

RESEARCH COMPENDIUM

YEAR: 2018-19



RESEARCH COMPENDIUM

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About Institution

In view of the growing demand for technical education and with the goal of establishing a premier technical education on par with international standards, a new technical institution by `name 'BMS Institute of Technology and Management' was established in 2002. Currently, BMSIT & M offers seven UG, three PG programs and Ph.D. /M.Sc. (Engg.) in seven disciplines. BMSIT & M considers research to be of equal importance as academics for the betterment of an institution. Research culture has been embraced well by the faculty members and research scholars at BMSIT and M. In this report, we present an overview of the research activities of Information Science and Engineering, BMSIT & M.

Vision

"To emerge as one of the nation's finest technical institutions of higher learning to develop engineering professionals who are technically competent, ethical and environment friendly for betterment of the society."

Mission

"Accomplish stimulating learning environment through high quality academic instruction, innovation and industry – institute interface."

About Department

The Department of Electronics and Communication Engineering started in 2002-03 with the vision: "To Provide Quality Education in Electronics, Communication and Allied Engineering fields to serve as Valuable Resource for Industry and Society". The department is a "Research Center" recognized by VTU, has well experienced and qualified faculty members who inspire the students to face the competitive world. 16 faculties are pursuing their Doctoral Degrees. Consistent performance by the students in VTU examinations is a reflection of the efforts by all faculty members. The department is equipped with latest equipment and laboratory amenities to meet the global standards.

Vision

"Provide Quality Education in Electronics, Communication and Allied Engineering fields to Serve as Valuable Resource for Industry and Society".

Mission

- 1. Impart Sound Theoretical Concepts and Practical Skills.
- 2. Promote Inter-Disciplinary Research.
- 3. Inculcate Professional Ethics.

Programme Educational Objectives

Graduates of the programme will:

PEO1: Work as professionals in the area of Electronics and allied engineering fields

PEO2: Pursue higher studies and involve in the interdisciplinary research work

PEO3: Exhibit ethics, professional skills and leadership qualities in their profession.

Programme Outcomes

- 1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
- 2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- 4. **Conduct investigations of complex problems:** The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline, that may not have a unique solution.
- 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.
- 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with t h e society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. **Project management and finance**: Demonstrate knowledge and understanding of t h e engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

Graduates will be able to:

- **PSO1:** Exhibit competency in embedded system domain.
- **PSO2:** Exhibit competency in RF and signal processing domain.



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FACULTY PUBLICATION -JOURNAL ACADEMIC YEAR 2018-19

| SLN O | Faculty | Title of the paper | Journal | Date | Index |
|----------|---|---|--|------------------|-------------------|
| 1. | Dr.Ambika R | Design n and Development of Real Time Vehicular Crash Detection System | GRENZ E International Journal of Engineering And Technology | Dec. 28, 2018 | Google Scholar |
| 2. | Dr.Ambika R | Routing Protocols for Underwater Wireless Sensor NetworksInternational Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-6S. | | April 2019 | Scopus |
| 3 | Dr.M.C.Hanumant haraju | Novel high speed Reconfigurable Le FPGA architecture s for EMD based image steganography | PGA Multimedia Tools And Applications D based | | Scopus |
| 4 | Dr. Shobha Rani | AIF based relay node selection approach to increase the scalability in wireless mesh networks | Comp soft, an international journal of advanced computer technology | Jan. 31, 2019 | Google Scholar |
| 5 | Proof Anil Kumar | Autonomous Ship Manoeuvring Control and Its Path Tracking Using Fuzzy Logic and Model Free Adaptive Control | International Journal of Science and Research (IJSR) | June, 2019 | Scopus |
| | D | Efficient Ship Track Keeping using Predictive PID Controller | International Journal of Innovative Technology and Exploring Engineering (IJITEE) | June 2019 | Scopus |
| 6 | Prof. Hamsavahini "Implementation of Automated US Vehicle Identity Recognition Jo System Ref | | IJSRD - International Journal for Scientific Research & Development | June 2019 | Google Scholar |
| 7 | Prof. Chandraprabha R | Prof.Smart real time manhole monitoring systemInternational R Journal of Engi Technology (IFChandraprabha RImage: State of the systemImage: State of the system | | July 2019 | Google Scholar |
| 8 | Prof. Shashikala J | Shashikala J Survey Paper on Real Time Vehicle Detect ion on Edge for Smart Traffic Management International Journa Emerging Technolo Innovative Research | | May 15, 2019 | Google Scholar |
| 9 | Prof. H S LaxmisagarAn Intelligent System To Detect Urban Flash Flood Using Wireless Sensors.Journal of Emerging Technologies and Innovative Research (JETIR) | | Journal of Emerging Technologies and Innovative Research (JETIR) | June 2019 | Google Scholar |



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| 10 | Prof. Sabina R | Synthesis and Characterization of Suns Quant um Dots material for Solar | Materia ls Today - Journal - Elsevier | Aug. 9, 2018 | Scopus |
|----|---|---|--|-----------------|-------------------|
| 12 | Prof.Jagannath K B | Design of High Speed, Low Power Error Tolerant Adder [Eta] and its Application in Image Processing | International Journal of Engineering Science and Computing IJESC | July 2019 | Scopus |
| 13 | Prof.Jagannath K BEfficient IoT Based Queue Management and RFID Regulated Payment System for Retail Sector | | International Journal of Engineering Science and Computing IJESC | July 2019 | Google Scholar |
| 14 | Mamatha K. R , | "Sparse Representation for Color Image Denoising " | International Journal of Engineering Science and Computing IJESC | July 2019 | Google Scholar |

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING FACULTY

| SL.NO | Faculty | Title of the paper | Journal/Conference | Date |
|-------|-------------------------|---|--|--|
| 1. | Dr. Ambika R | Network traffic classification techniques-a review | International Conference on Computational Techniques, Electronics and Mechanical Systems | Dec. 21, 2018 Belagavi |
| 2 | Dr. Jayadeva | Human Assisting Robot | First International Conference on Advances in Information Technology (ICAIT-2019), | 24 to 27 July 2019 |
| 3 | Dr. Shobha Rani | Centroid and Gateway based Hierarchical Routing Protocol for Wireless Sensor Networks. | 4 th International al Conference e for Convergence in Technology | Oct. 27, 2018,SDM Institute of technology, Ujiri, Mangalore |
| 4 | Prof. Rashmi N | A Review on RF Energy Harvesting | National conference on "Recent Trends in electrical and Electronics Engineering" | MNJ College of Engineering, Bangalore April 30, 2019 |
| 5 | Prof. Shashikala J | Colour Sensor Based Object Sorting | National Conference Jnana Chilume 2019 | Jain SET, Bangalore March 29, 2019 |
| 6 | Prof. Shivarudriah B | Implementation of Orthogonal Frequency Division Multiplexing using MATLAB® simulation for DSL (Broadband) applications | National Conference on Automation, Control and Communication | Jain Global Campus, Jakkasandra Post, Kanakapura Taluk, Ramanagara District- 562112 March 29, 2019 |
| 7 | Prof. Suryakanth B | Analysis of impact of Data size for Classification of Alzheimer's Disease using CNN | International Conference On Researches in Science and Technology(ICRST- 19) | Singapore April 7, 2019 |
| 9 | Mamatha K R | Detection and analysis of plant leaf diseases using Convolutional neural Network | International Conference on Recent innovative trends in Computer Science and applications 25th -26th Oct 20 | |



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Design and Development of Real Time Vehicular Crash Detection System

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Abstract—Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. Main causes for these road accidents are: lack of training institutes, unskilled drivers, poor road conditions, use of cell phone while driving, over loading and poor governmental plans in this regard. This paper presents solution for accident detection for human life safety. It presents about intelligent detection of an accident at any place and reports about the accidents on predefined numbers. The microcontroller continuously records all the parameters of automobile. When a vehicle meets with an accident, immediately vibration sensor will detect the signal and then microcontroller sends the alert message through the GSM modem.

Index Terms- Crash detection, ADXL335, GPS, GSM, Microcontroller.

I. INTRODUCTION

India has the highest motorization growth rates in the world accompanied by poor infrastructure and congested transport network. This led to an increase in the number of road accidents. The "Globe Status Report on Road Safety" listed by the World Health Organization (WHO) identified the major causes of traffic collisions as driving over the speed limit, driving under the influence, and not using helmets and seat belts. Failure to maintain lane or yield to oncoming traffic when turning are major causes of accidents on four lane, non-access controlled National Highways.

Road accidents are the outcomes of the interplay of various factors such as length of road network, vehicle population, human population and adherence/enforcement of road safety regulations etc. Road accident causes fatalities, injuries, disabilities and hospitalization with severe socio-economic costs across the country. Consequently, road safety has become an issue of concern both at national and international level. The United Nations has rightly proclaimed 2011-20 as the Decade of Action on Road Safety. India is also signatory to Brasilia Declaration and is committed to reduce the number of road accidents and fatalities by 50 per cent by 2020.

According to the Statistics report submitted by Ministry of Road Transport and Highways, total number of road accidents increased by 2.5 per cent from 489,400 in 2014 to 5.01,423 in 2015. The total number of persons killed increased by 4.6 per cent from 139,671 in 2014 to 146,133 in 2015. Road accident injuries have also increased by 1.4 percent from 493,474 in 2014 to 500,279 in 2015. Accident severity (number of

Grenze ID: 01.GIJET.4.3.2 © *Grenze Scientific Society, 2018* persons killed per 100 accidents) has gone up from 28.5 in 2014 to 29.1 in 2015. The analysis of road accident data 2015 reveals that about 1374 accidents and 400 deaths take place every day on Indian roads. It further reveals that 57 accidents take place and 17 lives are lost every hour on an average in road accidents in our country.

Another study conducted by the Bangalore Traffic Police in 2017 (September), show the number of road accidents in Bangalore alone is 3818 out of which 469 were fatal leading to 499 deaths. Vehicle accidents are something which do not knock on your door before taking place. These clearly bring to light the gravity of the situation and the enormous responsibility of vehicle drivers towards causing road accidents. These deaths could have avoided if the victims were treated as soon as possible.

The three major causes for road accidents are – Negligence, Overtaking, and use of alcohols while driving. Defensive drivers neither drink nor take drugs and drive. They understand that alcohol and drugs impair your ability to determine distances, reaction time, judgement and vision. However, modern – day cars have implemented few technologies to prevent accidents.

Different governmental and non-governmental organizations all around the world carry out workshops and other training programs to make people aware of careless driving. But still, this whole process has not been very successful till date. Some threatening statistics of road accidents that took place in India inform us that the emergency services are not being provided at proper time. The statistics included that the road accidents in one of the years, caused death of more than 130,000 and it indicates that it might jump to 150,000 by 2015. Although India has just 1 % of the world's vehicles, but accounts are 10% of world's total accidents. Mortality rate per 10,000 vehicles is 14 (less than two for developed countries). According to the study conducted by the Bangalore Traffic Police in 2017 (September) shown in figure 4, the number of road accidents in Bangalore alone is 3818 out of which 469 were fatal leading to 499 deaths. Having known about such threatening statistics, we aimed at implementing a system which could give immediate information to a rescue team about the accident occurrence, by which the rescue team can arrange for immediate safety measures. This helps the humanity by a great deal as human life is very crucial.

II. RELATED WORK

Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disasters. In previous works, when an accident occurs, the alert message has been sent automatically to the rescue team and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module [1]. This application has provided an optimum solution to poor emergency facilities provided to the road accidents in the most realistic way.

The prototype model of automatic vehicle accident detection and messaging using GSM and GPS modem has to be made in the following steps:

The layout of the whole set up has to be drawn in form of a block diagram.

The accelerometer sensor will first sense the occurrence of an accident and give its output to the microcontroller.

The latitudes and longitude position of the accident place is to be sent as message through the GSM.

The phone number will be pre-saved in the EEPROM.

Whenever an accident has occurred the position is detected and a message is to be sent to the nearest ambulance and the pre-saved number.

Hoang Dat Pham presented the development of the vehicle tracking system's hardware prototype [1]. The system utilizes GPS to obtain a vehicle's coordinate and transmit it using GSM modem to the user's phone through the mobile network. The developed vehicle tracking system demonstrates the feasibility of near real-time tracking of vehicles and improved customizability, global operability and cost when compared to existing solutions.

Fogue M presented the fast detection of traffic accidents [2], improving the assistance to injured passengers by reducing the response time of emergency services through the efficient communication of relevant information. This requires installing on board units (OBUs) in vehicles, in charge of detecting accidents and notifying them to an external control unit (CU), which will estimate the severity of the accident and inform the appropriate emergency services.

Figure 1 represents the statistics of road accidents and table 1 represents the statistics of the study conducted by Bengaluru traffic police.

| | Accident Statistics | | | | |
|------------------|---------------------|--------|-----------|---------|-------|
| YEAR | Fatal | Killed | Non-Fatal | Injured | Total |
| 2006 | 880 | 915 | 6681 | 6048 | 7561 |
| 2007 | 957 | 981 | 7469 | 6591 | 8426 |
| 2008 | 864 | 892 | 6908 | 6150 | 7772 |
| 2009 | 737 | 761 | 6138 | 5658 | 6875 |
| 2010 | 816 | 858 | 5667 | 5343 | 6483 |
| 2011 | 727 | 757 | 5297 | 4976 | 6024 |
| 2012 | 740 | 760 | 4767 | 4471 | 5502 |
| 2013 | 737 | 771 | 4493 | 4289 | 5230 |
| 2014 | 711 | 737 | 4293 | 4096 | 5004 |
| 2015 | 714 | 740 | 4114 | 4047 | 4828 |
| 2016 | 754 | 793 | 6752 | 4193 | 7506 |
| 2017 (Sentember) | 469 | 499 | 3349 | 3182 | 3818 |

TABLE I: STATISTICS OF THE STUDY CONDUCTED BY THE BENGALURU TRAFFIC POLICE



Figure 1 Statistics of Road Accidents

III. PROPOSED SYSTEM

Figure 2 represents the block diagram of the proposed system. The system consists of three units: vehicle unit, control unit and ambulance unit.

Vehicle Unit: For implementation of this project, vehicle unit should be installed in every vehicle. It consists of a microcontroller along with the accelerometer, GPS and GSM module and sensors to sense the accident. The accelerometer is used to check the speed of the vehicle. The changes in the axis of the accelerometer are observed. If the observed value is greater than the threshold value accident has occurred. On impact or when the speed increases, information about accident is sent to the control unit. This information consists of location of accident detected by the GPS module and then it is passed onto the GSM module.

Control Unit: Control unit is the brain of our system. It will contain all the information about the hospital location and the contact number of all the hospitals in order to send an ambulance to the accident spot. It calculates the nearest distance from the accident spot to the nearest hospital location through a Google API. It receives the message from another GSM module about the accident location and responds.

Ambulance Unit: This unit sends the ambulance to the accident location. The ambulance serves the victim from the accident location.

Anti lock breaking system (ABS) is an automobile safety system which allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while breaking preventing the wheels from locking up and avoiding uncontrolled skidding. Figure 3 represents ABS found in cars.

IV. SYSTEM DESIGN

The Embedded Technology is at its peak and acting as a game changer in many industries. It plays a major role in wide spread of industries, because of the key feature called integration. It brings different sources of departments, under a single umbrella. This increases productivity and quality of product with less human interference.

GPS and GSM module placed in the vehicle will send the location of the accident to the main server which will rush an ambulance from a nearest hospital to the accident spot. This system is completely automated; thus, it finds the accident spot and helps in reaching the hospital on time.



Figure 2. Block Diagram of the Proposed Work



Figure 3 ABS Found in Cars

Figure 4 Working of Breaks In a Car with and without EBD

The global positioning system gives the exact coordinates when there is a change in the axis of the ADXL 335 beyond a threshold point. Figure 2 represents the messages received. The coordinates are shown in terms of longitudes and latitudes as well as the speed with which the vehicle was traveling in terms of knots. Figure 3 represents the image on google maps.



Figure 5 Flow of control in the system

Figure 6. Sample of Messages Received





Figure 7 Image of Google Map Display

Figure 8 Location pointed using google maps

V. CONCLUSION

The system designed above reduces the loss of life due to accidents and the time taken by the ambulance to reach the hospital is also reduced. GPS and GSM modules placed the concerned vehicle will send the location of the accident to the main server. This in turn helps an ambulance from the nearest hospital to reach the accident spot without much delay. The system is completely automated; thus, it finds the accident spot and helps in reaching the hospital on time. Future enhancements which can be made to this system are: Use of 4G technology-based GSM modules, Installing Black-Box (similar to the ones used in aircrafts) and capturing the video of an accident.

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Routing Protocols for Underwater Wireless Sensor Networks

Seema S, R. Ambika

Abstract: Underwater wireless sensor networks (UWSNs) are extensively used in ocean exploration applications, such as ocean monitoring, pollution detection, ocean resource management, underwater device maintenance, etc. In underwater acoustic sensor networks, routing protocol design is an attractive research topic since it guarantees reliable and effective data transmission from the source node to the destination node. Out of many routing algorithms that have been proposed in recent years, energy efficient routing protocols are the challenge. In this paper, the challenging issues in designing the routing protocols that have been discussed, which can provide researchers with clear and direct insights for further research. In addition, this paper provides a survey of different simulation tools available for UWSN simulation.

Index Terms: Energy efficient, Routing protocols, Simulation Tools, Topology Control, Underwater wireless sensor networks.

I. INTRODUCTION

Underwater wireless sensor networks (UWSNs) are newly emerged wireless networks, by providing the most promising mechanism for discovering the underwater environment very efficiently. UWSNs are used for scientific, military and commercial applications [1]. These applications range from tactical surveillance to the study of marine life and include unmanned vehicle communication, pollution monitoring, oil extraction monitoring and aquiculture monitoring. UWSNs are self-organized networks, which consist of sensors that perform collaborative monitoring tasks over a body of water. The data collected by the sensor nodes are sent to sink and then gets forwarded to the base station through radio waves. Electromagnetic waves, optical waves and acoustic waves have been successfully used in UWSNs. Nevertheless, radio frequency (RF) waves are affected by high attenuation in water (especially at higher frequencies), thus requiring high transmission power and large antennae. Optical waves can to achieve ultra-high data-rate communications (Gbit/s), but are rapidly scattered and absorbed in water, so they are used for short-distance links. In contrast, acoustic waves enable communications over long-range links because they suffer from relatively low absorption loss.

The major challenges in the design of UWSNs are limited on-board storage, limited battery power as batteries cannot recharge and solar energy cannot be exploited, limited bandwidth, dynamic network topology as nodes tend to be mobile due to their self-motion capability or random motion of water currents. High propagation delay, Connectivity loss and High bit error rates (shadow zones), the impaired channel due to multipath and fading. Energy efficiency has also been a

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major design concern for UWSNs since all sensor nodes used in UWSNs are battery operated and it is difficult to accomplish battery replacement and the sensors acoustic modems usually consume much energy on data transmission. In UWSNs, one of the hot research areas is routing protocol design. A routing protocol guarantees reliable and effective data transmission from the source node to the destination node. Considering the differences between the terrestrial and the underwater environment, UWSN routing protocol design is more difficult and restricted than that of Wireless Sensor Networks (WSN) [2]. First, the continuously movement of nodes with water currents makes underwater routing highly unreliable; second, the high propagation delay in the underwater environment is inefficient; thirdly, the special characteristics of underwater acoustic waves and channels limit the application of UWSN technologies. Advance arrangements in the area of deployment is not possible, so the routing protocols should build highly reliable and effective communication links without any pre-arranged devices. Whenever the routing is broken during the data transmission, the routing protocol should able to repair or rebuild the routing in a timely way. The routing protocol must be robust self-adaptive to operate in harsh underwater and environments.

There are different aspects of the designing routing protocols, such as the network architecture, the data forwarding method, and the protocol operation data copies, the transmission method, clustering vs. non-clustering, single/multiple sinks, the cross-layer design routing and the non-cross-layer design routing. the control packets, etc.

II. ROUTING PROTOCOLS IN UWSNs

The process of forwarding data from source nodes to a sink when nodes are mobile is a very challenging task. And the major concern is to save energy and to handle the node mobility. Routing protocols are divided into three categories proactive, reactive and geographical. Proactive type effect a large overhead to create the routes, either periodically or every time when the topology modified. Reactive protocols cause large delays and require the source to initiate flooding of control packets to create the paths and are more appropriate for the dynamic networks. This makes both types of routing protocols unsuitable for UWSNs. Geographic routing considered the promising routing protocol for UWSNs. Geographical routing relies on geographic position information; hence the data packets are sent using its geographic location of the destination instead of the destination network address.

A. Efficient depth-based forwarding protocol (EDBF)

The communication in the UWSN faces many challenges and it consumes

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much more energy while the packet delivery ratio is low. This protocol uses the weight to select the next hop for data forwarding, which takes full account of the depth factor, the energy ratio and the next hop forwarding quality [3]. First, the depth factor calculated by the relative depth is used for determining the forwarding direction. Underwater sensor nodes are embedded with pressure sensors and can accurately calculate their depth according to the measured water pressure:

 $d = p/\rho g$

(1)

where d is the depth, p is the water pressure, ρ is the water density and g is the gravitational constant. Knowing the pressure of itself and neighboring nodes, hop count information, and two hops neighboring distances, it follows opportunistic directional data forwarding. Second, the energy ratio helps to ensure the load balance. Finally, the next hop forwarding quality is mainly calculated based on implicit acknowledgement (ACK) mechanism to avoid the worse links and the void areas. Besides, the EDBF protocol greatly reduces the use of control packets. Therefore, the EDBF protocol can timely update the routing table, which is well adapted to the dynamic underwater environment.

Packets in EDBF are of two types, hello packet and data packet. All packets use the same packet header which includes the Packet-type, Source-id, Packet-sequence, Forward-id, Depth, Energy and Next-id. This protocol adds the residual energy and depth into the header of the data packets which reduces the usage of the control packets for the packet designing. Each underwater node has a forwarding agent, which contains the next hop selection mechanism. The neighbor node with the largest weight will be selected as the next hop. For the data transmission, it uses the implicit ACK rather than the explicit ACK. Implicit ACK mechanism calculates the weight using depth factor, energy ratio and the forwarding quality of the neighbor nodes. The forwarding quality of neighbor nodes Q is an important factor in the weight calculation. The smaller value of Q indicates that there are more problems between N1 and N2, such as the link or node failure, the existence of void area around N2. If N1 receives the implicit ACK pkt from N2 for the first time, it will consider the strategy to be right and update Q12. However, if N1 receives the data packet from N2 again, it means that the further relaying of the packet is not smooth, so N1 will decrease Q12 and update it. The residual energy of the neighbor nodes is considered to improve the load balancing and the network lifetime. The neighbor information in the packet headers stored directly in one routing entry is only the neighbor node ID, while its depth, residual energy, and other factors are involved in the calculations of Q and W. Before sending the packets, some changes to the packet headers are necessary.

The EDBF protocol has less energy consumption, lower latency, higher delivery ratio in denser networks, and is more suitable for the complex and dynamic underwater environment.

B. Energy balanced unequal layering clustering protocol (EULC)

Underwater acoustic sensor networks (UASNs) are used extensively in activities such as underwater data collection and water pollution detection. Hence prolonging the battery life of UASNs by reducing their energy consumption is one of the means of mitigating this problem. The EULC algorithm designs UASNs with unequal layering based on node depth, providing a solution to the hot spot issue through the construction of clusters of varying sizes within the same layer [4]. The EULC algorithm divides UASNs into layers with an unequal layer spacing that gradually increases from top to bottom. The acoustic sensor nodes cluster exclusively within their layers with contending radii set based on the distances between the respective cluster-heads and the sink node. At the start of UASN deployment, the sink node broadcasts information to all nodes in the network; each node calculates its distance to the sink node based on the received signal power and then estimates its layer based on its depth. After layering, in accordance with their respective election thresholds and conditions the nodes in a given layer become cluster-head candidates, broadcasting cluster-head compete messages including cluster-head IDs, compete radii, weights, etc. The node with the largest weight is then elected as the cluster-head and broadcasts a message within it compete radius to announce its election. Upon receiving the successful cluster- head's election message the other cluster-head candidates join in the cluster, along with the non-cluster nodes within the layer. Within each layer, the node selected as the cluster-head must make note of its residual energy, node degree, and distance to the sink node. Within each cluster, non-cluster-head nodes send packets to the cluster-head node, which then integrates the packets and exports the result to the next cluster-head, which in turn further integrates and exports upwards to the sink node. It uses single- and multi-hop routing for intra- and inter-cluster data transmission respectively.

This algorithm reduces the cluster scale closer to the sink node, thus prolonging node lifetime and addressing the hot spot issue. To reduce energy consumption in inter-cluster communication, the next-hop node is selected in accordance with its residual energy and depth.

EULC outperforms the standard DEBCR and LEACH algorithms in terms of energy consumption, cluster- head numbers management, and network lifetime, thus verifying the energy efficiency of the acoustic sensors.

C. Void-Aware Pressure Routing protocol (VAPR)

This protocol directs a packet to any sonobuoy on the surface based on depth information available from on-board pressure gauges. The main challenge of pressure routing in sparse underwater networks has been the efficient handling of 3D voids. Available heuristics for 3D void recovery require expensive flooding [5]. VAPR protocol uses sequence number, hop count and depth information embedded in periodic beacons to set up next hop direction and to build a directional trail to the closest sonobuoy. Using this trail, opportunistic directional forwarding can be efficiently performed even in the presence of voids and attain loop freedom in static and mobile underwater networks to guarantee packet delivery.

In VAPR, each sonobuoy propagates surface reachability information to underwater nodes and each node updates its variables, namely minimal hop to the surface, sequence number, data forwarding direction, and next hop data forwarding direction. Based on the beacon sender's data forwarding direction, next-hop data forwarding direction is

set. Then its local states are updated and by incrementing the hop count and setting its current depth, data

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forwarding direction, and sequence number, each node prepares a beacon message to broadcast. This beaconing process will repeat, and all the nodes build directional trails toward their closest sonobuoys on the surface.

VAPR performs local opportunistic directional forwarding to deliver data according to the directional trails. The forwarding decision for routing is solely made based on the local state variables, namely the data forwarding direction and next-hop data forwarding direction and not on the hop-count information. If there is no void, packets can always be greedily routed via the upward direction, and we can solely rely on the data forwarding directions for routing. In presence of voids, there will be direction changes, and the next-hop forwarding direction is jointly used with the data forwarding direction to guide the routing direction.

VAPR ensures loop-freedom and outperforms HBR, DBR and HydroCast in terms of packet delivery ratio, average latency and energy consumption per message and significantly lowering the frequency of recovery fallbacks and by effectively handling node mobility.

D. Distributed Topology Control protocols

To impose the requirement of improvement in throughput efficiency of the network while conserving energy, two energy efficient geographic opportunistic routing protocols are proposed called improved Distributed Topology Control (iDTC) and Power Adjustment Distributed Topology Control (PADTC) [6].

iDTC provides void recovery through depth adjustment. In iDTC, each node locally determines if it is a void node or an isolated node. A node with no neighbor with positive ADV value is a void node and has no neighbor in its communication radius is an isolated node. In iDTC, only minimum transmission range is used. After a node determine that it is a void/isolated node, it attempts to move the node vertically to a new depth. Considering only the x and y coordinates, the new depth of a node is determined based on the Euclidean distance between node and closest sink. If this distance between node and its closest sink is less than the minimum communication range, displacement is computed. The difference between previous depth and displacement will be the node's new depth and it moves vertically to its new depth with a hope to find new neighbors who can forward the packet towards its destination. If the node is void region again, recovery procedure is computed again, and node is moved to another depth closer to sink. This procedure can provide a maximum displacement of a node towards sink equal to its transmission range.

PADTC is based on recovery procedure using increment in node's transmission range and depth adjustment. A void node increases its transmission range from minimum to maximum value and look forward to getting neighbor who can act as next hop forwarder using greedy opportunistic routing. When a void node fails to advance packet towards sink, it increases its transmission range to maximum value. The increased transmission range surely help to transmit packet towards destination, without costly depth adjustment operation. If incase, power increment is also helpless, PADTC executes depth adjustment procedure to move the node near sink to forward its packet directly to it.

Node displacement is a costly operation in terms of energy consumption. Therefore, displacement is minimized, and energy is saved. Increasing the transmission range is not as costly as moving the node vertically to a new location. In dense network scenario, most of the time next hop is found by incrementing the transmission range and there is no need to perform depth adjustment operation. However, in few cases, for example in low density networks, both range increment and depth adjustment operations are executed to forward packet towards sink.

Compared to DTC, iDTC and PADTC protocols guarantees the data delivery with much less energy consumption. Moreover, IDTC and PADTC perform minimum displacement in recovering a void node. The significant decrease in displacement leads to high packet acceptance ratio and less energy consumption.

E. Hydro Cast; hydraulic- pressure-based anycast routing protocol

This is a novel opportunistic routing mechanism to select the subset of forwarders that maximizes the greedy progress yet limits cochannel interference and an efficient underwater dead-end recovery method that outperforms the recently proposed approaches. Major challenges like ocean current and limited resources (bandwidth and energy) are addressed and the measured pressure levels are used to route data to the surface sonobuoys. It is stateless and completes its task without requiring expensive distributed localization [7]. Hydrocast nodes are equipped with a low-cost pressure sensor to measure their own depth locally. Many mobile sinks are also deployed on water surface, which move with water flow. To discover a positive progress area toward to the sink, this protocol exploits only the information that is estimated by measuring the pressure of water in different depths. In the first stage, forward selection set, an opportunistic forwarding mechanism is used to select a subset (cluster) of neighboring nodes with higher progress toward to the sink as the next hop candidates. The neighboring nodes that receive a packet will access their priority according to their distance to the destination; the closer to the destination the higher priority. In this subset, a back off timer is set which is set up proportional to the destination's distance and a node will forward the packet only when all nodes with higher priority progress to the destination. After receiving the data or ACK packet of a higher priority node, all other sensors with lower priorities will suppress their transmissions. By this way the possibility of collisions and redundant transmissions is minimized.

A distance-based timer is used to prioritize packet forwarding where the distance denotes the progress toward the surface. When the current forwarder broadcasts a packet, nodes that receive the packet set the timer such that the greater the progress, the shorter the timer. Among those that receive the packet, the highest priority node becomes the next hop forwarder. Then, the remainder of the lower priority nodes suppress their packet transmissions after listening to the next hop forwarder's data or ACK packet. Finding the optimal set for forwarding is computationally difficult, and thus, a simple clustering heuristic is proposed. To this end, the current forwarder requires the knowledge of the two-hop connectivity and neighboring nodes' pairwise distances.

In the second stage, called routing recovery mode, a local maximum recovery mechanism is introduced to deal with the

communication void. A node is considered as a local maximum node if there are

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Routing Protocols for Underwater Wireless Sensor Networks

no neighbors with lower pressure levels. To overcome this problem, each local maximum node finds and stores a recovery path to a node whose depth is lower than itself and explicitly maintain a path to the node called as route discovery method. This node could be another local minimum where there is a new recovery path or the point where the greedy forwarding can be resumed. Whenever a packet hits a local minimum, it is rerouted along the recovery path either safely to a node that can resume greedy forwarding or to a new local minimum. To determine the recovery route, 2-D flooding approach is used, where nodes at the local minima perform expensive hop-limited 2-D flooding to discover the escape nodes where the greedy mode can resume or to locate recovery paths to better escape nodes. This flood involves a significantly more manageable set of nodes.

III. SIMULATION TOOLS

In the underwater sensor network, the acoustic signals are used for communication among nodes because the radio signal works with additional low frequency and it cannot travel far away in underwater. Simulation-based testing can facilitate to signify whether the time and monetary investments are valuable [8]. Simulation is the most common approach for testing new protocol. Several advantages are like lower cost, ease of implementation, and realism of testing large-scale networks. Simulation is not as perfect as real environment. Thus, the designs of various simulators created most are accurate and useful for different situations/applications. The tool, which is using hardware as well as firmware to perform the simulation, is called an emulator. Emulation can unite both software and hardware implementation. Typically, emulator has greater scalability, which can emulate several sensor nodes at the same time.

A. Network Simulator-2

Network Simulators (NS) are a series of discrete event network simulators used in research and teaching. The core of NS-2 is in C++, with Object-Tcl (OTcl) based scripting. Linux operating system is the most compatible for NS-2. Due to lack of GUI, user should learn the scripting language and modelling techniques. NS-2.35 and above versions are used to model and simulate the underwater channel characteristics and propagation model. In NS-2 trace file is the output file generated after running a simulation and can be visualized in Nam. The trace file has a different format for wired, wireless, and mobile networks. To analyse the performance of the network, data from the trace file should be retrieved and analysed using awk scripts by setting the concerned performance metrics. An open source trace file analyser software named NS-2 visual trace analyser is also available to analyse trace files.

B. Network Simulator version-3

This is an open source, discrete event network simulator. It supports visualization and scripted using C++ and Python. The NS-3 Underwater Acoustic Network (UAN) framework can be used in modelling of underwater network scenarios. The UAN model has the channel, PHY, MAC and AUV models. Netanim is another visualization package which is integrated with the NS-3 package itself. Tracemetrics is a software developed to analyse the trace files. In NS-3 simulation, .pcap files can be generated and they can be imported to the well-known packet analyser software Wireshark.

C. Aqua-Sim

Aqua-Sim is a simulator for underwater sensor networks which is developed based on NS-2. It simulates acoustic signal attenuation and packet collisions in underwater environments. Aqua-Sim supports three-dimensional deployment and can be integrated with the existing codes in NS-2. Aqua-Sim and CMU wireless simulation package works in parallel. Aqua-Sim is independent and is not affected by any change in the wireless package. It can evolve independently because any change to Aqua-Sim is confined to itself and does not have any impact on other packages in NS-2.

D. Underwater Simulator (UWSim)

This is a tool for testing and integrating perception and control algorithms of real robots. It is used for marine robotics research and development. A virtual underwater scenario can be visualized and configured using standard modeling software. Controllable underwater vehicles, surface vessels and robotic manipulators, as well as simulated sensors, can be added to the scene and accessed externally through network interfaces. This tool provides an integration of the visualization tool with existing control architectures.

E. Desert

Desert is based on ns-miracle framework. It has c/c++ libraries to support simulation, emulation, test bed experiments and design of new protocols. It also supports cross layer protocol design and experiments. At the network layer, desert has modules for static routing, dynamic routing, flooding, and to assign IP addresses to nodes. It provides modules for six major MAC protocols in data-link layer. Desert offers three hardware platforms for emulation and test-bed experiments and different modules for simulating node mobility in both 2D and 3D scenarios.

F. QualNet

QualNet is a planning, testing and training tool that "mimics" the activities of an actual communication network. It gives a complete environment for design Protocol, creating and animating network scenarios. This consists of graphical tools that show more numbers of metrics gathered during simulation of network scenario. It maintains real-time speed to allow software-in-the-loop and can execute on a cluster, multi-core and multi- processor systems.

IV. CONCLUSION

Interest in UWSNs is increasing, and related research studies are in progress. However, underwater environment is a special environment that has many restrictions. Considering this restriction, many challenges face the design of the routing protocols of UWSNs. The routing protocols in UWSNs have the common objective of trying to increase the delivery ratio while decreasing the energy consumption and latency. However, current routing protocols have not designed to

defend against security attacks that can block or degrade network

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communication and performance.

In this paper, we introduced an overview of UWSNs characteristics, challenges and some of the UWSNs routing protocols and study their advantages and disadvantages. There are so many research challenges and open issues in routing protocol design for underwater wireless sensor networks, which needs to be investigated. Some of them are the propagation delay model, energy consumption, mobility, security, etc. The new research area is the utilization of intelligent algorithms in the underwater environment and how to use the intelligent algorithms to solve the issues in underwater wireless sensor networks has been a hot open issue in recent years.

Also, we provide a detailed survey on different simulation tools available to simulate underwater sensor networks. For each tool mentioned, its features, advantages and disadvantages are described so that a user can choose the best available tool to satisfy his research requirements.

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NETWORK TRAFFIC CLASSIFICATION TECHNIQUES-A REVIEW

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Abstract— With the growth in the amount of devices associated with the internet; the data that is getting circulated over the internet is also increasing. It is an undeniable fact that this data has significant presence for individuals as well as for organizations. A network needs to handle this massive amount of data traffic which contains malicious data as well. Therefore, it is very essential to distinguish between normal and abnormal traffic by analyzing the network traffic. A number of network traffic classification techniques are available. The researchers are trying to find the traffic classification techniques that do not depend on port numbers or that do not read the packet payload contents. In this study, an analysis of various traffic classification techniques and the application of several Machine learning techniques for traffic classification is carried out. This survey paper also presents a brief review of various machine learning techniques for traffic classification.

Keywords— Network security, Network Traffic, Traffic classification, Machine Learning.

I. INTRODUCTION

With the increased use of Internet, the quantity of devices that are linked to the Internet is increasing day by day. As the quantity of devices is growing, more data is getting circulated on the internet which contains malicious data as well. A network should handle this massive amount of data traffic and needs to identify malicious data in the data traffic. In order to perform this, there is a need of monitoring the network flow and detect any network intrusion. It is required because of numerous security threats that the people encounter are increasing day by day. Identifying numerous network attacks, especially unanticipated attacks, is also an inevitable practical problem. An attack detection system developed for this purpose can be used. An Intrusion Detection System (IDS) is one such system which is used to generate an alert by trying to discriminate between malicious or normal Dr. Ambika R Department of Electronics and Communications Engineering BMSIT&M BANGALORE, INDIA ambikar@bmsit.in

traffic by observing network traffic over the internet linked devices. It can also identify an attack, which may be an enduring attack or an intrusion that has previously happened.

The IDSs are generally classified into two categories: Signature-based detection and anomalybased detection. Signature based detection uses a latest database of known attack's signatures to detect incoming attacks. Anomaly-based detection uses a classifier which categorizes the given data into normal and abnormal data. [1].

Based upon where they monitor for intrusive behavior, IDSs are classified into two types: Network based and Host based. A network based IDS (NIDS) detects intrusions by observing traffic over the devices that are connected to the network. A host based IDS (HIDS) recognizes intrusions by monitoring activities related to a specific host.

This survey paper focuses on various methods for network traffic classification, with special emphasis on machine learning methods and their descriptions.

The remaining part of the paper is organized as follows: Section II describes the elementary information about various techniques for network traffic classification. Section III presents the basic concepts of Machine Learning. Section IV focusses on machine learning techniques for Network Traffic Classification. Finally, the conclusion is provided in section-V.

II. RELATED WORK

Recently, many investigators have proposed various approaches to classify network traffic. In this section, we discuss few techniques for network traffic classification. Three types of methods are available for network traffic classification: portbased, payload-based and machine learning-based [2].

In **Port-based** techniques network traffic identification can be done based on the port numbers. The Internet Assigned Numbers Authority (IANA) allocates these port numbers. In these techniques, many applications use the port number assigned by IANA on a local host in the network, which will be used as a meeting point and the other hosts may initiate communication using that local host. A classifier present in the network needs to check for TCP SYN packets, which is the initial step in TCP's three-way handshake protocol during session establishment, to recognize the server side of a new client-server TCP connection. By using the TCP SYN packet's target port number, the application will be directed to the respective port [4].Unfortunately, these techniques suffers from the following:

- As the applications are growing, they may use unpredictable port numbers [7].
- These techniques may not be suitable when some applications didn't registered their port numbers with IANA [4].
- These techniques may not be very much useful when the applications are using dynamically allocated port numbers.

So, more sophisticated classification techniques should be used for traffic classification. Subsequently, **payload-based techniques** are introduced [8].

The payload-based techniques depend on two assumptions:

- Third parties that are unaffiliated with both the source as well as to the recipient and unauthorized to inspect the packet payload are allowed to do so i.e, the payload is visible.
- The composition of packet payload of every application is known to the classifier.

In **payload-based techniques**, which is also known as Deep Packet Inspection (DPI), the contents of the packets are observed by referring characteristic signatures of network applications in the traffic. Most of the payload based techniques inspects the contents of the packet and tries to match them with a set of signatures stored in the database. These techniques provide accurate results compared to Port based techniques. These techniques are especially used for P2P traffic. Although these techniques provide accurate results, it has some disadvantages and weaknesses. These techniques are complex, involves high computational cost and processing load on identification device is also more. Also, applying this technique is difficult or impossible with encrypted traffic and because the contents of a packet are inspected, it suffers from violation of privacy policies and regulations [3].

Some of the limitations of port-based and payloadbased techniques can be avoided by using **Machine learning-based methods**. Using Machine learning methods for traffic classification leads to reduce computational costs and identify encrypted traffic easily [3].

III. BASICS OF MACHINE LEARNING

This section summarizes the elementary concepts of Machine Learning and summaries how ML techniques can be applied to Traffic Classification.

Applying Machine Learning Techniques for Traffic classification involves a number of steps that need to be followed: First, the features need to be identified. These features are required to identify and differentiate unknown traffic. The next step is to train the Machine Language classifier by associating the set of features with known traffic classes. Then, a machine learning algorithm can be used to classify unknown traffic using previous training. To determine how accurately the machine learning algorithm makes decisions when it is used with previously unseen data, the classifier accuracy should be measured. In order to measure the classifier accuracy, a number of metrics are introduced. These metrics uses the classification results of the machine language classifier. A summary of the classification results which are obtained by using the machine language classifier for a binary classification problem is shown in table 1.

| Metrics | | Actual class | |
|-----------|-------|--------------|-------|
| | | Х | Not X |
| Predicted | Х | TP | FP |
| class | not X | FN | TN |

Table1. Metrics used for measuring classifier accuracy

- True Positives (TP): Number of items of class X correctly classified as belonging to class X.
- False Positives (FP): Number of items of other classes incorrectly classified as belonging to class X.
- False Negatives (FN): Number of items of class X incorrectly classified as not belonging to class X.
- True Negatives (TN): Number of items of other classes correctly classified as not belonging to class X.

The most frequently used performance metrics for binary classification problems are:

- Accuracy: (TP+TN) / (TP+TN+FP+FN). Ratio of correct predictions to total number of predictions made.
- Precision: TP / (TP+FP). Ratio of total number of correctly classified items to the total number of predicted positive items.
- Recall: TP / (TP+FN). Ratio of total number of correctly classified items to the total number of positive items.

Most of the machine learning techniques that are used for Traffic Classification concentrates on supervised and unsupervised learning and a few techniques may also use hybrid techniques.

Supervised learning technique or classification method requires a complete labelled data set and aims at determining a model or function that describes the data. This model is then used to classify unknown classes. This technique trains the model with labelled data set and produces a predicted output with new data samples. Unsupervised learning technique or a clustering technique aims at determining patterns, structures, or knowledge in unlabelled data. When a portion of data is labelled, a hybrid technique may be used.

IV. NETWORK TRAFFIC CLASSIFICATION USING MACHINE LEARNING

In [3] Zhong Fan and Ran Liu considered two machine learning algorithms, Support Vector Machine (SVM), and K-means. These techniques are implemented by using realistic Internet traces. The impact of feature selection and model tuning on the performance of the classifier is studied. The classification outcomes were obtained by using five-fold cross validation. An analysis of these classification results indicate that the classification model based on supervised learning algorithms has higher classification accuracy than that of unsupervised learning algorithms. Their results also show that by using machine learning, it is possible to attain decent traffic classification accuracy and henceforth it is appropriate for numerous Software Defined Networking applications.

In [4] T. Nguyen and G.Armitage propose MLbased IP traffic classification in operational networks. The authors discussed a variety of significant necessities for choosing the ML-based traffic classifiers in operational IP networks and the scope of these classifiers in meeting the requirements. By considering Internet applications traffic as the input, the use of various machine learning algorithms was demonstrated. The authors also outlined the real-time classifiers' critical operational requirements.

