2nd INTERNATIONAL CONFERENCE ON
ADVANCES IN COMPUTING, ELECTRICAL, COMMUNICATION ENGINEERING AND MANAGEMENT
(ICACECEM-2022)
on
6th and 7th December, 2022

Organized by
Department of Electrical and Electronics Engineering

PROCEEDINGS OF THE
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CHAIRMAN MESSAGE

It is my great pleasure to welcome you to the Second International Conference on "Advances in Computing, Electrical, Communication Engineering and Management (ICACECEM-2022)", which takes place in PACE Institute of Technology and Sciences, Ongole, Prakasam, Andhrapradesh. This conference aims to provide ample opportunity for both academic and industrial communities to address new trends, challenges and emerging technologies in the field of Computing, Electrical, Communication Engineering, and Management.

All events will provide opportunities for discussions, debates, and exchange of ideas and information among conference participants. The conference would not have been possible without the enthusiastic and hard work of participants and faculty members.

I thank the ICACECEM-2022 steering committee, for their vision and leadership. We are awaiting the exciting presentatioins, discussions, and sharing of technical ideas with colleagues from around the world.

We thank you for attending the conference and we hope that you enjoy your visit.

Er. M. Venugopal BE, MBA
CHAIRMAN
PACE Institute of Technology and Sciences

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SECRETARY MESSAGE

We feel enthralled on this gracious occasion to welcome you to the Second International Conference on " Advances in Computing, Electrical, Communication Engineering and Management (ICACECEM-2022)" organized by Department of Electrical and Electronics Engineering on 6th & 7th December 2022 at PACE Institute of Technology and Sciences, Ongole, Prakasam, Andhrapradesh, India.The conference, I believe that this second International Conference provides abundant opportunity to the engineering and management field researchers across the country to transmit the knowledge generated through their research. We are sure this conference will quench the knowledge of thirst of research activists and share their knowledge and valuable experience and time in the field of computing, electrical, electronics, and management Sciences.

Finally, we would like to thank all the authors, editors and the delegates for their contributions and participation. The international conference will not be a success without your expertise and active participation. On behalf of the organizing committee, we thank you for making this conference a great success.

Dr.M.Sridhar B.E, M.Tech, MBA
SECRETARY
PACE Institute of Technology and Science

PRINCIPAL MESSAGE

I take the privilege to welcome the eminent researchers, academicians, and the students for the second international conference on "Advances in Computing, Electrical, Communication Engineering and Management (ICACECEM-2022)" organized by the Department of Electrical and Electronics Engineering on 6th and 7th December 2022 at PACE Institute of Technology and Sciences, Ongole, Prakasam, Andhrapradesh, India.

I am sure the conference will be extremely useful to researchers, faculty members and all those professionals involved in these areas. I am confident that the take away from the conference will be of immense value and give a boost to our research in the niche.

I expect it to be a great opportunity and inspiring the academic, industrial professionals, and researchers in this occasion to learn and share new knowledge in the latest trends of Computing, Electrical, Communication Engineering and Management. I hope that this international conference will provide a better platform to interact with the eminent speakers on the cutting-edge themes of Computing, Electrical, Communication Engineering and Management.

Dr. G. V. K. Murthy B.E, M.Tech, Ph.D
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HOD MESSAGE

I deem it my immence pleasure to invite you to the conference ICACECEM-2022, which is held on 6th and 7th December 2022, PACE Institute of Technology and Sciences, Ongole. Indeed it has been a real reputation and opportunities to us to organize a great event ICACECEM-2022 PACE.

We are delighted to see how step-by step time spent inplanning has come to an execution mode. Since this conference is a platform to support the recent research and technical growth in education, the participants of the conference will be able to improve own skill-set and deepen exchanges through lively discussions and interactions. Such need base conference is vital to both institutions and individuals

I would like to thank for the efforts of our members and referees for their invaluable help to make this event sucess. I thank the ICACECEM-2022 steering committee, for their tremendous efforts. We are anticipating for the pragmatic presentations, discussions, and sharing of technical ideas in the conference.

I hope the conference would give profound insights of research.

Dr. K. Venkateswarlu M.Tech, Ph.D
HOD
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CONVENOR MESSAGE

It is my pleasure to welcome you all to International Conference on "Advances in Computing, Electrical, Communication Engineering and Management (ICACECEM-2022)", during 6th and 7th December 2022 at Institute of Technology and Sciences, Ongole, India. I earnestly hope that attending the conference will be a rewarding experience for academician, students, research scholars upcoming young minds and industries to address new trends and challenges and emerging technologies on the topics relevant to today's fast moving areas of Computing, Electrical, Communication Engineering and Management. The conference focuses on specific engineering and management streams allowing the speaker to drill deep into the issue and ensure that we return to our workplace with actionable information that we can put to use futher. I thank the teaching and non faculty for their extensive help, management and faculty members of EEE Department for their relentless support.

