPS Module

It is high performance single-chip architecture. It's a low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

There module provides complete signal processing from antenna input to host port in either NMEA messages. The module requires 2.8V~4.3V power supply. The host port is configurable to UART. Host data and I/O signal levels are 2.85V CMOS compatible.

2.8 GSM-SIM900:

Fig 7: GSM Module

It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3/5V TTL interfacing circuitry, which allows you to directly interface to 5V microcontrollers(PIC, Arduino, AVR etc) as well as 3V3 Microcontrollers (ARM,ARM Cortex XX, etc). The modem needed only two wires (Tx,Rx) except Power supply to interface with microcontroller

2.8.1 The features of GSM Module

1. Dual-Band GSM/GPRS 900/ 1800MHz.
2. Input Voltage: 12V DC
3. Configurable baud rate.

2.9 Relay Driver:

Especially in circuits where high power transfer or mains AC load switching is involved, relays play the major role in implementing the operations. A relay, as we all know is an electromechanical device which is used in the form of a switch. It is responsible for switching an external load connected to its contacts in response to a relatively smaller electrical power applied across an associated coil. Basically the coil is wound over an iron core, when a small DC is applied to the coil, it energizes and behaves like an electromagnet. A spring loaded contact mechanism placed at a close proximity to the coil immediately responds and gets attracted toward the energized coil electromagnet force. In the course the contact connects one of its pair together and disconnects an complementary pair associated with it. The reverse happens when the DC is switched OFF to the coil and the contacts return to its original position, connecting the previous set of complementary contacts and the cycle may be repeated as many times as possible.

Fig 8: Relay

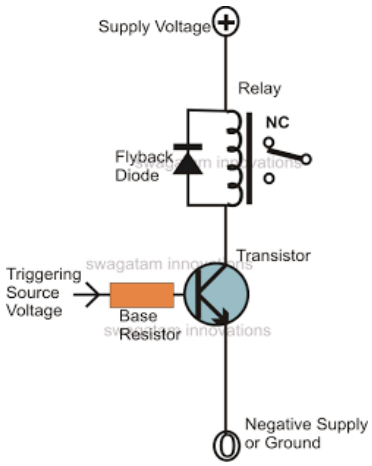

Fig 9: Relay Driver

3. Working Model:

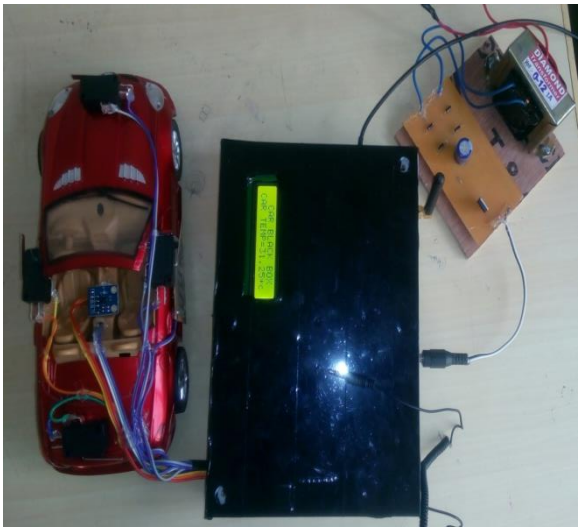

Fig 10: Experimental Setup

4. Results:

This system will be use full in all types of vehicles like cars trucks buses etc. and very much useful in post crash analysis and accident investigation. Help to alert emergency medical service team to reach at required location in shortest time. As system is using GPS and GSM it can use for tracking also. With multitude of sensor many physical parameters can be monitored and stored for future analysis. Impact sensor being installed in all sides and along motion sensor accident trigger is ensured with high accuracy. Accident alert is an advantage as we use KNN algorithm to find nearest hospital and no need of call center. The system can be made fireproof and shock proof.

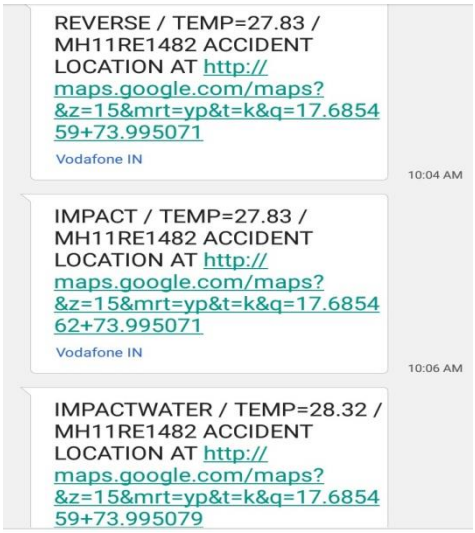

Fig 11: Final Result

5. Conclusion:

In this project, we will successfully design vehicle accident detection and tracking system by using GSM and GPS. When accident occurs, it senses by sensors. The coordinates of location of accident obtained by GPS, are sent via GSM network to user defined mobile number. It is the fact that implementation of system will increase cost of vehicle but it is better to have some percent safety rather than having no percent of safety. The proposed method will be highly beneficial for the automotive industry. The proposed system can also be used for traffic estimation and accidents survey in the country by health department with slight modification.

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AUTOMATIC SOLAR GRASS CUTTER

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Abstract
Now a day's pollution as well as power consumption increases day by day. we are developing a machine for grass cutting by using a renewable energy like solar .To achieve such advantage solar panel are used for converting the solar energy into electrical energy. We are using the battery for storing that energy. The aim of project is to cut the grass or lawn on the playground and in the gardens .basically ground are in two shape rectangular and circular hence we are making the cutter for two different shape of ground. So it's become fully automatic grass cutting machine under the obstacle detection technique with power source as battery. In this respective project we are using three DC motors in that one is for cutter to cut grass and other two for moving the robot in forward, backward, left and right direction. Speed of robot is totally depends on the torque of the motor.

Keywords: ***DC motor, Solar energy, Battery, Grass Cutting machine***

Introduction

In current technology manually handled grass cutting machine is mostly used for cutting grass, hence for reducing the man power in such work we are developing the automatic device .for this device mainly solar energy is used instead of electrical energy directly. By using solar panel sun energy is received and then this energy will convert into electrical energy which will stored in battery. Because of such energy utilization fuel consumption problem is reduced so no any polluting gas formed, indirectly this will help to keep environment clean.

A typical lawn mower needed a user to operate it in particular manner to get proper working of device and also to set the border around the area is to be used for cutting .thus we are developing the automatic solar grass cutter which is mainly working for particular area defined by user. This machine will helps us for rectangular and circular shaped ground. Hence we are putting two modes for cutting the grass such as user can select the ground shape according to their requirement. The main parts of the solar grass cutter are DC motors, relay switch, ultrasonic sensor and battery [1], For moving the robot four DC motors are used which are connected to wheels and one motor for cutter having low torque with high speed. When any obstacle is found robot stops so it will avoid damage to robot for that purpose ultrasonic sensor is used to detect and give the signal to controller to stop robot at particular distance which is defined by user [1].

This device is merely sophisticated and self-docking, hence it can be used easily at anywhere .over the traditional method such devices help in many ways. It is autonomous and also avoid the human interaction. With the help grass cutter people can easily maintain and beautify lawn, gardens and playgrounds.

Methodology

The methodology for this project is mainly dependent on solar panel [2], ultrasonic sensor and controller .The main objective of our grass cutter is to charge battery by renewable energy for automatic purpose also uses five DC motors, blade, relay and motor driver IC. The fig.(1) shows the block diagram of "Automatic solar grass cutter".

Block Diagram:

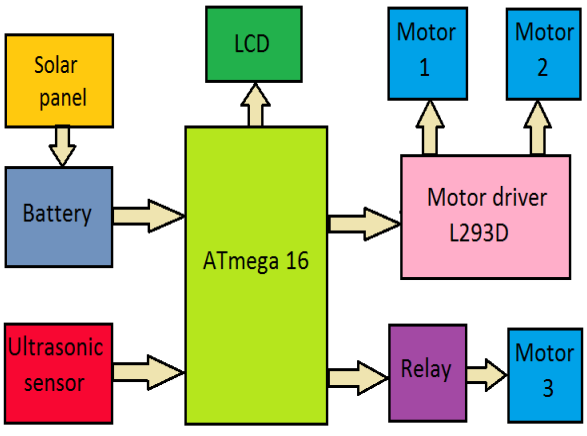

Figure 1: Block diagram of proposed system

The hardware components included in this paper are,

1. Solar Panel
2. ATmega16 Microcontroller
3. DC motor
4. Ultrasonic Sensor
5. Motor Driver IC
6. Battery
7. Relay
8. Blade
9. LCD Display

1. **SOLAR PANEL**:

Solar energy is renewable energy. It is abundantly available and free of cost. Solar panel works on photovoltaic principle [2] and it is set of photovoltaic cells. The solar panel can be used to generate and supply electricity in commercial and residential applications.

Fig.2 Solar Panel

Photovoltaic principle:

When sun rays falls on solar panel photons from the sun rays are absorbed in a semiconductor, that generates free electrons with higher energy then it create must be an electric field. This energy is used to do useful work.

2. MICROCONTROLLER:

For the controlling the grass cutter AVR Atmega16 microcontroller is used .This controller having 40 pins in DIP format. It is 8 bit microcontroller having RISC architecture with 131 instructions. It has high programming memory.Atmega16 has loads of on-chip peripherals like timers(both 8 and 16 bits),8-channel 10 bit ADCs,I2C bus,SPI bus,UART interface,watchdog timer.It executes an instruction in single machine cycle hence it have faster speed of execution over the other microcontrollers.

3. DC MOTOR:

Fig. 3 DC motor

Working principle:

Working principle of dc motor is that 'whenever a current carrying conductor is placed among magnetic field it induces mechanical force.'

DC motors are mainly used for two purpose such as for cutting grass by blade and moving the robot [3] .We used five dc motors in that four for each wheel respectively, two motors are parallel in connection and one for cutter. Motor for cutter of 45rpm, 12v with high speed low torque and motors for wheels are of 30rpm,12v.

4. ULTRASONIC SENSOR:

Working principle:

Ultrasonic sensors generates sound pulses with high frequency at regular intervals.Velocity of these pulses are same as that of the velocity of sound. If they incident on the an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

Fig.4 Ultrasonic sensor

Ultrasonic sensor having four pins VCC, trigger, echo and ground respectively. It has range up to 2m to 4m with operating frequency 40 KHz and measuring angle of $15^{0.}$ It is mostly used for obstacle detection [1].

5. MOTOR DRIVER IC:

Motor driver IC used in this paper is L293D [4].It is used to drive the DC motors. Circuitry for this IC is as shown in fig(5)

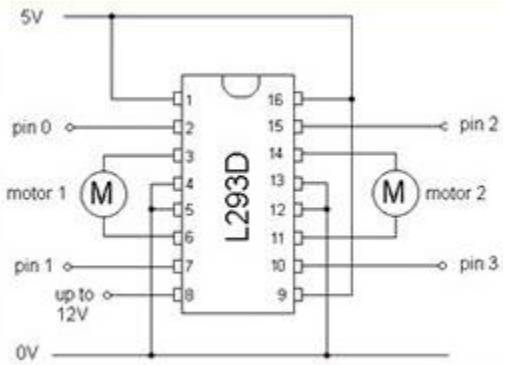

Fig.5 Circuit diagram of L293D

6. BATTERY :
Battery is used to store the solar energy which is then converted into electrical energy [5]. Batteries are only technically and economically available storage means. Battery used in this paper is of 12v dc.

7. RELAY :
Relays are switches that open and close circuits electromechanically or electrically. Relay is used for controlling motor of grass cutter blades acting as switch.

8. BLADE :
We are using linear blade [5] for cutting purpose which is made up of stainless steel. Blades are having good mechanical strength. Basically cutter is placed at centre of the machine.

10. LCD DISPLAY :
LCD is an electronic device which is used in many applications widely. In this paper we used 16 * 2 LCD display [1] which is very basic module and is very commonly used .In this paper it displays name of paper and distance between obstacle and robot.

Flow chart

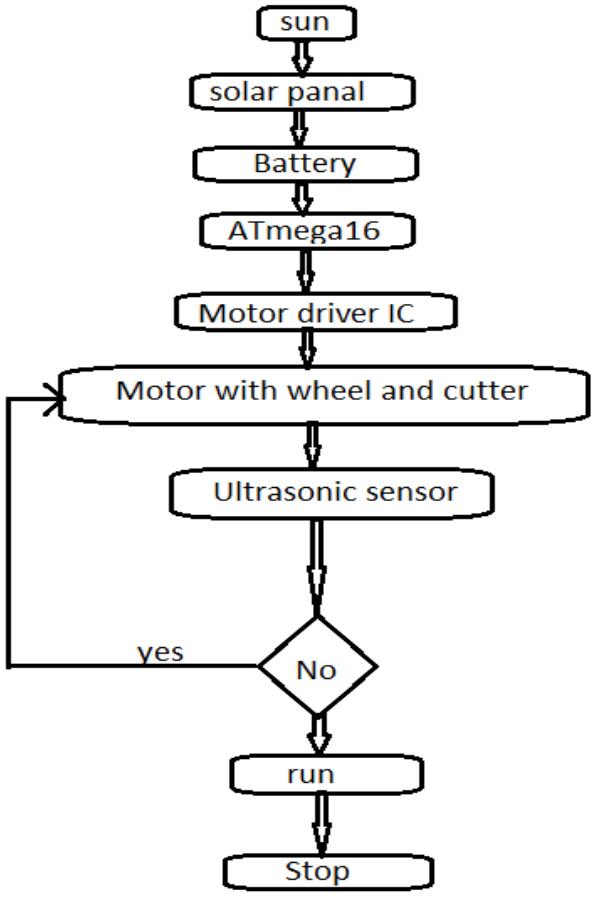

Fig. 6 Flow chart for working of machine

Results

Fig. 7 Circuitry of proposed work

Fig. 8 Machine on field

Conclusion
Our project name is 'Automatic solar grass cutter'. It is successfully completed. This project is more suitable for a common man as any non skilled person also handled it easily. It is automatic in nature by predetermined programming. It is having much more advantage like no fuel cost, no pollution. It also has less wear and tear because of less number of moving components and this can be operated on solar energy. It is highly efficient and accurate because it detects the obstacle using ultrasonic sensor and stop function as per the instruction given by the microcontroller .it can be used in day as well as night time as it have facility to charge batteries in day time. Finally this project is easily affordable with low maintenance can be used by people for better results.

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IoT Security Threats, Attack Scenarios in data protocol : Focus in MQTT

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Abstract— Internet of things (IoT) also called 'Web of Things' (WoT) is a wireless network between smart products or smart things connected to the internet. It is a latest and rapidly developing market which not only connects objects and people but also billions of gadgets and smart end devices. With the fast growth of IoT, security concerns vulnerabilities of these linked objects are also a steadily increased. Numbers of different communications protocols are currently used in the Internet of Things (IoT) devices. One of the protocols that are already standardized by ISO is MQTT protocol (ISO / IEC 20922: 2016). IoT developers usually use this protocol because of its minimal bandwidth requirement and low memory consumption. Sometimes, IoT device communicates confidential data that should only be accessed by authorized people or devices. Unfortunately, the MQTT protocol only provides authentication for the security mechanism which, by default also does not encrypt the data in transit thus data privacy, authentication, and data integrity become problems in MQTT implementation. This paper tries to discusses several reasons on why there are many IoT systems that do not implement adequate security mechanism. Further, it also discusses how we can attack this protocol easily using several attack techniques.

Keywords—Internet of Things (IoT), Protocols, MQTT,

I. INTRODUCTION

In this digital smart world, we are surrounding by smart devices such as smart watch, smart cars and smart home among others. In near future, we might use our devices like what we imagined in our dreams where objects are smart and connecting with each other. IoT or the Internet-of-Things is a promising area, which means things are connected to the network through the internet and transmitting data including live events on matters of seconds [1]. During the last decade, Internet of Things (IoT) approached our lives silently and gradually, thanks to the availability of wireless communication systems (e.g., RFID, WiFi, 4G, IEEE 802.15.x), which have been increasingly employed as technology driver for crucial smart monitoring and control applications. The number of IoT devices is growing rapidly where Cisco IBSG predicts the number of IoT devices will reach 50 billion by 2020 [2]. Nowadays, many protocols are used as a communication protocol in the IoT devices. Five of the most prominent protocols used for IoT is Hypertext Transfer Protocol (HTTP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), and MQ Telemetry Protocol (MQTT) [3]. Some considerations that must be taken into account when we choose the protocol are energy efficiency (total consumed energy for the given execution time), performance (total transmission time it takes to send messages and receive their acknowledgments), resource usage (CPU, RAM, and ROM usage), and reliability (ability to avoid packet loss, i.e. QoS) [4]. Moreover, when advanced functionalities (e.g. message persistence, wills, and exactly once delivery), reliability, and ability to secure multicast message are highly considered, MQTT protocol is one of the best options [5]. template, modified in MS Word 2007 and saved as a "Word 97-2003 Document" for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

A. MQTT Protocol

MQ Telemetry Transport (MQTT) is a messaging protocol using a publish/subscribe mechanism which is originally

designed by Andy Stanford-Clark and Arlen Nipper. It is currently in the OASIS (Organization for the Advancement of Structured Information Standards) standard. Currently, the MQTT protocol also has standard defined in ISO/IEC 20922: 2016 (Information technology - Message Queuing Telemetry Transport (MQTT) v3.1.1). This protocol is used widely for IoT system that has limited resources because of several reasons: lightweight, small bandwidth requirement, open and straightforward to be implemented [6]. Figure 1 shows the example of the usage of MQTT protocol. Publish and subscribe operations can be analogized like client and server models. The central server in MQTT is named broker that acts as the recipient of the message from the client which is, essentially, the entire node involved in the communication process [7]. The message itself can be in the form of publish or subscribe topic. Furthermore, all the devices connected using this protocol can become publishers and subscribers. Usually, in MQTT architecture, several sensors periodically publish the results of their measurements (i.e. payload data) to a topic address. Every device that has been registered as a subscriber to a specific topic will receive a message from the broker each time the topic is updated.

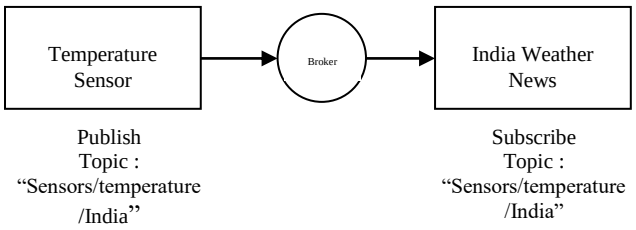

Fig. 1. An example of MQTT protocol use case

B. Security Requirement and Attack Surface

Information security is also an important thing to consider during making the decision of the protocols because some of the communication protocols in the IoT devices do not have a comprehensive information security mechanism. According to a book published by ISACA [8], the object of information security consists of three components: data confidentiality, data integrity, and data availability.

There is also access levels security requirements such as authentication, authorization, and access control which are explained in [9]. In fact, MQTT protocol is one of the protocols that do not yet have overall security mechanism because it only has authentication mechanism without encryption capabilities.

There are various considerations for IoT developer who wants to design security solutions in the IoT communication protocol. Firstly, the limitation of the IoT device itself (e.g. compute performance and low power consumption) that require a lightweight security protocol with small code footprint. Secondly, the heterogeneous environment where each of connected device may use different protocol and different security mechanism. Lastly, the reliability of network which may forces as to use security mechanism with minimum overhead [10]

By understanding the security requirement for IoT devices, we can now discuss the attack surface in IoT. Attack surface is a vulnerability that can be accessed and exploited in a system [11]. In [9], attack surface in IoT is divided into local network and public network. The local network is analog to internal attack where the attacker is on the same network as the IoT devices while the public network is analog to external attack where the attacker might reside anywhere in the public network to attack the IoT system [9].

Last year, a major incident related to IoT system was reported by RSA where the hackers had hijacked many IoT devices and provided access to compromised IoT devices and cameras in criminal forum [12]. Moreover, there was a distributed denial of service (DDoS) attack to krebsonsecurity.com site performed by botnets embedded in the IoT devices. Finally, taken from data owned by Threat Research Akamai team [13], there were reportedly millions of IoT devices used as proxies to route victims traffic to malicious sites.

II. Background

This section explains several reasons for why IoT implementation in the world does not use security mechanism.

A. Resource Constrained Device (RCD)

There are many devices categorized as a constrained device which, according to RFC 7228 [14], is further divided into three classes based on their RAM and ROM as follows.

TABLE I. TABLE I. CLASS IN CONSTRAINED DEVICE (RFC 7228)

Class	RAM (Data Size)	Flash (Code Size)
Class 0	<< 10 KB	<< 100KB
Class 1	~ 10 KB	~ 100KB
Class 2	~ 50 KB	~250KB

Because of the very limited computing performance, most of the resource constrained devices, especially class 0 device, cannot handle most of the security approaches [15], notably the mechanism which has heavy computation such as running TLS for transport security.

B. Vast number of devices

The significant number of connected devices appears to create more vulnerabilities [16]. For IT department, it is cumbersome to manage many different types of devices [17] especially when the security mechanism is applied to IoT system. For example, by using username and password to authenticate, the IT department will have to put much effort to maintain the security credentials (e.g. change the password periodically).

C. Lack of security awareness

The lack of security awareness makes a developer may prefer to choose functionality over security when trade-offs must be done [18]. On the other hand, according to the Bitdefender survey study [19] at US, Romania, Germany, Australia, France, and UK, only less than 50% of people from each country that aware of almost all security awareness parameters (e.g. privacy concerns, losing control of smart device, frequency of a software update). Another study from

HP Fortify states that 70% of devices use unencrypted network service [20].

III. Attack Scenarios on MQTT Protocol

In this section, we will discuss how an attack can be carried out on the MQTT protocol.

First, we assume that we do not know anything about the victim system that we want to attack (i.e. no prior knowledge of the infrastructure, defense mechanisms, and communication channels). This type of assumption is called black box penetration testing [21]. The attack is begun by performing information gathering that can be accomplished by using Shodan, Masscan, or NMAP [22]. For this paper, Shodan search engine will be utilized.

Fig. 2. Result of MQTT broker on port 1883 in Shodan

By inputting string " port:1883 "MQTT" " in search box inside Shodan, we perform searching on MQTT protocol on port 1883, the default MQTT broker port that doesn't use TLS mechanism for security purpose, to find available broker server. The search result provided in figure 2 shows at that moment (March 15, 2018), there were 45997 brokers with default port successfully indexed by Shodan.

Fig. 3. MQTT connection code in Shodan Page search result

Besides the result shown in Figure 2, there is also MQTT connection code on the right of each broker that is provided in Figure 3. All the brokers that have connection code of "0" are easier to be attacked because this kind of broker does not use any client authentication mechanism thus anonymous publisher or subscriber can connect to this broker freely.

For the first scenario, we can start to subscribe to all topics in that broker (subscribe to #) which may give us confidential data to be analyzed later. This attack scenario is illustrated in Figure 4

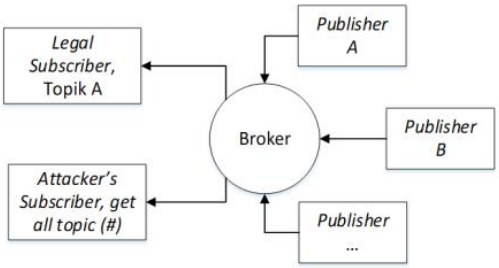

Fig. 4. Attacker can subscribe to all topic messages

Another scenario can be initiated by publishing data to the broker who does not have authentication mechanism which is illustrated in Figure 5. Street lamps act as subscriber where the legal publisher can publish a message to control the street lamps. On the other hand, since the broker does not have an authentication mechanism, an attacker can subscribe to the broker to get any message that is used to control the street lamps. By analyzing the control message, the attacker can publish his message to take over the street lights. This kind of scenario can also be used by an attacker to publish spam data so that both broker and subscriber get flooded and may result in denial of service.

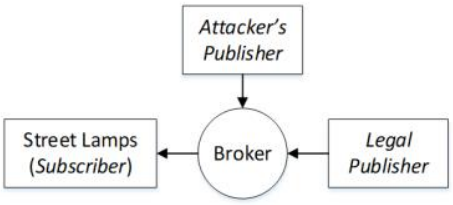

Fig. 5. Attack scenario from attacker's publisher

The first and second scenarios are a generic scenario that can be applied both in the local network and public network. The next scenario that will be discussed has the assumption that the attacker is connected to the same network with IoT system (e.g. at publisher network or broker network).

Using this assumption, the attacker can perform traffic analysis on that network to extract valuable information from data in-transit of MQTT protocol in the form of plain text, such as:

a. IP broker (usually public IP address)

b. Name of topic

c. Data payload

d. Port number of MQTT that IoT system use

IV. Conclusion

The security of IoT is a vital topic, due to the fact that it deals with sensitive data that flows over the Internet. In other words, security, privacy and trust are the main elements that businesses have to focus on when implementing IoT. However, the biggest challenge is performance and speed, if security is applied. The IoT devices are light and therefore manufactured keeping in mind low processing power and higher memory capabilities so that users can communicate with each other to minimize delay, and without effecting overall throughput in a high packet loss environment. In this paper we tried to focus on vulnerability of MQTT protocol which is mostly used in IoT application.

MQTT is one of the protocols used in IoT system where several scenarios to attack this protocol has been discussed in this paper. The first scenario takes places in the public network where we can scan the network by using Shodan search engine to search MQTT public server to make denial of service attack to devices (clients) connected to that broker or get/send incorrect data to its clients. This public broker can become a good candidate to control the botnet because of the nature of MQTT publish and subscribe. Then, from the local network, an attacker can sniff and modify packet data from the network to attack data privacy, data integrity, and MQTT authentication mechanism. Moreover, using nonstandard port (port obscurity) does not improve the security of MQTT at all. In future applications of IoT in consumer appliances as well as in industries it will become mandatory to provide strong security to prevent the attacks on private data of consumer.

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ADVANCED FOOTSTEP POWER GENERATION SYSTEM

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Abstract
The generation of power & its use is one of the major issue. Nowadays number of power generation techniques are available, non renewable & renewable. But still we can't overcome the problem of power need. In this paper we are generating the power by using piezoelectric sensor by simply walking & running on Footstep. The basic working principle of Piezoelectric sensor is based on the piezoelectric effect that means when we apply the mechanical energy to the sensor then it converted into the electrical energy. The voltage generated by sensor is stored in the Battery. By using this voltage we can drive various applications. Here we can design real time application. Our project model is easy to implement & cost effective.

Keywords: Piezoelectric Material, Force or Pressure, Power generation, Power utilization, Energy conversion.

1. Introduction

Nowadays, Electricity has become important for human life. Electricity is most commonly used energy resource; its demand is increasing day by day. This project is designed to convert mechanical energy into electrical energy. It is used to generate electricity from by walking on footstep.

In day to day life, the generation of energy by using the renewable sources is must. Hence, we are utilizing the wasted energy which is generated by human being. In human life walking is the most common activity. When walking activity is done by human being then energy is wasted in the form of vibration to the surface, this wasted energy is converted into the electrical energy using the principle of piezoelectric effect. Piezoelectric effect which has ability to generate electrical energy in response to applied mechanical stress or pressure. [1]

The basic working principle of 'power generation system' is based on the Piezoelectric Sensor. Piezoelectric effect is that measure changes in pressure, acceleration, temperature, strain or force and then converted into an electrical charge. It is a sensor which converts force applied on sensor into voltage with the help of mechanical vibrations. It basically converts kinetic energy into electrical energy. "Energy is cannot be created nor destroyed, it can only transformed from one form into the another". So here we are converting mechanical energy into electrical energy. [2]

2. Working

Fig 2.1 shows the block diagram of advanced footstep power generation system. This system basically consists of:

1. Piezoelectric Sensor.
2. Arduino (Pro-mini).
3. Bridge Rectifier.
4. Battery.
5. LCD display.

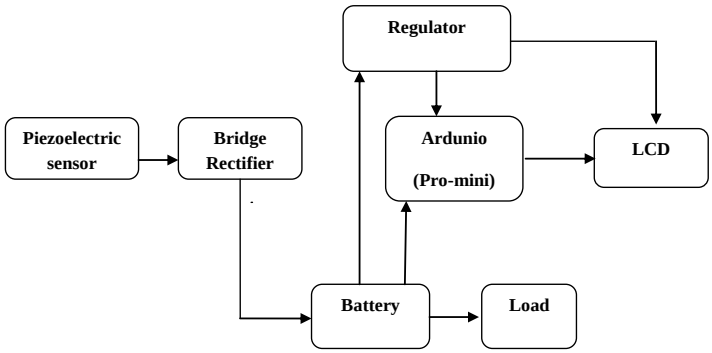

Figure 2. 1: Block Diagram of Footstep Power generation system

2.2 Piezoelectric Sensor

Piezoelectric sensor has specific but very interesting properties. This sensor has the important property to generate electrical energy from mechanical energy. That means, they can convert various mechanical parameter like pressure, vibration into electricity. [4]

These types of devices are mostly used where outside power is unavailable. Recent studies have shown that piezoelectric sensors are used as power generators.

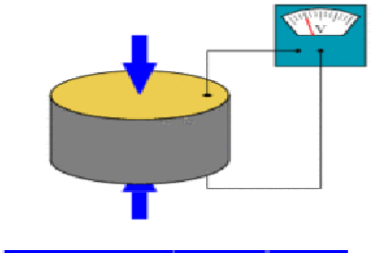

Figure 2.2.1. Piezoelectric sensor

There are various technologies are available to produce electricity such as water, wind etc. to generate the electricity we needed big plants and they are not affordable. [1] Piezoelectric sensor is based on principle of piezoelectric effect it has ability to generate electric charge from pressure. Piezoelectric sensors have different materials they do not need any external supply. PZT and PVDF materials are most commonly available in piezoelectric sensors.

2.3 Arduino (Pro-mini)

Here, we are using Microcontroller based Arduino for designing small circuitry. Arduino pro mini is basically operates at 3.3v and 8 MHz frequency.

Figure.2.3.1 Arduino (Pro-mini)

In the arduino pro mini we can connect any connector or wire as per our need because it does not come with connectors. It has 14 digital input\ output pins; there are two versions of pro mini one runs at
3.3v & 8 MHz and other at 5v & 16 MHz.

2.4 Lithium Ion Battery

Lithium ion battery is basically the most popular type of rechargeable batteries which are commonly used in home electronics. We are using 7.2 volt 15 watt battery for store the voltage. In this battery lithium ion moves from negative electrode to the positive electrodes during discharge & back when charging. The performance, cost & safety characteristics of lithium ion battery are good. For handheld electronics mostly uses the lithium ion battery.

2.5 16*2 LCD display

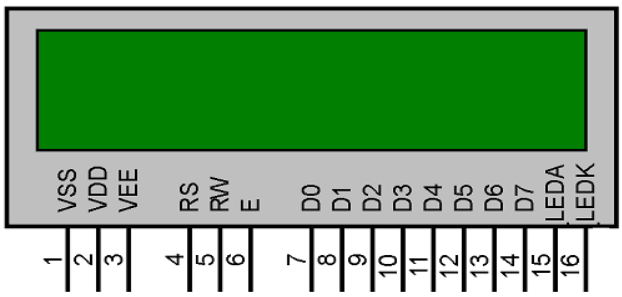

Figure 2.5.1 16*2 LCD display

LCD (Liquid Crystal Display) screen is a basic module and it is widely used to display characters in various devices and circuits. This display is so named because this has 2 lines and 16 characters per line. Each character displays in 5*7 pixel matrix. LCD is used here in 4 bit mode. 16*2 LCD has two registers that are command and data. Out of that command register is used to store the command instructions given to the LCD. The data register is used to store the data that are displayed on the LCD. The data is the ASCII value of the character.

3. Methodology

Footstep power generation system involves following methods:

1. Interface and transducing
   - Piezoelectric sensors are arranged in that manner to generate maximum output voltage.
   - Mechanical energy, pressure or force is converted into electrical energy.
2. Processing
   - Here the generated voltage will be fed into different blocks of a circuit parameter to get a proper output.
3. Storage
   - Final output will be stored in battery.
   - Drive various applications as per our need.
   - We can use this output to charge the mobile phone.
   - The overall operation of this system is based on piezoelectric sensor; wastage energy can be reforming this energy back to the usable form using piezoelectric sensor. By using energy conversion theorem and piezoelectric effect we are proposing a new method for power generation.[2]

4. Flowchart

Figure below shows the flowchart of the proposed system which shows the whole process of power generation. In this system first initializes input and output pins, LCD display & display any message as per your program on to the display.

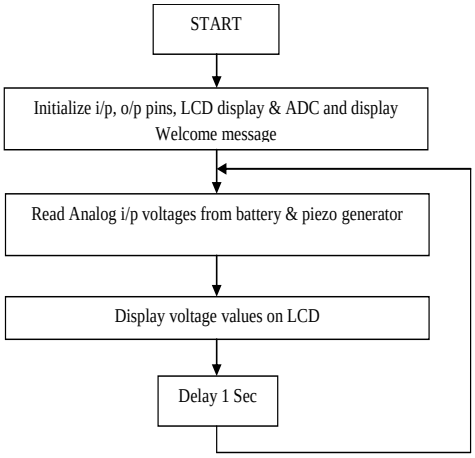

Figure 4.1 Flowchart

When we apply pressure, force or any mechanical energy to the sensor then sensor is converted this energy into the electrical energy, this output of the sensor is stored in battery. Read analog input voltages from sensor and battery and display battery voltage and generated voltage from the sensor.

5. Software

In the proposed system, Arduino IDE software is used for the programming of an Arduino controller. The program can be downloading with the help of Arduino IDE software itself. Before downloading, the program have to select Tools> Board menu. The ATmega328 is an Arduino which is always available with a boot loader which helps to upload new code to it without use of external hardware programmer.

6. Future Scope

In future we can use this system for speed breakers where travelling are more to generate maximum output of generation. If we are used this technique in populated area then we generate efficient electrical power for large purposes.

7. Advantages

- Economic
- Power generation is simply walking and running on the step.
- This is non-conventional system.
- Easy to install.
- No need of fuel input.
- No need of external power supply.

8. Application

- Mobile Charging.
- Colleges.
- Speed breakers.
- Railway stations.
- Shopping center.

9. Result

10. Conclusion

This technique of power generation is very useful in the rural area. Where, people face the problem related to the shortage of power. Arduino microcontroller proves to be smart, economic and efficient system for power generation. We can design real time application and its performance is really best. This is very cost effective & easy to produce. It can be utilized to drive both AC and DC load. Here we are utilizing the wastage energy and generate electrical energy.

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Home security using GSM technique

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Abstract-
In recent world, safety and security becomes very important aspect in everyone's life. Nowadays, robbery or burglary is get rising. This things happens especially when the owner is away from their homes. Today everyone's life is too busy due to their jobs, business or any other activities. Theft takes advantages of this opportunity. Due to this no one is left behind about the security system of their homes. The aim of this paper mainly is to focus on security system when user is away from his home. This system is very simple, inexpensive which is much suitable for smart home security.

Keywords: Arduino uno microcontroller, GSM module, Magnetic sensor, LCD display, camera, SD card and keypad.

Introduction-
The block diagram of "Arduino microcontroller based home security system" is as shown in figure. Initially, this system waits to receive a signal from input keypad which is 4*3 keypad. An LCD display in this system is used to indicate status of the system. This system is actually operates on three cases. That are-

Case 1- The first case is about the correct password. When any person enters correct password then he is allowed to enter into the home. "Password correct" is displays on the LCD display as well as the SMS is sent to the owner through GSM module and also the photos are captured through camera inside the room. After closing the door, the keypad is ready to enter password[1].

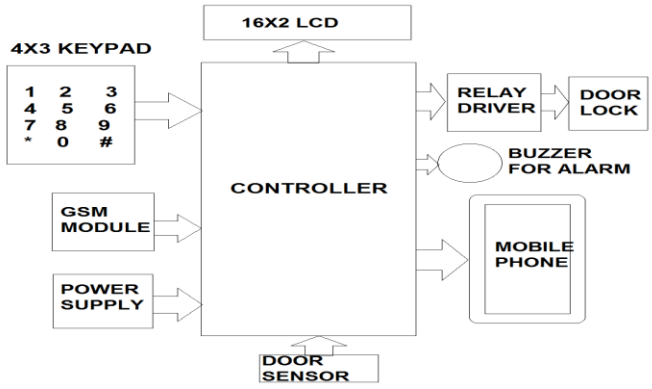

Fig.1- Block diagram of Home security using GSM technique

Case 2- The second case is about incorrect password. When any person enters incorrect password then he is not allowed to enter into the home. "Access Denied" is displays on LCD display and again keypad becomes ready to enter password[1].

Case 3- The third case is about override. In the case of breakage, if any person tries to break the system then magnetic sensor placed near door frame senses it and alarm starts buzzering to alert neighbours. The camera inside the room capture the photos and SMS is sent to owner i.e. our door is opened unauthorizely[1].

This system includes two parts- Software and Hardware. In a software part, a program is designed in Arduino IDE software according to block diagram. In accordance with the software instructions, a suitable circuit diagram is designed for hardware implementation [4].

Hardware-
Power supply-

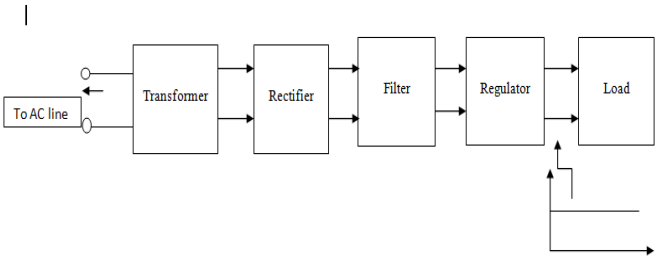

Fig. 2 Block diagram of power supply

Here, we used +12v and +5vdc power supply. The main function of power supply is to provide the required amount of voltage to essential circuits. To get the +5vdc power supply we have used here is IC 7805, which provides +5vdc and to get +12vdc power supply, IC 7812 is used. +12v is given to relay, Arduino and latch. +5v is given to GSM module, buzzer, LCD.

GSM module-

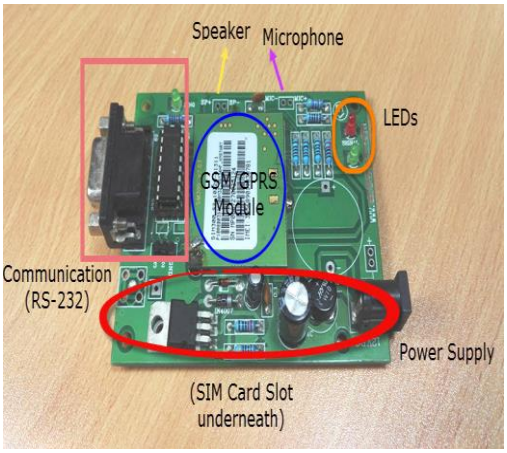

Fig. 3 Structure of GSM module

A GSM (Global System for Mobiles) is a wireless modem that is based on GSM modem should require a SIM card (Subscriber Identity Module) in order to operate it in respective frequency bands. Along with standard AT commands, GSM modems are supports an extended set of an AT commands. These extended AT commands are defined in the GSM standards [2][4][5]. With extended AT commands, you can do things such as-

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the charging status and charge level of batteries.
- Reading, writing and searching phone book entries.

16*2 LCD display-

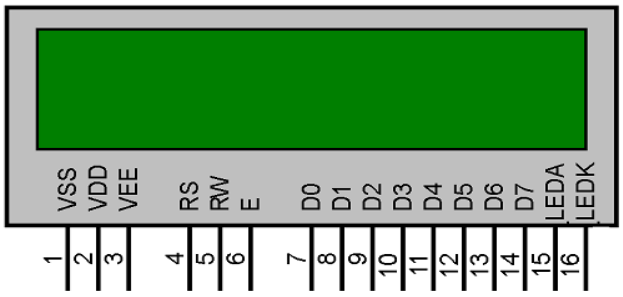

Fig 4. 16*2 LCD display

LCD (Liquid Crystal Display) screen is a basic module and it is widely used to display characters in various devices and circuits. This display is so named because this has 2 lines and 16 characters per line. Each character displays in 5*7 pixel matrix. LCD is used here in 4 bit mode. 16*2 LCD has two registers that are command and data. Out of that command register is used to store the command instructions given to the LCD. The data register is used to store the data that are displayed on the LCD. The data is the ASCII value of the character.

Keypad-

Fig. 5 4*3 keypad

There are total 12 keys in keypad which is 4*3 matrix. That is having 4 rows and 3 columns. The 12 keys are placed at the intersection of rows and columns. When button is not pressed gives logic zero. Whereas when button is pressed then it gives logic one i.e. +5v.

Magnetic sensor-

Fig. 6 magnetic sensor

Magnetic sensor has two parts- one part has magnet and other part has sensor. Out of which one is placed on door and other is placed on door frame.

Arduino Microcontroller-

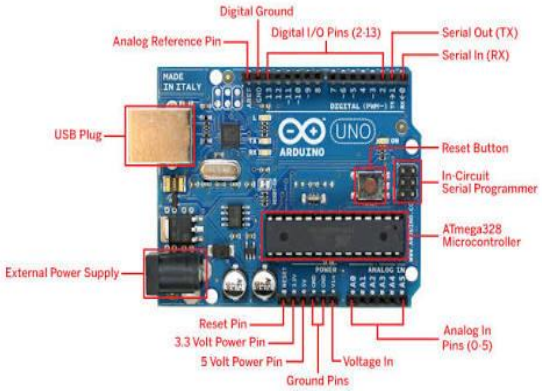

Fig. 7 Arduino microcontroller

In this proposed system, we used an arduino microcontroller. The programming of an arduino controller is easy, simple and has comparatively lower length as compared to other controller like 8051, 89C51. The libraries have already

declared in arduino IDE software which is basically used for programming of arduino microcontroller. Analog to Digital converter (ADC) is also inbuilt in this controller. No other burning software is required in arduino microcontroller like 8051 requires Flash magic. Because arduino IDE software already has a facility to download the program directly[1][3][5].

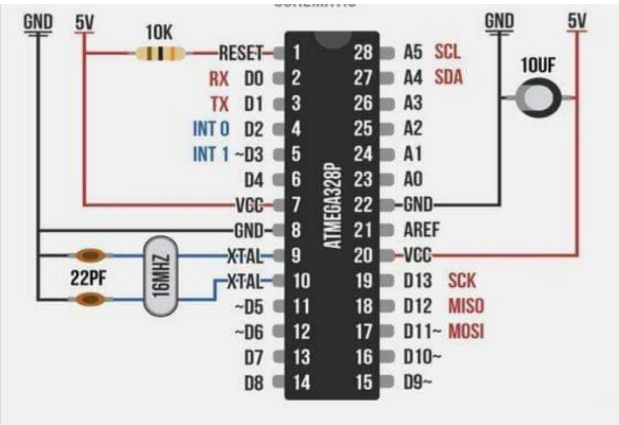

Fig. 8 Pin diagram of Arduino microcontroller

Relay and door lock-

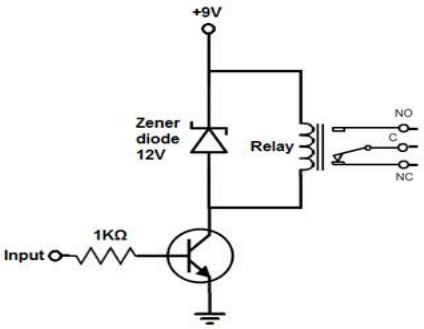

Fig. 9 Relay IC circuit

In this proposed system, door lock is used to lock and unlock the door. Here, door lock is solenoid valve which operates on 12v. Relay is like switch which is connected to a door lock which helps to open or close the door.

Software-

In the proposed system, Arduino IDE software is used for the programming of an Arduino controller. The program can be download with the help of Arduino IDE software itself. Before downloading, the program have to select Tools> Board menu. The ATmega328 an Arduino Uno is always along with a boot loader which helps to upload new code to it without use of external hardware programmer[4].

Flowchart-

Figure below shows the flowchart of the proposed system which shows the whole process of how to secure our home from theft. After the system turn on, an authorized or unauthorized opening of door gives notification via SMS to users mobile phone and also alarm starts buzzering[4].

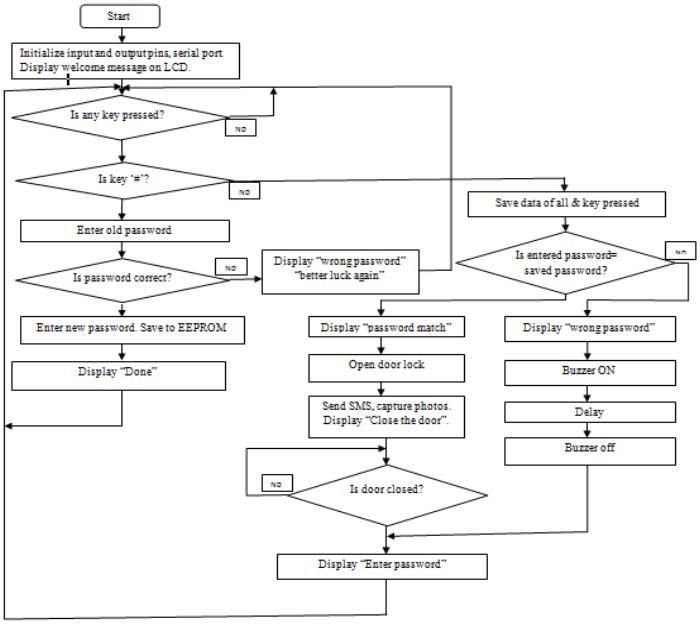

Fig. 10 flowchart

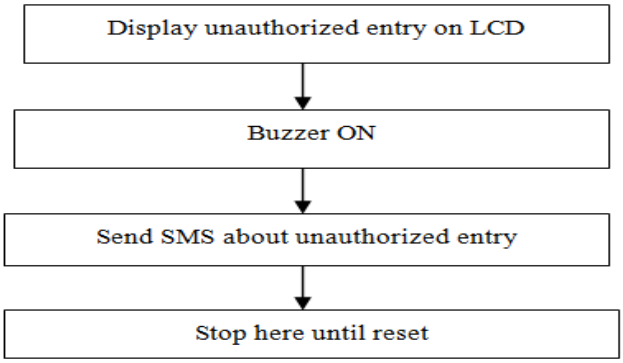

Fig.11 Interrupt Routine

Advantages-

- Provides security
- Low power consumption
- Components are easily available
- Simple and easy system
- Cost effective

Disadvantages-

- Low range
- Cannot be operate by remote
- Password leakage or forgotten is dangerous

Applications-

- At residential places for better safety
- At the organization
- With slight modification it can be used for controlling of switching of loads through password

- In the bank lockers
- Hospitals
- School or college

Results-

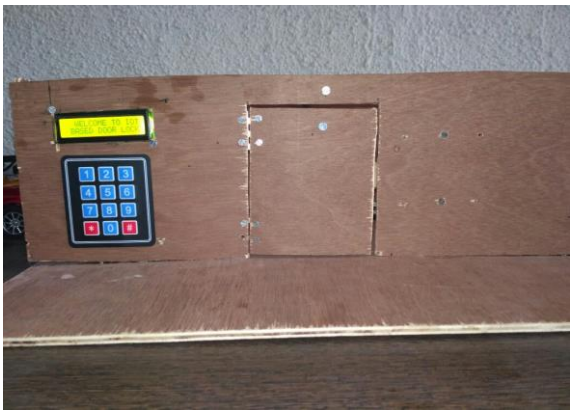

Fig. 12 Initial condition of project

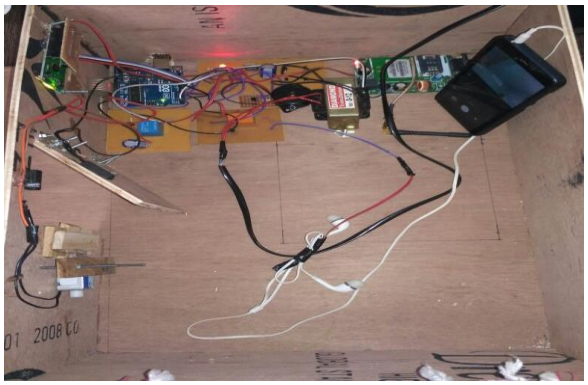

Fig. 13 Experimental set up

From this paper, we have designed and implemented a smart home security system based on arduino microcontroller along with GSM users. The system is

1. Cost effective
2. Easy to access

Future Scope-

- Here, we used keypad to enter password instead of this we can also use face recognition, finger prints and eye recognition.
- Here we used GSM module to send SMS instead of this we can also send the emails through GPS.
- Here we used latch to open the door instead of this we can use motor to open the door.

Conclusion-

This paper represents design and implementation of low cost but secure home security system for general users. Arduino microcontroller proves to be smart, economic and efficient system for home security. Peoples are more concerned to protect their houses from unauthorized entry. SMS through GSM is used to alert the owner via mobile phones wirelessly. So this system is the communication medium between system and user.

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IOT BASED PATIENT HEALTH MONITERING SYSTEM

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Abstract- *This paper focus on design and implement wireless biomedical parameters monitoring system based on different biomedical sensors and Arduino UNO. The main objective of system is to transmitting the patient's health monitoring parameters through wireless communication. These input data are uploaded in cloud server and transmitted to the mobile for doctor's reference .For this Purpose Andriod Blynk Application Patient Health Monitoring System also notifies the patient with possible precautionary measures to be practiced by them. This system suggests the patient with medical care and next step to be followed in case of critical situation.*

Keywords: Internet of Things, Arduino, ECG, Temperature, Pulse Rate.

1. Introduction

The electronics technology has entered in all aspects of day to-day life, and the medical field is not exception for this, so The need for well-equipped hospitals and diagnostic centers is increasing day by day as the people are becoming more
conscious and attention full about their health problems. Now let's try to find some reasons behind the increasing percentage of the patients. In today's world everyone life has become very fast.

In India, everyday many lives are affected because the patients are not timely and properly treated. Also for real time parameter values are not efficiently measured in clinic as well as in hospitals. Sometimes it becomes difficult for hospitals to frequently check patient's conditions. Also continuous monitoring of ICU patients is not possible. To deal with these types of situations, our system is beneficial. Our system is designed to be used in hospitals for measuring and monitoring various parameters like temperature, ECG, heart beat etc. The results can be recorded using Arduino displayed on a LCD display. Also the results can be sent to Cloud server. The Blynk application is used for the displaying this parameters. Doctors can login in the application and view those results.

A Patient health care monitoring system is necessary to constantly monitor patient's physiological parameters. The medical system focuses on the measurement and evaluation of vital parameters e.g. temperature, electrocardiogram (ECG), heart rate variability, Humidity etc. We can buy variety of sensors in the market today such as ECG sensors, temperature sensors, pulse monitors etc. The cost of the sensors varies according to their size, flexibility and accuracy. The Arduino UNO which is a cheap, flexible, fully customizable and programmable small computer board brings the advantages of a PC to the domain of sensor network

2. Materials and Methods

The design of the Patient health monitoring system consist of various steps, vise selection of proper sensors to sense physical parameters, design of signal conditioning circuit which support digital logic device, selection of controller and display unit.

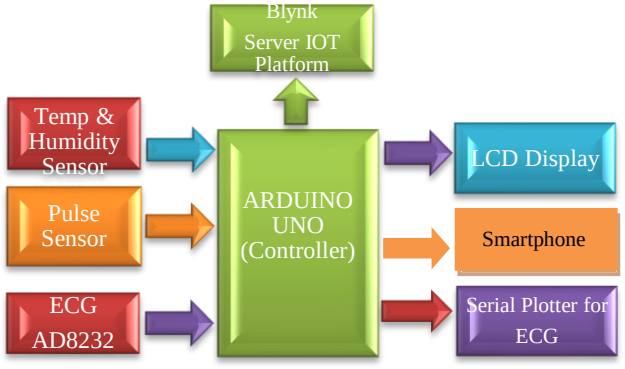

Fig 1: Block Diagram IOT based Patient Health Monitoring System.

The functional block diagram of IOT based Patient Health Monitoring System is shown in the fig.1.The whole system is designed around the Arduino Uno microcontroller. It consists of on chip peripherals like ADC, EEPROM, Flash Memory Timer which helps to reduce the cost and increase the efficiency and reliability of the system.

The sensor senses the physical parameters in this case temperature, Humidity, Pulse rate. Also an ECG module AD8232 is used to define Cardiogram. The all data is displayed on the application Blynk securely

2.1 Arduino Microcontroller:

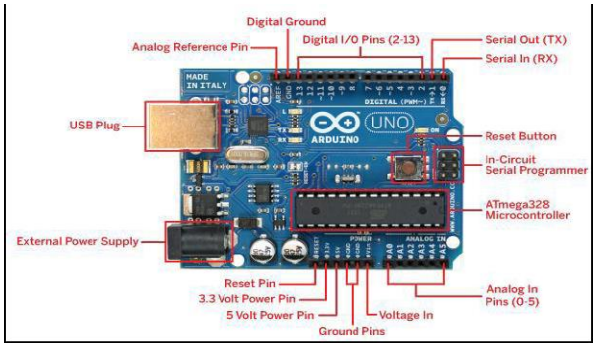

Fig 2: Arduino ATmega328 board

The Arduino ATmega328 is a programmable controller for prototyping electromechanical devices is shown in Figure.2. It has 6 analog input pins, labeled as A0 to A5; each pin provides 10 bits of resolution. Also it has 14 digital Input / output pins of which 6 can be used as PWM outputs. The Arduino software includes a Wire library to simplify use of the I2C bus. A software serial library allows serial communication on any of the Uno's digital pins.