In [5] Muhammad Shafiq, Xiangzhan Yu, Asif Ali Laghari, Lu Yao, Nabin Kumar Karn, Foudil Abdessamia propose a network traffic classification structure to identify / classify unknown network traffic classes using supervised learning techniques. This structure has been applied to four machine learning algorithms C4.5, Support Vector Machine, BayesNet and NaïveBayes to build a classification model using ten-fold cross validation. The analysis of results indicates that high accuracy can be achieved by using C4.5 algorithm when compared to the other four machine learning algorithms. In [6] Fatih Ertam, Ilhan Firat Kilinçer, Orhan Yaman, an analysis was performed to distinguish between normal or abnormal data that is received on the internet. In order to accomplish this objective, the KDD Cup 99 data set was used. This data set was classified by using the classifiers Naïve Bayes(NB), bayes Net(bN), Random Forest(RF), Perception(MLP) Multilaver and Sequential Minimal Optimization(SMO) algorithms. These classifiers were compared by using various performance metrics such as precision, recall, Fmeasure and accuracy. A five-fold cross validation method was used to provide raw data to the classifier. Best values for precision were obtained by using RF, SMO and MLP classifiers. Best mean accuracy values were obtained by RF and MLP classifiers.

V. CONCLUSION

This paper describes a review of various techniques for network traffic classification. Special focus was placed on determining whether it is possible to use Machine Learning techniques for classification of network traffic. It is observed that it is possible to make use of various machine learning techniques for traffic classification. This study also shows that a variety of Machine Learning techniques which can be used for traffic classification concentrate on using supervised and unsupervised learning and a few techniques also uses hybrid method. When determining the effectiveness of these methods, there is not a single criterion but several criteria that need to be considered. They include precision, accuracy, recall, true positive rate, false positive rate etc.

The subsequent phase of this exploration will focus on identifying diverse ways that can be used in improving the existing classification methods and developing more prevailing and operative techniques that can appropriately categorize network traffic.

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Autonomous Ship Maneuvering Control and Its Path Tracking Using Fuzzy Logic and Model Free Adaptive Control

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Abstract: Ship Electrical propulsion, is tested using Fuzzy logic and Model-Free Adaptive Control method where the best suited algorithm applied to control the speed and torque of the ship, where it makes ship adaptable to various sea situations. In case of Fuzzy logic, since ship has limited turning radii at specific path planning strategy is developed, where the ship trajectory turns around the way point. In higher order MFAC makes use of previous controlled information to improve the performance by introducing higher order learning law. The dynamic linearization is model free. Robust path planning methods are implemented to achieve the planned path with less delay in time avoiding surge.

Keywords: Ship Electrical Propulsion, Fuzzy logic, MFAC, Robust path, way points

1. Introduction

Studying the manoeuvrability of ship has great importance in order to avoid collision with unpredictable objects, moreover, it helps in determining ship constraints either in dynamics or control signal commands [1]. Electric ship propulsion motor drive propeller directly which the rotor and propeller have common shaft, the ship electric propulsion is more sensitive to load which have great influence on tracking accuracy [2].

The ship faces two problems, velocity and heading control and limited turning radii [3]. Dynamic equations developed using SSP systems are used. The control design is modelfree in MFAC where only input, output data of the system are considered and it makes use of more ship sailing control information, where controller design is made flexible [4]. Defining the way points and its circumference associated, leading to show how the navigation algorithm works including the development of fuzzy control used on board, path planning is robust and straight forward to be implemented on autonomous vehicle following lines and arcs with only storing the list of way points and radii. Here ship dynamics and kinematics has been studied to make the set of equations in surge and sway motions and these forces and moment are driven according to Newton law of motion [5]. Results of fuzzy logic and MFAC are validated to get the best response using reference outputs. The same is validated using Matlab and Simulink as Simulation tool [6].

2. Ship Manuvering Model Analysis

Equations of motion are constructed base on rigid body dynamics to describe the ship motion in 3 degree of freedom.

The three motions are; the longitudinal translation motion 'surge motion' produced by the longitudinal force 'X', The lateral translation motion 'sway motion' produced by the lateral force 'Y', and the rotational motion around the z-axis

'N', these forces and moment driven according to the Newtonian law of motion.

Earth fixed coordinated system (inertia)" O_0 -x₀ y₀ z₀" and body fixed coordinated system are the two right handed coordinate system" O-x y x" adapted for the ship manoeuvrability analysis. Where Ψ is the angle defined between x-axis original course x₀ .Drift angle (^β), defined between direction of speed and x-axis. The equations of motion in the earth fixed coordinate system.



Maneuvering refers to the study of large amplitude motion of ship in calm seas. Traditionally, heave, roll, and pitch are not considered in maneuvering equations due to their relatively low excitement in calm seas; only planar motion are factored in Maneuvering dynamics are distinctly slower than the other variety of ship motions.

Maneuvering by definition is large amplitude motion, nonlinear viscous forces cannot be excluded from the equations of motion.

The mathematical model separates the force experienced by the hull, propeller, and rudder and also includes the interaction effects between the components of model.

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3. General Block Diagram



ARM CORTEX M3: path tracking and collision avoidance algorithm is been implemented using this controller ARM cortex M3 and it is powered using DC battery.

Servo Motor: servo motor controls the rudder angle, which in turn controls the direction of the ship.

Brushless DC motor: brushless DC motor is used to run the propeller, and speed of the ship is been controlled by controlling the speed of this motor.

In the main hull, an Arm cortex M3 is placed to control the ship path and direction. There are two motors (brushless DC motor and servo motor) used in this ship, where one is to control speed of the ship and other one foe direction. Ultrasonic sensor used in this model to identify the distance and diameter of collision. Water pressure sensor is been place to the sides of the hull to sense the water pressure in order to avoid the ship sliding. SD card to save the waypoints set by the telemetry.

4. Algorithm and Flow Chart

- The pins of the control boards are initialized for sensors and motors.
- Speed of the brushless motor is set (speed at which the ship should move).
- Rudder angle is read (direction of the ship is decided by rudder angle).
- Based on the rudder angle set the speed of servo motor, which controls the rudder movement.
- Based on the rudder angle ship moves. During right or left dc motor speed will be reset (reduced).
- Sensor values will be monitored each time when the rudder angle is read.



Model Implementation in MATLAB

Simulation of the ship maneuvre behaviour by changing the ship control parameter is achieved by simulink software program. As consequences three modules were built to express the ship subsystems representing the ship hull, propeller, rudder modules.

The ship electrical propulsion motor control system was established under the matlab environment .The parameters used here are three phase current and the torque.

The ship electrical propulsion motor control diagram. And it is modelled using equations dynamic SSP system.



 $T_{\rm L} = {\rm sgn}(\omega) \frac{K_{\rm T}}{4\pi^2} \rho D^5 \omega^2$

Here we control torque of the motor .By the principle of electromagnetic energy conversion.

$$T_{\rm e}\left(i_{\rm a}, i_{\rm b}, i_{\rm c}, \theta\right) = P \frac{\partial \mathbf{W}_{\rm m}\left(\psi, \theta\right)}{\partial \theta}$$

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Improved propulsion motor control diagram



The load torque loop and magnetic flux loop, inverter and the propeller of the ship electrical propulsion motor can be regarded as generalized controlled object .And current loop is simplified by the proportional component (Kf).

Higher order MFAC control system is being to control the ship propulsion. Where n(t) is speed and $i_q(t)$ is the stator phase current.

Here we give previously calculated speed (n(t-1)), current($i_q(t-2)$), and future estimated current ($i_q(t+1)$)and present speed (n(t)). These values is been given to the PPD estimator, which acts as the feedback to the controller, which in turn regulates the flux $\varphi(t)$.

In the simulation environment both fuzzy logic and MFAC logic are tested, using the quadrature current as the input and torque as the output. Here we get better response in fuzzy logic, Where the output response almost reaches the desired reference output. whereas in MFAC there is a distortions and takes time to settle down.

Simulink environment created to test fuzzy logic subsystem and model predictive controller





Motor reference speed response and Torque response of fuzzy control

Motor reference



Torque response



Motor reference speed response and Torque response of model predictive control

Input output parameter response given by

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Three phase voltage given to motor as input Va, Vb, Vc



Ship Motion Module

The motion module represents the euler's equations of motion, inputs to the module are the 3 degree of freedom hydrodynamic forces and moments

Hull subsystems

Above block diagram is the representation of the hydrodynamic derivatives model that represents the hull characteristics such as hull form geometry. Where the components due to sway motion and the yaw due to yaw movement is been proposed. Where

X-> is the momentum due to hull in surge axis.

Y-> is the momentum due to hull in sway axis.

Hull subsystem (X_H)



Hull subsystem ($\mathbf{Y}_{\mathbf{H}}$)



Propeller subsystem

Here propulsive forces is been represented, where forces are dependent upon accurate representation of trust geometry, wake, lifting and drag propulsion-hull-rudder interaction. Here yaw effect on the propeller is negligible hence neglected.

 X_p -> is the momentum due to propeller in surge axis.



Rudder subsystems

In rudder subsystems ship motions and moments are gr4eatly influenced by the interaction between rudder to hull and rudder to propeller.

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Where $X_R \rightarrow$ is the moment due to rudder in surge axis. $Y_R \rightarrow$ is the moment due to rudder in sway axis. Rudder subsystem (X_R)



Here propulsive forces is been represented , where forces are dependent upon accurate representation of trust geometry, wake, lifting and drag propulsion-hull-rudder interaction

Rudder subsystem ($\mathbf{Y}_{\mathbf{R}}$)



Tracing the reference path

The ship is made to move on the reference path keeping the propeller speed constant and varying rudder speed .

Where x and y coordinates are



U – velocity in x axis (propeller), v- velocity in y axis (rudder) are shown in the response below.







5. Conclusions

Here we have considered speed error, wave current and rudder angle as input where we are controlling torque of the ship. Where as in the base paper [10] it's velocity and force that is taken and speed will be controlled. Output parameter is 'reference quadrature axis current. Parameters such as speed ,rudder angle(α) and quadrature axis current are taken as input. Based on the response of fuzzy logic and model predictive control logic, autonomous ship can be controlled and navigated unmanly using both the logics.

But the settling time taken by the fuzzy logic is less than that of the model predictive controller.

Volume 8 Issue 6, June 2019 www.ijsr.net Licensed Under Creative Commons Attribution CC BY Hence system which is under fuzzy control is more stable compared to model predictive controller.

In this ship model, a sea disturbances in sway and surge directions are considered, if any sea disturbance encountered in the yaw direction then model might not get through it. The model is taking a delay to get adapted to sea situation when collision is encountered hence future work on yaw direction control and adapting control could be undertaken.

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2319

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Efficient Ship Track Keeping using Predictive **PID** Controller

Anil Kumar D, Hari Prasad S. A

Abstract: Present day's unmanned surface vehicles are important where human cannot enter. Navigating these unmanned vehicles plays an important role. This work is proposed with an efficient navigation of unmanned vehicle using predictive proportional-integral-derivative (PID) variants controller. Many researchers are working on the ship track keeping efficiency. This work is an attempt made to reach the maximum efficiency in track keeping. PID controllers are very simple but only PID controller is less efficient compare to predictive and fuzzy controller. Fuzzy and neural network based controller complex in nature. The adaptive controllers are also used to keep the ship on track, but the adaptive controller also complex and sometimes fail to maintain the maximum efficiency. Predictive neural, predictive fuzzy also can be used but again complex. Keeping these limitations in mind an efficient ship track keeping using predictive PID variants is developed which is simple compare to predictive fuzzy and predictive neural and efficiency achieved is around 99.98% and this efficiency is compared with simple PID variants controllers.

Keywords: Predictive Controller, Ship Navigation, PID controller

I. INTRODUCTION

The unmanned vehicles are taking an important role in present technology. The unmanned surface vehicles which run in sea are also important to explore the places in the sea. The main important task in unmanned vehicles is navigation. The navigation takes an important role to make the vehicle to reach the proper destination. In navigation keeping the vehicle on track is also important. Having unmanned surface vehicle in sea is very important. It can be used by army to face the enemies. If unmanned vehicles are used with proper path following/navigation saves fuel. These are some of the advantages why unmanned vehicles are important in present technology. The ship navigation and keeping the ship on track is very important, because ship face sea disturbance, obstacles in the sea, sea waves. Considering all these disturbances, challenges are more to keep the ship on track. To keep the vehicle on track several control methods are used such as PID, predictive, and adaptive controllers.

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The PID controller is a simple and most widely used controller which can keep the vehicle on track. The self-tuned PID controllers are most widely used controllers which adjusted with control variable and tune the controller accordingly and try to keep the ship on track [1][2][3]. The predictive controller is one of the main controllers which will be used in ship navigation. In this, the path following is done by predicting the particular horizon and try to adjust the heading angle of the ship to keep the ship on track. This technique is used to achieve the maximum efficiency, but to predict and control the heading it takes time and time is also an important parameter in ship navigation [4][5]. The adaptive controllers can also be used for ship navigation such that the controller can adapt itself to the environmental and other conditions of the ship and try to keep the ship on track. This controller is also a widely used controller but it is complex system because of adaptiveness in the system the controller system becomes complex and may take more time compare to PID controller to decide the heading angle [6][7]. By observing drawbacks of the above three different controllers, this paper is proposing a new efficient algorithm which improves the efficiency of the control system. The proposed algorithm predicts the heading angle and controlling is done by PID controller. This Predictive PID variants controller is simple which predicts using predictive controller and controls using PID controller. Second section discusses about the predictive controller, third section is about predictive PID controller. The last section discusses about the simulation results of predictive PID controller.

II. PREDICTIVE CONTROLLER

To control and keep the ship on track in sea is very difficult as the sea dynamics keep changing. To consider these dynamic variations of the sea, a predictive controller plays an important role. The PID controller cannot be used for this non-linear behaviour of the sea condition and ship has to overcome all these uncertain conditions and has to be on track. The model predictive controller is used to control multiple inputs and multiple outputs (MIMO) system. In multiple inputs if any changes are found, accordingly the output variable also will be adjusted as per the predictions and measurements. The predictive controller advantages are process model is used to capture the dynamic and static interactions between input, output and disturbances, optimum set points are calculated, and accurate prediction avoids early warnings.



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The predictive controller is implemented using MATLAB Simulink. The model is as shown in the fig. 1. It consists of model predictive controller, plant, disturbance block, input variables. The output variables are controlled variables or manipulated variables (MV), the input variables are measured outputs (MO) as feedback from the system, reference variables as input variables, measured disturbances (MD) as disturbance for the system. The disturbance is the sea wave model which is used as disturbance for ship. The plant in this model is the ship, which is a Nomoto's fourth order model which given as [8]

$$\frac{r}{\delta} = \frac{k(1+T_2S)(S^2+2\eta\omega_0S+\omega_0^2)}{(1+T_1)(1+T_2S)(S^2+2\xi\omega_nS+\omega_n^2)}$$
(1)

where, K is the static yaw rate gain and T_1 , T_2 , T_3 are time constants. The Nomoto model is very simple and linear ship model which is most widely used. It supports all 6 DOF (degrees of freedom). For smaller rudder angle also it performs due to its consideration of all 6 DOF. The sea model used is modified Pierson Moskowitz [9]. The different wave spectrum is considered with frequency, amplitude, phase and direction of propagation. The final spectrum is derived and measured data of wave motions as, $S(\omega) = A\omega^{-5} \exp(-B\omega^{-4}) m^2 s$ (2)

where, $A = 8.1 \times 10^{-3} g^2$, and $B = 0.74 * g^4/V$. Here V is the wind speed at a height of 19.4 m over the sea surface, and g is the gravitational constant (9.8 m/s²). It is assumed that the waves are represented by Gaussian random process and that S (ω) is narrow banded, now, the concept of significant wave height is used to reformulate the PM spectrum as:

$$A = 8.1 * 10^{-3} g^2$$
 and $B = 0.0323 * \frac{g^2}{H_5^2} = \frac{3.11}{H_5^2}$

and the maximum value of (ω) is,

$$S_{max}(\omega) = S(\omega_0) = \frac{5A \exp\left(-\frac{\omega}{4}\right)}{4B\,\omega_0} \tag{3}$$

where,

$$\omega_0 = \sqrt[4]{\frac{4B}{5}}$$

Fig. 2 shows the P-M wave which is simulated in MATLAB. This wave gives a single wave spectrum, which occurs with ω_0 frequency and it has a height given by the equation (3).





The predictive controller is multivariable with internal dynamic model for prediction process is given as [5][10]

$$\psi(t+1) = \sum_{i=1}^{n} a_{1,i}\psi(t+1-i) + \sum_{i=0}^{m} b_{1,i}\Delta\delta(t-d-i) + \sum_{i=0}^{n} C_{1,i}\xi_1(t+1-i)(4)$$

where $\psi(t)$ is the output variable (heading angle), $\delta(t)$ is the input variable (rudder angle) of the system, 1(t) is a disturbance term which is assumed to be a white Gaussian noise with zero mean, (d + 1) is the time delay of the system, $\Delta = 1 - q^{-1}$ is the differencing operator $a_{1,i}$, $b_{1,i}$ b₁, i and $c_{i,1}$ are the coefficient n, m and r₁. The predictive controller performs better than PID Controllers.







Fig. 4 Output Response of the predictive controller



2386

III. Predictive PID Controller

The predictive controller plays an important role in predicting and measuring the ship dynamics. The predictor is used take the multiple set points as input heading angles, between present and next set point it divides into 5 steps and these steps are taken as set points for the predictor to predict the error and this predicted output is given to the plant and plant output is given to PID controller. The PID controller is used control the error as per the equation (4)

 $u(k) = K_p e(k) + K_l e(k) + K_D \Delta e(k)$ (4)

where K_P , K_I , and K_D are the proportional, integral, and differentiator constant respectively. The proposed predictive PID is implemented in MATLAB Simulink. The model block diagram is shown in fig. 5.



Fig. 5 Predictive PID Controller

The predictive PID controller is implemented with variants of PID like PID, PI and PD. All the three controllers are validated along with predictive controller and the best predictive PID is selected based on the efficiency of the system.

A. Predictive PID

In predictive PID controller the controller part is PID and PID controller is used and tuned as shown in fig. 5. The PID controller equation is given as

$$P + I \frac{1}{s} + D \frac{N}{1 + N \frac{1}{s}}$$
 (5)

where P is proportional, I is integral, and D is derivative. The PID controller implements controller with proportional, integral and derivative actions which are auto tuned and set the value such that the controller can work efficiently.

B.Predictive PI

In predictive PI, only P and I are used with only proportional and integral actions which are auto tuned and set the values for efficient working of the system as shown in fig. 6. The PI controller equation is given as

$$l^{2} + l \frac{1}{s}$$
 (6)

where P is proportional, I is the integral the values can be around 80.6 and 54 respectively. The controller auto tuned for stable system and the above values are set automatically.



F

Fig. 6 Predictive PI Controller

C.Predictive PD

The predictive PD controller is using only P and D are used with proportional and derivative actions which are auto tuned and set the values for maximum efficiency as shown in fig. 7. The PD controller equation is given as

$$P + D \frac{N}{1 + N\frac{1}{s}} \tag{7}$$

where P is proportional, D is derivative, N is filter coefficient. The tuned values with auto tuning are 80.6 and 0.1 respectively. The filter coefficient is around 500 which set automatically when the controller is tuned. The control system is auto tuned and is a stable system.



Fig. 7 Predictive PD Controller

IV. Simulation Results

The simulation results are compared with only predictive controller, predictive PID, predictive PI and predictive PD controller. The fig. 8 shows that the predictive controller output. The figure shows the trajectory of the ship.



Fig. 8 Trajectory of Predictive Controller

The fig. 9 shows the trajectory of predictive PID. In this the efficiency of the ship track keeping is improved compared to the only predictive controller. Fig. 10 and 11 shows the predictive PI and PD controller respectively. In predictive PD controller the highest efficiency is achieved.



Fig. 9 Trajectory of Predictive PID

The table 1 shows the comparison of all the controllers. The efficiency of each system is given.



Fig. 10 Trajectory of Predictive PI

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Fig. 11 Trajectory of Predictive PD Table 1 Comparison of Predictive and Predictive PID variants

| Different Controllers | Efficienc y (in %) | Execution Time (in Seconds) |
|---------------------------------|-----------------------|-----------------------------------|
| Predictive PID Controller | 99.93 | 5.7 |
| Predictive PD Controller | 99.98 | 5.7 |
| Predictive PI Controller | 99.88 | 5.7 |
| Predictive Controller | 92.9 | 5.3 |

It is observed that the predictive PD controller is most efficient controller. Almost all the controllers take same execution time except the predictive controller. The predictive controller takes around 0.4 seconds less time to execute compared to predictive PID variants controllers. The execution time of the system is not considered in this work, the focus is given to the performance with respect to efficiency. The efficiency of the system is improved by implementing predictive PID controller.

V.CONCLUSIONS

The predictive PID and PID variants is implemented and the efficiency of each variant is compared. The predictive PD based controller is more efficient when compared to other variants, it is observed around 99.98%. The predictive PD based controller is the best controller which can used for ship track keeping and as well as to keep the ship on track. Further, the work can be carried out to implement the hardware and real time test can be conducted for the proposed system.

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2388

SMART AND AUTOMATIC HEALTH MONITORING OF PATIENT USING WIRELESS SENSOR NETWORK

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Abstract—This paper presents the architectural design of a system for smart health-care using Wireless Sensor Network. Patient health monitoring is a common task in health-care areas from homes to hospitals. In proposed system, patients carry a batch of body-sensors to collect their physiological parameters. The Arduino is attached on the body of patients, facilitates the sensor node and sends sensor data to the server using WiFi. WiFi being used in many hospital applications, provide very less interference to the functionality of other devices. The server detects abnormal conditions of patients using the threshold value and sends the SMS and e-mail to the physician along with videofeed. The system allows the mobility of the patient wearing the sensors and the video-feed improves the communication with the doctor. Through this system we can improve the quality of treatment for the patients who may require the continuous remote health monitoring.

Index Terms—Electronic healthcare; Wireless sensor networks; Patient Monitoring; Web Services; Video surveillance

I. INTRODUCTION

In India, everyday many patients are affected because they are not regularly monitored [10]. Also, real time parameter values are not measured efficiently in hospitals because the patient cannot remain under surveillance all the time. It becomes uphill task for doctors to frequently check the patient conditions and continuous monitoring of their status [14]. To deal with these types of problems, our system can be proved beneficial. As the advent of technologies are transforming, one of the most important applications of technology is healthcare and wellness management [11]. Health-care is moving from reactive responses to tackle the dire conditions using a proactive approach characterized by early detection, prevention and better health management. In this framework, health condition monitoring and well being management are significant contributors to individual health-care [1].

This system is particularly important in countries having a significant aging population, like India where this technology can be employed to significantly improve the overall quality of life [11]. Our system is designed to be used in hospitals and home for measuring and monitoring various physiological parameters. The results are recorded using Arduino and sent

to a web-server for storing into a database. Also, the results are displayed on a website and doctors can log in to patient's account on the website and view readings of patient.

In this paper a prototype of basic human body parameter monitoring system based on Arduino micro-controller and web-server is implemented. Various basic physiological parameters such as fall detection, heart-rate, body temperature and ECG using [25] are measured using relevant sensors and sent to the micro-controller board for processing [1][8][9][21][23]. Arduino and the sensors together makes the Body Sensor Network (BSN), helps to measure above specified parameters. The computed parameters values are then sent to a web-server for display on the web page and stored in a database [1]. ESP8266, a WiFi module is used for communication between Arduino and Server. The necessary software is developed using Arduino IDE, HTML and PHP programming language. The measured physiological readings are updated in every 60 seconds. The detailed description is given in Section IV. The updated parameter values can be viewed from anywhere using an internet enabled device. Also, when the value of the physiological parameters cross threshold value the doctor/caretaker gets alerted.

This system is especially beneficial for elderly and ill patients at home who need frequent monitoring by the doctor and caretaker. The system sends alert notifications through SMS, e-mail and video-feed [15][17][24], if the patient's parameters cross the defined threshold. The detailed description of these services are given in Section V. This helps to take appropriate action at that instant of time and would save the patient from future health problem which may arise, also save their life in case of critical condition. Such a system can help in reducing hospital bills, arising from patient's hospitalization.

This paper is organized as follows, Section II provides details about the existing systems and their drawbacks. Section III presents system hardware and software requirement to measure the parameters. Section IV introduces methodology to achieve the required system . Section V presents the test results of notifications. The last section concludes our work and presents future work plans.

II. LITERATURE SURVEY

This section presents the current systems and methodologies and their limitations, for which the introduced system provides the solution. Various portable health monitoring apparatus available in market like Pulse-rate band, measures only one of the physiological parameters. The present devices are not capable of maintaining the database of readings, these only measure immediate values and alert using Bluetooth or GSM in [3][5][8]. While taking consideration of IoT in systems [4][6][7], the system proved quiet efficient in terms of database maintenance and patient's mobility, but these didn't prove well in sending alert to concerned patient efficiently. The system introduced in this paper not only measures several parameters but also maintain a database of the values to be used as a medical record. System along with SMS and E-mail sends video-feed in alert notifications [13][14][22]. Several other attempts using IoT have been made to customize many sensors to make BSN in [1][11][20] but the protocols were used for very low range of communication using Zigbee. Whereas, in the introduced system the BSN sends the data to a global server which is accessible from any point of the world. Table 1 shows the current available work and the improvisation by our system. Fig. 1. shows a graph of comparison between various technologies in terms of patient's mobility (wearibility and permissable patient-server distance), alert type and Database.

TABLE I: Literature Survey of Some Available Systems

| REF. | AVAILABLE METHOD- OLOGIES IN REFERENCE | IMPROVISATION MADE IN PROPOSED SYSTEM |
|------|---|---|
| [1] | Sensors Data is sent to a Lo- cal Server made using Rpi 3 via Zigbee | WiFi is used to send sensor Node Data to Global Server |
| [2] | Sensors are directly con- nected to Rpi Server making patient immobile | Data is sent to Global server through a portable Node |
| [8] | GSM is used to send Alert Notification to caretaker | Web services provide notifica- tions along with video feed |
| [11] | Alert is sent on the basis of current parameter value and no database is maintained | Database of body parameter is maintained as medical history |



Fig. 1: Evaluation Graph

A study from various Hospitals revealed that most of the health monitoring equipment being used are wired, because wireless devices causes interference in the apparatus being used at hospitals. The proposed system works on IEEE 802.11 b/g/n WiFi which is designed to work with other devices with least effect [16].

III. SYSTEM HARDWARE AND SOFTWARE REQUIREMENT

In this section, the signal flow of information is discussed along with the various hardware and software components being used in the the system.

A. Block Diagram of System with Hardware and Software Requirement

Fig. 2. shows the block diagram of Patient's Health Monitoring System using wireless sensor network. It consists of a wireless sensor node and a web-server. In the wireless sensor node, ECG, Pulse rate module, Fall Detector and Temperature Sensor are connected to the Arduino Uno. Arduino processes the incoming data from the sensors. Then the physiological readings from sensors are transmitted to web-server using the ESP8266 WiFi transmitter which is connected to Arduino's serial port. The web-server receives the data and check it with the threshold value for the registered patient. If the parameters are within threshold the data is stored displayed on website, otherwise an e-mail along with the link of live video feed will be sent to Doctor/caretaker's account and a SMS will be sent as offline alert.



Fig. 2: Block Diagram of Patient's Health Monitoring System using Wireless Sensor Network

B. ECG Sensor

An electrocardiogram (ECG) is measurement of electrical change in potentials between different sites on the skin as a result of cardiac activity. Fig. 3(a). shows the ECG Sensor AD8232 with operating voltage of 3.3V, which provides very less settling time with Arduino. Electrodes provided on this board are attached to Right Arm, Left Arm and Right Leg.

C. Pulse Sensor

Pulse rate is measured by the number of contractions of the heart per minute (bpm). The average normal resting adult human heart rate is 60 to 100 bpm. Pulse rate module shown in Fig. 3(b). uses photoplethysmography of IR light to detect blood volume change at finger tip, providing QRS interval.

$$PulseRate = (SamplingRate * 60)/QRS_{interval}$$
(1)

D. Fall Detector

Human body is prone to fall whenever the brain loose consciousness. The ADXL335 accelerometer shown in Fig. 3(c). Its high resolution can detect the inclination change with less than 1 degrees of variation as result of gravity tilt.

$$AxisValue = digitalValue * (V_{ref}/1023)$$
(2)

E. Temperature Sensor

The normal human body temperature range is 36.5 - 37.5 in Celsius (97.7 - 99.5 in Fahrenheit). The DS18B20 is used as temperature sensor shown in Fig. 3(d). communicates over a Wire bus with a micro-controller. It measures temperatures from -55 to +125 in Celsius with accuracy of 0.5. DB18B20 can convert 12-bit temperature to digital word in 750 ms.

$$Temperature(^{\circ}C) = V_{out} * (100^{\circ}C/V)$$
(3)



Fig. 3: (a) AD8232 ECG Sensor; (b) Pulse Sensor; (c) ADXL335 Fall Detector; (d) DS18B20 Temperature Sensor

F. Arduino Uno R3

The Arduino Uno-R3 is a 8 bit micro-controller board based on the ATmega328 with open source software. It has 14 digital I/O pins, 6 analog inputs, a 16 MHz crystal oscillator, 2KB of SRAM, 32KB of on chip flash memory and 1KB of EEPROM. Arduino is a low cost user friendly micro-controller that can be programmed easily for multiple applications.

G. ESP8266-01 Serial WiFi module

The ESP8266 WiFi Module is a System On Chip (SOC) with integrated TCP/IP protocol stack that can give access to any micro-controller to a programmed WiFi network. The ESP8266 is capable of either hosting an application as well as offloading all WiFi networking functions from another application processor.

H. IP Camera

An IP camera is a networked video camera that transmits data over Ethernet. IP camera provides remote access of video from any location with great resolution and scalability.

I. Software Requirement

1) Arduino Integrated Development Environment: Arduino Integrated Development Environment (IDE) used to write and upload code to the Arduino board. The Arduino IDE supplies a software library from the Wiring project. Arduino programming language is a greatly simplified version of C++.

2) AT-Commands: AT commands are instructions used to connect with WiFi networks. These open TCP connections without need to have TCP/IP stack running in the micro-controller. With use of AT commands we can simply connect any micro-controller to ESP module and start pushing data up to internet.

3) HTML and PHP: HTML is the standard markup language for creating web-pages and web applications. PHP is a server side scripting language used to create dynamic web-pages. These are used to at the server side of system for data storage and maintenance of user account.

IV. METHODOLOGY

This Section will give a detailed description of the functioning of bio-medical sensors to form a Sensor node, the wireless communication of data from node to server and deliver of notification along with the algorithm flowchart.

A. Working of Wireless Sensor Node

The working of sensor Node is shown in Fig. 4. The node is a junction of physiological sensors including heartbeat (pulse) sensor, ECG sensor,fall detector and temperature sensor which is made using Arduino Uno R3. Function of node is to collect data from various sensor and save them in different variables with proper delay.

The pulse rate sensor provides output with total calculation delay of 10 seconds. Thereafter, ECG sensor is initialized and output is stored with a calculation delay of 10 seconds according to the duty cycle. After this the values of temperature sensor and fall detector are recorded with the calculation delay of 5 sec each. The sensor data is then sent via ESP8266 to web-server. ESP8266 WiFi module communicates serially to web-server. The Node goes into idle mode for 30 sec to avoid the overlapping of next set of data, thus updating data at webserver in every 60 seconds.

B. Working of Web-Server

The working of web-server is described using Fig. 5. Web-Server works as a real time application to provide notification services. The ESP8266 WiFi module sends the node data to the web-server using AT- Commands. The web-server will receive the data using the GET commands and process it as four variables, corresponding to each of different sensors. The web-server will have an algorithm which compares the data coming to an account, with the threshold designated for the patient registered to that account. If the data is within the limit range it will be stored on a text file which will be later displayed on the website. The data on website can be later used as the patient's authentic report, by logging in the account.
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Fig. 5: Algorithm at Web-Server for Result Analysis and Alert Notification

In case the threshold is Crossed by one or more physiological sensor data, an alert notification will be sent to the doctor/caretaker's e-mail ID and mobile registered to that particular account, and a link of live streaming video from IP camera will be sent along with the e-mail. Then the data will be stored on the website. While alerting, the data is saved after the Notifying process so as to lessen the delay in sending the notification.

C. Generation of Live Video Link

The generation of Live Video-Feed and sending it's notification link is shown in Fig. 6. IP camera is used for this process along with an FTP standalone server. The IP camera will remain in idle mode to conserve power. Meanwhile the server will keep looking for the threshold crossing, once the threshold crossing is detected the IP camera is pinged by Web-Server. After waking up, the camera will start streaming the live video feed and send it to FTP server using the router's PORT address. The FTP server will provide the link for the current live video feed in the alert notification to doctor/caretaker. For security and power saving purpose, the generated link will be discarded after single use. The camera will be On until the user is viewing the live feed, and once the user will close the link the camera will go to idle mode after few minutes of no activity.



Fig. 6: Generation of Live Video Feed and Sending it's notification link

V. RESULTS AND DISCUSSION

This section explains functioning of the system using the demo of Website and Notifications.

A. Webpage View

The website acts as a history of patient's physiological reading. Each patient has their own account in which their prescribed threshold is fed. The parameters are displayed on the website, that can be accessed through log-in. The sample of web-page shown in the Fig. 7. is the demo of the recorded parameters in every 60 seconds (can be changed). The website is hosted on the global host, so it can be accessed from any part of the world, makes the monitoring of the patient easier.

B. Alert Notifications

The alert notifications is sent in two forms : Online and Offline. The Online notifications will consist of e-mail alert and live video link. The Offline notification is SMS.

| ← → @ http:// | 54.80.13.103/FinalPro | ject/read.php | , | | |
|---------------------|-----------------------|---------------|-----|------|------|
| @ Health Monitoring | g × | | | | |
| | | | | | |
| Patient's Name : P | atient 1 | | | | |
| Age : 2 | 2 | | | | |
| ID : 1 | 01 | | | | |
| Date and Time | | Pulse | ECG | Temp | Fall |
| 03-24-2018 03:31 | . pm | 87 | 656 | 38.1 | 1 |
| 03-24-2018 03:30 | pm | 85 | 649 | 38.1 | 1 |
| 03-24-2018 03:29 | pm | 85 | 648 | 37.9 | 1 |
| 03-24-2018 03:28 | pm | 83 | 648 | 37.4 | 0 |
| 03-24-2018 03:27 | pm // pm | 81 | 648 | 37.2 | 0 |
| 03-24-2018 03:26 | pm | 81 | 648 | 37.1 | 0 |
| 03-24-2018 03:25 | pm | 80 | 646 | 37.1 | 0 |
| 03-24-2018 03:24 | pm | 78 | 646 | 37.1 | 0 |
| | | | | | |

Fig. 7: Sample Web-page view of Patient's Health Monitoring System using Wireless Sensor Network

Note : Here, in order to show the demo of alert notifications the threshold is lowered.

1) *E-mail:* The E-mail is sent using the IMAP (Internet Mail Access Protocol) of G-mail at Port 587, which provides TLS (Transport Layer Security). Fig. 8. shows the sample e-mail alert. The mail consists of time of threshold crossing and a link to live video feed.



Fig. 8: E-mail Alert to Doctor/Caretaker's Account

2) Live Video Stream: Fig. 9. shows the demo of video-feed using its screenshot. The video is accessible soon as the link is arrived in the notification mail. The link gets discarded after once its being used to provide a security against data misuse

by unauthorized person who gets an access to an old link. The live video stream enables the doctor/caretaker to monitor condition of patient until they reach to provide help.



Fig. 9: Sample Screen shot of live video stream after clicking the link in mail, here : http://54.80.13.103/FinalProject/read.php?video=256874

3) SMS Alert: The result of SMS alert is shown in Fig. 10. The SMS is sent using SNS (Simple Notification Services) of Amazon Web Services (AWS) to provide notification to doctor/caretaker while they don't have access to internet. Mutiple number of SMS can be sent at a time to show a strong presence of alert, which can be handled using SNS service.



Fig. 10: SMS Alert Sent to Doctor/Caretaker's Registered Mobile

Both online and offline notifications will be sent to the registered doctor/caretaker. E-mail and the mobile number of caretaker and doctor can be changes anytime depending on the recipient's contact details.

C. Result Analysis

The field test of model showed that the reliability of the proposed system can reach upto 100 % when the true condition is met. The field test is done taking consideration of two parameters consisting of daytime and environmental temperature. In true condition when the threshold is met, the percent reliability can vary upto 4% with lowest of 96%. The system also lacks by sending false alarm based on noise condition with upto 3% false alarm at peak time of day when system is prone to maximum noise. The percent of reliability and false alarm of the system can be seen using Table II, which also shows the power consumption by the system. The system is proved quiet power efficient, with maximum usage of 4% of available power within an hour.

The first row explains that, at a given time, out of some trials, 98% of times the message came when true conditions were met, and two times message were lost. While doing similar trial, 1% times alert message came event though the there were no abnormalities. In overall process, total 2% of battery was depleted in 1 hour. Likewise, the temperature column follows same procedure. The study of system under various temperature and daytime condition showed that system works to its maximum capacity at 9 am with environment temperature less than 25 °C.

TABLE II: Result Analysis of Proposed System

| Measures | | % Reliability on Notification | Percent False Alarm | % Power Used (1 Hr.) |
|-----------------------|-------|----------------------------------|------------------------|-------------------------|
| | 12 am | 98 | 1 | 2 |
| Time of Day | 09 am | 100 | 2 | 2 |
| | 12 pm | 98 | 2 | 3 |
| | 03 pm | 96 | 1 | 3 |
| | 06 pm | 97 | 3 | 2 |
| | 15 °C | 98 | 2 | 4 |
| \approx Temperature | 20 °C | 98 | 1 | 3 |
| * | 25 °C | 97 | 0 | 2 |
| | 30 °C | 96 | 0 | 2 |
| | 35 °C | 98 | 2 | 3 |

VI. CONCLUSION

In this paper, Patient's Health Monitoring using Wireless Sensor Network is presented. The Bio-medical parameters are stored on a website, which can be used as patient's medical history in future. Several patients can register their devices to the server, and can access their parameters using accounts log-in (each account have different threshold value defined by doctor after thorough examination.). When the value of the physiological parameters exceeds designated threshold value, the doctor/caretaker gets alerted through SMS and e-mail. This robust system is useful for monitoring the health status of elderly and ill patients who are unable to visit hospital on daily basis and require constant assistance in critical conditions. This system aims to make the system portable, so that it won't hurdle patient's day to day activity.

Several future advancements can be applied for further progress of this work. One of most important future work aspect is making the system even more portable by redesigning the sensors and ASIC, according to the need of different categories of diseases. Customization of sensors and node controllers will help in increasing portability, reliability and even reduce power consumption compare to market available sensors. Additionally a mobile application can be designed, which being easier to access can replace the functionality of website. Integration of Google assistant in the system will provide a great support to patients to seek advice at any point of time. The system used in this paper can be considered for performing a future implementation of complete portable, automatic and smart health monitoring system.

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SMART REAL TIME MANHOLE MONITORING SYSTEM

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Abstract – A smart city is the future goal to have cleaner and better amenities for the society. Smart underground infrastructure is an important feature to be considered while implementing a smart city. Drainage system monitoring plays a vital role in keeping the city clean and healthy. Since manual monitoring is incompetent, this leads to slow handling of problems in drainage and consumes more time to solve. To mitigate all these issues, the system using a wireless sensor network, consisting of sensor nodes is designed. The proposed system is low cost, low maintenance, IoT based real time which alerts the managing station through an email when any manhole crosses its threshold values. This system reduces the death risk of manual scavengers who clean the underground drainage and also benefits the public.

Key Words- Smart underground, Drainage system monitoring, wireless sensor network, low cost.

1. INTRODUCTION

An integral part of any drainage system is the access points into it when it comes to cleaning, clearing, and inspection. Metropolitan cities have adopted underground drainage system and the city's municipal corporation must maintain its cleanliness. If the sewage maintenance is not proper, ground water gets contaminated causing infectious diseases. Blockages in drains during monsoon season, causes problems in the routine of the public. Hence, there should be a facility in the city's corporation, which alerts the officials about blockages in sewers, their exact location and also if the manhole lid is open automatically. Underground drainage consists of sewage system, gas pipeline network, water pipelines, and manholes. Temperature sensors are used to monitor electric power lines that are installed underground. Pressure sensors are deployed to avoid manhole explosions due to chemical release and electrical energy.

Paper [1] represents the implementation and design function of and Underground Drainage and Manhole Monitoring System (UDMS) with separate transmitter and receiver models. The vital considerations of this design are low cost, low maintenance, fast deployment, and a high number of sensors, long life-time and high quality of service. Paper [2] mainly acknowledges in the field of alerting the people about the gas explosion, increase in the water level and the opened lid. It uses IoT to make the drainage monitoring system in a highly automotive by using sensor for detecting and sending alerts through audible alarms with glowing of LED light and messages via Wi-Fi module to the authorities, storing the data in the cloud and displaying the details in the web browser.

This project overcomes the demerits of paper [1] by detecting drainage water blockage by installing water flow rate sensors at the intersection of nodes. When there is a blockage in a particular node, there is variation in the flow of drainage water which when cross the set value will display the alert in the managing station. Also demerits of paper [2] are solved by detecting temperature variations inside the manhole and alerting the same to the managing station through automatic mail. Also, flow rate sensors are used to detect the over flow of the drainage water and alerting the same to the managing station through automatic mail.

So, the main focus of this project is to provide a system which monitors water level, atmospheric temperature, water flow and toxic gases. If drainage gets blocked and sewage water overflows, manhole lid opens, it is sensed by the sensors and this data is sent to the corresponding managing station via transmitter located in that area. Maintenance of manholes manually is tedious and dangerous due to the poor environmental conditions inside. It is, therefore dangerous to go inside the manholes for inspection of its current state. To solve all the problems related to underground sanitation, a remote alarm system is necessary for transmitting data collected by the sensors set inside the manhole to the managing station. This project uses Wireless Sensor Networks (WSN) to implement this system. These nodes are composed of controller, memory, transceiver and battery to supply power.



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Fig 1a: Manual scavenger clearing blockage in a manhole



Fig 1b: Sensors embedded

2. METHODOLOGY



Fig 2. Functional block diagram

The functional block diagram describes the monitoring of manhole in underground drainage system. Any blockages, rise in temperature, explosion due to toxic gases, overflow, manhole lid left open is detected by the sensors. The signals from the sensors are fed to the controller, which is programmed to generate alerts.

In this we use sensors to detect blockage, floods, and gases. The sensors will identify the clogging inside the drainage system and will give information about the location and further actions will be taken care by the municipal. This system consists of

2.1 Sensor network

2.2 Transmission station

2.1 Sensor Network

Sensor Network consists of:

- i. Flow Sensor- YF-S201: Flow sensors are mainly used to measure the quantity or the rate of flow of liquids or gases. We are using it to detect overflow.
- Float horizontal sensor- FSH-01: Float sensor is used to detect the level of water in the system. This can turn on to ii. be as a pump, alarm and indicator. We are using it to detect blockages in drainage.
- Temperature sensor-LM35: Temperature sensor is a device used to measure the hotness or coldness of an object. iii. We are using this sensor to obtain the temperature underground.
- Ultrasonic sensor-HC-SR04: Ultrasonic detection is most commonly used in industrial applications to detect iv. hidden tracks etc. We are using it to detect the opening and closing of lid of manhole.
- Gas Sensor-MQ2: MQ2 Gas sensor detects combustible gasses and smoke. v.



2.2 Transmission Station

This station helps to send signals from sensors. This station consists of Raspberry Pi model B and Arduino Uno which are the two microcontrollers that are interfaced. The signals received by the Arduino from the sensors is converted from analog signals to digital signals with the help of ADC located in the Arduino board and further is processed and sent to the cloud and Raspberry Pi ,takes this as input data. An alert is displayed in the managing station and an email is sent to the respective authority.

3. FLOW CHART

The working of the whole unit can be explained by using the following flowchart as shown below.