B. Nagaraju M.Tech, (PhD)
CONVENOR
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About PACE Institute of Technology and Sciences

(Autonomous)

PACE INSTITUTE OF TECHNOLOGY AND SCIENCES (PACE ITS), was established Under the Srinivasa Education Society in 2008 at Valluru village near Ongole. It has been running successfully since the academic year 2008-2009. PACE, being an NRI project, is committed to creating a world-class technical education.

The Institution was established in the year 2008 with a humble beginning with a modest strength of 240 students, by the founders Er.M.Venugopal Rao, Chairman, and Er.M.Sridhar, Secretary & Correspondent. Ever since it has been flourishing from the minimum strength to the immense student strength in the stewardship of enlightened management. PACE has been situated in a panoramic area of 11.0 acres. The institute has obtained a place of pride and become a pioneer in imparting higher education in the rural domain. The management has initiated courses such as B.Tech, M.Tech, MBA, and Diploma.

The AICTE, New Delhi approved PACE Institute Of Technology and Sciences in the year 2008 and sanctioned the strength of 60 students for each branch of EEE, ECE, CSE, and IT. In the year 2009-2010, CIVIL and MBA were approved successively. In the consecutive year 2010, the college sanctioned the Mechanical and Automobile branches. An M.Tech Program (CSE), and 120 seats for B.Tech (CSE) were sanctioned by AICTE. In the year 2012, the institute was approved by AICTE for M.Tech Programmes in ECE and EEE, along with 120 seats for B.Tech (Civil & Mechanical). By adding another feather to the eminence of PACE, the State Board of Technical Education of Andhra Pradesh sanctioned Diploma (EEE & MECHANICAL) in the year 2012. The various courses run by the Management are endowed with a team of dedicated faculty working with a missionary zeal

About Department of Electrical and Electronics Engineering

The Department of Electrical and Electronics Engineering has been established with core Research and Development in Power Apparatus and Systems. The Department offers full time UG Programme, one hundred and twenty students are admitted every year. The Department comprises of highly qualified and efficient faculty members in which we see an utmost encouragement to the students. Class rooms are well equipped with the latest audio-visual equipment and modern laboratories. The Department provides adequate computing and sufficient library facilities. The Department has a stern Industry- interaction and also offers testing and consultancy services. The Faculty and students participate in National and International Conferences and present papers every year in reputed journals and International Conferences. In order to enhance the quality of faculty, periodic training programmes are being conducted by inviting eminent personalities from Industry and Academic Institutions and sponsoring the Faculty for various Faculty Development Programmes. The students are encouraged to conduct Intra-Departmental symposium and National Symposium in order to enrich their knowledge with the latest advancements. The Department has a Hobby Centre created for the students for developing their innovative and novel ideas in the field of Research and Development.

About Advances in Computing, Electrical, Communication Engineering and Management (ICACECEM-2022)

Recent improvements in Computer technologies make not orious advancements in communication and electrical engineering. This International Conference on Advances incomputing, Electrical and Communication Engineering and Management (ICACECEM-2022) aim to bring all those advancements to one place by exchanging numerous authors 'ideas and expert talks. The conference serves as a better platform to enrich research activities. Serves as a better platform to enrich research activities.

The conference covers a wide range of topics but it is not limited to the following:

TRACK1:
- PowerElectronics
- PowerSystems
- ElectricVehicles
- PowerQuality
- RenewableEnergySources
- SmartGrids
- FlexibleACTransmissionSystem
- OptimizationTechniques
- IndustrialAutomation

TRACK2:
- Antennas
- VLSI
- Embedded Systems
- Wireless Communications
- Image and video processing
- Cyber Security Systems
- Audio/Speech processing & Coding
- Pattern Recognition
- Radar Signal processing
- Biomedical Signal Processing
- Communication for Intelligent transport
- Optical and Satellite Communication
- Software Defined Radio
- 5G Communication
- Robotics & Human Machine Interface
- Cryptography

- Network Security

TRACK3:
- Nano technology
- Mobile and Cloud Computing
- Artificial Intelligence
- Machine learning
- Cyber Security
- Data Science
- Soft Computing
- IoT & Black Chain Technology

TRACK4:
- Finance
- HumanRecourse
- BusinessAnalytics
- Management
- Entrepreneurship
- SupplyChainManagement

The National Conference features eminent keynote speakers under the above areas followed by presentation by students, and researchers all over the country.

KEYNOTE SPEAKER

Hazarath Voleti,
Sr Engineer - Active Network Management of DERMS,
Stafford, England, United Kingdom.

I whole heartedly congratulate the Department of Electrical and Electronics Engineering of PACE Institute of Technology and Sciences,Ongole, Prakasam, Andhrapradesh, India and organizing committee for organizing two day international Conference on "Advances in Computing, Electrical, Communication Engineering and Management (ICACECEM-2022)" which provides to enrich the knowledge and exchange views between the academia, industry and research institutions. This may open some more opportunities to work research area and also fill the gaps in the industry.