The ATmega328 also supports I2C which is two wire interface and SPI communication. Everything needed to support is available on the single chip. The power is given to board by simply connecting it to a computer with a USB cable or powers it with AC-to-DC adapter or battery to get started. It consist of a 16 MHz ceramic Resonator, a USB connection, a power jack, an in-circuit serial programmer (ICSP) header and a reset button as shown in figure.

2.1.1 The features of ATmega328:

1. 5V Operating Voltage
2. 6-20V Input Voltage
3. 14 Digital I/O Pins of which provide 6 PWM output
4. 32 bit Flash Memory
5. 2KB SRAM
6. 1KB EEPROM
7. 16 MHz Clock Speed.

2.2 Temperature sensor and Humidity Sensor:

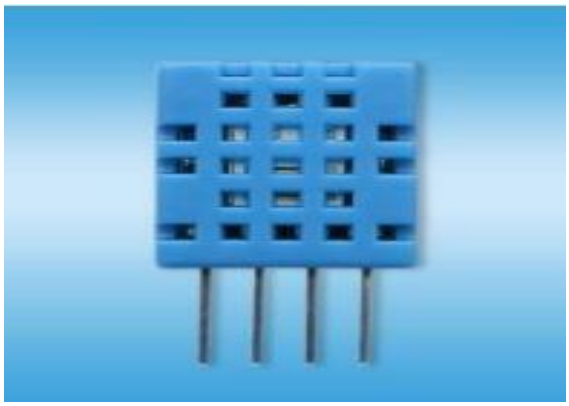

Fig 3: DHT 11 Sensor

DHT11 output calibrated digital signal. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology, assuring its reliability and stability. Its sensing elements is connected with 8-bit single-chip computer.

Every sensor of this model is temperature compensated and calibrated in accurate calibration chamber and the calibration-coefficient is saved in OTP memory.

Small size & low consumption & long transmission distance(20m) enable DHT11to be suited in all kinds of harsh application occasions. Single-row packaged with four pins, making the connection very convenient.

2.2.1 Electrical Characteristics:

Table 1. Electrical Characteristics

Item	Condition	Min	Typical	Max	Unit
Power supply	DC	3	5	5.5	V
Current supply	Measuring	0.5		2.5	mA
	Stand-by	100	Null	150	uA
	Average	0.2	Null	1	mA

2.2.2 Feature and Application:

1. Full range temperature compensated
2. Relative humidity and temperature measurement
3. Calibrated digital signal
4. Outstanding long-term stability
5. Extra components not needed
6. Long transmission distance

2.3 Pulse Sensor:

Fig.4: Pulse Sensor

Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino and Arduino compatibles. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. Pulse Sensor adds amplification and noise cancellation circuitry to the hardware. It's noticeably faster and easier to get reliable pulse readings. Pulse Sensor Amped works with either a 3V or 5V Arduino.

2.3.1 Specification

1. Diameter = 0.625" (~16mm)
2. Overall thickness = 0.125" (~3mm)
3. Working Voltage = 3V to 5V
4. Working Current = ~4mA at 5V

2.4 ECG Module AD8232:

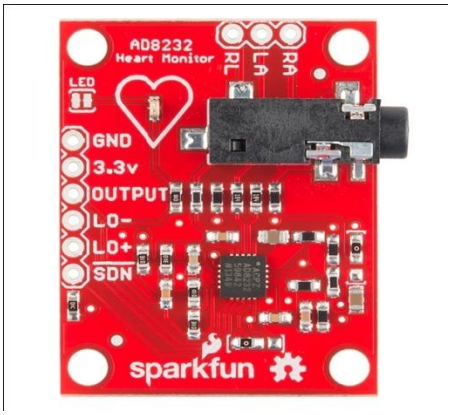

Fig. 5: AD8232 ECG Module

The AD8232 from Analog Devices is a dedicated single lead heart rate monitor front end integrated circuit. The AD8232 is an integrated signal conditioning block for ECG and other bio potential measurement applications. It is designed to extract, amplify, and filter small bio potential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement.

This design allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily.

Electrocardiography (ECG or EKG) is the method of recording the electrical activity of heart over a period of time using the electrodes placed on the skin.

We can use the electrode jack or else pin holes for electrodes. Connect corresponding electrode pads in skin and then provide 3.3V and GND power supply from the Arduino board, the SDN (shutdown) pin is not connected to any part. Output from the breakout board is taken to Arduino's A0 (Analog input 0) pin. To detect the Leads off situation LO – , LO + are connected to Arduino digital pin D11 and D10 respectively.

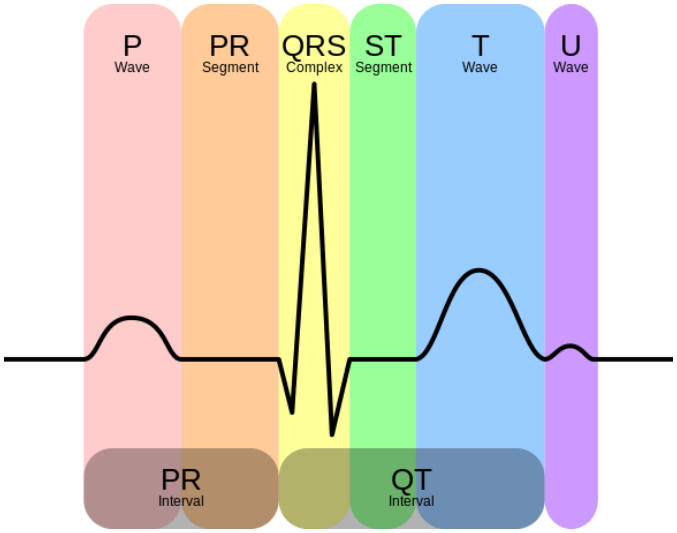

Fig.6: Electrocardiography

2.4.1 Pin Configuration:

Table 2. Pin Configuration

Board Label	Pin Function	Arduino Connection
GND	Ground	GND
3.3v	3.3v Power Supply	3.3v
OUTPUT	Output Signal	A0
LO-	Leads-off Detect –	11
LO+	Leads-off Detect +	10
SDN	Shutdown	Not used

2.4.2 Electrode Pads:

Table 2. Electrode Pad

Cable Color	Signal
Black	RA (Right Arm)
Blue	LA (Left Arm)
Red	RL (Right Leg)

Results and Discussion:

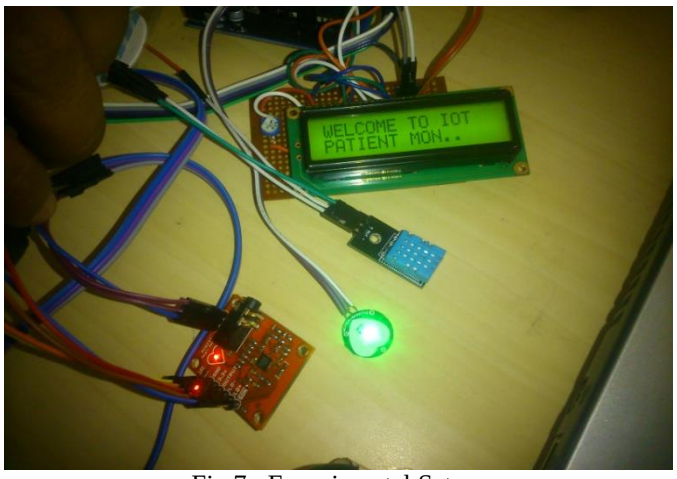

Fig 7: Experimental Setup

Fig 8: Temp and Humidity Result

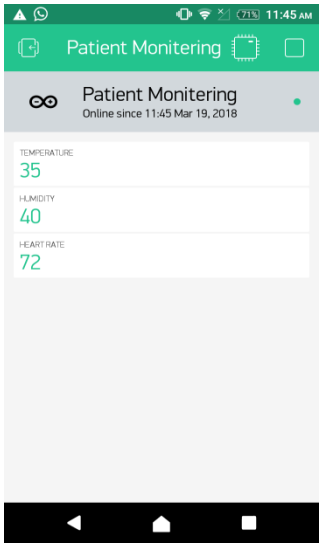

Fig 9: Blynk Application Server

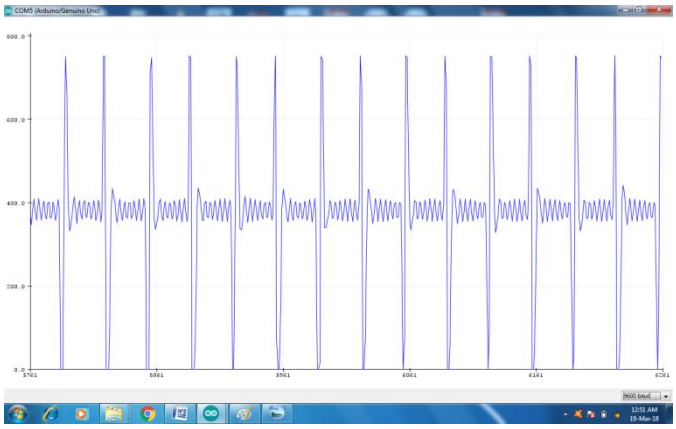

Fig 10: ECG Graph

Conclusion

Internet of Things has many applications in different areas. IOT has been already designed for Wireless sensor network (WSN). It has been developed for health monitoring.

This system presents the architecture of IOT and architecture of Smart health monitoring using IOT. By using the system the healthcare professionals can monitor, diagnose, and advice their patients all the time. The health parameters data are stored and published online.

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Recent Trends, Protocol Scope for Mobile Devices and Research Challenges in Internet of Things

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Abstract
The Internet of Things (IoT) is developing rapidly and becoming a hot topic around the world. On the basis of the reorganized Unit IoT and Ubiquitous IoT. The number of intelligent devices continues to grow exponentially, giving these smart things the ability to sense, interpret, control, actuate, communicate and negotiate – over the hyper-connected Internet of Things (IoT) space. There are several reports that predict that by the year 2020 there could be in excess of 20 billion devices connected to the internet and therefore, for understanding the complexities of this massive scaling, many research efforts are underway to model and design IoT-based systems

Keywords: Research challenges, recent trends, Applications in IoT innovation policy, innovative capacity, innovation strategy,

Introduction
The Internet of Things is a network, which uses information sensing devices such as radio frequency identification (RFID), infrared sensors, global positioning systems or laser scanners, to make any things connect to the Internet up to the information exchange and communication, in accordance with the agreed protocol in order to achieve intelligent identification, location, tracking, monitoring and management. Internet of Things is proposed based on the Internet, so it does not only have the traditional Internet security issues, but also has its own security particularity, such as large and complex network nodes, limited computing and storage capacity, relatively exposed environment and so on. The reader can read the information of the tags through radio frequency (RF) signal, while the back server communicates with the reader through a wired network. However, an unauthorized or illegal reader can also read and gather information from the tags within its scope; therefore, user privacy may be disclosed through stealing or modifying on the part of the attackers. Combined with the inherent vulnerability of wireless communications, RFID systems still face a variety of security challenges and threats

Most of the research questions, however, have focused on systems with fixed sensors/devices deployments that are tagged to a particular location without the scope for any form of mobility. A new development in this regard has been the emergence of mobile things that has given rise to mobile IoT or the 'Internet of Mobile Things' (IoMT). Examples include robots, unmanned aerial vehicles (UAV), and even commonplace moving objects such as cars, buses or trains. Even humans with wearable devices (such as smart watches, wrist bands, smartphones, etc.) would form part of the mobile IoT. Such objects would also remain connected to the internet even while moving around, giving rise to several innovation possibilities. As with all new innovation paradigms, such possibilities come with their own research challenges, including but not limited to the following:

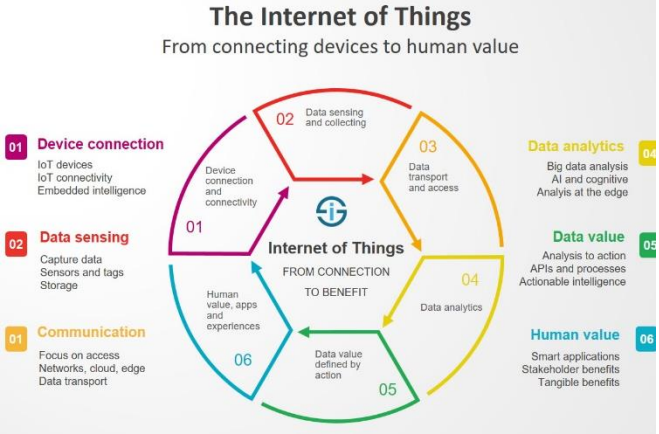
Related Work
With the wide range of application of RFID systems, there have been a large number of studies on the security threats incurred by using tags. The protection of user privacy in RFID systems is very particular, because the RFID chip is low-cost and its storage and computing capacity are very limited. It cannot carry out complex calculations or store large amounts of data; therefore, although the traditional symmetric encryption algorithm and asymmetric encryption algorithm are relatively perfect, they are not applicable for the RFID systems. Currently, at home and abroad there are two research fields on the security technology of low-cost tags, including physical methods and security protocols.

Physical methods mainly consist of the KILL command mechanism, the SLEEP label, electrostatic shielding, and so on. Although they can provide some security guarantees, they will cause much waste so that they are not suitable for large-scale application. In terms of resistance to security and privacy threats, designing security protocols is more practical.

As regards security protocols, there are many published papers. The minimalist cryptography algorithm [1] proposed by A. Juels et al. needs only simple XOR logic within the tags. This algorithm has low requirements on the tags and is easy to operate, but its security level is not high enough. Re-encryption technology [9], encrypting the tag repeatedly, is another RFID security mechanism. Its encryption and decryption is completed by the reader, while the tag just as carriers has low technology requirements. However, it does not have an authentication process and there are tracking problems in the interval of every re-encryption. The application of hash-based method is most widely useful, because it is able to provide mutual authentication between the reader and the tag. In addition, hash functions are considered to be the basic components of lightweight cryptography, and it can be achieved in the RFID chips easily. Presently, there are many authentication protocols based on the hash functions, such as hash lock protocol [2], random hash lock protocol [3], hash chain protocol [4], key value renewal random hash lock protocol [5], and so on. However, it is difficult for them to resist all kinds of security threats fully and effectively. Hash lock protocol and random hash lock protocol are vulnerable to replay attack and spoofing, while hash chain protocol can only provide strong one-way authentication and does not apply to the systems that contain a large number of tags. Key value renewal random hash lock protocol is a new method proposed by Zeng Lihua et al. who extend the random hash chain mechanism. In this protocol, the key value of the tag will be updated in each communication process to prevent the attack effectively. In summary, the various protocols only consider authentication and do not address the security issues in information transmission after the authentication. Therefore, this paper not only achieves mutual authentication between reader and tag, but also achieves sequence encryption for the information using the key stream generated by the linear feedback shift register to ensure information security in the transmission process. Finally, the paper forms a complete Secure Data Exchange Protocol that can be used in the RFID systems to provide privacy and information security

General Concept of IoT

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure. The figure of online capable devices increased 31% from 2016 to 8.4 billion in 2017. Experts estimate that the IoT will consist of about 30 billion objects by 2020. It is also estimated that the global market value of IoT will reach $7.1 trillion by 2020.



The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. "Things", in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, cameras streaming live feeds of wild animals in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring, or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest regarding "things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. The term "the Internet of things" was coined by Kevin Ashton of Procter & Gamble, later MIT's Auto-ID Center, in 1999.

The IoT is regarded as the next phase in the evolution of the internet. It will enable commonplace devices to be connected to the internet to achieve many disparate goals. With potentially billions of devices to be connected, it is clear that standardization will be required in order to avoid chaos. One estimate is that only 0.6% of objects that could be part of the IoT are currently connected. By 2020, there could be up to 50 billion devices connected to the internet, far greater than the number of human users as shown in Figure 1 below. The growth in the IoT follows an exponential curve while the growth in the number of human users follows a logarithmic curve. Electronics miniaturization, cost of electronic components, and the trend towards wireless communications are the three main drivers for IoT. These features are enabling physical objects to contain tiny embedded sensors and actuators that can connect to the internet. The core components of the IoT will be sensors and actuators, embedded processing, and connectivity and the cloud. Smart objects such as modern phones use sensors and actuators to interact with the real world. Embedded processing gives smart objects intelligence while connectivity and the cloud provide the means to communicate

and store data. The IoT will ultimately evolve into a network of people, processes, data, and physical objects that intercommunicate using wireless protocols

Research Challenges in IoT

The Internet of Things (IoT) is an extension of the Internet in which large numbers of "things", including sensors, actuators and processors, in addition to human users, are networked and able to provide high resolution data on their environment and exercise a degree of control over it. It is still at an early stage of development, and many problems/research challenges must be solved before it is widely adopted. Many of these are technical, including interoperability and scalability, as billions of heterogeneous devices will be connected, but deciding on how to invest in the IoT is a challenge for business, and there are also major social, legal and ethical challenges, including security and privacy of data collection, which must be resolved.

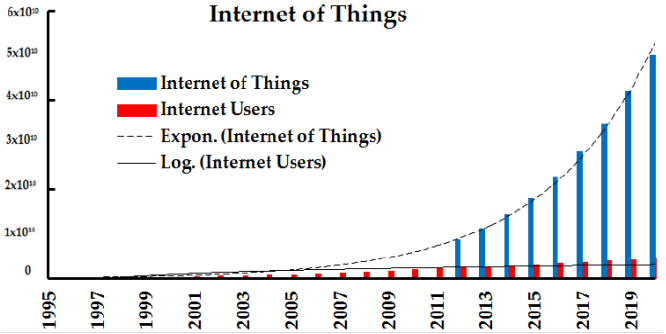


Fig.1 Internet of Things growth (data from http://www.internetlivestats.com/internet-users/ and IoT stats: statista.com). The red bars show the number of human internet users for the period 1995–2020; the blue bars show the number of devices connected to the internet, while the trend lines show a logarithmic growth for human users and exponential growth for number of devices connected

As the future IoT will be a multi-national, multi-industry, multi-technology infrastructure, the paper reviews the global standardization efforts that are underway to facilitate its worldwide creation and adoption. The main purpose of the paper is to give a broad survey, based on published literature, of the methods of Operations Research (OR), both the mathematical tools and techniques of "hard" OR, and the various approaches of Systems Thinking, including "soft" OR, which may assist in dealing with these problems. A subset of these is described in greater depth to better convey what might be involved in applying OR and Systems Thinking to the IoT. It is suggested that OR has a role to play in balancing the technical and non-technical research challenges which confront the IoT

1. Mobility induced sensor network design

The mobile IoT paradigm invalidates many of the assumptions of traditional wireless sensor networks, especially with regards to wireless technologies and protocols. In particular, mobile IoT devices would find it quite difficult to connect with each other and other components of the IoT network in the presence of mobility, intermittent connectivity and RF link variability. For example, internet-connected cars would need to transmit and receive data from different gateways depending on their location, which would keep changing due to their (the cars) mobility. This calls for radical new sensor network paradigms for IoT, perhaps borrowing ideas from mobile ad-hoc networks (MANETs)[4] or delay-tolerant networks

2. Robustness

In case of fixed deployed sensing and actuation platforms, it is common for devices to know their locations, have synchronized clocks, have knowledge of their neighbors for cooperating, configure a consistent set of parameters (such as consistent sleep and wakeup schedules, appropriate power levels of communication, and security keys). However, in case of IoMT, the topology of the system will be highly uncertain and may vary sporadically. In such a case, maintainability of a long-lived and dynamic system is problematic, and raises challenges in areas such as device discoverability, power usage optimization and communication protocols.

3. Coordination

IoMT brings together different kinds of mobile sensing opportunities: (i) opportunistic that piggybacks on the mobility of phones or vehicles, and (ii) controlled that provides a precise account of where to sample the environment (e.g., using UAVs). In the latter case, deployment and programmability of multiple UAVs for collaborative sensing tasks is non-trivial. The dominant practice is to create a set of pre-defined commands for each UAV. However, an increase in simultaneously-deployed UAVs renders this approach unmanageable as programmers must manually decompose the goal into a set of single-UAV parallel tasks. Moreover, they must estimate the duration of each task and balance the load between UAVs to fully exploit parallelism, while taking into account temporal constraints. The timing of a UAVs action depends on unpredictable factors (such as obstacles and crashes), which complicate this time analysis. Hence real-time coordination among mobile sensing and actuation platforms is a crucial research challenge that needs to be addressed if IoMT is to become successful.

4. Concurrency

In many application scenarios, communication among many types of mobile sensing entities needs to happen in real-time rather than in a delay tolerant manner. The run-time system needs to consider each such platform individually instead of treating all equally as they require individual, but coordinated planning. Therefore, dealing with parallelism and concurrency is markedly different. In mainstream sensor networks, it is network communication and input/output operations that need to occur in parallel with data processing. Hence while concurrency is an issue in IoT in general, it is particularly complex in IoMT due to the inherent unpredictability of the navigation time and movement patterns of mobile entities. For example, an internet-connected car moving through unpredictable traffic could exhibit highly variable mobility patterns and travel times between its source and destination; managing communication and input/output operations among multiple such cars – each of them with differing mobility patterns – would be challenging.

5. Modeling of mobility patterns

Designing a network comprising mobile sensing and actuation platforms has to take into account their mobility patterns. For example, motor vehicles travel in certain pre-defined patterns depending on the nature of the vehicle, e.g., commercial vehicles, public transport, private vehicles driven by commuters, etc. Modeling these patterns and understanding their variability over a period of time would yield valuable insights to solve the following research issues: what types of mobile sensors to install, which protocols would be most suitable, which types of sensing platforms can directly send messages to each other, which messages need to be routed through gateways, etc.

6. **Sensor aggregation and virtual sensing**

Due to large numbers of sensors in a network, it sometimes becomes necessary to aggregate multiple sensing streams as one 'virtual' sensor [6] that provides an integrated interface to other functionalities. An example of a 'virtual' mobile sensor could be aggregated traffic flow information on a highway that is derived from multiple vehicle sensors. This raises *inter alia* the following questions: which sensors can be aggregated (considering their mobility patterns); how is the aggregation to be implemented (given that mobile sensors – by definition – are mobile, and therefore, may not be always in proximity of each other); if a sensor moves out of range, can the aggregation be recovered through other means, i.e., is the aggregation mobility-tolerant; etc.

7. Optimal data capture and processing

A key issue in IoT systems is the enormity of data produced and transmitted on the network. Since most of this data may not be useful to any user, techniques for optimally filtering the data before storage and dissemination to users will emerge as a crucial research area. In our earlier work, we have explored the use of a goal-driven approach for data filtering. However, in case of mobile sensors (e.g., on internet-connected cars), the mobility patterns of the sensors that bring in the notion of time dependency would necessitate a rethink of our approach. Here too, the mobility of sensors would raise the same issue of mobility-tolerant aggregation as raised above. Hence what is appropriate data for users could depend on the time at which they request the data. Techniques such as spatio-temporal graphs[8] may become relevant in such cases.

8. Location-based data storage and representation

Optimal storage and representation of IoT data is a crucial topic, given the data volumes that may need to be stored for viewing and future analysis. To that end, our earlier work[9] proposed the idea of data storage and migration among multiple 'mini-Clouds'. Our approach, however, assumed a fixed configuration with predictable sensor network topologies and latencies. The introduction of mobile sensors invalidates that assumption, and calls for a rethink of the following: how to select the 'best' mini-Cloud to which a mobile sensor can send its data; how this selection can be made dynamic based on the mobile sensor's mobility pattern; how data sent from the same mobile sensor to multiple mini-Clouds can be represented in an integrated manner, and kept synchronized for the purpose of later retrieval and analysis; and how this representation can be extended to data sent from multiple related mobile sensors.

9. Service implementation via actuation

Users often need to make changes in the IoT network via actuation. Examples include: self-repair of resources, changing resource state, (re-) configuration, etc. Indeed, aggregating data from multiple sensors would also involve actuation. Typical actuations involving IoT resources are complex in nature, and need to be modeled as service compositions with each service in the composition modeling an actuation command. In the mobile IoT, this complexity will be further increased due to the mobility of the IoT resources themselves. This would also raise issues of quality of service (QoS) in terms of meeting pre-defined SLAs on deadlines and other QoS parameters. A deeper investigation of integration with network service composition[11] is therefore indicated.

10. Integration with opportunistic computing

The field of opportunistic computing12 is concerned with how users with portable electronic devices can interact with each other opportunistically, and implement tasks on the fly. Mobile IoT further enriches this with the possibility of users interacting with (fixed or mobile) sensors, thereby giving rise to opportunistic IoT.13 Some examples could be: human-centric sensing, data sharing, forming opportunistic alliances based on mutual 'friendship' in social networks, on-demand community formation (disaster response, flash mobs), etc. The key research challenge here would be to determine the most optimal approaches to facilitate decentralized opportunistic interactions among human users and the IoT network. We believe that IoMT has the potential to be a major game changer that will drive innovation in both traditional and nontraditional application domains. Therefore, in this article, our attempt has been to identify its core technical problems where mobility adds another complex dimension to existing spatiotemporal systems. While the compiled list is not exhaustive, it outlines the top ten challenges that need to be considered to potentially leap-frog into more advanced IoT outcomes

Conclusion

In Faster development of sensor and network technologies is facilitating immense deployment of Internet of Things (IoT) towards creating a smart world. In IoT, a massive number of heterogeneous resource–constraint devices communicate with each other without any human intervention and generate a huge amount of data. Unique research challenges posed by IoT are fascinating the research community. This paper presents some of the critical issues along with state of the art solutions towards them. In-depth discussion is provided on various key issues like heterogeneity and interoperability, scalability, QoS, and security. Directions for further researches in those areas are also pointed out

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IOT BASED HOME AUTOMATION USING RASPBERRY PI

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Abstract:
The aim of this project is to develop a system which will help to sort a problem of home or any institute with the help of Raspberry Pi kit. This home automation provides drastic changes from a simple home to smart home. Raspberry Pi works on constant internet connection or Wifi. As the kit is not costlier, this home automation helpful for everyone.
If you are outside, you can check the temperature of your Home and according to it, you can turn on the AC from the website. We will provide an Easy and reliable GUI for the user so that anyone can learn it easily. It will also consist of User Authentication with an Administrative feature to handle the number of users and the Admin can grant access to some home appliances to a particular user. We have planned to implement it on a live room so that if one enters in the room motion detectors will send the signals to raspberry Pi to turn on the lights or fans. If someone wants how much electricity consumption has occurred, then he/she can get the result of every minute Monitored with the graph of electricity consumed versus time and what is the bill and can take preventive measures.

Keywords: Home Automation system, Raspberry Pi, Internet of things, relays , Python, Web interface, Android.

Introduction:

In today's fast life world need automation to have ease in life. In domestic use we can achieve automation by using computer and information technology is known as home automation. This technology is used for monitoring and controlling home appliances. Home automation integrates many simple applications to major controller based applications. Home automations hasfeatures like improved security, enhance performance energy reduction as well as it is economic.

We can achieve home automation with wifi and Bluetooth but considering size, power range and features raspberry pi is the best option as a controller. It is credit card size single port computer or programmable PC. It has 40 GPIO pins so we can interface more devices. It has 512MB RAM also we can insert external SD card. It consumes power 3.7W. It uses 10/100kbps Ethernet.

Internet of Things (IOT) is the system where digital world connected to physical world forming global network. It is

network of physical devices to exchange data. It gives platform for device to device communication. With the help of IOT authenticated person can access information from anyplace, anytime and control devices.

We use ubidots platform which is free of cost for educational purpose ubidots platform enables data conversion from capture data to useful information. IOT is used in various fields like healthcare, automation, transportation, agriculture. This technology gives us intellectual, ease and quality of life.

Methods:

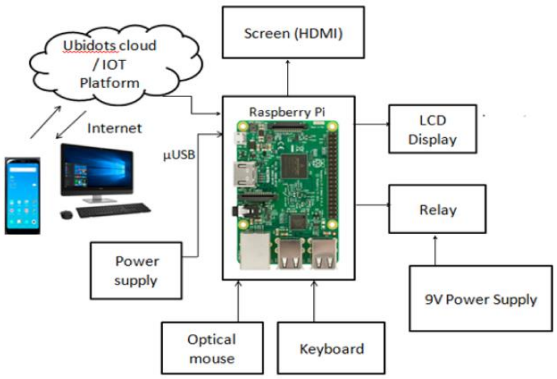
We have done this project in two section

1.Hardware section

2.Software section

Hardware section:

In our project, we use Raspberry Pi as processor. Relays used for switching purpose and LED's are used for outputs.



Raspberry pi :

Raspberry pi is credit card size (8.6x5.4cm) single board computer or a programmable PC.

It consumes power less than 5 W.

It supports open source Linux operating system

Raspberry pi supports full HD video output. It has multiple USB ports so we can connect optical mouse and keyboard.

It has 512 MB SDRAM.

It has 40 GPIO pins.

Specifications of Raspberry Pi:

Sr.No	Parameters	Specifications
1.	Processor	Broadcom BCM 2835 SOC
2.	Core	ARM 11 (700 MHz)
3.	RAM	512 MB
4.	GPU	Broadcom Video core IV
5.	Bluetooth	4.0
6.	Networking	10/100 Mbit/s Ethernet
7.	Power Supply	Micro USB
8.	Operating System	Raspbian

Relay :

Relay is automatic switch that detect conditions in circuits and causes to change their positions to close or open circuit as per requirement. Relay contact can handle large power in various shape and size. They are design to operate on particular voltage range between 5V to 12V. Relay current energies coil. In our project we used SPDT (Single Pole Double Throw) type relays.

In our project we have used 4 relays for switching 4 LED's. It also use 9V adapter.

LED :

In our project we use four LED's as hall light, kitchen light, hall fan, and kitchen fan resp. This LEDs are connected to GPIO pins of Raspberry Pi. This LEDs are nothing but home appliances that we can monitor and control from far away from home.

Software section :

In software we have used software which are compatible to IOT and Raspberry Pi both.

Python:

Python is high level programming language. Python is suitable for raspbianoperating system. Python language has automatic memory management. Python language is easy to understand. In python programming we have to call python library to access python tools.

Ubidots :

Ubidot is IOT platform. It capture sensor data and convert it into sensor information. It built wireless connection between hardware and IOT. Ubidots platform is

now free for educational purpose for developing, testing and learning internet connected applications. To use this ubidots app we have to download the ubidots application and create an authenticated key and that is written in program. So that we can access data and monitor and control devices remotely.

VNC:

VNC is another platform. VNC is Virtual Network Computing. It is used to control other computer which is remotely located. For that purpose we have to install VNC server.

Proposed Work:

Initially we have boot Raspberry Pi. Python language is suitable for Raspberry Pi programming.so we choose python language platform we create Ubidots dashboard on PC. VNC server also installed and IP address is given in program.

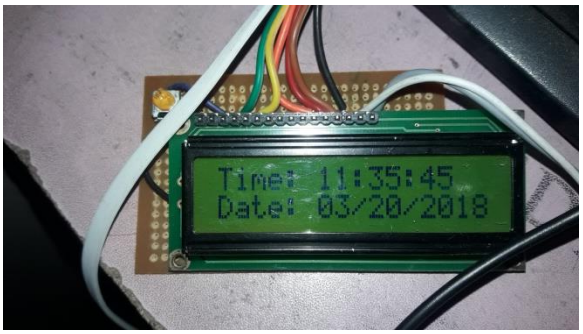
Depending on appliances that we are going to control we generate keys on Ubidots dashboard. We use SPDT relays for switching and LEDs used as appliances that we are controlling. We can create dashboard on smart phones also to control devices from anywhere. Providing Internet to both hardware situated at home and operating device smart phone or laptop we can achieve home automation.

If we are away from home then we are able to see and control any wastage of electricity in our home on Ubidots dashboard. Then we can off devices .we have get local temperature which is directly get from Internet so we can on/off temperature maintaining devices.

Results:

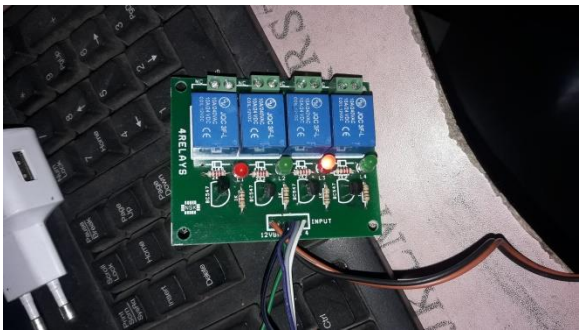
Below is the dashboard of ubidots platform created on PC.

Time and date is indicated on LCD at start



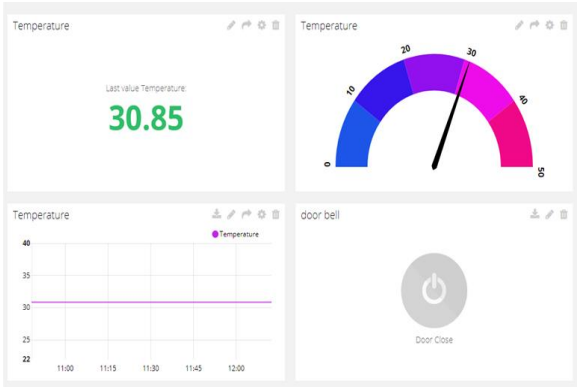
Kitchen light is on is indicated on LCD.Also it will display on Ubidots screen.

Kitchen light is on observed in hardware



Then by swithing off Ubidots screen button of kitchen light the corresponding kitchen light of home get off.

Here we obtain local temperature and we can also get graph of previous temperature result.



Conclusion:

The proposed project gives us intelligent way of controlling home appliances remotely through internet. This system makes human life easy and confortable with automation. Also this system reduces energy wastage due to careless nature of people.

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Smart vehicle with smart road side units

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Abstract

An approach to overcome the accidental problem happens during driving vehicles. Now a day's peoples are driving very fast we lost our valuable life, by making small mistake while driving (school zones, speed breaker or other road side units). This system controls the speed of the vehicle at steep turns, speed breakers. It is designed, to provide the information to the driver, whether the next turn is right/left, is there any traffic jam or road side units in the coming way. Ones the information is received from the zones through zigbee, the system is automatically alerts the driver to reduce the speed according to the zones. It also assists during heavy rains and mist conditions.

Keywords zigbee, zones, wireless system, arduino, vehicle unit.

Introduction

In today's life for most people, driving is a necessity. You go to work, run task, take the child to school; and every time you are taking a risk. Millions of car accidents occur every year, of which tens of thousands prove deathdealing. Even safe drivers can become victims in road accidents. The million's of the peoples are died due to accidents, this was become due to high speed of driving. This problem would be prevented by using smart vehicle system.

The project presented here is an approach towards safety implementation. The main aim of the project is automatically sensing the areas, zones like "hospital Zone", "Work zone" or "school Zone". We are developing a system which will sense the zones and accordingly inform the driver and also assist him in controlling the vehicle. As the design of this system goes, the project proposed here consists of a set of units Zone, Area Unit and Vehicle Unit In traditions, these special zones or areas are indicated at the roadside on a pillar or poles. As an example, near hospital zone, the sign board displays "hospital Zone" Ahead, Drive Slowly, or "Curve Zone", Area Do not go fast. Drivers go at very high speed as usual near hospital zone, or operate the harsh driving causing accident in the curve zone. As a result, making the whole concept of displaying warning messages on the roadside boards does not help to provide a better alternative.

One can develop a system which will automatically sense zones automatically and inform the drivers and also assist him in controlling the vehicle voluntarily. Here we use the Zigbee TransReceiver, which is notifying the driver to reduce the speed according to the zones. That is provide traffic regulation , safety and convenience of the people. This project can be effective in avoiding accidents and traffic congestion.

In this project the notification is display on LCD, and gets alerts to driver for controlling the speed limit of vehicle. In present system there was not get any alerts to driver about zones or road side units. The driver needs to check all special zones or traffic signs which are indicate at the roadside on pillar or road sign poles, but any time that is not possible because of drivers go at very high speed as usual near school zone or operate the harsh driving causing accident in curve zone.

So in our project we are going to design a system, which will notify the driver before the special zones or other road side units. This process is done by using zigbee transreceiver. zigbee transreceiver is provide the information to the driver through microcontroller. When the information or notification is display on LCD, a small beep is produced.

Methods

This 'smart vehicle with smart road side unit' system work link this each monitoring zones are fitted with transmitter unit with unique identity code in all the vehicle the receiver section is needed display will be fitted on the dash board for visual represented of the alert massages send by respective zone transmitters

The modules in the project are zigbee transreceiver modules for establishing wireless communication in this system two zigbee modules are used one for transmiting section and another for receiving section Arduino for overall functioning and control IR sensors used for detecting vehicles and send specific output to the Arduino through comparator.

The controlling device of the whole system is a Arduino A7mega328p.The project is divided into two part first is hardware development and second is software development.'c' language is used to execute the program in Arduino ,which would get signal from sensors and display the states on LCD display.

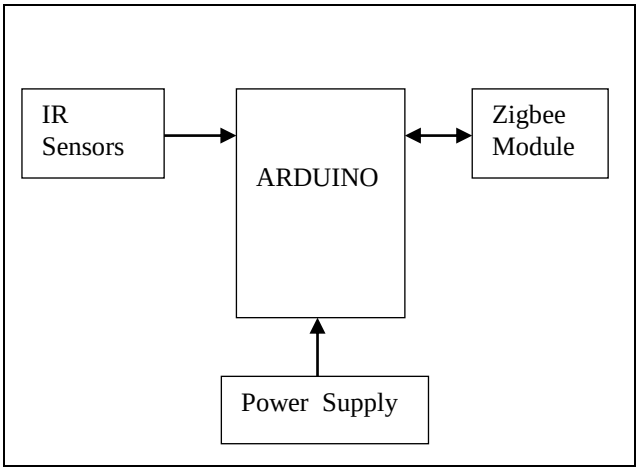


Fig: Transmitter

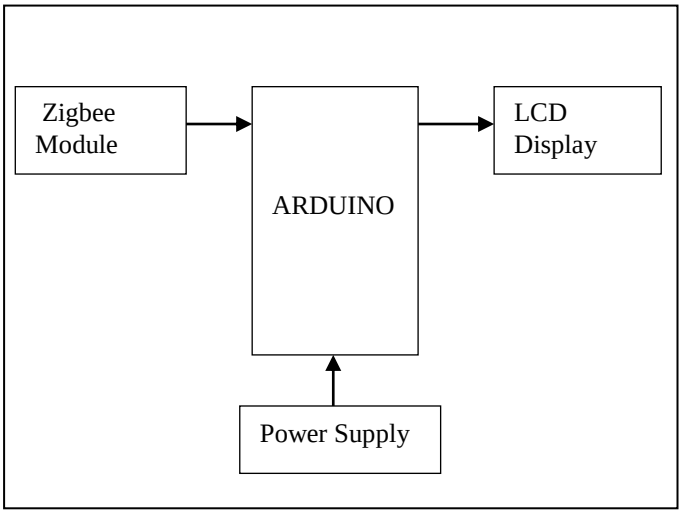


Fig. Receiver

According to block diagram,there are four sensors which is IR Sensors. This sensors work as a input in the transmitter circuit and will be interface with the arduino ATmega328p. the output of this system are LCD Display and Buzzer.zigbee module work as the transmission medium for which the the data will be transferred wirelessly to the receiving zigbee in the receiver circuit. The received data will then be displayed in the LCD display.

Arduino

The Arduino ATmega328 is a programmable microcontroller for prototyping electromechanical devices is shown in Figure.2. It has 14 digital Input / output pins of which 6 can be used as PWM outputs, a 16 MHz ceramic Resonator, a USB connection, a power jack, an in-circuit serial programmer (ICSP) header and a reset button as shown in figure. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno has 6 analog inputs, labeled A0 through A5, each of which provides 10 bits of resolution. A software serial library allows serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C which is two wire interface (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus [6]. The features of ATmega328 are 5V Operating Voltage, 6-20V Input Voltage, 14 Digital I/O Pins of which provide 6 PWM output, 32 bit Flash Memory, 2KB SRAM, 1KB EEPROM, 16 MHz Clock Speed.

Zigbee

We used zigbee series 2 OEM RF Module ,which is design to operate within the zigbee protocol and support the unique needs low power wireless sensor networks, low cost. The modules require minimal power and provide reliable delivery of data between remote devices. The modules operate within the ISM 2.4 GHz frequency band.

This module allows a very reliable and simple communication between microcontroller, computers, systems. Point-to-point, point-to-multipoint and peer-to-peer topologies supported.

Voltage regulator

The L78 series of three-terminal positive regulators is available in TO-220, TO-220FP, D²PAK and DPAK packages and several fixed output voltages, making it useful in a wide range of applications.

These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type embeds internal current limiting, thermal shutdown and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

IR Sensors

Infrared sensors is interface to sense and detect vehicle by emitting and infrared energy and then measuring the amount of energy that has been reflected. It can been used in multiple conditions and operations. the sensor could measure accurately the vehicle position. It also sensitive to the outdoor environment and conditions.

Software

Sketch arduino software

A Sketch is the name that arduino uses for a program it's the unit of code that is uploaded to an run on an arduino board.

DipTrace software

DipTrace Is a EDA/CAD software for creating schematic diagrams and printed circuits boards. DipTrace has 4 modules: schematic capture editor, PCB layout editor with built –in shape – based autorouter and 3D – preview and export, component editor , and pattern editor.

Objective

The technology chosen for the wireless network is zigbee. Driver go at very high speed as usual near school zone or operate the harsh driving causing accident in the curve zone. the main objective to design a device for monitors the zone.

Result

A.zigbee functionality test result

This process is for checking and testing how far the zigbee transmitter can connect with zigbee receiver.Before that,the Xbee module need to be interfaced before it can be used as serial communication medium.

The X-CTU software has several other functions beside configure the Xbee module. Each main tab has its own function to develop the communication by using the Xbee module.below are the explanation of its function:

i.**personal computer(PC) settings**

Allow user to choose the desired COM port and configure ports to fit the radio settings.

ii.**Range Test**

Allow user to achieve a range test between two radios.

iii.**Terminal**

Allow access to the computers COM port with a terminal emulation program.

iv.**Modem Configuration**

Allow the ability to program the firmware setting via a graphical user interface.

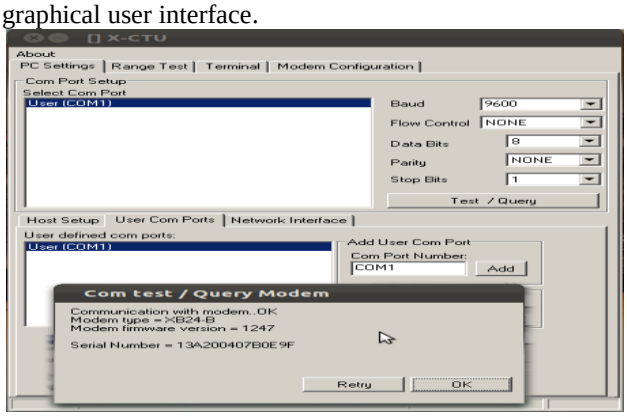


Fig1 Port setting

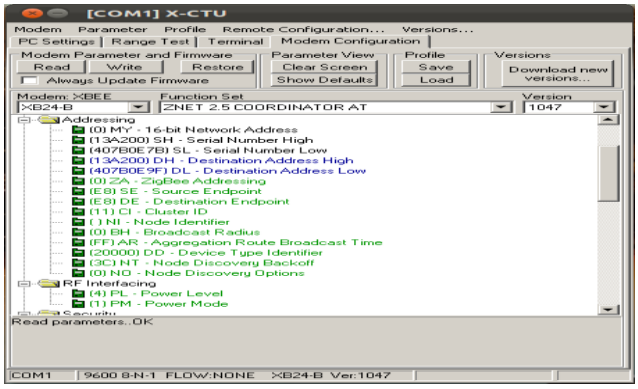


Fig2 configuration of destination address

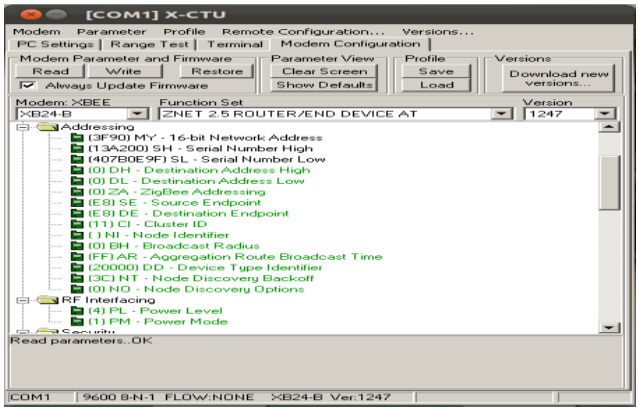


Fig3 configuration of destination address

After finished the setting both of the zigbee module using X-CTU software in the PC, both the zigbee is tested whether it can communicate each other or not.it also to make sure the range of communication whether the zigbee refers to its specification or not.

Table1 shows the range between zigbee1 and zigbee2 and also the result of data that received from the transmitter zigbee. For this project,zigbee is used as wireless communication tool. The zigbee offers communication upto 120 meter and it can supported until the maximum range.

RANGE(M)	ZIGBEE ANALYSIS
Meter 0 to Meter 20	The Zigbee 2 received data from transmitter accurately and instantaneously
Meter 0 to Meter 40	The Zigbee 2 received data from transmitter accurately
Meter 0 to Meter 60	The Zigbee 2 received data from transmitter accurately
Meter 0 to Meter 80	The Zigbee 2 received data from transmitter accurately
Meter 0 to Meter 100	The Zigbee 2 received data from transmitter accurately
Meter 0 to Meter 120	The Zigbee 2 received data from transmitter accurately

Table1: Collected Data Analysis

Interface LCD display with Arduino:

Based on this project, the LCD display was connected with ATmega328p arduino to display messages.

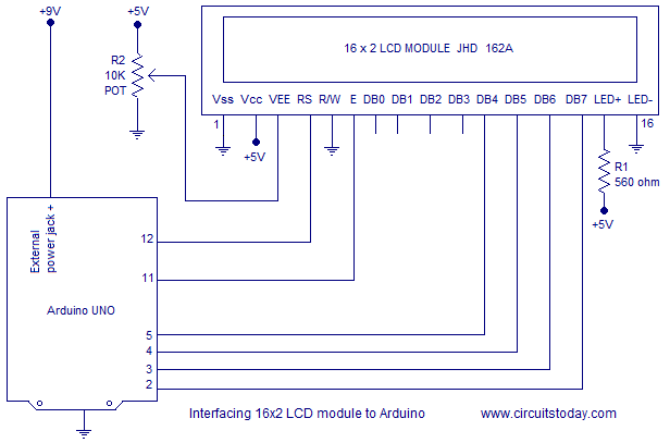
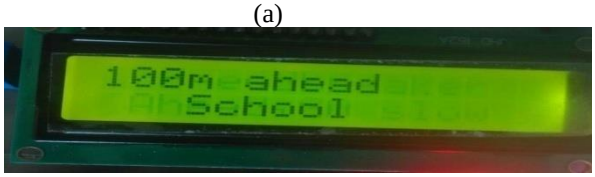


Fig schematic LCD display interface with Arduino

In this part, the sensors will interface with ATmega328p Arduino to ensure that the the Arduino and sensors are successfully connected. If the connection between the sensors are perfect, the data can be sent and view at the LCD display. There are two partitions in this system namely transmitter and receiver part. For the transmitter part, it will be placed near the zone. The input of the system consist of IR sensor while the output part consist of buzzer and reset button.

(a)



(b)

(c)

(d)

Fig(a) hospital zone,(b)school zone,(c)chowk,(d)hotel

Above results are display on the LCD display. Here the sensors are placed at before some distance from the zones. When the car which have receiver device cut that sensor then specific message will display onto the LCD display, through the zigbee communication.

Conclusion

A wireless monitoring system have been successfully developed using zigbee technology and the result is satisfactory. With significant improvement in range and reliable data accuracy in real time, this project promise a bright future with a high commercial value

It has been mainly designed in order to avoid the accidents and to alert the driver about the speed limits for safe travelling.

It is used to control the speed of the vehicle in hospital, school and work zones.

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IOT BASED LAB AUTOMATION SYSTEM USING ARDUINO

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Abstract:-

In this paper, we have presented an effective implementation of (IOT) Internet of Things which are used for monitoring Lab appliances. Many a times our lab appliances in college like light, Fan, Computers, etc remains ON & due to which much of the Energy get wasted. To overcome this problem we have developed Android App through which we can know the status of every appliance & we can control it from anywhere & Saves Electricity. The android mobile is used to send the commands to the Arduino to control all the Lab appliances present in the lab.

The main feature of this system is to control the Voltage levels of appliance of lab like speed of fan based on temperature, intensity of light based on light intensity etc. and another feature is we may get the status of our Lab appliances through the App. In this system we use different Sensors like temperature and LDR for different application. This gives huge advantages to smart technology using IOT.

KEY WORD:-

Home Automation System, Android App, Arduino UNO board Atmega328, Wi-Fi module, Sensors, LCD Display, Relays.

Introduction:-

In this project smart environment condition monitoring by various sensors(temp and light level) for providing necessary data to manually as well automatically adjust the comfort level in college Lab by optimizing use of energy is developed. In this project we have used Arduino board and Wi-Fi module, temperature sensor to detect temperature. We have developed Android application will allow the user to manually as well as automatically ON and OFF the lights.[1] The system consist of Arduino UNO board which is use as a controller which interfaced between hardware and software system. To access this system we require the internet connectivity which is provided by WiFi module ESP8266. To sense the light intensity and to automatically turn ON OFF light according to the change in intensity we have used LDR, and to monitor the temperature the LM35 temperature sensor also used along with it which will sense the temperature and accordingly fan will turn ON and OFF[2].

This system allows users, to remotely control multiple electrical appliances using a Android App based on IOT that means from internet. In this project we have described about controlling all the electric appliances using the android application via internet controlled by Arduino At mega and Wi-Fi Module. We are using Wi-Fi Module to receive the command from Android Phone and processed by Arduino.

The main objective of this paper is that to design implement a control system to monitor the various equipment's from anywhere in the world using cloud internet techniques. This is also designed for controlling the power consumption of connected equipment's and save electricity.[3].

Problem statement:-

In our project, we have presented an effective implementation of IOT (Internet of things) which are used for electrical energy management system. Many a times our Electric Appliances like Light, Fan, Computers, etc remains ON and due to which much of the energy get wasted.

To overcome this problem we have develop Android App through which we can know the status of every Appliances and we can control it from anywhere and Saves electricity.

Proposed system:-

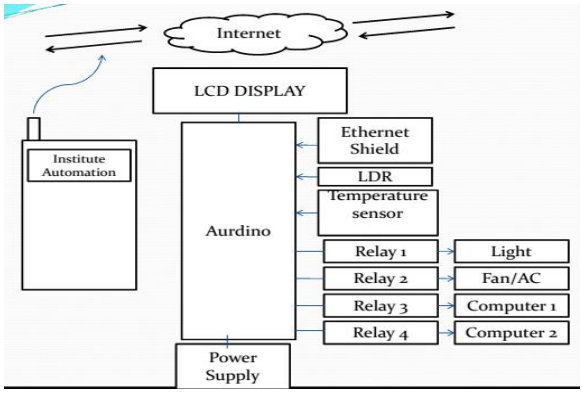

Fig.1. Proposed System of Lab Automation

Working:-

The model of Lab Automation system is as shown in the above fig.1. This model consists of Hardware system as well as Software System. Hardware consist of Arduino UNO board, Sensors like Temperature sensor (LM35), LDR, Wi-Fi module, LCD display, Relay. This hardware components are used to control our Lab Appliances. We have used four number of relays to which we have connected electric appliances like light, fan, and two computers. Basically relay acts as a switch which controls all those electric devices. Initially all this devices are connected to the internet through Wi-Fi module to control and monitor. Sensors are interfaced to Arduino board in order to control temperature and light intensity. We can control the speed of fan using temperature sensor depending on the room temperature. Similarly light automatically turns ON and OFF depending on the intensity of light. The status of light and fan is also displayed on LCD display.

Software system consist of Java based Android Application and Arduino hardware is programmed in Arduino sketch using c language which is used to configure the Arduino UNO board & sensors.

This system that allows users, to remotely control multiple electrical appliances using a Android App based on IOT that means from internet. In this project we have described about controlling all the electric appliances using the android application via internet controlled by Arduino At mega and Wi-Fi Module. We are using Wi-Fi Module to receive the command from Android Phone and processed by Arduino.The main feature of this system is to control the voltage level of electric appliances like speed of fan based on temperature using temperature sensor (LM325) and light will automatically turns ON/OFF as per the intensity of light using LDR. All these appliances are controlled using an Android application that is installed in our Android mobiles[3].