4. PROPOSED SYSTEM

In the proposed method, development of IoT based drainage and manhole monitoring system is designed. This system monitors atmospheric temperature, release of toxic gases, blockages, overflow in drains and manhole lid position. Maximum levels are set and sensors keep monitoring the changing conditions. As the levels reach a maximum set point the sensors detect and send the signal to controller, where it commands the IoT network to generate alerts to the municipal corporation.



Fig 4a. Model of smart city



Fig 4b. Experimental setup



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5. RESULT

This system detects the blockages and water level in the manhole. It also monitors the continuous water flow rate. With the help of sensors temperature, humidity and gas leakage can be identified. The system also informs whether the manhole lid is open or closed by using the ultrasonic sensor.

When a particular sensor reaches the respective threshold level, then that respective value of the sensor will be sent to the microcontroller. Microcontroller updates the live values of all the sensors using IoT. If any problem arises in the manhole, sensor senses it and sends that information to the microcontroller. Furthermore, the microcontroller sends the signal and the exact location of the manhole through IoT to the managing station. Then, an automatic mail is sent by Raspberry Pi. This alerts the person-in-charge to take the required actions regarding the problem occurring inside the manhole.

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Fig 5a. Alerts displayed in the managing station



Fig 5b. Alerts sent through email

6. CONCLUSION

Sensor unit automatically senses and updates the live values of the physical parameters like temperature, humidity, water level and flow rate, blockages, and manhole cap is open or closed through IoT. This makes the system smart and automated. The deployment of Wireless Sensor Networks (WSN), helps in the implementation of the Smart cities in a developing countries. This WSN can also be useful in designing of environmental monitoring systems, which helps in monitoring of volcanic activities, flood detectors and other system. By a small modification in the implementation, this project can be used in agriculture fields or other environmental fields to monitor and control the systems.

In future, Smart cities infrastructure could be modified for intelligent communication and management of traffic signals, street lights, transit applications, active lanes, and so on. With the integration of smart devices in a city infrastructure can makes life in a city a lot easier. Also further by using PLC controller and SCADA systems, drainage water can be controlled, monitored and also this water can be used to irrigate plants, clean toilets, etc. This PLC and SCADA systems can be used as a treatment system for drainage water. Primarily, PLC controls the process of sewage treatment plant and SCADA is a remote terminal unit, which monitors and controls the entire area.



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NOVEL RECEIVER DIVERSITY COMBINING METHODS FOR SPECTRUM SENSING USING META-ANALYTIC APPROACH BASED ON P-VALUES

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Abstract

The need for efficient spectrum utilization with reduced error rates has brought a paradigm shift in wireless communication systems from a Single Input and Single Output (SISO) systems to Multiple Input Multiple Output (MIMO) systems. Conventional diversity combiners are used to boost the received Signal to Noise Ratio at the Cognitive Radio receiver. However, these methods require perfect estimation of the channel. This paper proposes a Meta-Analytic approach based on p-Values for combining the data received from a secondary user equipped with multiple antennas. The effect of the p-Value method as receiver diversity combiner is studied and is compared with the existing non-coherent combining schemes, which do not need channel state information. The weighted Z test and Fisher's method are used to combine the p-Values derived from the Anderson Darling (AD) and Jarque Bera (JB) test statistics. A ballpark figure of the merits of these diversity combining methods are provided in this study. Through extensive Monte Carlo simulations, it is shown that the weighted Z test using the Anderson Darling test statistic provides a probability of detection very close to the existing non-coherent diversity combiners. Hence, this novel statistical approach based on p-Values provides a promising solution to combine the test statistics from multiple receiver antennas.

Keywords: Diversity combiners, Goodness of fit tests, p-Value, Probability of detection, Spectrum sensing.

1.Introduction

Sensing the availability of the radio channel is one of the salient tasks in Cognitive Radio (CR). The sensing performance can be enhanced by either augmenting the Signal to Noise Ratio (SNR) measured at the cognitive radio device or increase the dimension of the received signal space. In a practical wireless environment, it is critical to increasing the received SNR, as the signal received at CR can be deeply faded and shadowed. The reliability of wireless communication system suffers when the signal received at the CR antenna is faded. To overcome this effect of small-scale fading in the detection of primary user activity, diversity techniques are employed to provide an improvement in the received SNR and hence, achieve a higher probability of detection [1, 2].

In the past decades, different kinds of diversity combiners have been exhaustively investigated in the literature. From the studies, the Maximal Ratio Combining (MRC), Equal Gain Combining (EGC), and Selection Combining (SC) are the most commonly used diversity combiners. These diversity combining techniques no doubt provide an improvement in the received SNR but they demand the learning of the Channel State Information (CSI). Hence, this increases the implementation complexity [3-5]. The MRC technique to maximize the output SNR is discussed in [5, 6] with the assumption that the exact channel information can be estimated at the receiver. But practically the perfect estimation of the channel cannot be achieved and hence, this estimation error decays the sensing accuracy.

To mitigate the impact of the channel estimation error on the detection performance several diversity combining techniques were proposed in the literature. The non-coherent combining schemes, which do not need the CSI are investigated in [7]. Under this category, the square law combiner (SLC) and square law selection (SLS) are studied, which produces the decision statistic using the outputs of the square-law devices available in each of the diversity branch. Akbari et al. [8] proposed the use of evolutionary algorithms on receiver diversity based on the Imperialistic Competitive Algorithm (ICA). It is shown that this combiner does not demand the CSI, and it provides superior performance compared to MRC.

In most of the studies, to test for the null hypothesis several independent tests are performed. In most instances, it is necessary to integrate these results from independent tests to decide on the presence of the null hypothesis. The results from such independent tests are combined using the meta-analytic approach. From the review of the existing literature, these approaches using p-Values have been widely used by evolutionary biologists to combine the results from different studies. The p-Value method is widely used as it provides the strength of evidence in disagreement with the null hypothesis. Studies in [9-13] have investigated on combining the p-Values from independent tests.

Hence, this paper adopts the above-discussed method and proposes the p-Value based approach to combine the data received from multiple branches of the CR receiver. The proposed statistical test is more robust as it is independent of the primary user signal. However, these tests require the noise distribution to be known a priori. The preliminary focus of this study is to analyse the effect of meta-analysis based approaches such as the p-Value method as receiver diversity combiner and compare it with the existing non-coherent combining schemes, which do not need CSI. Figure 1 gives the classification of the diversity combining algorithms. To overcome the effect of imperfect estimation of channel state information, the p-

Values approach based on statistical methods is the first of its kind for combining data from diversity branches. These methods depend only on the exact significance levels or p-Values and not on the form of the data. Hence, they are called non-parametric or omnibus tests.



Fig. 1. Classification of diversity combining techniques.

The challenges of reliable sensing at very low signal-to-noise ratio in a fading environment are addressed by employing multiple sensing antennas at a CR receiver. Hence, this study considers SIMO (Single Input, Multiple Output) models and it is often used to reduce the impact of ionospheric fading and interference in wireless communication. The channel is considered to be affected by Additive White Gaussian noise (AWGN). The primary signal is considered as a sinusoidal pilot tone. Two significant blind sensing schemes considered for calculating the test statistic are 1) Energy detection 2) Goodness of Fit test. The efficacies of these methods are evaluated using Monte Carlo simulations. The results show that the proposed combining method provides detection very close to the existing noncoherent diversity combiners.

This paper is organized as follows: Section 2 gives the overview of blind sensing schemes for primary user detection, Section 3 discusses the proposed method, Section 4 discusses the results and Section 5 concludes the paper.

2.System Model

Consider the scenario of Single Input Multiple Output (SIMO) system with one transmit antenna and multiple receiver antennas. Assume that each CR contains M antennas. The M diversity branches are assumed to be sufficiently far from each other. Hence, this paper takes full advantage of this assumption that the received signals are statistically independent with negligible correlation. Corresponding to the signal received in the *i*th antenna of the CR device the hypotheses H_0 and H_1 are defined as:

$$H_{0}: x_{i}[k] = v_{i}[k]$$

$$H_{1}: x_{i}[k] = h s[k] + v_{i}[k]$$
(1)

where *h* is the amplitude gain of the channel, *i* is the antenna index (*i*=1, 2,..*M*) at each CR, s[k] is the transmitted signal by PU and $v_i[k]$ is the AWGN noise component.

Two scenarios considered in the study are:

Case 1: The sample sizes received from each of the i^{th} antenna are same.

Case 2: The sample sizes received from each of the i^{th} antenna are different.

Two methods of detection of PU are detailed as follows:

2.1. Energy detection based sensing

Energy Detector (ED) is a blind sensing method with low computational and implementation complexities. Each individual branch at the receiver is provided with an energy detector to provide the instantaneous individual branch energy measurements. The energy of the received signal at the *i*th branch is Y_i and N the sample size. The decision static Y_i is compared against a fixed threshold λ .

$$Y_i = \sum_{k=1}^{N} [x_i[k]]^2$$
(2)

The simple hypothesis testing problem is formulated in Eq. (3). The probability of detection is investigated under the Neyman-Pearson (NP) criterion (using constant false alarm rate):

$$Y_i = \begin{cases} H_1 \\ \geq \\ H_0 \end{cases}$$
(3)

Non-coherent diversity combiners

The non-coherent combining schemes are more preferable to provide the diversity gain when the CSI is unavailable. One such method in this category is the square law techniques. The operation in Eq. (2) is executed using a square law device provided at each diversity branch of the CR receiver. The signal received from each *i*th antenna is combined to form a better estimate of the primary user signal than using single antenna using Square Law Selection (SLS) and Square Law Combining (SLC) [7].

• Square-law selection

The energy vectors from *M* diversity branches, Y_1, Y_2, \dots, Y_M are used in SLS. The branch with the highest energy is selected. The test statistic is given in Eq. (4):

$$Y_{sls} = max(Y_1, Y_2, \dots, Y_M) \tag{4}$$

• Square law combining

The energy vectors from *M* diversity branches, Y_1, Y_2, \dots, Y_M are gathered and combined in SLC to make a combined decision. The test statistic is given in Eq. (5):

$$Y_{slc} = \sum_{i=1}^{M} Y_i \tag{5}$$

2.2. Goodness of fit tests based sensing

The most well-known class of Gaussianity tests are used to determine whether a signal's samples are normally distributed or not. These tests check for the departures from the normal distribution. When the random variable X under consideration is normally distributed, the null hypothesis H_0 is declared [14]. The detection of the signal embedded in noise can be done by the Goodness of Fit Test (GoFT). It is a blind non-parametric hypothesis testing method, which decides on the null hypothesis if the received samples follow the noise Cumulative Distribution Function (CDF) denoted as F_0 .

Let x[k] denote the set of *N* discrete time vector observations k=1, 2,...N. The *i*th component of x[k] denoted as $x_i[k]$, i=1, 2,...M. The signal detection in noise is given as a simple hypothesis testing problem in [15-17] and is expressed as

Decide on H_0 : if $F_n(x) = F_0(x)$

Decide on H_i : if $F_n(x) \neq F_0(x)$

(6)

where $F_n(x)$ is the empirical CDF of the received sample.

In statistical hypothesis testing, there are two categories of errors namely 1) False positive or type *I* error that occurs when H_0 is rejected when it is really true. 2) False negative or type II error that occurs when H_0 is erroneously failed to be rejected when it is really false. The type *I* error rate is also called the significance level and is usually denoted as alpha (α) and the latter is denoted as beta (β).

In most of the studies [10-13], experimenters have used either a significance level of 0.05 or 0.01. Lower significance levels require stronger sample evidence to be able to reject the null hypothesis. The 0.01 level is more conservative than the 0.05 level. Hence, this study considers type 1 error in signal detection in noise with α =0.05 and the critical values are calculated using this assumption.

The goodness of fit tests can be broadly categorised into i) Empirical Distribution Function (EDF) Tests and ii) Tests based on descriptive measures. This paper features two important GoFTs one from each of the above-mentioned categories.

• Empirical Distribution Function (EDF) Tests

Anderson Darling Test

Anderson Darling (AD) test is the best distance test for small samples. To test the normality of a random sample x[k] the Anderson-Darling test statistic formulated in [18, 19] is given as:

$$A_n^2 = -N - \frac{\sum_{k=1}^{N} (2k-1)(\ln z_k - \ln z_{(N+1-k)})}{N}$$
(7)

with $y_k = (x_i - \breve{x})/S$,

$$\tilde{x} = \sum_{k=1}^{\infty} x_{k} / N$$
 and $S^{2} = \sum_{k=1}^{\infty} (x_{k} - \tilde{x})^{2} / (N - 1)$ (8)

According to D'Agostino and Stephens [20], when the mean and variance of the sample are unknown, the adjusted AD statistic is

$$A = A_n^2 \left(1 + \frac{0.75}{N} + \frac{2.25}{N^2}\right) \tag{9}$$

where $z_k = F_0(y_k)$ is the assumed distribution, N denotes the sample size, ln is the natural logarithm.

The spectrum sensing problem is expressed as:

$$H_0: \mathbf{A} \le \lambda_{cv} \tag{10}$$

 H_1 : A > λ_{cv}

where λ_{cv} is a critical value. If the computed value of *A* exceeds the critical value then H_0 is rejected. A table of thresholds for different values of P_f is given in [14].

Tests based on descriptive measures

Jarque and Bera test

The Jarque and Bera (JB) test is another goodness-of-fit test originally proposed by Bowman and Shenton [21] to check for normal distribution. It uses the skewness and kurtosis to determine whether the sample data is from a normal distribution. The data is declared to follow a normal distribution if the JB test statistic asymptotically has a chi-squared distribution with two degrees of freedom [22, 23].

The JB test statistic is the combination of the squares of normalized skewness and kurtosis and is given as follows:

$$J = \frac{N}{6} \left(\gamma_1^2 + \frac{(\gamma_2 - 3)^2}{4} \right) \tag{11}$$

where γ_1 is the skewness and γ_2 is the kurtosis and *N* is the number of samples. The spectrum sensing problem using JB test can be expressed as

$$H_0: J \le \lambda_{cv} \tag{12}$$

$$H_I: J > \lambda_{cv}$$

The critical values of the JB test for different sample sizes are given in [22]. The primary user signal is declared present if the Jarque Bera test statistic is greater than the critical value and is declared as noise otherwise.

3.Proposed Method

In data analysis, it is generally insufficient using only a single one-dimensional summary statistic. Hence, this paper proposes a meta-analysis approach based on p-Values to combine data from independent tests to perform the overall assessment. The block diagram of the proposed method is given in Fig. 2. The *M* independent samples $x_i[k] i=1, 2...M$ from *M* diversity branches of the CR receiver are tested for normality using AD test or JB test. The test statistic is used to determine the p-Value using the formula mentioned in Table 1 and the interpretation of the test results are given in Table 2. The new test statistic is obtained by combining the p-Values using the methods discussed in Section 3.2.



Fig. 2. Block diagram of the proposed method.

Table 1. p-Value formula for Anderson Darling test as given in [20].

| AD statistic | p-Value formula |
|---------------------------|--|
| <i>A</i> > 153.467 | p = 0 |
| $0.6 < A \le 153.467$ | $p = e^{(1.2937 - 5.709 * A + 0.0186A^2)}$ |
| $0.34 < A \le 0.60$ | $p = e^{(0.9177 - 4.279 * A - 1.38A^2)}$ |
| $0.20 < A \le 0.34$ | $p = 1 - e^{(-8.318 + 42.796 * A - 59.938A^2)}$ |
| $A \leq 0.20$ | $p = 1 - e^{(-13.436 + 101.14 * A - 223.73A^2)}$ |

Table 2. Decision table.

| Method | Condition | Decision |
|----------------|---------------------------------------|-----------------------|
| Classical test | If (test statistic > critical value) | H_0 is rejected |
| Classical test | If (test statistic < critical value) | Ho cannot be rejected |
| p-Value | $(p-Value < \alpha)$ | H_0 is rejected |
| p-Value | $(p-Value > \alpha)$ | Ho cannot be rejected |

3.1. Significance of p-Value

Fisher justified that the p-Value can be viewed as an index of the "strength of evidence" against H_0 , with small p indicating an unlikely hypothesis [24].

The steps involved in hypothesis testing using p-Values as specified in [24] are given as follows:

- Define the null and alternative hypotheses.
- Determine the test statistic from the sample data.
- Calculate the p-Value using the value of the test statistic obtained from step 2.
- Fix the significance level α =0.05 and interprets the results using Table 2.

Thus using the p-Value the compatibility of the data with the null hypothesis is measured but this value does not provide the probability on the correctness of the null hypothesis.

3.2. p-Value based diversity combiner

From the samples received from *M* diversity branches of the CR receiver, the test statistics $(A_1, A_2, ..., A_M)$ and its corresponding p-Values $(p_1, p_2, ..., p_M)$ are computed. This paper adopts the following statistical methods to integrate the p-Values from independent tests [9-13] to have an overall assessment on the detection of the primary user signal activity.

• Fisher's test

Fisher [25] proposed one popular method of combining the p-Values. Let p_1 , p_2 , ..., p_M be the significance probabilities of the test statistic A or J in the i^{th} sample received from each diversity branch of the CR receiver. The joint assessment of the normality is based on the M values of the statistic. The different significance probabilities obtained from M diversity branches are combined using Fisher's method as given in Eq. (12).

$$F_T = -2ln(\sum_{i=1}^M p_i) \tag{12}$$

• Z test

Stouffer et al. [26] proposed another approach called the *z* test to combine these p-Values. This method primarily converts to *z* values using the relation $z_i = F^{-1}$ (p_i), where F^{-1} is the inverse CDF of standard Gaussian distribution. The *Z* test statistic for CR receiver equipped with *M* antennas is formulated as

$$Z_T = \left(\sum_{i=1}^{M} \frac{z_i}{\sqrt{M}}\right) \tag{13}$$

• Weighted Z test

Mosteller and Bush [27] generalised the *Z*-test by giving weight *w* to each *Z*-Value. Under the null hypothesis, Z_w follows normal distribution described with parameters $\mu = 0$ and $\sigma^2 = \sum_{i=1}^{M} w_i^2$. The weights are usually taken as the sample sizes. The weighted *z*-test is defined as:

$$Z_{W} = \left(\frac{\sum_{i=1}^{M} w_{i} Z_{i}}{\sqrt{\sum_{i=1}^{M} w_{i}^{2}}} \right)$$
(14)

Algorithm 1. p-Value based diversity combining

1. Obtain *M* observation samples from each of the diversity branches of the CR node.

- 2. Let Z_{i} , (i = 1 ...M) be the observation vector. Sort the observations from each branch in ascending order.
- 3. Calculate the AD test or JB test statistic using Eqs. (7) (11)
- 4. Let A_i (i = 1...M) denote the test statistic obtained for M diversity branches.
- 5. Using the formula given in Table 1 calculate the p-Value $p_1, p_2, ..., p_M$
- 6. The p values are combined using Eqs. (12 to 14) to obtain the new decision statistic.
- 7. Reject null hypothesis if the new decision statistic is less than the predefined significance level.

4. Results and Discussion

4.1. Monte Carlo simulations

The performance analysis of spectrum sensing using receiver diversity in a CR environment are carried out using 1) Energy detection and 2) Goodness of Fit Test. The detection probability is used as a standard of measurement to determine the sensing accuracy. The following assumptions are made in the simulations.

- The system model has Single Input Multiple Output.
- The primary transmitter signal is a sinusoidal pilot signal of known frequency.
- Additive White Gaussian Noise with $\mu = 0$ and $\sigma^2 = 1$.
- The significance level (type *I* error) is set to $\alpha = 0.05$.
- The test statistic and hence, the p-Values are independent as they are calculated from samples received from different diversity branches, which have a negligible correlation.
- Sample sizes in the study:

Scenario 1: The sample size received from each of the i^{th} antenna is held constant, i.e., 100 samples.

Scenario 2: The sample size received from each of the i^{th} antenna is varied, the sample sizes are taken as 10, 50, 240 samples.

In Fig. 3 probability of detection vs. SNR using the square-law techniques for N = 100 samples, M = 3 and $P_f = 0.05$ under scenario 1 are studied. As evident from the Eqs. (4, 5), the SLC method of diversity combining outperforms SLS. This is supported by the simulation results presented in Fig. 3. The Fisher's method, Z test and the weighted Z test are investigated as diversity combiners in the context of spectrum sensing. The detection probability using the above-mentioned diversity combiners are studied using AD test and JB test in Figs. 4 and 5 respectively for sample lengths considered in scenarios 1 and 2. Detection probability is used as a metric to evaluate the performance of the earlier mentioned tests as diversity combiners.



Fig. 3. Probability of detection vs. SNR for sinusoidal pilot signal for N = 100 samples, M = 3 and $P_f = 0.05$ under scenario 1.

From Figs. 4 and 5, the following observations are made:

- It is observed that the AD test shows a higher probability of detection compared to the JB test.
- The weighted Z test performs better than the Z test and Fisher's test in both AD and JB test studies for case 2, i.e., when the numbers of individuals in a sample are different. It provides detection very close to the existing square law combiners.
- When the sample sizes are equal, the performance of the weighted *Z* test and *Z* test is identical.
- In the low SNR regimes, the weighted Z test works as a better diversity combiner compared to the other two methods as it provides a higher probability of detection.



Fig. 4. Probability of detection vs. SNR of the proposed method using AD test with sinusoidal pilot signal, M = 3 and $\alpha = 0.05$, $\mu = 0$.



Fig. 5. Probability of detection vs. SNR of the proposed method using JB test with sinusoidal pilot signal, M = 3 and $\alpha = 0.05$, $\mu = 0$.

Table 3 gives the tabulation of p-Values, Fisher's test, weighted Z test and Z test statistic for scenario 1 and scenario 2 for M=3. The p-Values from M diversity branches are combined using Eqs. (12-14) to obtain the F_T , Z_T and Z_W test statistic.

From Fig. 6 and the tabulation, the following can be inferred.

• As the number of samples used for hypothesis testing grows, it yields smaller p-Values hence, increases the probability of detection of the primary user.

As the mean of the random noise increases, the power of the combined test statistic also grows [13]. From the scatter plot in Fig. 7, it can be inferred that as the SNR increases there is a linear decrease in the p-Value, which helps in validating the decision of rejection of null hypothesis as the SNR increases (or decision on the presence of the PU signal).

| Study | Sample length | μ | Z-test | WZ-test | Fisher's test | p-Value from <i>M</i> diversity branches | | om <i>M</i> y es |
|------------|------------------|---|---------|---------|------------------|--|------------|------------------------|
| | | | | | | p 1 | p 2 | p 3 |
| Scenario 1 | 100 | 0 | -0.5915 | -0.5915 | -1.0255 | 0.96 | 0.44 | 0.26 |
| | 100 | 1 | 0.0106 | 0.0106 | -0.8040 | 0.59 | 0.54 | 0.35 |
| Scenario 2 | 100 | 0 | -0.5852 | 0.1667 | -0.9826 | 0.54 | 0.98 | 0.10 |
| | 100 | 1 | -0.0399 | 1.2971 | -0.9614 | 0.67 | 0.88 | 0.05 |

| Table 3. Comparison of the p-Value combining | |
|---|--|
| techniques for $M = 3$ receiver diversity for SNR of -20 dB | |



Fig. 6. Effect of number on samples on probability of detection for M = 3, using weighted Z-test.



Fig. 7. Scatter plot of SNR vs. p-Value for M = 3, $\alpha = 0.05$, N = 100 and sinusoidal pilot signal.

5. Conclusions

A novel meta-analytic approach to combine the data received from multiple diversity branches of the CR receiver is proposed. A ballpark figure of the merits of these diversity combining methods are provided in this study. Results show that AD test shows superior performance compared to JB test. The weighted Z test using the AD statistic is preferable compared to other methods as it shows superior detection compared to the Z test and Fisher's test even when the samples received from each antenna is varied. Also, the algorithm proposed improves the detection of the PU in low SNR regimes. Through extensive Monte Carlo simulations, it is shown that the Weighted Z test using the Anderson Darling test statistic provides primary user detection very close to the existing non-coherent diversity combiners. It is also observed that the probability of detection obtained with the proposed method is higher than the functional requirements of obtaining a detection probability of 0.9 as specified in the cognitive radio IEEE 802.22 Wireless Regional Area Network (WRAN) Standard [28]. Hence, this novel statistical approach based on p-Values provides a promising solution to combine the test statistics from

multiple receiver antennas. Furthermore, this study can be further extended to detection when the p-Values of individual diversity branches are correlated.

| 1 (omenciature) | S | | | |
|-----------------------|-----------------------------|--|--|--|
| A Ande | rson Darling test statistic | | | |
| h Amp | litude gain of the channel | | | |
| H_0 Null | hypothesis | | | |
| H_1 Alter | nate hypothesis | | | |
| <i>i</i> Anter | nna index | | | |
| J Jarqu | e Bera test statistic | | | |
| k Samp | ole index | | | |
| M Num | ber of antennas in each CR | | | |
| N Samp | ble size | | | |
| P_d Proba | ability of detection | | | |
| P_f Proba | ability of false alarm | | | |
| s[k] Trans | smitted signal | | | |
| v[k] Noise | e component | | | |
| x[k] Recei | ived signal | | | |
| Y Energ | gy measurement | | | |
| Greek Symbols | | | | |
| α Type | I error rate | | | |
| B Type | II error rate | | | |
| γ_1 Meas | ure of skewness | | | |
| y ₂ Meas | ure of kurtosis | | | |
| λ Fixed | l Threshold | | | |
| λ_{cv} Critic | cal Value | | | |
| μ Mean | 1 | | | |
| σ^2 Varia | nce | | | |
| Abbreviations | | | | |
| CSI Chan | nel State Information | | | |
| SIMO Singl | e Input Multiple Output | | | |
| SNR Signa | al to Noise Ratio | | | |

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Implementation of Automated Vehicle Identity Recognition System

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Abstract— In this paper we have proposed and designed an automated vehicle identify recognition system using image processing. The captured image of the vehicle number plate is processed and characters are recognized using Convolutional neural network (CNN) and authenticated by implementing it on Raspberry Pi.

Key words: Image processing, CNN, Raspberry Pi

I. INTRODUCTION

The increase growth in the number of automobile has facilitated human life but it has lead to various issues like traffic congestion, traffic problem etc. The rapid growth in the number of vehicles demands for the efficient automatic vehicle identification system. So automatic license plate detection and Recognition is necessary. Automatic vehicle identity recognition is surveillance method that uses Convolutional Neural Network. They can also used at CC TVs or ones specifically designed for the task. The basic process involves image capturing, detection of number plate, segmentation and recognition of characters. In the proposed system Convolutional Neural Network and Raspberry pi is used and we have used Open Computer Vision and Python for Programming which is better than MATLAB. OpenCV can be used for Real Time Applications.

II. METHODOLOGY

A proposed automated vehicle identity recognition system is as shown in the figure (1). The images of Indian vehicle number plate with different font size, styles and background are processed using image processing. The convolutional neural network used is wide to recognise the characters and numbers in the plate without errors.

The car license plate recognised using many other methods previously like MATLAB and DSP. Those methods had complexity in getting accurate result, time taken, efficient rate etc. To overcome such complexity other method is proposed using OpenCV. The language used here is Python. Raspberry Pi used here is mainly for recognizing the captured image, and it acts as real time displaying system.



Fig. 1: Proposed Automated Vehicle Identity Recognition System The hardware part consists of raspberry pi 3B, camera and LED. This is called as Raspberry pi camera module.

The recognition is done by raspberry pi from the image which camera captures in real time. This module is connected to a monitor, which is used for display. Raspberry pi is also connected to mouse and keyboard. Raspberry pi can also be connected to the PC monitor, laptop or TV monitor. In this case it is been connected to the PC monitor along with mouse and keyboard. Monitor is used to display the captured image and also the recognised character. Mouse and keyboard are the supporting features, which gives access to the monitor for controlling the raspberry pi recognition. After capturing the image the basic image processing steps are taken place. For each individual step the specific algorithm should be used based on the applications, because these algorithms can improve the recognition rate, efficiency rate and reduces the time taken.



Fig. 2: Flow Chart of Processing of Image

The general image processing steps are used for this process, here we used many algorithms for each step. Classification is done by CNN algorithm. For segmentation separate region is parted and segmented after that classification step is taken place. CNN classifier is used to recognise the characters present on the vehicle number plate. These algorithms called out in the package. Inpython, programming code is grouped as package.

A. Real Time Input:

Camera, which is connected to Raspberry pi capture the image of the car in front and to process vehicle number plate detection and recognition. We give an image of car as input that goes through the image pre-processing stages that improves the image quality leads to better result in later stages.

B. Pre-processing:

Pre-processing is an important step in any image analysis. The most motive of pre-processing is to reinforce the standard of the image which will be processed for recognition .Various processes that we tend to area unit progressing to apply area unit changing, RGB image to Gray scale, noise reduction and binarization of an image. In python many packages are available to perform pre-processing.

C. Segmentation:

Character segmentation is carried on the binary image of the extracted number plate. The algorithm used here is horizontal scanning that makes use of a scanning line that finds the conditions satisfying the beginning and end position of the character.

Features will be extracted from segmented number plate.

D. Classification:

To recognize the segmented characters efficiently, we used convolutional neural network training to train our system over a dataset downloaded. After the training, we used the same neural network model for recognizing the characters.

III. CONVOLUTIONAL NEURAL NETWORK

A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in a input image, provide significance to different perspectives/questions in the picture and have the capacity to separate one from the other. The prepreparing required in a CNN is much lower when contrasted with other order algorithms. While in crude techniques channels are hand-built, with enough preparing, CNN can gain proficiency with these qualities.

The architecture of a CNN is comparable to that of the availability example of Neurons in the Human Brain and was propelled by the association of the Visual Cortex. Singular neurons react to improvements just in a confined locale of the visual field known as the Receptive Field. An accumulation of such fields Overlap to cover the whole visual territory.

A. Layers of Convolutional layer Network

The fundamental layers present in a Convolution Neural Network are as recorded underneath. The CNN's layers each play out a predefined activity that prompts satisfying the general undertaking of the CNN. The CNNs are commonly utilized for classification and object recognition purposes and accordingly, the layers present in the system help in deciding the set features of the images gained.

The vital layers present are as per the following:

- 1) Convolutional layer
- 2) Relu layer
- 3) Cross channel Normalization layer
- 4) Pooling layer

- 5) Dropout layer
- 6) Fully Connected layer
- 7) Loss layer



Fig. 3: Convolutional Neural Network

IV. HARDWARE & SOFTWARE REQUIREMENTS

A. Hardware

Raspberry Pi 3model B is used for processing, which has 1GB RAM, 4USB ports, SD card is used for memory, 40 pins. It is more powerful and efficient processor when compared other models of Raspberry Pi. This also has inbuilt Wi-Fi and Bluetooth models. The recommended programming language for Raspberry Pi is python.



Fig. 4: Raspberry Pi 3 Model B

B. Software

- Keras is the open source library written in python for Neural Network and supports CNN.
- Tensorflow is the open source platforms used for building models in Machine Learning.
- OPenCV consist of library of programming functions for real time applications. It supports deep learning frame works like Tensorflow.
- Tkinter is the standard python interface for Graphical User Interface (GUI).

V. RESULTS

The performance of this proposed algorithm has been tested on several vehicle plates and provides very satisfactory results.

In our project we have classified the vehicles into two category, namely Registered vehicles for which Parking is allowed and Not Registered vehicles are allocated for visitors parking.



VI. CONCLUSION

The proposed work shows that free and open source technologies are matured enough for scientific computing domains. The system works satisfactorily for wide variations in illumination conditions and different types of number plates commonly found in India. When compared to simulation process it is for sure, a better alternative to the existing proprietary systems. Currently, we have proposed the algorithms for automated vehicle identity recognition system. We have implemented this system on Open CV library. The algorithms which is suitable for this application is been chosen and the process were performed and executed successfully.

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932

An Intelligent System To Detect Urban Flash Flood Using Wireless Sensors

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Abstract: Urban flash flood are the most interminable type of unforeseen event worldwide resulting from intense storms leading to large amount of rain within a concise period. These are notably pernicious because of the short timescales on which they occur, and because of the population size of cities. Since most flood casualties are caused by a lack of information on the impending flood ,sensing such catastrophes is critical to generate authentic and detailed warnings .To provide short term forecasts to address this issue we are deploying a wireless sensor detection system to accurately detect the water level and sense the intensity of rainfall to alert the counterminous areas. This is based on the combination of arduino uno with two RF modules along with sensors .Firstly we intend to have a threefold methodology to identify a potential benefits in measuring the water level. Secondly using GSM module notification is sent via SMS and also triggers the buzzer. There are many existing technologies for flash flood measurements, but they have many drawbacks and hence give unreliable results and are not real time based. In this system the delay of the warning is less and will be operating 24 hours so that it can detect flash flood adequately and is very economical

Keywords: Urban flash flood, Arduino Uno, sensors, **RF** module, GSM module, SMS, Wireless Sensor Network(WSN).

I.INTRODUCTION

A flash flood is nothing but a rapid flooding of geomorphic low-lying areas such as rivers, washes, basins and dry lakes. It is due to heavy rain along with a severe thunderstorm, tropical storm, hurricane or melt water from snow or ice flowing over ice sheets.

Flash floods is due to collapse of debris dam or natural ice or a man-made dam. Flash floods can be distinguished from regular by a timescale of which is less than six hours. The water that is provisionally available is frequently used by shrubbery with rapid germination and short growth cycles, and by particularly modified animal life.

Flash floods occurring quickly is due to various things, but it is due to enormously deep rainfall from thunderstorms. It is due to Dam or Levee Breaks and debris flow. Flash flooding may occur due to the various reasons like the location, intensity of the rainfall, distribution of the rainfall, topography, vegetation types, soil type and soil water control. So, as discussed many factors influences where the Flash floods may occur. Occasionally, rainfall over an urban area will cause flooding faster and more-severe.

In the urban areas the solid surfaces do not allow water to penetrate the ground, hence the water runs off to the lower region rapidly.Flash Flooding occurs so fast that people are jammed off-guard. Their circumstances may become hazardous if they come across high, vigorous water while traveling. If people are at their homes or businesses, the water may increase rapidly and shut in them, or cause harm to the assets without them having a possibility to guard the assets.

II.EXISTING SYSTEMS

In past decades various flood detection methods were introduced. Among them one of the system uses images. Images are here captured by satellite in different ways which detect the areas where flood has been occurred. These techniques are useful only in flood localization but they cannot foresee whether flood occurs or not in the next hours. A prototype intelligent system was developed for flood warning and alert in real time. It uses an ARM Microcontroller, Marvel 88F6281 and for Interface and Data Integration Unix FreeBSD was used. The data will be transmitted using radio communication technique to make proper decision. A flood warning system was introduced by E.Tate and K. Cauwenberghs where in cluster of servers collect the data and process data from the hydrological observation station in the real time.the available results can be then displayed on client computer by distant access.

The flood warning system used in the most developed country are costlier and it depends on the proficient hydrologists who supervise real-time data 24 hours a day and run complicated computational models at a centralized place. These kinds of possessions are excessive & unreasonable for poor counties as well as emergent country. Floods ends with the loss of abundant lives and leaves the flooded area with enormous demolition of assets every year, particularly the temper of flash flood in the deprived and emergent countries is most conspicuous, where people are the sufferer of the natural mercy.

III.SYSTEM MODEL

Intense rain dropping can be the main reason for flash flood that too in short span of time.

Flashflood occurs with very light warning or nil warning and can reach to the maximum in very short span of time before we take any action. As and when the intensity of the rain increases major portion of the rain water runoff and very light will be absorbed by the land. The extra overflow water can be very dangerous and can result into fast swelling rivers and streams. Low areas will also be pooled.

Streams that were just dried up or light wet few minutes before can be now a ranging torrent few in few minutes.

In addition, city sewer systems can quickly become overwhelmed and back up, resulting in street and overland flooding. It is the sum of these factors that creates a flash flood. So a system is necessary to spread the news quickly during the flood disaster to the general public.

Rapid application development(RAD) model is used in the proposed algorithm, which shortens the construction cycle to build the project.



Many advantages lies in this model. The development time can be the main advantage of the system which is very less. Next advantage can be increased reusability of the component and

Integration from very beginning solves a lot of integration issues.

The main disadvantage is this model is this requires an individual who is experienced and familiar with the system to be developed.

To identify the requirements of the system depends on the individual performance and the strong team. This model can be built using system that is modular.

This needs highly expert designers. This requires high enslavement on modeling skills.

The team may be tempted to rush the product, skipping important forecast and design consideration.

IV.SYSTEM PROPOSED

In our system , audunio uno microcontroller is used. The controlled at the transmitter is interfaced with the sensor used. Sensor used in our system are water level sensor, raindrop sensor ,temperature and humidity sensor.

The raindrop sensor used determines the intensity of the rainfall.

The temperature sensor and humidity sensor at the transmitter is used to foretell the persistency of rainfall causing flood.

The high risk of flood can be identified using the water level sensors that is placed at a position called bottom line, when it touches the bottom line indicates moderate risk of flood and the higher level indicates high risk of flood.

The levels of risk can be indicated by using LED / Alarm system that is placed one at the transmitter and another at the receiver. Once the sensors are actuated it sends the signal to the micro-controller.

The signal is processed at the transmitter and sent to the receiver using RF module attached to the receiver.

The GSM module is attached to the microcontroller at the receiver side to sense alert messages to the number stored in the database system. As the water level increases this process is repeated.



Fi

g 1 : Wireless communication between Transmitter and

Receiver

V.CONCLUSION

The system will find out the present water level by using wireless sensor network, which will also provide warning of SMS using GSM modem. SMS is very much supportive cautious information exchange tool that can give out the information to floods sufferer in a particular region. This system is able to notice a level of water and fling that data to the main flood control centre close or too far away from the sensor that senses the level of water. The need of radio communication module in this project is used as the medium to transmit the information from transmitter module to the receiver module.

Flood is alarmed with the valuable lives and wealth of a country that is why it is required to take crucial actions to avoid and contract with the after consequence .The Flood Observatory System is designed to be an intelligent system which is capable of sending real time water level information from a remote location to a monitoring station which could be at a distance away, regardless of time. The self monitoring in the Flood Observatory System ensures that the system performs efficiently and reliably for the monitoring station. The flood monitoring and detection system monitors and know the development of floods and then send flood notification SMS to the residents of such zones for necessary action. The main purpose of this project is to send alert to riverside people so they can safely move from flood area it gives advanced alert through SMS. We design a system with low-cost, small-sized, easily configurable and extensible WSN systems to monitor, detect, and track various environmental phenomena and events.

This technology could be further customized or enhanced as per the individual necessitate and interests. We have discussed some basic thoughts of this technology and depending on ground-breaking applications, user can upgrade as per prerequisite.

System can be upgraded to increase the distance between transmitter and receiver by using different frequencies of RF Module for which special permission is required. A Bluetooth module can also be interfaced to get updates about various parameters involved for flood detection in the smart phone. The features/hardware can be added/modified to suit any application. This project is subjected to future work.

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SMART AND SECURE HOME USING FACIAL RECOGNITION SYSTEM

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Abstract--The two important facets of human being is security and surveillance. The most significant feature of any home security system is to be able to detect who is entering or leaving the house. This paper presents a new technique which can prevent theft in highly secure home environment with reduced power consumption and more reliable standalone security device for both security and intruder detection through "face recognition door lock security system". This system is acheived by using Raspberry pi circuit.Each time an individual walks in front of the door, the system

I. INTRODUCTION

recognizes the face and if the face is recorded then the

door is unlocked. Otherwise the door does not unlock.

 $\mathbf{B}_{\text{iometrics}}$ is the technical term for body measurements and calculations. It refers to metrics related to human characteristics. Biometrics authentication is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance if they are the person they claim to be. Biometrics verification can be achieved through the property that human trait linked to a person is like a unique data stream. Some solutions are already available in the market such as: passwords or pins have been in use for security. These solutions still have many disadvantages as they fail to provide complete protection leading to theft till date. Instead, facial recognition can be used as they are one's biometric trait. These are distinctive and cannot be altered or stolen easily. The level of security is thereby increased.

Our project is mainly focused on facial recognition aspect.

Face is most commonly used biometric to recognize people. Over the decade facial recognition has

received extensive attention from researchers and developers due to human activities present in various applications such as security like airport, criminal detection, face tracking and forensics. In comparison to all the other biometrics that are present like palm print, iris or fingerprint, face recognition is comparatively non-intrusive in nature.

The intended project involves two step process; Face detection and Face recognition. The former Face detection involves identification of the face whereas the latter face recognition involves capturing a face and comparing it with the database.

II. SYSTEM DESCRIPTION

The proposed system uses Haar feature-based cascade classifiers for real time face recognition.

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

Here we have used it for face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it.



Fig 1. Haar cascade feature extraction

We select the features with minimum error rate, which means they are the features that best classifies the face and non-face images.

III. SYSTEM IMPLEMENTATION



Fig 2. Block Diagram

The following procedure gives the description of the applications used for data gathering, face detection, training and face recognition. We coded our project in Python using OpenCV platform. First stage was setting up the Raspberry pi 3 model b+ by installing raspbian operating system on to the micro-SD card and installing Win32 Disk Imager on the machine. There are three ports for the Raspberry Pi 3 Model B+ a micro USB port, HDMI port, stereo output and composite video ports, which gives even more audio visual options. After plugging in all the cables and plugging in the power link last. The system boots up like so.

The next stage is to install OpenCV. This process can be quite time consuming since many dependencies and prerequisites have to be installed. First thing is to expand the filesystem to include all available space on the micro-SD card and reboot the system to conceive the result. Then update and upgrade any existing packages. We installed some developer

tools, including CMake, which helped us configure the OpenCV build process. The OpenCV library comes with a sub-module named highgui which is used to display images on to our screen and build basic GUIs. Many operations inside of OpenCV can be reformed further by installing a few extra dependencies. After installation of complete dependencies we downloaded the OpenCV source code. Before we can begin compiling OpenCV on our Raspberry Pi 3, we need to install, a Python package manager. After this we created the Python virtual environment that we'll use for computer vision development. A virtual environment is a tool used to keep the dependencies required by various projects in isolated environments. Next and last python dependency to install is called Numpy, a Python package used for numerical processing. Finally, we compile and install OpenCV.

We used Raspberry pi camera for face detection. To interface the pi camera with raspberry pi board we connected the camera strip between the TRRS/AV socket and the HDMI connector. By powering up the system the camera module is enabled. Putting in a few commands we were able to snap a picture with the raspberry Pi. Next stage is the face detection. For the face detection system we used Haar-cascades Classifier. Despite the fact that training is required for creating new Haar-cascades, OpenCV has a powerful set of Haar-cascades that we used for this project. Using face-cascades alone led to random objects being identified and thus eye, nose and mouth cascades were incorporated to obtain stable face detection. Haar Cascade is the most common way to detect a face or any object. Using a few lines of code we were able to detect a face, using Python and OpenCV.

Next we had to gather face data (images) of the people to be identified. Executing the Python script and by capturing a few Ids. We gathered all the data required for training. To incorporate a new user or to change the photos for one that already exists we have to run the script each time.

Lastly we take all the user data from the dataset and run the script to train the OpenCV recognizer. This is completed directly by a specific OpenCV function. Now the system is ready to recognise some faces.

The Pi camera captures a face using the recognizer and if this individual had their face captured and trained before then the recognizer will make a prognosis returning its id and an index, this shows how confident the recognizer is with this match.

A servo motor is a type of DC motor that, upon receiving a signal of a certain frequency, can rotate itself to any angle from 0-180 degrees. Its 90 degree position is generally referred to as neutral position, because it can rotate equally in either direction from that point. We interfaced servo motor to the raspberry pi and generated a code suitable for the motor to acts as a door. Therefore when any individual attempts to open the door, the security system detects if the individual is a intruder or not and hence unlocks the door if the face is recognized.