I appeal to all the participants to involve themselves in meaningful deliberations during the technical sessions and also use the specialists available for discussions. I whole heartedly wish the conference a grand success.

LIST OF FULL-LENGTH ARTICLES

Global System of Mobile Communication Based Low Voltage Transmission Line Fault Detection and Location

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Abstract— **The frequent power interruption in Ethiopia is the main problem. This is due to transmission line as well as distribution line faults. The main aim of this research is to develop short message service (SMS) based low voltage distribution line fault detection and location system. The system can increase the reliability of electric power to customers by minimizing the maintenance time of power outages due to transmission line faults using an accurate fault location method depending on the available information at the fault location.**

Transmission Line fault is the most common fault; it may be triggered by lightning strokes, the fall of trees across the lines, and other mechanical means. These faults must be addressed as soon as they occurred to assure the continuity of the electric power supply. Thus, it is necessary to detect the fault as early as possible.

This research presents a fault detection and location technique for low voltage overhead transmission line using one end impedance-based fault detection and location on Global system of mobile communication (GSM) based. The GSM based transmission line fault detection is designed to detect the low voltage transmission line fault for the Ethiopia electric power (EEP) workers to easily recognize the current condition of the transmission line through SMS texting. The system takes voltage and current magnitude as input parameters and then measured them using voltage and current sensors by interfacing with an Arduino microcontroller. The location of the fault is identified by calculating the fault impedance and then the text is sent to announce the fault location.

The proposed system helps to detect the low voltage transmission line faults continuously and hence to guard the fault of transmission line due to the constraints such as unsymmetrical and symmetrical types of faults mainly short circuit faults. If any of this does occur, then the EEP workers can easily detect the fault and maintenance will be done within a short period of time. Therefore, the system will provide the solution for the problem complaints of society (customers) due to the outage of power within a short period of time.

We have successfully implemented and tested a prototype of GSM based low voltage distribution line detection and location system in the laboratory. We have managed to detect and locate a fault by receiving SMS on Mobile. Our system significantly improves the current manual and time-taking fault detection and location mechanism on EEP distribution lines.

Keywords— *fault location, Impedance based, GSM modem, Distance relay*

I. INTRODUCTION

It might be difficult to locate a defect in a transmission line unless it is a serious. But over time, this little flaw will cause harm to various infra structures and endanger human life. It might also start a fire. A breakdown in the transmission line is a common cause of power outages. Consequently, home activities that use the electric system, small enterprises, and even large industries (companies) will stop until the customers announce the fault for EEP workers. Consequently, home activities that use the electric system, small enterprises, and even large industries (companies) will stop until the customers announce the fault for EEP workers and maintenance takes place. In Ethiopia today, we don't have a mechanism in place that would allow us to real-time notification of a defect. We don't have a realtime system, which is concerning because it causes harm to the connected equipment underneath and poses a risk to nearby people. To avoid such incidents to the maximum extent, maintenance or checking of the transmission lines must be carried out frequently. This leads to increased manpower requirements to search whether there are transmission line faults or not.

That is why we encourage solving the problem using GSM (Global system mobile with texting SMS) based low voltage transmission line fault detection. This system of transmission line fault detection simplifies the difficulty of identifying whether the fault is happening or not for a specific location. Hence, from the information we have, customers were tired to inform them (EEP workers) that the fault was happening in their location and there is a time delay to solve the problem. To overcome these problems, we are proposing a GSM based low voltage transmission line fault detection system.

II. BACKGROUND

Thousands of transmission and distribution lines make up this vast network. This figure is rising as a result of the rising demand for electricity. Transmission and distribution lines can develop faults as a result of adverse weather, wildlife, faulty equipment, etc. Devices like automatic reclose can fix some of the issues that are momentary. Temporary failures typically don't involve human intervention and don't have a lasting impact on the power

supply. When maintenance teams are dispatched to the problem location to assess the damage and restart the power supply, some defects become permanent. Modern power systems must be safer and more dependable since consumers in today's culture are more sensitive to power outages.

Therefore, a reasonably accurate estimation of the fault site can substantially assist the engineers in locating the defective machinery and accelerating the restoration of the power supply. Fault location techniques are divided into three groups according on the signal employed [1]:

1. Techniques rely on the voltage and current's fundamental frequency
2. Techniques rely on fault-generated high-frequency travelling waves
3. Uses of artificial intelligence

The fundamental-frequency components of the voltage and current signals are extracted by fundamental-frequency fault location techniques, also referred to as impedance-based fault location methods, in order to determine the faulted line's impedance. The calculated impedance is considered to be a measure of the distance to the fault. An IEEE guide [2] listed some notable definitions for fault location estimation in modern electric power systems. Fault location error is defined as the percentage error in fault location estimate based on the total line length. A homogeneous line is a transmission line where the impedance is distributed uniformly on the whole length. These two definitions will be used many times in the application of impedance-based fault location techniques. The impedance-based method is widely used in the modern power system because of its easy implementation. It can be further classified into one-end or two-end depending on how many terminal voltages and currents are required [3]. One-end impedance-based method uses the voltage and current captured at one terminal of the line. It is a straightforward method and requires simple communication channels. Positive-sequence-reactance method calculated the apparent impedance seen by one terminal based on the voltage and current measurements [2].