3.1 LDR:-

LDR is the Light Depending Resistor operates on the principle of photo conductivity. As when light falls on the LDR intensity increases, the resistances decreases. Similarly, When the darkness is sense by LDR intensity decreases, the resistance increases. Resistances is inversely proportional to the light.

Fig.2. LDR Sensor

3.2 LM35:-

The LM35 sensor is used to detect the level of temperature in our Lab. As the temperature level exceed above the set point then fan will automatically turn ON. Similarly when the temperature level goes below set point then fan will automatically turn OFF. The advantage of LN35 sensor is low cost & highest sensitivity between +2deg C & +250deg C and power consumption at only +5v DC.

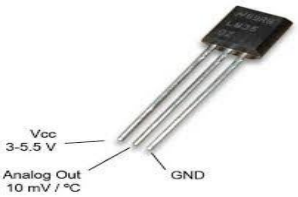

Fig.3. LM35 Temperature sensor

ARDUINO Atmega328:-

As we are using Arduino UNO board Atmega328, which is open sources single board microcontroller. It has many analog and digital IO pins. It operates with 5v power supply, which is connected from either USB port or External power supply. It can function between 5V – 20V.
It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack and reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started[1].

Arduino UNO board helps to develop interfacing between Hardware and Software.Arduino is programmed in Arduino sketch using C language which is used to configure the Arduino UNO board & sensors

Fig.4.Arduino UNO Board Atmega328

Wi-Fi Module ESP8266:-

The WiFi Shield allows an Arduino board to connect to the internet using the 802.11 wireless specification (WiFi). It is based on the Wireless IEEE 802.11b/g/n wifi System in-Package.[1] There is an onboard micro-SD card slot, which can be used to store files for serving over the network. It is compatible with the Arduino Uno and Mega. It is low cost wifi chip with TCP/IP capability and MCU integrated which gives possibility to control I/O digital pins.

It must be powered with DC current from any kind of source that can deliver stable 3.3V and atleast 250mA. It usually has two LEDs, a red one for power & blue one for data transmitting. Red LED is always on when module is powered ON & blue LED blinks during serial activities. Then by connecting Wifi module to Arduino board, program is stored in wifi module and in the program SSID and password is written so that to provide internet connection to wifi module through any router or mobile phone to operate the proposed system.

Fig.5.Wi-Fi module ESP8266

ANDROID APPLICATION:-

Software system consist of Java based Android Application and Arduino hardware is programmed in Arduino sketch using c language which is used to configure the Arduino UNO board & sensors.

Android is a mobile operating system that is based on a modified version of Linux. Google purchased Android and took over its development work as well as its development team. Google wanted Android to be open and free; hence, most of the Android code was released under the open source Apache License, such as think speak server which an open server, which means that anyone who wants to use Android can do so by downloading the full Android source code.

Now days we have many tools to develop android application like MIT APP Inverter, Android SDK, Think speak server. The Think speak server is an open server on google The Android SDK provides the tools and APIs key and channel ID necessary to begin developing applications on the Android

platform using the Java programming language. By providing an open development framework, Android offers developers the ability to build extreme innovative applications. Developers have full access to the same framework APIs used by the core applications. Android includes a set of C/C++ libraries used by various components of the Android system.

As shown in below fig.6 android application is developed for android mobile which shows the status of every appliances which is ON/OFF.

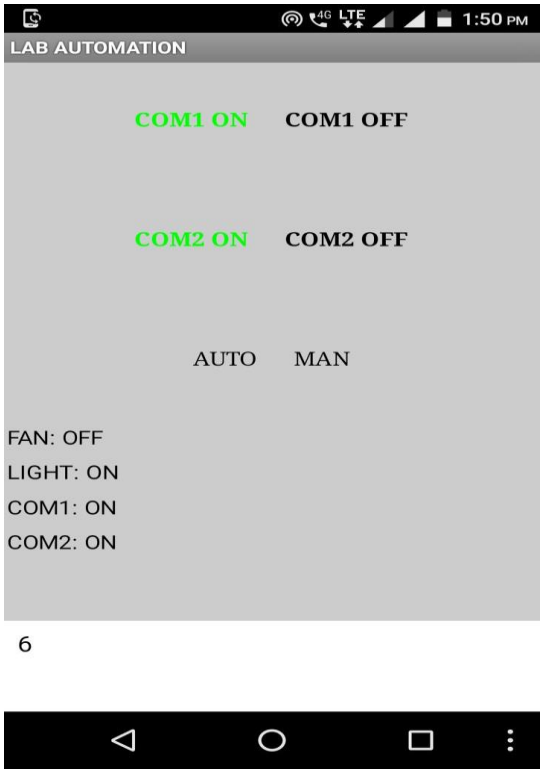

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Fig.6. Android Application

RESULT:-

The below figure 7 shows the output of bulb at Low intensity level. At night time light intensity levels in environment will be low. Based on the light intensity levels of light automatically turns ON. Intensity levels will be displayed on LCD based on LDR Values.

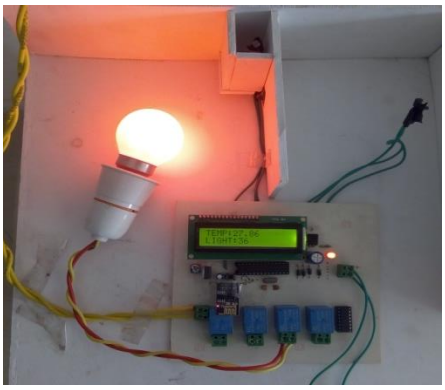

Fig.7. Output at a Low intensity levels

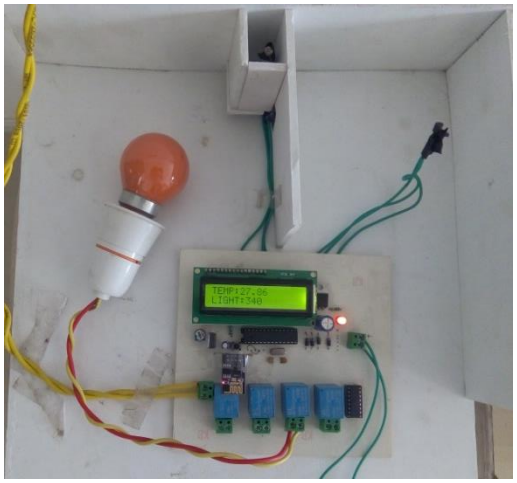

Fig.8. Output at High Intensity levels

As shown in the fig.8 output of a bulb at high intensity level. At the day time intensity level in the environment is high so based on intensity level bulb automatically turns OFF and intensity level and temperature level is displayed on LCD and automatically lights and fan turns ON/OFF depending on the intensity level and temperature level

Fig.9.Intensity level and Temperature level displayed on LCD

The below figure 10 shows the Lab automation model. It has Arduino mega, LDR, LM35, LCD, relay, relay driver circuit and Wi-Fi

module. Light, fan, two computers named comp1 and comp2 in application are connected to relay. In this all the devices are controlled by using android mobile application we have developed shown in fig.6. In this we can control the light and fan based on intensity levels and temperature levels using LDR and LM35 sensor. And the status of each and every appliances is shown in the android application we have developed.

Fig 9. Result of IOT based Lab Automation

CONCLUSION:-

We have conclude that by implementing these system we can access the live data and also control the device interfaced with our system. This system that allows users, to remotely control multiple electrical appliances using a Android App which has been developed. And also system is controlled automatically by using LDR and temperature sensor which changes the output according to the intensity level and temperature level. And also shows the status on android application.

FUTURE SCOPE:-

We can extend this system by providing notifications to the user and in future we can also add some voice alerts, SMS or alarm system. This system can be expanded to include various other options which could include home security feature such as open-door and motion detection and also we can use it for gas leakage or fire detection.

This kind of a system with respective changes can be implemented in the hospitals for disable people or in industries where human interaction is impossible or dangerous, and it can also be implemented for Home security feature like capturing the photo of a person moving around the house or person entering in the house and storing it onto the cloud. This will reduce the data storage than using the CCTV camera which will record all the time and stores it.

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Solar Wind Hybrid System with Maximum Power Point Tracking

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Abstract
The use of non renewable resources of energy generation, which has lead to a disadvantage of increasing the greenhouse gas emission and enlargement of carbon footprints. To avoid these effects we have designed solar and wind hybrid system . Solar and wind energy are the renewable resources so they are available in adequate so we are utilizing solar and wind power hybrid system with durable battery backup. A microcontroller is used to monitor the power from solar panel and wind generator. The switching action is provided from microcontroller to the battery charger based on power received from solar panel and wind generator. The system charges the battery using wind and solar power only, which will make it more cost effective, efficient and reliable. Maximum power point tracking (MPPT) algorithm is used for exploiting maximum power from photovoltaic panel and wind turbine to charge the battery which will increase durability and battery life.

Keywords*:* Battery, Hybrid System, Solar, Wind,MPPT

Introduction

In the recent times the need for energy has increased globally. Increasing concern of global warming and the reduction of fossil fuel reserves made us to increase our energy production which in turn has put extra pressure on our non- renewable resources. The solution for this is to generate energy by using renewable resources of energy. The more suitable form of renewable energy is the solar energy and wind energy because of adequate availability of sun energy and average wind speed.

A solar panel uses energy of the incident photons on its surface and convert it into electrical energy. The solar panel consists of small silicon cells. The cell output voltage for a single cell is of the order of 0.7V which cannot be utilized for power generation[1]. These cells are placed in series-parallel combinations to get desired voltage. The wind energy is utilized by converting the kinetic energy of wind in to rotational motion[2]. This rotational motion is converted into usable electrical energy. To perform this operation a wind generator has been used which contains a wind turbine and an alternator. The systems that contains only solar or wind generation are productive but there are some problems linked with both of them. The solar power is not available for 24 hours and wind is not continuous all the time[3]. So to overcome these problems a hybrid system containing solar and wind has been designed. A system designed in this paper utilises both solar and wind system for the power generation.

To enlarge solar panel output power, we need to continuously track maximum power point of the system. The maximum power point depends on the irradiance levels, the panel's temperature, and the load connected[2].

Maximum power point tracking (MPPT) algorithms can be used in many different forms. The major principle of MPPT is to utilize the maximum available power from solar panel by making them operate at the most efficient voltage that is maximum power point of solar panel. MPPT checks output of solar panel and compares it with the battery voltage then fixes the best power that PV module can produce to charge the battery and converts it to the best voltage to get maximum current into battery.

The MPPT algorithm is used with charge controller. The charge controller is an electronic circuit which monitors inputs from solar and wind and generates control for the charging. The charge controller is connected to both solar and wind inputs. It senses the voltage level from solar panel and wind generator. Then as per the algorithm defined it selects the suitable resource that is either solar or wind turbine to store the charge. The batteries used in the system are 12V batteries so we need at least 13-14 volts system input to charge them continuously.

Block Diagram of Proposed System

Fig. 1 shows the block diagram for solar wind hybrid system. In this module there are two resources wind resource and solar panel. Wind turbine converts the kinetic energy of wind into rotational motion using wind turbine and this rotational motion is converted into usable electrical voltage. This ac voltage is given to the AC- DC rectifier to convert it into DC signal. Then DC signal is given to DC- DC converter. The DC-DC converter is used for charge regulation or battery regulation which limit rate at which electric current is added to or drawn from electric batteries. The DC-DC converter used is SEPIC (Single Ended Primary Induction Converter).The output of SEPIC converter is controlled by duty cycle of controlled transistor. SEPIC converter exchanges energy between capacitor and inductor. DC-DC converter is connected to microcontroller. MPPT control circuit is implemented in microcontroller, that has A/D converter and PWM signal mode. It read the voltage and current of wind turbine through A/D ports of microcontroller and calculate output power. It also calculate power by reading the voltage and current of battery side in same way. The buck converter is controlled by microcontroller . Microcontroller sends corresponding control signal to buck converter and control duty cycle of converter by PWM signal through controller to accordingly increase, decrease or turn off the DC-DC converter. Driver unit is used to give gate signal to DC-DC converter. Battery is used to store the energy so that device can be powered when sun is not shinning and wind

energy is not adequate to generate power.

Solar panel uses energy of incident photon on its surface and convert it into electrical energy. This energy is given to the DC-DC converter. DC-DC converter used is buck converter. As the power from solar panel is greater than that we required to charge battery buck converter is used. Buck converter matches the voltage and current solar panel to battery voltage and current. Solar energy is given to microcontroller which reads voltage and current from solar panel and battery by using ADC ports and it gives the control signal to the buck converter and duty cycle of buck converter is controlled by microcontroller. The driver unit is used to give gate signal to the MOSFET. If the load is of AC type then the DC energy stored in the battery is converted into AC power by using inverter.

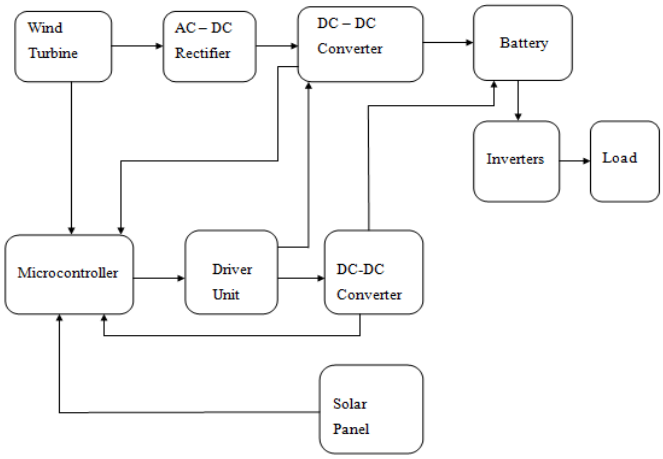

Fig.1 Block diagram of proposed system

Flow Diagram of Charge Controller

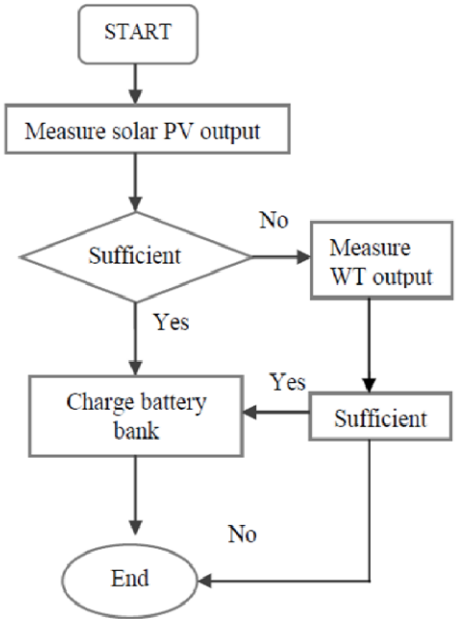

Fig.2 Flow chart of charge controller

Charge controller consists of microcontroller, DC-DC buck converter. It measures solar panel output first if it is sufficient to charge the battery then battery will be charged using solar panel and it output from solar panel is insufficient then charge controller perform the switching action and battery is charged by wind turbine output.

Perturb and Observe Method

There are various MPPT algorithms like perturb and observe method, Incremental conductance method, parasitic capacitance and constant voltage method. But perturb and observe method is widely used because it is easy for implementation. If the operating voltage of the PV array is varying in a given direction and if the power drawn from the solar panel increases, this means that the operating point has moved towards the maximum power point and therefore, the operating voltage must be further perturbed in the same direction. Otherwise, if the power extracted from the PV array decreases, the operating point has moved away from the MPP and therefore, the direction of the operating voltage perturbation must be reversed. If the voltage of solar panel goes on increasing then output power of solar panel is also increases, then the system starts increasing the operating voltage until the power output begins to decrease. This method is also referred as hill climbing method, because of its dependence upon rise of power curve against voltage below maximum power point and fall above that point.

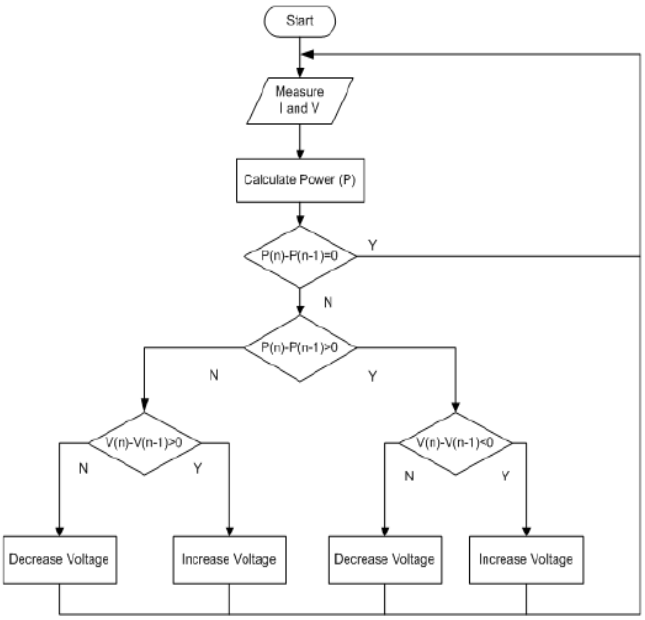

Fig.3 Flow chart of Perturb and Observe algorithm

Perturb and observe method compares current solar output (P_n) with previous solar power (P_{n-1}). Solar power is determined by measuring current (I) and voltage (V). Until the difference between previous power and recent power is not equal to 0, this algorithm will try to find optimal the optimal point in the right or left side of recent position. The maximum power is obtained when difference between (P_n) and (P_{n-1}) is

0.The perturb and observe method is implemented on buck converter by adjusting PWM duty cycle. If recent power is bigger than the previous power, the duty cycle will be increased until maximum power point is found. The maximum power point is calculated by using relation between dI / dV and –I / V. If dP / dV is negative then MPPT is lies on right hand side of recent position and if is dP / dV positive the MPPT is on left side of recent position.

Design Of Buck Converter

The LM2576 is a Step Down Converter which is the most basic forward mode converter. Its basic schematic can be seen in Figure 4 .The operation of this regulator has two different time periods. The first time period occurs when the series switch is on, the input voltage is connected to the inductor. The output of the inductor is the output voltage, and the diode is reverse biased. During the first time period, since there is a constant voltage source connected across the inductor, the inductor current begins to increase linearly ramp upwards, as described by the following equation:

$$I_{L(ON)} = \frac{(V_{IN} - V_{OUT})\, t_{ON}}{L}$$

During this "ON" period, energy is stored in the inductor in the form of magnetic flux. The next time period is the "OFF" period of the power switch. When the power switch is off, the inductor voltage reverses its polarity and is clamped at one and diode voltage drops below ground. Due to this current starts flowing through the rectifier diode and thus maintaining the load current loop. This removes the stored energy from the inductor. The inductor current during this time is:

$$I_{L(OFF)} = \frac{(V_{OUT} - V_D)\, t_{OFF}}{L}$$

This second period ends when the power switch is turned on. The converter is regulated by varying the duty cycle of the power switch. The duty cycle is given as follows:

$$D = \frac{t_{ON}}{T}$$

Where T is the period of switching.
For the step down converter with ideal components, the duty cycle can be given as:

$$D = \frac{V_{OUT}}{V_{IN}}$$

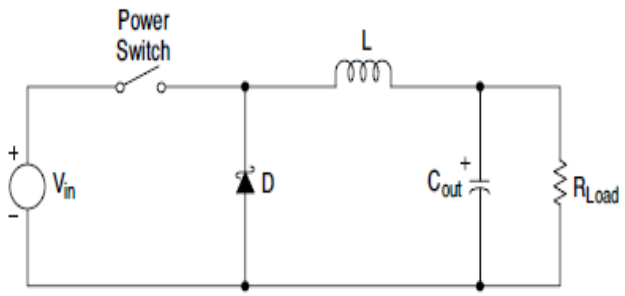

Fig.4 Basic BUCK Converter.

Procedure to design BUCK converter:

$V_{IN\,(max)} = 40V$

$V_{OUT} = 14.2\ V$

$I_{Load\,(max)} = 3A$

i. Selection of programming resistors R_1 and R_2:

$$V_{OUT} = V_{ref}(1 + R_2/R_1) \qquad \ldots\ldots(1)$$

Where, $V_{ref} = 1.23V$

Resistor R_1 can be between 1K and 5K.So, we have selected $R_1 = 2K\Omega$.
Therefore, from equation no. (1)

$R_2 = 18.97\ K\Omega$

ii. Input capacitor selection(C_{in}) :

A 100µf , 150V aluminium electrolytic capacitor located near the input and grout pin provides sufficient bypassing.

iii. Catch diode selection(D_1):

Use 40V 1N5822 schottky diode.

iv. Output capacitor selection (C_{OUT}):

$$C_{OUT} \geq 13300 * \frac{V_{IN(max)}}{V_{OUT} * L}$$

$C_{OUT} \geq 170.2944$

So, we have selected capacitor of 220 µf.

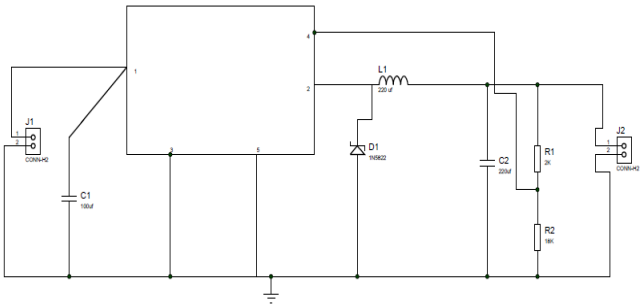

Fig. 5 Schematic of Designed BUCK Converter

Experimental Result

The input to the system is given from variable power supply which is used as output of wind mill and anther input is from solar panel. The input from buck converter is given to the buck converter which will step down the input voltage to 14.2V that is required to charge the battery. The output of solar panel is given to the microcontroller in which MPPT Perturb and observe algorithm is implemented. As the open circuit voltage of 12 volts solar panel is 16 volts the output of solar panel is constant 16 volts. As battery require 14.2 voltage to charge solar panel output is given to the buck converter to step down 16 volts to 14.2 volts. The fig.6 shows test setup.

Fig. 6 Experimental Setup

When the input voltage is below the threshold voltage then battery get charged by solar power. Fig. 7 shows message on LCD when input voltage is below the threshold voltage.

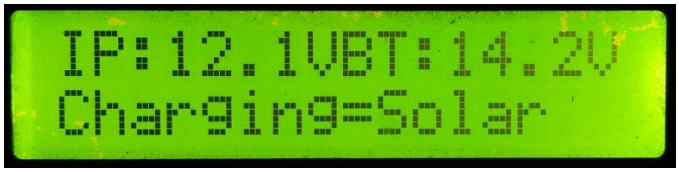

Fig. 7 Message Displayed on LCD when input voltage is below threshold voltage.

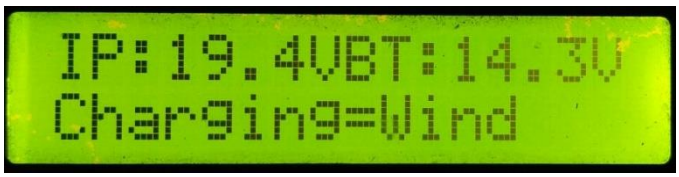

Fig. 8 Message Displayed on LCD When Input Voltage is Above threshold voltage

Conclusion

In coming year, man will be more depends on renewable energy sources. Because of the disadvantages involved in using solar or wind energy individually, a hybrid system which avoids the individual advantages will become more famous in coming years. This system has advantages that it does not produces pollution and requires less maintenance. In this paper a new buck circuit is designed for solar wind hybrid system and this circuit has lower cost than other buck converter. The MPPT charge controllers is used to extract maximum power from solar panels instead of investing in more number of solar panels. The proposed idea can be further upgraded by using wireless technology so that there is wireless transmission of data.

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Design And Manufacturing of Drone

(Robocodex)

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Abstract

UAV (Unman Arial Vehicle) is growing too much fast rate. Now there are different types of drone are available. Every and each drone there is a particular formula for designing a drone. Some special techniques for selection of batteries, motors, propellers. There are no of application of drone like some malicious activities, industrial activity etc. In this report, we give information about drone, how to enhance efficiency and performance of drone. This report also includes no of parameter like Agility of drone, thevelocity of drones etc. Now there are Arial drones are available too much. This report also gives information about how to make ground and air drones. Nowadays drone also takes asmall part in anindustrial application like transportation, security, safety etc.Working in combination with GPS, the flying machine may be remotely controlled or can fly autonomously by software controlled flight plans in their embedded systems. Drones are most often used in military services. However, it is also used for weather monitoring, firefighting, search and rescue, surveillance and traffic monitoring.

Keywords:UAV, Drone, DJI.

Introduction

UAV is known as drones. Now there are lots of application of drones or UAV like military, security, surveillance, safety etc. for different purposes there is need a different drone or UAV that's totally dependent. In some drone, there is also uses an IR and UAV technologies separately for thebenefit to explore. This action is completely done by thetemperature difference between inside and outside sources [1]. This same technology also used for safety and security purposes but there is a used thermal sensor to perform this activity. That sensor directly connected to theelectrical controlling unit and send asignal to thereceiver. DJI is a popular company making drones for adifferent application. There is work conducted with regards to security of drones, little work has been published with regards to the forensic analysis of drones [2]. But DJI is mostly focused on solving number of problem arising in theenvironment through drone e.g. Phantom series, Mavic pro platinum etc. In all drone need some power to run. That's one important for selection parameter of drone. In drone, there is always trying to minimizing power loss through no of techniques. When study sun sniffer and IR its clear that irregular temperature pattern corresponding power loss can be corrected quantitatively [3]. Energy efficiency of drones is animportant parameter for selection criteria. If there is number of drones and all drones operated with mobile targeting there is need a LAS (localized altitude scheduler) provides the drones with the required functions in order to compute the minimum possible altitude based on the position of the targets that each drone currently covers, the position of the targets that the neighboring drones cover, and the minimum and the maximum allowed altitude [4]. Drones there is a positive and negative side also included. The positive side is it's used for security, surveillance, safety, industrialization etc. but drone also used for injured people, it will create serious risk for safety and security. It will largely impact on world. Therefore there is must legalization of drone now in us and UKis moved forward to thelegalization of drones. It's totally focus on avoiding illegal uses of drones and enhance safety mostly public zones and border side of countries. New regulations must be created and enforced to provide possible solutions, but also the current law can be interpreted in order to incorporate new emerging uses of the drones [5].

Generally, Drones are made for human convenience. But all work is done separately on ground or aerial. Robocodex is a UAV that can survive on ground as well as in air with some detachable units are using to easily survive in air. When robotdoesnot survive in air then that can land on therobot and survive on ground at a certain ground level it may not survive on ground then it detaches the drone and survives in air with the help of blades. With having GPS (Global Positioning system) drone can easily find out the main chassis so it is easier for working. Robocodex has two units to survive that are Drone which survives in air and Robot which survive on ground. Both systems attached by using some mechanism

which helpful to survive combine. The robot has attached with solar panel to increasing battery backup for own as well as Drone. If at any condition drone battery is low then by GPS find out Robot for recharging their batteries. And again start the mission. Robot can survive at hills and valley with their robust chassis structure. With long-lasting battery life. Robocodex is a perfect robot with new invention which can survive on ground as well as in air.

METHODOLOGY –

In Robocodex there is we are trying to enhance performance and efficiency of drone. This is possible with help of renewable energy sources it won't impact largely but just enhance life cycle time of drone. Normally drone can run approximately 15-20 min .(Depending on type and application) it will improve up to 25-30 min. Lots of drones are just aerial drones there is no more space for ground robot it is also important that drone can also run on ground this will improve movability drone and make more flexible to bidirectional. This all operation is done through belts, motors and some rollers. This is possible by designing and making frame such that can survive in both aerial drones. For designing frame there is number of parameters are matter like propeller size, type of motor used etc. motor selection is important for drone normally its varies with type of drone is used. Motoris created necessary thrust that can lift the drone. There is another most vital part is frame size. It is totally depending upon type of propeller, batteries, ESC etc.

General using parts in robocodex, by using Brushless DC motor can fly in air, KK2.1.5 Multi-Rotor control board to control rotor speed, ESC (Electronic Speed Controller) to distribute supply as per need for stability, LI-Po Battery as a power, Arduino-Uno is work similar like microcontroller but actually easier than microcontroller. Arduino is using for handling robot and drone as per transmitting signal and with landing gear to land on ground if their some problems in robot. Generally drones do not have any extra power sources carrying capacity, but robocodex can easily get power by sun with using solar panel as well as at the ground robot have extra battery source to recharge drone battery to enhance the flying time.

Material Selection

Drones are light in weight. There isnumber of things matters when drone is in air, generally velocity and acceleration both are important for drone. If the drone has light in weight velocity and acceleration easy to enhance with minimum power consumption. It is totally depending on type of material selection for drone so most of the drones made up of carb fiber, plastic, acrylic material. Those are material light in weight and gives high strength. Those material are comfortable for manufacturing drone.

Propeller Selection

Selection of propeller is depending weight of drone. There are different types of propeller available in market i.e. two bladed three bladed and multi-bladed. Number of blade increases power required for lift drone is decreases i.e. if we select multi-bladed propeller that will help to reduce power consumption and improve efficiency of drone. In propeller pitch angle and angle of attack is most important. Propeller either design for clockwise and counter-clockwise there is another most important parameter is mounting of propeller.

Motor Selection for drone

Motors are huge impacts on payload. Number of motors need for drone is depending on type of drone for Quad-copter need four motors. This motor is different as compare to general gear and servo motors. Normally there is used brushless DC motors.

Battery Selection

In Quad-copter Mostly Li-PO battery is suitable to get bet flight time and performance it is most important t select best Li-PO battery is depending on number of motors used and size and weight of drone. Battery Discharge rate also matters for selection of drone. It is denoted by 'C rating'. If C rating is low battery being damage and drone is in down performance i.e. Drone can't release current fast enough to power the motor and vice versa.

Theoretical Calculations

Normally using a quadcopter, hex copter andoctocopter. All these drones are in same but there is difference in number of propellers used in drones. In Quadcopter there are four propellers, in Hexacopter there are six propellers and in Octacopter there are eight propellers.

Thrust Calculation

Drone selection is totally based on thrust required to move a drone. Whatever thrust will come is distributed in all above propeller's. That way there is first need to select thrust to weight ratio.

It's decide all parameters of drones, normally there is thrust to weight ratio is 2, 3 is given to a drone. For example if you have a drone heaving maximum weight is 3 kg. So there is need to find thrust acting on each drone propeller

T/W = 2

T = 2*3

T = 6 kg.

I.e. total thrust acting on a drone is 6 kg. To find thrust acting on each drone propellers is total thrust divided by number of propellers. Here is consider a quadcopter.

Ti = (6/4)

Ti = 1.5 kg.

Robot Motor Calculations

Where: V is Voltage i.e.12 volt

P is Power in Watt

I is Current in Ampere i.e.5 Ampere

At maximum level input parameters

$$P = V \times I$$

$$60 = 12 \times 5$$

60 Watt

As per standard selection of motor table specifications are

Voltage	No Load		Load Torque				Stall Torque		Weight
Rated Voltage	Speed rpm	Current ma	Speed rpm	Torque kg-cm	Output W	Current I	Torque kg-cm	Current I	gm
12	60	5	45	18.5	60	5	25	7	360

Table no 1. shows the selection criteria for selection of motor.

Conclusion

We can enhance the efficiency of drone b selecting proper propellers, weight and material for manufacture of drone. That will help reduce the power consumption and performance of drone. It is totally depending on type of motor selection, thrust to weight ratio and battery. As per the blade size change it also changes in thrust calculation.

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Design And Manufacturing of Drone

(Robocodex)

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Abstract

UAV (Unman Arial Vehicle) is growing too much fast rate. Now there are different types of drone are available. Every and each drone there is a particular formula for designing a drone. Some special techniques for selection of batteries, motors, propellers. There are no of application of drone like some malicious activities, industrial activity etc. In this report, we give information about drone, how to enhance efficiency and performance of drone. This report also includes no of parameter like Agility of drone, thevelocity of drones etc. Now there are Arial drones are available too much. This report also gives information about how to make ground and air drones. Nowadays drone also takes asmall part in anindustrial application like transportation, security, safety etc.Working in combination with GPS, the flying machine may be remotely controlled or can fly autonomously by software controlled flight plans in their embedded systems. Drones are most often used in military services. However, it is also used for weather monitoring, firefighting, search and rescue, surveillance and traffic monitoring.

Keywords:UAV, Drone, DJI.

Introduction

UAV is known as drones. Now there are lots of application of drones or UAV like military, security, surveillance, safety etc. for different purposes there is need a different drone or UAV that's totally dependent. In some drone, there is also uses an IR and UAV technologies separately for thebenefit to explore. This action is completely done by thetemperature difference between inside and outside sources [1]. This same technology also used for safety and security purposes but there is a used thermal sensor to perform this activity. That sensor directly connected to theelectrical controlling unit and send asignal to thereceiver. DJI is a popular company making drones for adifferent application. There is work conducted with regards to security of drones, little work has been published with regards to the forensic analysis of drones [2]. But DJI is mostly focused on solving number of problem arising in theenvironment through drone e.g. Phantom series, Mavic pro platinum etc. In all drone need some power to run. That's one important for selection parameter of drone. In drone, there is always trying to minimizing power loss through no of techniques. When study sun sniffer and IR its clear that irregular temperature pattern corresponding power loss can be corrected quantitatively [3]. Energy efficiency of drones is animportant parameter for selection criteria. If there is number of drones and all drones operated with mobile targeting there is need a LAS (localized altitude scheduler) provides the drones with the required functions in order to compute the minimum possible altitude based on the position of the targets that each drone currently covers, the position of the targets that the neighboring drones cover, and the minimum and the maximum allowed altitude [4]. Drones there is a positive and negative side also included. The positive side is it's used for security, surveillance, safety, industrialization etc. but drone also used for injured people, it will create serious risk for safety and security. It will largely impact on world. Therefore there is must legalization of drone now in us and UKis moved forward to thelegalization of drones. It's totally focus on avoiding illegal uses of drones and enhance safety mostly public zones and border side of countries. New regulations must be created and enforced to provide possible solutions, but also the current law can be interpreted in order to incorporate new emerging uses of the drones [5].

Generally, Drones are made for human convenience. But all work is done separately on ground or aerial. Robocodex is a UAV that can survive on ground as well as in air with some detachable units are using to easily survive in air. When robotdoesnot survive in air then that can land on therobot and survive on ground at a certain ground level it may not survive on ground then it detaches the drone and survives in air with the help of blades. With having GPS (Global Positioning system) drone can easily find out the main chassis so it is easier for working. Robocodex has two units to survive that are Drone which survives in air and Robot which survive on ground. Both systems attached by using some mechanism

which helpful to survive combine. The robot has attached with solar panel to increasing battery backup for own as well as Drone. If at any condition drone battery is low then by GPS find out Robot for recharging their batteries. And again start the mission. Robot can survive at hills and valley with their robust chassis structure. With long-lasting battery life. Robocodex is a perfect robot with new invention which can survive on ground as well as in air.

METHODOLOGY –

In Robocodex there is we are trying to enhance performance and efficiency of drone. This is possible with help of renewable energy sources it won't impact largely but just enhance life cycle time of drone. Normally drone can run approximately 15-20 min .(Depending on type and application) it will improve up to 25-30 min. Lots of drones are just aerial drones there is no more space for ground robot it is also important that drone can also run on ground this will improve movability drone and make more flexible to bidirectional. This all operation is done through belts, motors and some rollers. This is possible by designing and making frame such that can survive in both aerial drones. For designing frame there is number of parameters are matter like propeller size, type of motor used etc. motor selection is important for drone normally its varies with type of drone is used. Motoris created necessary thrust that can lift the drone. There is another most vital part is frame size. It is totally depending upon type of propeller, batteries, ESC etc.

General using parts in robocodex, by using Brushless DC motor can fly in air, KK2.1.5 Multi-Rotor control board to control rotor speed, ESC (Electronic Speed Controller) to distribute supply as per need for stability, LI-Po Battery as a power, Arduino-Uno is work similar like microcontroller but actually easier than microcontroller. Arduino is using for handling robot and drone as per transmitting signal and with landing gear to land on ground if their some problems in robot. Generally drones do not have any extra power sources carrying capacity, but robocodex can easily get power by sun with using solar panel as well as at the ground robot have extra battery source to recharge drone battery to enhance the flying time.

Material Selection

Drones are light in weight. There isnumber of things matters when drone is in air, generally velocity and acceleration both are important for drone. If the drone has light in weight velocity and acceleration easy to enhance with minimum power consumption. It is totally depending on type of material selection for drone so most of the drones made up of carb fiber, plastic, acrylic material. Those are material light in weight and gives high strength. Those material are comfortable for manufacturing drone.

Propeller Selection

Selection of propeller is depending weight of drone. There are different types of propeller available in market i.e. two bladed three bladed and multi-bladed. Number of blade increases power required for lift drone is decreases i.e. if we select multi-bladed propeller that will help to reduce power consumption and improve efficiency of drone. In propeller pitch angle and angle of attack is most important. Propeller either design for clockwise and counter-clockwise there is another most important parameter is mounting of propeller.

Motor Selection for drone

Motors are huge impacts on payload. Number of motors need for drone is depending on type of drone for Quad-copter need four motors. This motor is different as compare to general gear and servo motors. Normally there is used brushless DC motors.

Battery Selection

In Quad-copter Mostly Li-PO battery is suitable to get bet flight time and performance it is most important t select best Li-PO battery is depending on number of motors used and size and weight of drone. Battery Discharge rate also matters for selection of drone. It is denoted by 'C rating'. If C rating is low battery being damage and drone is in down performance i.e. Drone can't release current fast enough to power the motor and vice versa.

Theoretical Calculations

Normally using a quadcopter, hex copter andoctocopter. All these drones are in same but there is difference in number of propellers used in drones. In Quadcopter there are four propellers, in Hexacopter there are six propellers and in Octacopter there are eight propellers.

Thrust Calculation

Drone selection is totally based on thrust required to move a drone. Whatever thrust will come is distributed in all above propeller's. That way there is first need to select thrust to weight ratio.

It's decide all parameters of drones, normally there is thrust to weight ratio is 2, 3 is given to a drone. For example if you have a drone heaving maximum weight is 3 kg. So there is need to find thrust acting on each drone propeller

T/W = 2

T = 2*3

T = 6 kg.

I.e. total thrust acting on a drone is 6 kg. To find thrust acting on each drone propellers is total thrust divided by number of propellers. Here is consider a quadcopter.

Ti = (6/4)

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Robot Motor Calculations

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A Review on Combustion, Performance and Emission Characteristics of Diesel and Biodiesel Fuelled Engine.

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Abstract- The emissions from diesel engines also seriously threaten the environment and are considered one of the major sources of air pollution. Many countries are evaluating a variety of alternative fuels for use in motor vehicles in an attempt to reduce greenhouse gas emissions and to improve the energy security of the country. Biodiesel and other bio fuels are substitute fuels capable of replacing fossil fuels on large scale in the transportation sector. Biodiesel have good ignition characteristics due to their long chain hydrocarbon structure. On the other hand, their disadvantages include higher viscosity, higher pour point, lower calorific value, and poor volatility. The addition of a fuel additives is one of the possible approaches for reducing these problem because of the obvious fuel oil constituent influences on engine performance and emission characteristics. The present work is a literature review on combustion, performance and emission characteristics of diesel and biodiesel blend. According to the results of the review, additives are an effective method for obtaining the reduction in the PM, CO, CO_2 and UHC emissions but minimum increase in the NO_X emission. If the additives are added in diesel and biodiesel at appropriate proportion, it will improve the engine combustion and performance characteristics.

Keywords— Biodiesel, Chicken oil, Engine performance, Engine emission, Esterification process, Transesterification process. Biodiesel, diethyl ether, NO_X, Fuel Consumption, Viscosity, Calorific value, Thermal Efficiency, Combustion, emissions

I. INTRODUCTION

In this century, it is believed that crude oil & petroleum products will become limited and expensive. Day-to-day, fuel economy of engine is getting improved and will continue to progress. However, massive increase in number of vehicles has started dictating the fuel demand. Gasoline and diesel fuels will become limited and very costly in the near future. World energy demand is increasing continuously, specifically the demand of petroleum fuels. World energy consumption is expected to increase to 180,000 GWh/year by 2020. Continuously rising petroleum consumption is causing increased load of pollutants in atmosphere. The rapid urbanization, increased air population and the decreasing availability of the fossil fuels have created awareness for effective utilization of the available fuel. Reciprocating engines (CI & SI both) are widely used for transportation and agriculture applications due to their reliability and durability. Diesel engines have a higher thermal efficiency then gasoline engines. However, there are two major challenges possess the use of diesel engines. One is related with fossil fuel sustainability and the other is related with environmental concern on engine emissions. Diesel engines are the major contributors of various types of air polluting exhaust gases such as particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_X), unburnt hydrocarbon (UHC) and other harmful compounds. Harmful exhaust gases and particulate matter (PM) which are present in atmosphere unsafe for lives and property. Advanced research in the combustion of diesel fuels in engine shows that the brake thermal efficiency, brake power can further be increased by allowing the fuel to combine with more oxygen atoms to form better combustion, this also reduces the smoke, carbon monoxide (CO) and unburnt hydrocarbon (UHC) emissions. Due to the better fuel economy diesel engines have been widely used in the automotive area. However, the limited reserve of fossil fuel and deteriorating environment have made scientists seek to alternative fuels for diesel while keeping the high efficiency of diesel engine. Of the various alternate fuels under consideration, biodiesel is the most promising alternative fuel to diesel due to the following reasons.

1. Biodiesel can be used in the existing engine without any modifications.
2. Biodiesel is made entirely from vegetable sources and animal wastes; it does not contain any sulphur, aromatic hydrocarbons, metals or crude oil residues.
3. Biodiesel is an oxygenated fuel; emissions of carbon monoxide and soot tend to reduce.
4. Unlike fossil fuels, the use of biodiesel does not contribute to global warming as CO_2 emitted is once again absorbed by

the plants grown for vegetable oil /biodiesel production. Thus CO_2 balance is maintained.
5. The Occupational Safety and Health Administration classifies biodiesel as a non-flammable liquid.
6. The use of biodiesel can extend the life of diesel engines because it is more lubricating than petroleum diesel fuel.
7. Biodiesel is produced from renewable vegetable oils/animal fats and hence improves the fuel or energy security and economy independence.
Biodiesel is mainly comprised of mono-alkyl esters of long chain fatty acids and it was defined in standard ASTM D6751. Normally feedstock such as vegetable oil and animal fat is used to produce biodiesel through transesterification method. It may be used in any diesel automotive engine in its pure form or blended with some additives. No modifications are required in the existing diesel engines, and the result is a less expensive, renewable, clean-burning fuel. The problems associated with the use of biodiesel are thus very complex and no satisfactory solution has yet been achieved despite the efforts of many researchers around the world. The combustion characteristics of the biodiesel can be improved by blending it with additives. The additives have been considered for reducing the ignition temperature of particulates. However, the reduction of particulate emissions depends on the molecular structure and oxygen content of the fuel and also depends on the local oxygen concentration in the fuel. To reduce particulate emissions, fuel-compatible oxygen-bearing compounds should be blended to produce a composite fuel containing 10-25% v/v of oxygenate. Therefore, the composition of biodiesel and the use of additives directly affect properties such as density, viscosity, volatility, behaviour at low temperatures, and the ignition delay. With additionally to the environmental characteristics of biodiesel, it is evident, that there is a latent demand of this product because of the recent rises in the price of oil, and the realization that fossil fuels will eventually run out, this resulted in renewed interest in fuel made from plant oils or biodiesel. That is why it is necessary to study the potential of biodiesel with additives, as well as to study its feasibility, if it will be used as a alternative fuel in the future.

EFFECT OF FUEL ADDITIVES ON COMBUSTION, PERFORMANCE AND EMISSION CHARACTERISTICS OF BIODIESEL FUEL

Fuel additives become crucial tools not only to enhance performance and combustion of diesel engines but also produce lesser emissions that meet the international and regional standards. Various results of improvement in diesel properties have been obtained by using different additives. The additives were used by different researchers to improve the performance and emissions of diesel engines. These reviews are taken up to identify the various additives used to improve the properties of fuel and the performance of a diesel engine and its emissions. Further research needs to develop diesel specific additives for better performance, combustion and emissions of diesel engines. Use of multi-functional additives for diesel will lead better fuel conservation and emission control takes place.

Prakash T et al. [1] study is focused on investigation of CI engine by using biodiesel which is produced from the waste chicken oil. Here waste chicken was taken to extract oil from it and that oil is used in the production of biodiesel. And the produced biodiesel was taken to check the properties of it such as calorific value, viscosity, density, flash and fire point. After that the analysis were carried out for various biodiesel blends produced and results showed that the use of chicken oil biodiesel for substitution of diesel fuel was good without modification on engine upto B40. By considering performance parameter the brake thermal efficiency increases and brake specific fuel consumption decreases on using chicken oil biodiesel also slightly lower NO_X and higher HC and CO emissions were noted on using biodiesel in engine emission test. However by compared to pure (D100) diesel fuel 22.03% higher NO_X and 24.05% lower CO with 46.15% lower HC were observed with chicken oil biodiesel.

M. Pugazhvadivu et. al. [2] Carried out tests single cylinder direct injection diesel engine fuelled with blends of biodiesel and diesel at different proportions. The engine performance and emission characteristics were determined. The engine NO_X emission was noted to be higher than the diesel fuel operation with all blends. Diethyl ether was then added at different proportions to the blends. The addition of diethyl ether to the blends reduced the NO_X emission at low and medium loads; however at high loads the NO_X emission was higher compared to diesel and lower compared to the corresponding biodiesel blend.

Kantharaju T et. al. [3] Studied transesterification process for chicken fat biodiesel blends of B20, B40, B60, B80 and B100. The fuel consumption test of a constant speed CI engine was conducted to evaluate the performance of the engine on diesel and chicken fat biodiesel blends. The characterization of fuel was analysed by plotting graphs and important property like specific gravity of biodiesel blends were compared with the fossil diesel and 100% biodiesels. The engine performance and emission characteristics were analysed. It was found that the density and brake thermal efficiency were more than diesel fuel; while calorific valve and brake specific fuel consumption were less than diesel fuel. Also chicken fat biodiesel blends with diesel have more CO_2 and O_2 emission.

Saravanan D. et. al. [4] In CI engine, the combustion is heterogeneous and the time allowed for mixing of fuel with air in particular oxygen is very less so there is partial mixing of the fuel which makes the mixture rich at certain places leading to the formation of particulate matter and very leaner at some places leading to formation of NOx. In his research he mixed diethyl ether with diesel for 5% and 10%, and the combustion and emission characteristics were analyzed. Blending diethyl ether with diesel and its usage in conventional diesel engine increased the brake thermal efficiency and reduced the BSFC. The NOx emissions were reduced and there was an increase in the CO and HC emission, this could be avoided if optimum diethyl ether and diesel fuel blending ratio were used without making the fuel mixture to be too lean. The high latent heat of

evaporation of diethyl ether counter acts the cetane benefit which increases the HC emission.

CONCLUSION

The present review, discussed the combustion, performance and emission characteristics of diesel and biodiesel fuel blend with additives. The conclusions drawn from the present study are the following points:

- Various fuel additives are available which possess more oxygen content compared to diesel. If these additives are added in diesel and biodiesel at appropriate proportion it will improve the engine performance and emission characteristics.
- Based on the performance, minimum increase in Brake Specific Fuel Consumption (BSFC) and with higher improvement in Brake Thermal Efficiency (BTE), have found by adding the additives to both diesel and biodiesel.
- Based on the emissions, reduction in CO, CO2, PM, NOx and UHC for diesel fuel and minimum increase in NOx for biodiesel blended with additives is observed by previous studies.
- Based on the combustion, reduction in ignition delay and peak cylinder pressure and increase in combustion duration is observed for diesel and biodiesel blended with additives.

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TO STUDY THE INFLUENCE OF MEXICANA BIODIESEL, ITS BLENDS AND ETHANOL AS ADDITIVE IN DIESEL ENGINE

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Abstract

In this research paper, our aim was to investigate new non-edible oil except Karanja, Jatropha, and Neem. Argemone Mexicana weed crop and its seeds oil biodiesel is extracted by Transesterification process with methanol. And tested on a single cylinder, four stroke diesel engines connected to eddy current dynamometer fuelled with argemone biodiesel and blend with diesel fuel under different load condition. In this work 6%,12%,18%,24%,30% and 36% argemone Mexicana blends are used. 5% Ethanol is used as an additive in diesel fuel. The performance parameters like brake power (BP) ,brake specific fuel consumption(BSFC), brake thermal efficiency(BTHE) compared and with diesel fuel..

Keywords: Argemone Mexicana oil, Mexicana biodiesel, performance testing, esterification, transesterification,

Introduction:

Biodiesel is an alternative fuel similar to conventional or fossil diesel. Biodiesel is produced from vegetable oil, fats, waste cooking oil, soybean etc. the concept using vegetable oil as a fuel dates back to 1895 when Dr.Rudolf Diesel developed the first diesel engine to run on vegetable oil. Rudolf diesel stated:" The use of vegetable oil for engine fuels may seen insignificant today. But such oil may become in source of time as important as petroleum and the coal tar products of the present time biodiesel is a natural biodegradable fuel defined as mixture of fatty acid methyl or ethyl esters derived from vegetable oil or animal fat sand it is used in diesel engines and heating system. Thus this fuel could be considered as mineral diesel substitute that having an advantage of reduction Greenhouse gases because it is renewable resource. Biodiesel is formed by two step chemical process that are esterification and transesesterification. In the first step, the oil is treated by an acid dissolved in methanol to reduce FFA content, whereas in the second step the preheated esterified oil is transesterified with methanol in the resence of base catalyst to form ester and glycerol.

Literature Review

Mandeep Singh et.al. [1] studied on Experimental investigations on performance and emission characteristics of variable speed multi-cylinder compression ignition engine using diesel/Argemone biodiesel blends". In these paper the argemone Mexicana biodiesel and its blends tested on multicylinder compression ignition, indirect injection engine 10% 20% 30%and 40% blends are tested on engine and analyze the engine performance and emission characteristics at varying loads (0,25,80&75%) and speeds(2500-4000r/min) and results are compared with the diesel fuel .the 30%blend used in an engine gives the higher thermal efficiency and lower CO,HC and smoke emission .it does not required any modification in engine

Parmjit singh et.al.[2] studied on Optimization of biodiesel from argemone oil with different reaction parameters and performance analysis in CI engine. In this paper argemone Mexicana biodiesel and blend with diesel is tested on single cylinder four stroke engine which is connected to eddy current dynamometer .for investigating the performance parameter of a engine the optimization of biodiesel different molar ratio reaction time and catalyst concentration are used the specific fuel consumption uses decreased for AB20 at full load condition the brake thermal efficiency and brake power was maximum for AB20 at full load conditions.

Rakesh kumar et.al.[3] studied on experimental analysis of engine performance and combustion characteristics using dual biodiesel blends.In this paper dual biodiesel blends (argemone Mexicana and mahua) are tested on single cylinder four stroke constant speed and variable load diesel engine it is used for investigating the performance and combustion characteristics as compared with mineral diesel .he is investigate the higher blends of dual biodiesel he gives the better performance and combustion characteristics and lower blends gives the lower performance of compared to mineral diesel fuel the indicated thermal efficiency is slight higher and volumetric efficiency is higher as compared to mineral diesel in these experimentation the heat release rate is lower as compared to mineral diesel.

Mrunmay jadhav et. al.[4] Characterisation of Mexicana methyl ester on single cylinder four stroke diesel engine.In this paper biodiesel is tested on single cylinder four stroke diesel engine for investigating the parameter performance like Brake thermal efficiency ,Brake Specific Fuel Consumption ,and Emissions HC & CO. the results are compared with diesel fuel then brake thermal efficiency increases and mechanical efficiency is equal to the diesel fuel .the emissions are decreases with compared to diesel fuel also decrease the fuel consumption at different speed and loads.

M.H.Attal,et.al.[5]studied on Performance evaluation of C.I.engine with change in different engine variables and using methyl ester of argemone Mexicana. In these research paper methyl ester of argemone Mexicana biodiesel is tested on single cylinder V.C.R. four stroke engine using various engine parameter such as compression ratio, fuel injection pressure, load etc .and investigate the performance and emissions of compression ignition engine .in these paper observed the brake thermal efficiency increased where as bsfc reduced if compression ratio increases then emissions are also reduces.

H.Jordar, M.K. et.al.[6] studied on modeling and validation of some combustion parameters in a VCR engine fuelled with argemone Mexicana biodiesel-diesel blends using RSM .In these research paper methyl ester of argemone Mexicana biodiesel is prepared in two steps transesterification process and biodiesel its blends tested on variable compression ratio

multi fuel engine to investigate the combustion parameters like in cylinder pressure net head replace rate the results of ANOVA suggested that the proposed model is best fit and the validation of the models are carried out by comparing the predicted values of output responds with that of experimental results the sensitivity analysis revealed that loads is most important for the output responds followed by compression ratio and blend.