Fig 3. Flow chart

IV. RESULT

This project is built using a Raspberry pi 3 model b+ with OpenCV Library and coded in Python language. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. After gathering 30 images for capturing the image in the dataset and training the program for the system to store the images. The result obtained are as follows :





Since we captured and trained our faces, the system compared the real time images to the images stored in the dataset. Whenever it detected the authorized person it sent electric pulses to the servo motor making it rotate at a angle of 90 degrees and acting as a door it unlocked.

We also tried it with an intruder whose face was not stored. It showed the following result :



The system detected the unauthorized person as unknown and hence the servo motor did not rotate.

V. CONCLUSION

This project proposed an system for door access control through facial recognition has been presented. The system is achieved and verified by using the enrolled facial images in the database. There are several methods that can be used to achieve this purpose. Some of them include using PCA or eigenfaces. Although there are various other techniques that are present to implement, this mechanism provides a better performance. The Haar Cascade methodology is one among them as it provides an accurate performance.

In this proposed system the user details are fed into the database though face detection, face training and face recognition.Whenever a person was detected by the camera it was compared with the database. If the person is detected the door is unlocked if not, the door remains idle. The result of this project is to provide a higher level of security which was realized with the help of OpenCV platform and Raspberry pi.

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Effect of annealing on the properties of Cu₂SnS₃ thin films using spin coating

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Effect of Annealing on the Properties of Cu₂SnS₃ Thin Films using Spin Coating

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Abstract. Copper Tin Sulphide is a leading prospect in thin film hetero-junction solar cells owing to its germane electrical and optical properties. It is a ternary direct band gap p-type amalgam with substantial potential significance in thin film solar cells. Its components are innocuous, copious in earth crust and inexpensive. This treatise seeks to delineate the deposition of CTS thin films on soda-lime glass substrate by a jejune sol-gel spin coating technique at distinct temperatures. The upshot of annealing temperatures on the development and properties of the films are examined by exploring their optical, structural, morphological properties using apposite characterization methods. XRD analysis avers genesis of cubic structure of CTS. SEM investigation reported adequate facet for solar cells. The optical quantifications reveals that the gap between the energy bands of the films decline from 1.61eV to 1.45eV after annealing. Suchlike energy gap magnitudes are optimal for semiconducting materials as an imbiber layer of thin film solar cells.

INTRODUCTION

Currently over 90% of the solar market is silicon based. The commercial photovoltaic devices are based on usual thin film solar cell constituents such as CIGS (Copper Indium Gallium Selenide), CdS (Cadmium Sulphide), CdTe (Cadmium telluride) and GaAs (Gallium Arsenide). These materials have high conversion efficiency of approximately 20 % [1]. The pricey and paucity of In, Te and Ga, also the noxiousness of Cd and its environment influence restricts the large-scale fabrication [2]. Copper Zinc Tin Sulphide is an emanating absorber material that supplant prevailing CIGS and CdTe absorbers [3, 4]. However, it has unstoppable growth context engendering to the creation of secondary and triad stages alongside the preferred one. To overcome the above drawback, we have to consider the triad material with the corresponding structure and material properties of CZTS. CTS is one such candidate. CTS components are harmless, abundant in essence and hence it can be used for cost effective solar cell applications. It has energy gap between 0.82 to 1.7eV and absorption coefficient of about 10⁴ cm⁻¹ [2].

Copper Tin Sulphide thin films were prepared employing different procedures: spray pyrolysis [3], sputtering [5], co-evaporation [6], chemical bath deposition [7] etc. Nevertheless, most of the techniques demands sulfurization [1]. In this present work, we use sol-gel spin coating technique [2] for the deposition of CTS without any additional sulfurization. This approach is competent as it is flexible, flair cost-effective practice, which can be utilized to synthesize Copper Tin Sulphide thin films. In this exploration, Copper Tin Sulphide thin films were accumulated on soda-lime glass at disparate substrate temperatures. The optical, structural and morphological properties of the spin coated Copper Tin Sulphide thin films are appraised and described. The epithet methods include X-ray diffraction: utilized for phase identification, scanning electron microscopy (SEM): used to scrutinize the surface morphology of the film, energy dispersive x-ray analysis (EDAX) or energy dispersive spectroscopy (EDS): employed for inspecting the film elemental constitution and ultraviolet-visible spectroscopy: exerted for the quantitative determination of different analytes.

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EXPERIMENTAL DETAILS

Spin coating technique was used to deposit Copper Tin Sulphide thin films over substrates made up of glass. The substrates were cleansed successively using ultrasonic bath of deionized water and acetone, and deionized water again for 20 minutes followed by drying them using dryer. Further, 2M of Copper(\Box II) Chloride CuCl₂.H₂O; 1.3M Tin(II) Chloride Dehydrate SnCl₂.2H₂O; and 8M Thiourea H₂NCSNH₂ were added in the solvent mixture consisting deionized water/ethanol (v/v 30:70) to prepare precursor solution. A yellow color solution was obtained after stirring the solvent mixture at 65°C for about an hour. Subsequently, spin coater was used to deposit the resultant solution over the glass substrate at 2500 rpm for a minute succeeded by drying the substrate at 100°C for 15 minutes. This step was iterated thrice to attain a desirable thickness. Subsequently, tubular furnace was used to anneal the films at 350°C and 400°C in inert Argon atmosphere for about an hour. Further SEM (Scanning Electron Microscopy), Energy Dispersive X-Ray Analysis (EDAX) and X-ray Diffraction (XRD) were used to characterize the samples.

The morphological, optical and structural properties of the thin films are analyzed by carrying out respective characterization. PANalytical X'Pert3 Powder X-ray diffractometer is utilized to examine the structural characteristics. The morphology of the film surface along with uniformity, were studied employing scanning electron microscopy (SEM) (VEGA3 TESCAN). EDAX was carried out to obtain the composition of elements in the film. Optical Properties of CTS thin films was studied using SPECORD 5600 UV-VIS.

RESULTS AND DISCUSSION

Structural Characterization

Figure 1 exhibits the X-Ray Diffraction (XRD) patterns of as-deposited plus annealed CTS thin films. From the figure, it is evident that these patterns bear more diffraction crests, which denotes films are polycrystalline in essence. In this case, we can only observe peaks characteristic of cubic phase of CTS. The crucial XRD vertices are found at $2\theta = 28.19^{\circ}$, 43.80° , 46.94° , 50.01° , 55.64° , 72.46° . Figure 1 indicates that the films display extremity peak at $2\theta = 28.19^{\circ}$, demonstrating favored increase in the (111) plane. Additional crests are also available with nether intensity. As deposited thin film contains secondary stages of Sn_xS_y and Cu_xS . In Figure 1(a), crests due to Sn_2S_3 , SnS_2 , CuS, Cu_3SnS_4 , stages seemed at various diffraction angles. Similar XRD patterns were observed in [8, 9, 10]. Annealing the samples shrinks width and ameliorated the potency of the peaks. As the annealing temperatures were increased, the impurities present were diminished. This reveals that the annealing of films has upgraded its crystallic properties. Table.3 provides the d-spacing values observed in the samples, which are in sound accordance with the values of the cubic stage of CTS (JCPDS 89-2877). Cubic crystal structures' lattice parameters were computed by employing the equation [2, 11]:

$$d_{hkl} = \frac{1}{\sqrt{\frac{h^2 + k^2 + l^2}{a^2}}}$$

Where (hkl) are Miller indices and d is the distance (interplanar). The lattice parameters values are a = b = c = 5.43 Å. The d_{hkl} is the interplanar space, calculated by Bragg's Law [2, 12]:

$$d_{hkl} = \frac{n\lambda}{2sin\theta}$$

Where *n* is any positive integer, $\lambda = 1.541$ Å is the radiation wavelength and θ is Bragg's angle of the (hkl) planes related to the structure.

It was observed that the JCPDS 89-2877 were in close compliance with the assessed lattice parameters. The tantamount values of a, b, c reveals that the stage is cubic.

The grain size D was computed using Scherer's formula [2, 13]:

$$D = \frac{0.9\lambda}{\beta cos\theta}$$

Where β is the FWHM of the (111) peak and λ is the X-ray wavelength and θ corresponds to Bragg diffraction angle. For the thin films annealed at 350°C and 400°C, the crystallite sizes are evaluated as 1.18 Å and 1.09Å respectively.

Moreover, the lattice strain effect can be determined by exerting the below equation (William-Hall method) [2-14]:

$$\varepsilon = \frac{\beta}{4tan\theta}$$

Using the William and Smallman formula, the dislocation density Ψ was computed [2, 15]:

$$\Psi = \frac{1}{D}$$

It is limpid from Table.1 that as the annealing temperature raises, the crystallic size of the films augments while the strain, dislocation density and number of crystallites dwindles.



FIGURE 1. XRD specimen of CTS thin films for: (a) as-deposited, (b) 350°C, (c) 400°C annealed samples.

TABLE1 synopsis of computations from Debye Scherer formula and conclusions of Williamsone Hall investigation of lattice shear.

| Samples | FWHM(°) | D(Å) | $\Psi(nm^{-2})$ | ε(10 ⁻³) |
|---------|---------|------|-----------------|----------------------|
| 350°C | 1.2156 | 1.18 | 71.8 | 0.00121 |
| 400°C | 1.3015 | 1.09 | 84.2 | 0.0013 |

| TABLE 2. Annealed thin films | ' Elemental | Constitution | ratios f | rom | EDA | Х |
|-------------------------------------|-------------|--------------|----------|-----|-----|---|
|-------------------------------------|-------------|--------------|----------|-----|-----|---|

| TABLE 2. Annealed thin thins Elemental Constitution failes from EDAA | | | | | | | | |
|--|-------------------|-------|-------|-------|--------------|--|--|--|
| Temperatures(°C) | Atomic Percentage | | | | Atomic Ratio | | | |
| | Cu | Sn | S | Cu/Sn | S/(Sn+Cu) | | | |
| 350 | 22.45 | 27.08 | 50.47 | 0.83 | 1.02 | | | |
| 400 | 21.02 | 27.90 | 52.65 | 0.75 | 1.08 | | | |

| 2θ(°) | hkl | d-spacing (Å) | | | Compounds |
|-------|-----|---------------|--------|-----------|----------------------------------|
| | | Pragmatic | values | JCPDS Ref | |
| | | 350°C | 400°C | | |
| 28.19 | 111 | 3.1639 | 3.1624 | 3.1350 | Cu_2SnS_3 |
| 43.80 | 220 | 2.0640 | 2.0475 | 1.9198 | Cu_2SnS_3 |
| 55.64 | 311 | 1.666 | 1.6403 | 1.6372 | Cu ₂ SnS ₃ |

 Table.3 Juxtaposition of the JCPDS References and d-spacing values observed

Morphological Characterization

The Copper Tin Sulphide thin films were annealed at temperatures 350°C and 400°C in an argon atmosphere are morphologically analyzed using the SEM (Scanning Electron Microscope) micrographs. Figure 2.(b) reveals that, films annealed at 350°C is homogenous in large scale with no distortions or cracks. The micrograph results are in different morphological structures of the thin films such as quasi-equilateral hexagonal/ hexagonal shaped, flowery morphology and rock-akin shape. The elemental decomposition/elemental constitution of the as-deposited and annealed films was analyzed using the element dispersive spectroscopy (EDAX). Gravimetric analysis for Cu, Sn and S was carried out (Table2). The S/(Sn+Cu) atomic ratio is proximate to stoichiometry of Cu₂SnS₃. Since EDS spots microcrystalline stages, it defines the fact that it has phases that are not yet crystallized which gives weak Cu/Sn ratio. The 400°C annealed samples shows advancement in the particle size (Figure 2.(c)), also there is a genesis of development of crystalloid structures. Indeed EDS discovers well-neigh all the stages where as XRD reveals solely the crystalline stages.



Figure 2. SEM micrographs of Cu₂SnS3 imbibers: (a) as-deposited, (b) annealed at 350°C, (c) annealed at 400°C

Optical Characterization

From the results of XRD and SEM it is found that the films exhibit cubic CTS as dominant phase with (111) as the favored direction. The crystallinity of the films is improved after annealing the samples at 350°C and 400°C. From the graph of $(\alpha hv)^2$ versus photon energy (hv), the energy band gap (E_g) was estimated. For a direct energy band gap semiconducting material, this graph need to be linear close to the absorption edge, which is in our case (Figure 3). In order to calculate the energy gap, the linear zone of the obtained plot is extrapolated to hv=0. Using the plot it is found that the energy gap at 350°C is 1.52eV and that at 400°C is 1.45eV. The procured outcome are in good accordance with the standard report.

The nature of the optical transition can be estimated by using the formula [16, 17]:

$$hv = A(hv - E_g)^n$$

Where 'n' can take values 3/2, 1/2, 3 or 2 relying on whether the transition is direct-forbidden, direct-allowed, indirect-forbidden or indirect-allowed respectively and 'A' is a perpetual.



Figure 3. Plot of the photon energies and the square of the product of absorption coefficients of the thin films for (a) as deposited, (b) annealed at 350°C, (c) annealed at 400°C.

CONCLUSION

Thin films were obtained by depositing Copper Tin Sulphide on soda-lime glass substrate. The facile spin coating method without sulfurization was employed to synthesize thin films. Samples were later annealed in argon atmosphere at 350° C and 400° C for 1 hour and further investigation of optical, morphological and structural characteristics of CTS thin films were done. The XRD upshots show that, annealing the samples improved the result. In addition, XRD analysis reveals that the samples have CTS in cubic structure with (111) favored alignment. It is evident from the above analysis that the films annealed at 400° C are suitable as absorber materials for solar cell application. Furthermore, SEM and EDAX analysis were performed to ensure the uniformity of the sample surface and to provide elemental identification and quantitative compositional information.

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Colour Sensor Based Object Sorting

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Abstract: Automation or automatic control, is the use of various control_systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, etc. The paper presents sorting of object using microcontroller based on color.

Keyword: — Automation, sorting, colour sensors, microcontrollers.

I. INTRODUCTION

Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination. The benefits of automation include labor savings, savings in electricity_costs, savings in material costs, and improvements to quality, accuracy and precision.

In the existing system the objects are sorted manually mostly by human beings. This creates a tendency for human errors to come into account and thus result in the work going wrong. If objects or parts in industries are not sorted correctly then there is a high chance of huge chaos and the final product being defective.

II. REVIEW OF LITERATURE

In many packaging industries, color object counting and sorting is the major task that needs to be done. Traditionally, the object sorting process was done by the manually. However, this method has some disadvantages such as increase in the cost of the product, slow, and inaccuracy due to the human mistake. Existing sorting methods are used to set of inductive, capacitive and optical sensors do differentiate color.

Nowadays, the competition is so intense that the efficiency of the product is regarded as the key to success. The efficiency of the product includes the speed of the production, lowering material and labour cost, improving quality and decreasing the rejection. Taking all the things under consideration this project is developed which is very useful for industries. The aim of this project is to obtain fully automatic material handling system. This is done with the help of microcontroller unit. This unit synchronizes the movement of the robotic arm to pick the moving objects on the conveyor belt. It sorts the coloured.



III. PROPOSED SYSTEM

An automatic sorting machine has main task of sorting components according to the sizes. This also consist of conveyor belt, which reduces the efforts of material handling. Also both processes take place simultaneously viz material handling and inspection [2]. The following figure shows the block diagram of the proposed system.



Fig1: Block diagram for object sorting

When a supply of 3.4V is given to the DC motor (12V, 3.5rpm) it starts to rotate. It will control the movement of the conveyor belt on which the product is placed. If there is an object the sensor produces an output frequency which is Proportional to the color of the object and the selected photo diode configuration in such a way that it provides maximum frequency for the respective color to the respective photo diode. Hence sensor gives maximum frequency for red colored object when red filter is selected, and in the same way other colored object are also sensed by corresponding filters.

When the light falls on the product it is reflected back to the color sensor. As mentioned before, color sensor TCS2300 has 4 colour filters for green, red, blue and black (no color), which is opted by its select pins. Filters are selected by the program saved in the microcontroller. Frequency output from color sensor depends on the color of the object as well as the select pin configuration input from



microcontroller. Select pin can select one of the four photo diode filters which can give output according to the color of the object.

If there is an object the sensor produces an output frequency which is Proportional to the color of the object and the selected photo diode configuration in such a way that it provides maximum frequency for the respective color to the respective photo diode. Hence sensor gives maximum frequency for red colored object when red filter is selected, and in the same way other colored object are also sensed by corresponding filters. Frequency received during each filter selection is counted and saved to separate registers and these values are examined for taking the greater one, in order to identify the color of the object.

The second and third DC motors are used to control the gateway of the particular color object. If placed object is red, the color sensor sense the color of the object and it sends the signal to the microcontroller and display the name RED ITEM with the help of the LCD Display. In our project, red object go straight ,blue drop the left and green object drop the right side with the help of the gateways. The products will finally fall to the corresponding sections in the container.

Then the IR sensor sense how many objects moved on the conveyer belt and it sends the signal to the microcontroller. At the last displays the total number of object moved on the conveyer belt with the help of the LCD display unit. Once the power up dc motor starts, moving the conveyer belt so that the objects on the conveyer belts also starts moving. Color sensor starts sensing the objects which are moving on conveyer belt. Then the sensed signal sends to the display unit via Arduino for displaying the color of the object.



Fig 2: Conveyer belt

In this project microcontroller Arduino UN0 is used for motion control and object detection. The microcontroller works on the set of instructions that are preprogrammed and stored in the memory. It then takes the instructions from its program and one by one.



IV. RESULT & DISCUSION

The paper presents design, development of the sorting object. Using microcontroller Arduino UN0 the objects are sorted as per the color. The color detection is identified by the color sensor. The sensed signal is sent to a microcontroller unit and sent to 16x2 LCD display for displaying the color of the sensed object. Here IR sensor is used for counting the number of objects which are moved on the conveyor belt that count value is also displayed on the LCD.

In this, objects of 3 colors red, blue and green are chosen for demonstration purpose. The system output is displayed on the LCD display i.e name of the project - automatic color sorting, color of the object-red or blue or green and final count of the objects – item number which are sorted.



Fig3: LCD Display

Above figure shows final result displayed on the LCD display of count value of the objects which are passed on the conveyor belt.

V. CONCLUSION

It is very useful in wide varieties of industries along with the help of color sensor and conveyor belt, especially in the packaging section. Automatic sorting machine enhances efficiency, practicality, and safety of operators. It ensures remarkable processing capacity as well as peerless performance including color detection. Of course we need to add high speed DC motors and sensors

object sorting system using embedded system are an embedded system approach for object color detection and object sorting can be successfully implemented. Due to use of embedded system for color determination, manual efforts are reduced which produces result in improving accuracy as well as saves money and time.



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Design and Development of Real Time Vehicular Crash Detection System

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Abstract—Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. Main causes for these road accidents are: lack of training institutes, unskilled drivers, poor road conditions, use of cell phone while driving, over loading and poor governmental plans in this regard. This paper presents solution for accident detection for human life safety. It presents about intelligent detection of an accident at any place and reports about the accidents on predefined numbers. The microcontroller continuously records all the parameters of automobile. When a vehicle meets with an accident, immediately vibration sensor will detect the signal and then microcontroller sends the alert message through the GSM modem.

Index Terms- Crash detection, ADXL335, GPS, GSM, Microcontroller.

I. INTRODUCTION

India has the highest motorization growth rates in the world accompanied by poor infrastructure and congested transport network. This led to an increase in the number of road accidents. The "Globe Status Report on Road Safety" listed by the World Health Organization (WHO) identified the major causes of traffic collisions as driving over the speed limit, driving under the influence, and not using helmets and seat belts. Failure to maintain lane or yield to oncoming traffic when turning are major causes of accidents on four lane, non-access controlled National Highways.

Road accidents are the outcomes of the interplay of various factors such as length of road network, vehicle population, human population and adherence/enforcement of road safety regulations etc. Road accident causes fatalities, injuries, disabilities and hospitalization with severe socio-economic costs across the country. Consequently, road safety has become an issue of concern both at national and international level. The United Nations has rightly proclaimed 2011-20 as the Decade of Action on Road Safety. India is also signatory to Brasilia Declaration and is committed to reduce the number of road accidents and fatalities by 50 per cent by 2020.

According to the Statistics report submitted by Ministry of Road Transport and Highways, total number of road accidents increased by 2.5 per cent from 489,400 in 2014 to 5.01,423 in 2015. The total number of persons killed increased by 4.6 per cent from 139,671 in 2014 to 146,133 in 2015. Road accident injuries have also increased by 1.4 percent from 493,474 in 2014 to 500,279 in 2015. Accident severity (number of

Grenze ID: 01.GIJET.4.3.2 © *Grenze Scientific Society, 2018* persons killed per 100 accidents) has gone up from 28.5 in 2014 to 29.1 in 2015. The analysis of road accident data 2015 reveals that about 1374 accidents and 400 deaths take place every day on Indian roads. It further reveals that 57 accidents take place and 17 lives are lost every hour on an average in road accidents in our country.

Another study conducted by the Bangalore Traffic Police in 2017 (September), show the number of road accidents in Bangalore alone is 3818 out of which 469 were fatal leading to 499 deaths. Vehicle accidents are something which do not knock on your door before taking place. These clearly bring to light the gravity of the situation and the enormous responsibility of vehicle drivers towards causing road accidents. These deaths could have avoided if the victims were treated as soon as possible.

The three major causes for road accidents are – Negligence, Overtaking, and use of alcohols while driving. Defensive drivers neither drink nor take drugs and drive. They understand that alcohol and drugs impair your ability to determine distances, reaction time, judgement and vision. However, modern – day cars have implemented few technologies to prevent accidents.

Different governmental and non-governmental organizations all around the world carry out workshops and other training programs to make people aware of careless driving. But still, this whole process has not been very successful till date. Some threatening statistics of road accidents that took place in India inform us that the emergency services are not being provided at proper time. The statistics included that the road accidents in one of the years, caused death of more than 130,000 and it indicates that it might jump to 150,000 by 2015. Although India has just 1 % of the world's vehicles, but accounts are 10% of world's total accidents. Mortality rate per 10,000 vehicles is 14 (less than two for developed countries). According to the study conducted by the Bangalore Traffic Police in 2017 (September) shown in figure 4, the number of road accidents in Bangalore alone is 3818 out of which 469 were fatal leading to 499 deaths. Having known about such threatening statistics, we aimed at implementing a system which could give immediate information to a rescue team about the accident occurrence, by which the rescue team can arrange for immediate safety measures. This helps the humanity by a great deal as human life is very crucial.

II. RELATED WORK

Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disasters. In previous works, when an accident occurs, the alert message has been sent automatically to the rescue team and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module [1]. This application has provided an optimum solution to poor emergency facilities provided to the road accidents in the most realistic way.

The prototype model of automatic vehicle accident detection and messaging using GSM and GPS modem has to be made in the following steps:

The layout of the whole set up has to be drawn in form of a block diagram.

The accelerometer sensor will first sense the occurrence of an accident and give its output to the microcontroller.

The latitudes and longitude position of the accident place is to be sent as message through the GSM.

The phone number will be pre-saved in the EEPROM.

Whenever an accident has occurred the position is detected and a message is to be sent to the nearest ambulance and the pre-saved number.

Hoang Dat Pham presented the development of the vehicle tracking system's hardware prototype [1]. The system utilizes GPS to obtain a vehicle's coordinate and transmit it using GSM modem to the user's phone through the mobile network. The developed vehicle tracking system demonstrates the feasibility of near real-time tracking of vehicles and improved customizability, global operability and cost when compared to existing solutions.

Fogue M presented the fast detection of traffic accidents [2], improving the assistance to injured passengers by reducing the response time of emergency services through the efficient communication of relevant information. This requires installing on board units (OBUs) in vehicles, in charge of detecting accidents and notifying them to an external control unit (CU), which will estimate the severity of the accident and inform the appropriate emergency services.

Figure 1 represents the statistics of road accidents and table 1 represents the statistics of the study conducted by Bengaluru traffic police.

| Accident Statistics | | | | | | | | |
|---------------------|-------|--------|-----------|---------|-------|--|--|--|
| YEAR | Fatal | Killed | Non-Fatal | Injured | Total | | | |
| 2006 | 880 | 915 | 6681 | 6048 | 7561 | | | |
| 2007 | 957 | 981 | 7469 | 6591 | 8426 | | | |
| 2008 | 864 | 892 | 6908 | 6150 | 7772 | | | |
| 2009 | 737 | 761 | 6138 | 5658 | 6875 | | | |
| 2010 | 816 | 858 | 5667 | 5343 | 6483 | | | |
| 2011 | 727 | 757 | 5297 | 4976 | 6024 | | | |
| 2012 | 740 | 760 | 4767 | 4471 | 5502 | | | |
| 2013 | 737 | 771 | 4493 | 4289 | 5230 | | | |
| 2014 | 711 | 737 | 4293 | 4096 | 5004 | | | |
| 2015 | 714 | 740 | 4114 | 4047 | 4828 | | | |
| 2016 | 754 | 793 | 6752 | 4193 | 7506 | | | |
| 2017 (Sentember) | 469 | 499 | 3349 | 3182 | 3818 | | | |

TABLE I: STATISTICS OF THE STUDY CONDUCTED BY THE BENGALURU TRAFFIC POLICE



Figure 1 Statistics of Road Accidents

III. PROPOSED SYSTEM

Figure 2 represents the block diagram of the proposed system. The system consists of three units: vehicle unit, control unit and ambulance unit.

Vehicle Unit: For implementation of this project, vehicle unit should be installed in every vehicle. It consists of a microcontroller along with the accelerometer, GPS and GSM module and sensors to sense the accident. The accelerometer is used to check the speed of the vehicle. The changes in the axis of the accelerometer are observed. If the observed value is greater than the threshold value accident has occurred. On impact or when the speed increases, information about accident is sent to the control unit. This information consists of location of accident detected by the GPS module and then it is passed onto the GSM module.

Control Unit: Control unit is the brain of our system. It will contain all the information about the hospital location and the contact number of all the hospitals in order to send an ambulance to the accident spot. It calculates the nearest distance from the accident spot to the nearest hospital location through a Google API. It receives the message from another GSM module about the accident location and responds.

Ambulance Unit: This unit sends the ambulance to the accident location. The ambulance serves the victim from the accident location.

Anti lock breaking system (ABS) is an automobile safety system which allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while breaking preventing the wheels from locking up and avoiding uncontrolled skidding. Figure 3 represents ABS found in cars.

IV. SYSTEM DESIGN

The Embedded Technology is at its peak and acting as a game changer in many industries. It plays a major role in wide spread of industries, because of the key feature called integration. It brings different sources of departments, under a single umbrella. This increases productivity and quality of product with less human interference.

GPS and GSM module placed in the vehicle will send the location of the accident to the main server which will rush an ambulance from a nearest hospital to the accident spot. This system is completely automated; thus, it finds the accident spot and helps in reaching the hospital on time.



Figure 2. Block Diagram of the Proposed Work



Figure 3 ABS Found in Cars

Figure 4 Working of Breaks In a Car with and without EBD

The global positioning system gives the exact coordinates when there is a change in the axis of the ADXL 335 beyond a threshold point. Figure 2 represents the messages received. The coordinates are shown in terms of longitudes and latitudes as well as the speed with which the vehicle was traveling in terms of knots. Figure 3 represents the image on google maps.



Figure 5 Flow of control in the system

Figure 6. Sample of Messages Received





Figure 7 Image of Google Map Display

Figure 8 Location pointed using google maps

V. CONCLUSION

The system designed above reduces the loss of life due to accidents and the time taken by the ambulance to reach the hospital is also reduced. GPS and GSM modules placed the concerned vehicle will send the location of the accident to the main server. This in turn helps an ambulance from the nearest hospital to reach the accident spot without much delay. The system is completely automated; thus, it finds the accident spot and helps in reaching the hospital on time. Future enhancements which can be made to this system are: Use of 4G technology-based GSM modules, Installing Black-Box (similar to the ones used in aircrafts) and capturing the video of an accident.

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JNANA CHILUME – 2019: Emerging Trends in Food Technology & Advance Chemistry

Implementation of Orthogonal Frequency Division Multiplexing using MATLAB[®] simulation for DSL (Broadband) applications

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Abstract: Orthogonal Frequency Division Multiple Access (OFDMA), is a multi-user version of OFDM (Orthogonal Frequency Division Multiplexing) digital modulation scheme, where in multiple access is being achieved in OFDMA by assigning subsets of subcarriers to individual users, that permits simultaneous low data rate transmission from several users. Here completely different groups of subcarriers and /or OFDM symbols are used for sending the signals to/from multiple users. The main objective of this paper is to study and implement an OFDM as a multiple access system with the impact of many radio channel impairment factors. The simulation of the system is carried out using MATLAB[®] simulation tool. An application of the OFDM scheme for DSL (Digital Subscriber Line) is studied and implemented using simulation model and may be extended for different applications like mobile communication, digital television and audio broadcasting, powerline communication etc.

Keywords: OFDM, DSL, Matlab, Channel noise

I. INTRODUCTION

The analog telephone frequency range includes a restricted information measure, thus if data communication equipment is limited to use solely that range, then only small amounts of information can be sent and received over the connection at on time. In the same means that a lot of lanes on a highway enable more cars to travel on that at one time, broadband telecommunication permits a wide band of frequencies or channels to transmit information at the same time on a wire, which suggests more data can be sent in a given amount of time. A number of broadband access platforms exist, however the one with the most rapid uptake is DSL (Digital Subscriber line).

Typical telephone cabling is capable of supporting a larger range of frequencies (around 1MHz).With DSL modems, the digital signal is not restricted to 4 kHz of voice frequencies, because it does not need to travel through the telephone switching system. DSL modems enable up to 1MHz of bandwidth to be used for transmitting digital (data) alongside analog (voice) signals on the same wire by separating the signals, thereby preventing the signals from interfering with one another. Fig I shows how the analog and digital frequencies are split.

There are various different DSL technologies. The range of DSL types reflects the various different applications requiring different information rates. Generally, the variations of DSL technology have been implemented to satisfy the requirements of various users, like home users, small to medium sized businesses, schools and colleges.





Fig I: Splitting the frequencies

The DSL variants may be broadly divided into the three following groups:

1. Symmetric DSL 2. Asymmetric DSL 3. Symmetric and Asymmetric DSL

ADSL is that transmission of integrated voice and data services with higher information rates downstream (to the user) than upstream. ADSL will reach speeds of up to 10Mbps downstream and 1Mbps upstream. ADSL permits customers to use both their traditional telephone service and high-speed digital transmissions on an existing telephone line.

II. REVIEW OF LITERATURE

A Digital Subscriber Line (DSL) is a type of broadband connection that takes advantage of the present telephone cables to enable high-speed data transmissions to and from a customer's premises [1].

The DSL transmission technology exploits the very fact that each one of the telephone signals are below four kilohertz in frequency and makes use of the remainder of the 1MHz that a typical copper combine line can support. ADSL (Asymmetric Digital Subscriber Line) a very important variant of the DSL family, is extremely popular and uses specialized modulation technology referred to as DMT (Discrete-Multi Tone) to divide the available bandwidth on a copper pair line and build multiple channels for sending and receiving signals, that are cited as Frequency Division.

This technique can squeeze multiple modulated carriers tightly along at a reduced bandwidth without the need for guard bands while at the same time keeping the modulated signals orthogonal (perpendicular) on order that they do not interfere with one another [2], thereby guaranteeing no overlapping of frequency carriers at the same time achieving higher information rates.

To overcome the attenuation and crosstalk affecting the performance of DSL, an Optical Fiber Cable is suggested instead of twisted pair metallic cables as it offers less attenuation and immunity to interference and crosstalk.

III. MATERIALS & METHODS

3.1 OFDM Concept

Orthogonal frequency division multiplexing (OFDM) is a multicarrier transmission technique that relies on frequency division multiplexing (FDM) used as a digital multi-carrier modulation technique. A large number of closely spaced orthogonal subcarrier signals are used to carry data on several parallel data streams or channels.

In typical FDM multiple-frequency signals are transmitted simultaneously in parallel where the information contained in each signal is modulated onto subcarriers and thus the subcarrier

multiplexed signal usually contains a wide range of frequencies. Each subcarrier is separated by a guard band to avoid signal overlapping.

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The subcarriers are then demodulated at the receiver by using filters to separate the frequency bands. In contrast OFDM employs several subcarrier frequencies orthogonal to each other (i.e. perpendicular) and thus they do not overlap. Hence this method [2] can squeeze multiple modulated carriers tightly together at a reduced bandwidth without the need for guard bands while at the same time keeping the modulated signals orthogonal in order that they do not interfere with one another, as illustrated in Fig II.



Fig II: Comparison of FDM with OFDM

In the upper spectral diagram 10 non-overlapping subcarrier frequency signals which are arranged in parallel depicting typical FDM are shown, each being separated by a finite guard band. OFDM is displayed in the bottom spectral diagram where the peak of one signal coincides with the trough of another signal. Every subcarrier, however, should maintain the Nyquist criterion separation with the minimum fundamental measure of T (i.e. a frequency unfold of 1/T) for every subcarrier.

3.2 OFDMA concept

In OFDMA systems, the multiple user signals are separated within the time and/or frequency domains. The subcarriers and also the OFDM symbol period are the best allocation units in the frequency and time domain respectively. Hence, multiple users are allocated completely different slots in the frequency and time domain, i.e., completely different groups of subcarriers and/or OFDM symbols are used for transmitting the signals to/from multiple users. For example as shown in below Fig V, wherein the subcarriers in an OFDM symbol are represented by arrows and the lines shown at different times represent the different OFDM symbols.



3.3 OFDM Implementation

OFDM uses the inverse fast Fourier transform (IFFT) for the purpose of modulation and also the fast Fourier transform (FFT) for reception. The subcarriers are positioned perpendicularly and thus the reason why the technique is referred to as orthogonal FDM.

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Since the orthogonal feature permits high spectral efficiency close to the sampling rate where efficient bandwidth use may be obtained, OFDM usually exhibits a nearly white frequency spectrum (i.e. without electromagnetic interference between the adjacent channels).



Fig VII: Functional block diagram of OFDM modulation and demodulation

Fig VII shows the block diagram of OFDM modulation and reception. By using narrow orthogonal subcarriers, the OFDM signal gains strength over a frequency-selective weakening channel, and eliminates adjacent subcarrier crosstalk. At the receiving end, the OFDM signal can be demodulated with a fast Fourier rework (FFT) and easily equalized with a complex gain at every subcarrier. The Cyclic prefix acts as a buffer region or guard interval to guard the OFDM signals from ISI.

IV. RESULTS & DISCUSSION

4.1 Description of the Individual elements

Transmitter

The OFDM Transmitter System object generates an OFDM signal primarily based upon the IEEE 802.11a standard with a equipped ASCII payload. Each transmission frame is formed of many OFDM symbols, together with preamble and information symbols. Identical frames are recurrent by the transmitter based on the value equipped. Frames are padded to fill the OFDM grid once necessary.

Channel

This element simulates the effects of wireless transmission. It degrades the transmitted signal with both phase and frequency offset, a delay to mimic channel delay between transmitter and receiver, and AWGN. The amplitude of the AWGN is given in dB.

Receiver

This OFDM Receiver System object will recover the original transmitted payload message

BER Calculation

This component calculates the system FER and BER based on the original payload message and also the decoded bit stream from the detected frames at the receiver. The undetected frames are not counted within the calculation.

Display of Recovered Message

The recovered message at the receiver is displayed for every detected frame. Since the original message length is not sent to the receiver, the padded bits in every frame are also recovered into characters and displayed.



Scopes

- constellation diagrams showing the received signal before and after frequency domain equalization
- vector plot of the equalizer taps used for a given frame
- spectrum analyzer displaying detected frames of information
- time plot displaying the start of detected frames
- time plot displaying the frequency estimate of the transmitter's carrier offset for detected frames **Case 1:**

| Channel noise | Sample | Phase | Frequency | No. of frames | No. of frames |
|---------------|-------------|--------|-------------|---------------|---------------|
| level (dB) | offset/Dela | offset | offset (Hz) | transmitted | detected by |
| EbNo | у | (dB) | | | receiver |
| 10 | 10 | 10 | 1000 | 1000 | 999 |







Case 2:

| Channel noise | Sample | Phase | Frequency | No. of frames | No. of frames |
|---------------|-------------|--------|-------------|---------------|---------------|
| level (dB) | offset/Dela | offset | offset (Hz) | transmitted | detected by |
| EbNo | У | (dB) | | | receiver |
| 10 | 1 | 1 | 100 | 100 | 100 |

At EbNo = 10.00dB, 100 frames detected among the 100 transmitted frames with FER = 0.330000 and BER = 0.007161



Case 3:

| Channel noise | Sample | Phase | Frequency | No. of frames | No. of frames |
|---------------|-------------|--------|-------------|---------------|---------------|
| level (dB) | offset/Dela | offset | offset (Hz) | transmitted | detected by |
| EbNo | у | (dB) | | | receiver |
| 100 | 100 | 150 | 100 | 1000 | 1000 |



V. CONCLUSION

Following are the conclusion drawn after studying and implementing the OFDM module.

• Basic principles behind multi carrier modulation are to replace a wide band signals with narrow band signals.

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- Larger the SNR clearer is the signals after transmission.
- SER (Symbol Error Rate) decreases as SNR increases.

5.1 Advantages

- Robust to Inter symbol Interference (ISI)
- Avoids Inter channel Interference (ICI)
- High spectral efficiency
- Receiver simplicity (low implementation cost).
- Bit Error *Rate performance is better*.

5.2 Disadvantages

- Loss in efficiency due to guard interval
- High peak to average power ratio
- Sensitivity to frequency Synchronization

5.3 Applications of OFDMA

Used in modern communication systems such as Digital television and audio broadcasting, DSL internet access wireless network, 4G mobile communication, Powerline communication

VI. FUTURE SCOPE

The technique of implementing OFDM for DSL applications can be carried forward by developing a hardware module of the same and can be installed in organizations which are using broadband facility by including this module inside the broadband device.

VII. ACKNOWLEDGEMENT

I express my sincere gratitude to Dr. Chandrasekar Shastry Director, Center for Distance Education & Virtual Learning, Jain University for motivating me to take up this work. Also I would like to acknowledge BMS Institute of Technology and Management, Bengaluru for providing the lab facility for implementation of the project.

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(ICRST-19)

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Editorial:

We cordially invite you to attend the International Conference on Researches in Science and Technology (ICRST-19), which will be held in The Pan Pacific Singapore, Singapore on April 07th, 2019. The main objective of ICRST -19 is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in Researches in Science and Technology. This conference provides opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relations and to find global partners for future collaboration.

These proceedings collect the up-to-date, comprehensive and worldwide state-of-art knowledge on Researches in Science and Technology. All accepted papers were subjected to strict peer-reviewing by 2-4 expert referees. The papers have been selected for these proceedings because of their quality and the relevance to the conference. We hope these proceedings will not only provide the readers a broad overview of the latest research results on Researches in Science and Technology but also provide the readers a valuable summary and reference in these fields.

The conference is supported by many universities and research institutes. Many professors played an important role in the successful holding of the conference, so we would like to take this opportunity to express our sincere gratitude and highest respects to them. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra help in the review process, and to the authors for contributing their research result to the conference.

Since February 2019, the Organizing Committees have received more than 30 manuscript papers, and the papers cover all the aspects in Researches in Science and Technology. Finally, after review, about 12 papers were included to the proceedings of ICRST - 19.

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of International Conference 2019. We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions make this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

Acknowledgement

ITAR is hosting the International Conference on Researches in Science and Technology this year in month of April. International Conference on Researches in Science and Technology will provide a forum for students, professional engineers, academician, and scientist engaged in research and development to convene and present their latest scholarly work and application in the industry. The primary goal of the conference is to promote research and developmental activities in Science, Technology and to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in and around the world. The aim of the Conference is to provide a platform to the researchers and practitioners from both academia as well as industry to meet the share cutting-edge development in the field.

I express my hearty gratitude to all my Colleagues, staffs, Professors, reviewers and members of organizing committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to travel such a long distance to attain this conference.

Dr. Albert Munroe President Institute for Technical and Academic Research (ITAR)

CONTENTS

| S.NO | TITLES AND AUTHORS | PAGE NO |
|------|---|-------------|
| 1. | Evaluation of Enzymological Parameters in Tissue of Clarias Batrachus nd Labeo Rohita > Dr. Sudha Summarwar > Jyotsana Pandey > Deepali Lall | 1-3 |
| 2. | Embedded Solution for Aircraft Fault Detection and Passenger Safety System Us Wireless Technology > JayendraChavan > AjitShinde > Hrishikesh More > RavindraPatil > SachinGurav | ing 4-7 |
| 3. | Enhancement to CCTV Footage Technology using Keyframes and Background Substraction > Shivam Bhatia > Chethan S | 8-11 |
| 4. | Effect of Inorganic and Organic Fertilisers on Walnut Quality and Leaf Macro Nutrient Status > Imtiyaz A. wani > Rayees A. Ahanger | 12-15 |
| 5. | New Records of Bloodsucking Flies Associated with Wild Birds of Haftad-Gholl Protected Area, Iran (Diptera: Hippoboscidae, Calliphoridae) > Araghi MP > Gilasian E > Samaie A | eh 16-19 |
| 6. | Socio-Economic Determinants of Sweet Melon Production in Balanga Local Government Area of Gombe State, Nigeria > Omorogbe I > Aina OS > Yakubu SA > Hassan AA | 20-25 |
| 7. | CO2 Purification using an Aqueous Amine Absorbent in the Syngas > Jeong Ho Choi > Soung Hee Yun > Yeo Il Yoon > Jung-Hyun Lee | 26-31 |
| 8. | An Approach to Measure Similarity of Software Projects at the Design Phase | 32-37 |

CONTENTS

| S.NO | TITLES AND AUTHORS | PAGE NO |
|------|--|---------|
| 9. | Effect of Ultrasonic stress in Semiconductor Materials and Devices > Awadhesh Prasad | 38-41 |
| 10. | Diagnosis of lesion with statistical method of Anova1 & two ways for multi-MRI images with format. Dicom | [42-47 |
| 11. | Effect of Friction Stir Welding on Mechanical properties of Zn-22Al Superplastic Alloy | e 48-53 |
| | Hamed Mofidi Tabatabaei Tadashi Nishihara | |
| 12. | Analysis of Impact of Data size for Classification of Alzheimer"s disease using Convolution neural Network > S Dhanush > Sneha N > Suryakanth BM | 54-58 |

Evaluation of Enzymological Parameters in Tissue of Clarias Batrachus nd Labeo Rohita

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Abstract: -- In this study, oxidative stress was evaluated in Clarias batrachus and Labeo rohita by measuring indicators of the integrity of the enzymological parameters such as Superoxide dismutase (SOD) and Glutathione reductase (GR). The present investigation was carried out on eighty fishes of two species i.e. Clarias batrachus and Labeo rohita collected from various areas of Bisalpur during extreme cold conditions. The markers of oxidative stress included tissue enzymes i.e. Superoxide dismutase (SOD) and glutathione reductase(GR). The mean values of SOD and glutathione reductase in all the tissues were significantly higher in Thadoli area, followed by Negdiya and Nasirda. The lowest values were obtained in Bisalpur area. In Thdoli area concentration of dissolved oxygen was highest. In each area, the SOD and GR activity significantly differed among all the tissues collected i.e. heart, kidney, liver and gills. In each area, the activity of SOD and GR were highest in gills and lowest in the heart of both the fishes collected from all four areas. In each area, in each tissue, the SOD and GR activity were significantly higher in Clarias batrachus than in Labeo rohita.

Key words — Superoxide dismutase, Glutathione reductase, Clarias batrachus and Labeo rohita.

I. INTRODUCTION

Aquatic environment is a sink for many environmental contaminants which can be absorbed by aquatic organisms leading to disturbing of antioxidant/prooxidant balance in fish (Lackner, 1998; Livingstone, 2001, Lushchak, 2011). Moreover, dependently on the source of pollutant, steady-state ROS concentration can be enchanced transiently or chronically, disturbing cellular metabolism and its regulation and damaging cellular constituents (Lushchak, 2011).