The voltages and currents at one or both ends of a transmission line are used in impedance-based fault location techniques to identify whether a fault has occurred or not. Usually, these computations call for the transmission line's impedance per unit length. The single-ended, impedance-based fault location method is appealing since it is straightforward, quick, and communication-free.
Two different single-ended fault location methods exist:
• Simple Reactance
• Takagi-based

When there is no large fault resistance or load current, the basic reactance approach performs admirably for homogenous systems. The fact that one-terminal impedance-based fault location techniques only use measurements from one end of the transmission is one of their main drawbacks. There are numerous strategies to mitigate this issue. The Takagi method is one of these approaches that is most well-known. With this modification, the computation now takes into account the variation between the currents observed before and after the fault. As a result, the fault impedance is

taken out of the study, eliminating a key source of inaccuracy [4].

III. METHODOLOGY

We employ a GSM-based impedance method for the detection and location of low voltage transmission line faults in this paper. The voltage and current values are measured by interfacing the voltage sensor and current sensor with the Arduino microcontroller in order to locate the transmission line fault. Using the voltage sensor, the main voltage is measured at each instant and fed to the Arduino analog input. In order to do that, it is first transformed down to a safe voltage, and then divided further before being applied to one of the analog inputs of the Arduino. The voltage sensor output is nominally 9 V for 220V input at full load. Thus, the voltage is further reduced by the potential divider formed by R1 and R2 to get the desired input of the Arduino. And to ignore the negative component of the input to the Arduino, we use an offset capacitor. Hence the input range of the Arduino is from 0V to 5V [6]. In the same way, the current sensor is used to measure the main current at each instant. But to feed the measured current to the Arduino analog input, it must be changed to voltage and reduced to the desired input of the Arduino. This voltage is measured by the analog input of the Arduino microcontroller [5].
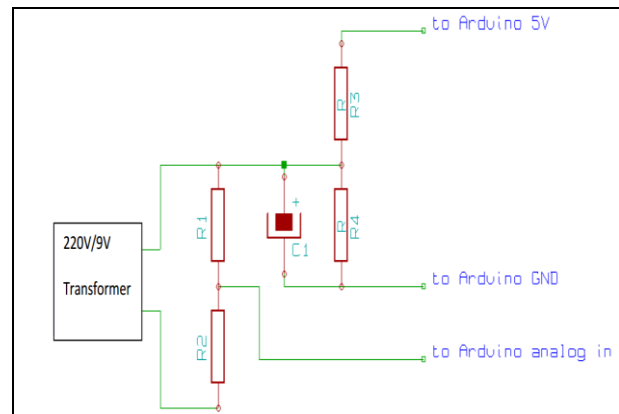

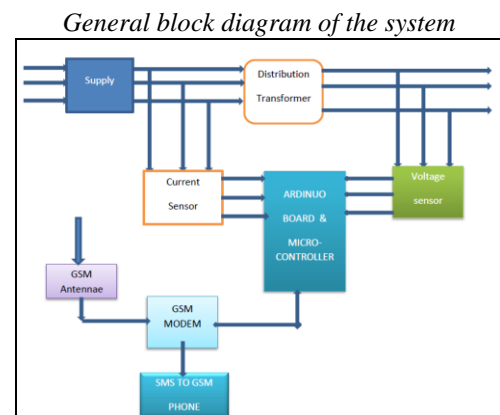Fig.1. Circuit diagram of Potential transformer sensor

Fig.2. Block diagram of GSM based low voltage transmission line fault detection and location.

Flow chart of the system methodology
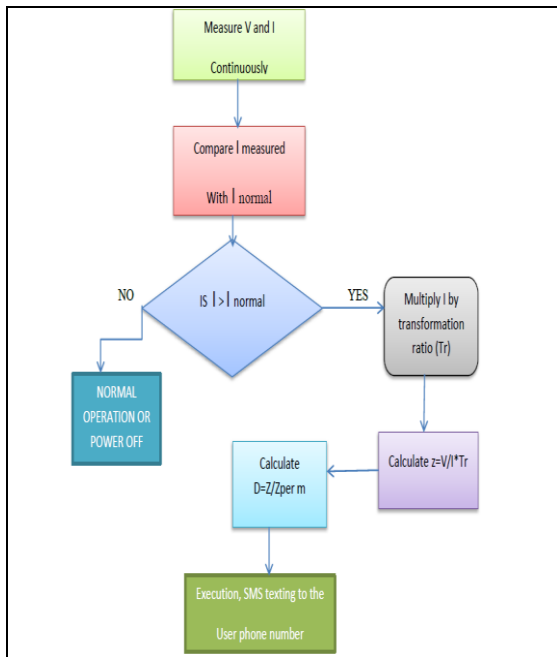
Fig.3. Flow chart of the system