Methodology:

Extraction of oil:

The extraction process Argemone Mexicana seeds were dried at 100°C for 2 hours in the oven to remove the excess moisture. The dried seeds were then weighed and powdered. The fine seed powder was then subjected to Soxhlet extraction using n-hexane as a solvent. The duration of each batch was 15 hrs for complete extraction. The solvent required for extraction of per kg seeds was in the ratio of 10:1 (10ml solvent for 1gm seeds). The oil was recovered from the solvent by rotary evaporator.

Esterification:

Argemone Mexicana oil contains 19.58% free fatty acids. The methyl ester is produced by chemically reacting Mexicana oil with an alcohol (methyl), in the presence of catalyst. A two stage process is used for the transesterification of Argemone Mexicana oil. The first stage (acid catalyzed) of the process is to reduce the free fatty acids (FFA) content in Argemone Mexicana oil by esterification with methanol (99% pure) and acid catalyst sulfuric acid (98% pure) in one hour time at 57°C in a closed reactor vessel. The Argemone Mexicana oil is first heated to 50°C then 0.7% (by wt. of oil) sulfuric acid is to be added to oil and methyl alcohol about 1:6 molar ratio (by molar mass of oil) is added. Methyl alcohol is added in excess amount to speed up the reaction. This reaction was proceeding with stirring at 650 rpm and temperature was controlled at 55-57°C for 90 min with regular analysis of FFA every after 25-30 min. When the FFA is reduced upto 1% the reaction is stopped. The major obstacle to acid catalyzed esterification for FFA is the water formation. Water can prevent the conversion reaction of FFA to esters from going to completion. To achieve acceptable percentage of FFA, we performed this stage two times. After dewatering the esterified oil is fed to the transesterification process.

Transesterification process

The experimental set up is shown in figure. A 2000 ml three necked round –bottom flask was used as a reactor. The flask was placed in heating mantle whose temperature could be controlled within $\pm 2\ ^{0}C$. One of the two side necks was equipped with a condenser and the other was used as a thermo well. A thermometer was placed in the thermo well containing little glycerol for temperature measurement inside the reactor. A blade stirrer was passed through the central neck, which was connected to a motor along with speed regulator for adjusting and controlling the stirrer speed.

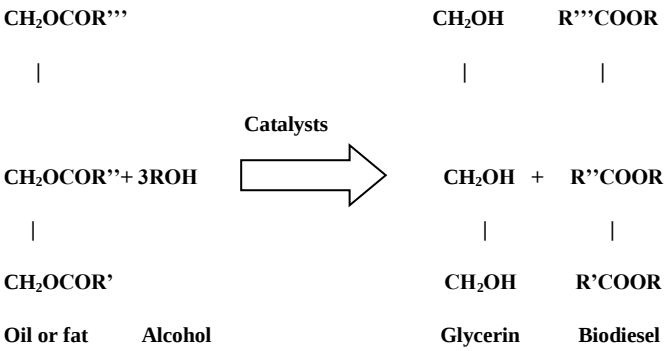
Fig.1Transesterification Process

Transesterfication Reaction

Transesterfication or alcoholysis is the displacement of alcoholic form an ester by another in process similar to hydrolysis, except an alcohol is used instead of water. This process has been widely used to reduced the high viscosity of the triglycerides. The transesterifiction reaction is represented by the general equation as below-

RCOOR' + R"OH↔RCOOR" + R'OH

General equation of transesterification



General equation for methanolysis of triglycerides

Physiochemical Analysis:

Physio-chemical properties of biodiesel were evaluated in accordance with Bureau of Indian standards (BIS) in Indian Biodiesel Corporation, a certified laboratory at Baramati, Dist.pune, and Maharashtra. In this table, the properties of diesel and blends of argemone mexicana are easily understood. The properties like density, calorific value, cetane no., viscosity, moisture, flash point, pour point etc. It is shown in table 1.

Table 1.Physio-chemical properties

Sr.	Test Description	Ref. Std. ASTM 6751	Reference		Diesel	Mexicana biodiesel and blends					
			Unit	Limit	B00%	B6%	B12%	B18%	B24%	B30%	B36%
1	Density	D1448	gm/cc	0.800-0.900	0.830	0.833	0.384	0.836	0.838	0.841	0.844
2	Calorific value	D6751	MJ/Kg	34-45	42.50	42.41	42.20	42.09	41.96	41.86	41.55
3	Cetane no.	D613	-	41-55	49.00	49.44	49.70	49.88	49.95	50.11	50.26
4	Viscoisity	D445	mm2/sec	3--6	2.700	-	-	-	2.96	-	-
5	Moisture	D2709	%	0.05%	NA	NA	NA	NA	NA	NA	NA
6	Flash point	D93	^{o}C	-	64	-	-	-	92.0	-	-
7	Fire point	D93	^{o}C	-	71	-	-	-	102.0	-	-
8	Cloud point	D2500	^{o}C	-	-4	-	-	-	3.0	-	-
9	Pour pont	D2500	^{o}C		-9	-	-	-	-1.0	-	-
10	Ash	D	%	-	0.05	-	-	-	0.1	-	-

Table 2. Diesel Engine specifications

Engine	Kirloskar engine, 1 cylinder,4 stroke
Power rating	3.5 KW
Engine speed	1500 rpm
Cylinder Bore	87.5 mm
Stroke Length	110 mm
Swept Volume	661.45 cc
Cooled Type	Water cooled 1200LPH,Calorimeter 250 LPH
Compression Ratio	17.5
Dynamometer	Eddy current type
Load Indicator	Digital, supply 230 AC
Rotameter	Engine Cooling
Governing	Class 'B1'

EXPERIMENTAL SETUP

The test rig is used for the experiment is a single cylinder, four strokes, diesel engine connected to eddy current dynamometer fuelled with argemone mexicana biodiesel with different blends for loading. The setup having provision is made for airflow, fuel flow, temperatures& load measurement. The engine stands panel box consisting air box, fuel tanks, manometer, fuel measuring unit, engine speed indicator. The rotameters are provided for measuring cooling water & calorimeter water flow. It is used to study the brake power, indicated power, frictional power, brake thermal efficiency, specific fuel consumption, and mechanical efficiency. In this research investigation seven blends were prepared 6% (v/v) argemone biodiesel with 94%(v/v)diesel fuel denoted by B6 (argemone biodiesel blend).The experiment was conducted using diesel and biodiesel blend with diesel B12,B18,B24,B30,B36.under different load and speeds.

The engine was started by hand cranking. The engine speed runs up to 1500 rpm. The engine is attached to the eddy current type dynamometer at one end and other with a drive shaft coupling flange for loading. A throttle is used to control and increase the speed of the engine as the control variable. The dynamometer and engine are cooled by a continuous supply of water to dissipate the generated heat. The other end of the dynamometer is hooked up to the digital readout system which contains the digital RPM meter and loading unit that experimental readings can be obtained.The graphical representation. The single cylinder, four stroke diesel engine having following specifications. This diesel engine is vertical water cooled and it is manufactured by Kirloskar Company. This engine is used to carry out experiments on diesel and biodiesel blends and compared. It is shown in table 2.

EXPERIMENTAL RESULTS

The experiment is performed on single cylinder, four stroke diesel engines at different engine speeds, at no load condition, and at different load conditions. Initially, the experiment is performed for diesel fuel and thereafter with the help of blends of argemone biodiesel i.e. at B00,B6, B12, B18, B24, B30, B36.The performance parameters like brake power, mechanical efficiency, brake thermal efficiency, brake specific fuel consumption.They are discussed in this section.

Performance Parameters-

1. Effect on Brake Power: Brake power for diesel and all argemone biodiesel blends are calculated and compared with diesel. It is observed that the power increased with increased in load. There are slight variations in brake power for diesel and all biodiesel blends. It is because of the calorific value of diesel is more than that of argemone biodiesel. The graphical representation is shown in fig.1.

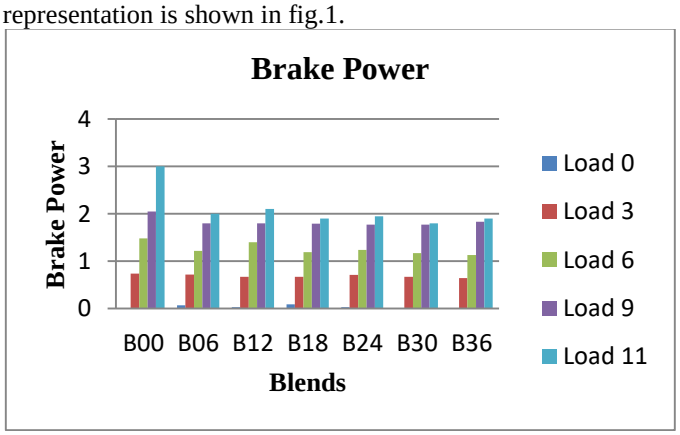


Fig.1 Effect on Brake power

2. Effect on Brake Specific Fuel Consumption:Specific fuel consumption is defined as the amount of fuel consumed per unit of power developed per hour. It is a clear indication of efficiency with which the engine develops power from fuel.It

is observed that the brake specific fuel consumption decreases with increased in load. It is because of a higher percentage of brake power with load. And it is seen from the graph the bsfc of diesel is much higher than that biodiesel. The graphical representation is shown in fig.2

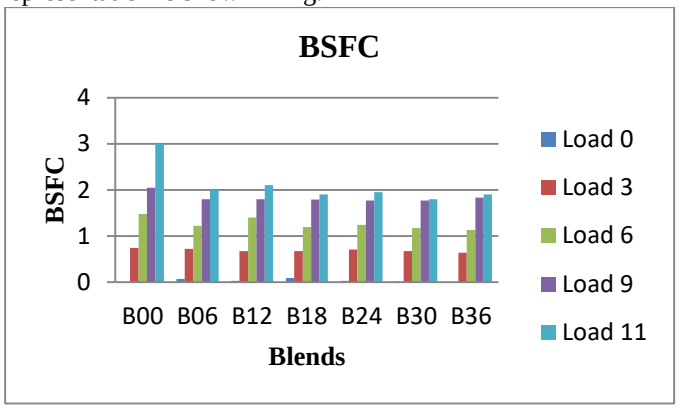


Fig.2 Effect on BSFC

Effect on Mechanical Efficiency:

Mechanical efficiency measures the effectiveness of a machine. It is defined as the ratio of break power to indicated power. We have plotted the graph of Mechanical Efficiency for each blend at different loads. And we have observed that the mechanical efficiency increases with increase in load. The mechanical efficiency of diesel fuel is higher than B24, B30.Graphical representation of load vs. mechanical efficiency is shown in fig.3

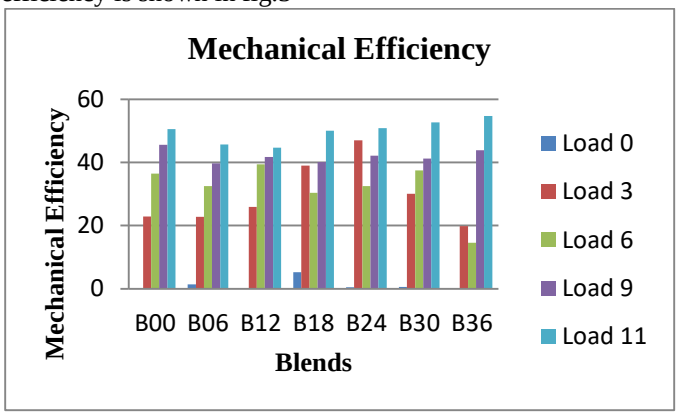


Fig.3 Effect on Mechanical Efficiency

Effect on Brake Thermal Efficiency: Thermal efficiency of an engine is defined as the ratio of the output to that of the chemical energy input in the form of fuel supply. The results were obtained that thermal efficiency is gradually increasing both for diesel and biodiesel. It is observed that thermal efficiency up to B20 is equal to diesel fuel, beyond that it is increased significantly. The graphical representation is shown in fig.4

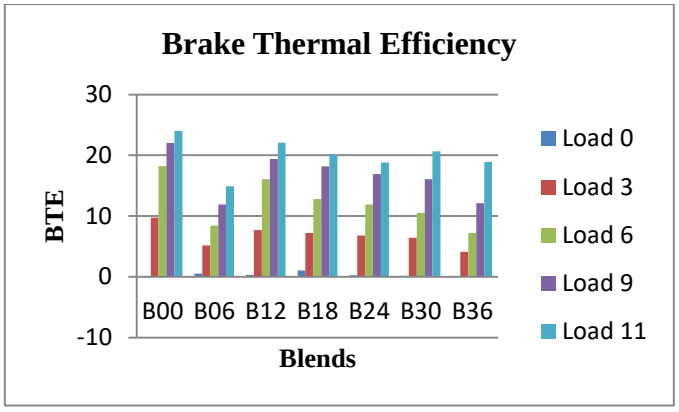


Fig.4 Effect On Brake Thermal Efficiency

Conclusion

In this study, the argemone mexicana oil has a potential to become an alternative fuel in next few decades due to depleting fossil fuels at a faster rate all over the world. In this study we are found out some conclusions, they are as following:

1. The maximum brake thermal efficiency is obtained to be for B24, B36 is high as compared to diesel. Due to a high amount of oxygen content are present in the fuel, they lead to proper combustion and better atomization of the fuel.
2. The mechanical efficiency is obtained equal for B6, B12, B18, and B24 as compared diesel fuel & the brake fuel specific consumption was decreased at different speed & load conditions as compared to diesel as a fuel.
3. The kinematic viscosity and density of argemone biodiesel are higher as compared with diesel as a fuel & calorific value of biodiesel is lower as compared with diesel fuel.

Hence Mexicana as biodiesel in CI engine has wide future scope .

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WEIGHT OPTIMIZATION OF BUTTERFLY VALVE BY REDESIGNING AND FEA ANALYSIS

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Abstract
In this paper design and modification of Butterfly valve is done. Modelling of butterfly valve is done with the help of software CATIA V5R20. For structural analysis is carried with help of Ansys 12.0 The best optimised model is that in which shell thickness is reduced by 2mm, lifting rib decreased by 15mm and side rib by 10mm reduced 10.408kg weight, because the maximum stress level much lower than the yield stress value of material. And disc model is selected from the finite element analysis result dome shape having radius 300 mm diameter. FEA results for this optimized model shows that the stresses in ribs also increased because of decrease the thickness. Then weight reduces of valve body is Final weight of optimised valve body=200.78kg

Keywords: Optimization Butterfly valve, Analysis

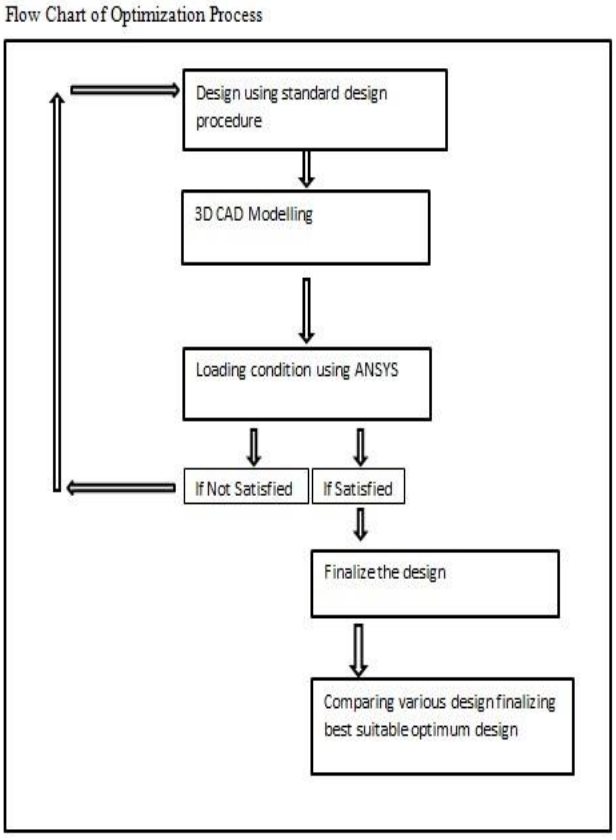
Introduction

Valve is mechanical device that controls the flow of fluid and pressure within system or process. A valve controls system or process fluid flow and pressure by performing any of the following function: Starting and stopping the fluid flow, varying the amount of fluid flow, controlling the direction of fluid flow, Regulating the downstream system or process pressure.

There are many valve design and types that satisfies one or the more function identified above. Valves are widely used in various industrial branches, especially in power plant pipeline installations, Agricultural applications etc.

The aim of this paper is to design optimization of butterfly valve to reduce its weight. Casting of this butterfly valve (including valve body and disc) is very heavy and weight almost 305 kg so this component chosen for the optimization manufacturing rate of this class valve is about 15 quantities per month by reduction in weight, unnecessarily material involved in valve body gets reduced which ultimately result to reduction in manufacturing cost of butterfly valve.

Today is possible to see various application samples of FEM in many different disciplines of applied sciences. For instance, they should inevitably be applied in valve design processes in today's developing technological area. Optimization is the act of obtaining the best result under given circumstances. In design, construction, and maintenance of any engineering system, engineers have to take many technological and managerial decisions at several stages. The ultimate goal of all such decisions is either to minimize the effort required or to maximize the desired benefit. Since the effort required or the benefit desired in any practical situation can be expressed as a function of certain decision variables, optimization can be defined as the process of finding the conditions that give the maximum or minimum value of a function.



3d Cad modelling of valve

CATIA enables the creation of 3D parts, from 3D sketches, sheet metal, composites, and moulded, forged or tooling parts up to the definition of mechanical assemblies. It provides tools to complete product definition, including functional tolerances as well as kinematics definition. CATIA provides a wide range of applications for tooling design, for both generic tooling and mould & die.

CATIA offers a solution to shape design, styling, surfacing workflow and visualization to create, modify, and validate complex innovative shapes from industrial design. Now using this CATIA VR 20 software creating model of valve.

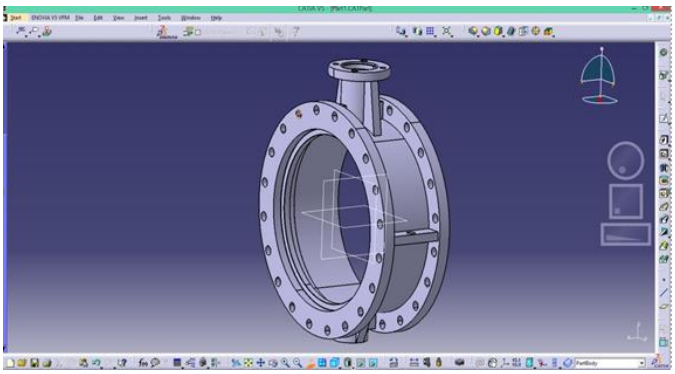


Fig:1 3D Design of valve

Finite element Analysis of valve

The created 3D of model of valve can be imported and required boundary condition can be applied easily. Hence we selected ANSYS Software is selected for the analysis of this valve.

In a particular our modelled valve in CATIA software then changes its extension of file from .CAT to .igs or .stp. In ANSYS-Work bench it is accurate and user friendly software .Hence for an optimisation of valve in an ANSYS-Work bench it is easy and accurate.

The study focused on the stress of the valve. Therefore, all components of the assembled solid model of the valve were not used in the FEM analysis. The commercial FEM software package, Ansys Workbench, was utilized for the FEM stress analysis process. The FEM analysis was set up in 3D, linear, static and isotropic material model assumptions. When real working conditions were evaluated, the boundary conditions were applied to the model properly.

Firstly material properties are defined as Grey Cast Iron having tensile ultimate strength as 140 Mpa.

Geometry of part is imported in ANSYS Workbench which is saved in .igs file format. Assignment of Material grey cast iron is further carried out after importing for further analysis

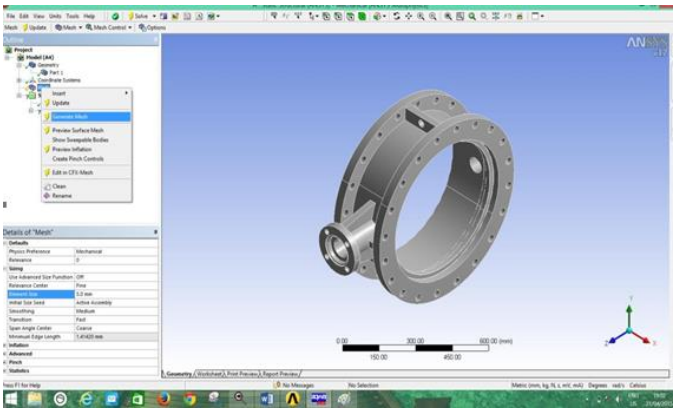


Fig 2: Material properties define the body of valve

For generating mesh in this software element is fine meshing is selected for generating good results as shown Figure 3

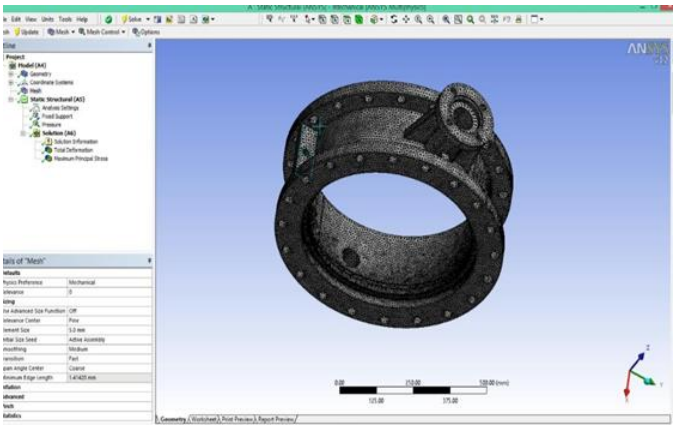


Fig 3: Mesh Generation

For applying boundary Conditions Structural loading means applying internal pressure to valve body. Internal pressures 1.5 MPa were applied on the all inner surface of a valve body, which is shown by rose red coloured arrow in the Figure4 . All degree of freedoms of inlet and outlet flanges is restricted and it is shown with the help of blue colour in the Figure 4

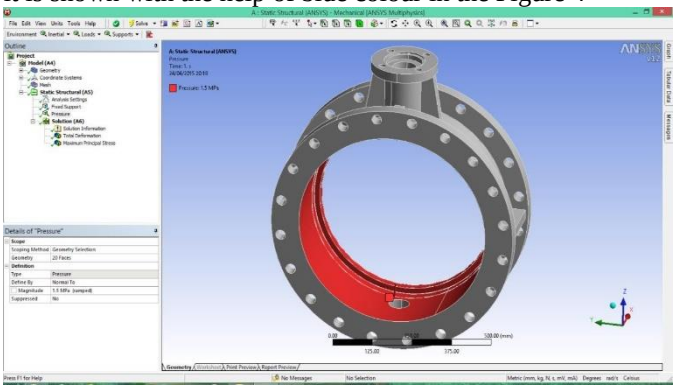


Fig4: Applying boundary condition and pressure

Results are obtained in this software after defining Total deformation and Equivalent Stress (von-misses stress) as shown in Figure 5

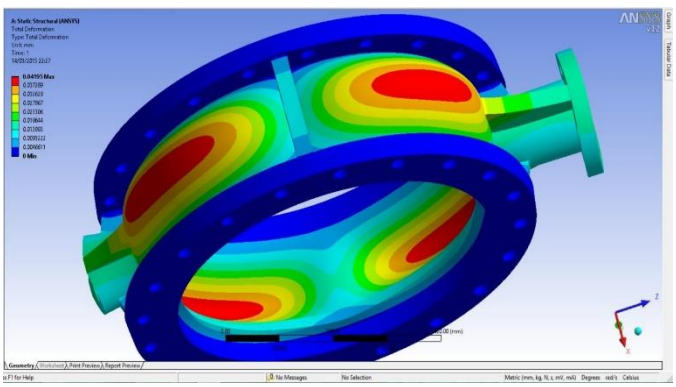


Fig5: Total deformation of valve Body (ST=22, SR=30, LR=30)

From above obtained results it is clear that the maximum principal stress is 58.879 MPa founds in the circumference of valve body's disc seat at 1.5 MPa internal pressures shown in red colour in Figure 5 .While minimum principal stress at flange corner for 1.5 MPa internal pressures. As the internal pressure acts on the internal effective pressurizing area of valve body, results to expand the valve body. Ribs tries to hold the valve body in original position so ribs subjects to heavy tensile stress. As the internal pressure increases stresses in the valve body increases linearly as shown in Figure5. Same procedure was carried out to perform to same iteration

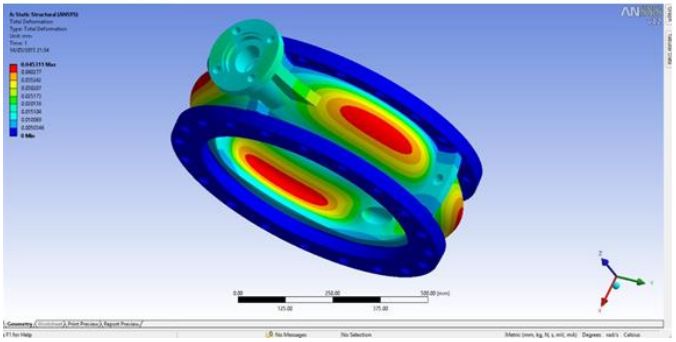


Fig6: Total deformation of valve Body (ST=21, SR=30, LR=30)

From above obtained results it is clear that the maximum principal stress is 63.291MPa founds in the circumference of valve body's disc seat at 1.5 MPa internal pressures shown in red colour in Figure 6.While minimum principal stress at flange corner for 1.5MPa internal pressures. As the internal pressure acts on the internal effective pressurizing area of valve body, results to expand the valve body. Ribs tries to hold the valve body in original position so ribs subjects to heavy tensile stress. As the internal pressure increases stresses in the valve body increases linearly as shown in Figure 6

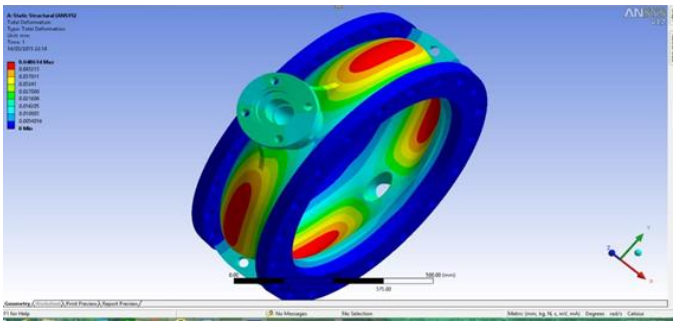


Fig7: Total deformation of valve Body (ST=20, SR=15, LR=20)

From above obtained results it is clear that the maximum principal stress is 66.534 MPa founds in the circumference of valve body's disc seat at 1.5 MPa internal pressures shown in red colour in Figure 7.While minimum principal stress at flange corner for 1.5 MPa internal pressures. As the internal pressure acts on the internal effective pressurizing area of valve body, results to expand the valve body. Ribs tries to hold the valve body in original position so ribs subjects to heavy tensile stress. As the internal pressure increases stresses in the valve body increases linearly as shown in Figure 7

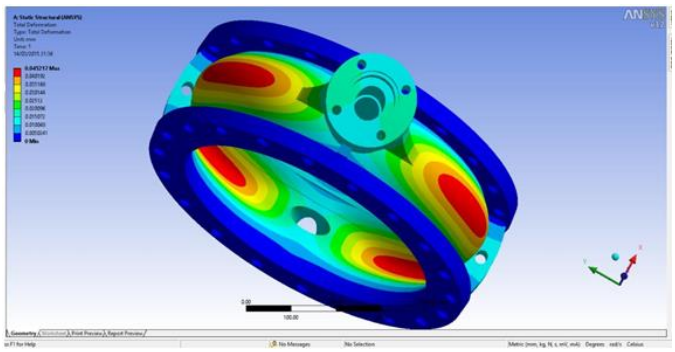


Fig8: Total deformation of valve Body (ST=21, SR=25, LR=30)

From above obtained results it is clear that the maximum principal stress is 63.392MPa founds in the circumference of valve body's disc seat at 1.5 MPa internal pressures shown in red colour in Figure 8.While minimum principal stress at flange corner for 1.5 MPa internal pressures. As the internal pressure acts on the internal effective pressurizing area of valve body, results to expand the valve body. Ribs tries to hold the valve body in original position so ribs subjects to heavy tensile stress. As the internal pressure increases stresses in the valve body increases linearly as shown in Figure 8

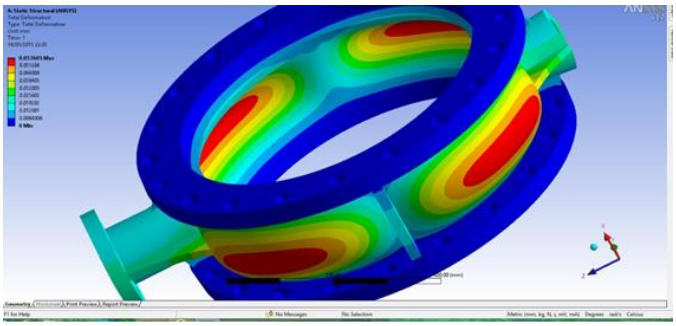


Fig9: Total deformation of valve Body (ST=21, SR=25, LR=30)

From above obtained results it is clear that the maximum principal stress is 76.091MPa founds in the circumference of valve body's disc seat at 1.5 MPa internal pressures shown in red colour in Figure 9.While minimum principal stress at flange corner for 1.5MPa internal pressures. As the internal pressure acts on the internal effective pressurizing area of valve body, results to expand the valve body. Ribs tries to hold the valve body in original position so ribs subjects to heavy tensile stress. As the internal pressure increases stresses in the valve

body increases linearly as shown in Figure 9

Table:-1 Selection of model

Iteration	Shell Thickness (mm)	Side Rib (mm)	Lifting Rib (mm)	Max. Principle Stress (MPa)	Deformation
1	22	30	30	58.879	0.04195
2	22	25	30	59.015	0.041683
3	21	30	30	63.291	0.045311
4	21	25	30	63.392	0.04521
5	20	30	30	66.375	0.049125
6	20	25	30	66.28	0.049046
7	20	20	30	65.442	0.048943
8	20	25	25	67.028	0.04889
9	20	20	25	67.948	0.048817
10	20	16	25	65.449	0.048722
11	20	20	20	66.56	0.048728
12	**20**	**15**	**20**	**66.534**	**0.048614**
13	20	16	16	66.148	0.048505
14	20	15	15	65.404	0.048475
15	19	15	20	69.294	0.052791
16	18	15	20	76.091	0.057605

According to BS5155 Standards we select model no 12 and corrosion allowance 2mm to thickness. Therefore weight reduces of valve body is Final weight of optimised valve body=200.78kg Therefore total weight reduced= Initial weight valve body - Final weight valve body= 213.188-202.78=10.408kg.

Disc.

Disc Modelled in CATIA V5R20 as per drawing given by the company. Part is modelled in CATIA V5R20 and weight of disc is known here as shown Figure and Figure and file is save in .igs format for importing in Ansys workbench

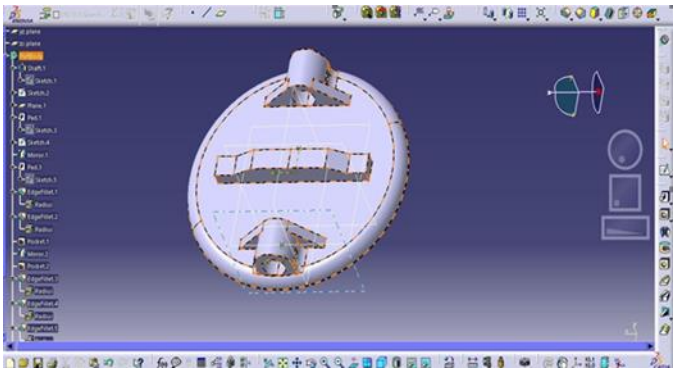


Fig:10 3D Design of Disc

Firstly material properties are defined as Grey Cast Iron having tensile ultimate strength as 140 Mpa.

Geometry of part is imported in ANSYS Workbench which is saved in .igs file format. Assignment of Material grey cast iron is further carried out after importing for further analysis

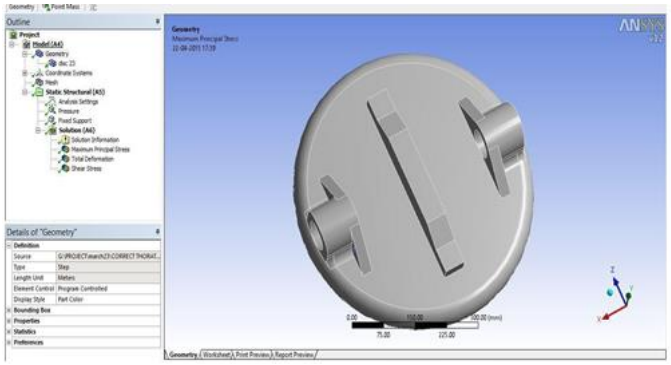


Fig:- 11 Disc imported in ANSYS workbench

For generating mesh in this software element size is taken as 5 mm and mesh is generated as shown

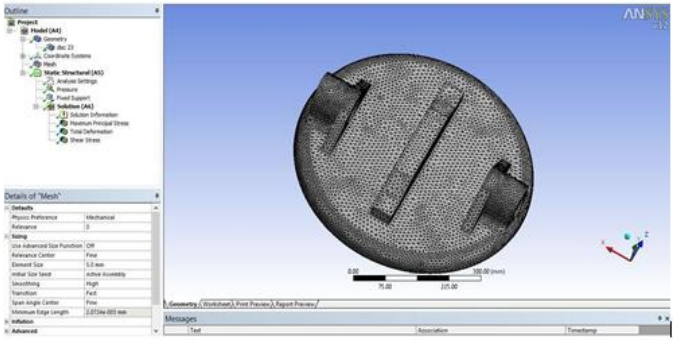


Fig12: Mesh Generation

For applying boundary Conditions Structural loading means applying internal pressure to valve body. Internal pressures 1.5 MPa were applied on the all inner surface of a valve disc, which is shown by rose red coloured arrows in the Figure All degree of freedoms of inlet and outlet flanges is restricted and it is shown with the help of blue colour in the Figure 13

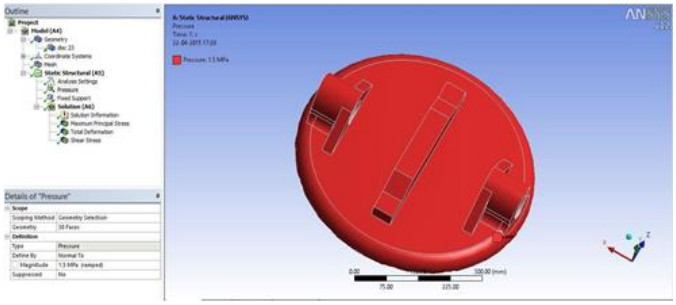


Fig13: Applying boundary condition and pressure

Results are obtained in this software after defining Total deformation and Equivalent Stress (von-misses stress) as shown in Figure

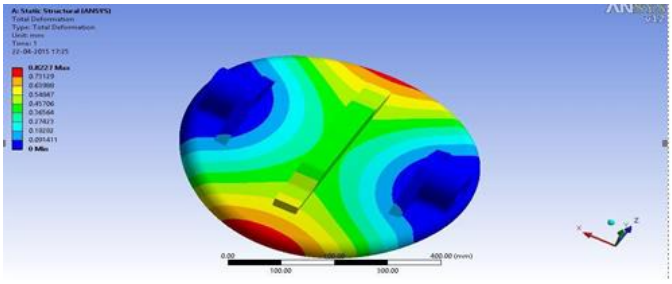


Fig14 : - Total Deformation

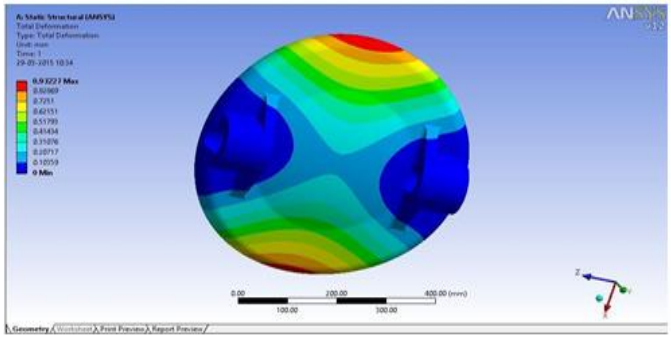


Fig 15:- Total Deformation of Dome shape having radius R700mm

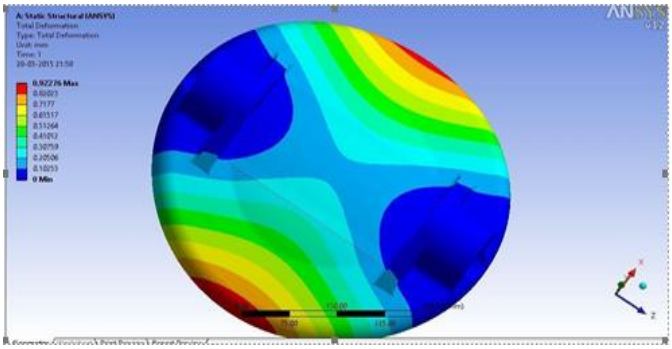


Fig 16 :- Total Deformation of Dome shape having radius R700mmwith 3 middle rib

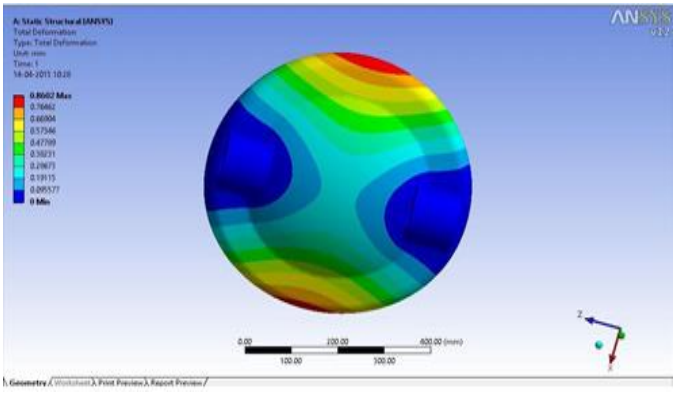


Fig17 :-Total Deformation of Dome shape having radius R300mm

Iteration No.	Specification of disc	Weight of disc in kg	Maximum principle stress	Deformation
1	As per the company data	91.71 kg	468.45 MPa	0.8227
2	Increase the thickness of By 10mm	89.323 kg	256.95 MPa	0.77173
3	Dome shape having r700 and rib	87.382 kg	531.84 MPa	0.93211
4	Dome shape having r700 and 3 rib	88.306 kg	514.68 MPa	0.92276
5	Dome shape having R500mm	88.91 kg	262.79 MPa	0.81079
6	Dome shape having R300mm	87.572 kg	372 MPa	0.8602

Result and conclusion

In this paper work an attempt has made for weight optimization of butterfly valve. Various models are created by changing the design parameters and analyses this models for better results. Experimental structural strain and stresses measured by actual pressurizing the valve body and compared it with FEA results. Strain gauge technique gives good results for the measurement of strain and stress at the point of interest. Results of finite element method for the structural analysis of valve body are well in agreement with experimental results, as the deviation is maximum deviation is unto 8.388 MPa and 2.4485 MPa which is allowable. Twenty one new different optimized models are created by changing design parameters and analyzed. As there is restrictions to change the flange dimensions, valve body thickness and rib dimensions.. Results of decreasing wall thickness and decreasing the rib thickness are better than only reduction in the reducing the wall thickness. The best optimized model is that in which shell thickness is reduced by 2mm, lifting rib decreased by 15mm and side rib by 10mm reduced 10.408kg weight, because the maximum stress level much lower than the yield stress value of material. In the optimization of disc we have observed that stress concentration on disc is reduces if we gives dome shape is given instead of plane shape. The best optimized disc model is selected from the finite element analysis result dome shape having radius 300 mm diameter. FEA results for this optimized model shows that the stresses in ribs also increased because of decrease the thickness.

Acknowledgement
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Design And Development Of Six Way Valve

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Abstract
The mechanical device that control the flow and pressure within a system or process is called valve. They are essential components of a piping system that conveys liquids, gases, vapors, slurries etc. The six-way valve is a fluid control valve whose body has six ports equally spaced round the valve chamber. For Modelling of valve CATIA V5 R20 software is used. This paper presents the issues on the formation of the innovation policy of a six way valve. Considerable attention is paid to the key problems faced in design and development of six way valve in modern conditions. The paper presents a comprehensive assessment of the innovative capacity of the six way valve. The measures to improve the organizational support of the innovation activities are determined.

Keywords: Six way valve, Ball valve, CATIA V5 R20

Introduction

A valve is device that directs or controls the flow of fluid or gas by opening, closing or partially obstructing various passageways. This system can be used in agricultural sector to provide the flow of fluid according to the requirements. In present days of competition it is very important to select the best of the available solution due to ever-increasing demand on engineers to lower the cost of production to withstand competition has prompted engineers to look for rigorous methods of decision making, such as optimization methods, to design and produce products both economically and efficiently. Furthermore advancing computer technology, computers are becoming more powerful, and correspondingly, the size and the complexity of the problems being solved using optimization techniques are also increasing. Optimization methods are coupled with use of modern tools of computer aided design to enhance the creative process of conceptual and detailed design of engineering systems. An optimal design is the best attainable solution to the design problem within the given constraints. Optimizing parameters which is to be minimized includes cost, weight, stress, deflection etc and parameters which is to be maximized includes power transmitting capacity, load carrying capacity, energy storing capacity etc. The aim of this project is to provide six outlets with one inlet keeping the pressure constant through every outlets and allow the flow from outlets according to requirements.

Problem Statement

The goal of this project is to develop a valve which can provide six outlet through one inlet keeping the pressure and flow constant.
The flow of fluid can be allowed or restricted through the outlets according to the requirement in agriculture, industrial and commercial applications.

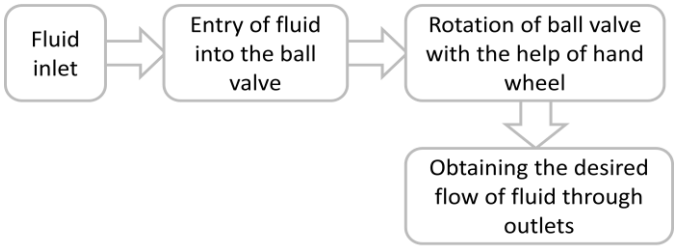
Market Survey

Market survey done by the field visit, farmers interaction, visit valve manufacturing industries. The field visit of valve manufacturing industries was most important to the investigating the exact requirement of fluid or gas as per requirement. The detail discussion about valve requirement concluded the different needs of farmers and industries.

Customer Needs Data

The six way valve is faster than conventional processes. In various fields such as agriculture and industries, variety of flow of fluid or gas is required. This variations cannot be satisfied with the general valves. With the six way valve it is possible to provide six outlets from one inlet according to the requirement.

Process of a work



Layout of processes

Working Action

The assembly of six way valve consist of upper casing, lower casing, ball valve, hand wheel. Six holes are drilled on the circumference of ball valve as well as on the circumference of the lower casing in order to satisfy the required mechanism. The stem is attached to the ball valve on to which hand wheel is connected, with the help of the hand wheel ball can be rotated inside the casing.

Concept Generation

The product concept is the description of the technology, working principles, and from of the product.The concept of a six way valve expressed in the three dimensional sketch on designing software as CATIA V5 R20 and accompanied a description. The concept generation processes being with a set of customer need and target a result in a set of product concept will make a final selection.

The following parts to be used in concept design

1)Ball Valve 2) Upper Casing 3) Lower Casing 4)Hand Wheel 5)Stem.

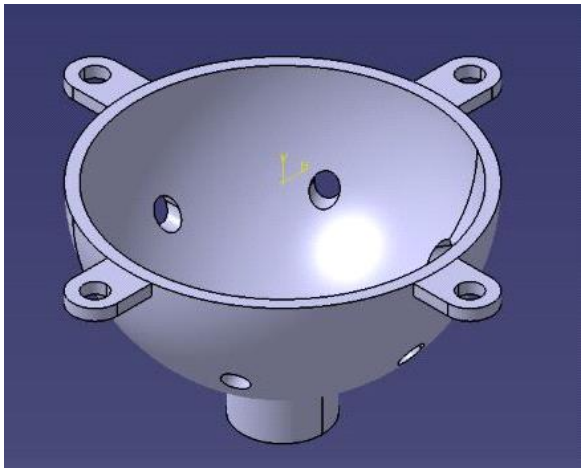


Figure: Lower Casing [3]

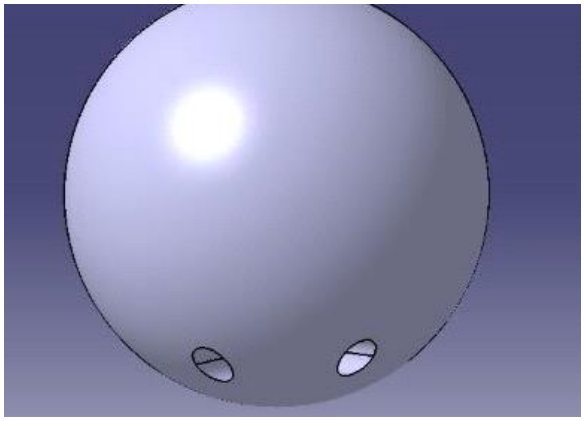


Figure: Ball Valve [1]

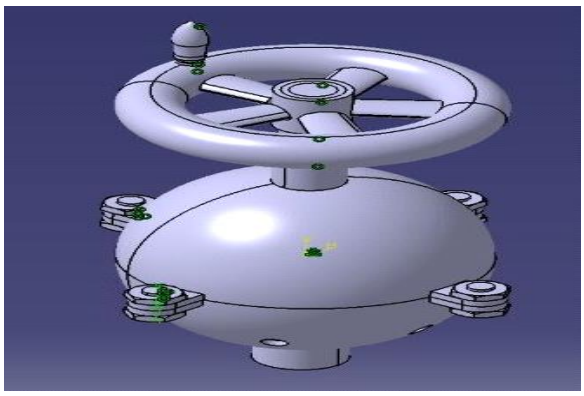


Figure: Assembly [3] [Concept 1]

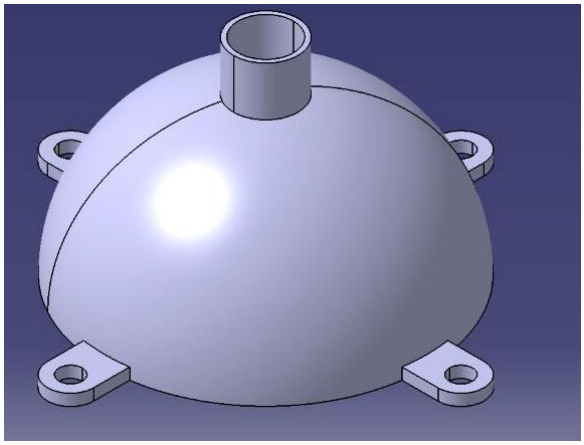


Figure: Upper Casing [2]

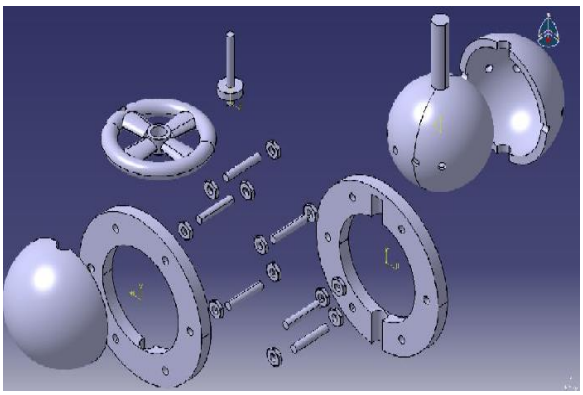


Figure: Details [4] [Concept 2]

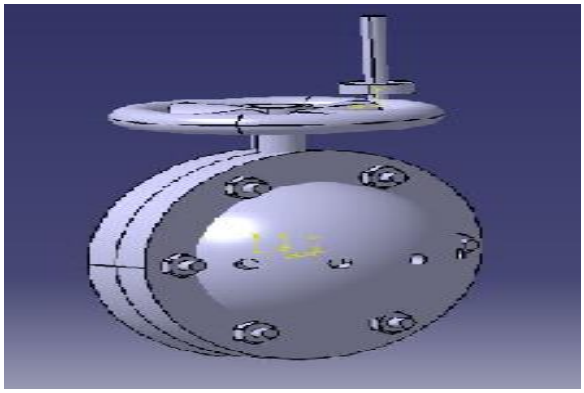


Figure: Assembly [5] [Concept 2]

Material Selection

The challenge in making a material choice is actually verifying that the chosen material best fits the application. This involves taking into account working conditions and flow media properties. Most important concerning the working conditions is to know the pressure and temperature ratings and for working media is to take in consideration corrosive and erosive properties. some of the important parameters considered during selecting the materials are as follows

Withstanding Stresses: Strength in a valve is its ability to withstand the internal stresses generated by containing and controlling the fluid under pressure. Strength can be measured in several ways, but the most common measure is by quantifying the metal's tensile strength. Tensile strength is the resistance of the metal to stretch or break when pulled. The ability of the metal to stretch slightly is called "ductility," and some ductility is generally useful in valve applications. But not all metals have good ductility. For example, cast iron is not ductile at all and it bends very little before it breaks. This lack of ductility is called "brittleness." While brittleness is expected in cast iron, it is not expected and definitely not wanted in most valve metals such as cast steel. Generally, the brittle cast irons are only used for lower pressures, particularly below 300 psi and in situations where water hammer is not an issue. Higher pressures are reserved for the stronger and more ductile steel and high alloy valves.

Corrosion Resistance: The second major consideration in choosing a valve material is its corrosion resistance. Corrosion is the breakdown of a metal due to attack by various chemical reactions. We all have seen corroded bolts or rusted out fenders on a car. This rust and corrosion is a result of a chemical oxidation of the steel caused by a combination of oxygen and iron, with moisture helping to accelerate the process. In valve materials, basic exterior rusting of the valve is usually secondary to the corrosion going on within the valve due to the unique characteristics of the fluid contained inside it. Some fluids result in virtually no corrosive action to the inside of the valve. For example, steel valves in non-sour crude oil service could conceivably last forever, because the clean oil keeps the corrosion and oxidation from occurring, and the lubricity of the oil keeps the valve in tip-top shape. Another important aspect of a valve material's strength is that metals become softer and lose their strength as the operating temperature is raised. For example, a low-carbon-steel, grade WCB valve has an operating pressure of 285 psi at 100 degrees, but only 50 psi at 900 degrees! The dangers of corrosion damage are particularly high in the chemical manufacturing industry where the issues of strong chemicals, high pressures and high temperatures cross paths. The harsh acids and other compounds can sometimes eat through metals such as iron and steel in a matter of days or even hours. The development of corrosion-resistant alloys was borne out of the necessity to help contain and control the flow of these products. These corrosion-resistant alloys are in the family of nickel alloys commonly known as stainless steels. Most of them are an alloy of chromium and molybdenum, plus other elements that combine to create their corrosion resistant armor.

Valve Body: Valve body or shells are usually manufactured from a combination of castings. The castings are made by pouring molten metal into a mold or pattern of the appropriate shape. The parts are then removed from the mold, cleaned up and machined as necessary.

Concept Selection

The concept selection is the process of narrowing the set of concept alternatives under consideration. Although concept selection is a convergent process, it is frequently iterative and many not produce a dominant concept immediately. A large set of concept is initially winnowed down to a smaller set, but these concepts may subsequently be combined and improved to temporarily enlarge the set of concept under consideration. The concept selection on two process but here we use a concept screening method.

Table:-1 Concept Selection by Screening

Selection Criteria	Concept 1	Concept 2
Easy to Handle	+	+
Easy to use	+	+
Readability of settings	-	+
Does metering accuracy	-	+
Durability	-	+
Ease of manufacturing	+	-
Portability	-	+
Sum + 's	3	6
Sum - 's	4	1
Net Score	-1	5
Rank	**2**	**1**

The process of concept selection we select a concept no 2 is the most efficient concept. Therefore we select the concept no 2.

Conclusion

The six way valve has been developed which is able to provide six outlets from one inlet according to the requirement. The valve needs the modification in a design. The six way valve can be manufactured at a well equipped mechanical workshop without any sophisticated machinery.