Oxidative stress in fish is a general consequence of the environmental pollution. Ansaldo et al. (2000) suggested in Antarctic fish, an environment with a very low and constant temperature and high oxygen concentration might be an important factor for oxidative stress affecting their metabolic adaptive strategies. Activity of the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx), vitamin E levels and total antioxidant capacity (TRAP) were measured in liver, gill, heart and muscle homogenates of Antarctic fish. Gill SOD activity was three fold higher in channichthyids than in nototheniids while CAT and GPx were significantly higher in the gills of channichthyids. The increased SOD activity of channichthyids probably reflects the large PO2 gradient across their gills.

In this study, oxidative stress was evaluated in Clarias batrachus and Labeo rohita by measuring indicators of the

integrity of the enzymological parameters such as Superoxide dismutase (SOD) and Glutathione reductase (GR). Activities of superoxide dismutase (SOD) and Glutathione reductase (GR) in the tissue of Clarias batrachus and Labeo rohita were chosen as bioindicators.

II. MATERIAL & METHOD

The present investigation was carried out on eighty fishes of two species i.e. Clarias batrachus and Labeo rohita collected from various areas of Bisalpur during extreme cold conditions. The markers of oxidative stress included tissue enzymes i.e. Superoxide dismutase (SOD) and glutathione reductase (GR).

2.1 Superoxide dismutase (SOD)

It was determined by colorimetric method as described by Maan (2010). The method is based upon the ability of superoxide dismutase to inhibit the reduction of nitroblue tetrazolium by superoxide. One unit is defined as that amount of enzyme causing half the maximum inhibition of nitroblue tetrazolium reduction. A series of ten test tubes were set and various quantities of each supernatant sample (0.1, 1, 2, 3,4,5,6,7,8,9 and 10 μ I) were added. In each tube 0.2 ml of EDTA-cyanide reagent, 0.1 ml NBT and 3 ml of phosphate buffer were added. The tubes were incubated by placing them in light box providing uniform light intensity. For this a foil-lined box (4' long X 8" X 6") with an internally mounted 40 W fluorescent bulb was used. The tubes were incubated for 5 minutes to achieve a standard

temperature. Then 0.05 ml riboflavin was added. All tubes were again incubated in the light box for 12 minutes. Then at 560 m μ wavelength, the % transmission of each tube was determined at one minute interval in an increasing order. The amount of sample resulting in 50% of transmission was determined by a curve and put in the formula to calculate SOD units as follows:

Units/ ml= µl of serum resulting in 50 % transmission

Here, 1000 = Conversion factor

After calculation the values were converted into kU L-1. Then units were calculated per mg of proteins as discussed for other enzymes.

2.2 Glutathione reductase

It was determined by the colorimetric method as described by King (1965). Supernatant is treated with coenzyme solution for reduction of endogenous substrates. Then substrate is added and enzyme activity is determined by change in extinction. In a spectrophotometer cuvette 2.4 ml buffer, 0.5 ml supernatant and 0.1 ml of coenzyme solution were added and kept for 2 minutes. After this 0.1 ml of substrate solution was added and optical density was determined at 340 mµ at every one minute interval. Five readings were taken. The activity was determined as follows: Activity (kU L-1) = Change in OD per minute at 340mµX1000X0.5X2 (1000 is the dilution factor, 0.5 is the quantity of serum and 2 is the time in minutes for first reaction). Then units were calculated per 0.5 ml of supernatant. From protein estimation, total quantity of protein was calculated in 0.5 ml of supernatant. Then units per ml were converted to units per mg of protein.

III. RESULT & DISCUSSION

On the basis of results of enzymological parameters of fishes obtained from other three areas were compared from respective parameters of fishes from Bisalpur area.

3.1 Superoxide dismutase (SOD)

Mean ±SEM values of superoxide dismutase in tissues of Clarias batrachus and Labeo rohita are presented in table 1.The mean values of SOD obtained from fishes of Bisalpur and Nasirda areas were more or less similar to the available control values (Stephanie et al., 2006). The higher values in Thadoli and Negdiya areas over and above the control values reflected the oxidative stress. The mean values of SOD in all the tissues were significantly higher in Thadoli area, followed by Negdiya and Nasirda. The lowest values were obtained in Bisalpur area. In Thdoli area concentration of dissolved oxygen was highest. Higher concentration of SOD in fishes of Thadoli area indicated the presence of oxidative stress. In each area, the SOD activity significantly differed among all the tissues collected i.e. heart, kidney, liver and gills. In each area, the acticity of SOD was highest in gills for both the fishes. Activity was lowest in the heart of both the fishes collected from all four areas. The increased SOD activity probably reflected the large PO2 gradient across the gills. In each area, in each tissue, the SOD activity was significantly higher in Clarias batrachus than in Labeo rohita. The higher value of tissue SOD in the fishes from Thadoli area was probably to scavenge the free radicals produced due to some environmental or ambient factors. To correlate, in Thadoli area, water samples showed the higher levels of pH, alkalinity, turbidity, hardness etc. Higher activity of SOD in tissues of fishes indicated towards oxidative stress as environment induced oxidative stress was confirmed in some previous studies on the basis of higher activity of SOD during by Kataria and Kataria (2009a) in mammals. On the basis of above discussion it can be reiterated that higher dissolved oxygen, high pH, higher alkalinity, higher turbidity etc. generated free radicals to produce oxidative stress in fishes of Thadoli area.

3.2 Glutathione reductase (GR)

Mean ±SEM values of glutathione reductase (GR) in tissues of Clarias batrachus and Labeo rohita are presented in table 2. The mean values of GR in all the tissues were significantly higher in Thadoli area, followed by Negdiya and Nasirda. The lowest values were obtained in Bisalpur area. In Thdoli area concentration of dissolved oxygen was highest. Higher concentration of GR in fishes of Thadoli area indicated the presence of oxidative stress. In each area, the GR activity significantly differed among all the tissues collected i.e. heart, kidney, liver and gills. In each area, the activity of GR was highest in gills for both the fishes. Activity was lowest in the heart of both the fishes collected from all four areas. In each area, in each tissue, the GR activity was significantly higher in Clarias batrachus than in Labeo rohita.

Glutathione reductase probably provides a protective effect against ambience stress. On this basis, the results of present study theorise the presence of oxidative stress in fishes.

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TablesTable 1. Effect of varying ambiences on SOD activity intissues of Fishes collected from different areas /villages ofBisalpur Reservoir (n=10)

| SOD, | Areas | | | | | | | |
|-----------------|---------------------|---------------------|-----------------------|-----------------------|----------------------|----------|----------------------|---------|
| U/mg protein | Bis | alpur | Nasirda | | Thadoli | | Negdiya | |
| | С Ь | Lr | C à | ЗĿй | C b | Lr | С Ь | Lz |
| Heart | 180.00% | 160.00* | 290.20 ^b | 260.00 h | 380.00 b | 360.00 % | 330.00 ^b | 310.50* |
| | ± | ÷ | ± | ¥ | ±. | ± | ± | ÷ |
| _ | 5.00 | 5.11 | 6.21 | 5.11 | 4.14 | 4.11 | 4.14 | 4.11 |
| Kidney | 200.71 ^b | 180.54 ^b | 310.20 % | 280.00 ^h | 401.00 ^b | 382.54* | 352.00 ^b | 329.50* |
| | ± | ± | + | + | + | ± | * | ± |
| | 5,00 | 3.11 | 6.21 | 5.11 | 4.14 | 4.11 | 4.14 | 4.11 |
| Liver | 220.0 ^h | 200.0 ^k | 332. 00 ^b | 301. 00 b | 419.00 ^b | 400.04 h | 371.10 ^b | 349.00* |
| | ± | ± | ± . | ± | ± | ± | * | ± |
| | 5.00 | 5.11 | 6.21 | 5.11 | 4.14 | 4.11 | 4.14 | 4.11 |
| Gills | 240.0 ^h | 220.0° | 352.00 ⁵ | 321. 00 ^b | 439.00 ^b | 420.05 b | 391.80 ^b | 379.90 |
| | ± | ± | ± | + | # | ± | * | ± |
| | 5.00 | 5.11 | 6.21 | 5.11 | 4.14 | 4.11 | 4.14 | 4.11 |

n= Number of fishes

SOD= Super oxide dismutase

All the means values of a parameter super scribed by same letter denotes significant ($p \le 0.05$) differences among different areas.

C b = Clarias batrachus

L r =Labeo rohita

| Table 2. | Effect of | varying a | mbiences | on gluta | thione |
|-----------|-------------|------------|-----------|-----------|--------|
| reductas | se activity | in tissues | of fishes | collected | from |
| different | areas /vill | lages of B | isalpur i | reservoir | (n=10) |

| Glutathione reductase,U /mg protein | Areas | | | | | | | |
|---|----------|--------|---------|-------|---------|-------|---------|-------|
| | Bisalpur | | Nasirda | | Thadoli | | Negdiya | |
| | Cb | Lr | С в | Lr | C b | Lr | C 8 | L |
| Heart | 1.55* | 1.50* | 1.7* | 1.6 ª | 2.9* | 2.8 ° | 1.9* | 1.8* |
| | ± | ± | ± | ± | ± | ± | ± | ± |
| | 0.001 | 0.003 | 0.002 | 0.001 | 0.004 | 0.003 | 0.002 | 0.001 |
| Kidney | 1.75 • | 1.60 • | 1.8* | 1.7 * | 3.9 * | 3.8* | 2.9 * | 2.8* |
| | ± | ± | ± | ± | ± | ± | * | ± |
| | 0.001 | 0.003 | 0.002 | 0.001 | 0.004 | 0.003 | 0.002 | 0.001 |
| Liver | 1.85* | 1.70* | 1.9* | 1.8 * | 4.1 * | 4.0* | 3.0* | 2.9* |
| | ± | ± | ± | ± | ± | ± | ± | ± |
| | 0.001 | 0.003 | 0.002 | 0.001 | 0.004 | 0.003 | 0.002 | 0.001 |
| Gills | 1.95* | 1.80* | 2.0 • | 1.9* | 5.3 • | 4.8* | 4.0 * | 3.5* |
| | ± | ± | ± | ± | ± | ± | ± | ± |
| | 0.001 | 0.003 | 0.002 | 0.001 | 0.004 | 0.003 | 0.002 | 0.001 |

n= Number of fishes

All the means values of a parameter super scribed by same letter denotes significant ($p \le 0.05$) differences among different areas.

C b = Clarias batrachus

L r =Labeo rohita

3

Embedded Solution for Aircraft Fault Detection and Passenger Safety System Using Wireless Technology

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Abstract: —The recent years were quite bad for aviation world due to serious aircraft crashes. Lots of human being lost their lives in plane crashes over last 3 years and this became very serious & sensitive issue in the world. So we are proposing the idea of detachment of passenger compartment on the detection of major problem in an aircraft which predicts the fatal crash of airplane. We are using some advanced sensors to detect the accidental occurrences of defects or faults in an aircraft. These sensors are selected according to most common problems of aircraft crashes. On detection of sensors data, the data is compared with threshold limits & if the data reaches beyond threshold it predicts the possible crash of plane and gives signal to the detachment control panel On the signal of sensors, the passenger compartment will get ejected from the fuselage and with help of parachutes or will land safely on ground without any fatal loss. We are using arduino platform with AVR ATmega328 microcontroller. It is 8 bit microcontroller with 32kb memory. This controller board comes with 14 digital I/O pins and out of these 14 pins fro 6 pins provide Pulse Width Modulation (PWM) output signal. This board also comes with 6 analog input pins. This board can be powered by USB as well as external dc jack with 5 to 12 v input supply.

Index Terms- Aviation, detachment, predict, fatal, fuselage

I. INTRODUCTION

Today we are living in 21st century in which human life safety is more important than any other things. But as century's increases technology also get increases similarly risk for human life too. But with that risk, humans get research the effective solution on that.

Similarly recent years were quite bad for aviation world due to serious aircraft crashes. Although today airplanes have become a lot safer over the past few decades. Much work goes into making sure that aircraft are safe since there's almost always a loss of life when a flight crashes. Lots of human being lost their lives in plane crashes. This became very sensitive & serious issue in the world. So companies are interested in improving safety in aircraft. So we are proposing idea of the ejection and the recovery system of passenger compartment in an accidental crash situation of aircraft. In this technique the passenger compartment of the aircraft gets ejected from its main body when any accidental or critical situation gets occurred. The ejected passenger compartment get fly in air with the help of parachute attached at the top of the compartment. Rubber tube filled with air used as floater which saves the compartment from drowns. Sensors are selected according to most common problems of aircraft crashes. On detection of sensors data, the data is compared with threshold limits &

if the data reaches beyond threshold it predicts the possible crash of plane and gives signal to the detachment control panel On the signal of sensors, the passenger compartment will get ejected from the fuselage and with help of parachutes or will land safely on ground without any fatal loss.

We use arduino board with ATmeg328 controller. It is 32 kb 8 bit microcontroller. This controller board has 14 I/O digital pin from which 6 pins are used as Pulse Width Modulation (PWM) output, 6 analog input pins. A USB connector used for 5V power supply and a power jack is used for applying 3.3V-9V power supply to the board.

II. OBJECTIVE AND SCOPE

The main objective of our project is to make development in the aviation technology and make aircraft safer than past few decades. This technology can be readily used by aviation industry for creating more safe aircrafts which saves the passenger life in critical situation like fire, wings fault, turbine fault etc. This project has the large scope as it has the following features which help in making it easy to use, modify and understand it.

Parachute attached at the roof and rubber tubes inflate

on bottom of cabin.

- Storage space holds passenger luggage underneath the cabin.
- Automatic excessive angle change system.

III.PRESENT STATE

- Present State:
- According to ICAO(International Civil Aviation
- Organization), over the past 10 years there are 8% of all accidents happen during takeoff, landing- 21% cruising flights-71%.
- The accident rate in Africa, for instance, is nearly five times that of the worldwide average, according to the International Civil Aviation Organization, part of the United Nations. Such trouble spots also happen to be where air travel is growing the fastest
- The analysis of causes of accident show that 75% of them happen because of human factor, other because of omission aeromechanics. To reduce the influence of human factor by rising up safety of airplane is impossible. The new principle of aircraft construction is needed for possibility of collective rescuing by evacuation of them crashing airplanes in the range from several hundreds of meters to several km.
- There are 12.25 fatalities per million flight deaths.
- A plane crashes one out of 1.2 million flights.
- There is a 24% survival rate of passengers on a fatal crash.
- There were 111 plane crashes in 2014, which went down from 138 in 2013.
- Technological improvements are also helping to lower the accident rate. Cockpits now come with systems that automatically warn if a jet is too low, about to hit a mountain or another plane. Others detect sudden wind gusts that could make a landing unsafe.
- The next generation of technology promises to help prevent even more accidents. Honeywell Aerospace launched a new system 18 months ago that gives pilots better awareness about severe turbulence, hail and lightning. The company is also developing a system to improve pilots' vision in stormy weather: an infrared camera will let them see runways through thick clouds earlier than the naked eye would.
- After implementation of project:
- The year 2014 left a strong impression on the aviation industry, with Malaysian Airline's MH 370 going missing to various plane crashes. It was just a bad year and the industry had to fight out the odds. But, there was still no solution to prevent or at least battle plane crashes in a way it saves the lives of the passengers. But our project a small step to solve that problem.

- In this project such aircraft construction is offered. Which provides separation of the lower part of the fuselage with situated there passengers and their luggage, gradual decline of separated part and its soft landing(splashdown), afterwards providing an opportunity for its searching and finding by rescuers.
- The guaranty of success of offered airplane structure is in the fact that outlined in structure solutions are based on lifelong checked technical solution of landing in transport aviation

IV. PROCESS DESCRIPTION/METHODOLOGY

Block Diagram



There are two ARDUINO base stations present which are connected with each other through XBEE module. First Arduino Detect the fault occurred in aircraft by using fire sensor. Accelerometer sensor. And second Arduino board controls the servo motor and ultrasonic sensor, which is in aircraft station. XBEE module is the wireless communication model. It communicates with other XBEE which in line of sight with it. The fire/flame sensor detects the small fire in aircraft and sends that signal to the ground station Arduino. Ultrasonic sensor is used to detect the distance of falling compartment from ground. Servo motor is used for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

B. Circuit Diagram



Fig 2. Interfacing Of Flame Sensor And Servo Motor.



Fig 3.Interfacing of Ultrasonic Sensor with Servo Motor.





V.PROPOSED WORK

• Hardware Part:

• MCU: (Arduino unit)

As Arduino are the simple and effective controller boards used in digital circuit design in industry, this system uses it for the centralized operation and digital processing. The embedded technology is used in arduino.

The Figure Shows Arduino board with ATmeg328 controller. It is 32 kb 8 bit microcontroller. This controller board has 14 I/O digital pin from which 6 pins are used as Pulse Width Modulation (PWM) output, 6 analog input pins. A USB connector used for 5V power supply and a power jack is used for applying 3.3V-9V power supply to the board.

It is a simple microcontroller board. It is an open source computing platform and has an environment for developing software for the Arduino board. It takes input from sensors or switches and controls the outputs. Arduino boards are inexpensive compared to other microcontroller based devices.

- SENSOR:
- Flame Sensor

A flame sensor detects the presence of fire or flames. In extremely hazardous environments, flame sensors work to minimize the risks associated with fire. There are several different types of flame sensor - some will raise an alarm while others may activate a fire suppression system or deactivate a combustible fuel line. Among the many different types of flame sensor, ultraviolet flame sensors, near IR array flame sensors, infrared flame sensors and IR3 flame detection sensors are the most prominent.

• Ultrasonic Sensor(HC-SR 04)

Ultrasonic sensors are based on measuring the properties of sound waves with frequency above the human audible range. They are based on three physical principles: time of flight, the Doppler Effect, and the attenuation of sound waves. Ultrasonic sensors are nonintrusive in that they do not require physical contact with their target, and can detect certain clear or shiny targets otherwise obscured to some vision-based sensors. On the other hand, their measurements are very sensitive to temperature and to the angle of the target.

• Accelerometer Sensor

One of the most common inertial sensors is the accelerometer, a dynamic sensor capable of a vast range of sensing. Accelerometers are available that can measure acceleration in one, two, or three orthogonal axes. They are typically used in one of three modes. As an inertial measurement of velocity and position. As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s²).As a vibration or impact (shock) sensor. There are considerable advantages to using an analog accelerometer as opposed to an inclinometer such as a liquid tilt sensor inclinometers tend to output binary information (indicating a state of on or off), thus it is only possible to detect when the tilt has exceeded some threshold angle.

• SERVO MOTOR

A servo motoris a <u>rotary actuator</u> or <u>linear</u> <u>actuator</u> that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term *servomotor* is often used to refer to a motor suitable for use in a <u>closed-loop</u> <u>control</u> system.

• XBEE:

Xbee is a device which is used for wireless technology which provides connection between the devices. It is the low cost, low power wireless network used for instrument control.784 MHz, 868MHz and 915 MHz Data rate varies from 20 Kb/s to 250 Kb/s.

Its transmission distance is limited to 10 to 100 meters line of sight. It depends on power output and environmental factors. It can use long distance communication using intermediate devices. It can be used in several applications such as wireless light switches,
smart grid, medical devices etc. It is used for wireless transmission purpose.Xbee was designed to provide high data <u>throughput</u> in applications where the <u>duty cycle</u> is low and low power consumption is an important consideration.

IV.RESULT

From our project we got some sensor result. For Accelerometer Sensor

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For Servo motor:



For Ultrasonic Sensor

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VII. CONCLUSION

From all above the project, we said that the project is very useful to increase the percentage of human safety when plane get crashed. It will become a very important life saving technology in plane engineering. But Passenger might have to pay more money to fly on a plane.

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Enhancement to CCTV Footage Technology using Keyframes and Background Substraction

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Abstract:-- This paper deals with two very important concepts in Image Processing i.e. Video Summarization and Background Subtraction. Video Summarization is one of the most important concepts in today's image processing world. Video Summarization is a process of creating and presenting a meaningful abstract view of the entire video in a summary. There are two main types of Video Summarization techniques available in the literature, key frame based and video skimming. This paper will deal with key frame based approach. Background Subtraction also known as foreground detection is a technique in the field of image processing and computer vision where an image's background is extracted for further processing. The idea of the research paper is mainly focused on the problem of ever increasing CCTV footage length that has to be monitored. My project aims to reduce the CCTV video length based on key frames and also incorporates the concept of Background Subtraction enabling the user to focus on Object of Interest.

Keywords—Video Processing, Background Subtraction, Video Summarization, Key frame, Video Skimming, Region of Interest(ROI).

I. INTRODUCTION

Wondered how tiring and exhausting it is for the CCTV footage invigilators to go through CCTV footage in case of an unfortunate incident. Keeping in mind the above issue we have come up with an idea which will incorporate concept of Video Summarization using key frame based approach and Background Subtraction.

Video processing systems are based on the stream processing architecture. In this architecture the video frames from a continuous stream are processed one (or more) at a time. This type of processing becomes handy where systems have live video or where the video data is so large that incorporating the entire visual data into the workspace is inefficient [1]. Keeping in mind the need of the hour, a large number of cameras are installed to record video 24*7 which results in a large amount of data. Processing this large amount of visual data requires a large amount of resources like time, man power, and hardware storage and so on [2]. This is where concept of Video Summarization comes to rescue. Video Summarization is one the most important concept in present image processing world. It is a process of creating and presenting a meaningful abstract view of the entire video in a shorter video. There are two main types Video Summarization techniques available in the of technical world. One of them is based on key frames generation concept while the other one is based on the concept of video skimming. The research paper incorporates the concept of key frame generation where key frames are generated from a video using MATLAB. A

plot of mean gray values of the frames generated along with Adaptive Background and Binarized Difference Image is also generated.

There are certain cases where you need to focus on an object of interest; this is where Background Subtraction comes in the picture. Background Subtraction is one of the most common and widely used techniques which let you calculate the foreground mask by performing a subtraction operation between the current frame and the background which more or less is the static part of the scene and lets you to focus on the Object of Interest [3].



II. LITERATURE SURVEY

Priyamvada R Sachan and Keshaveni [4] presented a paper on Video Summarization in which the CCTV Footage video is segmented into contagious shots. From the contagious shots generated one or more key frames are generated from each shot and a summary video is

generated from the keys frames selected. Saran K B and Sreelekha G [5] published a paper on Background Subtraction in which the moving vehicles are detected, number of vehicles is estimated and the detected vehicles are estimated using the mixture of Gaussians and Artificial Neural Network (ANN) with a new set of features. Ashvini A. Tonge and Sudeep D Thepade [6] put forward a paper on Video Summarization keeping in mind the large amount of CCTV footage available. In the above paper key frame are extracted for video content summarization using the concept of Orthogonal Transforms and Fractional Energy Coefficients. Ijiya Chugh, Ridhima Gupta, Rishi Kumar and Prashast Sahay [7]. published а paper Video Summarization in which on various possible techniques for key frame extraction from the video stream are discussed This paper was published keeping in mind the various problems faced by various researchers and projects to properly execute or create a system which can perform video frame extraction and face recognition. The paper makes sure that only those scenes which are required by the user are taken into consideration hence saving a considerable amount of resources. Yijie Lan, Shikui Wei, Ruoyu Liu and Yao Zhao [8] ,presented in a paper on Video Summarization in which an approach of summarizing a video based on viewpoint of emotion. Ground-truth emotion scores of each frame are firstly obtained from dataset annotated by humans. Then, we extract emotional features of each frame from training video sets. Later, using linear regression predictive model is trained from the feature vectors and emotion scores. Concurrently, the videos are segmented into various segments. Then, a subset of segment whose length is below a specific value is selected by optimizing the sum of their emotion scores. This subset of segment is what is treated as a desired summarized video. Yanghong Zhang, Qing He, Haibin Wang, Guan Guan, Tao Xu and Haodong Chen [9], proposed a paper on Background Subtraction in based on a detection algorithm in which pixel level is used to construct the background model for background segmentation. The authors based on this algorithm proposed a spatiotemporal-based algorithm which helps in construction of the background model for the background segmentation. The paper has adopted the property of color clustering to determine the similarity dynamically. The experimental result on the 2012 Change Detection dataset depict that the above algorithm outperforms most of the algorithms. Gongyan Wang, Jing Xu and Ming Fang [10], put forth a paper on Background Subtraction in which 11 different are compared using the BMC dataset and gives guidelines to choose different algorithms by computing the F- measure, Peak Signal-Noise Ratio , Structural Similarity and D-Score etc. Ali Javed, Khalid Bashir Bajwa, Hafiz Malik, Aun Irtaza and Muhammad Tariq Mahmood [11], proposed a study where an automatic summary of cricket

video using first rule induction to detect audio clips in cricket videos and then a decision tree framework is designed for video summarization. This paper has evaluated on a diverse dataset with an average accuracy of 95% signifies the effectiveness of Video Summarization. This helps in broadcast over the low- bandwidth networks and transmission over time constraints.

III. METHODOLOGY

The paper incorporates two basic concepts i.e. Video Summarization and Background Subtraction.

A. Video Summarization

For Video Summarization, a key frame based approach is used. There are five basic steps that govern the Video Summarization:-

1. Number of frames is determined along with the height and width of the frames. Then, the key frames are generated from the uploaded video.

2. The frames are converted from RGB format to gray scale format. The mean red level, green level and blue levels is determined. A plot between Frame number and Gray level is displayed with mean red level, green level and blue level.

3. An adaptive background window is displayed where slight difference between each frame and background is displayed. This helps to track the movement of the object of interest.

4.A Binarized Difference Image window is displayed where the difference between current and previous frame is displayed. A binary image is a digital image that has only two possible values for each pixel i.e. 0 and 1.[12]

5. A summary video is generated from the key frames generated using Blender.

Pseudo Code for Key Frame Generation is as follows:-

Select the video file you want to generate frames for //video Object = Video Reader(NameOfTheMovieFile) Determine the number of frames //numberOfFrames=videoObject.NumberOfFrames Determine the height of the frame //vidHeight = videoObject.Height Determine the width of the frame //vidWidth = videoObject.Width for frame = 1 : numberOfFrames//Loop through all the frames thisFrame = read(videoObject, frame)// Extract the frame from the movie structure. hImage = subplot(2, 2, 1) //Display the Frame image(thisFrame) Enhancement to CCTV Footage Technology using Keyframes and Background Substraction

caption = sprintf('Frame %4d of %d.', frame, numberOfFrames)//Caption the frame title(caption, 'FontSize', fontSize) [1].

B. Background Subtraction

The second concept i.e. Background Subtraction is a unique method by which a subject is identified in the first frame and then followed in subsequent frames n the presence of a moving background. The write-up tends to provide insight on how background subtraction is done and how for better vigilance you can concentrate on object of interest.

The method incorporated for Background Subtraction in this paper is Frame Differencing. The region of interest being white in some cases like a white car you might need to use some morphological operators to find the center of Region of Interest (ROI) and the bounding box. In this method, the background model at each pixel location is based on pixel's recent history. The history can be the average or the median of the previous n frames:

 $\begin{array}{l} Bi(x,y)=median\,\{Ii-n+1(x,y),Ii-n(x,y),...,Ii-2(x,y),Ii-1(x,y),\}.\\ A pixel belongs to the foreground if \\ |Ii(x,y)-Bi(x,y)|>T,\\ Where T is a defined threshold. The estimated background can \end{array}$

be updated as follows:

Bi(x,y) = α Ii(x,y) + (1- α)Bi-1(x,y) if Ii-1 is foreground, Bi(x,y)=Bi-1(x,y) if Ii-1 is background,

Where α is the learning rate, usually a small value(0.05). [13][14]

IV. RESULT

This paper focuses on the concept of Background Subtraction and Video Summarization. Keeping in mind the basic idea of the research work, a CCTV video footage was taken into consideration. The Video Summarization part of the research paper was taken care by using the key frame generation concept and Blender. From the key frames generated a clip was generated with background subtracted and main focus on Region of Interest (ROI).



Figure 2: Depicting key frame generation, Graph displaying mean gray levels, Adaptive Background and Binarized Difference Image.



Figure 3: Depicting background subtraction as per the Region of Interest(ROI).`



Figure4: Depicting how a video is generated from key frames generated.

V. CONCLUSION

The paper incorporates two very important concepts of Video Processing i.e. Video Summarization and Background Subtraction. The project encompasses Video Summarization is by generating a summarized clip of a large CCTV video using the key frame based approach. The key frames generated are then taken in consideration for Background Subtraction and a video clip is generated with background subtracted based on the Region of Interest (ROI). The Background Subtraction is based on an important concept of Frame Differencing. [14]

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Effect of Inorganic and Organic Fertilisers on Walnut Quality and Leaf Macro Nutrient Status

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I. INTRODUCTION

Supply of all the essential plant nutrients in sufficient quantity and appropriate proportion is one of the major factors controlling the nut quality and leaf nutrient status. Production of fruit crops has undergone enormous change due to continuous use of inorganic fertilizer over a long period causing serious damage to soil fertility, environment and health. Sustainability in horticulture with respect to maintenance of soil fertility and stabilized fruit production is the main concern in the present situation. Hence, there is a need to think of alternate source of safe fertilizers which may improve quality and leaf nutrient status without having adverse effects on soil properties. The high nutrient requirement of fruit crops can be met through an integrated use of organic manures and chemical fertilizer since organic manures in INM generally improve the physical, chemical and biological properties of the soil along with its moisture holdings capacity which results in enhanced crop productivity and the quality of crop produced. Therefore, present investigation will be carried out to standardize integrated nutrient management programme for sustainable walnut production as no systemic work has been done in relation to walnut nutrient management.

II. MATERIAL AND METHODS

The experiment consisted of four selections [SKAU/002 (S1), SKAU/008 (S2), SKAU/024 (S2) and SKAU/040 (S2)] and six treatments [T1 (NPK recommended as per package of practices through inorganic fertilizers), T2 {100 % through manure (FYM 50% + vermicompost 25% + poultry manure 25%)}, T3 (75% NPK through inorganic fertilizers + 25 % through FYM), T4 (75 % NPK through inorganic fertilizers + 25 % through vermicompost), T5 (75 % NPK through inorganic fertilizers + 25 % through inorganic fe

vermicompost + 1/3 poultry manure)} replicated thrice in Factorial Randomised Block Design during 2011 and 2012. The observations were recorded on kernel weight, Kernel percentage,Kernel fill,kernel protein content and kernel oil content by following standard procedures. Leaf samples from walnut trees were collected and analysed for macronutrient status.

III. RESULTS AND DISCUSSION

The results obtained in present study indicate that kernel weight, kernel protein and kernel fill were significantly affected by different fertilizer treatments. Maximum kernel protein content was found in treatment T4 which differ significantly from treatments T1, T2, T3 and T6 but is statistically at par with treatment T5. The improvement in nut quality might be due to improvement in physical properties of soil and increase growth of micro-organisms. The maximum kernel protein content in treatment T4 might be due to the fact that protein is made up of amino acid which is mostly constituent of nitrogen. Treatment T4 enhanced the uptake of nitrogen which must have assimilated in amino acid and finally into protein. The increase in oil content under combined fertiliser application may be due to increased availability of micronutrients and K that help in converting primary fatty acids to their end products by increased activity of acetyl CO-A.This increase in nut parameter with combined application of vermicompost and inorganic fertilisers might be due to the fact that vermicompost would have improved soil texture and provided micronutrients such as zinc, iron, copper, manganese etc. and better microbial establishment in the soil. The biological activity of the micro-organism would have helped the soil to become ready to serve zone for essential nutrients to plant root system. Zinc is involved in the biochemical synthesis of the most important phytohormone IAA through the pathways of conversion of tryptophan to IAA. Iron is involved in the chlorophyll synthesis besides being part of co-enzymes of respiratory chain reaction. Copper and manganese are important activators of co-enzymes. Organic manures in combination with inorganic fertilisers must have helped in metabolic changes through the supply of such important micronutrients and enzyme activation which ultimately must have improved nut parameters.

Among selections S1 showed highest kernel weight, which differed significantly from S3 and S4 but is at par with S2. Kernel percentage was maximum in S1 followed by S3 and S2. This difference in nut parameters among different selections might be due to their genetic make-up. Different selections showed marked differences with regard to, kernel protein content and maximum protein content was observed in selection S2 which differed significantly from S1, S2 and S3. Kernel fat content was highest in selection S2 followed by S1, S4 and S3. This difference in quality parameters of nut may be due to genetic constitution of individual selections.

Maximum leaf nitrogen content was observed in treatment T4 followed by T5, T1 and T3 while lowest was recorded in treatment T2 and T6. Phosphorus content of leaves differed significantly with different fertiliser treatments and recorded higher P content in treatment T2 which showed marked difference with all other treatments but is statistically at par with treatment T4. Potassium content also showed marked difference among different treatments. The highest K content was observed in treatment T4 followed by T1 and T5, while as lowest was found in treatment T6. The highest leaf N content in treatment T4 might be due to the fact that application of vermicompost alongwith NPK must have enhanced mineralization of organic nitrogen thus making more nitrogen available to the plants. Higher nitrogen can also be attributed to the improvement in soil aeration, better soil moisture retention in root zone, increased microbial nitrogen fixation due to the conjoint application and improved its availability to the plants. The addition of vermicompost improves physical properties of soil, moisture retention in soil rhizosphere, improved root development by mycelial network of arbuscular mycorrhizal fungi, thus increased the water absorption and hence improved nutrient contents of leaf Phosphorus applied to the soil in inorganic form get fixed but addition alongwith organic manure release P slowly due to microbial culture present in the soil, solubilised the fixed phosphorus and make it easily and readily available to plants.

It is evident from the data that maximum leaf calcium was observed in treatment T4 followed by T5 and T3, while as lowest was found in treatment T1. Highest magnesium content was recorded in treatment T4 and minimum in T1. This increased calcium and magnesium content in leaves might be due to the fact that vermicompost is a rich source of calcium and with the application of higher quantity of vermicompost, availability of Ca would have increased hence more leaf Ca.

IV. CONCLUSION

Thus it may conclude that conjoint application of organic and inorganic fertilizers showed substantial improvement nut quality and leaf macro nutrient status. Application of 75% RDF through inorganic coupled with 25% vermicompost was the best treatment for optimum nut quality and leaf nutrient status. Among the selections, S2 showed better performance with respect to yield and quality followed by selection S1 in walnut under Kashmir conditions.

Effect of integrated nutrient management on kernel weight (g) in walnut

| | | | 2011 | | | | | 2012 | | | | | Poolec | £ | |
|-----------------------------|------------|-----------------|---------------------|-----------------|--------------|----------|----------|-----------------|------|------|-----------------|------|--------|------|----------|
| Instment | \$1 | \$ ₂ | Sį | \$ ₁ | Mean | 5, | \$2 | \$ ₁ | S, | Mean | \$ ₁ | 51 | Si | 54 | Mean |
| τι | 6.48 | 6.73 | 5.33 | 6.37 | 6.30 | 6.53 | 673 | 5.84 | 6.43 | 6.38 | 6.47 | 6.73 | 5,77 | 6.40 | 634 |
| T ₂ | 6.15 | 6.07 | 5.53 | 5.71 | 5.87 | 6.61 | 6.13 | \$.70 | 5.88 | 6.06 | 6.38 | 6.10 | 5.62 | 5.80 | 5.97 |
| τ_1 | 6.07 | 6.55 | 5.78 | 5.99 | 6.10 | 6.67 | 6.68 | 5.78 | 6.45 | 6.45 | 6.37 | 662 | 5.78 | 6.23 | 6.25 |
| τ4 | 7,46 | 7.40 | 6.87 | 6.65 | 7.10 | 7.53 | 7.50 | 6.87 | 7.00 | 7.25 | 7.50 | 7,45 | 6.92 | 6.83 | 7.17 |
| τş | 7.21 | 6.52 | 8.57 | 5,90 | 6.55 | 7.21 | 6.76 | 6.63 | 6,07 | 6.67 | 1.21 | 6.64 | 5.60 | 5.99 | 6.61 |
| Τŧ | 6.47 | 6.15 | 5.86 | 5.67 | 6.04 | 6.70 | 639 | 5.89 | 6.01 | 6.25 | 6.58 | 6.77 | 5,88 | 5.84 | 6.14 |
| Mean | 6.63 | 6.57 | 6.05 | 6.05 | | 6.68 | 6.70 | 6.14 | 6.81 | | 6.75 | 6.63 | 5.09 | 6.18 | |
| C.D:00.05-(5) | | | 0.27 | | | | | 6.17 | | | | | 0.21 | 1 | |
| C.D:00.05 (T) | | | NS | | | | | 6.48 | | | | | 0.45 | | |
| C.D:00.05 (S×T) | | | N5 | | | | | N5 | | | | | N5 | | |
| lj = NPK(recom | nended as | ger gac | lage of p | ractices | (trough | inorgani | cfetilia | ŝ | | | | | 5 | : • | 9041)003 |
| 5 = 100 % throug | și natura | FYNIS | S-ver | nicorp | ost 25% + | pouitys | tarute) | 25%) | | | | | 5 | : : | 9044/009 |
| l ₁ = 358.MPK.fm | u¢ ing | anic fer | silærs+ | 25% fr | ध्रद्वं प्रश | ute (PI | ł, | | | | | | ş | : : | 9040/024 |
| L = 75%MP(tr | tugh intor | panic fer | tilærs i | 25%fr | rough ita | ture ve | rricons | estį | | | | | 5 | . : | 904U/04 |
| 5 = 75% MPK 6 | nuñ ira | anic fe | diren. | 155.6 | n di ra | a ra lo | de la | e rel | | | | | | | |

Te = 75% MPK through inorganic fertilizers + 25% through manute (1,% PFM + 1,% inemicompost + 1,% poultry manute)

Effect of integrated nutrient management on kernel percentage in walnut

| | | | | | | 0 | | | | | | | | | |
|------------------|-------|-----------------|-----------------|--------|--------|-----------------|-------|-------|-------|-------|-------|--------|----------------|--------|-------|
| | | | 2011 | | | | | 2012 | | | | | Pooled | ę., | |
| restrent | ŝ, | \$ ₁ | \$ _i | ŝ, | Maan | \$ _t | \$1 | 51 | \$4 | Mean | \$1 | S, | 1 ₁ | ŝ, | Mean |
| T _T . | 56.99 | 32.18 | \$3.57 | \$2.22 | \$3.74 | 55.75 | 52.45 | 55.71 | 52.81 | 53.41 | 56,88 | \$2.32 | 53,64 | 52,27 | 53.78 |
| Ť2. | 57,0t | 54,20 | 53.53 | 50.71 | 52.88 | \$2.01 | 54,20 | 55.55 | \$2.0 | 54.00 | 57.03 | 54.20 | 55.55 | 51.59 | 54,08 |
| T ₁ | 54.05 | 57.69 | 52.58 | \$2.20 | \$2.88 | 54.90 | 53,13 | 52.75 | 52.48 | 53.27 | 54.45 | 52.91 | 57,66 | 52.30 | 55.07 |
| Ta. | 58.01 | 55.45 | 55.05 | 53.32 | 55.45 | 58.54 | 55.62 | 55.37 | 9.6 | 55.67 | 58.08 | 15.53 | 55.21 | 53.43 | 55.56 |
| T ₄ | 56.77 | 54.33 | 54.16 | 52.40 | 54.42 | 56.85 | 56.22 | 54.44 | 52.60 | 54.53 | 56.81 | 54,28 | 54.30 | \$2.50 | 34.47 |
| T ₄ | 53,96 | 53.35 | 53,75 | 52.35 | 55.34 | 55.46 | 54,01 | 53,81 | 52.57 | 58.96 | 54.71 | 13.68 | 53,76 | 52.46 | 53.65 |
| Meen | 56.13 | 53.70 | 58.37 | 52,20 | | 56.50 | 51.94 | 53.93 | 52.65 | | 56.32 | 53.82 | 53.85 | 52,43 | |
| C.D58.05 (5) | | | 1.76 | | | 110000 | | 1.56 | | 1000 | | | 1.18 | | |
| C.D(8.85 (T) | | | 115 | | | | | 85 | | | | | M5 | | |
| C.058.85 (8×1) | | | 115 | | | | | NS. | | | | | NS | | |

| $T_{\rm c}~=~100$) econnected as per package of practices) through inorganic fertilizers | \$ = \$040002 |
|---|------------------|
| T_ = 100% through manute (FM 50%+ vermicompost 25%+ poultry manute 25%) | ž = sanion |
| Ty = 75K MPR through inorganic fertilizers + 25 % through manute (PIM) | 5; = 904004 |
| $T_{\rm c}~=~75\rm MPK$ frough inorganic leftiliers + 25 % frough narure (verticompost) | $\xi_i = 300041$ |

T₁ = 75 KIPK through inorganic fertilizers + 25 K through manure (poultry manure)

Te = 75 KIPK Brough inorganic Fertilizers + 25 % Brough manure (1)8 PIN + 1,8 iermicompost + 1,8 poultry manure)

Effect of integrated nutrient management on kernel protein content (%) in walnut

| 1200000 | | | 2011 | | | | | 2012 | | | | | Pooled | į. | |
|-----------------------------|-----------|----------|----------------|---------|------------|-----------------|---------|-------|-------|-------|-------|-------|-----------------|-----------------|-------|
| Trestment | \$1 | \$2 | S _E | S4 | Mean | \$ ₁ | \$1 | \$; | \$4 | Mean | 51 | \$2 | \$ _j | \$ ₆ | Mean |
| -T _T | 16.26 | 16.84 | 15.41 | 16.21 | 16.18 | 16.19 | 16.8 | 15.52 | 15.28 | 15.95 | 16.23 | 36.82 | 15,47 | 15,74 | 16.06 |
| Ť ₁ | 14.41 | 15.48 | 15.07 | 1433 | 14.82 | 15.15 | 15.48 | 15.23 | 15.33 | 15.30 | 14.78 | 15.48 | 15.15 | 14.83 | 15.06 |
| \overline{t}_{\pm} | 15.26 | 16.35 | 16.57 | 16.49 | 16.17 | 15.17 | 16.55 | 16.75 | 16.29 | 16.13 | 15,21 | 16.45 | 16.66 | 16.39 | 15.18 |
| 74 | 1879 | 18.81 | 17.58 | 17.8 | 18.25 | 18.85 | 30 | 17.63 | 17.17 | 18.38 | 18.82 | 18.54 | 17,61 | 17.88 | 18.31 |
| $\frac{\pi}{2}$ | 15.92 | 17.95 | 17:14 | 17,13 | 17.25 | 1721 | 17.85 | 17.14 | 17.23 | 17.36 | 17.06 | 17.9 | 17.14 | 17.18 | 17,32 |
| T ₄ | 15,32 | 16.74 | 15,29 | 16.1 | 15.86 | 15.52 | 扬乃 | 15.38 | 16.27 | 15.98 | 15.42 | 16.75 | 15,34 | 16.18 | 15.92 |
| Mean | 16.15 | 17.08 | 16.18 | 16.34 | | 16.35 | 17.08 | 16.28 | 16.39 | | 16.25 | 17.95 | 16.28 | 16.87 | |
| C.DS0.05 (S) | | | 0.70 | | | | | 0.62 | | | | | 0.58 | | |
| C.D58.05 (T) | | | 1.45 | | | | | 1.85 | | | | | 1.22 | | |
| C.050.05-(S×T) | | | NS | | | | | NS | | | | | NS | | |
| T ₁ = NPC(recor | rmended | a per pa | eckage of | pactice | s through | inogan | cíetile | ers | | | | | ş | : 9 | AU(02 |
| T ₂ = 100 % firm | ugh mans | re FM | il%+ne | miang | ast 25%+ | , thus, | narure | 5%) | | | | | ħ | : 9 | AU(08 |
| Ta = 758.0989 | raugh inc | rencie | rilæs- | -25%8 | rough ma | rure (Pl | M | | | | | | 2 | : 9 | 2004 |

 Tig
 75 % MPK through inorgenic Tetilizers + 25 % through manure (vernicompost)