Circuit diagram connection of the system component on Proteus
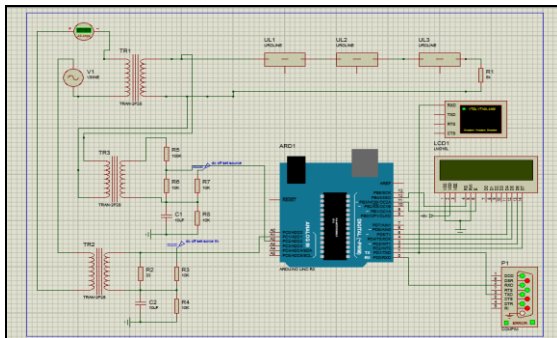
Fig.4. Circuit connection of the component of the system in Proteus.

This system uses the value of voltage and current from the voltage sensor and current sensor as input for the Arduino. So, according to the value of the input, the Arduino microcontroller will analyze the data and it will show the state of the line whether it is faulty or not, and at which location the fault occurred by initiating the GSM modem to sends SMS texting. The Arduino has two inputs, one of them from the voltage sensor and the other from the current sensor. The voltage transformer is connected to the secondary side of the distribution transformer and measures the voltage at every instant and the current sensor is connected to the primary side of the distribution transformer and will measure the current value at every instant. Consequently, the location of the low

voltage transmission line fault can be calculated by taking the value from the voltage sensor and the value from the current sensor and the Arduino microcontroller initiates the GSM modem to send SMS texting to the EEP maintenance department head.

IV. RESULTS

Proteus simulation and result for single phase line to ground fault
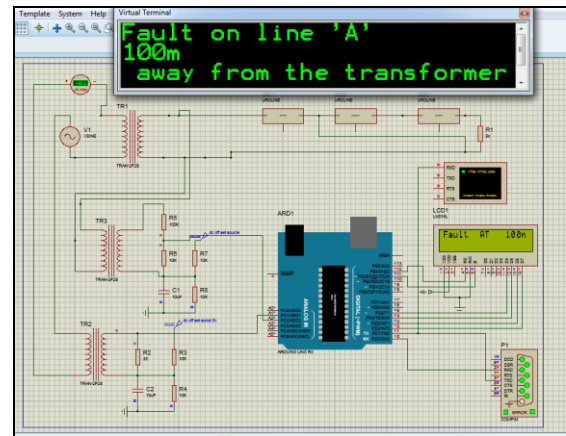
Fig.5. Simulation result of the fault at 100m
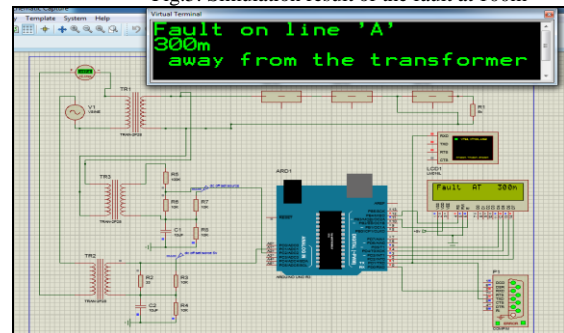
Fig.6. Simulation result of the fault line at 300m
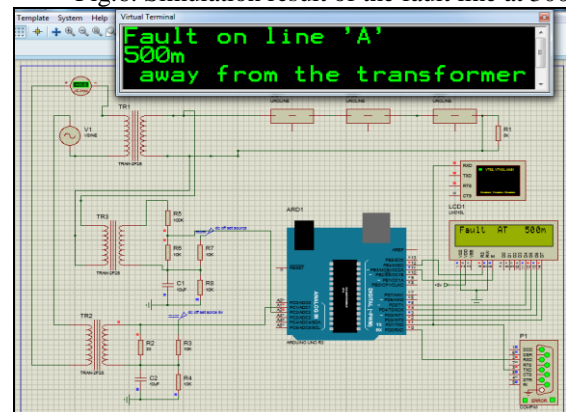
Fig.7. Simulation result of the fault at 500m

Components configuration and result of hardware implementation
The overall implementation of GSM based low voltage transmission line fault detection and location has the following hardware components.
1) Voltage sensor
2) Current sensor
3) Arduino microcontroller
4) GSM modem
5) USB cable
6) Capacitors and resistors

These components are connected as follows for the prototype implementation of the system

Fig.8. Hardware connection of the system

Hardware implementation results

Fig.9. SMS Texting result of transmission line fault at 300m and 500m

The fault on the transmission line needs to be restored as quickly as possible. The sooner it is restored, the less the risk of power outage, damage to equipment components, loss of revenue, customer complaints, and repair crew expenses. Rapid restoration of service can be achieved if a precise fault location method is implemented.