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Design and Optimization of Steering Knuckle with Integrated Spindle

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Abstract
Steering Knuckle is linked with other linkages and supports the vertical weight of the car, hence plays major role in many direction control of the vehicle. It requires high quality, durability and precision. The main objective of this paper is to explore performance of the steering knuckle. This can be achieved by performing a detailed load analysis. Therefore, this study has been dealt with two steps. First part of the study involves the determination of loads acting on the steering knuckle through hand calculations. Then the stress analysis will be performed using analysis software and based on it optimization of steering knuckle will be suggested. This may also improve the depth knowledge of its function and performance in terms of durability and quality.
Keywords: Spindle, Optimization, Stress Analysis, EN8, Redesign Knuckle

Introduction

Steering knuckle is main part in any vehicle because it requires lots of attention in selection because once it is damaged then it has to be replace with the new one. Steering knuckle is a prominent component in car which takes the loads from the wheels and transfers these forces to the suspension system. Structural Components such as a steering knuckle might be strong enough to withstand a single applied load but has a chance to fail when subjected to a fatigue or dynamic loads. Depending on the vehicle and suspension design, the steering hub or spindle will also vary slightly. In the case of all front wheel drive or vehicles, the steering knuckle will also be the location where the power steering comes into play.

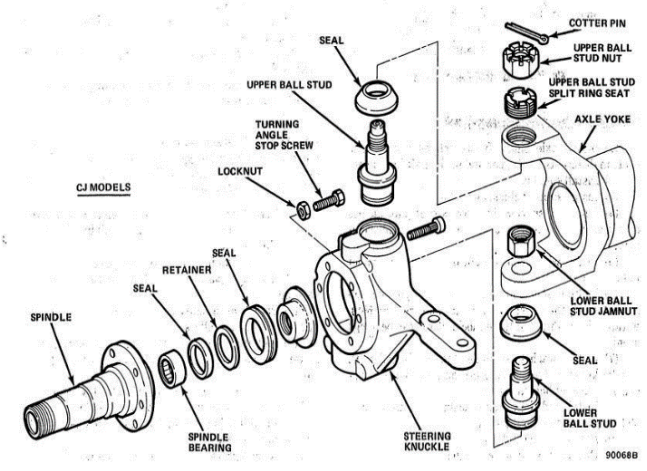

Figure 1: Exploded view of Knuckle joint with spindle

The vehicle wheel mounts to the exterior portion of the knuckle with the help of attaching itself to a spindle or a hub as shown in fig.1. The suspension inboard connection and the tie rod will attach through the using a special mounts that allows the knuckle to pivot when the steering wheel is turned. To put this in simpler terms, the steering knuckle holds the wheels in place on the vehicle and lets you change the direction that you are driving.

Literature Review

Mehrdad Zoroufi and Ali Fatemi [1], this research program aimed to access fatigue life and compare fatigue performance of steering knuckles made from three materials of different manufacturing processes. These include forged steel, cast aluminum, and cast iron knuckles. In light of the high volume of forged steel vehicle components, the forging process was considered as base for investigation. Monotonic and strain-controlled fatigue tests of specimens machined from the three knuckles were conducted. Static as well as baseline cyclic deformation and fatigue properties were obtained and compared. In addition, a number of load-controlled fatigue component tests were conducted for the forged steel and cast aluminum knuckles. Finite element models of the steering knuckles were also analyzed to obtain stress distributions in each component. Based on the results of component testing and finite element analysis, fatigue behaviors of the three materials and manufacturing processes are then compared. It is concluded that the forged steel knuckle exhibits superior fatigue behavior, compared to the cast iron and cast aluminum knuckles.

Chang Yong Songa, Jongsoo Lee [2], this paper discusses reliability-based design optimization (RBDO) of an automotive knuckle component under bump and brake loading conditions. The probabilistic design problem is to minimize the weight of a knuckle component subject to stresses, deformations, and frequency constraints in order to meet the given target reliability. The initial design is generated based on an actual vehicle specification. The finite element analysis is conducted using ABAQUS, and the probabilistic optimal solutions are obtained via the Moving Least Squares Method (MLSM) in the context of approximate optimization.

For the meta-modeling of inequality constraint functions, a constraint-feasible moving least squares method (CF-MLSM) is used in the present study. The method of CF-MLSM based RBDO has been shown to not only ensure constraint feasibility in a case where the meta-model-based RBDO process is employed, but also to require low expense, as compared with both conventional MLSM and non-approximate RBDO methods. The conclusions were that the braking stress is more critical than the bump stress for a wishbone-type knuckle. Constraint-feasible meta-model-based RBDO methods improve design performance under both bump and braking conditions and satisfy the given target reliability.

Wan Mansor Wan Muhamad [3], the study emphasizes about the effect on fuel efficiency by the reduction in the mass of the steering knuckle. The shape optimization technique is used to achieve this. Hyper works was used to achieve this result. The finite element model was prepared using hyper mesh and the analysis is done using Optistruct software. The static analysis is carried out by applying dynamic loading conditions and optimization was done using shape Optimization method. The results showed that there was 8.4% reduction in mass of steering knuckle. It has also been observed that the maximum stress has not changed significantly. Therefore, the overall weight of the vehicle can be reduced to achieve savings in costs and materials as well as improve fuel efficiency and reduce carbon emissions to sustain the environment.

Viraj Rajendra Kulkarni [4],This paper focuses on optimization of steering knuckle targeting reducing weight as objective function, while not compromising with required strength, frequency and stiffness. Taking into consideration static and dynamic load conditions, structural analysis and modal analysis were performed. Finite element model was developed in Hyper-Works. 10 node tetrahedral elements were used for meshing, providing better results in less time. On constraining the knuckle, combined load of brake torque on the caliper mounting, longitudinal loads due to traction, vertical reactions due to weight and steering reaction, the finite element model was solved using RADIOSS solver. The stress levels and deformation was checked using Hyper-View for static as well as dynamic conditions.

FEA results were verified by analytical calculations. Optistruct solver was used for performing Topology Optimization to minimize the amount of material to be used and setting geometric parameters as design variables. Optimization method used in this study in reducing the mass of the existing steering knuckle to 53.33%. This implies the first CAD model was over designed. Even if slightly optimized model would been investigated observing results the reduction of mass would have definitely been over 10%. The maximum stresses and displacement is within control and yielding a factor of safety around 2.8 to 3 necessary for such a crucial part in an automobile. Displacement is under 0.08 mm and frequency obtained is at higher range thus eliminating cause of resonance. Geometric model was modified and iterated until satisfactory results were achieved.

Mahesh P. Sharma [5], has studied static analysis of steering knuckle is carried out. Design a knuckle which accommodates dual caliper mountings for increasing braking efficiency & reducing a stopping distance of a vehicle. CAD modal of knuckle was prepared in CREO2.0. Static analysis was done in ANSYS WORKBENCH by constraining the knuckle, applying loads of braking torque on caliper mounting, longitudinal reaction due to traction, vertical reaction due to vehicle weight and steering reaction. Also, reducing the weight of vehicle component plays vital role in increasing efficiency of vehicle and reducing fuel consumption. The study also illustrates the shape optimization of same knuckle and saved material resource. Shape optimization of knuckle was done using ANSYS WORKBENCH making objective function as reducing weight. These FEA results are verified by comparing with analytical calculations. Considering these results modal is modified.

B.Babu,M.Prabhu,P.Dharmaraj et al.[6],Have studied steering knuckle plays major role in many direction control of the vehicle it is also linked with other linkages and supports the vertical weight of the car. Therefore, it requires high precision, quality, and durability. The main objective of this work is to explore performance opportunities, in the design and production of a steering knuckle. This can be achieved by performing a detailed load analysis. Therefore, this study has been dealt with two steps. First part of the study involves modeling of the steering knuckle with the design parameters using the latest modeling software, and also it includes the determination of loads acting on the steering knuckle as a function of time. This is done for finding out the minimum stress area. Then the stress analysis was performed using analysis software. The steering knuckle can be modeled, and analyzed under the actual load conditions.This may also improve the depth knowledge of its function and performance in terms of durability and quality.

The steering knuckle has been modeled and analyzed using CATIA. The various parameters such as Nodal displacements, Stress distribution are completely analyzed and studied. This study shows that the areas where the stress concentration is maximum due to the applied load and the portions that have to be considered in the design of steering knuckle in order to avoid frequent failures to improve its reliability.

Purushottam Dumbreet al.[7],Have studied the weight of the vehicle is going on increasing due to additional luxurious and safety features. The increasing weight of the vehicle affects the fuel efficiency and overall performance of the vehicle. Therefore the weight reduction of the vehicle is the real need of today‟s automotive industry. Steering knuckle is one of critical component of vehicle. It links suspension, steering system, wheel hub and brake to the chassis. There is scope to reduce the unsprung weight vehicle. Steering Knuckle is a non-standard part and subjected to various loads at different conditions. Weight reduction of steering knuckle is the objective of this exercise for optimization. Typically, the finite element software like OptiStruct (Hyper Works) is utilized to achieve this purpose. For optimization, Nastran / Ansys / Abaqus could also be utilized. The targeted weight or mass reduction for this exercise is about 5% without compromising on the structural strength.

Kamlesh Chavan et al.[8],Have studied the steering knuckle on your vehicle is a joint that allows the steering arm to turn the front wheels. The forces exerted on this assembly are of cyclic nature as the steering arm is turned to maneuver the vehicle to the left or to the right and to the center again. For the proposed work over the `steering knuckle‟, the objective is to identify the nature and magnitude of stresses over the component while contemplating improvement in the design. Taking into consideration static and dynamic load conditions, structural analysis and modal analysis were performed. Finite element model was developed in Hypermesh10. 10 node tetrahedral elements were used for meshing, providing better results in less time. FEA/ CAE software like Abacus solver shall be engaged to simulate and predict the level of stresses for the given input loads. OptiStruct is used as optimization tool for finding out the stress distribution, density distribution

over the component. After analyzing the result from OptiStruct the component is modified by removing the material from low stress region. For validation of the project experimental setup was designed which consist of Universal Testing Machine for applying strain gauge for measuring the displacement and suitable fixture for holding the component is used. After applying the loading the stress and displacement are recorded. It observed that part is safe under given loading conditions and percentage variation of result with the FEM analysis is found out.

Patel Akash A.[9],Has studied the purpose of analysis the acting force upon the steering knuckle while in track or random load for a vehicle. Steering knuckle is main important part in the vehicle because that requires lots of attention in selection because once it is damaged then it have to replace with the new one. Structural Components such as a steering knuckle might be strong enough to withstand a single applied load. But what happens when the part operates over and over, day after today? To predict component failure in such cases requires what‟s called fatigue or durability analysis.

For our purposes, a constant or static load does not cause failure. What counts is the impact of working or fluctuating loads. Failures or fractures take place when cracks get so large that remaining material can no longer endure stresses and strains. In classic structural analyses, failure predictions are based solely on material strength or yield strength. Durability analysis goes beyond this, evaluating failure based on repeated simple or complex loading.

S. Vijayarangan, N. Rajamanickam, V. Sivananth [10],Have done the structural analysis of steering knuckle made of alternate material Al-10 wt.% Tic was performed using commercial code ANSYS. The results of steering knuckle made of MMC (Al-10 wt. % Tic) were compared with that of aluminum alloy and SG iron steering knuckles for its performance based on real time load cases. It is found from this analysis; the knuckle strut region has maximum stress and deflection during its life time. The critical strut region cross section area of knuckle was analyzed and geometrically optimized for minimum bending stress and deflection using genetic algorithm available in Mat Lab. Since, the knuckle experiences time varying loads, fatigue analysis also performed on MMC model before and after optimization. The life of the MMC knuckle is evaluated for maximum load case. The results obtained from numerical analysis and experimental testing encouraged using particulate reinforced metal matrix composites for critical component steering knuckle with a weight saving about 55% when compared with currently used SG iron.

Literature gap:

- In above literature study only simple knuckle has been considered but in my study steering knuckle can be made compact by integrating with spindle which helps in good steering capabilities, cost reduction, fuel efficiency etc.
- Redesigning the knuckle in CATIA V5 with an integrated steering knuckle.
- After redesign of steering knuckle is to verify by using ANSYS, HYPERMESH to perform finite element analysis. The static structural analysis is done.
- The experimental analysis is done on universal testing machine. And axial and bend test the results are obtained to find its performance.
- The results from experimental testing are to compare on software and the theoretical study and find out prediction of best solution can be conclude

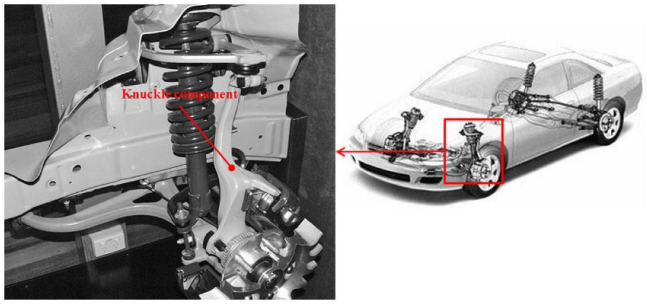

Figure 2. : Location of Steering Knuckle in Car

Steering Knuckle

Steering knuckle requires lots of attention in selection because once it is damaged then it have to replace with the new one. This problem can be solved by redesigning the steering knuckle. So, the steering knuckle can be made compact by integrating with spindle which helps in good steering capabilities and in turn saves cost. The study is performed to find out best possible solution & improve strength. The Redesign of steering knuckle is to verify by using customize package of ANSYS, HYPERMESH to perform finite element analysis. The static stress analysis is Perform and the results are compared with theoretical calculations.

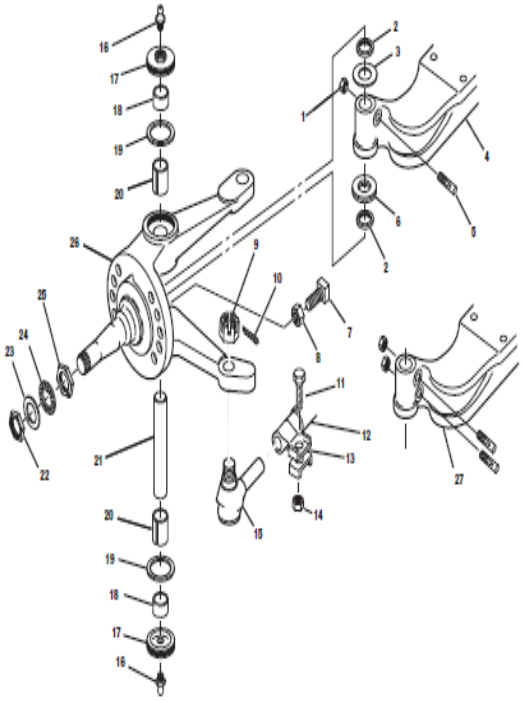

Figure 3 : E Family Steering Knuckle Exploded View

1 - Nut, Draw Key	10 - Pin, Cotter	19 – Gasket
2 - Seal, Grease	11 - Bolt, Clamp	20 – Bushing
3 – Shim	12 - Tube, Cross	21 – Kingpin
4 - Axle Beam	13 – Clamp	22 - Nut, outer Spindle
5 - Key, Draw	14 – Nut	23 - Washer, Retainer
6 - Bearing, Thrust	15 - Tie Rod End	24 - Washer, Spindle
7 - Screw, Stop	16 - Lube Fitting	25 - Nut, Inner Spindle
8 - Nut, Jam	17 - Cap, Knuckle	26 - Steering Knuckle
9 - Nut, Slotted	18 - Foam Insert	27 - Dual Draw Key Beam

Steering knuckle consist of bearing hub, steering arm and suspension brackets. Dimensions are required for calculating of boundary conditions for vehicle dynamics equations. Hence its CAD model is necessary. The conventional model used by Alto vehicles is non-integrated spindle. One of its engineering services vendors Zest Technology has provided the step file of conventional CAD model, which is made by the commands in CATIA of Pad, pocket, fillet, and geometrical selections in part design module. Dimensional parametric model is generated in drafting module of CATIA having top, side and front view as given below. Parametric generation of drawings will help to get the dimensions useful in forces calculations in static and dynamic loading conditions on steering knuckle.

A one-piece steering knuckle assembly for vehicles has a flanged body wherein the tie rod arm, hydraulic brake caliper bracket and, in some instances, the steering arm extend from the flanged body in a one-piece forged manner. There are enlarged bosses extending from the flanged body opposite the wheel spindle, the bosses having a bore which are axially aligned to receive a king pin. The flanged body, wheel spindle, tie rod arm and brake caliper bracket are all formed from a single steel billet as a one-piece heavy duty forging. Such a design eliminates the brake caliper/knuckle joint and the tie rod arm/knuckle joint, and thus, it results in savings in assembly time and weight.

Figure 4 : Conventional Steering Knuckle

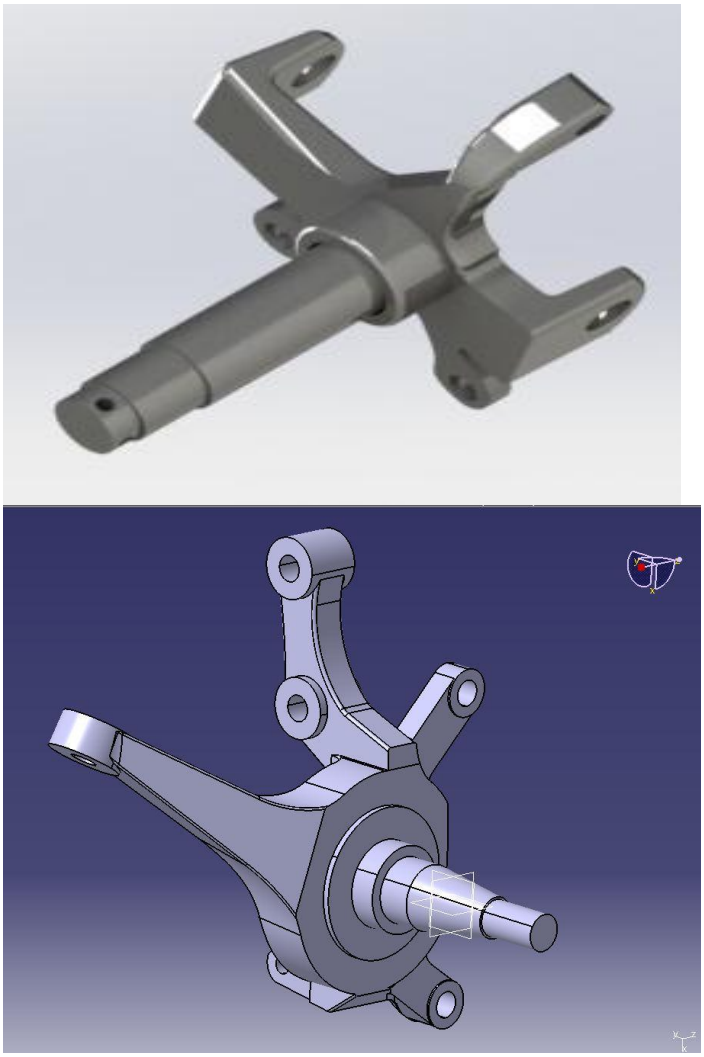

Figure 5 : CAD model of Steering Knuckle with integrated Spindle

The proposed model provides a one-piece steering knuckle assembly for vehicles such as trucks or the like wherein a hydraulic brake caliper bracket is provided and Wherein a Wheel spindle, tie rod arm and brake caliper bracket are integrated into the flanged body in a one-piece manner. There are enlarged bosses extending from the flanged body opposite the Wheel spindle, the bosses having a bore Which are axially aligned to receive a king pin. The flanged body, Wheel spindle, tie rod arm and brake caliper bracket are all formed from a single steel billet as a one piece heavy duty forging. Such a design eliminates the brake caliper/knuckle joint and the tie rod arm/knuckle joint, and thus, it results in savings in assembly time and Weight.

Final Prototype

The experimental investigation is performed on fabricated prototype on universal testing machine. Compression test and axial test has been performed on the prototype of integrated steering knuckle produced. The input conditions are recreated in the lab while the component is being tested. The boundary and loading conditions are matching the practical working conditions in which the vehicle is expected to perform. An

equivalent maximum load of 1400 N is applied on the prototype for testing purpose.

Figure 6: Final prototype of integrated steering knuckle with fixture plate

1) Objective of Experimentation:

The stress analysis of an integrated steering knuckle, which is employed in 4 wheeler belonging to the medium segment of the Indian automotive market. In the design of this kind of integrated steering knuckle both the elastic characteristics and the fatigue strength have to be considered as significant aspects. In addition to this particular elastic property, as a result of the research effort in reducing the mass of components typical of the automotive industry, these springs have to face very high working stresses. The structural reliability of the steering knuckle must therefore be ensured. So for this purpose the static structural (stress) analysis using finite element method has been done in order to find out the detailed stress and displacement distribution of the integrated steering knuckle.

The modified simple steering knuckle is manufactured as per the dimensions obtained. The integrated steering knuckle stress and deflection is obtained and verified by software. This knuckle testing is Perform for finding its behavior in the practical application. The knuckle testing is carried out under atmospheric conditions. The parameter study is performed for the variation which is studied in software verification. The overall objective is to determine the stress and deflection with respect to the load variation.

2) Components:

The experimental set up consists of following components

- Test component – Prototype of Integrated steering Knuckle.
- Load frame - Usually consisting of two strong supports for the machine.
- Load Cell- A force transducer or other means of measuring the load.
- Cross head - A movable cross head (crosshead) is controlled to move up or down. Usually this is at a constant speed: sometimes called a constant rate of extension (CRE) machine.
- Means of measuring extension or deformation - Many tests require a measure of the response of the test specimen to the movement of the cross head. Extensometer is sometimes used.
- Output device - A means of providing the test result is needed. Some older machines have dial or digital displays and chart recorders. Many newer machines have a computer interface for analysis and printing.
- Conditioning - Many tests require controlled conditioning (temperature, humidity, pressure, etc.). The machine can be in a controlled room or a special environmental chamber can be placed around the test specimen for the test.
- Test Fixtures, specimen holding jaws, and related sample making equipment.

3) Description of Machine:

The component produced for the experimentation which is used for the testing. The input conditions are recreated in the lab while the component is being tested for performance. The loading and the boundary conditions will be matching the practical working conditions in which the vehicle is expected to perform. For simplicity, a Universal Testing Machine is engaged along with a suitable fixture for the component testing purposes and load cell are being used for recording the displacement in the component while loading. The load applied is 5000N which is the maximum load acting along the strut region.

C. Specimen:

1) Integrated steering knuckle

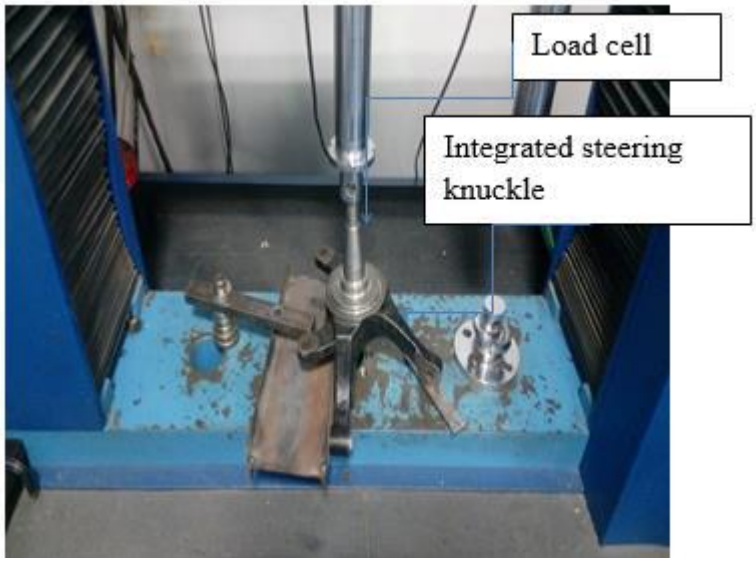

Figure 7: Experimental set up of integrated steering knuckle for lateral test

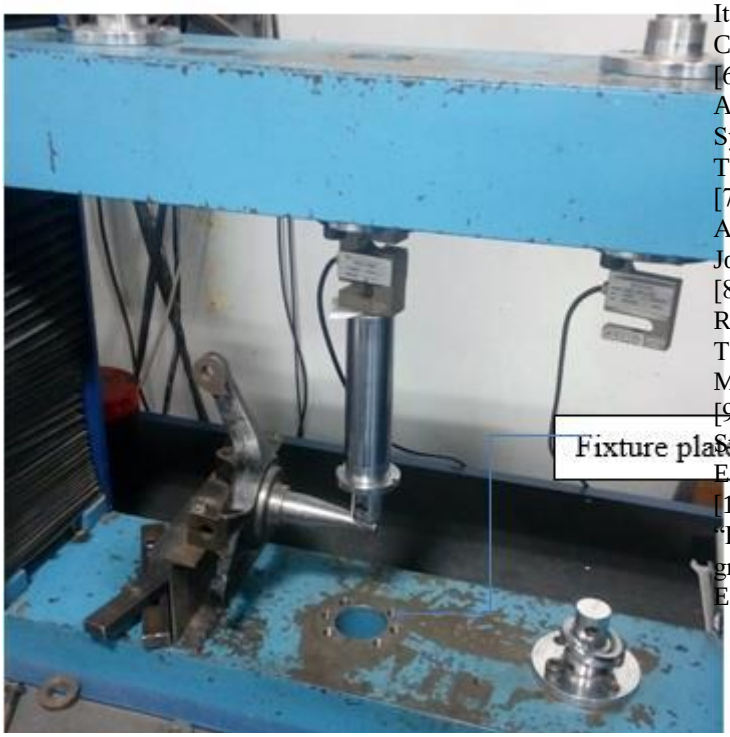

Figure 8: Experimental set up of integrated steering knuckle for longitudinal (bend) test

Conclusion

In most of the cases steering knuckle faces a problem that once it is damaged it has to be replaced by other. So, here is a scope for us to improve. We can make use of a spindle that is integrated with steering knuckle and check for its improved performance. Integration of spindle with knuckle will help to withstand the dynamic loads and prevent sudden damage. Also its weight can be optimized and expected to perform under better fuel efficiency

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Design and Development of Automatic Pneumatic Bumper for Four Wheeler

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Abstract
The technology of electronics plays a major role in the field of automation. The aim is to design and develop a control system based on electronically control bumper activation is called Automatic Pneumatic Bumper System. This project consists of Ultra-sonic sensor module, Control Unit, bumper system. The Ultra-sonic sensor senses the obstacle. If there is any obstacle closer to the vehicle (within 60cm), the control signal is given to the control unit and actuate the pneumatic system. The bumper comes forward, Bumper system is provided for protection of vehicle engine and damage of the vehicle.

Keywords: Automatic, Ultrasonic sensor, Pneumatic, Bumper, Actuator.

Introduction

India is the largest country in the use of various types of vehicles. As the available resources to run these vehicles like quality of roads, and unavailability of new technologies in vehicles are causes for accidents. The number of peoples which are dead during the vehicle accidents is also very large as compared to the other causes of death. There are different causes for these accidents, so today implementation of proper automatic pneumatic bumper system for four wheeler to reduce the damage is must for vehicles. We have pleasure in introducing our new project “Design and Development of Automatic Pneumatic Bumper System for Four Wheelers”, which is equipped by ultrasonic sensor circuit and Pneumatic bumper activation circuit.

Sometime driver may not able to pay the full attention during night travelling so there are many chances to accidents. In currently used vehicles generally bumpers used are of rigid types. These bumpers have specific capacity and when the range of the accidental force is very high then the bumpers are fails and these force transferred towards the passengers and frontal assembly of vehicle. So to reduce the damages due to bumper failure we design the automatic pneumatic bumper system, in which ultrasonic sensor measure the distance between the front obstacles and sends the signal to control unit. Control unit operates solenoid valve, due to that pneumatic actuator starts working and bumper changes it's position in forward direction. After the obstacle goes away from vehicle, actuator comes in it's original position. The project involves whenever the obstacle comes in front the car the sensor senses the obstacle and command to control unit which operates pneumatic actuator and the bumper extend out, by which we can reduce damages of car. This system plays very important role to reduce damages of cars and also helpful for saving human life. This system is suitable for all types of vehicle like cars, trucks, buses, etc.

Literature Review

Rohit P. Jain, Dr. V. Singh [1] the infrared sensor light is emitted by emitter, any object in the path of emitted light is reflect. the detector collects reflected light and further gives control signal to control unit, and solenoid valve activated. The oil passes to the double acting hydraulic cylinder, which further moves the bumper. Provide benefit of automated movable bumpers to avoid accident. The bumper system has been designed to satisfy the safety norms Economic commission for Europe (ECE 26).

Shrinivasa Chari v, Dr. Venkatesh P. R., Dr. Prassana Rao N. S. , Adil Ahmed S. [2] the infrared sensor used for detecting obstacle and proximity sensor used for detecting

speed. The pneumatic bumper activated only when the vehicle speed above 30-40 km per hrs. and obstacle within 3-4 feet. Bumper activation system is depend on the vehicle speed.

Mr. Shinde Abhijeet B., Mr. Panase Prathamesh S. ,Mr. Chemate Pravin D. , Mr. Pawar Sandip R., Prof. Dhage S. K. [3] the system consist of automatic breaking and pneumatic bumper system. When obstacle comes in front of vehicle automatic breaking system activated, simultaneously when driver try to apply break then automatic bumper system is activated. By using this system can obtain control over the speed in short distance and reduce the damage of vehicle.

Mr. Nivesh Thepade, Mr. Lakhan Thombare, Mr. Pritish Varude, Prof. Ashish Umbarkar [4] proximity sensor senses nearby obstacle and give signal to computer circuit which gives output to transistor circuit. Transistor circuit controls motor by relay and pneumatic circuit actuators like solenoid valve. The solenoid valve actuates bumper. Improve the technique prevention of accident and by implementing this system reduce cost of high end cars by giving similar kind of safety.

Amol Karad, Yogesh Bhuse, Rohan Jadhav, Rahul Koyande, Prof. Aher S. S. [5] infrared sensor operate control unit and control unit cut off power supply of engine when obstacle in front of vehicle, simultaneously by limit switch automatic bumper system activates. Braking system works by two method with safety of vehicle.

Prof. Amir Sayed, Vipin Raut, Nikesh Khobragade [6] uses infrared sensor which is used to sense the vehicle coming in front of our vehicle. The sensor sends feedback signals to engine through the relay control to activate the solenoid valve which allows the flow of compressed air to the cylinder during the working of automatic pneumatic bumper system simultaneously the driver also try to stop the vehicle by applying brake pedal which somewhat slows down engine, this system provides pre-crash safety to the vehicle. By using the automation, bumper of vehicle extended out and provide safety to vehicle.

Problem Statement

The system consist of ultrasonic sensor, control unit and pneumatic bumper system. The ultrasonic sensor is used to detect the obstacle which comes in front of vehicle within a distance 1 meter, the pneumatic bumper activated only when the vehicle speed above 30-40 km per hours. There is any obstacle closer to vehicle the ultrasonic sensor sends signal to control unit and it operates the pneumatic actuator which is connected to bumper of vehicle, bumper comes forward and reduce damage to vehicle. This is feasible to design and manufacture.

Methodology

A. **Ultrasonic Sensor**

Ultrasonic sensor are divided into three broad categories: transmitters, receivers and transceivers. Electrical signals are converted into ultrasound by Transmitters, receiver converts ultrasound again into electrical signals , and transceivers can do both transmit and receive ultrasound. In a similar way to radar and sonar, ultrasonic transducers are used in systems which evaluate targets by interpreting the reflected signals. For example, the distance of an object can be calculated by measuring the time between sending a signal and receiving an echo. Ultrasound can be used for measuring wind speed and direction (anemometer), tank or channel fluid level, and speed through air or water. Device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water, for measuring speed or direction. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. The applications which uses ultrasonic sensors are medical ultrasonography, humidifiers, sonar, non-destructive testing, burglar alarms and wireless charging.

Ultrasonic transducers convert AC into ultrasound, as well as the reverse. Ultrasonic, typically refers to piezoelectric transducers or capacitive transducers. When voltage is applied to Piezoelectric crystals, they change size and shape ; AC voltage makes them oscillate at the same frequency and produce ultrasonic sound. Capacitive transducers use electrostatic fields between a conductive diaphragm and a backing plate. Ultrasound transmitters can also use non-piezoelectric principles. such as magnetostriction. Materials with this property change size slightly when exposed to a magnetic field, and make practical transducers. It is the sensors measure distance by using ultrasonic waves. They are best suited for the detection of transparent and dark objects, reflective surfaces, shiny objects and of bulk materials and liquids. Ultrasonic sensors allow for the measurement and reliable detection of objects. They send pulsed ultrasonic waves of a certain frequency and determine the objects distance from the duration of the ultrasound that it reflects

Table 1: Electric parameter of ultrasonic sensor

Working Voltage	DC 5V
Working Current	15mA
Working frequency	40Hz
Max. ramge	4m
Min. ramge	2cm
Measuring angle	15degree

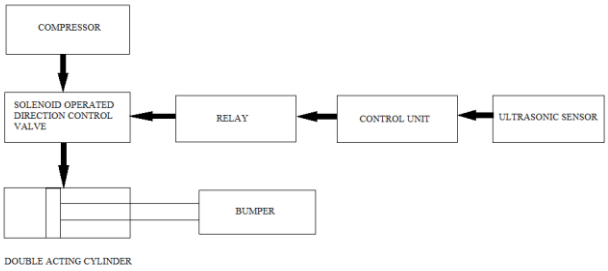

Figure 1 : Schematic system diagram

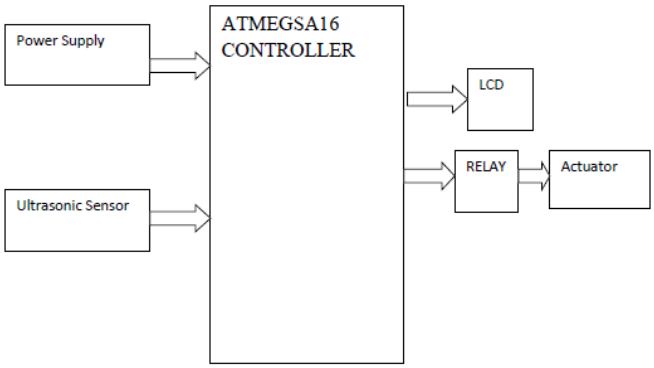

Figure 2 : Power Supply to system

Figure 3 : Sensors

B. **Control Unit**

System uses a bridge rectifier, it is an Alternating Current to Direct Current converter that rectifies mains AC input to DC output. A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This rectifier use for the purpose of when we have alternating current as a input. It is combinations of resistors, inductors and capacitors. Electronic filters are circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal, it convert pulsating direct current to pure direct current. Regulator is electronic device which maintain the constant voltage. In our project we use 7805 voltage regulator, because we require 5v at output of regulator.

C. **Pneumatic Bumper**

Pneumatic cylinder are mechanical devices which use the power of compressed air to produce a force in a reciprocating linear motion. Something forces a piston to move in the desired direction just as n case of hydraulic cylinders. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers prefer to use pneumatics because they are cleaner, quieter and do not require large amounts of space for fluid storage. Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement.

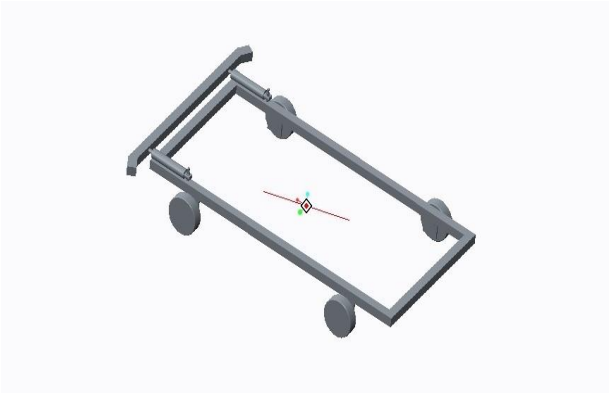

Figure 4 : Bumper Assembly for four wheeler

Conclusion

The main aim of this work is to improve the accident prevention technique, also it aims in reducing the hazard from accidents like damage of vehicle, injury of humans, etc. This project work has provided us an excellent opportunity to use our limited knowledge. We are feeling that we have completed the work within time successfully. This system can be installed in both heavy duty as well as medium duty vehicles. Hence by using this system the accidents and damage to the vehicles can be minimized.

Acknowledgment

This project work is supported by Associate Professor I/C H.O.D. of Mechanical Department AGCE, Satara and Guide Mr. Kamble A. V. .

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EXPERIMENTAL ANALYSIS OF HEAT TRANSFER ENHANCEMENT BY USING VARIOUS INSERTIONS OF TWISTED TAPES

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Abstract

There is need to increase in performance of thermal systems. The performance of thermal systems like heat exchanger can be increased by using various heat transfer techniques. Heat exchangers are widely used in many industrial sectors for both heating and cooling. The thermal performance of heat exchanger can be successfully increased by various insertions of twisted tapes in the flow passage [1]. The twisted tapes used are twist with plain single twisted tape, twisted tape with drilled holes, and twisted tape with clockwise and anti-clockwise direction [2] with twist ratio of 9.23 and 9.16. The twisted tape tabulators are a device for increasing the heat transfer rate in the heat exchanger system. Due to these insertions it is observed that an increase in Reynolds number (Re), the heat transfer coefficient increased, where as the friction factor decreases.

Keywords: Heat transfer enhancement, twisted tapes, twists ratio, Reynolds number, Heat transfer coefficient, Friction factor.

Introduction

The heat is defined as the form of energy which can be transferred from one system to another system across their boundaries due to temperature difference existing between the two systems. During heat transfer, it is observed that the heat energy always flows in direction from higher temperature medium to lower temperature medium and the transfer of heat energy stops once both the medium reach to their equality of temperature. Several heat transfer enhancement (HTE) techniques have been used in many engineering applications such as nuclear reactor, chemical reactor, chemical process, automotive cooling, refrigeration and heat exchanger etc. Heat exchanger is device used in many industries to recover the waste heat. Heat exchanger with the convective heat transfer of fluid inside the tubes is frequently used in engineering application. In many industries to augment of heat transfer is utilize many technical methods are used and most one of the method is twisted tape insert in the concentric tube. These techniques are also referred as Heat transfer Enhancement or Intensification. Augmentation techniques increase convective heat transfer by reducing the thermal resistance in a heat exchanger. Twisted tapes a type of passive heat transfer augmentation techniques have shown significantly good results in past studies.

Modes of heat transfer:-

The heat can be transfer from one substance to another substance by the following three modes:

1. Conduction
2. Convection
3. Radiation

All modes of heat transfer require to existence of temperature difference and the heat is always transferring in the direction of decreasing temperature.

Significance of study

After achieving the objective, the manufacturing industry will have an alternative method un saving the cost of production and increasing the rate of production. By determining the heat transfer coefficient, the industrial could use the method to control the rate of heat transfer for cooling system such as heat transfer in heat exchanger. In normal situation, Worker that handle the heat exchanger must have specific experience and skills. This study also helps the non-Experience workers to handle the heat exchanger in obtaining the optimum rate of heat transfer. On the other hands, using air as the heat transfer fluid minimize the friction in the tube. Thus a further study is needed in order to accomplish the vision and within given the limitation. Some of the research questions that has been proposed through this paper is method to determine the coefficient of heat transfer for air with inserted tape. The paper will discuss on the effect of inserted tape with shape variations.

Objectives

1. Determination of heat transfer coefficient of air with inserted tape through experiment.
2. Observe and compare the experimental value of heat transfer coefficient from previous litterateur.
3. The aim of this present work is to enhance thermal performance characteristics by studying multiple twisted tapes in different arrangement.
4. Study for forced convection heat transfer.
5. To achieve high heat transfer rate, high Nusselt number as compare to smooth tube with minimum frictional losses.

Scope

1. Experimental work can be done at **low Reynolds number** using viscous liquids, as the tapes have shown comparatively better results at low Reynolds number.

2. **Distance between two consecutive holes** can be varied to see their effect on heat transfer & friction factor.
3. To create turbulent flow, high Reynolds number used in range 4000 to 12000.

Tape Geometry:

Fabrication of twisted tape:

The aluminum strip of length 50 cm, width 26mm and thickness 1 mm were taken. Holes were drilled at both ends of every tape so that the two ends could be fixed to the metallic clamps. Desired twist was obtained using a lathe machine. One end was kept fixed on the tool post of lathe while the other end was given a slow rotator motion by rotating the chuck side. During the whole operation the tape was kept under tension by applying a mild pressure on the tool post side to avoid its distortion.

Four tapes were fabricated with different twist ratios varying from y/w 9 to 10 As shown in fig1, fig2,fig3 below.

Fig1.plain single twisted tape

Fig2.Twisted tape with drilled holes

Fig3.Twisted tape with clockwise-anticlockwise direction

As shown in figure above (fig. 1,2,3) these two tapes were made in opposite direction that is clockwise-anticlockwise direction and joined together with the help of Araldite solution. Details of twisted tape inserts are given below in table.

Twisted tape	ST	ST-DH	DT-CW	DT-ACW
No. of tapes	1	1	2	2
Tape width (mm)	26	26	12	12
Tape pitch length (mm)	240	240	110	110
Tape thickness (mm)	1	1	1	1
Material	Al	Al	Al	Al
Twist ratio (y/w)	9.23	9.23	9.16	9.16

Experimental Method:-

1. Ensure that mains ON/OFF switch given on the panel are at OFF position and dimmer stat at zero position.

2. Connect electric supply to the set up.

3. Fill water in manometer up to half of the scale, by opening PU pipe connection from the air flow pipe and connect the pipe back to its position after doing so.

4. Switch ON the mains ON/OFF switch.

5. Set the heater input by the dimmer stat, voltmeter in the range 80 to 100 volt.

6. Switch on the blower.

7. Set the flow of air by operating the valve v1.

8. After ½ hrs. Note down the reading of voltmeter, ampere meter, and manometer and temperature sensors at every 10 min. Interval with and without insertion of twisted tapes.(till observing change in consecutive readings of temperature ± 2˚c).

9. Repeat the experiment for different flow rate of air.

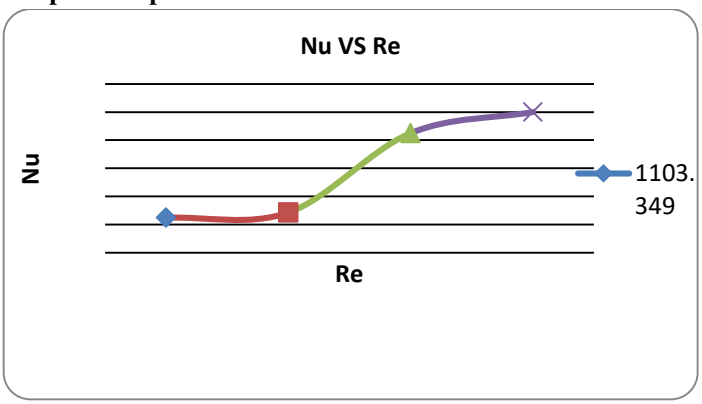
Results:-

As we achieve maximum heat transfer rate by inserting twisted tape with holes. Therefore below results are comparison between without insertions of twisted tape and insertion of twisted tape with holes.

Tabulated form

Sr.no	Re	M	f	Nu
1	1472.96	$5.712*10^{-5}$	0.03921	9.018
2	7477.098	$3.2057*10^{-3}$	0.05882	24.98

Graphical representation:-



Discussion:-

Based on the results of experimental analysis it was found that The variation of Nusselt number with Reynolds number for all insert from the plain tube is, Nusselt number increases with the increase of Reynolds number. In this case Nusselt number for single twist insert is increased by 0.8-0.13 times as compare to plain tube. For single insert with holes is increased by 2.5-2.76 times . the variation of Nusselt number with Reynolds number for double twist insert with same direction (clockwise) increased by 0.15-0.20 times as compare to plain tube. For double twist insert with opposite direction (anticlockwise-clockwise) is increased by 0.10-0.15 times as compare to plain tube. Therefore favorable results are obtained with insertions of twisted tape having holes.

Conclusion

In the present work, an experimental study has been conducted to investigate the heat transfer enhancement with the help of single twist insert, twist insert with holes and insert with change in direction of flow in circular tube under uniform flux condition. From the experimental results, the conclusions can be summarized as follows:

1. In the presence of twisted insert, the heat transfer augmentation takes place by two mechanisms, In first case as the insert act as swirl flow generator produces helical flow at periphery, due to which centrifugal forces are induced when rotating helical flows are super imposed with axially directed central core flow. As the density of air decreases with temperature resulting centrifugal force move the heated fluid from boundary layer towards the core of flow passage and hence heat transfer augmentation is achieved.

2. In other case, heat transfer enhancement is achieved as this insert is used for increasing the heat transfer surface area. Also this insert acts as turbulence promoter which increases the flow turbulence level incorporation in the flow passage and increases turbulence level by disturbing the laminar layer.
3. Experimental programmed was carried out to investigate the performance of various insert. The results are presented in the form of Nusselt Number.
4. The experimental setup is validate with Dittus-Boelter correlation. The results are in good agreement.
5. It is observed that, Nusselt number for various twisted insert is higher than plain tube. The Nusselt number for twisted insert is increased by 1.53 to 2.77 times as compare to plain tube for all range of Reynolds number.

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‘‘DESIGN OF PROGRESSIVE TOOL FOR MOUNTING BRACKET OF FUEL TANK’’

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Abstract

The progressive die performs a series of operations in a single die with two or more workstations. The finished part is obtained after every blow of press machine. The design and development of progressive dies is one of the important phases of sheet metal fabrication. The small error on any workstation can cause heavy manufacturing losses due to die failure, distortion of part geometry. This research focuses on the design of a progressive matrix. By using progressive we can produce a precise component in this work. The authors design a progressive die that has two workstations. The frist operation is piercing and second is blanking.

Keywords: Progressive Die, Mounting Bracket, Piercing And Blanking .Catia V5

1. Introduction

The matrix that executes two or more operations in one go is called a progressive matrix. This die is used to produce a finishing piece in one go. Compound matrix is also use for this; but its construction is more complicated than single matrix. In a progressive matrix, the strip is fed from one end and the finished part is extracted at bottom. There, the metal strip passes on different workstations and the related operations are carried out there.In this article, progressive matrix have two workstations. The first workstation performs piercing operation and the second performs the blanking operation. At the first work station, hole is pierced. That hole are used to locate the stopper during the blanking operation. For locating the stopper, positioning pins are used on the surface of the die and guide pins are used on the punch surface.The main objective of this article is to design a progressive matrix, prepare a matrix model and calculate varies forces.

2. Material for Die Components

The entire press tool is not required high strength material. Because not all parts of the press tool intervene. Here, the most important members punch, die and cutting edge. These pieces are required stronger material. The main principle while selecting the material for this part is given as;

i. The material of the tool has more resistance to wear, abrasion or adhesion than the material of the piece. Also its frictional force is more than the partial matter.

ii. The hardness of the material is greater than that of the material of the piece.

iii. Fatigue, shear, compressive strength is greater than the resistance of the partial material and resistance to plastic or elastic deformation is less than the resistance of the workpiece material.

The material of the piece is made of mild steel. So here, the type of steel D2 is used to punch and die. It has more hardness and strength than mild steel. OHNS, EN8, EN12 materials are also used when wear and deformation are greater; such as the guiding pillar, the adjusting ring, the stacking ring, the guard plate and so on.

3. Design of Progressive Die

Top Plate, Bottom Plate and Pillars Guide are the most basic part of the world. This alignment is done here to improve accuracy, part quality, die life and reduce installation time. The lower plate supports the die, the die housing, the risers, and so on. And the top plate supports the punch, the punch holder plate, the pillar sleeve guide, and so on.

3.1 Die Clearance

The set of the matrix depends on the property of the material of the piece. If the material is ductile in nature, the game is weak and for brittle materials, it is an important game. If the game is given upside down then there for the ductile material it passes through the means of the matrix here it pulls the matrix instead of cutting. And in the ductile material, it damages the sharp edges of the punch and dies. The matrix clearance for mild steel is 2.5% or 5% thick per side.

C = 2.5 % of thickness

= (2.5/100) x 6 = 0.15 mm

Or C = 5% of thickness

= (5/100) x 6 = 0.3 mm

Large clearance increases the tool life. So here take 5% of thickness per side

4. Force Analysis

- **Shear Force:-**

The shear stress can be given as;

Fs = L.S. x t x Ƭ

L.S.- Total Shear stress t- Part Thickness

Ƭ- Shear strength of part material

At the first progressive workstation die two holes are drilled through the piercing operation. So, the shear force for drilling these holes is given by;

Fs = L.S. x t x Ƭ

Here; L.S = 2× Perimeter of hole

= 2 x π x dia. Of hole

= 2 x 3.1415 x 10 = 62.832 mm

t=6 mm

Ƭ = 392.4 N/mm2

∴ Fs1 = 62.832 x 6 x 392.4

= 147.93 kN

At the second workstation, there is a blank produced by the delete operation. So, the shear force for the delete operation is given as;

Fs = L.S. x t x Ƭ

Here; L.S. = Perimeter of Blank

= 494.78 mm

t = 6 mm

Ƭ = 392.4 N/mm2

∴ Fs2 = 494.78 x 6 x 392.4

= 1165.43 kN

Total shear stress is given as;

T.S.F. = Fs1 + Fs2

= 147.93 + 1165.43=1313.36KN

- **Stripping Force**

The stripping force is required to remove the punch band after the cutting operation. It is given as 10% of the total shear force

Stripping Force = 10% of total shear force;

= 0.1 x 1313.36 = 131.34 KN

- **Total Force:-**

Total force require for cutting is given as;

T.F. = T.S.F. + Stripping Force

= 1313.36 + 131.3

= 1444.70 kN

The factor of safety is consider to be 20% more.

∴ Requirement of press capacity is 120% of Total Force;

= 1.2 x 1444.7

= 1748.55 kN

= 176.72 Tone

But in this press machine is comfortable for th above the requirement of 200 Tone.

4.2 Design Of Die Parts

- **Die Block**

The lower assembly is the female part of the perforation tool. The most important part of the

bottom assembly is the die block. The cutting edge is given to the die block. The earth is also provided on the matrix block. This land is intended for good cutting. The land for the dice is given by the 1.5t.
For the first station, we select the two buttons for the drilling operation. These are standards. It is taken from the MISUMI standard. book. The selection depends on the size and cost of it. From the requirement here MHD 20-35 P10.80 type of die buttons are used.
At the second workstation for the delete operation, the thickness of the matrix block is given by the formula;

$$Td=\sqrt[3]{\text{shear force}}$$

Where;

Td :- Thickness of die plate (in mm).

Shear force:- For blanking operation in kg.

At the blanking operation;

Shear Force =1165.5 KN
= 118.81Tones

∴ thickness of die block is;

Td = 118.81 × 103 3
= 49.16 mm ≈ 50 mm

∴ The stress in the die block is given as;

$$\sigma = \frac{Force}{Surface\ area} = \frac{1165.5\times10^3}{240\times200}$$
$$= 24.30\ N/mm2$$

The allowable resistance of the material D2 is 2000 N / $mm2$. And the calculated value is 24.30 N / $mm2$ is less than the allowable force. So, the design of the die block is safe.

• Bottom plate

The bottom plate is the base of the lower assembly. There are blocking blocks, elevators, guiding pillars are mounted on the bottom plate. This bottom plate is used to clamp the lower set of the press tool on the bolster plate using the clamping devices. The bottom plate is made from mild steel material.

The thickness of the bottom plate is given as;
T = 1.5 Td = 1.5 x 5

= 75 mm.

The stress occur on the plate is given by;

$$\sigma = \frac{\text{Force}}{\text{surface area}}$$

$$= \frac{1444.7\times10^3}{600\times550} = 24.30\ N/mm^2$$

Allowable limit is 410N/ $mm2$. So the design is safe here.

• Punch

Punch is part of the press tool. The cutting operation is performed here. Thus, the material required for the manufacture of the punch is harder than the material of the workpiece. So, the material d2 is used for the manufacture of punches. The hardness of this material is 52-56 HRC.
Travel = (Entry in Stripper Plate)+ (Entry in die) +(Part Thickness)

= 5 + 3 + 6 = 14 mm

The thickness of the punch depends on the punch with the stripper So we take 71 mm as punch thickness. The is given clearance during the cutting operation. For the piercing punch is larger than its diameter. So the effect of performance on performance. The critical force acting on the punch is given by Euler's formula such that

$$Fric = \frac{2\pi2EI}{l^2}.$$

Where;
E – Modulus of Elasticity (For D2 material 2.1 x 105)

I – Minimum moment of inertia for punch.

$$I_{min} = \frac{\pi D^4}{64} = \frac{\pi\times10^4}{64} = 490.87\ mm^4.$$

The critical maximum length of punch is

$$I_{max} = \sqrt{\frac{2\pi2EImi}{p}}$$

Where;

P - load acting on a punch (73.97 kN)

∴ lmax = 165.85 mm

This is the maximum length which performs work safely. Here I take the length of punch as l = 90 mm. Area of punch is;

A = (π x D2/4) = 78.54mm2

fg = (I/A)0.5 = 2.5v

Slenderness ratio (SA) = (Le/rg) = 72

Transition slenderness ratio:

$$(TSR) = \sqrt{\frac{2\pi^2E}{Syc}}$$ Syc =2000N/mm2(For D2 material.)

∴TSR = 45.52

There is buckling force is calculated by Euler's formula. Because S.R. is greater than T.S.R..