 Tig
 75 % MPK through inorgenic Tetilizers + 25 % through manure (pountry manure)

T_E = 75 K NPK through inorganic fertilizers + 15 K through manute (JB PM + 1,8 vernicompost + 1,8 poulty manute)

Effect of integrated nutrient management on kernel fat content (%) in walnut

| | | | 2011 | | | | | 2012 | | | | | Pooled | ļ | |
|----------------|-------|----------------|--------|--------|-------|-------|--------|--------|-------|---------|-------|--------|--------|--------|--------|
| Treatment | \$1 | 1 _T | \$1 | ş, | Mean | 51 | \$1 | 5, | 5, | Mean | \$1 | \$2 | \$5 | \$c | Men |
| T ₂ | 57,34 | 58.12 | 35.83 | 56.57 | 56.95 | 57.6 | 58.15 | 55.09 | 56,67 | 57.13 | 57,47 | 56.13 | 56.01 | 56.82 | 57.0 |
| T ₂ | 54.97 | 56,73 | 51,73 | 55.9 | 54,71 | 57.3£ | 58.16 | 56.31 | 56,16 | 56.97 | 56.11 | 57.19 | 54.00 | 56.03 | 55.84 |
| 11 | 59.63 | 59,03 | 55.89 | 57,47 | 58.26 | 58:13 | 55.17 | 573 | 57,57 | 58.29 | 59.38 | 59.1 | 37.1 | \$7.52 | 94.2 |
| T ₄ | 61,4 | 62.76 | 57.47 | 59.07 | 60,18 | 61.85 | 62 | \$7.67 | 59.65 | 60.60 | 61.62 | 12.99 | \$7.57 | 58.37 | \$0.31 |
| Te | 59,01 | 60,27 | 57.27 | 58.21 | 58.68 | 58.01 | 60.58 | 57.27 | 58.35 | 58.80 | 59.01 | 90.48 | 57,27 | 58.28 | 58.75 |
| Te | 58.21 | 58.2 | \$2,78 | 56.36 | 56.39 | 58.34 | \$8.34 | \$4.52 | 56.61 | 56.95 | 58.28 | 58,27 | 53.65 | 56.45 | 16.67 |
| Mean | 58,48 | 59.1 | 55.35 | \$7.3E | 1 | 58.86 | 59.6 | 56.53 | \$7.5 | 1 | 58.64 | 59.35 | 55.94 | \$7.38 | 2225 |
| C.050.05(5) | 90000 | 0.85 | 2.55 | 1.55 | 1986 | 2211 | | 2.21 | 0 | - 12000 | | 0.0007 | 1.65 | | 0.50 |
| C.090.05 (T) | | | NS | | | | | 1.95 | | | | | 1.24 | | |
| C.050.05(5+T) | | | NS | | | | | NS | | | | | 115 | | |

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 T₂
 IPK (economended as per package of practices) through norganic fertilizers
 S₂
 SV4U000

 T₂
 IDD % through noruse (PMI SD% + vermiciampost 25% + poulby marve 25%)
 S₂
 SV4U000

 T₂
 IDD % through noruse (PMI SD% + vermiciampost 25% + poulby marve 25%)
 S₂
 SV4U000

 T₃
 IDD % through norganic fertilizers + 15 % through marve (PMI)
 S₃
 SV4U004

 T₄
 ITS % VPK through norganic fertilizers + 15 % through marve (vermiciampost)
 S₄
 SV4U040

 T₄
 ITS % VPK through inorganic fertilizers + 25 % through marve (poulby marve)
 Sv4U040
 Sv4U040

T₂ = 15 % NPK through inorganic fertilizers + 15 % through manute (1,3 PFM + 1,3 vermicompost + 1,3 poultry manute)

Effect of integrated nutrient management on leaf nitrogen (%)

| | | | 2011 | | | | | 2012 | | | | | Pooles | £ | |
|-----------------------------|------------|-----------|---------------------|-----------------|----------|-----------------|-----------|-------|-----------------|------|------|--------|--------|------|------------|
| Treatment | \$1 | 5, | \$5 | \$ ₁ | Near | \$ ₁ | \$1 | \$1 | \$ ₁ | Near | \$1 | \$1 | \$1 | \$į | Mean |
| Ť | 2.73 | 2.75 | 2.75 | 2.73 | 2.74 | 2.74 | 2.76 | 275 | 2.75 | 275 | 2.73 | 2.75 | 2.75 | 2.74 | 2,74 |
| T ₂ | 2.66 | 2.64 | 2,68 | 2.64 | 2.66 | 2.74 | 276 | 2.78 | 276 | 276 | 2.70 | 2,70 | 273 | 2.70 | 2.71 |
| T ₂ | 2,69 | 2,73 | 268 | 2.68 | 2.70 | 273 | 275 | 274 | 2.75 | 2.74 | 2,71 | 274 | 271 | 2.72 | 2.72 |
| T ₄ | 177 | 2.78 | 2.75 | 2.78 | 2.77 | 2.78 | 2.80 | 285 | 2.85 | 2.81 | 2.78 | 2.79 | 2,79 | 2.8t | 2.79 |
| Tg. | 2.71 | 25 | 2,74 | 275 | 2,74 | 273 | 2.76 | 2.76 | 2.78 | 276 | 2.72 | 2.75 | 2.75 | 2.77 | 2.75 |
| T ₄ | 2,68 | 2,69 | 2.68 | 222 | 2.68 | 2.70 | 273 | 2.76 | 2.75 | 274 | 2.69 | 2,71 | 272 | 2.74 | 2.71 |
| Mean | 2.71 | 2.72 | 271 | 2.72 | | 2.34 | 2.76 | 277 | 2.17 | | 2.72 | 2.74 | 2,74 | 2.75 | |
| C.D50.05 (S) | | | NS | 1 | | | | NS | , | | | ****** | NS | | |
| C.D:90.05(T) | | | 0.05 | | | | | 0.04 | | | | | 0.04 | | |
| C.D:90.05 (S=T) | | | 85 | | | | | N5 | | | | | NS | | |
| 1 ₁ = NPK (recom | nended a | per pac | kage of ; | practices | (trough | irorgani | c fertila | 85 | | | | | s | • | 58,41,002 |
| t₂ = 100%trau | gh manura | PYN S | 05+ier | nicompo | nt 15% + | poutry | nanure. | 585 | | | | | 5 | - | 50,005 |
| T ₂ = 75%N₽Kth | ough inor | pinic fer | tilærs+ | 25 K thr | ougt mar | ure (FM | 4 | | | | | | 5 | : | SKA U (024 |
| T ₄ = 75%NPK∰ | rough incr | pricte | főlærs i | 2586 | rough ma | ture (ve | micong | (teo | | | | | S | | 5041/040 |
| T₂ = 75%NPK 8 | raugh ina | nganic fe | rfilaers- | 25%8 | rough re | eure (pi | a yeta | rure) | | | | | | | |

Te = T5% NPK through inorganic feetilizers + 25% through manure (1/3 PIN + 1/3 vermicompost + 1/3 poultry manure)

Effect of integrated nutrient management on leaf phosphorus (%)

| | | | 2011 | | | | | 2012 | | | | | Poolec | ł. | |
|----------------|--------|-------|------|------|-------|----------------|-----------|----------------|------|-------|------|----------------|----------------|----------------|-------|
| Independent | \$1 | \$2 | S, | 5. | Mean | S ₁ | \$1 | S ₁ | 51 | Mean | 51 | S ₂ | S ₁ | S _E | Maan |
| T ₄ | 0.25 | 6.24 | 0.25 | 0.24 | 6.25 | 0.16 | 0,25 | 0.26 | 0.25 | 0.25 | 0.25 | 0.26 | 0.24 | 0.25 | 0.25 |
| τr | 0.29 | 0,29 | 0.26 | 0.26 | 0.28 | 0,3 | 0.3 | 0.31 | 0.5 | 0.30 | 0.5 | 0.29 | 0.29 | 0.28 | 0.29 |
| T ₄ | 0.24 | 0,39 | 0.25 | 0.25 | 0.24 | 0.25 | 0.25 | 0.25 | 0.26 | 0.25 | 0.25 | 0.34 | 0.25 | 0.25 | 0.25 |
| Τ4 | 0.21 | 0.80 | 0.72 | 0.23 | 0.36 | 0.27 | 0.26 | 0.27 | 0.28 | 0.27 | 0.24 | 0.53 | 9,25 | 0.25 | 0.32 |
| Té | 0.27 | 8.26 | 0.25 | 0.25 | 0.26 | 0.28 | 0.27 | 0.26 | 0.28 | 0.27 | 0.27 | 6.27 | 0.26 | 0.27 | 0.27 |
| Te | 0.25 | 0.25 | 0.25 | 0.22 | 0.24 | 0.26 | 0.76 | 0.26 | 0.27 | 0.26 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Mean | 0.25 | 0.34 | 0.25 | 0.24 | | 0.27 | 0.28 | 0.27 | 0.26 | | 0.26 | 0.31 | 0.26 | 0.25 | |
| C.058.05 (S) | 11.185 | 1.113 | 85 | | 11236 | 1211.7 | 938) 9 | NS | 1 | 32//3 | 2015 | 1985 | N5 | | 10000 |
| C.058.05 (T) | | | 0.07 | | | | | 0.02 | | | | | 0.02 | | |
| C.058.05 (S×T) | | | 15 | | | | | 115 | | | | | 115 | | |

14

5 = 934040

| $T_{\rm g}~\approx~$ MPK (recommended as per package of practices) through inorganic levillaers | 5 ₁ = 3844,002 |
|---|----------------------------|
| 7₂ = 100% through manure (PIW 50% + vermicompost 25% + poultry manure 15%) | 5 ₀ = 56.44,008 |
| % = 15% MAX through inorganic fertilizers + 25 % through manute (PM) | S ₀ = 58.44,004 |
| $T_{\rm c}~=~75$ % MPK through inorganic fertilizers + 25 % through manure (vernicompost) | S ₂ = 3640(040 |
| Ty = 75% MPK through inorganic fertilizes + 25% through manure (poultry manure) | |

Te = 75% MPK through inorganic fertilizers + 25% through manure (1,13 PIM + 1,13 vernicompost + 1,13 poultry manure)

Effect of integrated nutrient management on leaf potassium (%)

| | | | 2011 | | | | | 2012 | | | | | Pooled | ŧ | |
|-------------------------------|-----------|-----------|----------|----------|-----------|----------|----------|------|------|-------|------|------|----------------|-----------------|---------|
| Trestment | S1. | \$2 | \$1 | 5, | Mean | 51 | 52 | \$1 | \$4 | Mean | 51 | \$2 | 51 | \$ ₄ | Mean |
| T ₁ | 163 | 166 | 1.66 | 1.68 | 1.95 | 164 | 1.65 | 10 | 1.69 | 1.67 | 163 | 1.65 | 1.67 | 1,69 | 1.66 |
| T ₁ | 1.42 | 141 | 1.16 | 1.44 | 1.41 | 1.54 | 1.69 | 1.68 | 1,71 | 1.68 | 153 | 1.56 | 1.57 | 1.57 | 1.55 |
| T ₁ | 1.55 | 149 | 147 | 1.51 | 151 | 159 | 151 | 1.57 | 1,60 | 157 | 157 | 150 | 1.52 | 1.56 | 154 |
| T ₄ | 1.75 | 169 | 1.69 | 1.68 | 1.69 | 1.71 | 1,74 | 134 | 171 | 1.73 | 1.70 | 171 | 1.72 | 1.70 | 1.71 |
| T _t | 1.56 | 164 | 1.65 | 1.64 | 1.62 | 1.61 | 1.67 | 1.68 | 1.68 | 1.66 | 1.59 | 1.66 | 1.67 | 1.65 | 1.64 |
| T4 | 1.52 | 151 | 1.47 | 155 | 151 | 1.39 | 153 | 1.52 | 1.58 | 157 | 1.95 | 1.52 | 1.52 | 1.56 | 154 |
| Nean | 1.56 | 157 | 1.55 | 1.58 | | 1.63 | 1.62 | 1.66 | 1.67 | | 1.59 | 1.60 | 1.61 | 1.62 | |
| C.DSD.05 (5) | 101000 | 19807 | MS | 1000 | 00000 | | | 15 | 1 | 19900 | 0.92 | 0.00 | NS | | 202.00 |
| C.DSD.05 (T) | | | 0.16 | | | | | 0.04 | | | | | 0.05 | | |
| C.DS0.05 (S×T) | | | NS | | | | | NS | | | | | N5 | | |
| T _E = NPK(recomm | ended as | per pad | age of p | ractices | though | norgeni | terilae | 5 | | | | | Sj | = \$ | KAU/002 |
| 7 ₂ = 100 K throug | t manure | (PIM SC | 86+sert | ricompo | st 25%+) | ocity r | ranure 2 | 584 | | | | | S ₁ | = \$ | K4U/008 |
| l ₃ : 75% MP(fra | uphinang | poic lert | liaers+) | 5%th | अहरे तहर | ure (Fr) | Ē. | | | | | | S | = 5 | KAU/024 |
| T _e = 75%MPKtm | ough inon | gnicter | tilaers+ | 5%tr | olgh mar | ute (ver | nicorp | st | | | | | ş | ÷ 5 | KAU/D40 |
| ls ≈ 75% MPK thr | cugh incr | ganic fer | files+ | 25%fr | rough mai | ure (po | dty na | ture | | | | | | | |

Te 5% MPK through integratic Tertilizers + 25% through manute (1,0 PM + 1,0 vernicompast + 1,0 poulty manute)

Effect of integrated nutrient management on leaf calcium (%)

| | | | 2011 | | | | | 2012 | | | | | Poolec | 1 | |
|----------------|------|------|------|------|------|----------------|------|------|------|------|------|------|--------|------|------|
| Insatznent | \$1 | \$2 | \$j | \$4 | Mean | S _t | \$2 | \$j | 54 | Mean | \$1 | \$2 | \$j | 54 | Mean |
| Ťs | 2.26 | 2.26 | 2.25 | 2.24 | 225 | 2.27 | 2.25 | 226 | 275 | 2.25 | 127 | 1.15 | 2.25 | 2,24 | 2.25 |
| Tz | 2.31 | 2.51 | 2.31 | 2.32 | 2.81 | 137 | 2.58 | 2.35 | 2,34 | 2.36 | 2.34 | 2.35 | 2.33 | 233 | 2.34 |
| T ₁ | 2,43 | 2,42 | 2.42 | 2.44 | 14 | 2.44 | 2.42 | 2,43 | 245 | 2.44 | 2,44 | 2.42 | 243 | 2.45 | 2.48 |
| T4 | 257 | 2.58 | 2.58 | 2.57 | 2.58 | 2.58 | 2.59 | 2.61 | 2,59 | 2.59 | 1.58 | 158 | 2.6 | 2.58 | 2.58 |
| t _s | 2.54 | 1.56 | 2.54 | 2,57 | 2.55 | 2.55 | 2.56 | 2.55 | 2.58 | 2.56 | 2.55 | 256 | 2.55 | 2.58 | 2.56 |
| Té | 2.45 | 2,48 | 2,44 | 2.44 | 2.44 | 2.45 | 2.44 | 2.45 | 2,45 | 2,45 | 2,46 | 2.44 | 245 | 2,44 | 2,45 |
| Mean | 243 | 2.42 | 2.48 | 2.43 | | 2.45 | 2.43 | 2.44 | 2,44 | | 2,45 | 2.42 | 2,48 | 2.44 | |
| C.DSD.05 (S) | | | MS | 2 | | | | NS | | | | | NS | | |
| C.0:90.05 (T) | | | NS | | | | | 0.24 | | | | | NS | | |
| C.DS0.05 (5×T) | | | MS | | | | | NS | | | | | NS | | |

| s ₁ = 9040002 |
|---------------------------|
| s _e = scalidos |
| s _t = skaukta |
| s, = skaljoki |
| |

To = 75% MPK through inorganic fertilizers + 25% through manure (poultry narure)

Te = 75% MPK through inorganic fertilizers + 25% through manute (L)9 PM + 1,8 vermicompost + 1,8 poultry manute)

Effect of integrated nutrient management on leaf Magnesium (%)

| | | | 2011 | | | | | 2012 | | | | | Poole | l | |
|----------------------------|------------|-----------------|----------|----------|-----------|------------|-----------|-------|------|------|------|------|-------|------|----------|
| Insitment | \$1 | \$ ₁ | 5, | 54 | Mean | \$1 | \$1 | \$1 | \$4 | Mean | \$1 | \$1 | \$1 | 54 | Mean |
| T _L | 85 | 8,49 | 0.51 | 0.5 | 0.50 | 0.51 | 0.5 | 0.52 | 0,51 | 0.51 | 8.51 | 0.5 | 0.51 | 8.51 | 6.51 |
| T ₂ | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.52 | 0.53 | 0.53 |
| f2 | 0.53 | 0.54 | 653 | 0.54 | 0.54 | 0.54 | 0,55 | 0.54 | 6,54 | 0.54 | 0.54 | 0.55 | 0.54 | 0.54 | 0.54 |
| T ₄ | 0.55 | 0.55 | 0.54 | 8.56 | 0.56 | 0.57 | 0.57 | 0.56 | 857 | 0.57 | 0.56 | 0.56 | 0.55 | \$57 | 0.36 |
| 1 | 0.57 | 0.55 | 654 | 0.55 | 0.55 | 0.57 | 0.55 | 0.55 | 0.5E | 0.56 | 0,57 | 0.55 | 6.93 | 6.56 | 0.55 |
| T ₄ | 0.52 | 0.91 | 0.52 | 0.51 | 0.52 | 0.53 | 0.52 | 0.53 | 0.52 | 0.53 | 0.53 | 0.52 | 0.52 | 0.52 | 0.52 |
| Neas | 0.54 | 0.52 | 8.58 | 0.53 | | 0.56 | 0.58 | 0.54 | 0.54 | | 0.55 | 0,58 | 0.53 | 0.54 | |
| C.D50.05 (5) | | | NS | | | | | NS | | | | | NS | | |
| C.D50.05 (T) | | | 15 | | | | | 0.05 | | | | | 115 | | |
| C.DSD.05 (5× T) | | | 15 | | | | | N5 | | | | | 15 | | |
| T ₁ = NPK (reco | mented | as per p | iciage d | practice | sitnag | h inorgan | ricfettil | 25 | | | | | | : - | 9.44(00) |
| T₁ = 100%tha | uşt rəru | te (PIN | 50%+ve | ernicom | pest 25%- | + poelitri | กลามาย | 25%) | | | | | | : | 504008 |
| T ₁ = 75%NPKt | hrough inc | ngari c fe | rfilærs | 1256 | rough ma | nure (P | (V) | | | | | | 3 | ig = | 90,004 |
| T ₄ = 75%NPK1 | hrough in | organic f | etilaers | +25%8 | haugh m | anure v | ermicara | pesti | | | | | 3 | 1 - | 90100 |
| 6 | a on | | 100 | | 1.07 | - 53 | 55 | | | | | | | | |

T₂ = T5 % NPK through inorganic fertilizers + 25 % through manure (poultry manure)

Te = 75 SNPK through integenic fertilizers + 25 Schrough manute (1/3 PVN + 1/3 vernicompost + 1/3 poultry manute)

New Records of Bloodsucking Flies Associated with Wild Birds of Haftad-Gholleh Protected Area, Iran (Diptera: Hippoboscidae, Calliphoridae)

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Abstract— We have studied the parasitic flies of wildlife of Haftad-Gholleh Protected Area, Iran, for the first time and report here the three hematophagous fly species of birds: the louse fly Ornithophila metallica (Schiner) (Hippoboscidae), and bird nest flies Trypocalliphora braueri (Hendel) and Protocalliphora azurea (Fallen) (Calliphoridae). The genera and species O. metallica and T. braueri are new to Iran

Keywords: Avian myiasis; Louse flies; Ornithophila metallica; Trypocalliphora braueri; Protocalliphora azurea; Blow flies

I. INTRODUCTION

Avian myiasis-causing flies and bird's bloodfeeding ectoparasite flies mainly belong in the family's Calliphoridae and Hippoboscidae. The family Hippoboscidae, commonly known as louse flies, consists of 213 hematophagous species of birds and mammals worldwide [1]. This family is known in Iran only by the single species Pseudolynchia canariensis (Macquart), pigeon fly that has been repeatedly recorded from various cities across the country [2-5]. Aside from being a nuisance to their hosts, hippoboscids are capable transmitters of pathogenic and parasitic agents, including avian trypanosomes and mammals' bacteria, causing serious diseases in wild birds [6] and ruminant animals [7,8]. They are also the only known vectors of apicomplexan parasites of the genus Haemoproteus to birds and transmitters of filarial nematodes to domestic and wild mammals [9,10].

The majority of myiasis-inducing species belong to the family Calliphoridae, esp. subfamily Chrysomyinae, whose members are known as important facultative and obligatory parasites. Bird myiasis records are not as frequent as mammals' most likely due to the inaccessibility of the hosts. With respect to Iran, the reports of avian myiases have been poorly documented [11,12], mainly because of difficulties in larval identification. Although the said technical problem often necessitates the rearing of the maggots for a reliable identification at adult stage, in a recent case of avian wound myiasis in southwestern Iran the myiatic agent was successfully identified at larval stage [13]. The genera Protocalliphora Hough and Trypocalliphora Peus contain specialist bird nest parasites whose larvae feed on the blood of nestling birds through tunneling under their skin, causing a type of myiasis called subcutaneous myiasis, and eventually leading to heavy damages to the tissues or death of young birds [14]. The species P. azurea (Fallen) is widely spread in the Palaearctic region and remains the only species of birds' subcutaneous myiasis agents that has been recorded from Iran so far [15].

II. MATERIAL AND METHODS

Haftad-Gholleh Protected Area covers an estimated area of 97,400 hectares (240,680 acres) and is home to a large number of vulnerable mammal and bird species (Figure 1). Using Malaise traps, the specimens were collected in 75% ethyl alcohol and preserved at the Hayk Mirzayans Insect Museum (HMIM), Tehran, Iran. In case of the examination of male genitalia, we detached the whole abdomen to clear it in hot 10% KOH and then washed it lightly in glacial acetic acid



Figure 1: A general view of Chekab valley, Haftad-Gholleh protected area, Iran.

New Records of Bloodsucking Flies Associated with Wild Birds of Haftad-Gholleh Protected Area, Iran (Diptera: Hippoboscidae, Calliphoridae)

to remove the base. After dissecting the male genitalia, the abdomen was glued back to its original place and the genitalia transferred to a microvial and pinned below the associate specimen. Specimen data: $13^{-}19^{-}$ Ornithophila metallica; 233 399 Protocalliphora azurea; 19Trypocalliphora braueri; Iran: Markazi province, Amr-abad village, Haftad-Gholleh Protected Area, Chekab valley, 2219 m, 34°07′05.3"N 050°16′25.3"E, 28 May-15 June, 2016, Malaise trap near pool, E. Gilasian & M. Parchami-Araghi. Birds of haftad-gholleh protected area Hafted-Gholleh is home to an estimated 71 species within 26 families of wild birds and serves as a sanctuary for a number of migrating birds as well. We have listed the following common avian taxa of this area to underline the impact of hematophagous flies on the bird fauna: Monticola solitarius (L.) (blue rock thrush), Accipiter spp. (hawks), Falco spp. (falcons and kestrels), Coturnix spp. (quails), Columba spp. (pigeons), Cuculus spp. (cuckoos), Coracias spp. (rollers), Merops spp. (bee-eaters), Upupa spp. (hoopoes), Galerida spp. (larks), Hirundo spp. (passerines), Muscicapa striata (Pallas) (spotted flycatcher), Emberiza melanocephala Scopoli (black-headed bunting), E. cia (L.) (rock bunting), E. citrinella L. (yellowhammer), Turdus spp. (true thrushes), Motacilla spp. (wagtails), Lanius spp. (typical shrikes), Parus spp. (tits), Passer spp. (sparrows.), Sturnus spp. (starlings), Corvus spp. (crows), Pica pica (L.) (Eurasian magpie), Ammoperdix spp. (partridges), Gypaetus spp. (vultures), Aquila spp. (eagles), Athene noctua (Scopoli) (little owl), swifts (Apodidae) and woodpeckers (Picidae) [16].

III. RESULTS AND DISCUSSION

We, for the first time, collected three species of bloodsucking flies from Haftad-Gholleh Protected Area where strictly feed on wild birds. The recorded fly species are as follows: Ornithophila metallica (Schiner), Protocalliphora azurea (Fallen) and Trypocalliphora braueri (Hendel). Both O. metallica and T. braueri are new genus and species records for the Iranian fauna.

Ornithophila metallica (Schiner)

Both sexes of the hippoboscid O. metallica are hematophagous ectoparasites and ingest blood from a wide variety of birds (Figures 2 and 3). Maa [17] listed the host birds for the two Palaearctic members of Ornithophila Rondani, O. metallica and O. gestroi Rondani, and categorized the former as a species with "having high population density and very wide host and distributional ranges" and found the latter to be a species with "low population density and much more restricted host/ or distributional ranges." O. metallica is widely distributed in the Old World including Iran's neighboring countries of Pakistan, Afghanistan and Turkey (Figures 4-10) [17]. These species are commonly known as bird blow flies or bird nest flies. Trypocalliphora is a monotypic genus, with a single Holarctic



Figure 2: Ornithophila metallica (Schiner): Dorsal view.



Figure 3: Ornithophila metallica (Schiner): Lateral view.

species T. braueri which differs from its closest related genus Protocalliphora in having additional notopleural setae. Although some Dipterists consider Trypocalliphora a subgenus within Protocalliphora [18], other calliphorid taxonomists argued that Trypocalliphora is to be considered as a valid genus [19-21]. These species display different types of parasitic strategies as the larvae of P. azurea feed on the blood of young birds of the order Coraciiformes and remain on the surface of the birds, but the hematophagous larvae of T. braueri infest nestlings of the order Falconiformes and burrow beneath the skin of their hosts, causing a form of parasitism called subcutaneous myiasis [18].



New Records of Bloodsucking Flies Associated with Wild Birds of Haftad-Gholleh Protected Area, Iran (Diptera: Hippoboscidae, Calliphoridae)

Figure 4: Protocalliphora azurea (Fallen): Dorsal view



Figure 5: Protocalliphora azurea (Fallen): Lateral view.



Figure 6: Protocalliphora azurea (Fallen): Male genitalia, lateral view



Figure 7: Protocalliphora azurea (Fallen): Male genitalia, posterior view.



Figure 8: Protocalliphora azurea (Fallen): Male sternite





Figure 10: Trypocalliphora braueri (Hendel): Lateral view

IV. CONCLUSION

Haftad-Gholleh Protected Area, like most of Iranian natural habitats, has been experiencing destructive interventions from illegal human activities, including poaching, that aggravating the vulnerability of its wildlife to epidemics and parasites as an ovine rinderpest epidemic heavily emaciated the population of wild goats of this area in 2015. In terms of birds, the sprawling build-up areas, power lines and transmission towers pose significant threats to migrating birds of the area and nearby parks. In a framework of a faunistic project, we are working to document the insect diversity of Haftad-Gholleh Protected Area to underscore the need for improving the conservation measures and policies towards a standard protection of the area and its fauna and flora.

V. ACKNOWLEDGEMENTS

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Abstract— The potentials of the horticulture sub-sector in solving the prevailing food crisis in Nigeria remain largely untapped because of inefficient use of production resources. The study examined socio-economic determinant of sweet melon production in Balanga local government area of Gombe state. A two stage sampling procedure was used in drawing a sample size of sixty sweet melon farmers from three communities. Data collected were analyzed using both descriptive and multiple regression models. The result revealed that the majority of the farmers were male, married, and literate, with small holding. A coefficient of multiple determinants, R2 of 0.765 indicated a high relevance of the input in explaining the observed variation in melon production. The regression co-efficient of experiences, farm size and house hold size were significant at 5% level of probability, therefore, making the three factors important determinant of output from sweet melon production. Based on findings from the study, it is recommended that government should provide credit facilities with less bureaucracy and low interest rate to producers; this will enable farmers to increase their farm size and in turn increase output

Keywords: Socio-economic; Determinant; Sweet melon; Production; Balanga

I. INTRODUCTION

Sweet Melon (Cucumis melon L.) is a warm, long season horticultural crop that is adapted to all climatic zones. Annual world production of melon has increased from 9 million (700,000 ha) in 1992 to 22 million (1.2 million ha) in 2002. Major producing countries are China with 400,000 ha, West Asia (Turkey, Iran, Iraq) 200,000 ha, the America (United State, Mexico, Central and South American countries) 165,000 ha, Northern African (Egypt, Morocco, Tunisia 110,000 ha. Southern Asia (India, Pakistan, Bangladesh 100, 000 ha). European Union (Spain, Italy, France Greece, Portugal) 95,000 ha, Romania 50,000 ha Japan 13,000 ha and Korean republic 11,000 ha FAO [1]. Each country has its own specific melon cultivars of the crop which are sold in local markets. In Africa, it is an economic crop for urban markets, grown in drier region and non-high lands. Statistics on production and marketing in Africa are not available for most countries except Cameroon (3500 ha) and Sudan (1200 ha), Senegal and surrounding countries are exporting the melon during the winter to Europe FAO [1]. Mature fruits of sweet melon cultivars are usually consumed fresh for the sweet and juicy pulp. The pulp is also mixed with water and sugar or sometimes with milk, and served as a refreshing drink or made into ice cream. Immature fruits of non-sweet types, including snake melon are used as a fresh cooked or pickled vegetable. They can also be stuffed with meat, rice and spice, and fried in

oil. Sweet melon is often confused with cucumber and often used as such. The seeds are eaten after roasting they contain edible oil. The Hausa people in Nigeria grind the kernels to a paste and make it into fermented cakes. The young leaves are occasionally consumed as a pot herb and in soups. The leafy stem and also the fruit provide good forage for all livestock. In reunion and Mauritius a decoction of seeds and roots is used as a diuretic and vermifuge [2]. Sugar content and aroma are important factors determining the quality of sweet melon. Esters derived from amino acids are important components of the characteristics flavour, sulphur containing compound also play a role. Several C-9 alcohol and aldehydes, including Z-non 6-Enal, are characteristics of the melon aroma. To get the best aroma fruits should be harvested only 2-3 days before they are fully ripe. The edible seed kernel contains approximately 46% of yellow oil and 36% protein [3]. Given the increasing popularity and importance of sweet melon as a desert to many households in Nigeria, it is imperative to understand the problems facing the producers of sweet melon. Olukosi and Isitor[4] identified several possible factors that are constraints to production of fruit and vegetables. These include low farm gate price, high cost of labor input, inadequate supply of improve inputs and inefficient marketing system Due to the increasing demand and importance of sweet melon, venturing in to its enterprise holds promising potentials. However, there is little or no attention given to sweet melon production technology while only a few is done on its

marketing as well. Thus, there is need for further investigation into socio-economic determinants of sweet melon production in Balanga local government area of Gombe state and also determine the factors influence sweet melon production in the study area.

Problems of sweet melon production

According to Adamu et al. [5], in his studies of profitability of sweet melon production and marketing in Kirfi Local Government Area; Bauchi State shows that majority (87.5%) of the producers and marketers face the problem of transportation due to poor feeder roads, similarly (50%) and (62.5%) of the producers and marketers experienced inadequate capital to improve their productivity and farming business respectively. Moreover, 75% and 37.5% of the producers and marketers complained of glut (on-season problem) respectively. It is noteworthy that about 31.3%, 56.3% and 81.3% of all the producers complained of inadequate improved seeds, labor, disease attack as well as low farm gate price respectively. This indicated that water melon producers in the study area undergo the water melon business under unpredictable situation as was also reported by Singh [6], for vegetable and tomato producers in the semi-arid regions and Yamaltu Deba Local Government Areas of Gombe State, Nigeria. Similarly, other authors reported many problems that are limiting the fruit production as, Dieter [7], shows that in his report, fluctuation in the price of fruit also contributes a major problem in its business. Agricultural production has been increasing at (2%) two percent per year while demand has been increasing at slightly less rapid rates. This means that agricultural prices income have to be low. Similarly Adegeve and Dittoh [8], reported that prices of fruits and other agricultural produce are often manipulated by speculators with adverse effects on the producers and the consumers there is too much seasonal variation in price due mainly to lack of storage facilities and insufficient supply. Also according to the Abbott [9], shows that most fruit do not have adequate storage or ware housing facilities. The existing infrastructural facilities such as access roads, transport, market storage and processing are far from being adequate Singh [6]. Food processing plants are virtually none existing. These pose a serious problem for effectively processing of agricultural producers. Hence, affect the effective production of fruit and other agricultural produce. In the same studies carried by Adegeve and Dittoh [8], also reported that some marketing problems can be traced to lack of information about production, for example sellers may not be able to identify source of supply of commodities, while producers may curtail their production as a result of poor sales. Therefore, there must be an information system where buyer and seller can be aware of each other problems.

Also according to them, the problem of transport in marketing of fruit and vegetables has many dimension, in some cases there are insufficient vehicles to carry goods from farm (purchase place) to markets (serving places) and from rural market to the towns. In other cases, transport accounts for a large proportion of production costs. In some instances there are no roads where they exist they might be seasonal. Feeder roads are usually few and in most cases have to beconstruction and maintained by communal efforts. Adegeve and Dittoh [8] reported that all effort has geared towards producing more without thinking about how to market them. There is need to know about new technologies in food storage preservation and marketing. Thus, there is need for research on consumers demand and preferences, handling and packaging to reduce lose in fruit and vegetable as well as in other agricultural produce marketing.

Some of these problems reported by Singh [6] include:

- Problems of price variability.
- Inadequate processing and storage facilities.

• Lack of information about production and marketing.

- Lack of transport facilities.
- Lack of uniform weight and measures.
- Inadequate research on fruit market, etc.

II. METHODOLOGY

Area of the study

Gombe state was created on 1st October, 1996 by the military Government headed by General Sani Abacha, the commander-in-chief of Armed forces of the federation. It was formally under Bauchi state. The state has eleven local government councils with its administrative headquarters in Gombe. Gombe state shares common boundary with Borno state in the east, Bauchi state by the west, Yobe state by the north and Adamawa state by the south. It is located in latitude 10°15' north and longitude 110 east. Her population is estimated of 1.5 million covering the area land mass of about 20, 265 square kilometer [10]. The area of the study was Balanga Local Government and it has covered three distinct areas in the local government namely, Maidara, Daban Magarya and Bakasi. The study area is located in coordinates 9058'N 11°41'E. Balanga is a local government area in the south east of Gombe State, Nigeria bordering Adamawa State. It's headquarters Talasse. It has an area of 1,626 Km2 and a population of 212,549 at

the 2006 census. The climate condition of the local government area is characterized by two distinct seasons, dry and wet. The hottest months are March and April which recorded up to a temperature of about 40-42°c while the

coldest months are December to February with a minimum temperature of about 20-22°C and the area received the mean annual rainfall of 321.4 mm/annum [11]. Sample procedure and sample size The data for this study were generated through the use of structured questionnaire complemented with data were collected from sixty sweet melon producers in Balanga local government area of Gombe state. Purposive sampling technique was used to select three villages and proportional sampling was used in selecting twenty respondents from each village. Twenty questionnaires each were administered to sweet melon producers in Maidara, Daban Magarya and Bakasi. The data were collected by the researcher withhelp of two well trained personnel's within the period of eight weeks, beginning from June-July 2015.

Method of data analysis

The statistical tools employed in this study include descriptive statistics analysis, such as frequency distribution, percentage and mean were used for the analysis of socio-economic characteristics of sweet melon producers. The relationship between the socio-economic characteristics and production of sweet melon was determined using multiple regressions model. The model was specified as:

Y=f(X1,X2,X3,X4,X5,X6,X7,X8,u)

Where,

Y=Output in Pyramid/Bill (Kg)

X1=Age (Years)

X2=Years of Experience (Years)

X3=Farm Size (Ha) X4=Household Size (No. of Person) X5=Level of Education (Years) X6=Marital Status (1=Married, others=0) X7=Extension Contact (Yes=1, No=0)

X₈=Membership of Cooperative (Yes=1, No=0)

U=Constant term

The above model was specified and estimated in four functional forms. The functional forms tried include the linear, exponential, semi-log and double-log. The functional form which gives the best fit in term of R2 value was selected because it agree with a priori expectation.

III. RESULTS AND DISCUSSION

Socio-economic characteristics of sweet melon producers

Table 1 shows that majority (98.3) of the sweet melon producers in the study area were male. This implies that the participation of female in sweet melon production in the study area is very low. This agrees with the finding of Adamu et al., [5] who reported that males dominated the farming aspect of water melon in Kirfi Local Government Area of Bauchi State Nigeria. This is because most of the people in the study area are Muslims and "Purdah" is practice for female and house wives (not allowed in to farming) as enshrined in the culture of northern Nigeria. On marital status of the respondents, the results revealed that 95% of the sweet melon producers in the study area were married while only 5% were single in the study area. This is in line with study made by Atman et al., [12] which revealed that (98.99%) of vegetable marketers in Yamaltu Deba Local Government of Gombe State, Nigeria were married. This is because majority of the producers in the area were Muslims and their religion permits them to marry at early ages. It is clear from the table that majority of the respondents were in the age category of 31-45 years representing 61.7% followed by those within the range of 16-30 years with 20%, those within the range of 46-60 years represents 18.3%, none of the respondent fall within the age of 61-75 years. The result further shows that a minimum of 19 and maximum of 53 years was recorded with a mean ages of the producers as 39 years, standard error of the mean was found to be 0.88% and 54.3% co-efficient of variability, implying that there is variability in the age of the respondents. The result depict that production of sweet melon in the study area are mostly carried out by relatively middle aged people. This category of people is believed to be more flexible in their decision making and adopt new ideas more readily, and the aged are risk-aversive. The results also indicated that 50% of the respondents attended Qur'anic schools, 23.3% had primary education, 16.7% had secondary education, while 8.3% had no formal education and 1.7% had attained tertiary education. The literacy level among the respondents was relatively high. It is expected that the sweet melon producers in the study area could readily adopt new ideas of agricultural production and can make accurate use of production decision. This is in line with the study made by Atman et al., [12] which reported that literacy status of respondents is necessary to explain the strength or weakness observed in their management ability and adoption of innovation. Educations are an important tool in increasing adoption of improved farm practices and ultimately improve in farm production and productivity. On occupation of the respondents, the result indicated that 43.3% of the sweet melon producers in the study area were engaged in farming alone; 33.3% engaged in farming and

22

trading/business. 8.3% were into farming and livestock rearing while, 8.3% were sweet melon producers and civil service, 6.7% of the respondents were engaged in farming and others artisan activities such as driving, mechanic and car washing. The result means that majority of the respondents were full time farmers in the study area. The results revealed that majority had between 11-15 and 16-20 persons in their

| | Frequency | Percentage |
|-------------------------------|---------------------|------------|
| | Sex | |
| Male | 59 | 98.3 |
| Female | 1 | 1.7 |
| | Marital Status | |
| Married | 57 | 95 |
| Single | 3 | 5 |
| | Age | |
| 16-30 | 12 | 20 |
| 31-45 | 37 | 61.7 |
| 46-60 | 11 | 18.3 |
| | Educational Level | |
| No formal Education | 5 | 8.3 |
| Quaranic Education | 30 | 50 |
| Primary Education | 14 | 23.3 |
| Secondary Education | 10 | 16.7 |
| Tertiary Education | 1 | 1.7 |
| | Occupation | |
| Farming alone | 26 | 43.3 |
| Farming and Trading | 20 | 33.3 |
| Farming and Livestock | 5 | 8.3 |
| Farming and Civil Services | 45 | 8.3 |
| Farming and Artisanship | 4 | 6.7 |
| | Household Size | |
| 1-5 | 12 | 20 |
| 6-10 | 12 | 20 |
| 11-15 | 13 | 21.7 |
| 16-20 | 13 | 21.7 |
| 21-26 | 9 | 15 |
| 27-30 | 1 | 1.6 |
| | Years of Experience | |
| 1-5 | 56 | 93.3 |
| 6-10 | 4 | 6.7 |
| | Farm Size | |
| 0.5-1 | 29 | 48.3 |
| 1.5-3 | 31 | 51.7 |
| | Source of Finance | |
| Family and Friend | 53 | 88.3 |
| Bank Loan | 4 | 6.7 |
| Cooperative Societies | 3 | 5 |
| | Cropping Pattern | |
| Intercropping | 26 | 48.3 |
| Sole Cropping | 20 | 33.3 |
| Both | 14 | 23.4 |

Table 1: Socioeconomic characteristics of respondents (Source: Field Survey, 2015).

households, representing 21.7% each, Household size of 1-5 and 6-10 persons also had 20%. The mean households' size

of the respondents was found to be 13 persons with standard error of the mean of 0.25, and co-efficient of variability of 23.7%. The result clearly indicated that, the minimum number of persons in a household was found to be one with a maximum of 27 persons in the study area. The low variability among the household size is most likely attributed to polygamous nature in Northern Nigeria, similar to what was reported by Umoh [13] in Bauchi metropolis. The result also revealed that minimum year of experience was found to be 1 year with the maximum of 6 years. The mean years of experience of respondents was found to be 3.1 years, standard error of the mean value of 0.12 and the co-efficient of the variability of 28.7%. This means that majority of the producers in the study area had not stayed long in the business because the fruit production was newly introduced to the area. The result indicated that majority (51.7%) of the respondents had a farm size category of 1.5-3.0 hectares following by those in the category of 0.5-1.0 hectare representing 48.3%. The result further shows that a minimum of 0.5 and maximum of 3 hectares was recorded with mean hectares of 1.5, standard error (SEX) of 0.008 and co-efficient of variability (CV) was found to be 1.19%. This implies that the farmers have small-scale managed farms. Majority (88.3%) of the respondents sourced their initial capital through family and friends, 6.7% obtained their capital from bank loan while, only 5% obtained financial support from co-operative societies. This indicated, the only means of financing their business was through family and friends. This agrees with the findings of Atman et al. [12] who reported that, tomato producers and marketers were only financing their business through informal means that is through own savings, money lenders, family and friends), as none of the respondent's claimed to have obtained money for financing his business from government. The result indicated that majority (43.33%) of the sweet melon producers engaged in intercropping pattern while 33.33% of the respondents were engaged in sole cropping and only 23.33% were engaged in both sole and inter cropping. This is in line with the study by Yusuf et al., [14] which stated that the higher the number of crops in the mixture the less the profitability. Also Yusuf [15], discovered in his research on Egusi melon that the more the number of crops in the mixture the less the yield and the less the profitability, which he attributed to the competitive effects of the various crop in the mixture (Table 1).

Regression results for the socio-economic determinants of sweet melon production

Multiple regression analysis was used to determine the socio-economic factors influencing the sweet melon production in the study area. In order to compare and assess

in detail the necessary parameters, four functional forms viz: linear, double-log, semi log, and exponential function were fitted to the data. The result presented in Table 2 shows the estimated impacts of socio-economic factor of respondent on production output (age, experience, farm size, house hold size, education attainment, married status). Double-log function was found to have the best fit and therefore chosen as the best lead equation. The R2 of the double-log function was found to be 0.768. This implies that about 76.8% of the variation in output of the respondent was accounted for by joint action of the six independents factor while the rest 23.2% of the variation was due to error. The overall regression result was significant with F-statistic value of 35.717 at 5% level of probability. The regression coefficient of experiences, farm size and house hold size were significant at 5% level of probability, therefore, making the three factors important determinant of output from sweet melon production. The other three factors age, education attainment and marital status were not significant and therefore, constituted weak determinants of production output. Farmers with high experience are more likely to produce more sweet melon than their counterparts with low experience, and also farmers with large farm size are more likely to produce more melon with their counterparts with small farm sizes and the farmers with large house hold size are more likely to produce more sweet melon than their counterparts with small household size which are similar to Ugwumba [16].