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Optimal Power Distribution Allocation in Restructured Power System

L.J Baktha Singh[1] B.Sujitha[2] G.Anvitha[3] B.Veronica[4] G.Trinadh[5]

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ABSTRACT: **In the power system the loads are consumers. Utilization of electricity of the consumer change time to time. This may be increased or decreased. Hence the power system is to be considering as variable system. As utilization of electricity changes, the powe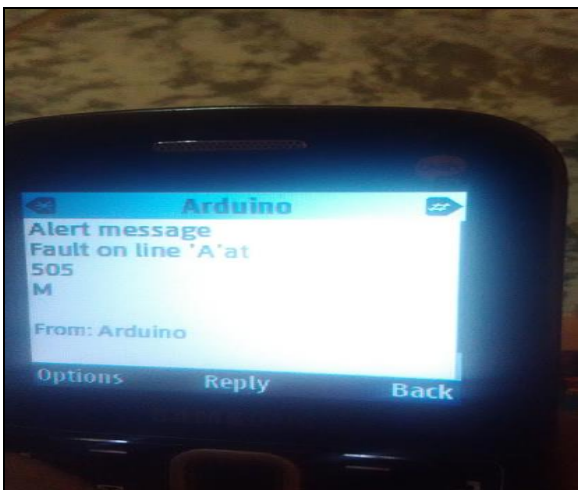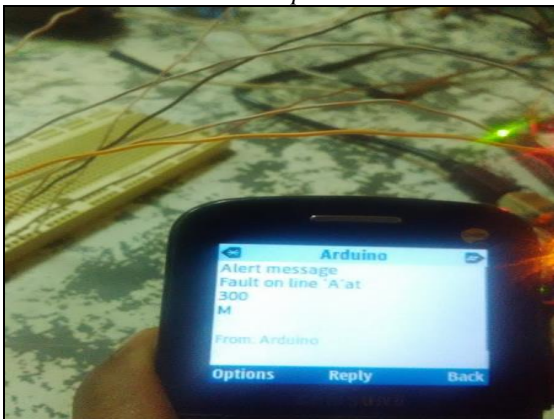r system parameters also changes. This will leads uncertainty in the power system. The many procedures introduced to optimize the power system such that the demand is increased and losses and cost are decreased. Even though there is small deviation in the procedure that created much better results in the power system. This paper mainly concentrate on the reusing process for designing the electrical power distributed circuits with compromised assigning of hybrid electrical power receiving end alternators. The reusing procedure is improved to give great answer for electrical power system problem. The 'Improved Equilibrium optimization algorithm (IEOA)' is used to solve the above problem. The different consumer levels are considered to check effect of this procedure.**

Keywords: Power Distribution system optimization, Power system network reconfiguration, Optimal allocation DGs, Multi objective optimization

I. INTRODUCTION

An electrical system involves electrical components deployed to supply, transfer, and utilization of electric power. An example of a power system is the electrical grid that provides power to domestic and factories within an extended area. An electrical grid is the system which is connected to AC generators to give electrical power, the transmission systems that take the power from the electrical power generators to the consumer center and the distribution system that gives electricity to domestic and factories. The consumers like industry, hospitals, commercial buildings, and homes construct power systems as per their requirements.

Generally one line diagram is used to represent the total components of power system. As the requirement of bulk consumers is three phase alternating power, and moreover this may be require at homes, factories, under the water, on the water, remote places, hilly areas, underground areas etc. To give electrical power at these areas, the strong system is required to overcome the problems of the system while operating. The major issues of the electrical power system while operating are increasing electrical power wastages, no load to full load poor voltage variations, poor reliability and even less protection.

Under these conditions, to operate the electrical power system successfully, it is required to pay much attention.

II. METHODOLOGY

A. Conventional Eoa

In conventional Equilibrium optimizing procedure, the starting focuses of the particles with assigned quantity are

In each solution, the particle's focuses are kept to calculate a system's objective function to know its state. In each solution, the particles are reconfigured based on equal priorities that have 4 best so far particles. Mathematically It is given by

$$Knew = Keq + \frac{G}{\lambda}(1 - E) + (K - Keq).E$$

Where,

K and **Knew** are the existing and updated focus values of the particle, respectively.

Keq is a random focus value to take from equal priority pool.