Fcri $= \frac{= \pi^2 EI}{l^2}$ = 171731.12 N > 73965 N

Applying load is less than critical load; so design is safe here.

Spring Selection:-

The spring is used here to give the pulling force and also to maintain the roughing. This selection of strand is therefore given by the extraction force.

The stripping force is 147.93 kN required here.

There for spring is selected in the PAWAN Std. book. PAWAN is the spring manufacturing company. They give their standards. Referring to this requirement, the force is 147.93 kN and the 14 mm stroke is provided by a PYE 64x50 spring. This spring's specification is given as;

Load caring capacity of spring = 11.35 kN.

Travel of this spring = 16 mm. There for number of spring (N)

$$N = \frac{\text{stripping load}}{\text{load carring capacity of spring}} = \frac{147.93}{11.55}$$

= 14 Springs.

- **Top Plate:-**

The upper plate is the base of the upper assembly. There are punches, springs, guide pillar, rings are mounted on the top plate. This top plate is used to clamp the upper set of the press tool on the cross plate using the clamping devices. The top plate is made from mild steel material.
The thickness of the top plate is given;

T=Td
=50

The stress occur on the plate is given by

$$\sigma = \frac{\text{force}}{\text{surface area}} = \frac{1444.7\times10^3}{600\times550}$$

= 4.38N/mm^2

GUIDE PILLAR

They are used here for the alignment of the upper assembly with the lower assembly. He guides the punch through the matrix. These also manufacture by hardening the material to resist the buckling effect.
The diameter of the guide pillar is given by;

D = 0.6 x Td
= 0.6 x 50
= 30mm ≈ 32 mm.

For the guiding pillar, its length is greater than its diameter. Thus, the effect of length occurs on the performance of the overall performance. For the manufacture of guiding pillars

E- Modulus of Elasticity (For St-42 material 2.1 x 10^5)
I- Moment of inertia for pillar.

St-42 material is use.

$$= \frac{\pi D^4}{64} = \frac{\pi\times 384}{64}$$ = 102353.87 mm^2

Here take the length of pillar as l = 160 mm.
Area of punch is;

A = (π x D2/4) = 1134.11mm2
fg = (I/A)0.5 = 9.5 mm.

Slenderness ratio (SA) = (Le/rg) = 33.68
Transition slenderness ratio:

$$\frac{1444.7\times10^3}{600\times550} = \sqrt{\frac{2\pi^2 E}{Syc}}$$

Syc = 860 N/mm2

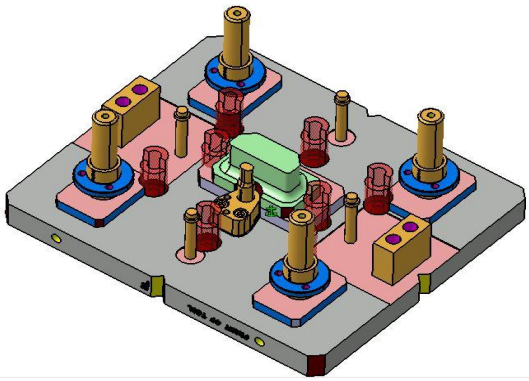
∴ TSR = 112.08

There is buckling force is calculated by Johnson's formula. Because T.S.R. is greater than S.R;

$$Fcri = A\left(Sy - \frac{Sy^2 Le^2}{\pi^2 4 Ee^4 g}\right)$$

= 946635.66 N > 722350 N

Applying load is less than critical load; so design is safe here.



Figure;1 Punch Assembly/ Upper Plate

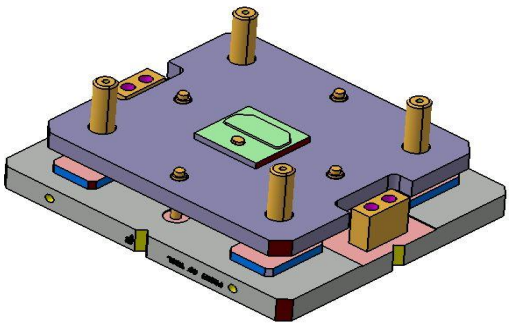


Figure:2 Bottom Plate Of Die

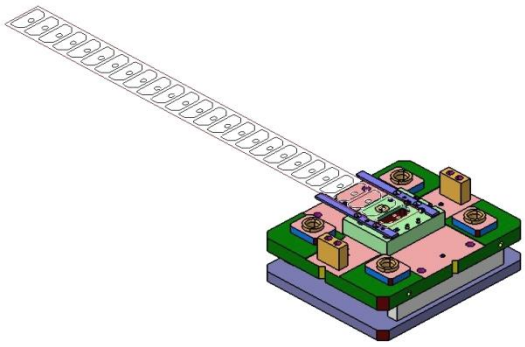


Figure:3 Stipe Feeding/ Operation

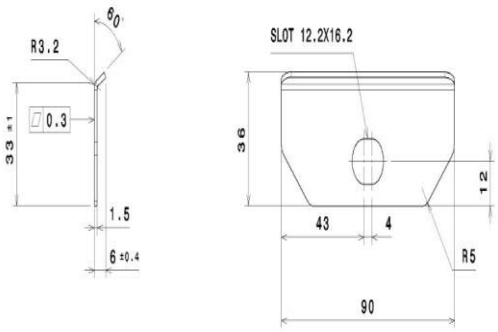


Figure:4 Braket 2D Drawing/Design

5. Conclusion:

The progressive die is an economical way to form metal parts with strength, ductility and wear resistance characteristics. This research focuses on the progressive two-stage die designed for the manufacture of saddle plates. The composite matrix is also used to make this plate but its design is more complicated and economically more expensive.

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Performance & Emission Analysis by Using Biodiesel & Its Blends

(Chicken Fat)

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Abstract:

Increasing population and urbanization has led to tremendous demand for fuels. It results in the rise in the prices of fuels in the International market. It disturb the Indian Economy. Emission of various factors like Hydrocarbon, Carbon monoxide, Nitrogen oxide etc. had led to rise in pollution. Also it has led to problems like acid rains, global warming and human health. Today there is need of replacing traditional fuel by biodiesel. In this paper a two-step catalytic process was chosen for the synthesis of the biodiesel. As the Viscosity of free fatty acid obtained from extraction of Chicken fat hence Methanol, Sulphuric acid and sodium hydroxide as catalyst to reduce the viscosity. The first step is Esterification as pre-treatment and then the Transesterification process is carried out. the biodiesel can be prepared from waste chicken fat, vegetable oil, soybean, rapeseed, peanut, karanja etc. Chicken fat biodiesel emits less quantity of pollutants like CO2, NOX, and HC etc. It is also free from sulphur. The experimental work also analyse the performance of Diesel Engine and Compression parameters like Indicated Power, Break Power, Friction Power, Mechanical Efficiency, Volumetric Efficiency, Break Specific Fuel Consumption etc. are recorded along with Viscosity,Density,Calorific Value, Flash Point

etc.The observations recorded can be further used for research purpose.

Keywords: Waste Chicken Fat, Esterification and Transesterification, Biodiesel Production, Performance and emission analysis, ANOVA.

Introduction:

India ranks 4th largest energy consuming nation in world. India's economy has often has been unsettle so its need to import about 70% of its petroleum demand from the worlds market. In India 90% of imported petroleum oil is consumed for the transportation and energy generation so its economy is very high. Russia is the largest country having the natural energy while Saudi Arabia has huge stock of non-renewable energy. The most common feedstock of biodiesel is rapeseed oil in Europe and soybean oil in the United States of America.

The need of energy is increasing continuously due to rapid increase in the number of industries and vehicles owing to population explosion. The sources of this energy are petroleum, natural gas coal, hydrocarbon and nuclear.. Today the world is facing two major challenges which include the energy fuel consumption and environmental degradation. The global challenge today had forced to long term research and finds a way of producing a renewable feedstock of animals, vegetables, seeds etc.

Research on renewable energy resources are being carried out massively due to fulfil the demand of energy consumed by tremendous population, energy disaster, global climatic anthropogenic and environmental pollution due to toxic gases emitted from vehicles. Fossil fuels are vital source of non-renewable energy. Fossil fuel is a fuel produced by natural process and are found abundantly on earth.

Rudolf Diesel is called as the inventor of the first diesel engine which was originally designed to run on fuel derived from peanut oil. According to ASTM biodiesel is defined as the "mono alkyl esters of long chain fatty acids derived from renewable lipid feedstock, such as vegetable oil and animal fats, for use in CI engine." In 1980s and 1990s the R&D was conducted to evaluate a variety of a biodiesel blending stocks, develop emission data, engine performance, and develop manufacturing cost. The main commonly sources of production of biodiesel in India are non-edible oil and animal fat (waste chicken fat) etc.

Transesterification is a process of exchanging the organic group R" of an ester with the organic group R' of an alcohol. Although the transesterification reaction can be catalysed by either acids or bases the most common means of production is base-catalysed with glycerine as a by-product. The idea of using biodiesel instead of fossil fuels has manifested as a way to minimize the net carbon left by emissions from CI engines. The biodiesel blends prepared from chicken fat does not contain Sulphur, aromatic hydrocarbons, metal and crude oil residues. These properties improve combustion efficiency, emission profile. Biodiesel fuel blends reduce particulate material (PM), hydrocarbons, and monoxide and Sulphur oxides.

.1.Methodology:

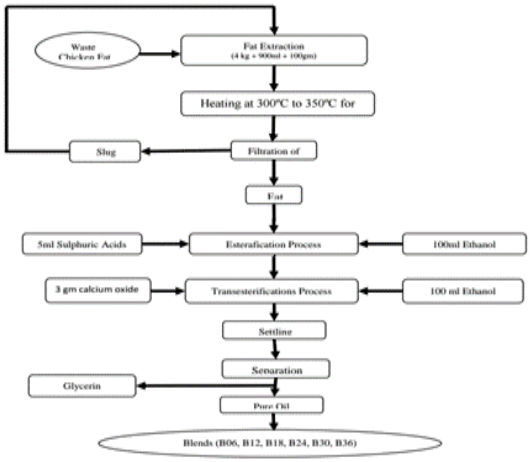


Fig. Flow Chart

1.1.Identification of raw material:

According to require of raw material we collected waste chicken fat from chicken Shop located near the Biodiesel lab. For extraction of fatty oil we mixed or added 4Kg fat with 900ml known quantity waste oil and 100gm of salt (NaCL) and providing heating at 300^0C- 350^0C, For continuously 5 hrs. To avoid sticking of waste chicken fat to the s/f of vessel we stirrer it after every short internal of time period . This process is carried out in dark room in the absences of air moisture and light .After extraction of oil we separated the waste slug from the oil generated. This slug can be again heated for the extraction. The obtained oil is kept for cooling. On the next day we filtered the oil obtained and collected 1000 ml of oil in measuring flask. Then we heated it

at 90^0C for 10 min to remove the moisture content in the oil. After completion of heating we kept the vessel for cooling.

2. Esterification Process:

For esterification process we required components like mechanical transistor stirrer, speed regulator, thermometer, heat mentor, and distillatory apparatus we poured 1000 ml of waste chicken fat oil in the heating jar and heated it up to 60^0C at constant steering speed of 25 rpm. When the temperature of oil is 40^0C, we added 5ml of sulphuric acid and 100 ml of ethanol at same temperature. Ethanoic acid reacts with ethanol in presence of concentrated sulphuric acid. It acts as a catalyst. When the temperature reach 52 ^{0}C we stopped heating and kept for cooling for 90 min in the same jar.

1.3. Transesterification Process:

After cooling, we again supplied heat to the oil at constant steering speed of 40 rpm. We added 3gm of Calcium Oxide and 100 ml of ethanol at 40^0C.Calcium Oxide act as a heterogeneous catalyst for biodiesel production. The end temperature observed was 59^0C for 60 min .The heater and stirrer was switch off and kept for cooling.

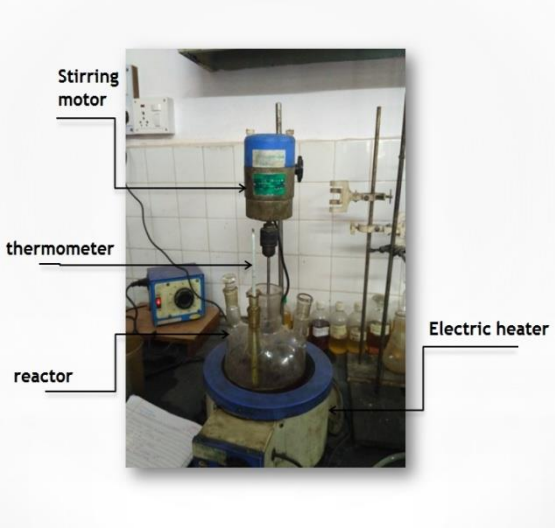


Fig.1.3. Transesterification Process

1.4. Settling and Separation Process:

After cooling the oil is transfer to the volumetric flask for settling of glycerine. Due to high density the glycol settle at the bottom. This by-products is removed by using the knob used at the bottom of vessel. Thus a biodiesel is obtained .This oil is packed in the cans. Thus the production of the biodiesel is prepared.

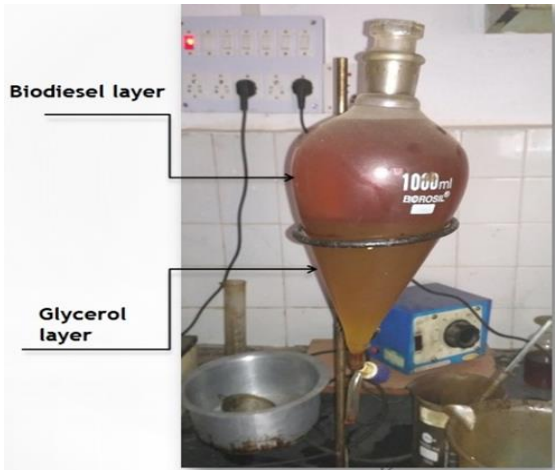


Fig.1.4. Settling and Separation Process:

Fig: Biodiesel Blends

2. Experimental Procedure

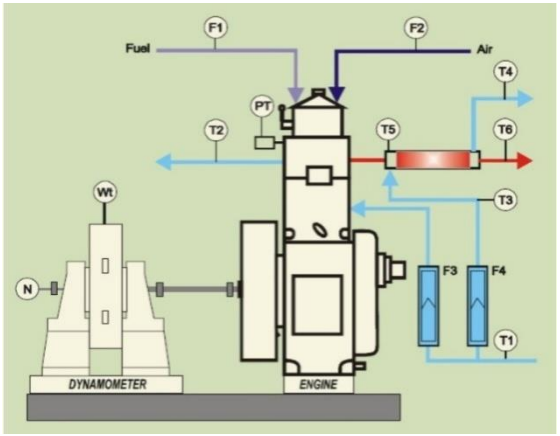


Fig: Experimental set

A] Engine details

(a) Combustion Parameters:

Specific Gas Constant (kJ/kgK): 1.00, Air Density (kg/m^3): 1.17, Adiabatic Index: 1.41, Polytrophic Index: 1.28, Number ofCycles: 1, Cylinder

Pressure Reference: 0, Smoothing 2, TDC Reference: 0

(b) Performance Parameters:

Orifice Diameter (mm): 20.00, Orifice Coefficient of Discharge: 0.60, Dynamometer Arm Length (mm): 185, Fuel Pipe dia (mm): 12.40, Ambient Temp. (Deg C): 27, Pulses Per revolution: 360, Fuel Type: Diesel, Fuel Density (Kg/m3): 830, Calorific Value of Fuel (kj/kg): 42000

(c) Procedure

- First of all the blend B06 which is composition of 6% biodiesel and 94% diesel is poured in the VCR Engine.
- The air is removed by loosing the nut.
- Then by using anvil key the nuts on engine are made loose so as to vary the Compression Ratio.
- By rotating the spanner towards rhs and lhs the CR can be varied. Again the nuts are fasten by using anvil key.
- After this the motor is start to provide the cooling water inlet.
- The IC Engine software is started on the computer which records the complete reading.
- The Compression Ratio selected for the testing were 14, 16, 17.5 with varying load of 0, 4, 8 and 12.
- The load is set by using nob on the VCR testing Set up which is displaced on the computer.
- The rotameter reading for engine and calorimeter are filled manually in the software
- The nob for fuel is started for 1 minute, during this the complete report about the performance and compression is recorded in the software
- This data is saved for further studies.
- Above procedure is repeated again and again for the varying Compression Ratio with varying Load.

3. Result and Charts:

A] Test Report

Indian Biodiesel corporation

E-mail : ibdc.bmt@gmail.com Ph. 02112- 221382 www.renewenergy.in

TEST REPORT

Name - Mr. Sushant Bansode
Instt.- Arvind Gavali COE, Satara
Reference- Analysis of Chicken fat oil biodiesel and blends
Services Required- on ph. Call

Sr.	Test Description	Ref. Std. ASTM 6751	Reference		Diesel	Chicken fat oil biodiesel blends + 3% ethanol					
			Unit	Limit	B00%	B6%	B12%	B18%	B24%	B30%	B36%
1	Density	D1448	gm/cc	0.800-0.900	0.830	0.832	0.833	0.835	0.836	0.838	0.840
2	Calorific value	D6751	MJ/Kg	34-45	42.50	42.42	42.31	42.18	42.03	41.92	41.88
3	Viscosity	D445	mm2/sec	3--6	2.700	-	-		3.10	-	
4	Moisture	D2709	%	0.05%	NA	NA	NA	NA	NA	NA	NA
5	Flash point	D93	°C	-	64	67.00	74.00	79.00	84.00	89.00	95.00
6	Fire point	D93	°C	-	71	-	-	-	99.0	-	-
7	Cloud point	D2500	°C	-	-4	-	-	-	3.0	-	-
8	Pour pont	D2500	°C		-9	-	-	-	-1.0	-	-
9	Ash	D	%	-	0.05	-	-	-	0.1	-	-

Lab Chemist :
(IBDC- Q.C.Dept.)

Verified By:

Terms

1 Sample will be preserve for 30 days w.e.f today, afterwards it will be destroyed immediately.
2 This test report is prepared for research work lab.testing & not for any commercial purpose or contineous production work.
3 This report is limited for the quantity of Sample only & not for any tanker size dispatch or commercial trade.
4 IBDC is solely private institute involve in Nuresery raising, large scale Plantation of non edible oil seed, seeds, oil & Fat testings & Production of Biodiesel for research purpose only.

Office : Above Malojiraje Co. Bank, Bhigwan Chowk, Baramati Dist. Pune - 413102., Maharashtra, India.
Works -Gat No 611, Behind NIAM Compound , Near Tukai Temple, At Malegaon BK. Tal. Baramati Dist. Pune - 413 115 Maharashtra, India.

Biofuel ... Green engery project under one roof

Fig: Test report

B] Results

3.1. Load vs. Indicated Power:

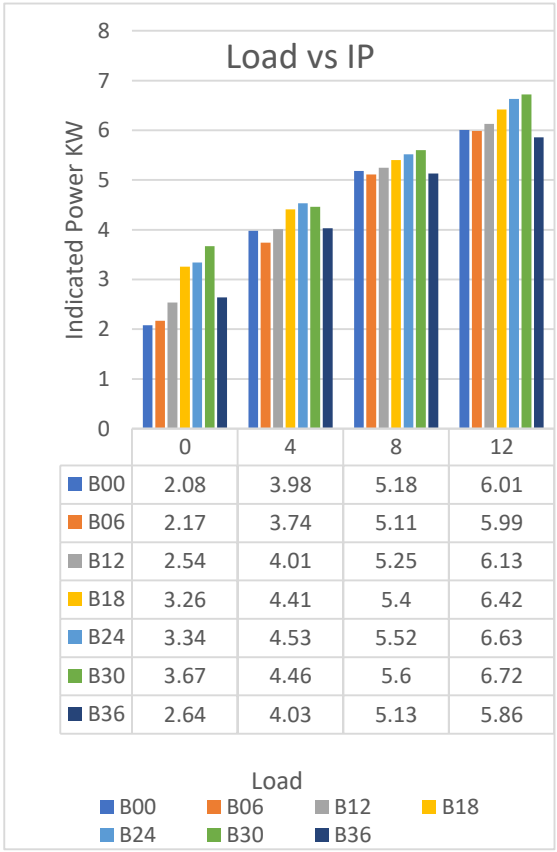
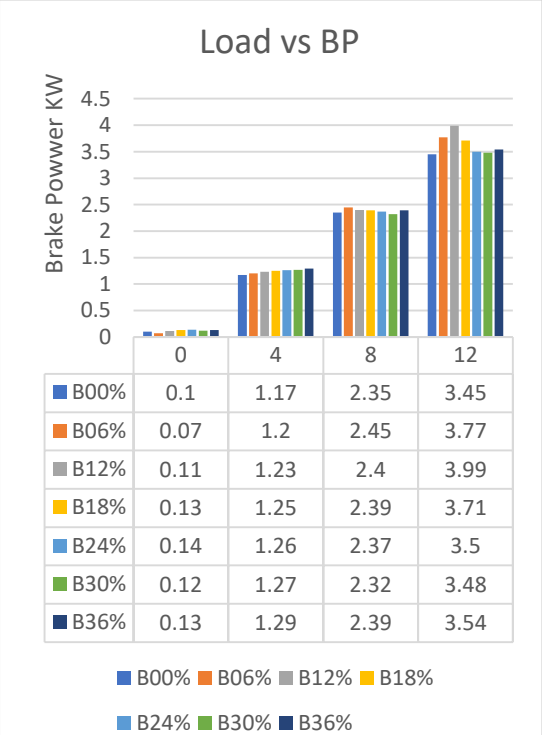


Fig3.1

Load is directly proportional to Indicated power. As the load increases, the indicated power also increases for all biodiesel blends and diesel.The I.P for B30 is maximum at load 12 while it is minimum for Diesel at load 0. Indicated power of biodiesel is higher than the pure diesel at all experimental load.

3.2. Load vs Break Power:

The Break Power increases with increasing load. At all experimental load conditions the brake power of Biodiesel is slightly greater than the pure diesel. The maximum Break Power is found to be 3.59 for B12.

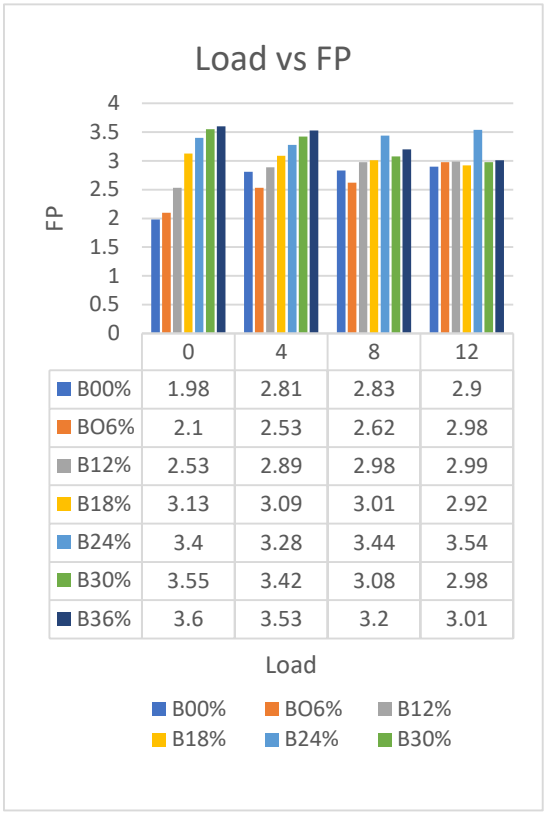


	0	4	8	12
B00%	0.1	1.17	2.35	3.45
B06%	0.07	1.2	2.45	3.77
B12%	0.11	1.23	2.4	3.99
B18%	0.13	1.25	2.39	3.71
B24%	0.14	1.26	2.37	3.5
B30%	0.12	1.27	2.32	3.48
B36%	0.13	1.29	2.39	3.54

Fig: 3.2

3.3. Load vs. Friction Power:

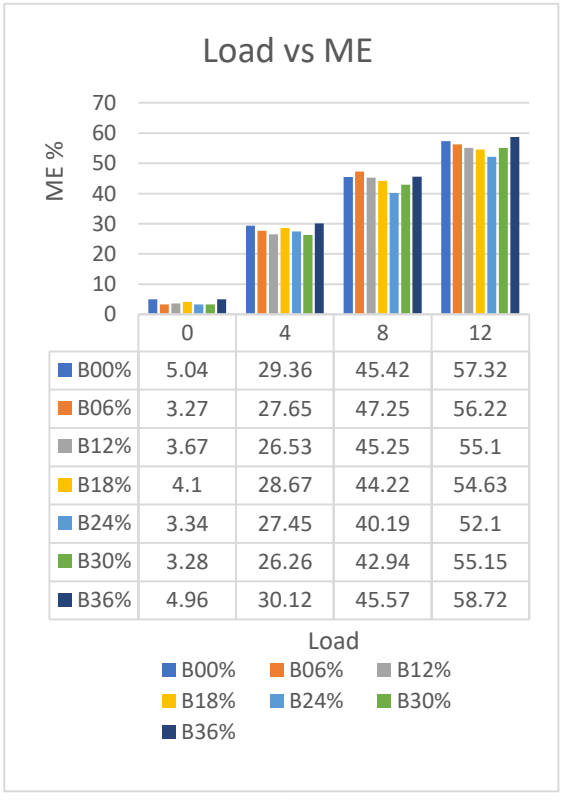
At all experimental reading recorded it is found that, the Friction Power for diesel is less than all other biodiesel blends. The F.P goes on decreasing with increase in load. The maximum F.P is found to be for B36.



	0	4	8	12
B00%	1.98	2.81	2.83	2.9
BO6%	2.1	2.53	2.62	2.98
B12%	2.53	2.89	2.98	2.99
B18%	3.13	3.09	3.01	2.92
B24%	3.4	3.28	3.44	3.54
B30%	3.55	3.42	3.08	2.98
B36%	3.6	3.53	3.2	3.01

Fig3.3

3.4. Load vs. Mechanical Efficiency:

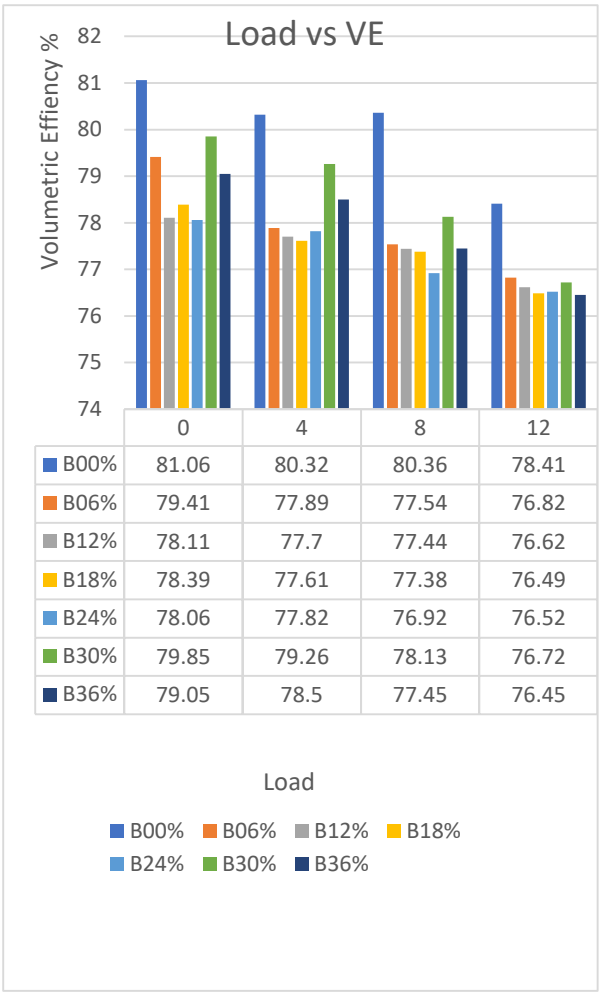


	0	4	8	12
B00%	5.04	29.36	45.42	57.32
B06%	3.27	27.65	47.25	56.22
B12%	3.67	26.53	45.25	55.1
B18%	4.1	28.67	44.22	54.63
B24%	3.34	27.45	40.19	52.1
B30%	3.28	26.26	42.94	55.15
B36%	4.96	30.12	45.57	58.72

Fig: 3.4

The Mechanical Efficiency increases with increase in load. The maximum M.E is found at B36 which is slightly greater than diesel at load 12.At a zero load conditions mechanical efficiency is higher than biodiesel but other experimental load conditions the mechanical efficiency is near about or higher than pure diesel.

3.5. Load vs Volumetric Efficiency:



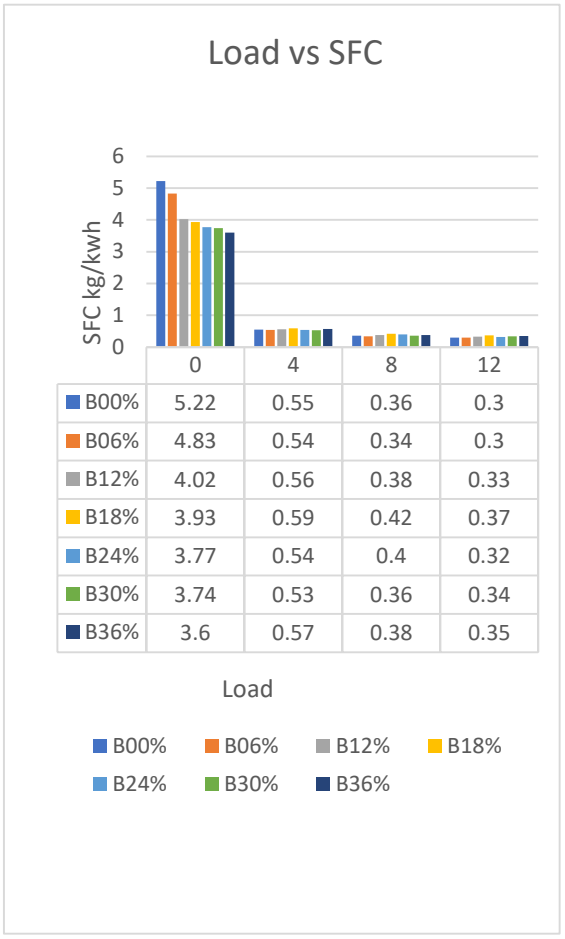
	0	4	8	12
B00%	81.06	80.32	80.36	78.41
B06%	79.41	77.89	77.54	76.82
B12%	78.11	77.7	77.44	76.62
B18%	78.39	77.61	77.38	76.49
B24%	78.06	77.82	76.92	76.52
B30%	79.85	79.26	78.13	76.72
B36%	79.05	78.5	77.45	76.45

Fig: 3.5

The Volumetric efficiency gets gradually decrease with increase in load. The least V.E is obtained for blend B36.At all experimental load condition volumetric efficiency of pure diesel is higher than biodiesel.

3.6. Load vs. Specific Fuel Consumption:

At zero load condition Specific fuel consumption of pure diesel is less than the biodiesel. But when load is increases specific fuel consumption of biodiesel is near about same to the pure diesel.



	0	4	8	12
B00%	5.22	0.55	0.36	0.3
B06%	4.83	0.54	0.34	0.3
B12%	4.02	0.56	0.38	0.33
B18%	3.93	0.59	0.42	0.37
B24%	3.77	0.54	0.4	0.32
B30%	3.74	0.53	0.36	0.34
B36%	3.6	0.57	0.38	0.35

Fig 3.6

4. Conclusion:

Due to the health risks of digestion of waste chicken fat, it is a cheap raw material and its low operating cost in biodiesel production make this study a promising one for possible technological applications. Chicken fat methyl ester blended with diesel fuel (B06, B12, B18, B24, B30 and B36) can be used as an alternative fuel in conventional diesel engines without any major modification. A Single Cylinder Four Stroke Compressed Ignition Engine was operated successfully using the diesel and biodiesel blends as fuel. In cylinder peak pressure slightly rose while the start of combustion was earlier. The properties are tested with standard ASTM 6751, which indicates that Density, Flash point for B36 is maximum compared to pure diesel. While the Calorific Value of Diesel is slightly greater than biodiesel blends. The maximum C.V after diesel is for B06.

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"PERFORMANCE STUDY OF ELECTRICAL DISCHARGE MACHINING (EDM) PROCESS"

Mr. Khan M.I.[1], Mr. Shinde V.V[2] , Miss. Suryavanshi P.S.[3] , Mr. Yadav R.J.[4], Mr. Bagal G.R. [5] , Mr.Bamankar P.B[6]

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Abstract :-

The Main objective of this performance study is to investigate the process parameter of EDM (Electrical Discharge Machine) using different Electrode and work piece material. The electrode and work piece material used are Fe-Mo alloy and OHNS (Oil hardened non-shrinking steel) respectively. Current, Pulse - On time, Time of work are considered as input parameters and their effect on MRR , TWR are studied . MRR, TWR are consider as output parameter . Taguchi method is selected and used foe experiment layout formation. For analysis purpose ANOVA method is used In Taguchi method L9 orthogonal array is selected for this research study. The result of this research study that out of three parameters current effect on Fe-Mo alloy electrode is more than time of work and pulse – on time . Therefore for the use of electrode proper selection of input parameters is important.

Keyword: - Fe- Mo alloy electrode , L9 Orthogonal array , EDM process , Taguchi approach etc.

Introduction:-

Electric Discharge machining is the one of the modern machining process which is mostly used to produce Die , moulds , part of aerospace and It also used in automobile industries . In this process material is removed by means of melting and evaporation of material by using electrical charge which connected to both electrode and work piece . This method is only used for electrically conductive material . In this process EDM doesn't make physical contact lies between work piece and electrode . It cuts the material of any hardness .EDM performances which are depends on Non – electrode parameter , work piece and electrical parameters . Electrical parameters :- gap voltage , peek current , pulse on-off time , power and cycle duty .

Non-electrode parameters :- Material , polarity , Electrode size .

Work piece parameters :- density , material , hardness , thermal conductivity , size .

The objective of this paper is to study the influence of pulse on , time of work , current . On output responses such as tool wear rate (TWR) , Material remove rate (MRR) .

The present day expectation of manufacturing industry are very high . High economic manufacturing of high performances of precision and complex part made of vary high strength materials . Every customer demands product to there own choice there is need for high quality , low cost , part made in small batches and large variety .Need Of Non Traditional Machining:- Sometime there are difficulties to machine on traditional machining due to following causes:-

1) Materials having low machinability is difficult to process on traditional machine.

2) Precision and high accuracy having prime importance.

3) It is expected to consider high preproduction rate .

For this causes we have following two remedies

1) Hot machining process i.e. Modification of traditional process.

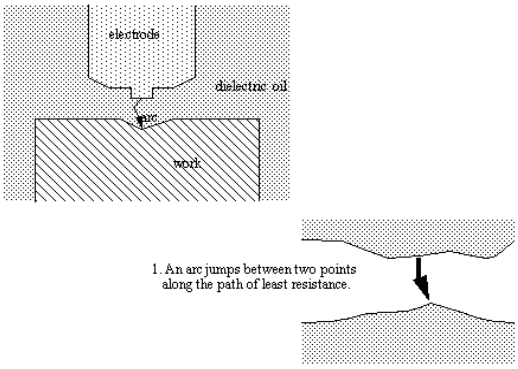
2) Use of non traditional machining process.

Electric Discharge Machining :-

It is one of the nontraditional machining process in electric discharge machine there is no contact between tool and work piece i.e. It is non contact machining process . Sometime there is difficulties in producing intricate and complex shape on work piece there for to produce or machine such intricate shape we use electric discharge machine and it is also used for machine hard metals like titanium, carbide and hardened tool steel .

Principle Of EDM :-

It is a controlled metal removal process that is used to remove metal by means of electric spark erosion in this process electric spark is used as the cutting tool to cut (erode) the work piece to produced the finished part to desired shape.



Literature Review :-

Chorng-Jyh Tzeng [1]investigated research on MRR ,TWR and Ra. At the time of manufacture of SKD61 by EDM this research was concluded. They used various hybrid methods like back propagation neural network (BPNN), a genetic algorithm (GA), and RSM. Conclusion of the research paper is the cutting parameters of discharge current and Pulse on time are most significant factors for MRR and Ra respectively.

M.M.Rahman [2]et Al. Taken input parameters as peak current and Pulse duration on performance characteristics of EDM. The result taken out are MRR,TWR,SR are greatly affected by the current and Pulse on time. MRR increases linearly with increase in current, SR also increases linearly with increase in current for different pulse on time.TWR decreased as increasing pulse on time.

Velusamy Senthikumar [3]researched that electrical discharge machining is an important process for machining intricate shapes like metal matrix composites . It is an important process for machining difficult shapes.

Y.H.Guru [4] investigated that higher discharge energy result in proper surface structure. Excessive machine damage can be avoided by using low discharge energy. He has done experiment on AISI D2 tool steel material.

S.prabhu [5] investigated effect of graphite tool or electrode on EDM. His investigation is done on AISI D2 tool steel using graphite electrode. The conclusion of the research drawn were pulse current was most effective parameter for surface roughness and second parameter which effects on surface roughness is pulse on time.

Experimental setup :-

There are various parts are consisting in EDM setup

1)Electrode

2) stabilizer (EDM generator)

3) high pressure pump

4)Electrode holder

5)servo mechanism

6)work piece holder

The research wear conducted using a EDM machine. Model ELEKTRA pulse mega 1M. EDM manufactured by MMT India . The tool is penetrated down words into the OHNS AISIO2 Work piece by using servo control before the experimentation work piece is machined by VMC into achieve finished surface at ground the down side of electrode is polished by using polish paper before each experiments . TO measure weight of electrode and work piece digital ONIDA weighing machine is used with 1 mg accuracy . The work piece is held by magnet holding device with machine base the electric supply is connected to tool and work piece which is called Cathode and Anode .Kerosene and parafilline are used as a dielectric fluid . The machining time is recorded by clock . Experiments are conducted in the order of L9 orthogonal array. After completion of

each test work piece was removed from the machine Wasted dried and weight on an weighing machine .

Selection of Work piece Material :-

OHNS has very important properties like high strength, high wear resistance and high hardness there for it is important tool. Because of its high strength conventional machine techniques cannot machined OHNS easily .Therefore it has to be machined on non conventional machining techniques like EDM. Therefore OHNS steel material is selected for this experimental study.

OHNS steel is general purpose tool steel. It is electric furnace melted, non shrinking, oil hardened steel . It contains

Technical Specifications :-

Machine Tool	
1) Work tank internal dimension (W x D x H)	800 x 500 x350 mm
2) Work table dimensions	550 x 350 mm
3) Maximum job weight	300 kg
4) Maximum Electrode weight	50 kg
5) Maximum job height above the table	250 mm
6) Servo system	DC servo
7) Dielectric capacity	400 lit .

Pulse Generator S 50 ZNC	
1) Pulse generator type	MOSFET
2) Maximum working current	50 A
3) Power supply	3 Phase ,415 V AC , 50 Hz
4) Connected load	6 kVA

Design Of Experiment :-

Taguchi Design:

Dr. Genichi Taguchi's approach or DOE is highly effective wherever and whenever it is suspected that the performance of a part or process is controlled by more than one factor. The main purpose is to give a clear understanding to make the DOE technique more effective in applications, and how relate the outcome of the technique to improve the quality of products and processes. When used for product design optimization, analytical simulation is the common approach, because hardware is not often available.

L9 Orthogonal Array :-

Taguchi L9 Orthogonal Array Design Matrix ;-

Experiment No.	Factor 1	Factor 2	Factor 3
E1	1	1	1
E2	1	2	2
E3	1	3	3
E4	2	1	2
E5	2	2	3
E6	2	3	1
E7	3	1	3
E8	3	2	1
E9	3	3	2

Table :- Level Values of Input Factors

Experimental Result :-

Sl No.	Factors	Level		
		1	2	3
1.	T_{on} (µs)	30	50	75
2.	I_p	10	15	20
3.	TW	0.1	0.2	0.3

During each drilling operation based on the Taguchi L9 orthogonal array, the machining time was noted down. The weights of the work pieces and the tools were measured by the digital weighing machine before and after each drilling operation. The diameter of the tool was measured with the help of a Dogmatic micrometer before and after each machining operation. The top surface and bottom surface. diameters of the drilled holes were measured by a microscope.

The experimental observations and calculations are shown in Table :-

Exp. No.	Weight of tool (gm)		Weight of W/P (gm)		Time Required
	Before	After	Before	After	Min.
1	37.78	37.58	2535	2532	44.03
2	37.58	37.46	2532	2529	33.11
3	37.46	37.35	2529	2526	32.08
4	37.35	37.12	2526	2523	34.21
5	37.12	36.94	2523	2520	26.4
6	36.94	36.81	2520	2517	28.01
7	36.81	36.59	2517	2514	26.12
8	36.59	36.46	2514	2511	27.46
9	36.46	36.3	2511	2508	24.52

The input and corresponding output values of experiment are shown in following table

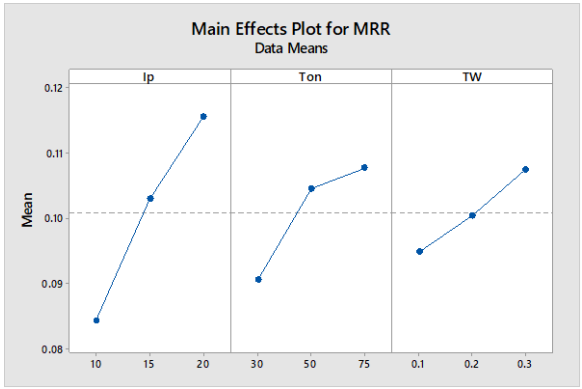
Exp.No.	Levels of Parameters			MRR	TWR
	Ip	TW	Ton	g/min	g/min
1	10	0.1	30	0.0681	0.004545
2	10	0.2	50	0.0909	0.003636
3	10	0.3	75	0.0937	0.003437
4	15	0.2	30	0.0882	0.006764
5	15	0.3	50	0.1136	0.006818
6	15	0.1	75	0.1071	0.004642
7	20	0.3	30	0.1153	0.008461
8	20	0.1	50	0.1092	0.004734
9	20	0.2	75	0.1223	0.005709

Effect Of Input Factors On Material Removal Rate (MRR) :- Analysis of Variance {MRR}

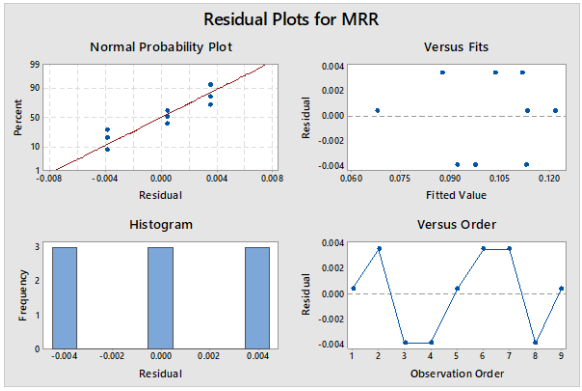
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Ip	2	0.001494	0.000747	18.04	0.053
Ton	2	0.000501	0.000251	6.05	0.142
TW	2	0.000244	0.000122	2.95	0.253
Error	2	0.000083	0.000041		
Total	8	0.002323			

Referring to the above analysis of variance (ANOVA) it is notice that peak current (IP) has more effect on material removal rate (MRR) and time of work (TW) has the least effect on material removal rate (MRR) .

Main Effects Plots :-



Residual Plots :-

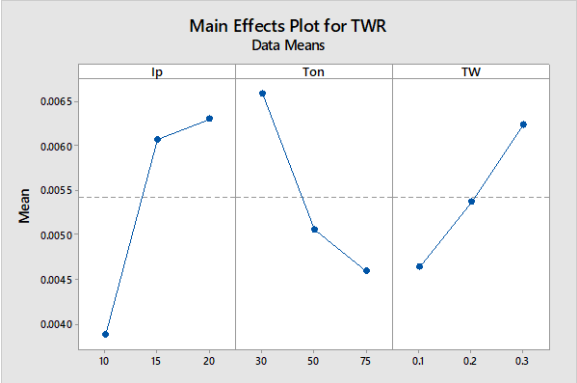


Effect Of Input Factors On Tool Wear Rate (TWR) :- Analysis of Variance { TWR}

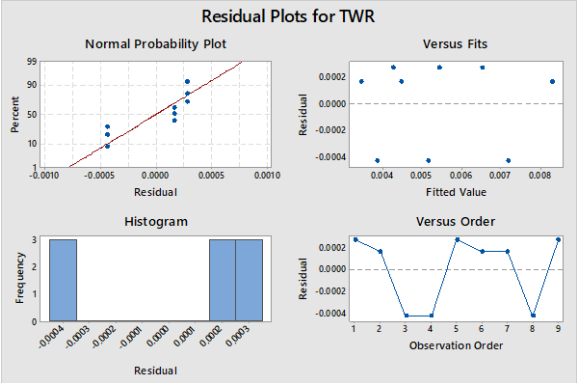
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Ip	2	0.000011	0.000005	12.25	0.075
Ton	2	0.000007	0.000003	7.41	0.119
TW	2	0.000004	0.000002	4.36	0.187
Error	2	0.000001	0.000000		
Total	8	0.000022			

Referring to the above analysis of variance (ANOVA) it is notice that peak current (IP) has more effect on Tool wear rate (TWR) and time of work (TW) has the least effect on Tool wear rate (TWR) .

Main Effects Plots :-



Residual Plots :-



Conclusion :-

Form the above research studied we have investigated that form the three input parameters current (Ip) , pulse on time (Ton) , Time of work (TW) current has more significant on material removal rate (MRR) and Tool wear rate (TWR) . Time of work (TW) has lesser significant on output parameter . We Used Fe-Mo alloy electrode which contributes in better surface finish because of molybdenum electrode. It contains the 0.278% carbon , 0.412% silicon , 4.77% Mn , 6.92% W , 0.441% V , 1.22% Ni , 27.229% Mo, 58.73% Fe . Electrode has less wear resistance the proper selection of input parameter is necessary for higher material removal rate (MRR) and lesser Tool wear rate (TWR) . From above literature review it is concluded that more research is carried out on peak current (Ip) and pulse on time (Ton) . There is no research on time of work (TW) input parameter . Thus the process is carried out on time of work (TW) process parameter to study its effects on Tool wear rate (TWR) and Material removal rate (MRR).

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An experimental study on performance characteristics Of waste cooking oil blends with diesel in a VCR engine.

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Abstract

Now days to fulfill the energy requirement there have been growing interest in alternative fuels like vegetable oil, biodiesel, biogas, LPG, CNG to provide suitable alternative fuel to diesel oil for internal combustion engine. Vegetable oil or cooking oil due to their agricultural origins and less carbon contain as compare to mineral diesel are produce less emission. In India massive wastage of cooking oil in big restaurants, household, food processing industry, packing industry because of this are not reutilized and ultimately get waste. For utilization purpose of these waste cooking oil and producing alternative fuel to traditional mineral diesel fuel. In present paper production and experimental study is carried out in I.C. engine laboratory on single cylinder four stroke computerized VCR engine. The analysis of chemical and physical property, performance and emission characteristic of pure diesel with waste cooking oil – diesel with various blends. All measurement is recorded for compression ratio 14, 16, 17.5 with varying load ideal to 12Kw.

Keywords:
WCO (Waste Cooking Oil), VCR (Variable Compression Ratio)

Introduction

Biodiesel is defined as the mono alkyl esters of long chain derived from renewable lipid sources. Biodiesel is basically produced through reaction of vegetable oil or animal fat with methanol in presence of catalyst to yield glycerin and methyl ester[1]. The biodiesel production is not somehow new because the use of vegetable oil as a fuel is date back to 1993 Rudolf diesel developed the first diesel engine which has run with vegetable oil (groundnut oil) as fuel[2]. The origins of biodiesel and commercial diesel blends have in industrial revolution in Second World War. To fulfill the market requirement and supply/demand ratio interaction of biodiesel is necessary now days. The use of biodiesel specially produced form waste cooking oil has popular subject for research to minimization of waste in sewage system and contaminating rivers and ground water. The use of waste cooking oil in compression engine reported to cause several problems due to its high viscosity. Bio diesel which is used as alternative fuel is prepared by transesterification of waste cooking oil with a methanol in presence of catalyst. The use of waste cooking oil as biodiesel feedstock reduces the cost of biodiesel production since the feedstock cost constitute approximately 75% to 80% of overall cost of biodiesel production. Hence use of waste cooking oil gives higher priority over edible oil as biodiesel feedstock. In this study, the performance characteristics of compression ignition diesel engine were measured using a biodiesel as an alternative fuel.

The tests were performed in Chemical and Mechanical Engineering department laboratories at steady state conditions for a four stroke single cylinder VCR engine.

1 Methodology:

1.1 Transesterification:

The major component of vegetable oil is triglycerides. When the triglycerides react with alcohol in presence of base catalyst, this is called "transesterification" in this reaction triglyceride are converted in to diglyceride, monoglyceride and finally converted in to glycerol. The process is explain in diagram

(a) Preprocessing: the cooking oil collect form the market and restaurants have various impurities and carbon and water contain to remove this impurities preprocessing is done**.** Here Filtration, Demoisture, Neutralization process is done.

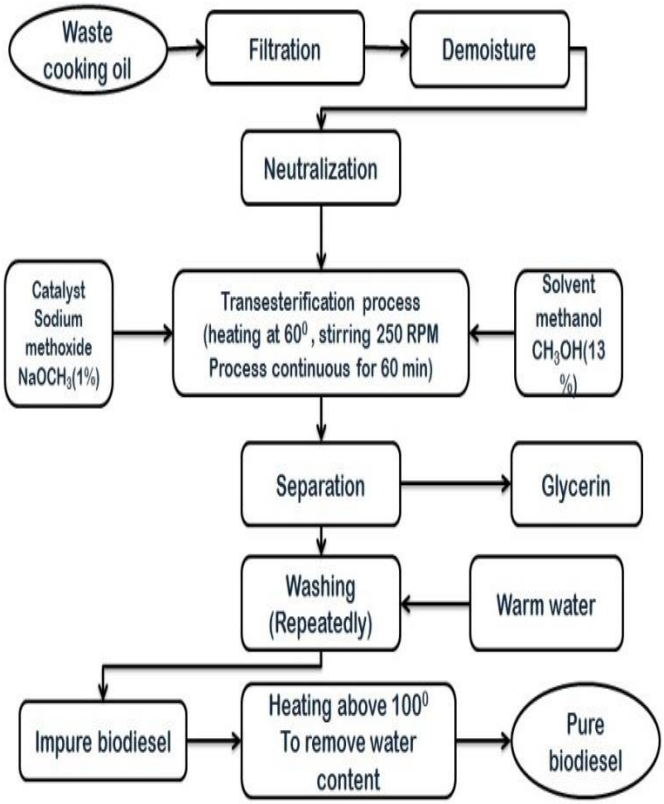

Fig.1.0 process of biodiesel preparation

(b) Tranesterification process: here the reaction of triglyceride with the methanol in the presence of catalyst is done in reactor. The methanol is used as solvent where the Sodium methoxide as a catalyst, the reaction temperature is maintain at 60^o and stirring speed is 250rpm constant to get the best result. This reaction continuous for 1 hr. during this period the methanol reacts with the triglyceride to form methyl ester and glycerol as a byproduct.

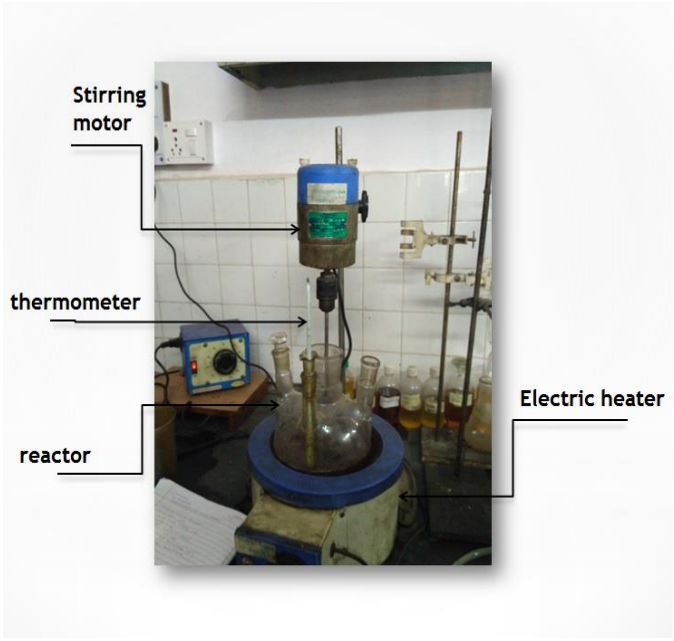

Fig 1.1 Trans-esterification Process

(c) Separation: after completion of process the mixtures is settled in the settling jar for 18hrs. So get the better separation of glycerol and ester.