IV. CONCLUSION

The study was conducted in Balanga Local Government Area, Gombe State. The main objective of the study is to obtained information

| Factors | Linear Function | Semi-Log Function | Double-Log Function | Exponential Function |
|-------------------------|---------------------|----------------------|------------------------|-------------------------|
| Constant | 338.245 (0.269) | 670.601 (1.223) | 3.617 (10.479)** | 3.071 (35.889)** |
| Age | - 0.110 (-0.780) | -0.186 (-1.073) | -0.168 (-1.409) | -0.86 (-0.825) |
| Experience | 0.519 (4.780)** | 0.463 (3.846)** | 0.583 (7.065)** | 0.598 (7.419)** |
| Farm Size | 0.312 (2.752)** | 0.362 (2.839)** | 0.317 (3.625)** | 0.245 (2.909)** |
| House Hold Size | 0.158 (1.249) | 0.155 (0.869) | 0.268 (2.191)** | 0.256 (2.734)** |
| Education Attainment | 0.009 (0.097) | 0.030 (0.312) | 0.025 (0.382) | 0.013 (0.185) |
| Marital Status | - 0.005 (-0.045) | | | 0.68 (0.831) |
| F-Statistic | 11.070** | 11.109** | 35.717** | 27.361** |
| R | 0.556 | 0.507 | 0.768 | 0.756 |
| R: Adjusted | 0.506 | 0.461 | 0.746 | 0.728 |

 Table 2: Regression results for the socio-economic

 determinants of sweet melon production

on socio-economic determinant of the respondents, in achieving these objectives; three villages (Maidara, Daban Magarya and Bakasi Areas) were purposively selected. Sixty respondents were randomly selected from the list frame of the sweet melon farmers. The respondents were issued with questionnaires, which were filled with the help of well trained enumerators and the researcher. Statistical tools such as descriptive statistics and multiple regression analysis were used in data analysis. The major findings of this study revealed that the majority of the sweet melon producers were male, married and were within the age bracket of 31-45 years with mean age of 39 years. The result further showed that the respondent had one form of education or the other with Qur'anic education as the highest up to 50%, and had 1-5 years experience with the mean 3.1 years of experience. Moreover, the result also showed that 43.3% of the respondents engage in farming alone and mainly sources their initial capital for the business through family and friends been (88.3%). The regression analysis of the socio-economic characteristics show that double-log regression was chosen as the lead equation based on the values of R2 of 0.768 with a standardized co-efficient of 0.256. The regression co-efficient of experiences, farm size and the house hold size were significant at 5% level of probability, therefore, making the three factors important determinant of output from sweet melon production.

V. RECOMMENDATION

Based on the findings the following recommendations were made:

1. Socio-economic characteristic of sweet melon farmers should be taken into consideration when formulating policies and also when introducing new technologies to rural farmers.

2. Provision of credit facilities with less bureaucracy and low interest rate to producers. This will enable farmers to increase their farm size and in turn increase their output.

3. Extension agent should be mobilized in the area to enhance the level of agronomic practices of melon farmers. Access to extension agents enhances the chances of having access to better crop production techniques, improved inputs as well as other production incentives and in turn leads to increase in output.

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CO₂ Purification using an Aqueous Amine Absorbent in the Syngas

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Abstract: -- The acetic acid production using syngas in the BP chemical process showed superior performance compared to using rhodium-based catalyst. However, CO2 in the syngas causes poison of the promoted-iridium and the performance of the catalyst degrades. Therefore, CO2 must remain at extremely low concentration below 20 ppmv. In this study, we try to develop the new CO2 capturing absorbent for replacing with BASF a-MDEA (activated MDEA). The absorption performance of amine absorbents was evaluated to keep the CO2 concentration low and the applicability of the absorbent for acetic acid production process was evaluated. A continuously stirred-tank reactor and differential reaction calorimeter were used to measure the CO2 absorption capacity and heat of reaction, respectively. As results among the amine absorbents, KIERSOL-N and KIERSOL-P showed better performance in both CO2 absorption capacity and heat of reaction than MEA's results and a- MDEA's results.

Index Terms — Acetic acid, Gas purification, CO2 control, amine absorbent.

I. INTRODUCTION

Acetic acid is used as a raw material for fine chemical products such as vinyl acetate and acetic acid ester. It is also a chemical substance widely used in such as terephthalic acid solution and dye [1]. A projected increase in the consumption of acetic acid has been reported at 4.0-4.5 % annually in China through 2020. China is expected to consume an average of 3-4 % of worldwide production [2]. The annual production of acetic acid is about 11.8 Mt/year, of which the production of acetic acid based on the methanol carbonylation technology is equivalent to about 80% [3],[4]. Processes for production of acetic acid using methanol carbonylation technology generally use noble metal catalysts such as iridium and ruthenium. The acetic acid production process based on ruthenium was widely used after being commercialized by Monsanto in 1970 [5]. In 1996, BP Chemical developed an improved methanol carbonylation process based on promoted iridium-iodide catalyst [6]. However, Bu4NI catalyst has the disadvantage that the iodide poisons the catalyzed reaction and reduces the reaction rate to 67% or less [7]. Therefore, many researchers have tried to improve the performance of catalyst using the iridium-complex [8],[9]. The annual production of acetic acid using iridium-complex catalyst was very high, but the problem of catalyst poisoning by CO2 occurred. Therefore, the use of CO2 capture technology was required to separate CO2 from the syngas. A primary syngas manufactured through partial oxidation is commonly used to produce acetic acid [10]. The primary syngas is composed of CO (60-70 %), H2 (30-40 %), CO2 (1-5 %), along with CH4 and other impurities. The H2S present in the syngas was removed via desulfurizer, and the CO/H2 was separated by the pressure swing adsorption process (PSA). The CO2 in the syngas was removed by CO2 capture technology, and the remaining CO2 should be limited to less than 20 ppm to prevent poisoning of the catalyst. Thus, high-level purification of CO2 is very important for increasing efficiency in the acetic acid production process. The CO2 capture technology used in the petrochemical industry was developed for gas purification purposes. In particular, the gas purification method using amines has been widely used commercially since its development by R. Richards in 1930 [11]. The typical amine absorbents are monoethanolamine (MEA), diethanolamine (DEA), and N-methyldiethanolamine (MDEA) [12]. Amines are classified as primary, secondary, or tertiary amines depending on their structural characteristics. MEA is a primary amine, which has the advantages of low cost and high CO2 absorption rate, but the disadvantages of low CO2 capacity, thermal degradation, oxidative degradation, corrosion, etc [13]-[16]. DEA has a relatively lower CO2 absorption rate than MEA does. MDEA is an absorbent used in early 1950, and has the advantage of treating H2S and CO2 simultaneously [17], but it has the disadvantage of a very low absorption rate [18]. In the 2000s, gas purification technology using amines was considered for application in carbon capture and storage (CCS) technology. The core technology of CCS is absorbents, and CO2 capacity, absorption rate and regeneration energy for CO2 capture process using a wet absorption method have been studied to evaluate the performance of absorbents. Recently, alternative absorbents in the form of cyclic amines such as

piperazine (PZ) and 2-methylpiperazine (2MPZ) have been reported for use as commercial absorbents in power plants because of their advantages of low absorption heat, high CO2 capacity and rapid reaction rate [19],[20]. In this study, various cyclic absorbents with potassium carbonate were evaluated to control CO2 in an acetic acid production process, one of petrochemicals. The CO2 absorption capacity and heat of reaction were measured and compared with MEA (30 wt%) and activated MDEA (α -MDEA; 40 wt% MDEA + 5 wt% PZ), in order to confirm the applicability of cyclic amines. When each absorbent was used, the concentration of emitted CO2 was kept below 20 ppm.

II. EXPERIMENT

The CO2 absorption capacity and heat of reaction were measured using a continuously stirred-tank reactor (CSTR) and differential reaction calorimeter (DRC), respectively. The mixed gases (3 vol% CO2 / balanced N2) used in the DRC experiment were purchased from Special Gas Co. in Korea. The CSTR experiments were conducted by mixing N2 (99.9999%) and CO2 (99.9999%) gas. MEA (2aminoethanol; ≥99%), PZ (piperazine; 99.0%), and potassium carbonate (K2CO3; 99.5%) were from Samchun Chemicals. MDEA (N-methyldiethanolamine; ≥99.0) from Sigma Aldrich and 2MPZ (2-methylpiperazine; 98%) from Acros Organics were also used. The following four different absorbents mixed with deionized water were used for the experimental comparison of performance: 1) Commercially available and widely used aqueous 30 wt% MEA solution, 2) α-MDEA for simultaneous treatment of H2S and CO2, 3) KIERSOL-N (a brand of the Korea Institute of Energy Research) [21], and 4) KIERSOL-P (a brand used for petrochemical applications).

III. EXPERIMENTAL SETUP AND PROCEDURE

A. Continuously stirred-tank reactor (CSTR)

The experimental apparatus used in this study is shown in Fig. 1. The pressure in the CSTR was maintained at 9.50 to 9.52 bar to simulate the absorber of the CO2 capture process. In the CO2 absorption capacity experiment, the measurement was made by supplying 500 mL of absorbent to a reactor with an internal volume of 750 mL. The reaction temperature during the experiment was controlled by a water bath. CO2 was supplied using a sparger to maximize contact with the surface of the absorbent; the stirring was done at a constant rate of 500 r min-1 during the reaction. CO2 (3 vol%) was supplied at a constant concentration, in combination with nitrogen, using a mass flow controller. The gas supplied was injected into each reactor at a rate of 1,000 cm \neg 3 min-1. The concentration of CO2 was inspected at five-minute intervals using GC (gas chromatography;

Agilent Technologies, model 7890A).



B. Differential reaction calorimeter (DRC)

Fig. 2 shows the configuration for the differential reaction calorimeter (DRC) experiment. The reactor had a double jacket structure with an inner volume of 250 mL. A total of 150 mL of the absorbent was injected into each reactor. The temperature in the reactors was kept constant during the reaction time using a thermostat. Two types of reactors were used: a reference reactor and a measurement reactor. The gas injected into the reactor was 3 vol% CO2 mixed gas. In order to maximize the reaction area of the absorbent, a sparger was used to give the injection a constant flow rate of 150 cm3 • min-1. The absorbent was stirred at a constant rate of 250 r • min-1 over the entire reaction time. Gas chromatography was used to analyze the concentration of CO2 exhausted after reaction with the absorbent inside the reactor. The absorbent underwent an exothermic reaction as it reacted with CO2; this reaction was measured in real time by the thermocouple located inside the reactor. Differences in the measured reaction heat were stored on the computer in real time. The details of the experimental procedure are available in a previous report [22].

IV. THEORETICAL FOUNDATIONS

A. Measurement of CO2 capacity using CSTR

The moles of CO2 absorbed by the absorbents (n_absorbed CO2) at each measurement point was calculated using Equation (1)-(3).



Figure 2. Schematic diagram of differential reaction calorimeter: 1) CO2 gas (3 vol% CO2 / balanced N2), 2) Water bath, 3) Inlet gas port, 4) Optional probe, 5) Motor, 6) impeller, 7) Absorbent, 8) Double jacketed reactor, 9) Calibration probe, 10) Temperatures and ΔT measurements, 11) Thermostat, 12) Reference reactor, 13) Gas chromatography.

$$n_{CO_{2},out} = \frac{P_{CO_{2},in} \times V_{CO_{2},in}}{R \times T_{CO_{2},in}} \tag{1}$$

$$n_{CO_2,out} = \frac{P_{CO_2,out} \times V_{CO_2,out}}{R \times T_{CO_2,out}}$$
(2)

$$n_{absorbed CO_2} = n_{CO_2,in} - n_{CO_2,out} \tag{3}$$

$$n_{absorbed \ CO_2} = \int_0^c n_{absorbed \ CO_2} t dt \tag{4}$$

where PCO2 (atm), VCO2 (mol/min), and TCO2 (K) are the partial pressure, volume, and temperature of CO2, respectively. The subscripts, 'in' and 'out' indicate inlet and outlet. CO2 absorption capacity at saturated point was calculated using equation (4).

B. Measurement of the heat of reaction using DRC

]The measurement of the heat of reaction between the absorbent and CO2 was conducted three times: (1) calibration time before the CO2 reaction, (2) for the CO2 reaction, and (3) calibration time after the CO2 reaction. The heat of reaction is indicated by temperature changes per unit time in the reference reactor and the measurement reactor. As can be seen in equation (5), the heat of reaction calibration factor Q (kJ) can be calculated using the reaction-heat-transfer coefficient (UA; W• K-1) and the cumulative time changes (Δ T; K).

$$Q_{cal\,(1)} = UA_1 \times \int_{t_0}^{t_{end}} \Delta T dt \tag{5}$$

The UA was calculated by injecting constant energy via the calibration probe; in this study, the measurement was made three times. The heat of reaction calibration after the reaction was calculated in the same way as the heat of reaction calibration before reaction. As shown in equation (6), the total heat of reaction calibration within the reactor was calculated as the arithmetic mean of the heat of reaction calibration before the reaction and the heat of reaction calibration after the reaction calibration before the reaction and the heat of reaction calibration after the reaction.

$$UA_{average} = \frac{UV_1 + UV_2}{2} \tag{6}$$

In order to measure the heat of reaction between CO2 and absorbent, the enthalpy of the standard state was measured based on the heat of reaction per mole of CO2, and was found to be $40 \,^{\circ}$ C.

V. RESULTS AND DISCUSSION

A. CO₂ absorption capacity

The CO_2 absorption capacity was expressed in mol of CO_2 dissolved in the absorbent per mol of absorbent (mol $CO_2 \bullet$

mol absorbents-1). Absorbents with high absorption capacity can dissolve large amounts of CO_2 in the CO_2 capture process and can thereby reduce operating cost. The CO_2 absorption capacity was measured to evaluate the absorption performance of each absorbent. The breakthrough curve of CO_2 is shown in Fig. 3–5 at the reaction temperature of 40–80 °C. In this figure, the y-axis is the ratio of the concentration of injected CO_2 (C_i) to the concentration of



Figure 3. CO2 absorption curve of absorbents at 40 °C.



Figure 4. CO2 absorption curve of absorbents at 60 °C.



Figure 5. CO2 absorption curve of absorbents at 80 °C

emitted CO₂ (C_o), and the x-axis is the reaction time of the CO₂ and absorbent. In general, the point at which the outlet concentration is 10% of the inlet concentration is called the breakthrough point. As shown in Fig. 3–5, the breakthrough point is reached in a short time as the temperature increases. From these results, it can be shown that the amount of absorption of CO₂ depends on the reaction temperature. Table 1 shows the amount of absorbed CO₂ in each absorbent at different temperatures. The maximum CO₂ capacity of a primary amine such as MEA is generally limited to 0.5 mol CO₂ \cdot mol amine⁻¹ due to formation of MEA carbamate (MEACOO⁻) and protonated MEA (MEAH⁺). However, the absorption capacity of the MEA in this experiment was 0.74 mol CO₂ \cdot mol amine⁻¹, which is higher than the theoretical value.

 Table 1. CO2 absorption capacity of each absorbent at temperatures from 40 to 80 °C

| - | CC | 02 absorption capa | city |
|------------|-------------|---|---------------------|
| Absorbents | (<u>mo</u> | $1 \text{CO}_2 \cdot \underline{\text{mol}}$ absorb | ent ⁻¹) |
| | 40 ℃ | 60 °C | 80 °C |
| MEA | 0.74 | 0.70 | 0.64 |
| α-MDEA | 0.63 | 0.38 | 0.23 |
| KIERSOL-P | 1.14 | 0.98 | 0.81 |
| KIERSOL-N | 1.17 | 1.00 | 0.84 |

These results were affected by the simulated pressure of the absorber (9.50–9.52 bar). The results for KIERSOL-P and KIERSOL-N at 40 °C were 1.14 and 1.17 mol CO₂ · mol absorbent⁻¹, respectively. KIERSOL-P showed 1.54 times greater CO₂ absorption than MEA and 1.81 times greater CO₂ absorption than a-MDEA. The difference in CO₂ absorption capacity at 60 °C was greater than at 40 °C. And, the difference in CO₂ absorption capacity at 60 °C was higher than at 40 °C. KIERSOL-P showed 1.40 times greater CO₂ absorption capacity than MEA, and 2.58 times greater CO₂ absorption capacity than a-MDEA. The CO₂ concentration remains low (< 20 ppm) after the absorbent. The curve of CO₂ in a low range of concentration is shown in Fig. 6-8, and the time is shown in Table 2 until the concentration of CO₂ reaches 20 ppm.



curve at 40 °C.



Figure 7. Initial CO2 concentration for CO2 absorption curve at 60 °C.



Figure 8. Initial CO2 concentration for CO2 absorption curve at 80 °C.

 Table 2. Interval for absorbent to reach CO2

 concentration of 20 ppm.

| Temperatur | | Interval | (min) | |
|------------|-----|----------|-----------|-----------|
| e (°C) | MEA | MDEA+PZ | KIERSOL-N | KIERSOL-P |
| 40 | 912 | 100 | 272 | 268 |
| 60 | 640 | 64 | 212 | 200 |
| 80 | 364 | 12 | 192 | 148 |

MEA provided the highest absorbent concentration at which the concentration of CO2 was kept below 20 ppm. Interval of absorbents with a CO2 concentration of less than 20 ppm increased following the order MEA > MDEA > KIERSOI-N > KIERSOI-P.

B. Heat of reaction

High CO_2 absorption rate, high cyclic capacity and low reaction heat are required to reduce the energy requirement in the CO_2 capture process [23]. In general, the heat of reaction accounts for more than 50% of the total energy requirement and is an important indicator for evaluating the performance of the absorbent. As the reaction between CO_2 and absorbents is reversible reaction, it is possible to anticipate the heat of adsorption by measuring the heat of endothermic reaction produced during the reaction between CO_2 and absorbents. The heat of reaction is the energy (kJ \bullet mol-1) that has increased through exothermic reaction per mol of CO₂ of each absorbent. Kim et al. found that when 30wt% MEA and CO₂ were made to react with each other at 40°C, the heat of reaction was 87.098 kJ • mol-1 [24], and Carson et al. reported that the reaction between 30 wt% MEA and CO₂ at 25 oC resulted in the heat of reaction 83.15kJ • mol-1 [24]. The results of this study showed that the heat of reaction of MEA was 96.00 kJ • mol-1, which was higher than previous report. Although preceding research was conducted using 10-30 vol% CO₂ based on flue gases of the power plant, this study used low concentration CO_2 (3 vol%) of petrochemical process. The heat of reaction of MEA was 96.00 kJ • mol-1 and that of a-MDEA was 68.22 kJ • mol-1. As a result of the experiment, while the heat of reaction of KIERSOL-N and P were similar to that of a-MDEA, it was 0.73-0.65 times lower than that of MEA. As a result of measuring the heat of reaction, it could be found that KIERSOL-N and P were better than MEA in the aspects of absorption capacity and heat of reaction.

| S1025-10 |
|----------|
| 96.00 |
| 68.22 |
| 69.76 |
| 62.83 |
| |

VI. CONCLUSIONS

We assessed CO₂ absorption capacity, low concentration duration of CO₂, and the heat of reaction between absorbents and CO2 in order to control 3vol.% CO2 emitted during the acetic acid production process under ultra-low concentration 20ppm, As a result of the experiment, the absorption capacity of KIERSOL-N and KIERSOL-P at 40°C was 1.14-1.17 mol CO2 • mol absorbent-1, which was rather higher than that of MEA (0.74 mol CO_2 • mol absorbent-1) or MDEA (0.63 mol CO₂ • mol absorbent-1). Although MEA kept the concentration of CO₂ under 20ppm longer than the others, KIERSOL-N and KIERSOL-P emitted low concentration CO₂ longer than MDEA. As for the heat of reaction, α-MDEA, KIERSOL-N and KIERSOL-P showed similar results, and MEA was found to have very high heat of reaction. The study results indicate that KIERSOL-N and KIERSO-P have high absorption capacity, low heat of reaction, and long low concentration carbon dioxide duration. Thus, KIERSOL-N and KIERSOL-P are expected to improve the efficiency of the acetic acid production process.

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An Approach to Measure Similarity of Software Projects at the Design Phase

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Abstract:-- Estimation of software comparability is one of the ideal approach to utilize experiences of effectively developed software. Experiences obtained from previous projects can help software industries to deliver software project in a short pe-riod of time. Although various approaches have been proposed throughout years on software similarity that helps to utilize the previous projects knowledge, none of these are based on design diagrams. However, research on measuring software similarity based on design paradigm is expected to use the historic projects knowledge in early phase of software development. This paper proposes an approach of measuring similarity by developing a tool named Software Design Similarity Measurement Tool (DeSiMeT). DeSiMeT ascertains a similarity score between two software projects utilizing class diagram, sequence diagram and state transition diagram. An experimental analysis has been conducted by running the tool using seven software projects to verify the approach. The analysis of the tool appears in a precision of 0.83, recall of 1 and F-measure of 0.91 which concludes that the tool performs well as a novel work.

Index Terms—Software Similarity, Historic Project, Software Design, Class Diagram, Sequence Diagram, State Transition Diagram

I. INTRODUCTION

In today's fast changing business environment, software industries attempt to rapidly develop their products so that they can speed up the delivery of their latest innovations to customers. This makes software development more chal- lenging as software developers need to design, implement, and test complex software systems as early as possible. As a result, software companies are in search of some solutions that can help to deliver good quality and error free software in right time. Experiences obtained from historic projects can help software industries to adopt shorter release cycles. In this regard, measurement of software similarity is one of the best way to use experiences of already developed software [1]. Proper identification of similar software helps to select development methods, design patterns and reliability testing models as well as is applicable in the areas of data mining, software testing, plagiarism detection and software security [2]. This helps software industries to decrease their efforts, costs and time of development cycle [3].

In this research, a method to measure similarity between software projects were proposed based on software design paradigm. The proposed method computes similarity between intended software project and historic software projects to use previous knowledge. More precisely, the problem can be addressed by the following questions:

• How to utilize the experiences of historic software

Here, we use design paradigms of different projects to

measure similarity among those. The proposed method solely focuses on the quantitative similarity measure. For this pur- pose, we use different design diagrams i.e. class diagram, sequence diagram and state diagram. To measure similarity score, a tool named Software Design Similarity Measurement Tool (DeSiMeT) is developed.

II. RELATED WORK

In the software engineering literature, a less work has been done that addressed the issue of measuring similarity between two software projects. Some works have been done based on fuzzy logic, Euclidean Distance, Graph Matching and Source code corresponded but these are not enough to solve the existing problems. Two approaches for measuring similarity between software projects based on fuzzy Cmeans clustering and fuzzy logic were presented in [7]. The proposed approaches overcame the problems of nearest neighborhood techniques. First approach was developed based on identification features of fuzzy sets and second approach was based on partition matrix that is obtained by fuzzy C-means. They stated that first approach outperforms second approach based on some experimental results. This approach is not applicable for linguistic values and only suitable for numerical and categorical data. Some specific research has been done for computing difference between class diagrams. A generic difference algorithm proposed for computing similarity of two UML models which were encoded in XML files from design diagram [14]. The implemented algorithm performed well on runtime for small documents but not good for a large documents. A

comparative result were presented using basic graph by denoting node and edge. In this approach, at first the elements of each document were detected and then calculated similarity by a defined function that worked with some predefined criteria. Weight was defined for each criteria in a way that may mislead to a missed correspondences. To optimize cost-resource for cloud environment an empirical analysis investigation was proposed in [13]. Authors presented a comparison analysis between open source cloud and organizational cloud to increase the performance of open source cloud by optimizing cost and resource. However, performance, of open source cloud can be enhanced by applying software similarity approach to find out the best result. Although various approaches have been proposed throughout years, none of these are based on design diagrams. However, research is expected to use the historic projects knowledge in software development. In this research, we mainly focused on the design phase of SDLC.

III. PROPOSED APPROACH

The novelty of this research is to measure similarity of

software projects based on some design diagrams in the design phase of SDLC. Firstly, in order to measure design similarity, we consider several design diagrams: (a) Class Diagram (CD) (b) Sequence Diagram (SD) and (c) State Transition Diagram (STD). These diagrams cover the overall design of any object oriented software project to the maximum extent. Later on, the diagrams are parsed by an open source automated tool i.e. StarUML and converted to XML format. Then the XML files are parsed by XML parser and compared using the structure and some comparison criteria. To demonstrate the approach, we have developed a tool and named it as Software Design Similarity Measurement Tool (DeSiMeT).

A. Overview of DeSiMeT

Top level view of the proposed tool's architecture is shown in the Fig. 1. The tool developed in a way that measured similarity between current project and historic project based on design diagrams those are declared in the previous section. Selected design diagrams are converted to XML format using an open source converter as the tool takes XML file as input.

B. Similarity Measurement Approach

Main purpose of this research is to find out the best similarity match of a current project with some historic projects. The proposed approach to measure similarity between software projects based on design depends on different UML diagrams which describe the external behavior of a project.

a) Structural Matching: In the view of a class diagram,

the whole system can be compared by relationships of classes. At first, class diagrams of a system are converted to XMLs and inputted to the tool. Then elements are parsed by an XML parser to proceed the next step. Class diagrams are considered as a graph where classes are denoted as node and relationships are denoted as edge.

$$(A \xrightarrow{Ag} D, A \xrightarrow{As} C, B \xrightarrow{Ag} C, D \xrightarrow{As} C, D \xrightarrow{G} E$$
 and $C \xrightarrow{As} E$)

Historic class also contains five classes and relation among the classes are:

 $(B \xrightarrow{Ag} A, B \xrightarrow{As} C, A \xrightarrow{Ag} C, A \xrightarrow{G} G, A \xrightarrow{G} F \text{ and } C \xrightarrow{As} F)$

b) Criteria Matching:

In the view of class each of the classes a similarity can be measured by comparing some criteria that is presented by Ketle et al. [14]. Due to the generic approach a function is defined by setting some criteria i.e. number of operations and number of attributes. In every case, graph matching can not provide accurate similarity score. Thus, quantitative value need to be considered as an important fact of measuring similarity of class diagram. A criteria matching algorithm is developed that is shown in Algorithm 2. For measuring criteria similarity, a class of first diagram is compared with all of the classes of the second diagram and stored. The same class can not be matched with any other class of the second diagram. The criteria similarity score is Ncalculated (Algorithm 2 Line 19). Finally, the total similarity between two class diagrams are measured by integrating the score of structural matching and criteria matching.

| Alg | gorithm 1 Structural Matching | |
|-----|---|---|
| 1: | input: XMLs (CD, SD, STD) | 9 |
| 2: | $output: finalScore_{structural}$ | |
| 3: | initialize $mat[u][v] \leftarrow 0$ | |
| 4: | initialize set frelations $\leftarrow R$ | |
| 5: | for $edges(u, v)$ in diagrams do | |
| 6: | $mat[u][v] \leftarrow getValue()$ | |
| 7: | end for | |
| 8: | procedure GETVALUE | |
| 9: | if $relations \in R$ then | |
| 10: | setValue = value | |
| 11: | end if | |
| 12: | end procedure | |
| 13: | $finalScore_{structural} \leftarrow matchBFS()$ | |

1) Similarity of Sequence Diagram: SD is used to show the interaction among the objects in a given scenario based on a time sequence. It is a logical view of a system under development that is typically associated with the use cases. A sequence of messages are exchanged among the participating instances through the interactions of the system and some actors or different subsystems or classes [17]. Sequence diagram is considered as a part of project to measure similarity as it represents the dynamic interactions of classes in execution [11]. Similarity measurement of sequence diagram is similar as class diagram using two phases such as :structural matching and criteria matching. The phases are described in the following sections.

a) Structural Matching: For structural matching, sequence diagram is also considered as a graph to measure similarity like class diagram. At first, the UML sequence diagrams of the system are converted to XMLs and inputted to the tool. The XMLs are parsed by the XML parser and a n n matrix is generated like class diagram. The lif elines are considered as node and sendMessage and replyMessage are considered as edge of the graph for generating matrix. Fig. 3 presents a sample example of sequence diagram and fig. 4 presents the generated matrix of fig. 3. For generating matrix, the values of edges are set as prime number to keep track the multiple call between two lif elines. Different values are set for sendMessage and replyMessage where sendMessage is defined by 2 and replyMessage is defined by 3 because these two edges are not same and address a different meaning for sequence diagram. Generated matrix is compared by the same algorithm that is used in class diagram is presented in Algorithm 1. The algorithm describes that all matrix is generated (Algorithm 1 Line 6). Value of edges are set based on message type between lif elines (Algorithm 1 Line 9-10). Similarly, for measuring similarity between two matrices of



Fig. 2: Generated Matrices of Fig. 2

FOOOOO

Historic Project

sequence diagram, a customize Breath First Search algorithm is used (Algorithm 1 Line 13) that is proposed by smith et al. [20]. b) Criteria Matching: Criteria matching of sequence diagram is a statistical similarity measured based on some criteria i.e. number of lif elines, number of sendMessage and number of replyMessage. Algorithm 2 is used to measure criteria matching like class diagram. However, a function is defined for this purpose and a sequence diagram from first project is compared with all of the sequence diagram of the second project and store the max value. If a match is found in the next step then it is ignored as it is already compared. Then, the similarity score is calculated (Algorithm 2 Line 19). Finally, similarity of sequence diagrams are measured by integrating the score of structural matching and criteria matching.

2) Similarity of State Diagram: STD describes the behavior of a system using states of the system and transitions between states [18]. It shows different states of an entity as well as how an entity respond to events by changing the states. Similarity of state diagram is measured into two phases like class diagram.

a) **Structural Matching**: State diagram is considered as a graph to measure similarity where the states are considered



Fig. 4: Generated Matrix of sequence diagram

ö

0 0 0 0

Current Project

Е

as node and transitions are considered as edge of the graph. At first, the UML state diagrams of the system are converted to XMLs and inputted to the tool. Then, the XMLs are parsed by the XML parser and a n n matrix is generated like class diagram. The value of edges are set as: start state to



Fig. 5: Example of State Diagram

general state is defined by 1, general state to general state is defined by 2 and general state to final state is defined by 3. Algorithm 1 is also used for structural matching of state diagram. Similarly, for generating matrix the function is used (Algorithm 1 Line 6). The value of edges are set based on transition type between state that is shown (Algorithm 1 Line 9-10). The matrices are compared like class diagram that is used (Algorithm 1 Line 13).

b) Criteria Matching: Some criteria i.e. number of states, and number of transitions are defined for measuring the statistical similarity of two state diagrams. A function is defined based on these criteria and the similarity is computed using the algorithm 2 like other two diagrams. However, a state diagram from first project is compared with all of the state diagram of the second project and store the max value. If a match is found in the next step then it is ignored as it is computed. The similarity score is calculated (Algorithm 2 Line 19). Then, the similarity of state diagrams are measured by integrating the score of structural matching and criteria matching. Finally, total similarity score of two projects is calculated by integrating the similarity score of class diagram, sequence diagram and state transition diagram.

IV. CASE STUDY

The goal of this case study is to evaluate approximation of the proposed approach. The experiment have been conducted on some design diagram of software projects. A tool DeSiMeT has been implemented in java for this purpose. A. Dataset

The analysis was performed on 7 different software project requiring different diagrams those are used in this research. These projects have been collected from the student of Institute of Information Technology, University of Dhaka. These projects are Inventory Management System Student Management System (SMS), (IMS), AmaderChakri.com (AC.com), Program Office Management System (POMS), Library Circulation System (LCS), Cricket Circle (CC) and Cloud Portal(CP). The project set is converted to XMLS using StarUml before running DeSiMeT as it takes XMLs as input. Table I shows the dataset in details. Project name, number of classes in class diagram, number of sequence diagrams and number of state diagrams of each project are presented in this table.

B. Study Result

For experimental result, dataset projects were run using DeSiMeT. The similarity score was measured between current project and historic project. In the dataset, IMS is the selected as current project and other projects as historic projects. For each historic projects, similarity values of class diagram, sequence diagram and state diagram were measured by comparing with current project that is presented in Table II. Here, first column presents the current project and second column presents historic project. Similarity values of Class Diagram (CD), Sequence Diagram (SD) and State Transition Diagram (STD) are also presented that were obtained from DeSiMeT. In the last column, similarity score of two projects are presented that is calculate d from the average value of CD, SD and STD.

C. Analysis

For the justification of DeSiMeT, an empirical analysis was performed. Table III presents the expected result and actual result of this tool. The expected similarity result was identified from a manual analysis that was performed by some software design experts. The actual result was generated from DeSiMeT and the similar project were chosen based on a threshold value that is greater than or equal 0.6 (threshold 0:6).

TABLE I: Result Analysis

| СР | HP | Actual Result (threshold ≥ 0.60) | Expected Result |
|-----|--------|---|--------------------|
| IMS | SMS | Yes | Yes |
| | AC.com | Yes | No |
| | POMS | Yes | Yes |
| | LCS | Yes | Yes |
| | CC | No | No |
| | CP | No | No |

Now, from the actual and expected result that is shown in the table III, the precision and recall of DeSiMeT can be measured. Let, tp =true positive, fp =false positive, fn =false negative. From Table I, tp = 5, fp = 1, fn = 0. Thus,

$$Precision = \frac{tp}{tp+fp} = \frac{5}{5+1} = 0.83$$

As, DeSiMeT provides 1 false negative result, it possesses the maximum recall. Using the precision and recall, the Fmeasure or the balanced F-score (F1 score) can be calculated.

$$F_1 = 2 \cdot \frac{Precision \cdot Recall}{Precision + Recall} = 2 \cdot \frac{0.83 \cdot 1}{0.83 + 1} = 0.91$$

V. CONCLUSION

for measuring In this paper, a generic approach similarity between software projects is proposed. The approach is based on a series of design diagrams those are converted to XMLs. One of the challenges to measure similarity between complex types which are represented by XML, is handled by different techniques for getting the best scores as described previously. The task is performed in three steps: similarity of class diagrams in first step, similarity of sequence diagram in the second step and similarity of state diagram in third step are measured. A prototype tool DeSiMeT is developed to prove the feasibility of the approach. A case study is presented that evaluates the applicability of the approach. In this case study, seven projects were selected to perform the empirical study. For DeSiMeT, the precision, recall and Fmeasure were calculated that possesses a precision of 0.83, recall of 1 and F-measure of 0.91. The result shows that the proposed approach performs well as a novel work. In this approach, only three UML diagrams are considered for similarity Measurement, in future more diagrams will consider for performing better result. This work directs to our next work to software reliability model selection based on similarity score between current project and historic project.

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Effect of Ultrasonic stress in Semiconductor Materials and Devices

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Abstract:-- Effect of Ultrasonic Stress in solid state devices and materials have been discussed with the help of electromagnetic wave theory. Ultrasonic stress (radiation pressure) changes the characteristics of solid state devices and materials. Analytical treatment of changed characteristics of solid state devices and materials have been discussed.

Index Terms— Maxwell's wave equation, Poisson's equation, Space Charge density, Attenuation and Dispersion of Stress Wave, Ultrasonic Radiation Pressure.

I. INTRODUCTION

Effect of ultrasonic stress is known in pure materials. Further, a systematic study has been made in solid state devices made from pure materials defined as Acoustoelectic effect. [1-13] due to ultrasonic radiation pressure effect when a sound wave propagates through a material containing free electrons, its momentum, as well as energy is attenuated. The momentum attenuation acts a dc force, causing the electrons to drift in the direction of force. When there is a closed circuit in this direction, a direct current is produced called "Acoustoelectric current" which is proportional to the sound intensity, as the momentum attenuation itself is. If on the other hand, the circuit is open, the drifting electrons produce a space charge whose electric field cancels the dc force due to the sound wave momentum attenuation. This back electric field is the "Acoustoelectric Effect" due to ultrasonic radiation pressure effect. The resistance of the material is changed due to acountic stress. There is a simultaneous bunching of electrons and holes in the solid state devices under the action of deformation potential of the travelling ultrasonic wave.

The phenomenon of phonon drag contributes to the thermometric power due to the momentum transfer to electrons from thermal phonons streaming down temperature gradient. It is qualitatively equivalent to the acoustoelectric effect, while quantitatively, it is different, since the ralations between typical wave length, mean free times and frequencies are entirely changed. For the propagation of acountic wave in piezoelectric semiconductor, there is a possibility of achieving acoustic gain by applying a dc electric field which causes the interacting charge carriers to drift in the direction of wave propagation faster than the sound. Ultrasonic wave carries a flux of momentum. A loss in energy from wave is equivalent to a proportional loss in momentum. This loss in momentum constitute a constant force acting on the object absorbing the energy (radiation pressure). The absorbers are the free charged carriers, and the ultrasonic radiation pressure is the acoustoelectric effect.

There is a simultaneous bunching of electrons and holes in a solid state devices under the action of deformation potential of the travelling acoustic wave. A sound wave in a solid gives rise to electric fields which accelerate electrons in much the same way as an electromagnetic wave. An analytical treatment of ultrasonic radiation pressure effect has been discussed.

II. ANALYTICAL TREATMENT: DESCRIPTION

Stress waves and Electrical Phenomena in Piezoelectric Semiconductors

For a one dimensional approximation, Electric field E produces a stress in the x_1 direction as follows: $\sigma = c\varepsilon - eE$ (1)

$$O = CE - EE$$
(1)

$$D = eE + pE \tag{2}$$

c = elastic constant, E = electric field

D = electric displacement

 ε = permitivity of a medium

 σ = surface charge density

e = piezoelectric constants relating electric field to stress

p = magnitude of the elastic displacement component Expressing E in terms of ε and differentiating (1) with respect to x leads to a wave equation. If D is assumed constant, this equation takes the form

$$\rho \frac{\partial^2 S}{\partial t^2} = c \left(1 + \frac{e^2}{cp} \right) \frac{\partial^2 S}{\partial x^2}$$
(3)

S is the displacement. The change in c due to the presence of the electric fields is thus obvious. The condition of constant D further leads to a zero space charge density through Poisson's equation

$$\frac{\partial \mathbf{D}}{\partial x} = Q \tag{4}$$

where as the continuity relation

$$\frac{\partial J}{\partial x} = -\left(\frac{\partial Q}{\partial t}\right) \tag{5}$$

For an extrinsic semiconductor in thermal equilibrium, the total space charge density Q may be expressed in terms of the energy levels and densities of the impurity states in the forbidden band, and the concentration of electrons in the conduction band. The condition of electrical neutrality corresponds to Q=0, and the acoustically produced space charge is the periodic variation of Q about zero.

J is the current density, indicates that in this case the varying current density due to the piezoelectric fields is zero, which corresponds to a very low conductivity in the medium.

In the case of very high conductivity, the field E accompanying the wave will be zero, and the elastic constant C will remain unaffected (Equation 1), whereas the stress wave will be accompanied by D fields, currents and varying space charge.

The case of specific interest here is that corresponding to intermediate values of conductivity, in the range encountered in semiconductors. In this range, equation (4) and (5) are used, together with an appropriate expression for J, to obtain values of D and E. These, in turn permit one to eliminate E from the wave equation.

For an extrinsic semiconductor (assumed to be n type), the current density may be expressed by

$$J = q (n + f n_s) \mu E + (\mu KT) f \left(\frac{\partial n_s}{\partial X}\right)$$
(6)

where the first term is due to drift and the second term is due to diffusion, q is the electronic charge, K is Boltzman's constant, T is the temperature, n is the mean density of electrons in the conduction band, and f is the fraction of acoustically produced space charge density n_s which is mobile.

Thus, $(n + fn_s)$ is the instantaneous local density of electrons in the conduction band. Equation (1) to (4) combined with plane wave representations of D and E

$$D = \frac{-i(nq \ \mu/\omega)E}{1+i\omega \left(\frac{k}{\omega}\right)^2 (\mu f KT/q)}$$
(7)

In the case of small conductivity modulation $(fn_s \ll n)$, equation (7) may be further simplified and written in the form

$$D = \frac{-i(b/\omega)E}{1+i\omega \left(\frac{k}{\omega}\right)^2 (\mu f KT/q)}$$
(8)

 $b = nq\mu$ represents the average conductivity.

The condition of small conductivity modulation $(fn_s \ll n)$ is satisfied when the effective drift velocity of the carriers in the piezoelectric field $f\mu E$ is much less than the velocity of the stress wave v. This imposes a limitation on the strain value:

$$\varepsilon \ll pv/f\mu e \tag{9}$$

In order to determine the attenuation and dispersion of stress waves, use is made of the conductivity frequency, defined by $\omega_c = \frac{b}{n}$, and the diffusion frequency, defined by,

$$\omega_D = \frac{q}{f\mu KT} \left(\frac{\omega}{K}\right)^2 \approx \left(\frac{q}{f\mu KT}\right) v^2$$

From equation (1), (2) and (8), one obtains
$$E = -\frac{e\varepsilon}{p} \left[\frac{1+i(\omega/\omega_D)}{1+i(\omega/\omega_D)+i(\omega_c/\omega)}\right]$$

In the case of negligible charge carrier diffusion ($\omega_D \gg \omega_c$) equation (9) may be simplified to:

$$E = -\frac{e\varepsilon}{p} \left[\frac{1 - i(\omega_c/\omega)}{1 + \left(\frac{\omega_c}{\omega}\right)^2} \right]$$
(10)

and the effective elastic constant is obtained by substitution into (1)

$$\sigma = C \left[1 + \frac{e^2}{cp} \frac{1 - i\left(\frac{\omega_c}{\omega}\right)}{1 + \left(\frac{\omega_c}{\omega}\right)^2} \right] \varepsilon$$
(11)

The velocity and attenuation are obtained in terms of the real and imaginary parts of the complex elastic constant

$$V = V_0 \left[1 + \frac{\frac{e^2}{2Cp}}{1 + \left(\frac{\omega_c}{\omega}\right)^2} \right]$$
(12)

$$\alpha = \frac{\omega}{V_0} \frac{e^2}{2Cp} \left[\frac{\omega_c}{1 + \left(\frac{\omega_c}{\omega}\right)^2} \right]$$
(13)

This expression show that at very low frequency V tends to V_0 and α tends to zero, whereas in the high frequency limit the become.

$$V = V_{\alpha} = V_0 \left[1 + \frac{e^2}{2Cp} \right]$$
(14)
$$\alpha = \alpha_{\alpha} = \frac{\omega_c e^2}{v_0 2Cp}$$
(15)

 ω_D is the frequency above which the wave length is sufficiently short for diffusion to smooth out carrier density fluctuations associated with the periodicity of the stress wave.

Expression (11) and (12) are obtained on the assumption that $\frac{e^2}{Cp}$ is small.

In the vicinity of $\omega = \omega_c$, a simple relaxation –type dispersion occurs. It should be emphasized that the relaxation frequency is given by the conductivity of the material.

When carrier diffusion is taken into account, the complete expression for velocity and attenuation become

$$V = V_0 \left[1 + \frac{e^2}{2Cp} \frac{1 + (\omega_c/\omega_D) + \left(\frac{\omega}{\omega_D}\right)^2}{1 + 2\left(\frac{\omega_c}{\omega_D}\right) + \left(\frac{\omega}{\omega_D}\right)^2 + \left(\frac{\omega_c}{\omega}\right)^2} \right]$$
(16)
$$\alpha = \frac{\omega}{V_0} \frac{e^2}{2Cp} \left[\frac{\omega_c/\omega}{1 + 2(\omega_c/\omega_D) + \left(\frac{\omega}{\omega_D}\right)^2 + \left(\frac{\omega_c}{\omega}\right)^2} \right]$$
(17)

In this case, for $\omega_D \gg \omega_c$, expression (12) and (13) retain their validity for all frequencies, except that \propto approaches a constant value $\left(\frac{\omega_c}{v_0}\right) \left(\frac{e^2}{2cp}\right)$ in the frequency range between ω_c and ω_D , and drops to zero as ω becomes larger than ω_D . For $\omega_c \gg \omega_D$, the velocity and attenuation may be expressed by:

$$V = V_0 \left[1 + \frac{e^2}{2Cp} \frac{(1+\omega^2/\omega_D\omega_C)}{2+(\omega^2/\omega_D\omega_C)+(\omega_D\omega_C/\omega^2)} \right]$$
(18)
And

$$\propto = \frac{\omega}{v_0} \frac{e^2}{2Cp} \left(\frac{\omega_D/\omega}{2 + (\omega^2/\omega_D\omega_C) + (\omega_D\omega_C/\omega^2)} \right)$$
(19)

The maximum velocity change occurs at the frequency $\omega = \left(\frac{\omega_D}{\omega_C}\right)^{1/2}$, whereas the frequency corresponds to maximum attenuation is

$$\omega = \left(\frac{\omega_D \omega_C}{3}\right)^{\frac{1}{2}}$$

Ultrasonic radiation pressure has been discussed analytically [13].