λ is a random value between zero and one;

E is an e-power term, and

G is producing rate.

$$E = p_1 \, sign(n - 0.5).(e^{-\lambda(1 - \frac{S}{S_{max}})} p_2 S/S_{max} - 1)$$

$$G = \begin{cases} 0.5b_1(K_{eq} - \lambda K)E & \text{if } b_2 \geq GP \\ 0 & \text{if } b_2 < GP \end{cases}$$

Where,

p_1 and p_2 are coefficients which are not variable ($p_1 = 2$, $p_2 = 1$);

n is unusual value between zero and one;

S and **Smax** are the present and the final number of the solutions respectively. b_1 **and** b_2 are unusual values between zero and one;

GP is a mentioned value that is called production occurrence (it is 0.5).

B. Proposed Ieoa

The major merit of the existing Equilibrium optimizing procedure is its high easiness in the reconstruction of particles and its ability to control between the unfamiliar and familiar properties.

$$I_{DV} = \{\sum_{p=1}^{Meq} \sum_{q=1}^{Meq} \| K_{eq}(i) - K_{eg}(j) \| \} / M_{eq}^2$$

In this paper, a reusing mechanism is introduced to give different solutions with controlled unfamiliar / familiar elements that depends on the far from the

particles to particles in the best so far pool. To achieve this, Euclidean distance diversity index (IDV) is calculated to represent the dive is augmented to find the farness among particles in the identical equal the identical equal pool.

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where, Keq represents the sum of the particles in the identical The proposed regenerating methodology is applied for each variable that is not in the range. It is depends on the power of the diversity in the identical equal pool.

If the diversity value is more, then the familiar real time solution is taken out. And when diversity value is less, then non familiar real time solution is taken out in a unusual.

systems. In each example, three cases are taken. The first one is nominal condition, second one is light load condition and third case is heavy load condition. The above three cases are tested for EOA and

Improved EO Also, the ability to control between the familiar and non familiar property is strongly provided by transforming the production probability from being

constant to be automatically changed with the solutions as given below: This transformation supports the exploitation phase if the focus on familiar is great or at the next case of the discourse of the solutions. Not only,

III.   FLOW CHARTS

The flow chart for EOA and IEOA are as shown in figure 3, 4.
The above methodology is verified with IEEE 33 distribution system and IEEE 69 bus systems. In each example, three cases
are taken. The first one is nominal condition, second one is light load condition and third case is heavy load condition.
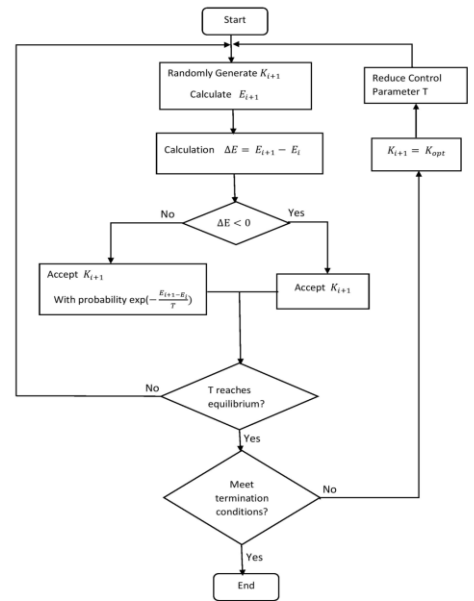The above three cases are tested for EOA and Improved EOA.
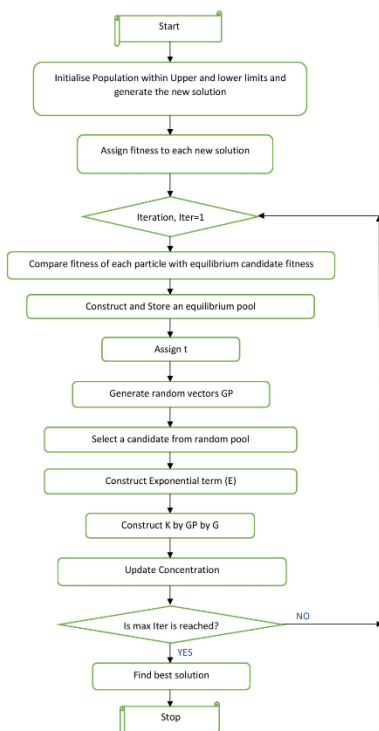

Fig 4: Flow chart of IEOA

Fig 3: Flow chart of EOA

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IV. SIMULATION RESULTS

Table 2: Simulation results of IEEE 69 distribution system

S.No.	Load condition	Items	Open lines	Power generation in KW	Losses In KW
1	Nominal load	Base case	69 to 73	-	234.202
		EOA	12,18,56,69,71	2270	36.745
		IEOA	10,25,49,67,72	2180	**31.896**
2	Light Load	Base case	69 to 73	-	47.058
		EOA	14,21,53,63,68	980	10.970
		IEOA	8,20,30,50,60	1006	**10.071**
3	Heavy load	Base case	69 to 73	-	701.541
		EOA	13,28,37,55,64	3567	104.270
		IEOA	15,25,34,49,69	3569	**98.214**

V. CONCLUSION

From the above examples, it is observed that, Improved EOA give low losses compared with EOA.