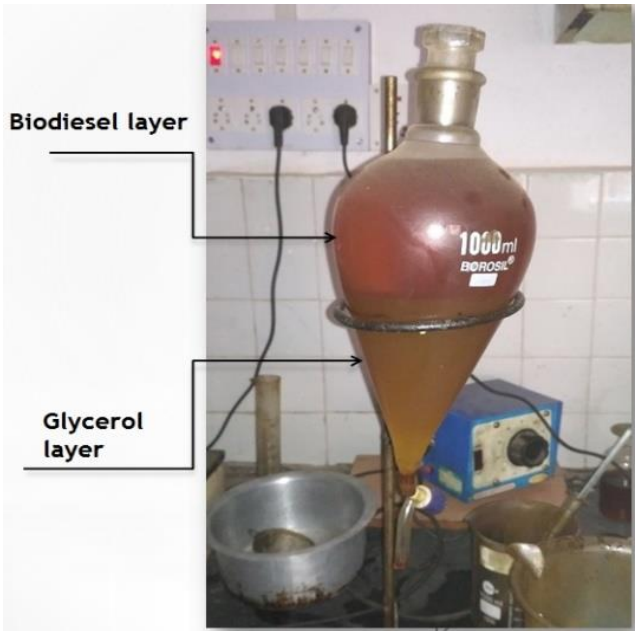

Fig.1.2 separation of glycerol

(d) Washing and post processing: After the separation process we get the ester with the amount of glycerol to remove the all contains of glycerol the washing with warm water is done and after washing heating above the 100^0 is done to remove the water contain.

After all these process we get the biodiesel as a final product. This biodiesel is mix with the diesel in the percentage

of diesel fuel to get the blends of biodiesel.

Fig.1.3 blends of biodiesel (waste cooking oil and diesel)

1.2 factors affecting biodiesel production:

(a) Water content: water contain in waste cooking oil will accelerate the hydrolysis reaction and simultaneously reduce the amount of ester formation. To avoid this preprocessing like filtration, neutralization, and demoisturization is done on feedstock oil.

(B) Free fatty acid: Waste cooking oil contains high free fatty acid content than the fresh cooking oils. Hence, it knows that higher free fatty acid contents will lead to formation of soap and water. Similarly, if free fatty acid content exceeds 3%, transesterification reaction will not proceed even with homogenous base catalyst [4].

(c) Catalyst Type: Various types of catalyst (homogenous, heterogeneous, enzyme catalyst) are available for production of biodiesel or ester. Disadvantages of use of homogenous catalyst are recovery of catalyst from final product and formation of soap is difficult. To overcome this issue most of the rescuers used to heterogeneous catalyst because heterogeneous catalyst does not affect by free fatty acid and moisture present in feedstock [4].

(c) Stirring speed: Mixing of reactant are very important to achieve completion of transesterification reaction and also to increase the yield of the product. The increase in stirring speed will shorten the reaction time [4]. Increase in conversion by increasing the stirrer speed from 100 to 200 rpm. But at 250 rpm, there was no significant increase in the conversion because of shearing in the enzyme molecules. Hence, it was suggested that 200 rpm the optimum speed for production of biodiesel using enzymatic reaction.

(d) Temperature: Temperature has significant influence on Transesterification reaction. If the reaction temperature is increased, then the rate of reaction and yield of product will also tend to increase. The temperature should not exceed the boiling point of alcohol. This will avoid vaporization of alcohol. But if the reaction temperature is maintained below 50^0C, then the viscosity of biodiesel will increase. Refaat et al. studied fresh and waste cooking oil from both domestic and commercial sources and reported highest yield at 65∘C for all the feed stocks using KOH catalyst [4].

2.0 Experimental Procedure:

The experimental test rig consists of a variable compression ratio engine, eddy current dynamometer as loading system, fuel supply system for both Diesel oil and biodiesel supply, water cooling system, lubrication system and various sensors and instruments integrated with computerized data acquisition system for online measurement of load, air and fuel flow rate, exhaust emissions and smoke opacity. Following fig. gives the information about experimental test rig.

Product	VCR Engine test setup 1 cylinder, 4 stroke, Diesel (Com.)
Product code	234, 234H*
Engine	Make Kirloskar, Type 1 cyl., 4 stroke Diesel, water cooled, power 3.5kW at 1500rpm, stroke 110mm, bore 87.5mm. 661cc, CR17.5, Modified to VCR engine CR 12 to 18
Dynamometer	Product 234: Type eddy current, water cooled, Product 234H: Type Hydraulic
Propeller shaft	With universal joints
Air box	M S fabricated with orifice meter and manometer
Fuel tank	Capacity 15 lit with glass fuel metering column
Calorimeter	Type Pipe in pipe
Piezo sensor	Range 5000 PSI, with low noise cable
Crank angle sensor	Resolution 1 Deg, Speed 5500 RPM with TDC pulse.
Data acquisition device	NI USB-6210, 16-bit, 250kS/s.
Piezo powering unit	Make-Cuadra, Model AX-409.
Temperature sensor	Type RTD, PT100 and Thermocouple, Type K
Temperature transmitter	Type two wire, Input RTD PT100, Range 0–100 Deg C, Output 4–20 mA and Type two wire, Input Thermocouple,
Load indicator	Digital, Range 0-50 Kg, Supply 230VAC
Load sensor	Load cell, type strain gauge, range 0-50 Kg
Fuel flow transmitter	DP transmitter, Range 0-500 mm WC
Air flow transmitter	Presure transmitter, Range (-) 250 mm WC
Software	"EnginesoftLV" Engine performance analysis software
Rotameter	Engine cooling 40-400 LPH; Calorimeter 25-250 LPH
Pump	Type Monoblock
Overall dimensions	W 2000 x D 2500 x H 1500 mm
Optional	Computerized Diesel injection pressure measurement

Fig. 2.1 engine specification

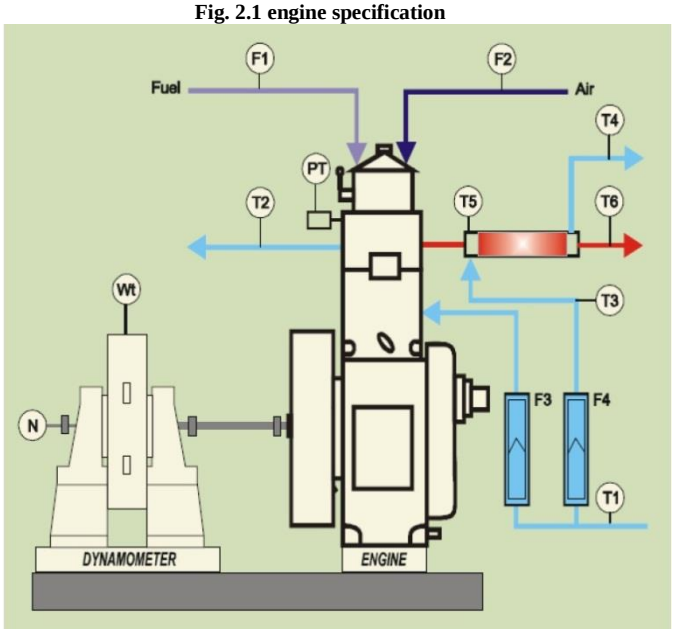

Fig. 2.2 Experimental setup.

The setup consists of single cylinder, four stroke, Multi-fuel, research engine connected to eddy current type dynamometer for loading. The operation mode of the engine can be changed from diesel to Petrol or from Petrol to Diesel with some necessary changes. In both modes the compression ratio can be varied without stopping the engine and without altering the combustion chamber geometry by specially designed tilting cylinder block arrangement. The injection point and spark point can be changed for research tests. Rotameters are provided for cooling water and calorimeter water flow measurement. A battery, starter and battery charger is provided for engine electric start arrangement. The setup enables study of VCR engine performance for brake power, indicated power, frictional power, BMEP, IMEP, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, A/F ratio, heat balance and combustion analysis. Lab view based Engine Performance Analysis software package "Enginesoft" is provided for on line performance evaluation.

3.0Results and charts:

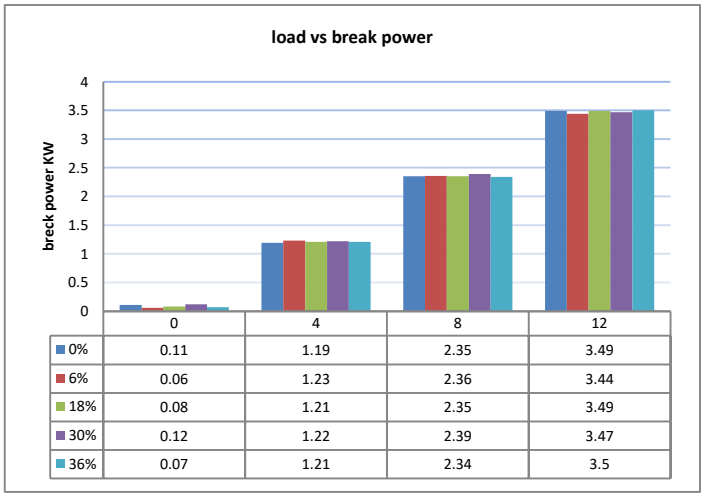

Fig. 3.1 load vs. Break power:

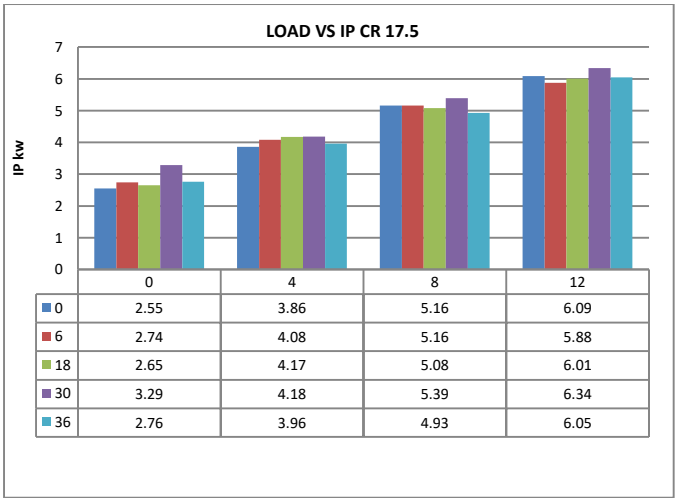

Fig. 3.2 load vs. indicated power:

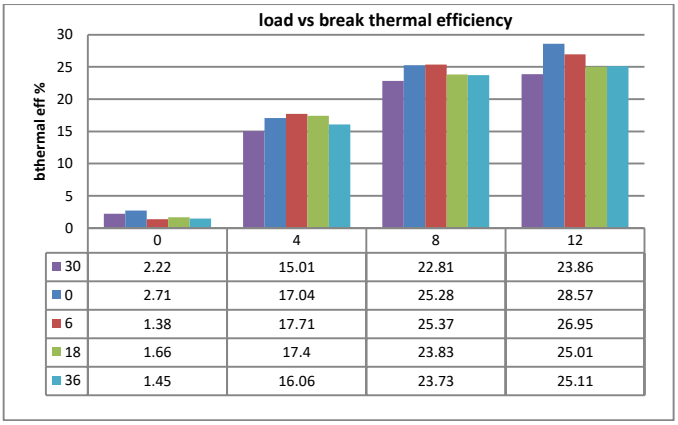

Fig. 3.3 load vs. break thermal efficiency

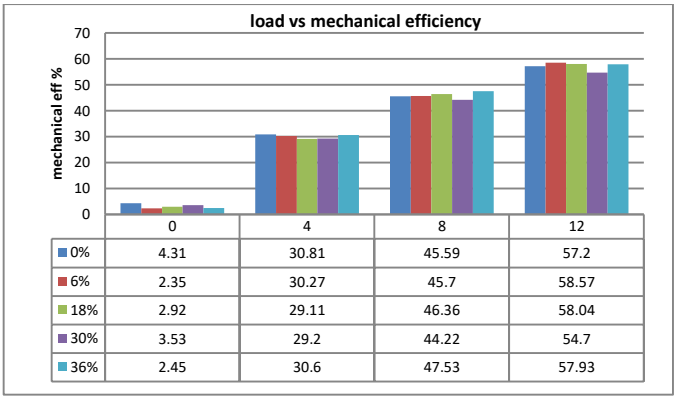

Fig. 3.4 load vs. mechanical efficiency

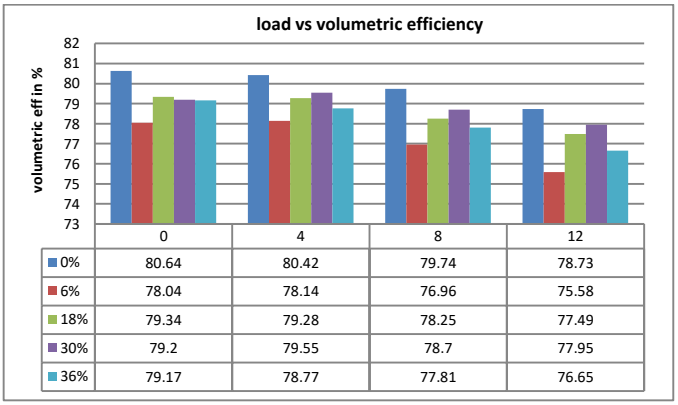

Fig. 3.5 load vs. volumetric efficiency

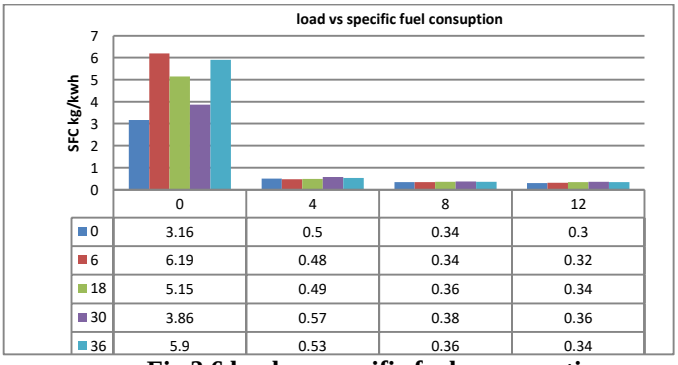

Fig 3.6 load vs. specific fuel consumption:

4.0 Discussion:

4.1 Biodiesel Fuel Characteristic And Properties:

Biodiesel is non-toxic and safe for use and it can be used easily in unmodified diesel engine. The viscosity of biodiesel oil is high and it can be easily mixed with our pure diesel. The trans-esterification process is very easy for making biodiesel from waste cooking oil. The flash point of pure biodiesel is very high and it changes with respect to its blend. The sulphur content in biodiesel is lesser than pure diesel. It is main environmental advantage of biodiesel that reduces pollution in environment.

4.2 Load vs. Break Power:

At all experimental load conditions the brake power of biodiesel is near about the pure diesel.

4.3 Load vs. Indicated Power:

Indicated power of biodiesel is higher than the pure diesel at all experimental load.

4.4 Load vs. Mechanical Efficiency:

At a zero load conditions mechanical efficiency is higher than biodiesel but other experimental load conditions the mechanical efficiency is near about or higher than pure diesel.

4.5 Load vs. Volumetric Efficiency:

At all experimental load condition volumetric efficiency of pure diesel is higher than biodiesel.

4.6 Load vs. Specific Fuel Consumption:

At zero load condition Specific fuel consumption of pure diesel is less than the biodiesel. But when load is increases specific fuel consumption of biodiesel is near about same to the pure diesel.

5.0 Conclusion

The use of waste cooking oil as a feed stock for production of biofuel has proved to be substantial value and the best utilization techniques to recycling the waste cooking of and various sources are available in larger quantities in the community. The chemical properties to be tested are closely similar in observation so the biodiesel produced from waste cooking oil gives similar chemical and physical property as compare to pure diesel fuel. And when we produce the biodiesel from waste cooking oil then the cost of diesel is been reduced by 20 to 22 Rs from same amount of diesel fuel.

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A Review on the Thermo Acoustic Refrigeration System

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Abstract:
Due to increased consumer demands for higher functionality and reliability in low-power hand held devices, the thermal output from the components within handheld devices has increased. Therefore, the necessity for better thermal management in these handheld devices has increased. Different cooling techniques using thermo acoustic and forced convection was introduced and investigated for low-power handheld devices Design factors such as the selection of the working gas, configurations for the stack, the drive ratio, and operating frequency were optimized to maximize the cooling capability were considered. An improvement in the cooling performance achieved was remarkable. Thus, a cooling system using the bulk air flow generated by a vibrating cantilever beam is a feasible solution for typical handheld devices, yet the capability of the vibration motor and the limitation of the cramped interior in the devices should be considered.

Keywords: Thermo acoustic, cooler, sound, greenhouse effect, CFC

Introduction:
Refrigeration is the process of removing heat from a body or enclosed space so that its temperature is first lowered and then maintaining at a level below the temperature of surroundings. From creating comfortable home environments to manufacturing fast and efficient electronic devices, air conditioning and refrigeration remain expensive, yet essential, services for both homes and industries. However current cooling technologies continue to generate greenhouse gases with high energy costs., in an age of impending energy and environmental crises, An innovative alternative for cooling that is both clean and inexpensive is Thermo acoustic refrigeration. Through the construction of a functional model, we will demonstrate the effectiveness of thermo acoustics for modern cooling. Refrigeration relies on two major thermodynamic principles. First, a fluid temperature rises when compressed and falls when expanded. Second, when two substances are placed in direct contact, heat will flow from the hotter substance to the cooler one. While refrigerators that used nowadays utilizes pumps to transfer heat on a macroscopic scale, thermo acoustic refrigerators rely on sound to generate waves of pressure that alternately compress and relax the gas particles within the tube. Thermo acoustic refrigerator is a device that operates efficiently by using sound waves, environmentally friendly and non-flammable gases, and is suitable for handling residential refrigeration needs. The thermo acoustic refrigerator is relatively simple and inexpensive to construct, operate has no moving part. Thermo acoustic refrigerators tend to be lightweight and compact, and contain no harmful refrigerants, which make them environmentally friendly. This aspect will make it very appealing option in the future.

Literature Review:
Different literatures of thermo acoustic refrigeration system have been studied which are discussed as below.
P.K.Bansal et al. [1] discussed household refrigeration systems by using the thermo acoustic refrigeration cycle and how it can be applied to real world uses. The commercial viability of this technology is determined by comparing it to a vapour compression system. The two goals of the papers are to determine practical applications where thermo acoustic refrigeration may prove a strong rival to current methods, and to determine what future developments are required for this technology to be of commercial value.
Daniel J. Cosch [2] thermo acoustic refrigeration, cooling by using sound, is a concept that most people have not thought of, or even heard of. It is very simple concept, yet may take the place of conventional refrigeration which uses CFC's that are thought to damage the ozone layer. A prototype acoustic refrigeration was built with a resonant tube length of 100-cm and operating at 260-Hz with air. One of the acoustic refrigerators main components is thermo acoustic stack. The

optimal stack length is around 8-9 cm for a 100 cm resonant tube.

Newman et al. [3] achieved temperature as low as -65ºC in their thermo acoustic device. They used it to study the effect of some important thermo acoustic parameters, such as the Prandtl number by using binary gas mixture.

Hariharana et al. [4] by using laser Doppler anemometry together with microphone acoustic pressure measurement, measured acoustic power flow in the resonator of a thermo acoustic refrigerator. They found agreement between the experimental and theoretical results.

Chen M Ju [5] studied thermo acoustic phenomenon in pulse tube refrigerator. They used thermo acoustic prime mover to create an acoustic wave to drive refrigerator. They studied the characteristics of the thermo acoustic prime mover and the effect of working fluid i.e. helium and different proportions of helium-argon mixture, on the thermo acoustic refrigerator. They achieved a cryogenic temperature of 120K in their experiments.

Ghorbanian et al. [6] used thermo acoustic refrigerator and the prime mover to remove heat from an electronic circuit. They drove the thermo acoustic devices at the frequencies between 4- 24 kHz and investigated the performance of the devices.

Bansal et al. [7] analyzed the performance a thermo acoustic refrigerator to variable loading and compared data experimentally. In their experiments, the temperature of cold heat exchanger varied to achieve temperature difference of 0.5 and 10K along the stack and hot heat exchanger maintained at ambient temperature. They measured and calculated cooling load for these temperature differences while varying the driving frequency between 30 and 65 Hz.

Konaina et al. [8] conducted experiments on thermo acoustic cooler consisting of acoustic loop tubes with two stacks inside. Stack-1 was employed as prime and stack-2 as heat pump. They used the mixture of air and helium gas at atmospheric pressure as the working fluid. They observed the temperature drop of approximately 16ºC. They also found that self-sustained sound had higher harmonics which lowered the efficiency of the system.

Zhao et al. [9] described an analytical model the interaction between sound wave and solid surface. They found that the thermal –relaxation dissipation at the gas is minimal whenever the temperature oscillations in the wall follow the temperature oscillations in the gas. They conducted that the tube material with smallest combination thermal conductivity, density and specific heat and a gas with largest possible combination of above properties could minimize the thermal-relaxation losses.

Garrett et al. [10] found expressions for the phase difference, between the temperature and pressure waves by using single-plate, linear theory for the thermo acoustic phenomenon at ideal conditions.

Hofler [11] used a combination of holographic interferometry and high-speed cinematography to visualize and qualify temperature fields near stack plate between the pressure and velocity nodes of acoustic standing wave. They found that heat is transfer either from the working fluid to the plate or vice versa. They measured heat fluxes transferred from colder fluid to the hot stack plate at edge of single stack plate and they investigated the difference between heat transfer in steady flow convection and oscillatory flow.

Garrett et al. [12] discovered relation between size of cold and hot heat exchangers and entropy generation rates in thermo acoustic device and the temperature differences along the regenerator stack and their location in resonator. They found that heat transfer effect is more important than the viscous effect in the quick decrease of entropy generation. In their study they found that the size of heat exchanger on the hot side should be smaller than that at cold side.

Reid et al. [13] numerically investigated the influence of stack plate length when the plate spacing is greater than the thermal penetration depth. They observed that there was a heat pumping-effect on the long and short plates compared with particle displacement length. Further, the energy dissipation close to plate increases quadratically with the particle displacement and they found no heat transfer when plate spacing was equal to the thermal penetration depth.

Landsberg [14] studied the acoustic disturbance theoretically He solved a complete set of time averaged second order equations of fluid dynamics of viscous , thermally conducting fluid between closely spaced parallel plates, when derivative of temperature in the absence of acoustic disturbance with respect to the direction of plate length is not equal to zero.

W.Man et al. [15] used the finite difference method to solve the equations of thermo acoustic refrigerators, thermo acoustic engine and sterling regimes. They assumed short stack and the linear temperature gradient across the stack. They solved the equations for the both traveling and standing wave and compare the results with measured values.

Kirkconnell et al. [16] explained the detail design criteria for thermo acoustic refrigerator in order to achieve an optimal system. They used linear thermo acoustic theory describe the design criteria. They used dimensionless independent variables decrease the number of parameters and to simplify the equations. They establish a method to obtain the premium design of the different parts of the thermo acoustic refrigerators.

Swift [17] simulated a thermo acoustic device and numerically investigate the unsteady flow and the temperature field in the vicinity of an idealized thermo acoustic refrigeration. The numerical model simulates the unsteady mass, momentum and energy equations in the thin plate and low Mach number limits. They also analyzed the variations of thermal performance of the device against the heat exchanger length and positions.

Swift et al. [18] measure the phase angle dependence of cooling power of Gifford-McMahon refrigerator for the regenerator spherical particles with different diameters.

Components of Thermo acoustic refrigeration system:

The important components of thermo acoustic refrigeration system are as follows:

1. **Resonance Tube**

Fig. No. 1

2. **Amplifier**

Fig. No. 2

3. **Speaker**

Fig. No. 3

4. **Function Generator**

Fig. No. 4

5. **Stack**

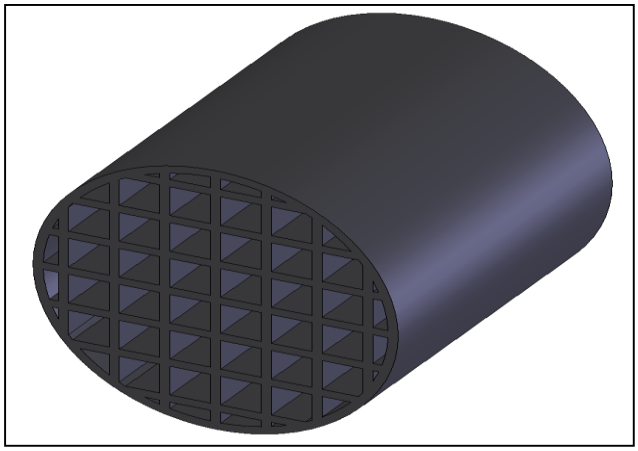

Fig. No. 5

6. **Temperature Sensor**

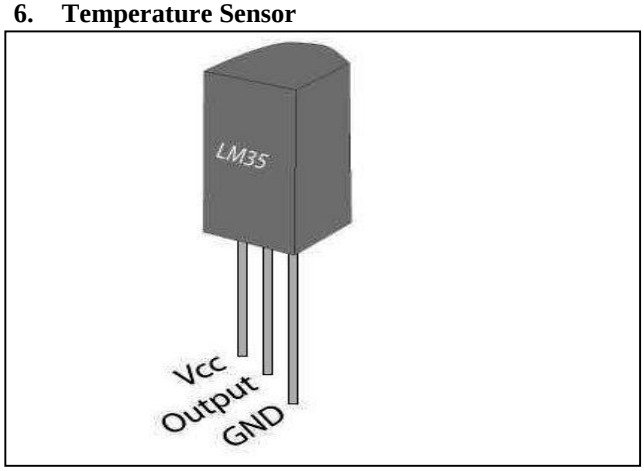

Fig. No. 6

7. **Metallic Stopper**

Fig. No. 7

Results and Discussion:

The conventional refrigeration system uses CFC's that create depletion of ozone layer. The thermo acoustic cycle can be applied for real world uses particularly in household refrigeration system. The Prantl number has significant effect on the performance of thermo acoustic refrigeration. The thermal properties of the tube has effect on the thermal relaxation losses. The location of the stack affect the performance of the thermo acoustic refrigeration system.

Conclusion:

From this review paper it is concluded that the cooling effect can be obtained by using sound waves. If resonating length is reduced, temperature gradient across the stack end increases. The resonating tube length below certain value then the frequency of vibration increases to such an extent that the particles of medium do not get enough time for transfer of heat. Hence performance of the system decreases. If the diameter of the tube is reduced, temperature difference across the stack end increases.

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Multi-Objective Optimization of Multi-pass Turning Parameters by Response Surface Methodology

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Abstract

This paper elaborates multi-objective optimization of multi-pass turning process parameters by using design of experiment tool viz. response surface methodology. Three process parameters that are cutting speed, feed and depth of cut are taken into account for the optimization procedure wherein intended to minimize the surface roughness and maximization of material removal rate. Multi-pass turning, where multiple passes are used for rough turning operation and single pass is used for finishing operation.

Keywords

Response Surface Methodology, Multi-pass Turning, Optimization, Response Optimizer, EN8, SR.

I.INTRODUCTION

The machining processes are commonly used in industries to produce components with high quality and also having cost effectiveness. Also these components not only have simple operations but also varying complex geometry.So to select appropriate combination of process parameters is important key to achieve quality as well as low cost.Single pass turning operations doesn't allow us to optimize the rough cut and finish cut independently so that multi-pass turning operations has advantage over single pass turning operation.

Suleyman Neseli et. al. [1] focuses on the influence of tool geometry on the surface finish obtained in turning of AISI 1040 steel. In order to find out the effect of tool geometry parameters on the surface roughness during turning, response surface methodology (RSM) was used and aprediction model was developed related to average surface roughness (Ra) using experimental data.

Makadia and Nanavati [2] used design of experiments to study the effect of the main turning parameterssuch as feed rate, tool nose radius, cutting speed and depth of cut on the surface roughnessof AISI 410 steel.

Naga Phani Sastry et al. [3] set the three levels of the feed, three levels of speed, three values of the depth of cut, two different types of work materials and have been used to generate a total 20 readings in a single set. After having the data from the experiments, the performance measures surface roughness (Ra) of the test samples was taken on a profilometer and MRR is calculated using the existing formulae.

Gowd et. al. [4] applied the Response Surface Methodology (RSM) to accurately predict the mathematical models to estimate feed force, thrust force, cutting force and surface roughness on Inconel 600.

II.RESPONSE SURFACE METHODOLOGY

Response surface methodology (RSM) [1] is the strategy of doing experiments in order to optimize the target response, for which it uses the statistical and mathematical techniques. The relation between input and output response is postulated in low degree polynomial as

$$y = f(x_1, x_2) + \varepsilon$$

Where ε is error or noise.

Here, we used the central composite design(CCD) which comprises 2^3 factorial designs wherein α value kept as 1.633 to get rotatability feature of CCD. The value of α is selected such that CCD should not be in face centred because these designs are not rotatable.

III.METHODOLOGY

In this paper, response surface methodology is used to optimize the response; surface roughness and material removal rate. Turning process is mainly influenced by three main process parameters and they are namely cutting speed, feed and depth of cut. And parameters upper and lower bounds are selected accordingly and are easily understandable by table I,

Table I: Cutting Data

	Cutting Speed (rpm)	Feed (mm/rev)	Depth of Cut (mm)
Upper Bound	898	0.1	0.2
Lower Bound	2040	1.0	1.0

Specimen material chosen was EN8(080M40) because of wide application for industrial purpose. It is in round bar shape of having 40mm diameter. But 39mm was taken and 1mm relaxed for oxidation layer, stains etc. Machining was done by TNMG Cutting tool with nose radius 0.8mm.Machining was carried out on CNC Turning Centre consequently the experiments as specified in table II.

IV. RESULTS AND DISCUSSIONS

Second order model is used for analysis in respect to effect of input variables on output variables because second order model uses a quadratic term which helps to get curvature of output response. Results generated by Minitab 16 software are discussed and interpreted in this paper. Contour plots and surface plots are drawn by using mentioned software are presented and interpreted in successive pages.

Contour plot of surface roughness is shown by figure I which shows the various optimal combinations of three parameters over surface roughness value

Table II: Run order of experiment and their responses

Standard Order	Run Order	Cutting Speed	Feed	Depth of Cut	Surface Roughness (µm)	Material Removal Rate (mm^3/min.)
12	1	1469	0.5500	0.600	3.166	484.77
2	2	1819	0.2744	0.330	3.237	164.714
6	3	1819	0.2744	0.854	2.512	426.260
7	4	1119	0.8256	0.854	3.198	788.965
11	5	1469	0.5500	0.600	5.841	484.770
1	6	1119	0.2744	0.330	3.969	101.328
8	7	1819	0.8256	0.854	4.388	1282.509
4	8	1819	0.8256	0.330	6.131	495.583
10	9	1469	0.5500	0.600	8.746	484.770
9	10	1469	0.5500	0.600	3.025	484.770
3	11	1119	0.8256	0.330	13.619	304.869
5	12	1119	0.2744	0.854	2.310	262.224
14	13	2040	0.5500	0.600	3.328	673.200
15	14	1469	0.1000	0.600	3.837	88.140
13	15	898	0.5500	0.600	6.709	296.340
19	16	1469	0.5500	0.600	7.965	484.77
16	17	1469	1.0000	0.600	14.613	881.40
17	18	1469	0.5500	0.200	8.702	161.59
18	19	1469	0.5500	1.000	9.654	807.95
20	20	1469	0.5500	0.600	9.424	484.77

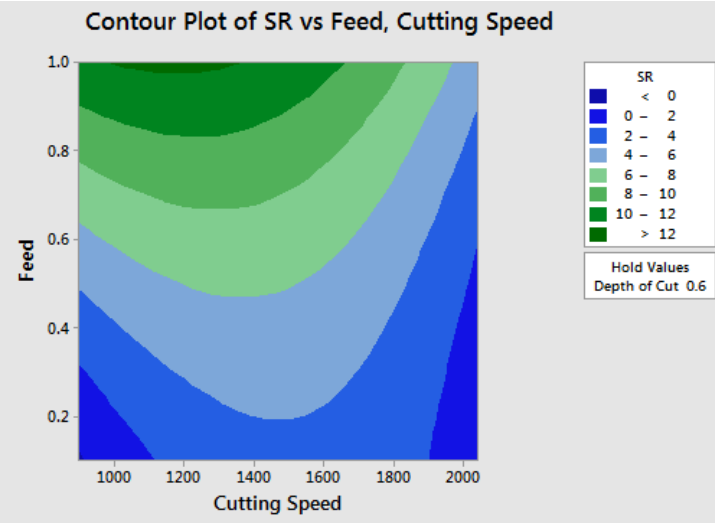

Figure I: Contour plots of Surface Roughness

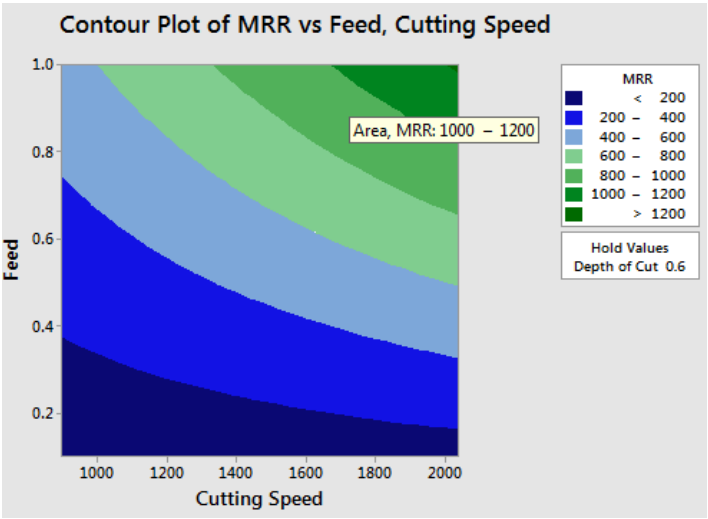

Figure II: Contour plots of Material Removal Rate (MRR)

A contour plot in of MRR (figure II) denotes that we can surely get higher MRR by keeping all parameter values at higher levels. Green shades are self-explanatory about setting the combination suitable to get higher MRR in case of rough cuts.

Response optimizer tool in Minitab software; generated the plot to get variables at optimal combination and the same self-explained in figure III.

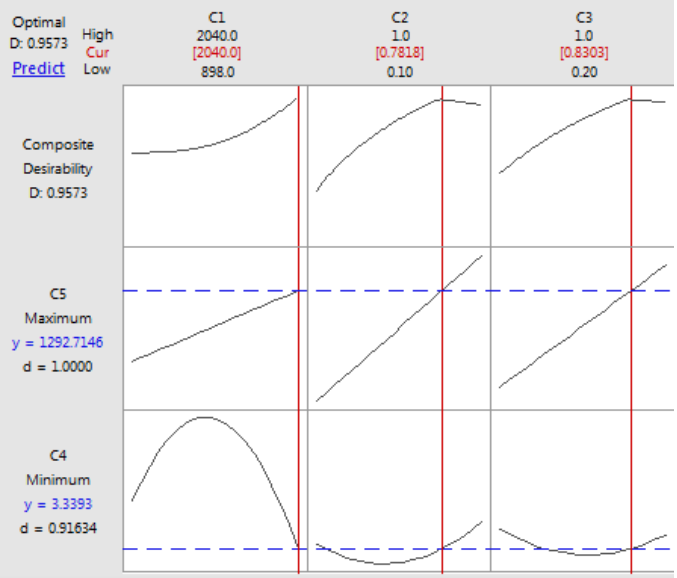

Figure III: Plot by response optimizer

VI. CONCLUSION

All discussed points above are concluded in the manner that the three parameters; cutting speed, feed and depth of cut values must be different for rough cut operation and finish cut operation.A multi-objective approach was set get single set of values for optimization.

Table III: Optimized input variables

Variable	Setting
v	2040
f	0.7818
d	0.8303

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A Review Paper on Design And Development Of Sheet Bending Machine

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ABSTRACT :

The paper deals with manufacturing or bending of sheet metal by using power operated sheet bending machine. Especially discussion made the productivity analysis of manually or power operated sheet bending machine. Considering manual operation is replaced by power operated devices .It also gives information about limitation of manually operated sheet bending machine and power operated sheet bending machine.

KEYWORD :

Shape, Bending, Cylindrical, Automatic, Hoppers, Frame, Fabrication, Production

INTRODUCTION :

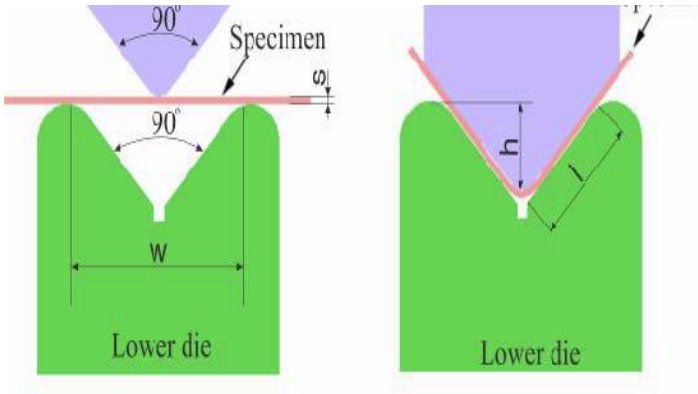
Sheet metal fabrication plays an important role in the metal manufacturing world. Sheet metal is used in the production of materials ranging from tools, to hinges, automobiles etc. Sheet metal fabrication ranges from deep drawing, stamping, forming, and hydro forming, to high-energy-rate forming (HERF) to create desired shapes. Fascinating and elegant shapes may be folded from a single plane sheet of material without stretching, tearing or cutting, if shape rolling of sheet metal is the bending continually of the piece along a linear axis. This causes alteration of the original form of the sheet as it passes through a pathway of series of rollers. The present invention relates to plate bending machines of the type which operates with rolls. Such machines involve certain well-known difficulties in respect of bending plates into conical shape. The invention has for its object to remedy this drawback and to enable, by including auxiliary means, the bending of conical mantles and the like

FEATURES:

- Low initial cost
- Low tooling cost
- Easy & Quick setting
- Enormous versatility
- Accurate repetition & bending
- User friendly
- Easy maintenance
- Standard spares, hence easy availability

Standard Features/Accessories:

- Main Drive is power screw
- Frame built of laser cut high strength steel, welded, stress relieved and sand blasted.
- operating system installed in top chamber.
- spring loaded in back pressure safety
- guide way of both side
- Mechanical component are fixed at highly FOS



OBJECTIVES OF THE WORK:

The following are the objectives of the work:

a. To make a bending machine to bend metal sheets up to 8 mm.

b. To make on simple working principle.

c. To reduce the time for operation.

d. To make in minimum cost.

APPLICATIONS:

- Fabricating/Rolling
- Boilers, Pressure Vessels
- Storage Tanks, Silos
- Tubes and Pipelines
- Pumps, Burners and Filters
- Heating and Ventilation
- Wind Towers, Power Generation

DESIGN PARAMETERS IN PROJECT:

1. Design of punch
2. Design of die
3. Design of power screw
4. Design of nut

5. Design of base frame

DESIGN OF PUNCH AND DIE:

Consider the design of punch and die is up to 3mm of thickness of sheet and material of sheet metal is GI

1. Bending radius:-

When bending angle is 90^0 then minimum bend radius is given standard for GI material of sheet is follows

Bend radius = 0.5 ×(thickness of sheet)

r = 0.5×t

r = 0.5× 3

r = 1.5mm

2.Bend allounce :-

$$B = \alpha/360\times(2\pi)(r+k)$$

Where,

B = bend allounce along neutral axis

α = bend angle

r = inside radius

k = distance of neutral axis from the inside surface of the bend

value of "k" is given by for v bending is (k=0.33t)
then k=0.33t=0.33×3=0.99mm

$B = 90^0/360^0\times(2\pi)(1.5+0.99)$

B = 3.91mm

3.spring back**:-**

Spring back means during the puch is back stroke bending angle will be decrease 3^0 to 4^0 then spring back of give operation of bending is

Spring back = 3^0 to 4^0

4.bend pressure:-

It is defined as the pressure or force exerted on sheet in given required bending operation this parameter is called is " Bend Pressure"

It is denoted as " F" and measure in " Newton"

$$F = k.l.\sigma_{ut}.t^2/w$$

Where,

F= bend pressure in N

K= die opening factor=0.33t=0.99

l = length of bend=1500mm,

w= width of bend=1500mm

σ_{ut}= ultimate tensile stress= 400 N/mm^2

t = Blank thickness in mm=3mm

$F=0.99\times1500\times400\times3^2/150$

F =5346 N

Design of Power Screw:-

The design power screw material is M.S. and it Standard Consideration Are as Folows

$\sigma_c=\sigma_t=85$ N/mm^2

$\sigma_s=55$ N/mm^2

$\sigma_y=260$ N/mm^2

FOS= 3

And modulus of Elasticity is give by standard table are as follows

Power Screw=$E_{Ms}=10\times10^4$ N/mm^2

For Nut = $E_{Ci}=20\times10^4$ N/mm^2

1.Axial load on power screw:-

It is indicated " W" and measured in Newton. Then Axial Load on Power screw is follows

$$W = \pi/4\times(d_i^2)\times(\sigma_c)$$

Where,

d_i=core diameter in mm

σ_c =compressive stress in N/mm^2

W= axial load on Power screw in N

But, load on power screw= Load on punch

W=5346 N

$$W = \pi/4\times(d_i^2)\times(\sigma_c)$$

$5346= \pi/4\times d_i^2)\times85$

d_i=8.94mm

d_i=9mm

2.Length of power screw:-

Length of power screw is denoted in "L" and it measured in "mm".In design of Power screw the length of power screw is defined very important factor.

Then length of power screw are as follows

$$W= \pi/4\times(d_i^2)\times(\sigma_c)((1-(\sigma_y L^2/k^2)/(4k\pi^2E)$$

Where,

W= axial load in N

L=Length of power screw in mm

K= least radius of Gyration

E=Modulus of Elasticity in N/mm^2

σ_c = Compressive Stress in N/mm^2

And modulus of Elasticity is give by standard table are as follows

Power Screw=$E_{Ms}=10\times10^4$ N/mm^2

For Nut = $E_{CI}=20\times10^4$ N/mm^2.....(Given Standard values)

L = 224.84 mm

L = 225mm

Refrences of standard table in machine design book other values will be given are as follows

d_i=core diameter = 9mm

d_o=nominal diameter=14mm

P=Pitch=4mm

L=Lead=4mm

A=Core Area=71mm^2

D=Mean diameter=12mm

3.Helix angle:-

$\alpha=\tan^{-1}(lead/\pi D)$

$\alpha=\tan^{-1}(4/\pi 12)$

$\alpha=6.05^0$

$\alpha=6^0$

4.torque:-

assume coefficient of friction is $\mu=0.15$

but $\mu=\varphi$

then $\varphi=0.15$

torque$(T)=W\times D/2\times\tan(\alpha+\varphi)$

T=2592.18 N.mm

5.No.of threads:-

$A=\pi/4\times(d_0^2-d_i^2)\times n$

Where,

A=Area of Core In mm^2

d_0^2=nominal diameter in mm

d_i^2=core diameter in mm

n = no. threads on Power Screw

$A=\pi/4\times(d_0^2-d_i^2)\times n$

$71=\pi/4\times(14-9)\times n$

n= 14.2

n =15 Nos.

DESIGN OF NUT:-

In design of nut the Material selection is very important factor.

Given standardization og machine design book mtrial of power screw is MS and material of nut is CI.

1.Design Height of Nut:-

For CI material is

H=2d

Where,

H=height of nut in mm

d=nominal diameter in mm=14mm

then,

H=2d

H=2×14

H=28mm

All data refer is design handbook following values are given from table are as follows

Pitch=4mm

Nominal diameter=14mm

Designation of nut=M36

Stress=817N/mm^2

Minor diameter of nut=31.67mm

DESIGN OF BASE FRAME:-

All parts are designed to specific load. All load are subjected on base frame approximately length and thickness designed to future references' are as follows

Thickness of base frame=t=40mm

ACTUAL WORK:-

punch and die:-

Base plate with Die and punch:-

Support frame assembly:-

Final assembly:-

RESULT:-

0.5 to 3mm sheet is bending(V-brnd) at 90^0.

CONCLUSION

As compare to the manually operated sheet bending machine the power operated sheet
Bending machine is better. The productivity of power operated sheet bending machine is higher. The part of
Machine is able to handle the heavy load on machine. The time required to complete bending operation is
Less and the requirement of extra worker's reduced. Power operated sheet bending is less time consuming
Process with high productivity

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Review On Special Purpose Horizontal Boring Machine.

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ABSTRACT:-

In machining, boring is the process of enlarging the hole that has already drilled by means of single point cutting tools. Especially in automotive industries bore can vary in diameter and form, from bigger piston bores in motor cylinder to rather small bore in fuel injection system. Special purpose horizontal boring machine becomes a machine that enables you to do a variety of standards and specialty operations easily and with great accuracy. It can specially used to bore the motorcycle cylinder block. It allows making holes in large or long cylinder blocks that ordinarily couldn't drill. It can bore cylinder blocks of various diameters and length with ease. The machine reduces the cycle time, increases the productivity, reduces the vibrations and accuracy of the products.

KEYWORDS:-Boring, cutting speed, Feed, Surface roughness, Boring process, Machine tool, AutoCAD.

INTRODUCTION:-

In a horizontal boring machine, the work is supported on a table which is stationary and the tool revolves in a horizontal axis. Horizontal boring machine can perform boring, reaming, threading, facing; milling grooving and many other applications with suitable tools. The work pieces which are heavier and symmetrical can be easily held and machined. Different types of horizontal boring machine have been designed to suit the different purpose. Horizontal boring machine becomes a machine that enables you to do a verity of standards and specialty operations easily and with great accuracy. It allows making holes in large or long pieces that ordinarily couldn't drill.

Most of the manufacturing industries are going for automation to increase the productivity and to overcome shortage of skill labour. The purpose of this machine is to reduce the cycle time by replacing boring machine by special purpose horizontal boring machine. These special purpose machine is used for boring of cylinder of various motorbikes and these machine can correct hole location, size, or alignment and can produce a good finish if a feed is fine and correct. Handwheel of the traditional horizontal boring was replaced by the hydraulic cylinder.

The various parameters will be studied including Increasing production rate, reduce the cycle time, Reduce machining cost, reduce need of skilled labour, compact the size of the machine and many more properties will be compared with the other boring machine. The outcome of the project work will be helpful for long term production of Cylinder Block. After completion of project work production process will be easy, Cycle time will reduce, accuracy, performance and precision will be increased and work production process will be user friendly.

PROBLEM STATEMENT:-

Now a day's production demands are increased, the procedure of vertical boring was replaced by horizontal boring because of advantages of the machine over vertical boring. Traditional boring machine required more time to loading-unloading the job. i.e. Increase in cycle time and efforts of operator. The horizontal boring machine is used to reduce the machining time. Traditional boring can give more fatigue to the operator as compared to horizontal boring machine. The horizontal boring machine is reliable machine over vertical boring machine which is highly affects production rate, cycle time, accuracy, loading-unloading and cost.

RELEVANCE:-

- Precision of the machine during operation is high.
- Robust nature of machine offers the less vibrations produced in machine during machining.
- The machine keeps the high performance during operation.
- Extreme rigidity offers very accurate work.
- Fixing of the work on the machine keeps easy.
- It is user friendly when operated by new user.

Applications of HBM:-

- HBM can be used to drill, bore, and ream holes.
- This is widely used in batch production where work-piece is less.
- This machine can also be used for machining type parts like gear boxes and engine blocks.

Important parts of the horizontal boring machines:-

- **Base frame:-**It supports overall machine assembly. All components of machine are mounted on the base frame. Metal used for Base Frame is mild steel plate. Slope is given to the base frame for the purpose of removing bur.

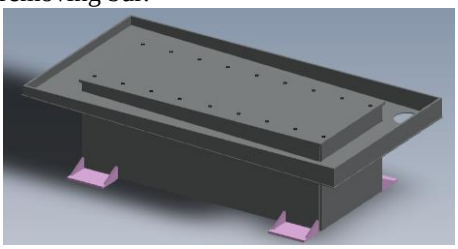

Fig.1-**Base frame.**

- **Riser block:-**The main function of riser block is increase the height of spindle assembly. This is also made from mild steel plate. It supports the spindle assembly as well as electric motor.

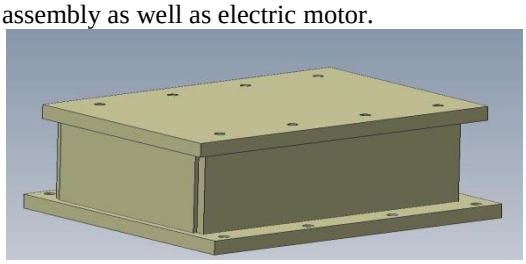

Fig.2- Riser block.

- **Linear motion slide base:-**It is used for giving linear motion to the sliders, base slide, top slide. It is also made up of mild steel.
- **Fixture:-**Fixture is mounted on the fixture base plate. It is used for holding the cylinder block and to reduce the loading-unloading time of the job.

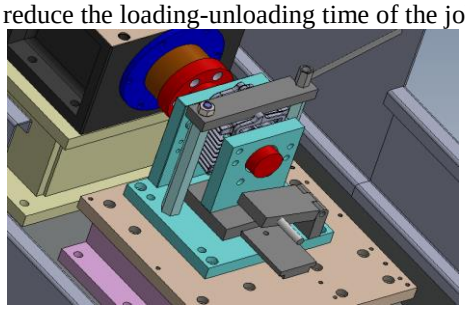

Fig.3- Fixture.

- **Spindle assembly:-**Spindle assembly consists of spindle, bearings, tool bar holder, pulley, spacers, and housing. Spindle housing is made up of casting process and material used for it is cast iron. It is used for transmit the power from electric motor to boring bar.

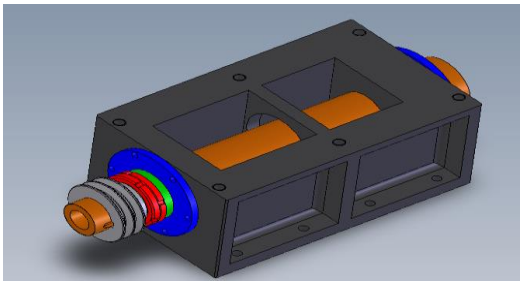

Fig.4- Spindle assembly.

- **LM Base slide:-**It is mounted on the base. It carries guide-ways and sliders as well as it supports LM top slide.
- **LM Top slide:-**LM top slide mounted on the four sliders and guide-ways. Fixture assembly mounted on top slide. It is connected to the hydraulic cylinder by using hex pull rod.
- **Sliders:-**Sliders are used for sliding of top slide on the guide-ways. It gives reciprocating motion from hydraulic cylinder to the job.

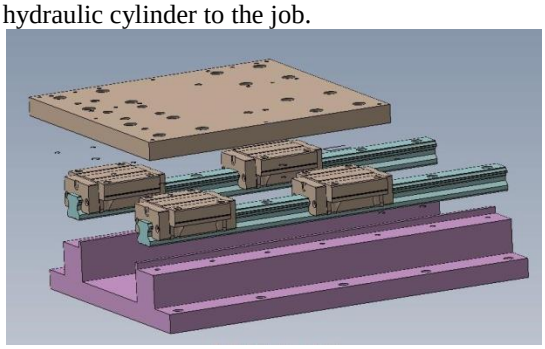

Fig.5-LM Slide Assembly.

- **Cylinder mounting bracket:-**It is also called as 'L'plate. It supports the hydraulic cylinder rod. It is mounted on the base frame.
- **Boring cutter:-**It is connected to spindle shaft. It takes motion from electric motor. Boring cutter remove excess material from workpiece.

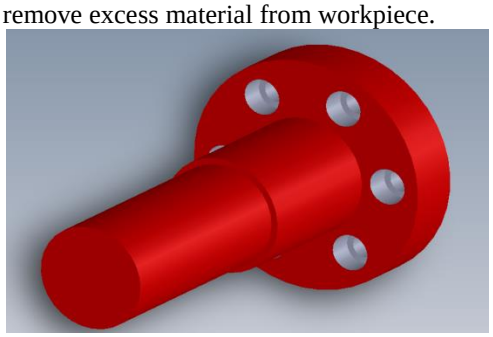

Fig.6-Boring Cutter.

- **Hydraulic cylinder :-** Double acting cylinder is used in this project. It is gives linear motion to LM top slide. Oil is used as working fluid.

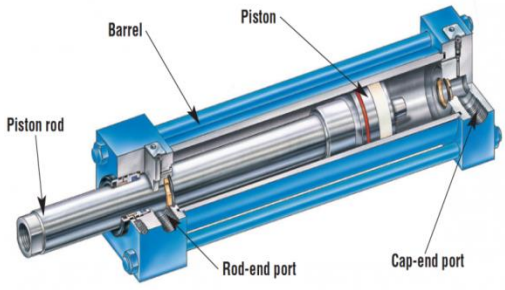

Fig.7- Hydraulic cylinder

- **Bearings:-** Bearing is mechanical element that permits relative motion between two parts, Such as the shaft & the housing, with minimum friction. The bearing takes up the forces that act on the shaft or the axel & transmits them to the frame or the foundation.