II. CONCLUSION

Discussion of the interaction of ultrasonic waves with lattice vibrations or with defects in a solid follows a pattern very close to that of thermal conductivity theory. The interaction or coupling between ultrasonic waves and conduction electrons proceeds through the absorption and emission of phonons. At sufficiently low temperature there is also energy transfer from ultrasonic waves to conduction electrons.

Electrons are coupled to the lattice and interact with stress waves in at least two distinct ways. Lattice waves interact with ultrasonic stress waves, and nuclear quadrupole coupling link the nucleus with the lattice and hence with ultrasonic stress waves.

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Diagnosis of lesion with statistical method of Anoval & two ways for multi-MRI images with format. Dicom

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Abstract: -- This paper deals with real time surface detection for image processing and analysis. We propose an appropriate analysis method with analysis of variance two ways to detect all surfaces of images in accuracy time. The results indicate that Anova_2 converge to the solution in accuracy time in comparison with Anova_1 for linear model.

Index Terms— Anova, 1,;Anova 2; Statistical; Regression.

I. **INTRODUCTION**

Segmentation means division of an image into several connected regions. Basically, it could define a region as a group of connected similar pixels, or a set of connected pixels surrounded by discontinuities (edges). Split and merge uses the first approach. Many methods are used in surface detection in image processing and analysis. They are classified into two groups depending on time execution: accuracy time (real-time execution), and non-accuracy time (non-real-time execution). One of methods in image detection is analysis of detection (Anova). Anova is a hypothesis test method. It has two techniques: one way Anova (Anova_1), two way Anova (Anova_2). ANOVA_1 is a hypothesis test in which only one categorical variable or single factor is considered. It is a technique which enables us to make a comparison of means of three or more samples with the help of F-distribution. It is used to find out the difference among its different categories having several possible values.[1-2]

The null hypothesis (H0) is the equality in all population means, while alternative hypothesis (H1) will be the difference in at least one mean.

Anova_1 is based on the following assumptions:

- 1. Normal distribution of the population from which the samples are drawn.
- 2. Measurement of the dependent variable is at interval or ratio level
- 3. Two or more than two categorical independent groups in an independent variable.
- 4. Independence of samples.

5. Homogeneity of variance of the population.

Anova_2 is a hypothesis test wherein the classification of data is based on two factors. For instance, the two bases of classification for the sales made by the firm are first on the basis of sales by the different salesman, and second by sales in the various regions. It is a statistical technique used by the researcher to compare several levels of the two independent variables involving multiple observations at each level. ANOVA examine Two way affected by two factors on the continuous dependent variable. It also studies inter-relationship between independent variables the influencing the values of the dependent variable.[1-2]

Assumptions of two-way ANOVA:[1-2] .

1. Samples are drawn for distribution of population.

2. Measurement of dependent variable at continuous level.

3. Two or more than two categorical independent groups in two factors.

4. Categorical independent groups should have the same size.

- 5. Independence of observations
- 6. Homogeneity of the variance of the population

II. BACK GROUND

2.1 ANOVA1 the Analysis of Variance

Regration analysis of variance a.

The relationship between two variables is the dependent 'one' and the independent 'operation'. [3-5]
(1)

b. Fitted Regretion Line

Equation (1) presents the true regression line which is usually never known. However, the regression line can be estimated where estimating the coefficients β_1 and β_0 for an observed data set. [6-7]

$$E(Y) = \beta_0 + \beta_1 x \tag{1}$$

Equation (2) represents the actual values of y which are assumed to be the sum of the mean value, E(Y) and a random error term ϵ .

$$Y = E(Y) + \epsilon$$

= $\beta_0 + \beta_1 x + \epsilon$ (2)

The least square estimates, $\beta_0 \beta_0$ and $\beta_1 \beta_1$ are obtained

from using the following equations:

Equations (3), (4) represent the least square estimates β_1 and β_0 respectively:

$$\hat{\beta}_{1} = \frac{\sum_{i=1}^{n} y_{i} x_{i} - \frac{\left(\sum_{i=1}^{n} y_{i}\right) \left(\sum_{i=1}^{n} x_{i}\right)}{n} \qquad (3)$$
$$\sum_{i=1}^{n} (x_{i} - \bar{x})^{2}$$
$$\hat{\beta}_{0} = \bar{y} - \hat{\beta}_{1} \bar{x} \qquad (4)$$

Where $\overline{\mathbf{x}}$ is the mean of all predictor variable calculated

using equation (5), and \overline{y} is the mean of all observed values

calculated using equation (6):

$$\bar{x} = (1/n) \sum_{i=1}^{n} x_i$$
. (5)

After know $\beta_1 \beta_1$ and $\beta_2 \beta_0$, the fitted regression line will be

written as:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x \tag{6}$$

Where the difference between the corresponding observed value, y_i and the fitted value, \bar{y}_i is called the residual e_i :

$$e_i = y_i - \hat{y}_i \tag{7}$$

c. Calculation of the statistique F₀

The statistic F_0 test the significance of regression is calculated as follows:[6-7]

$$F_0 = \frac{MS_R}{MS_E}$$

Where: MSR is the regression mean square and MSE is the mean square error.

(8)

To calculate the statistic F_0 , it must study the following six models [3][4][5]

c.1 Total Sum of Squares (SS_T) model

The SS_T is obtained using the equation (9):

$$SS_{T} = \sum_{i=1}^{n} (y_{i} - \bar{y})^{2}$$

$$- \sum_{i=1}^{n} y_{i}^{2} - \frac{(\sum_{i=1}^{n} y_{i})^{2}}{n}$$
(9)

c.2 Sum of Squares regression (SS_R) model

The SS_R , can be obtained using the equation(10):[5]

$$SS_{R} = \sum_{i=1}^{n} \mathcal{P}_{i}^{2} = \frac{\left(\sum_{i=1}^{n} \mathcal{P}_{i}\right)^{2}}{n}$$

$$= \hat{\mathbf{y}}' \hat{\mathbf{y}} = \left(\frac{1}{n}\right) \mathbf{y}' \mathbf{J} \mathbf{y}$$

$$= \mathbf{y}' \left[\mathbf{H} = \left(\frac{1}{n^{2}}\right) \mathbf{J} \right] \mathbf{y}$$
(10)

(10)

c.3 Sum Squares Error (SSE)operation

The SS_E is obtained using the equation (11):

$SSE=SS_{T}-SS_{R}$ (11) c.4 The total Mean Squares (MS_T) model

The (MS_T) are obtained by dividing the SS_T with their

associated degrees of freedom. The number of degrees of freedom associated with SS_T is n-1 since there are an 'n' observations, but one degree of freedom is lost in the calculation of the sample mean \bar{y} .

$$MS_T = \frac{SS_T}{n-1} \tag{12}$$

c.5 The regression mean square (MS_R) model

The number of freedom degrees associated with the SS_R, is k. so, There are k+1 degrees of freedom associated with a regression model with k+1 coefficients $\beta_0,\beta_1,..\beta_k$. However, one degree of freedom is lost because the deviations $(\hat{y}_i - \bar{y})$, are subjected to the constraints that they must

sum to zero
$$\sum_{i=1}^{n} (\tilde{y}_i - \bar{y})^2$$

The MS_R is obtained using the equation (13):

$$MS_R = \frac{SS_R}{k} \tag{13}$$

Since there are n observations in all, The number of degrees of freedom associated with the error sum squares is: n-(k+1), but (k+1) degrees of freedom are lost in obtaining

the estimates of $\beta_0, \beta_1, \beta_2, \dots, \beta_k, \beta_0, \beta_1, \beta_2, \dots, \beta_k$ to calculate

the predicted values $\tilde{v}_i \tilde{v}_i$. [5-7]

c.6. The Mean square Error (MS_E) model

The MS_E is obtained using equation (14):

$$MS_E = \frac{SS_E}{n - (k + 1)}$$

The MS_E is an estimated of the variance $(\tilde{\sigma}^2 \tilde{\sigma}^2)$ of random

(14)

error terms.

2.2 Anova 2 two ways

The ANOVA 2-way is probably the most popular layout in our Design and Experiments. To begin with, we have to define a factorial experiment.[1]

An experiment that uses every combination of factor levels as treatments is called *a* factorial experiment.

a.1. two-way factorial experiment Model

In a factorial experiment the factor A at a levels and factor B at b levels.

The model for the general layout can be written as:

$$y_{ijk} = \mu + \tau_i + \beta_j + X_j + \varepsilon_{ijk}$$

$$y_{ijk} =$$

 $\mu + \tau_i + \beta_j + X_j + \varepsilon_{ijk}$

$$i = 1, 2, ... a; j = 1, 2... b; k = 1, 2 ... r$$

Where :

- is the overall mean response,
- *i* is the effect due to the *i*-th level of factor A,
- $_{j}$ is the effect due to the *j*-th level of factor B and

 Υ_{ij} is the effect due to any interaction between the *i*-th level of A and the *j*-th level of B.

Due to any interaction between the *i*-th level of A and the *j*-th level of B.[1]

a.2. Fixed factors and effects models

We consider the levels of factor A and B chosen for the experiment to be the only levels of interest in the experimenter. The factors A and B are said to be fixed factors and the model is a fixed-effects model. When an AxB factorial experiment is conducted with an equal number of observations per treatment combination, the total (corrected) sum of squares is partitioned as:

$$SS(total) = SS(A) + SS(B) + SS(AB) + SSE$$
 (15)

where :AB represents the interaction between A and B. For reference, the formulas for the sums of squares are:

$$SSA = rb \sum_{i=1}^{a} (\bar{y_i} - \bar{y})^2 \qquad SSA = rb \sum_{i=1}^{a} (\bar{y_i} - \bar{y})^2$$
(16)

$$SS(B) = \operatorname{ra} \sum_{j=1}^{b} (\overline{y_{i}} - \overline{y})^{2}$$

$$(17)$$

$$(17)$$

$$(18)$$

$$SS(AB) = r \sum_{j=1}^{r} \sum_{i=1}^{b} (\overline{y_{ij}} - \overline{y}_i - \overline{y}_j + \overline{y})^2$$

$$SSE = \sum_{k=1}^{r} \sum_{j=1}^{b} \sum_{i=1}^{a} (y_{ijk} - \overline{y}_{ij})^2$$
(19)

c.3.The breakdown of the total corrected of mean sums squares

The table ANOVA result can be used to test hypotheses about the effects and interactions. The table (I) shows the resulting ANOVA for an $a \ge b$ factorial experiment.

| TABLE I. | ANOVA | RESULT FOR | ANA | X B | FACTORL | AL |
|----------|-------|------------|-----|-----|---------|----|
| | | EXPERIMEN | T. | | | |

| Source | SS | Df | MS | F |
|------------|-------|-----------------------------|--------------------------------|-------------------|
| Factor A | SS(A | (<i>a</i> -1) | MS(A) = | $F = MS_A / MS_E$ |
| |) | | <i>SS</i> (A)/(<i>a</i> -1) | |
| Factor | SS(B) | (<i>b</i> -1) | MS(B) = | $F = MS_B / MS_E$ |
| В | | | <i>SS</i> (B)/(<i>b</i> -1) | |
| Interactio | SS | (<i>a</i> -1)*(<i>b</i> - | MS(AB)= | $F=MS_{AB}/MS$ |
| n AB | (AB) | 1) | <i>SS</i> (AB)/(<i>a</i> -1). | Ε |
| | | | (<i>b</i> -1) | $=SS_{AB}/(a-$ |
| | | | | 1)*(b-1) |
| Error | SSE | (<i>n</i> - <i>ab</i>) | $MS_E =$ | |
| | | | $SS_E/(n - ab)$ | |
| Total | SS | (<i>n</i> -1) | | |
| (Corr- | | | | |
| ected) | (Tota | | | |
| | 1) | | | |

III. EXPERIMENTAL

3.1 Algorithm

In this part, we use a general algorithm which can let us applied the defined methods in image treatment. -We read a pathological and normal images with format "Dicom"

-We apply ANOVA 1 way.

-We apply ANOVA2 ways.

-We compare between the both techniques in order to achieve the best technique that gives the best accuracy time for surface detection in multi images.

For the test, we have used a computer which has these identifications:

- Model : SONY (RSOL-VAIO)

- Processor : Intel(R) core™ i5-3210M.CPU @2.55ghz

- Memory (RAM) : 4.00 Go
- Operating system : windows 7_ 64bits.
- Matlab® 13 (R2013a).

Let's explain in more detail:

The anatomical model used to generate simulated brain MRI data consist of a set of 3-dimensional "fuzzy" tissue membership volumes, one for each tissue class (white matter, grey matter, cerebrospinal fluid, fat...). The voxel values in these volumes reflects the proportion of tissue present in that voxel, in the range [0, 1]. The volumes are defined at a 1mm isotropic voxel grid in Talairach space, with dimensions 181x217x181 (XxYxZ) and start coordinates -90,-126,-72 (x,y,z).

In addition to the fuzzy tissue membership volumes, a discrete anatomical model is provided which consists of a Class label (integer) at each voxel, presenting the tissue which contributes the most to that voxel (0=background, 1CSF, 2=grey matte, 3white matter, 4=Fat, 5=muscle/skin, 6=skin, 7=skull, 8=glial matter,9=connective,10=MS lesion).

Brain web Simulated MRI Volumes for Brain with Multiple Sclerosis Lesions select the desired simulated volume using the switches (see figure1). These simulations are based on an anatomical model of a brain with MS lesions, which can serve as the ground truth for any analysis procedure.

In this pre-computed simulated brain database (SBD), the parameter settings are fixed to 3 modalities, 5 slice thicknesses, 6 levels of noise, and 3 levels of intensity nonuniformity. You can also request simulations done with arbitrary parameters from the BrainWeb custom MRI simulations interface.

The voxel values in each image are magnitude values, rather than complex, real or imaginary.

We apply the algorithm of ANOVA1 ways in our data. The results of ANOVA1 techniques for multi-frames are shown in figure4, and the duration of execution time is shown in figure5.

Modality: (you can choose one of the following pulse sequences)

Slice thickness: (in-plane pixel size is always lx1mm)







Figure 3. Elapsed time of ANOVA2 in T2 for multi-frame



Figure4.Results of ANOVA 1 techniques for multi-frames in T2



Figure 5. Elapsed time of ANOVA1 in T2 for multi-frame

IV. DISCUSSION

In the both figures (2) and (4) in relaxing time T2 Anova1 and Abova2 detect the disease in the same precision but with accuracy in ANOVA2 (0.36s) in front of ANOVA1(1.036s).see figures and (3)(5).



Figure6.Results of ANOVA 2 techniques for multi-frames in T1.





Figure9. Time of execution of ANOVA1 in T1

We apply the algorithm on 20 images compressed with mnc (image dicom) detected with ANOVA 2 for time: T1. The results of ANOVA 2 techniques for multi-frames are shown in figure6, and the duration of execution time is shown in figure7. We apply the algorithm on 20 images compressed with mnc (image dicom) detected with ANOVA 1 for time: T1. The results of ANOVA1 techniques for multi-frames are shown in figure8, and the duration of execution time is shown in figure9.

• Discussion

In the time T1 & from the both figures (6) and (8) ANOVA2 detect frames better and with accuracy 0.35seconds (figure8.) in front of ANOVA1 0.56second (figure9.) where its result is worse.

IV. CONCLUSION

In this paper, we have applied two linear resolution methods to extract the place of diseases for MR images .Our results indicate that the statistical method with Anova2 converges to the solution in accuracy time in comparison with the ANOVA1 way where it couldn't detect well frames with relaxation time T1.

So the time of execution is very important to clarify the best method of detection.

As perspective we proposed to compeer Anova with network ANN.

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Effect of Friction Stir Welding on Mechanical properties of Zn-22Al Superplastic Alloy

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Abstract: -- Present study discusses the trials of friction stir welding (FSW) on Zn-22Al superplastic alloy. The effect of different process parameters of FSW tool on mechanical behavior of the welded zone has been discussed. The results are discussed in terms of mechanical properties and microstructure observations. A new developed FSW tool which was investigated in our laboratory was used in the experiments to investigate the structural changes of microstructures of the material as well. Results revealed a fine grain structure after FSW within the stir zone.

Index Terms— Friction stir welding, Mechanical properties, Superplastic alloy, Zn-22Al.

I. INTRODUCTION

Friction stir welding (FSW) is a solid-state joining process using friction heat. This method was developed at TWI in Cambridge, England and patented in 1991 [1]. Because FSW is particularly appropriate for aluminum alloys, which tend to be problematic for standard welding, initial research efforts concentrated on these alloys. Copper alloys and magnesium alloys were also examined and possible applications to titanium alloys, stainless steels, and metal matrix composites (MMCs) are currently being explored [2]-[7]. However, only a few studies of FSW on superplastic alloys have been conducted [8]. The Superplastic alloys have gathered interest in many different fields of studies. Weight saving is the most important requirement in the area of aircraft industry, There is a need for devices fabricated by superplastic forming in medical and biomaterial fields, like dentistry. For many reasons like problems with casting with titanium [9] fabrication by superplastic forming has been attracting interests [10], [11]. However, very little information is available regarding friction stir welding of superplastic alloys.

Zn–22Al is a well-known superplastic material that has been widely used in different fields of studies. Zn–22Al can be obtained as sheet for thermal forming and is often useful in low-volume applications where tooling costs must be kept low. It is also used for electronic enclosures, cabinets and panels, business machine parts, and medical and other laboratory instruments and tools. [12] Studies of controlling and improving the mechanical properties of this alloy have been conducted in our laboratory. It has been reported in a previous study that the tensile strength increases after FSP. Additionally, in friction stir-processed Zn–22Al, a high strain rate sensitivity exponent m of 0.59 was observed on the high strain rate side at 250 °C, and the possibility of grain refinement by FSP has been indicated. [13] Microstructural changes in superplastic Zn–22Al alloy caused by FSP were also investigated in another study [14] In particular, the change in the average grain size was experimentally determined and grain refinement of the Zn– 22Al alloy by FSP was proved to be possible. Nishihara has reported initial results for the FSW of superplastic Zn–22Al eutectoid alloy, which demonstrated that FSW produces a fine grain structure within the joint part. [8] In the present study, trials of FSW on Zn-22Al superplastic alloy are carried out in different process parameters of FSW tool.

II. EXPERIMENTAL PROCEDURE

Fig.1 (a) shows the experimental setup. A vertical milling machine was set up to perform FSW trials. Different parts of the FSW system are shown in Fig. 1 (a). The Shoulder part of the FSF tool with a diameter of 15mm and an angel of -5° is made of Inconel 625 because of its heat resistance, while a high-speed steel forming tap (M6 \times 1) with a height of 1.5mm is used as the probe part of the tool to improve the stirring performance. This particular tool which is shown in Fig.1 (b) was first developed in Kokushikan University. [13] Experiments are performed on 3 mm thick Zn-22Al eutectoid superplastic alloy. Two phases of Zn-22Al superplastic alloy are used in this study. Starting microstructures of studied alloy is shown in Fig.2 (a) is the as-received Zn-22Al without any heat treatment and Fig.2 (b) shows the Lamellar grain structures of Zn-22Al which was achieved after heat treatment. Table I shows the chemical composition of the material. Experiments are performed on various process parameters of FSW tool for each phase of Zn-22Al alloy. Table II shows the process parameters for as-received material and table III shows the parameters for annealed material.

III. RESULTS AND DISCUSSIONS

A. Microstructural Observation

Fig. 3 shows the appearance of a friction stir welded material. Rotation of the tool is counterclockwise and direction of the process is as shown in the photo.



Fig. 1 (a) FSW machine with jigs, backing plate (b) FSW tool showing probe and shoulder part



Fig. 2 Starting microstructure of the Zn-22Al alloy as-received (b) annealed

| Table I Chemico | l composition | of Zn-22Al alloy |
|-----------------|---------------|------------------|
|-----------------|---------------|------------------|

| Cu | Al | Mg | Ti | Zn |
|------|------|-------|-------|------|
| 0.52 | 21.1 | 0.010 | 0.034 | Bal. |

 Table II Process parameters of FSW tool during the process for as-received Zn-22Al

| Rotation speed [rpm] | Travel speed [mm/min] | Plunge depth [mm] | Tilt angle [°] |
|----------------------------|--------------------------|-------------------------|--------------------|
| 880 | 400-1200 | 2.7 | 3 |

 Table III Process parameters of FSW tool during the process for annealed Zn-22Al

| Rotation speed [rpm] | Travel speed [mm/min] | Plunge depth [mm] | Tilt angle [°] | |
|----------------------------|--------------------------|-------------------------|----------------|--|
| 440 | 50-800 | 2.7 | 3 | |

Fig. 4 and Fig. 5 show the macro photos of the cross-section for both as-received and annealed materials. Cross-sections are perpendicular to the direction of processing and are

etched with sodium-hydroxide. It can be confirmed that FSW has significantly changed the structure of base metal. Affected area decreases as travel speed increases, also a larger un-joined part between butted sheets was observed as the travel speed increased. The amount of created heat-input during the FSW process is thought to be the reason of change in length of the un-joined part. Heat input increases as the travel speed decreases [15], therefore weld becomes deeper for parameters which have smaller heat-inputs. Stirring time becomes longer as travel speed decreases, therefore FSW tool has more time to push the material which is soften by friction heat. This could be another reason of having smaller un-joined part as travel speed decreases. Fig. 6 shows the microstructural observations for different part of annealed material after FSW. It makes a comparison between the microstructures of a low and a high travel speed. It can be confirmed that un-joined part between sheets disappears as the travel speed is decreases. Microstructure of stir zone, TMAZ (thermo mechanically affected zone) and unaffected area are shown in the figure.

As Nishihara had suggested about finer grain size within the stir zone after FSW [8], it can be confirmed that finer grain structures have been achieved after FSW. It can be confirmed from Fig. 7 that FSW has significantly changed the structure of base metal. Secondary electron microscopy photos of base metal, heat affected zone (HAZ), thermo mechanically affected zone (TMAZ) and stir zone are shown in figure. Notably finer grain structures after FSW process is obtained within the stir zone. A study on effect of friction stir process on the grain refinement of Zn-22Al alloy has been published earlier. [14] It revealed that depending on the process parameters of FSW tool during the process, a grain size of 0.3 μ m and a high superplasticity could be obtained.



Fig. 3 Appearance of a friction stir welded Zn-22Al alloy



Fig. 4 Macro photos of cross-section after FSW in asreceived alloy for a rotation speed of 880 rpm and a travel speed of (a) 400 mm/min (b) 600 mm/min (c) 800 mm/min (d) 1000 mm/min (e) 1200 mm/min



Fig. 5 Macro photos of cross-section after FSW in annealed alloy for a rotation speed of 440 rpm and a travel speed of (a) 50 mm/min (b) 100 mm/min (c) 200 mm/min (d) 400 mm/min (e) 800 mm/min



Fig. 6 Microstructure observation of friction stir welded annealed Zn-22Al for (a) travel speed of 50 mm/min (b) travel speed of 800 mm/min showing: A. unaffected zone B. stir zone C. TMAZ D. interface area



Fig. 7 SEM photos of friction stir welded Annealed Zn-22Al (a) unprocessed annealed Zn-22Al with lamellar structure (b) HAZ (c) TMAZ (d) SZ

A. Bend Test

Face and root bend test were carried out after applying FSW for different tool process parameters.

Face bend test results revealed that maximum load increases as revolutionary pitch increases (Fig. 8 (a)). Lower strength for lower travel speeds could be attributed to the high heat input when decreasing the travel speed. Material gets soften as a result of high heat-input; therefore a lower load is attained. For as-received alloy maximum load starts to decrease as travel speed reaches 1000 mm/min (revolutionary pitch of 1.1). For annealed alloy maximum load stops increasing when travel speed reaches 400mm/min (revolutionary pitch of 1.1). It could be confirmed from root bend tests Maximum load decreases as travel speed increases (Fig. 8 (b)). This is contributed to a larger Unjoined part at higher travel speeds. As mentioned before as travel speed increases, due to the lack of heat input, a bad fellow of material happens during the process which leads to a larger un-joined part which affects the strength. Fig. 9 shows the macro-photo of cross-section after bending tests for as-received alloy. As it can be confirmed from Fig. 9 (a), in root bend test, for a high travel speed the crack starts from the un-joined part and continues throw the stir zone. Lack of material flow causes larger interface which affects the strength. As the travel speed decreases, crack tends to start from the boundary between stirred and un-affected area and continues throw the stir zone (Fig. 9 (b)) For face bended Zn-22Al, for lower travel speeds specimens seemed to be brittle and crack tended to start from the retreating side and went through the stir zone (Fig. 9 (c)). The reason for this fact could be the grain refinement of stir zone which makes the material harder but also more brittle. For higher travel speeds the specimens tended to be more ductile and broke in a sharper angle. This can be attributed to the lower hardness of stir zone in a high travel speed specimen which makes it less brittle. Cracks tended to start from the retreating side and went around the stir zone (Fig.9 (d)). As travel speed reaches 1200 mm/min, no crack was seen and the sample specimen was bended till in U-shape form (Fig.9 (e)).

Fig. 10 shows the macro-photo of cross-section after bending tests for annealed alloy. Same phenomenon for annealed alloy was observed as for the as-received alloy. It can be observed in Fig. 10 (a) that for a low travel speed, crack occurs in the middle and travels throw the stir zone in both root and face bend tests. As travel speed increases (to 200 mm/min in this case) crack occurs and starts in the unjoined part and travels around the stir zone in root bend test (Fig. 10 (b)). After face bend test for higher travel speeds (200 to 800 mm/min), crack starts from the boundary between stirred and un-affected area or rather no crack was observed. However, crack occurred in un-joined part and continued throw stir zone after the root bend test. Larger unjoined part in a higher travel speeds is the reason for the mentioned result (Fig. 10 (c)).



Fig. 8 Effect of travel speed on maximum load in friction stir welded Zn-22Al after (a) face bend test and (b) root bend test



Fig. 9 Cross-section photos of friction stir welded Zn-22Al after bend tests showing (a) root bend test (travel speed: 1200 mm/min) (b) root bend test (travel speed 400 mm/min) (c) face bend test (travel speed: 400 mm/min) (d) face bend test (travel speed: 1000 mm/min (e) face bend test (travel speed: 1200mm/min)



Fig. 10 Cross-section photos of friction stir welded Zn-22Al after bend test for a tool rotational speed of 440 rpm and (a) travel Speed: 50 mm/min (b) travel speed= 200 mm/min (c) travel speed= 800 mm/min

C. Tensile Test

Tensile tests were carried out after the process to confirm the effect of different tool process parameters on the strength of friction stir welded alloy. As it can be confirmed from Fig.11 (a), tensile strength has a decreasing tendency as the travel speed and rotational pitch (the ratio of rotation speed to travel speed) increases. As it was discussed in earlier section, un-joined part becomes larger due to lack of heat-input for a higher travel speed, which results in decreasing the strength and also joint efficiency (Fig. 12). Based on the bending and microstructural results higher elongation must have been observed as the tool travel speed increases, however, as it can be confirmed from Fig. 11 (b), a scattered results have been obtained for the elongation after tensile test. One reason that can be argued is that the un-joined part in higher travel speeds act to weaken strength also prevents the specimen to be elongated. Another reason is that for lower tool travel speeds a fine-grain structure has been obtained within the stir zone, which makes the specimen tougher and more ductile as well. It was published in another study that the superplasticity characteristics of Zn-22Al and strain rate sensitivity exponent (m-value) increases after the friction stir process [14]

D. Hardness Test

Hardness tests of the cross-sections were carried out for different distances under the surface. The measurements have been taken at 1.0 mm intervals extending horizontally. Fig. 12 shows the hardness distribution for different travel speeds. It can be confirmed that FSW has a high effect on hardening the material within the stir zone. Comparing to the hardness of 150 HV for annealed Zn-22Al, maximum hardness of 300 HV is achieved within the stir zone for a travel speed of 50 mm/min (Fig. 12 (a)). This can be attributed to the grain refinement due to stirring. Hardness tends to slightly increase as we get closer to the surface. Hardness decreases as the travel speed of the tool increases (comparing the maximum hardness of 300HV within the stir zone for travel speed of 50 mm, hardness of about 230HV is achieved for the travel speed of 800 mm/min). Although hardness increase within the stir zone is still observed for higher travel speeds comparing to the hardness of base metal, no significant change in hardness was observed and it can be contributed to the insufficient grain refinement during the process. Base on the Hall-Petch relation [16], [17], hardness increases as the grain size decreases. It can be concluded that stirring performance of probe decreases as the rotation pitch (travel speed/ rotation speed) increases, therefor it can be predicted that there will be a not sufficient grain refinement within the stir zone.

III. CONCLUSION

Trials of friction stir welding on Zn-22Al superplastic alloys were carried out and the effect of different process parameters of FSW tool (travel speed and rotation speed) on mechanical behavior of the welded zone has been discussed. It could be confirmed that process parameters determines the microstructural evolution and mechanical properties of the processed zone. Present study could give readers an indication of the proper parameters during the FSW process. These parameters could affect the temperature of the processed zone. The knowledge of the processed zone temperature in FSW is of great interest as well which could be one of the important future investigations for researchers. Below are the main points obtained in present study,

1. Microstructural observations revealed that finer grain size was achieved after FSW within the stir zone. The lamellar structure of annealed Zn-22Al was changed into a fine equiaxial grain structure within the stir zone.

2. Tensile strength increased as the revolutionary pitch



Fig. 11 Effect of revolutionary pitch on (a) tensile strength and (b) elongation (c) joint efficiency after FSW for asreceived and annealed Zn-22Al alloy





Fig. 12 Hardness distribution for tool rotation speed of 440 rpm and travel speed of (a) 50 mm/min (b) 100 mm/min (c) 200 mm/min (d) 400 mm/min (e) 800 mm/min

decreased. Higher joint efficiencies were achieved for lower revolutionary pitches as well.

3. Hardness of Zn–22Al increased toward the stir zone as a result of grain refinement. Hardness increased as the travel speed of the tool decreased. Considering the relation between hardness and grain size, it can be concluded that higher revolutionary pitch results in a finer grain structures within the weld and stir zone.

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Analysis of Impact of Data size for Classification of Alzheimer's disease using Convolution neural Network

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Abstract: -- Alzheimer's disease (AD) is a neurodegenerative disease affecting a large population worldwide. Accurate detection of AD at an early stage gives families ample time to prepare and make use of better medical facilities. Machine learning and deep learning models and in particular predictive and pattern recognition models have enabled researchers and doctors in gaining a better understanding of complex medical issues. Various machine learning techniques have been used along with imaging techniques like PET, MRI, SPECT etc., to analyze and predict AD. In this paper, we analyze the impact that the size of the data has in the classification of Alzheimer's Disease when classifying using PET scan images of patients using Convolution Neural Network (CNN).

Index Terms- Deep learning, Alzheimer's Disease, Convolution Neural Network, PET.

I. INTRODUCTION

Alzheimer's Disease (AD) is a neurodegenerative disorder and is the most common form of Dementia accounting for 60 to 80 percent of Dementia cases [1]. It is characterized by the decline in thinking ability and changes in behavior starting in middle to old age. The symptoms develop slowly but worsen over time to a point where it can get serious enough to interfere with normal life. In its early stages, the memory loss is mild while in the later stages, the patient's conversation and their ability to respond degrades dramatically [2]. As the disease progresses, symptoms include difficulties with speech and writing, problemsolving, decreased judgment among others. During the advanced stages of AD, the neural damage hampers normal bodily functioning such as basic motor functions such as walking, talking and other and during the final stages, the patient becomes completely dependent upon their caregivers. AD affects nearly 45 million worldwide and these numbers are expected to increase many-fold in the coming decades and is projected to grow to nearly 90 million by the year 2050. According to 2018 Alzheimer's Disease Facts and Figures [1], an estimated 5.7 million Americans are living with AD which includes an estimated 5.5 million above the age of 65 and another 200,000 under 65 who have a younger-onset of Alzheimer's disease. AD is the 6th leading cause of Death in the United States and is the only disease amongst the top 10 leading causes of death that cannot be cured or prevented. Whilst the number of death cases due to other ailments such as Heart disease, Cancer, Diabetes etc., are on a decline, the number of deaths due to AD have increased by about 120% in the past 15 years. The reality is that only about half of those with probable dementia is recognized in the primary care setting [3]. Brain functional imaging, such as Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET) or Magnetic resonance imaging (MRI) have proved to be a very effective tool for data extraction in the diagnosis of AD by using noninvasive methods. Early detection of Alzheimer's disease has a lot of benefits that can help the patient and their loved ones in making timely decisions. Early diagnosis allows people with AD and their families to receive timely practical information, advice, and support; giving them access to available drug and non-drug therapies that may improve their cognition and enhance their quality of life. Undetected Alzheimer's disease places older adults at risk for delirium, motor vehicle accidents, medication errors, and financial difficulties to name a few. Hence, this project aims at improving the accuracy of early detection of Alzheimer's disease in order to help the people take the right decision at the right time. With this in mind, in 2004, the Alzheimer's Disease Neuroimaging Initiative (ADNI) was launched, funded by the National Institute on Aging, the Foundation for the National Institutes of Health, and other companies as a public-private partnership with the goal of analysing whether a combination of PET, MRI, SPECT or other biomarkers and clinical assessments will be useful for detecting AD at an early stage. Several researchers, taking advantage of the large dataset available through ADNI have developed several advanced machine learning and pattern

recognition techniques to map the degenerative patterns and identify individuals who are at risk of AD.

II. LITERATURE SURVEY

Various classification methods have been proposed to automatically classify between affected patients and healthy individuals. Examples of few techniques used for classification include support vector machine (SVM) [4], boosting [5], artificial neural networks [6], k-nearest neighbor [7] and linear discriminant analysis [8]. There are two broad approaches to classifying the data;

i. Single Modal Approach and,

ii. Multimodal Approach.

Also, there are two main learning algorithms used for the process of classification viz., machine learning techniques such as Linear regression, Support vector machine, k-nearest neighbor etc., and the other using deep learning algorithms such as Convolution neural network. Whilst Machine Learning is a statistical method of learning where each instance in a dataset is described by a set of features, Deep Learning is a method of statistical learning that extracts features or attributes from raw data.

i. SINGLE MODALITY APPROACHES

In the following, we will briefly discuss a few approaches used by researchers. Stefan Klöppel, Cynthia M. Stonnington et al. (2008), the dataset collected was divided into 4 groups 1,2,3 and 4 consisting of 20 AD and 20 Control normal, 14 AD and 14 Control normal, 33 with probable mild AD and 57 healthy patients and, to test the ability to differentiate between various forms of dementia, 18 AD patients and an additional group of 19 subjects with pathologically confirmed FTLD respectively. For groups I and III, MRI scans were collected over a period of 10 years. Images were visually inspected for artifacts or structural abnormalities. Images were segmented into grey matter (GM), white matter and cerebrospinal fluid and they were trained using Support Vector Machine Algorithm [3]. The research was based on the pathologically proven data sets, collected from different centers as an input for effective classification [2]. The researchers were able to accurately classify 96% of the patients.

In 2010, R. Chaves, J. Ramírez et al. collected the SPECT data from 97 participants out of which 54 suffered from AD while the rest 43 were normal controls. The authors, using Association Rule Mining found the association between the attributes in the datasets using activated brain regions of interest. These regions of interest were obtained using voxels of each image and considering them as features. The results showed a classification accuracy of 95.87%. Saman

Sarraf et al. (2016) used Convolution neural network on the fMRI data of 28 AD patients and 15 normal controls. The data were divided into three parts: training (60%), validation (20%), and testing (20%). The number of epochs was set to 30, and the batch size was 64, resulting in 126,990 iterations [13]. The authors were able to successfully classify AD from normal with an accuracy of 96.86%. To our knowledge, this is the highest accuracy achieved for a single modality classification to date.

ii. MULTIMODAL APPROACH

While the use of single biomarkers has yielded promising results, they are designed to characterize the differences but this cannot be used to extend to the individual. With this in mind, R Chaves et al. (2013) used the SPECT data of 41 Control Normal and 56 AD patients divided into 3 groups of 30, 22 and 4 patients along with PET data of 75 each AD and Control normal. Classification system consisted of four stages: (i) masking procedure, (ii) discretization of mean intensity, (iii) AR mining, (iv) leave-one-out (loo) cross-validation (CV) [11]. The authors were able to successfully classify SPECT data with an accuracy of 96.91% while the accuracy achieved for just PET was 92%.

D. Zhang et al.. (2011) came up with a method to classify AD patients from healthy ones using three different biomarkers i.e., MRI, PET, and CSF. The authors used the baseline data set with a total of 202 subjects, out of which 51 had AD, 99 had MCI and 52 were healthy controls. Different tests were conducted for MRI, PET and CSF and an accuracy of 93.2% was achieved. Authors claimed that multimodal classification method (using all MRI, PET, and CSF) achieves consistent improvement and is more robust over those using individual modality, for any number of brain regions selected [2].

iii. LIMITATIONS

These studies we outlined are but a few examples of the strides being made and obviously, there are a lot many other impressive studies with good results. But that cannot let us turn a blind eye to the potential issues in the process. Being able to identify issues whether it be with the input data, algorithm, validation etc., is an important part of the prognosis. With that in mind, some of the main issues we found include issues such as sample size, class imbalance, and usage of the unproven dataset. While it is easy to achieve higher accuracies, these methods cannot be used to represent a larger population of data. Also, small samples are prone to overtraining. Imbalanced classes and usage of unproven data along with the usage of small data sizes put some doubt on the robustness of the training algorithms.

III. METHODOLOGY AND ALGORITHM

While Machine learning algorithms are useful for applications where the data sizes are small to medium, Deep learning algorithms benefit from larger dataset. Going with the hypothesis that larger datasets improve the robustness of the classification process, we will be going with a deep learning algorithm known as Convolution Neural Network (CNN). The process of building a Convolutional Neural Network involves four major steps:



We acquired the PET data of 95 patients with confirmed AD and 104 healthy individuals from ADNI. The network was initialized as a sequential network using the Keras image processing library and the Keras layer for convolution was used for training and testing. Also, we used the Maxpooling function for pooling. In Maxpooling, the maximum value pixel from the respective region of interest is needed. The next layers flatten and dense is used to convert the 2D array into a single long continuous linear vector and to perform the full connection of the neural network respectively. The convolution function generates the convolution layers based on a number of filters, the shape of the filter, input shape of the image and the type of image. Here, we are using three convolution layers with the first two containing 32 filters and the last one containing 64 filters, all 3*3 in size. The images were monochromatic and of size 128*128 pixels. The activation function 'relu' was used.

Maxpooling with a pooling matrix of 2*2 was used to get the precise region of the features and have a minimum pixel loss. The primary aim of a pooling operation is to reduce the size of the images as much as possible. The key thing to understand here is to reduce the total number of nodes for the upcoming layers. The images were pre-processed to prevent over-fitting. Overfitting is when training accuracy is great but the test accuracy is very poor due to overfitting of nodes from one layer to another. The images were given to the model for training and testing across 10 epochs and the final result was stored in an HDF5 file for prediction testing. We divided the data into five groups; 1, 2, 3, 4 and 5; for training, and testing starting from a small group consisting of 10 AD patients and 10 healthy individuals to the whole dataset with 95 AD patients and 104 normal controls. In order to maintain robustness each data set was trained and tested across five runs and the mean values of these were considered. All the groups were divided in a ratio of approximately nine-part for training to one part for validation. For the first group, we considered a dataset of 10 patients suffering from AD and 10 patients who were tested to be healthy. With this, we divided the group to 9 people for training and one person from each for testing. Next, we considered a group of 25 AD patients and 25 control normal divided into 22 each for training and 3 subjects for testing. The third group consisted of 50 each from AD and healthy individuals which we dived into 45 subjects for training and 5 for validation. The fourth group consisted of 75 individuals each who were divided into 67 for training and 8 for testing and the final group consisted of the whole data set where 85 patients each were used for training and the rest for testing.

IV. RESULTS AND DISCUSSIONS

A detailed analysis of the result is given herewith. The main goal of using small test cases was to showcase the issue of overfitting when using a small dataset. When a small sample size is used in the training process, the neural network tends to "memorize" rather than learn; leading to a very high training accuracy but a low validation accuracy. This result can be seen in the first two groups very prominently where the mean training accuracies are 99.6% and 95.2% respectively but the validation accuracy were merely 46.34% and 50.61% respectively. Analysis of Impact of Data size for Classification of Alzheimer's disease using Convolution neural Network

| TAB | TABLE I. Training accuracies achieved in 5 runs | | | | | | |
|-------|---|-----------|----------|-------|-------|--|--|
| | Group 1 (10 AD, 10 CN) | | | | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | | |
| 99.60 | 99.62 | 99.55 | 99.63 | 99.64 | 99.61 | | |
| | Gr | oup 2 (25 | AD, 25 (| CN) | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | | |
| 95.22 | 95.19 | 95.13 | 95.25 | 95.26 | 95.21 | | |
| | Gr | oup 3 (50 | AD, 50 (| CN) | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | | |
| 92.11 | 91.97 | 91.96 | 92.00 | 91.99 | 92.01 | | |
| | Gr | oup 4 (75 | AD, 75 (| CN) | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | | |
| 87.27 | 87.34 | 87.33 | 87.30 | 87.29 | 87.31 | | |
| | Group 5 (95 AD, 104 CN) | | | | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | | |
| 82.85 | 82.80 | 82.86 | 82.82 | 82.83 | 82.83 | | |



Fig. 2. Mean Training accuracies of 5 runs

| TABLE II. | Validation | accuracies | achieved | in 5 runs |
|-----------|------------|------------|----------|-----------|
|-----------|------------|------------|----------|-----------|

| Group 1 (10 AD, 10 CN) | | | | | | |
|-------------------------|------------------------|-----------|----------|-------|-------|--|
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | |
| 46.33 | 46.38 | 46.31 | 46.32 | 46.35 | 46.34 | |
| | Gr | oup 2 (25 | AD, 25 (| CN) | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | |
| 50.60 | 50.64 | 50.61 | 50.61 | 50.58 | 50.61 | |
| | Group 3 (50 AD, 50 CN) | | | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | |
| 55.69 | 55.61 | 55.63 | 55.64 | 55.63 | 55.64 | |
| | Gr | oup 4 (75 | AD, 75 (| CN) | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | |
| 59.29 | 59.35 | 59.31 | 59.28 | 59.30 | 59.31 | |
| Group 5 (95 AD, 104 CN) | | | | | | |
| Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Mean | |
| 64.30 | 64.36 | 64.31 | 64.31 | 64.29 | 64.31 | |



Fig. 3. Mean Validation accuracies of 5 runs

With the group 3 and 4, the mean accuracies did drop with accuracies of 92% and 87.31% respectively but the validation was on an upward trend with 55.64% and 59.31% respectively and the last group with the whole dataset achieved an accuracy of 82.83% with a validation accuracy of 64.31%. The results showcase the importance of having a large, class balanced data set for improved prediction accuracy. As the data size increased the overall training accuracy decreased. This downward trend in the accuracy can be attributed to the presence of abnormalities in the training data. With further optimizations in the learning algorithm we will be able to attain better training accuracies than those achieved here, but that process is out of the scope of this research. The main take away point from this is that the validation accuracy increases with the increase in sample size and that machine learning and deep learning techinques do indeed greatly benefit from large datasets.

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