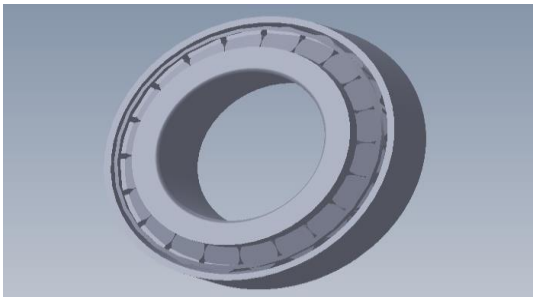

Fig.8- Bearings.

- **Electrical motor:-** It converts Electrical energy into mechanical energy & transmits the motion from one shaft to another shaft by using pulley belt mechanism.
- **Canopy cover:-** It is used for safety purpose.

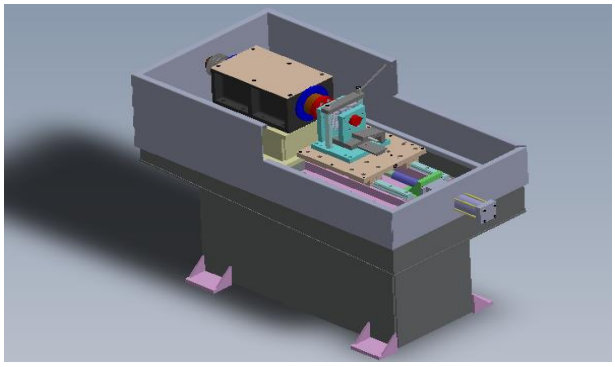

Fig.9-Horizontal Boring Machine Assembly

MATERIAL REQUIREMENTS:-

Selection of material:-

MILD STEEL

Mild steel is the most widely used steel which is not brittle and cheap in price. Mild steel is not readily tempered or hardened but possesses enough strength.

Mild Steel Composition:

Mild steel contains-

- Carbon 0.16-0.18%(Maximum 0.25% is allowable)
- Manganese 0.70-0.90%
- Silicon maximum 0.40%
- Sulphur maximum 0.04%
- Phosphorous maximum 0.04

CAST IRON:-

Cast iron is a group of iron-carbon alloys with a carbon content greater than 2%.Its usefulness derives from its relatively low melting temperature. Carbon(C) ranging from 1.8-4 wt%, and silicon(Si) 1-3 wt% are the main alloying elements of cast iron.

Cast irons have become an engineering material with a wide range of applications and are used in pipes, machines and automotive industry parts.

Cast iron contains-

Carbon1.8-4%, Silicon1-3%

Machine used for:-

Machine specialize in boring and resleeving motorcycles cylinders from big bores to blind holes of MAHINDRA, HERO, HONDA, etc. The machine can bore them with one of our quick way boring bars allowing us to provide extreme precision and a quick turn around rate.

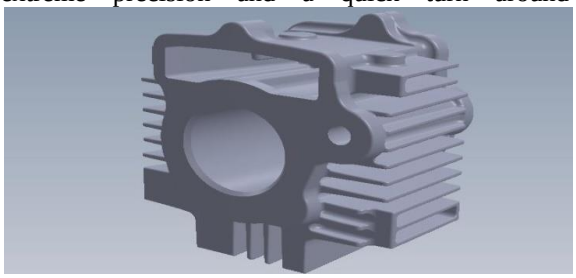

Fig.10-Mahindra cylinder Block

LITERATURE REVIEW-

Z.J.Pasek [1] et al describes three strategies used in the development of an agile line boring station for precision machining of long bores. One mechanism, a "smart" line boring. Tool with built-in instrumentation and control for real-time, facilitates correction of the boring process. Another, a dual-ballscrew system enables correction of tool pitch errors.

Chetankumar M.Patel [2] et al describes, “Design and manufacturing of 8 cylinder hydraulic fixture for boring. Paper proves utility of hydraulics in fixture design in three different ways: (i) reduces cycle time, (ii) reduces operator fatigue and increases productivity and (iii) reduces wear and tear of fixture components.

Christina Schmitt [3] et al studied that the finishing of precise bores is an important machining step; especially in the automotive industries .Quality parameters for these bores are form- and geometric accuracy as well as surface roughness and structure. A theoretical model has a high potential to improve the regulation of the honing process using a constant honing force.

Mayuresh P Vaishnav [4] et al observed that cutting speed; feed has significant effect on surface roughness. Coolant flow rate is the least significant parameter on surface roughness. Feed is the most significant parameter on surface roughness. The result of present investigation is valid within specified range of process parameters.

A.M.Badadhe [5] et al studied that the combination of optimum cutting parameters which will result in better surface finish. Machining with optimum cutting parameters will result in minimum machining time and hence increasing the productivity. Four parameters viz. spindle speed, feed, depth of cut and length to diameter (L/D) ratio of boring bar has been taken as control factors.

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Investigation of process parameter of laser beam machine for ferrous and non- ferrous material: Review

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Abstract: - Extensive research work is being done in laser cutting for improving the quality of cut. The quality of cut depends upon many control factors or parameters such as laser beam parameters (laser power, pulse width, pulse frequency, modes of operation, pulse energy, Wavelength, and focal position); material parameters (type, optical and thermal properties, and thickness); assist gas parameters (type and pressure) and processing parameters (cutting speed). The laser cutting is a very complex and nonlinear process due to involvement of many process parameters. The effect of this parameter for ferrous and non-ferrous material is different because of different in mechanical and physical properties. Now a days the use of nonferrous material in different industries goes on increases because of light in weight, corrosion resistive, easily machined etc.so it is necessary to find out optimum level of process parameter to get quality of surface of cut material with minimum scrap, Heat affected zone (HAZ) and kerf tapper.

In these paper we investigated the effect of these process parameters for different material on different quality characteristics such as material removal rate (MRR), kerf quality characteristics (kerf width, kerf deviation and kerf taper), surface quality (cut edge surface roughness, surface morphology), metallurgical quality characteristics (recast layer, heat affected zone, oxide layer and dross inclusions) and mechanical properties (hardness, strength).

Key Parameter: Laser beam machine (LBM), Aluminum, Taguchi method, Surface roughness (Ra), Heat affected zone (HAZ), Kerf Tapper.

Introduction:-

LASER stands for “Light Amplification by Stimulated Emission of Radiation”. There are two types of laser beam machining process as solid state (Ruby, Nd: YAG, Nd: Glass) & Gas state (N_2 & O_2).The laser machining process is used for cutting of die boards, straight and profile cutting of metallic

and non-metallic sheets. It is also used for cutting of polymers and polymer matrix composites, cutting of diamonds, aerospace materials such as titanium and Aluminium based alloys [2]

Laser has a wide range of applications, from military weapons to medical instruments. In industries it is used as an unconventional method for cutting and welding. The main advantage is that, it is a non-contact operative process from which a good precise cutting of complicated shapes can be achieved. The high power density of the focused laser beam in the spot melts or evaporates material in a fraction of a second and the molten material is removed with a coaxial current of the assist gas.[8]

Aluminum and its alloys are among the most versatile engineering materials in many industries such as the automotive, construction, and aerospace industry because of their unique properties. Aluminium is playing vital role in modern industries. Now a day's aluminium alloy has significant role in aeronautical industries. However it is one of the important materials due to its inherent properties such as high strength to low weight ratio, good corrosion resistance, high thermal conductivity and easy machinability and formability. While stainless steel provides the best combination of wear resistance and corrosion resistance, and is used in demanding medical accessories. [3, 6, 9]

Literature review:

1. V. Senthilkumar et (June 2017)

In this paper author has investigated on the input parameters as Laser power, Cutting speed, Assist gas pressure, Stand off distance. These input parameters has different effects on output parameters. The output parameters are Surface roughness, kerf width, kerf taper, heat affected zone. The methodology used in this paper is L16 Taguchi's orthogonal array. The material used for the experiment is aluminium alloy. The Surface roughness is best when speed and pressure are low and power and stand of distance are medium. Kerf width is best when power and speed are low, pressure is medium and stand of distance is high. Kerf tapper is best when power and pressure are high, speed is low and stand of distance is medium. Hardness is higher when the speed, power and stand of distance are low and pressure is high.

2. Prof. Vikram A. Patel et (March 2015)

In the paper the analysis is done on input parameters like Laser power, Gas pressure, Cutting speed, laser frequency, Nozzle tip distance. These input parameters has effect on output parameters. The output parameters are Surface roughness, Kerf width, Heat affected zone. The methodology used in this paper is Artificial Neural Network & GMDH shell regression software. The material used for experiment is Al 5052.In this paper comparative study has been done on output results of two methods (Artificial Neural Network & GMDH shell regression). The result of both the methods is very near or very less. But the values obtained by ANN method are more accurate as compared to other method.

3. Madić et (June 2015)

This paper is studied on input parameters as Laser power, Gas pressure, Cutting speed. These parameters has effect on output parameter. The output parameter is Kerf width. The methodology used in this paper is Monte Carlo method. The material used for the experiment is AlMg3. When power is high kerf width is low. When speed is medium kerf width is low. The value of kerf width is high when value of pressure is high. This is the effect of input parameters on output parameters. The

result is obtained by Monte Carlo method by the author. So the kerf width is sensitive to the input parameters and should be considered.

4. N.Periyasamy et (May 2015)

The author has investigated on input parameters as Laser Power, Cutting Speed, Assist Gas Pressure, Stand-Off Distance. These input parameters has impact on output parameters also. The output parameters are Surface roughness & kerf width. The method used for analysis is L9 Taguchi's orthogonal array. And the material used is aluminium. The parameters such as laser power, cutting speed, stand-off distance have major impact on surface roughness and kerf width. Whereas, the effect of assist gas pressure over surface roughness and kerf width is less significant. When cutting speed & power is high the surface roughness is high.

5. M. Lakshmi Chaitanya et (December 2014)

The author studied on input parameters like Pulse-Power, Pulse Frequency, Assist Gas Pressure, Pulse Width. These input parameters has impact on output parameters also. The output parameters are Kerf width, kerf deviation, kerf taper. The method used for analysis is Taguchi Method and Principal Component Analysis. And the material used is Al7075.In this paper it is seen that the pulse power is the significant factor for kerf width; pulse width for kerf deviation while assist gas pressure is significant for kerf taper. The value of kerf taper is low when the value of pulse power, pulse frequency, assisted gas pressure is high, medium & moderate respectively.

6. A.Parthiban et (March 2014)

Here the input parameters selected for analysis are Laser power, Cutting speed, Gas pressure, Focal position. These input parameters has impact on output parameters also. The output parameters are Top kerf width, Bottom Kerf width, Kerf Taper. The method used for analysis is Genetic Algorithm. And the material used is AA6061. Consequently laser power and focal position exert less effect on kerf dimensions compared to gas pressure and cutting speed. For achieving minimum kerf dimensions moderate cutting speed and gas pressure is required. The value of kerf taper is high when the laser power is high and cutting speed is low. Also when laser power & gas pressure is low, then value of kerf taper is also low.

7. Miroslav Radovanovic et (2011)

In this paper it is investigated that the input parameters as laser power, cutting speed, nozzle distance, gas pressure, gas type, focus position, laser cutting mode, laser pulse frequency, work piece thickness. These input parameters has impact on output parameters also. The output parameters are kerf, surface roughness, heat affected zone, striation formation, dross formation. Experiment planning according to the Taguchi method so that wider experimental range is covered and empirical data modeling by means of artificial neural networks provides an efficient approach for accurate modeling of laser cutting process. By coupling these models with optimization methods can find optimal cutting parameter settings for satisfying response characteristics in an effective way.

8. Dr.M.Thilak et (2015)

In this paper the author has studied on input parameters as Laser Power, Cutting Speed, Gas Pressure, Stand off distance. These input parameters has impact on output parameters also. The output parameters are kerf width, surface roughness. The material used is aluminium. It is observed that the effect of assist gas pressure over surface roughness and kerf width is less significant when compared to the other parameters like laser power, cutting speed,

stand-off distance which have major impact on surface roughness and kerf width.

9. Milo J. MADI et al (2012)

In this input parameters are selected as Laser power, Cutting speed, Assist gas pressure, Focus position. These input parameters has impact on output parameters also. The output parameter is heat affected zone. The methodology used is ANN mathematical model. The material used is stainless steel. The width of HAZ is highly sensitive to the selected laser cutting parameters and their interactions, the functional dependence between the width of HAZ and the laser power, cutting speed and focus position is highly non-linear, whereas in the case of the assist gas pressure this dependence is nearly linear, the effect of a given laser cutting parameter on the width of HAZ must be considered through the interaction with other parameters.

10. H. A. Eltawahni et

The author has investigated on input parameters as Laser power, Cutting speed, Focal point position, Nitrogen pressure, Nozzle diameter. These input parameters has impact on output parameters also. The output parameters are Upper kerf, Lower kerf. The material used is AISI316L. The upper kerf width increases as the laser power, nitrogen pressure and nozzle diameter increase, and it decreases as the cutting speed and focal position increase. However, the cutting speed is the main factor affecting the upper kerf.

11. S.Saravanakumar et (2015)

In this paper the input parameters are laser power, cutting speed, gas pressure. These input parameters has impact on output parameters also. The output parameters are kerf width, surface roughness, heat affected zone. The material used is AISI 304. The method used is ANOVA Analysis. Power had a major effect on the kerf width, while feed rate played a minor role. Decreasing power and increasing feed rate generally led to a decrease in HAZ. Feed rate has a major effect on surface roughness and striation frequency. Increasing feed rate generally led to increasing surface roughness and striation frequency.

12. M.P.Tamizhmani et (2016)

In this paper the author has investigated on input parameters as thickness, Gas Pressure, Cutting speed. These input parameters has impact on output parameters also. The output parameter is heat affected zone. The material used is SS410. The laser cutting quality depends mainly on the cutting speed, cutting mode, laser power and pulse frequency and focus position. The cutting parameters that provided dross-free and sharp cut surface during pulsed laser mode were: power=25W, cutting speed 90mm/sec, gas pressure =3 bar, time duration 20 min. The maximum hardness value obtained after machining in terms of Vickers hardness number is 136HV.

13. D. J. Kotadiya et (2016)

In this paper the author has studied on input parameters as Laser power, Gas pressure, Cutting speed. These input parameters has impact on output parameters also. The output parameter is surface roughness. The material used is SS-304. The method used for analysis is response surface method & regression analysis method. By using regression analysis method, the optimized value of parameters found as power 1.46 kW, gas pressure 0.70 bar and cutting speed 2.00 m/min for the minimum value of surface roughness 2.18179 µm. Based on these results, the optimal cutting condition, at which the surface roughness is minimized and both the delayed cutting phenomenon is estimated to improve both the quality of the cut section and the cutting efficiency.

Summary:

From literature review, it was concluded that laser beam machining was carried out for ferrous as well as non- ferrous material. In laser beam machining various cutting parameter are used like cutting speed, Laser Power, Pulse width, Type of pulse, Beam diameter, Gas Pressure, Type of gas, Continuity of gas, etc. to controlled the output parameter like surface roughness, kerf tapper, Heat affected zone etc. From literature review it depicts that some other non-machining parameter like material composition (microstructure), material geometry (thickness, width), are also effected on surface roughness, kerf tapper, Heat affected zone etc.

Aluminium alloy material is extensively used as an engineering application because of their excellent mechanical and physical properties. Due to limitations of standard molding processes, to achieving high dimensional accuracy and good surface finish, Aluminium alloy components can be produced by machining processes. While performing experimentation, researchers have used various cutting parameter for machining Aluminium alloy. Study of machining on Aluminium alloy shows different nature of surface roughness with respect to process parameters, indicating machining nature of all Aluminium alloy is not same. Hence effects of machining parameters need to be studied for different Aluminium material separately.

In Laser cutting process, the desired cutting parameters are determined either by experience or by handbook which does not ensure the selected parameter to be optimal. To determine the optimal cutting condition many researchers focused their research on optimization of cutting parameter in machining. For that reliable mathematical models have to be formulated to associate the cutting parameter with cutting performance in terms of statistical approach. Such as Taguchi approach, response surface methodology (RSM), Artificial Neural Network (ANN), Regression Analysis (RA), Genetic Algorithm (GA) etc.

Literature depicts that a considerable amount of work has been carried out by previous investigation for modeling, simulation and parametric optimization of surface properties of product in Laser machining operation. Laser beam machining on aluminium has different effect on the process. The input parameters for aluminium materials are laser power, cutting speed and pressure. These input parameters have major impact on the output parameters. When cutting speed is increased then surface roughness also increases. The width of HAZ is highly sensitive to the selected laser cutting parameters and their interaction.

Conclusion:-

From the above literature review we conclude that there are different process parameters which controls the laser beam machining process such as material properties(composition, geometry, Absorptivity), Beam properties(Wavelength, power, power density, beam interaction time), Process properties(process gas, coverage of large areas). And which has effect on the output parameters such as surface roughness, heat affected zone, kerf taper, kerf width.

Also it is concluded that different methods are used for the analysis such as Taguchi method, response surface methodology (RSM), Artificial Neural Network (ANN), Regression Analysis (RA), Genetic Algorithm (GA), etc. But taguchi method is more relevant for the accepted output parameters.

Problem statement:-

"Investigation of process parameter of laser beam machine for ferrous and non-ferrous material" & to find the relation between input parameters & output parameters to lower surface roughness, kerf taper & heat affected zone.

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Study of Effect of Solid Contaminants in the Lubricant for Ball Bearings Vibration Response

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Abstract:
Lubricant contamination is one of the major reasons for early bearing failure. The effect of lubricant contamination by solid particles on dynamic behavior of rolling bearings by using Vibration analysis method is discussed in this work. Three different materials, as iron Powder, Aluminum powder, and dust are used to contaminate the lubricant. The tests are conducted at different speed and load and change in the amount of vibration affected by grease contamination are determined. Vibration signatures are analyzed with respect to RMS values of amplitude in terms of acceleration and acceleration values at defect frequencies. A considerable variation in overall RMS acceleration and on acceleration value at all defect frequencies on changing contaminant material, size, concentration and running parameters is observed.

Keywords: Contaminants,lubricants,Rms value,frequencies

Introduction:

Bearings are in a central position in the monitoring of the condition of rotating machinery. The goal in the development of vibration measurement methods for rolling bearings has usually been to develop techniques for detection of bearing faults in their earliest stage. The vibrations are measured at point where bearing is supported. The vibration amplitude are directly related to the machine condition.

The different methods available for bearing condition monitoring are, vibration analysis method, acoustic emission method, shock pulse method, etc. Out of the above stated methods, Sir Juha mittain[1] applied the AE method for the study of effect of lubricant contamination. The effect of different contaminants on vibration characteristics is studied by Mr. Tandon[2] and also by Mr. Hariharan[7]. According to Juha Mittain[1], the AE method is most suitable method for such study but is costlier hence the next method of vibration analysis is suggested.

For measuring the vibration amount, the accelerometer is used which is highly efficient in measuring acceleration parameter of vibration which is selected for analysis in the current study. The different contaminant materials have generate different effect on amplitude of vibration, hence in the current experimental work three different materials iron powder, aluminum powder and dust are used as contaminant with different particle sizes, and with different concentration levels. Acceleration is considered as the parameter for analysis of vibration amplitude.

Problem Statement:

Particles are the most harmful form of lubricant contamination. A sample of lubricant may appear to be immaculate but actually contain many microscopic particles. Dirt, dust, sand, metal shards, metal oxide particles, soot, fibers, lint, coal dust, and other miscellaneous debris can contaminate lubricants. There are many types of contaminants. These include hard particles (silica), bauxite, wear debris (surface fatigue, cutting wear, flakes), soft particles (fibers, polymers, cellulose), water and corrosive chemicals, which can be ingested or generated within the machine.

There are many potential sources of these microscopic particles:-During production of the lubricant, raw materials and manufacturing equipment can introduce particles. New or used machinery and reservoirs may contain dirt, metal fines, casting sand, bits of solder, and fibers from rags, paint chips, chemical residues, sludge, and water. Particles can enter through apertures, leaks, worn seals, and vents in machinery. Fatigue and wear of aged or imperfectly balanced parts can generate wear particles. Contamination can occur when components are replaced or equipment is serviced.

Literature Review:

Generally bearings do not reach their calculated life time and they fail during service. Fifty percent bearings fail due to the lubrication problem. Mainly the lubrication fails due to contamination. The study of bearing failures is carried out by many authors.

Zhenyu Yang and Uffe C. Merrild[1] stated that, bearing faults could happen with the raceways, ball or rolling-element and the cage as well, such as a scratch on the surface of the raceway(s). The bearing faults can be caused due to improper installations of the bearing onto the shaft or into the housing, misalignment of the bearing, contamination, corrosion, improper lubrication, brinelling or simply due to wear-out. The experimental results show the powerful capability of vibration analysis in the bearing point-defect fault diagnosis under stationary operation. Bearing faults can be classified into two general categories: single-point defects and generalized roughness. A single-point defect is defined as a single, localized defect on a bearing component surface. Generalized roughness corresponds to the situation where the condition of a bearing surface has degraded considerably over a large area, and become rough, irregular, or deformed.

Extensive research work can be found focusing on the FDD (Fault Detection and Diagnosis) of the single-point defect, due to the fact that a single defect will produce one of the four characteristic fault frequencies depending on which bearing component contains the fault. The most popular way to detect these characteristic frequencies is to use the vibration measurement of the motor shaft plus advanced signal processing techniques. The Fast Fourier Transform (FFT) is the natural choice to retrieve frequency features from measured stationary time-domain data. Theoretically, the single-point fault characteristic frequencies can be predicted based on the shaft speed and the bearing geometry. By comparing the spectra generated based on a nominal operation and a fault-suspected operation around these characteristic frequencies, if some obvious difference can be observed, the corresponding fault scenario will be claimed.

Sir Juha Miettinen[2] gives the classification and distribution of the reasons for which rolling element bearings did not reach their calculated lifetime. Fifty per cent consists of lubrication problems: poor lubrication and contamination. The acoustic emission signal measured from a grease lubricated rolling bearing during its running indicates risks in the lubrication of the bearing. By reducing the level of the acoustic emission the risk of premature failure of the bearing can be reduced. The influence of the fundamental grease parameters and the running parameters of the bearing have been verified and an empirical model for predicting the AE pulse count rate for a deep groove ball bearing lubricated with clean grease has been formulated. Though he has used the AE method for his work, he also has given very great explanation of Vibration analysis method, as it is the most commonly used technique for condition monitoring. The idea current study which I have done is taken from same literature. As the author is used AE method and has suggested the Vibration Analysis Method as a second suitable method for condition monitoring, it is decided to follow the same.

N Tandon [3] in his research paper stated different condition monitoring techniques to detect the defect in rolling bearing. The vibration and stator current signal measurements
performed on the bearing of an induction motor are successful in detecting simulated defects in the outer race of the bearing. Current harmonics for bearing outer race defect characteristic vibration frequency has shown significant increase in the current spectrum components for maximum size of defect. The AE and SPM measurement performed are very good in detecting the bearing defect. On comparing the results of good and defective bearing, it is observed that AE peak amplitude and shock pulse maximum normalized value level increase much more than other techniques as defect size increases.

N. Tandon and et. al. [4] have been studied the grease used in the ball bearings of electric motors. According to him, the lubricating grease often gets contaminated either from external particles or particles generated within these bearings. The effectiveness of vibration, stator current, acoustic emission and shock pulse measurements in detecting the presence of contaminant particles in bearing grease has been investigated. Silica and ferric oxide particles were used to contaminate grease. The levels of vibration, stator current, acoustic emission and shock pulse appreciably increased as contaminant level and contaminant size increased. Acoustic emission peak amplitude proved to be the best condition monitoring technique for the detection of grease contaminants in motor bearings. It is followed by shock pulse maximum value and carpet value in terms of effectiveness. Vibration velocity, stator current, acoustic emission peak amplitude and SPM, dBM and dBC values of bearings were measured at different loads. The values for different levels of silica contaminants and for ferric oxide contaminants of different particle size are given in. It is observed that there is not much change in the parameters measured with increase in load. So, the plots for 15 kg load only are given in his report.

According to the results obtained by M. Kotb Ali, M. F. H. Youssef [5], the vibration amplitude affected by changing both load and/or speed, therefore, it is important to fix the measuring positions as well as speed and load as much as possible to implement a good maintenance vibration monitoring program.

Pavle Boˇskoski [7] has stated in his study that, precise selection of frequency band where the changes in vibration signatures are the most expressed. Consequently, the problem of improper lubricant detection through vibration analysis requires proper model that describes the elasto-hydrodynamic lubrication (EHL) influence on vibrations and systematic procedure for selecting the correct frequency band in which the demodulation resonance analysis can be performed. The results rise the question of the possibility of using vibration analysis for detecting more subtle lubricant changes, like contamination or aging process. As the lubricant characteristics change as a consequence of aging or external contamination its damping characteristics change. These changes at some point will become significant so their influence can be detected by observing the produced vibration signals. Thus, one may be able to effectively estimate the lubricant quality just by observing the produced vibration signals.

Mr. M.M.Maru [9] explains in his work, the effect of contaminant concentration on vibration is distinct from that of the particle size. The vibration level increased with concentration level, tending to stabilize in a limit. On the other hand, as the particle size increased, the vibration level first increased and then decreased. Particle settling effect was the probable factor for vibration level decrease. Vibration levels increased along the test in contaminated oil even with only 16 min of test. Such an increase in vibration is related to an effect produced by the wear of bearing elements. The bearing parts were severely damaged by a peeling-like mechanism, distributed along all the surfaces. Abrasion was also identified through ferrography. This was indicative of severe wear regime, although measurements of internal radial clearance of the bearings have indicated absence of dimensional wear. The vibration amount due to the bearing wear was dependent on the contamination feature. An apparent correlation between the trends of the worn bearing vibration and those of its overall surface damage was observed. The vibration due to the presence of particles was proportional to the vibration of the worn bearing as particle concentration increases. On the other hand, when the contaminant particle size increased, the dynamical action of the particles passing through the contact interface.

V Hariharan and P S S Srinivasan [12] worked on ball bearings and he tested the bearings in order to study the effect of solid contamination. The method of vibration analysis was effective in characterizing the trends in vibration due to solid contaminant in lubrication. The tests were conducted for defective and good bearings. Silica particles were considered as grease contaminants. Experimental tests have been performed on the ball bearings lubricated with grease, and the trends in the amount of vibration affected by the contamination of the grease were determined. The contaminant concentration as well as the particle size is varied. Vibration signatures were analyzed in terms of root mean square (RMS) values. From the results, some fruitful conclusions are made about the bearing performance.

The effects of contaminant and the bearing vibration are studied for both good and defective bearings. The results show significant variation in the RMS velocity values on varying the contaminant concentration and particle size contamination its damping characteristics change. These changes at some point will become significant so their influence can be detected by observing the produced vibration signals. Thus, one may be able to effectively estimate the lubricant quality just by observing the produced vibration signals.

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From the literature it is clear that, for the condition monitoring of bearing lubricated with contaminated grease the velocity parameter of vibration is applied hence here the acceleration parameter of vibration can be utilized. Also the different materials are used with different particle sizes and different concentration levels.

Methodology:

A.Test Bearing Preparation:

Bearing selected for test is a deep groove ball bearing with specification number 6206-2RS. 2RS indicates rubber seal on both sides. The test bearings are prepared by removing the existing grease from standard bearings and adding the grease which contains the contaminants with varying size and concentration. Total 27 test bearings are which contain the contaminant and one bearing with clean grease are tested for under current experimental work. The contaminants added are in three different sizes as 53µm, 75µm and 106µm and with different concentration levels as 5%, 15% and 25%. The bearings are numbered as B1 to B28 as below.

Table.1 Bearing sample numbers with specifications

Sr. No.	Material	Size	Concentration	Bearing Sample No.
1	Nil	Nil	Nil	B1
2	Iron-	53µm	5%	B2
3	Iron-	53µm	15%	B3
4	Iron-	53µm	25%	B4
5	Iron-	75µm	5%	B5
6	Iron-	75µm	15%	B6
7	Iron-	75µm	25%	B7
8	Iron-	106µ	5%	B8
9	Iron-	106µ	15%	B9
10	Iron-	106µ	25%	B10

B. Defect Frequencies:

The data obtained during experiment is analyzed at the defect frequencies of bearing. The frequency equations required for calculation of same are given below along with calculated defect frequencies for given bearing with given speeds.

Table.2 Frequency equations required

Ball-pass frequency for inner race (Fi)	$\frac{n}{2}Fr[1+(BD/PD)\cos\beta]$
Ball-rotational Frequency (Fb)	$\frac{PD}{BD}Fr\left[1-\left(\frac{BD}{PD}\right)^2(\cos^2\beta)\right]$
Ball-pass frequency for outer race (Fo)	$\frac{n}{2}Fr[1-(BD/PD)\cos\beta]$
Fundamental train frequency (Ft)	$\frac{1}{2}Fr[1-(BD/PD)\cos\beta]$

Where,

n:-No. of balls, Fr:-Shaft Rotation Frequency, BD:-Ball Diameter, β -Contact angle, PD:-Pitch Diameter

Table.3 Fault frequencies at various speeds

Sr. No.	(N) RPM	(Fr) Hz	(Fi) Hz	(Fo) Hz	(Fb) Hz
1	1080	18	97.90	64.09	82.49
2	1820	30.33	164.96	108	139
3	2960	4.66	270	176.83	227.59

C. Experimental Work

A. Test Rig:

The experiment is carried out on the test rig as shown in figure4.3. The setup is designed in order to get the nine speed variations, to have ease of applying the loading arrangement and to have the negligible setup vibrations.

For getting the vibration signatures the 4-channel FFT Analyzer is used. The accelerometer is used to sense the vibrations generated at the bearing surface. The accelerometer running parameters. The two main parameters are varied and combined to have different running conditions. The two parameters are Speed and Load. Three different speeds are selected for carrying out the test combined with three different loads. The three different speeds selected are 1080RPM, 1820RPM and 2960RPM, and three different loads selected are 10Kg, 20Kg, and 30Kg. Total nine combinations are obtained by varying speed and load, for carrying out the test on every single sample bearing.

B. Selection of Running Parameters:

Every sample bearing prepared is tested under different running parameters. The two main parameters are varied and combined to have different running conditions. The two parameters are Speed and Load. Three different speeds are selected for carrying out the test combined with three different loads. The three different speeds selected are 1080RPM, 1820RPM and 2960RPM, and three different loads selected are 10Kg, 20Kg, and 30Kg. Total nine combinations are obtained by varying speed and load, for carrying out the test on every single sample bearing.

C. Actual Test and Data Collection

Every test followed a sequence of three steps. In the first step, the bearing is running in healthy grease in order to stabilize the grease temperature. In the second step, the test is continued in healthy grease to collect the vibration data at different speeds and at different loads. In the third step, the contaminated grease is applied to the bearing. A separate bearing is used for each concentration level of the test. Vibration signals with contaminated grease are acquired from the bearing housing at different speeds. The above procedure is repeated for all concentration levels. Data is recorded and analyzed with respect to peak values and the root mean square (RMS) values, related to specific defect frequencies.

Results and Discussion:

By using the data obtained graphs are plotted and the detailed discussion is made as below

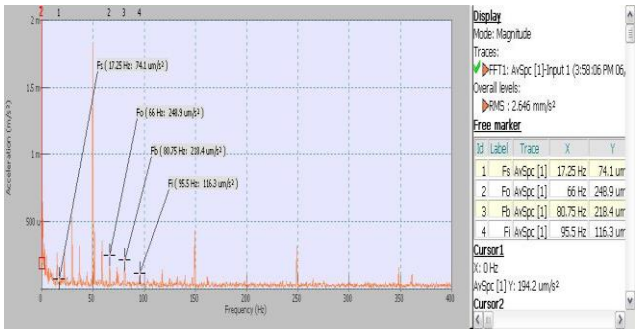
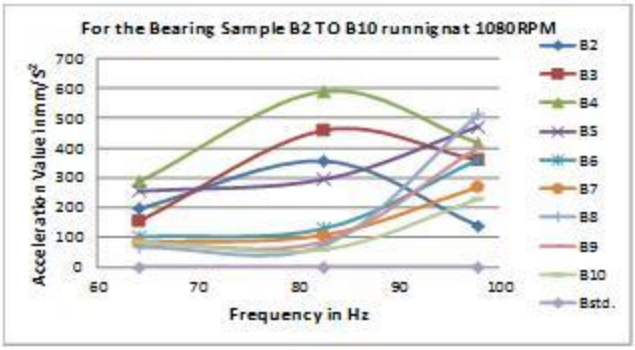


Fig. Acceleration-Frequency plot for bearing sample B1 running at 1080RPM

The Fig. 5.1 is obtained from the bearing lubricated with clean grease running at a speed of 1080RPM under the load of 10Kg.



The Fig indicates the effect of Iron-Powder as a contaminant with different sizes and different concentration levels with 1080RPM running speed and 10Kg load. The Fig. clearly indicates that at these running parameters contaminants affect more on the balls followed by inner-race. For the particle size 53µm, as the concentration level increased, the acceleration value goes on increasing for all the defect frequencies. Also it indicates that the effect of contaminant at lower particle size is more on Ball. Followed by inner-race and then on outer-race. It also describes that for higher particle size, at lower speed the effect is more on inner-race and least on outer-race. This is happening because at lower speed particles remain at inner-race portion because of their weight and cannot move towards the outer-race. Because of same they are affecting more on inner-race and very less on outer-race.

The Fig. is also about the effect of Iron-Powder as a contaminant with different sizes and with different concentration levels at 1820 RPM and 10Kg load. The graph indicates that as the speed is increased the contaminant has a considerable effect on outer-race as compare to inner-race. The effect of contaminant on inner-race and ball is quite similar. The same effect and same pattern of graph is observed at all particle sizes and at all concentration levels at these running conditions.

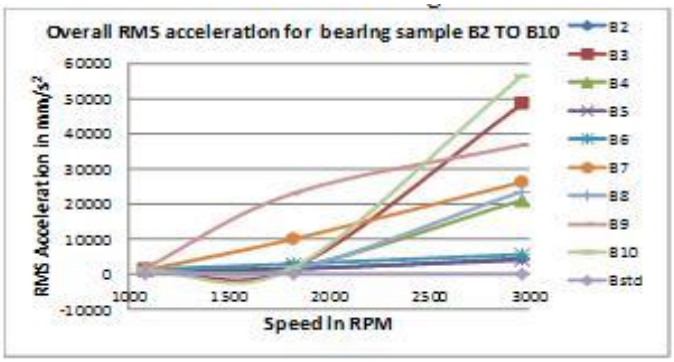


Fig. Running Speed Vs. Overall RMS Acceleration, for bearing sample B2 to B10

This Fig is more indicative of the effect of contaminant on the bearing and its rolling elements. The fig. clearly indicates that, for any sample bearing as the running speed increased the RMS acceleration value also goes on increasing. It means that, every contaminant affect more at higher speeds and the effect is less as the speed is lowered. Also the conclusion can be drawn as, for same particle size as the contaminant concentration is increased, at higher speeds the RMS acceleration value goes on increasing whereas at lower speed as the concentration is increased the RMS value first increases and then decreases. This may be happening because at lower speed the particles may escape from the rolling elements.

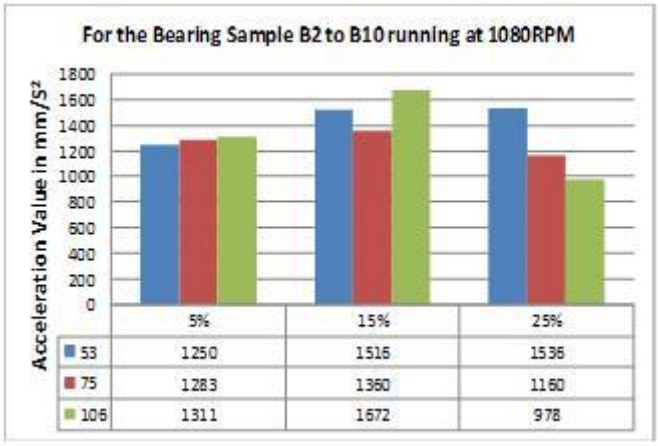


Fig. Overall RMS Acceleration Vs. Contaminant Concentration for bearing sample B2 to B10, at 1080RPM

The effect on RMS acceleration can also be indicated by above figure. The Fig. 5.15 shows the effect of concentration variation along with particle size on RMS acceleration value at speed, 1080

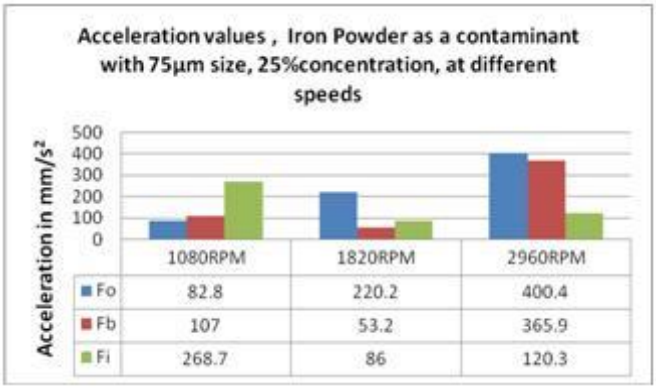


Fig. Acceleration Vs. Running Speed for Sample bearing

B5 the inner-race is more affected by contaminant at lower speed than the outer-race whereas at higher speeds the effect is more on outer-race as compare to inner-race

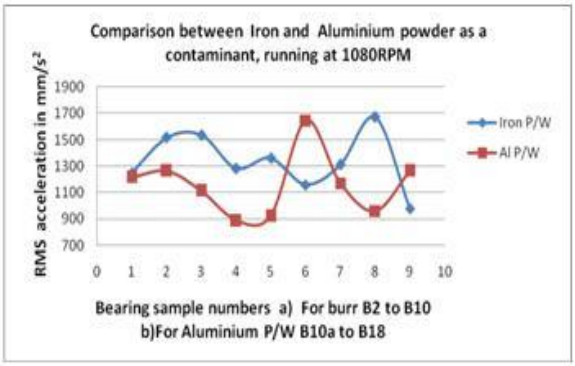


Fig. Comparison of Iron-Powder and Aluminium as a contaminant at speed 1080RPM

Conclusion:

The effect of contaminant concentration on vibration is different from that of particle size. The vibration level increased with the concentration level, starts stabilizing at a certain limit. With an increase in the particles size, the vibration level initially increases and then decreases. This decrease in vibration amplitude is due to more internal resistance of the bearing, due to not only the large particles but also the concentrations. It is observed that, as the material of contaminant is varied, there is variation in the vibration level. For the material Iron-Powder, the maximum effect is observed followed by Aluminum-Powder and dust. This effect is because of material properties like hardness, brittleness and malleability. But the pattern observed by changing the particle size and concentration is same for all materials. The effect of contaminant concentration on vibration is different from that of particle size. The vibration level increased with the concentration level, starts stabilizing at a certain limit. With an increase in the particles size, the vibration level initially increases and then decreases. This decrease in vibration amplitude is due to more internal resistance of the bearing, due to not only the large particles but also the concentrations. It is observed that, as the material of contaminant is varied, there is variation in the vibration level. For the material Iron-Powder, the maximum effect is observed followed by Aluminium-Powder and dust.

References:

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[7] Elbestawi, M. A. and H. J. Tait (1986) “A Comparative Study of Vibration Monitoring Techniques for Rolling Element Bearings”, Proceedings of the International Modal Analysis Conference, pp. 1510-1517.

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7. Number of New Externally Funded Research Projects Received

8. Funds Received During This Academic Year

Sponsored Project report on

Analyzing Phishing Attack Using NLP and Machine Learning

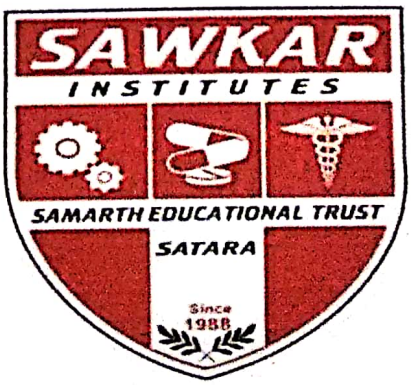
BACHELOR OF COMPUTER SECIENCE AND ENGINEERING

SUBMITTED BY,

Miss.Chavan Kajal Anandrao.
Miss.Gaikwad Pragati Sunil.
Mr.Gujar Somnath Chandrakant.
Mr.Ingale Akash Hanmant.
Mr.Jagtap Sanket Dnyaneshwar

Under the Guidance of

Prof. Karande H. A



ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA.

2018-19

Certificate

This is to certify that the major project report entitled

Analyzing Phishing Attack Using NLP and Machine Learning

Is a bonafide work carried out by

Miss.Chavan Kajal Anandrao.
Miss.Gaikwad Pragati Sunil.
Mr.Gujar Somnath Chandrakant.
Mr.Ingale Akash Hanmant.
Mr.Jagtap Sanket Dnyaneshwar

Under our supervision, during the year 2018-19 and submitted to the faculty of Computer Science and Engineering, AGCE Satara in partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Computer Science and Engineering.

Prof.Karande H.A.
(Guide of Department)

Prof. Karande H.A.
(Project Coordinator)

Prof. Hingmire V.S.
Dean (Academics)

Prof. Mrs.Sawant A.P
(Head of Department)

Head Computer Science & Engg.
Arvind Gavali College of Engg.
Panmalewadi

Prof. Bamankar P.B.
(Central Project Coordinator)

Dr. Viddhulata S. Mohite
(Principal)

Dr.Viddhulata Mohite
Principal
Arvind Gavali College
of Engineering,Satara

(External Examiner)

Date: 24/ 3 /2019

Arvind Gavali Collage of Engg.
Satara, Computer Department.
Panmalewadi Vary satara.

Subject: Letter approvingthe project Sponsorships.

Student Name:

1) Mr. Somnath Gujar.
2) mr. Ingle Akash
3) mr. Jagtap Janket
4] Miss. Chavan Kajal
5] Miss. Gaikwad Pragati

Sponsor Name: 3Star It Solution & Services Satara.

I agree to pay all expenses for the above student at Arvind Gavali collage Engg. Satara. This sponsorship includes, but is not limited to tuition, books, health insurance, room and food.

This sponsorship will cover the student beginning on 16/08/2018 and ending on 05/04 /2019.

With the allotment of this Sponsorship, student may utilize company resources and data set for building application. All Right regarding the application are reserved to the company. It is joint responsibility of both company and collage to maintain the confidentiality.

If you have any question, please do not hesitate to contact me by using the contact information listed above.

Sincerely,

Rohit Gavali

(Sponsor signature above)

Sponsor's Name: 3Star It Solution & Services.
Sponsor's Address: molacha Odha 26, shambhaji nagar, medha road, Behind Jayka Hotel Satara.
Sponsor's City and Posted Code: Satara, pin: 415001.
Sponsor's Mail address:3Staritsolution2017@gmail.com.
Sponsor's Mo. No. 9 9665713423

3 Star IT Solution Satara

3 Star IT Solution
Molacha Odha,26 Sambhajinagar,
Medha Road,Satara.Mob.:9665713423

Cost of The Project:

Project:	Analyzing Phishing Attack Using NLP and Machine Learning
Sponsored By:	3 Star IT Solution and Services, Satara
Location:	Satara

Project Cost:

Description	Charges	Amount
Creative and Responsive Design	No. of Pages (7)* 2000 (User Browser,Content Extractor, Image Extractor, Link Extractor, URL Analysis,URL Validation)	14000/
Domain Name	1500	1500/-
Hosting Server	2500	2500/-
	Total:	18000/-

Sponsored Project report on

Digital Library: Secure Search Engine with Verification Code On Cloud Computing

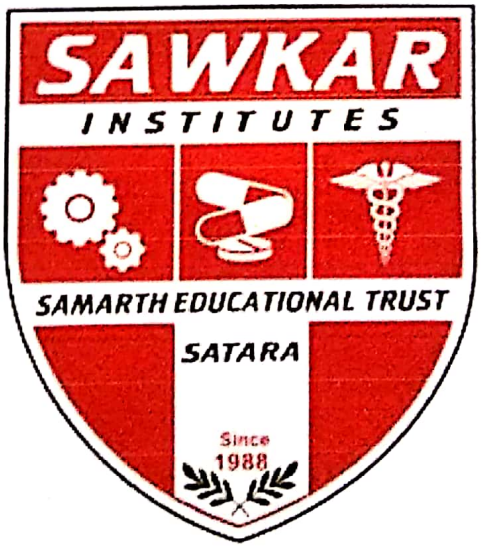
BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY

1. Kanase Poonam Balaso (25260)
2. Karale Ankita Shivaji (25261)
3. Patil Shraddha Somnath (25271)
4. Pawar Megha Ramdas (25273)
5. Suryawanshi Pranali Ashok (25278)

UNDER THE GUIDANCE OF

Prof . Karande H. A



ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA

2018-2019

Certificate

This is to certify that the Project report entitled

Digital Library: Secure Search Engine with Verification Code on Cloud Computing

Is a bonafide work carried out by,

Miss .Kanase Poonam Balaso.

Miss .Karale Ankita Shivaji.

Miss .Patil Shraddha Somnath.

Miss .Pawar Megha Ramdas.

Miss .Suryawanshi Pranali Ashok.

Under our supervision, during the year 2019-20 and submitted to the faculty of Computer Science and Engineering, AGCE Satara in partial fulfilment of the requirements for the award of the Degree of Bachelor of Engineering in Computer Science and Engineering.

Prof. Karande H. A.

Guide

Prof. Sawant A. P.

Head Computer Science & Engg.

Head of Department

Prof. Karande H. A.

Project Coordinator

Prof. Bamankar P. B.

Central Project Coordinator

Prof. Hingmire V.S.

Dean (Academics)

Prof. Patil S. P.

Dean (Administrative)

External Sign

Dr. Viddhulata S. Mohite

Dr.Viddhulata Mohite
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Principal

inventive
infotech

Address: 82, A Pantacha Got Raviwar Peth Satara

TEL: 02162-234422 / 9175585656/ 7507552198.

Web: www.Inventiveinfotech.in **Email:** Info@inventiveinfotech.In

Date : 8 /10 / 2018

To,

Whom It May Concern.

Subject : Regarding sponsoring students for Digital Library Project.

Respected Sir,

We are happy to inform you that we have selected five students from Arvind Gavali College Of Engg, Satara for our live Digital Library Project. The project deals with secured search engine with verification code in Cloud Computing.

We found them sincere & regular in their work.

The three students selected are :

1. Poonam Balaso Kanase
2. Ankita Shivaji Karale
3. Shraddha Somnath Patil
4. Megha Ramdas Pawar
5. Suryawanshi Pranali Ashok

Thank You,

Inventive Infotech

Proprietor

Cost of The Project:

Project:	Digital Library
Sponsored By:	Inventive Infotech, Satara
Location:	Satara

Project Cost:

Description	Charges	Amount
Creative and Responsive Design	No. of Pages (9)* 1500 (Homepage for digital library,Login /Registration Page, Owner Panel,View Published Articles Page, Form for Publishing Article, Logine Panel for user,Search Article page, Encryption Key Page, SMS Page)	13500/-
Domain Name	1500	1500/-
Hosting Server	3000	3000/-
	Total:	18000/-

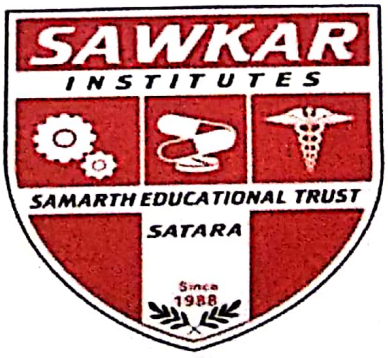
Sponsored project report on

ERP System For Turn Tech Automation

BACHELOR OF COMPUTER SECIENCE AND ENGINEERING

SUBMITTED BY,

Miss. Bagade Pooja Pramod.
Miss. Barge Sonal Shashikant.
Miss. Gaikwad Pratiksha Dilip.
Miss. Pawar Poonam Vitthal.
Miss. Yadav Pooja Sanjay.



ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA.

2018-19

Certificate

This is to certify that the major project report entitled

ERP System For Turn Tech Automation

is a bonafide work carried out by

Miss. Bagade Pooja Pramod.
Miss. Barge Sonal Shashikant.
Miss. Gaikwad Pratiksha Dilip.
Miss. Pawar Poonam Vitthal.
Miss. Yadav Pooja Sanjay.

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(Guide)

Prof. Mrs.Sawant A.P
(Head of Department)
Head Computer Science & Engg.
Arvind Gavali College of Engg.
Panmalewadi

Prof. Karande H.A.
(Project Coordinator)

Prof. Bamankar P.B.
(Central Project Coordinator)

Prof. Hingmire V.S.
Dean(Academics)

(External)

Dr. Mohite V. S.
(Principal)
Dr.Viddhulata Mohite
Principal
Arvind Gavali College of Engineering, Satara

QLOGICIEL
"We Build Relations"

To,

Arvind Gavali College of Engg.
Satara, Computer Science Department.

Panmalevadi Varye Satara.

Subject:-Letter Approving The Project Sponsorships.

Student Name:-

1 .Miss.Bagade Pooja.

2 .Miss.Barge Sonal.

3. Miss.Gaikwad Pratiksha.

4. Miss.Pawar Poonam. 5

.Miss.Yadav Pooja.

Sponsor Name:-Qlogiciel Technologies & Consulting Services.

I agree to pay all expenses for the above student at Arvind Gavali College of Engg. Satara. This sponsorship includes, but is not limited to tuition, books, health insurance, room and food. This sponsorship will cover the student beginning on 16/08/2018 and ending on 31/03/2019. With the allotment of this Sponsorship, student may utilize company resources and data set for building application. All Right regarding the application are reserved to the company .It is joint responsibility of both company and college to maintain the confidentiality.

If you have any question do not hesitate to contact me by using the contact information listed above.

Your Sincerely,

Pritam Vishwas.

QLOGICIEL TECHNOLOGIES & SERVICES SATARA

(Sponsor Signature Above)
Sponsor's Name:- Qlogiciel Technologies & Consulting Services.
Sponsor's Address:-Plot No-43 S.N.20k, Lakshmi Vihar Bldg, Visawa Park, Satara-415001 Sponsor's City & Posted Code:-Satara, Pin:-415001.

Sponsor's Mail Address:-pritam.vishwas@qlogiciel.com

Sponsor's Mobile No:-+91-9075091900

Cost of The Project:

Project:	ERP System for Turn Tech Automation
Sponsored By:	Qlogiciel
Location:	Satara

Project Cost:

Description	Charges	Amount
Creative and Responsive Design	No. of Pages (7)* 2000 (Login Page, Main Menu,Supplier Details Page, Company Details Page, Employee Details, GRN Details, ADD new Bank)	14000/-
Domain Name	1500	1500/-
Hosting Server	5000	4500/-
	Total:	20000/-

9. Other Achievements

Certificate of Participation

This is to certify that

Shital Chavan

participated in

'One day Workshop on R'

held at Arvind Gavali College Of Engineering, Satara

on **09 November 2019**

This training was organised by the Teaching Learning Centre, ICT at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre,
PMMMNMTT, IIT Bombay

Prof. Radhendushka Srivastava
Department of Mathematics,
Indian Institute of Technology Bombay

Spoken Tutorial

fossee better education
Promoting Free/Libre and Open Source Software

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

This training was made possible with help from Spoken Tutorial and FOSSEE Projects at IIT Bombay.
These Projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

Certificate

This is to certify that

Shital Chavan

from Remote Center ID 1380

successfully completed an **AICTE approved** Faculty Development Programme (FDP101x) on

Foundation Program in ICT for Education

conducted by Indian Institute of Technology Bombay
from September 13, 2018 to October 18, 2018

(Online activity from Thursday, 13 September 2018 to Thursday, 18 October 2018 and
Physical participation at Remote Center on 6 and 7 October 2018, together considered as two-week equivalent FDP course)

This FDP was held under the aegis of Pandit Madan Mohan Malaviya National Mission for Teachers and Teaching(PMMMNMTT), MHRD, GoI

Prof. Sridhar Iyer
Course Coordinator
IIT Bombay

Roll No:NPTEL18GE12S21780034

To
ARVIND GAVALI COLLEGE OF ENGINEERING
SATARA

6/521

Score	Type of Certificate
>=90	Elite + Gold Medal
60-89	Elite
40-59	Successfully Completed the course
<40	No Certificate

No. of credits recommended by NPTEL:2

Elite

NPTEL Online Certification

(Funded by the Ministry of HRD, Govt. of India)

This certificate is awarded to

MR. SUHAS PRAKASHRAO PATIL

for successfully completing the course

Introduction to Research

with a consolidated score of **80** %

Online Assignments	21.00/25	Proctored Exam	58.5/75

Total number of candidates certified in this course: **836**

Prof. A. Ramesh
Chairman
Center for Continuing Education, IITM

Aug-Sep 2018
(8 week course)

Prof. Andrew Thangaraj
NPTEL Coordinator
IIT Madras

Indian Institute of Technology Madras

FREE ONLINE EDUCATION swayam

Roll No: NPTEL18GE12S21780034

To validate and check scores: http://nptel.ac.in/noc