It is more significant in heavy load condition. It is less effective in light load condition.

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ICEEE003

A Literature Review on Electric Vehicles in Andhra Pradesh

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Abstract—In gift scenario, air pollutants has come to be a severe challenge for the India. According to current worldwide report, many towns within side the India are maximum polluted towns. Major sectors contributing to the air pollutants are business zone and shipping zone. Among this 51% of air pollutants is because of the economic zone and 27% via way of means of the shipping zone. Air pollutants contributes to the untimely deaths of two million Indians each year. In order to limit the air pollutants, Electric Vehicle (EV) can act as blessing in reducing the GHG emission. Electric Vehicles provide several benefits including reducing the pollutants stage and discount in oil import payments etc. Although there may be great quantity of threats in organising the Electric Vehicles in India. This paper gives the short literature assessment the Electric Vehicles and compiles the benefits and threats in selling EVs in India.

Keywords—Electric Vehicle, Emission, Charging station, Battery Technology

I. INTRODUCTION

Air pollution is one of the greatest threats in the global context, and in a country comprising of world second largest population of almost a 130 million (equivalent to 17.7% of world's population), people are finding problematic to breath in most of the metropolitan cities. India is facing some serious air pollution issues since a decade and it is increasing at an alarming rate. The main cause of this exponential increase in the pollution levels is poor fuel quality, old vehicles, inadequate maintenance, congested traffic, poor road condition and old automotive technologies and traffic management system.

The major pollutants emitted from the automobiles are hydrocarbons, nitrogen dioxide, lead, carbon monoxide, sulphur dioxide, and particulate matter. Reason behind large share of vehicular pollution is India's gigantic automotive industry i.e., 4th largest in the world. According to the Ref. [1], the population of electric vehicle in India is increasing at the rate of 37.5%. And the government is focusing the more concern towards the Electric Vehicles [2] and charging stations [3]. In reference [4], placement of charging station has been proposed to optimize the charging stations and provide the maximum power as per the requirement.

II. WORKING PRINCIPLE OF EVs

Fig. 1 shows the working principle of electric car in which the e-motor gets energy from a controller which collects the power from a battery. The e-vehicle works on an electric principle. Battery pack provides the power to the electric motor. Therefore, e-motor uses the energy received from the rechargeable battery to rotate the transmission system, thereby, wheels rotate. Moreover, a potentiometer is hooked to the accelerator pedal of the car which signals the controller how much power is to be delivered to the electric motor.
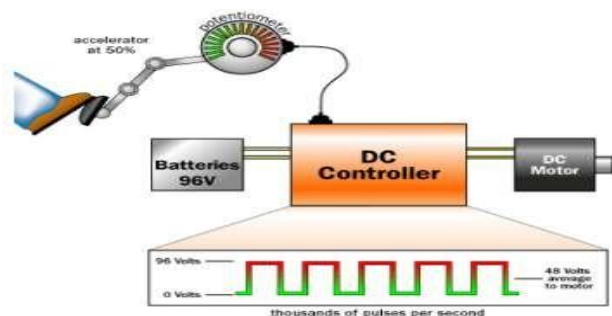
Fig.1. Principle of Electric Car [5]

III. ADVANTAGES OF EVs

In order to reduce air pollution, we need to move towards an alternate source of transport from convention ICE vehicles and EVs can act as an alternate source of transportation giving plenty of advantages to the consumers which are mentioned below:

A. EVs are environment friendly

Compared to ICE vehicles EVs does not produce smoke resulting in no pollution. EVs don't even have an exhaust system, meaning they have zero emissions. And since gas-powered vehicles are large contributors to greenhouse-gas making the switch to an EVs can help in making the planet healthy.

B. Electricity is the cheaper than gasoline

Per kilometer cost to EVs is cheaper compared to ICE vehicles. The fact cannot be denied that many EVs run at one-third of the cost, given that electricity is significantly less expensive than gasoline. And since consumer charge there EVs in garage most of the time, installing solar panels at home can save even more money.

C. Low maintenance

Due to absence of internal combustion engine in EVs its maintenance requirement becomes less.

IV. CHALLENGES AHEAD

Presently, there are many more challenges to establish the Electric Vehicle future. The major role to run the Electric Vehicle in India is power generation. Without electricity, we cannot imagine Electric Vehicle future. Therefore, responsibility of distribution network increases to supply the proper electric power without failure. Which can be possible by proper monitoring of the network. Phasor Measurement Unit (PMU) [6-10] measure the voltage and current in real time and protect the network from any failure. In reference [11], voltage stability problem has been discussed and

resolve by using the PMU which is installed and the power system buses.

A. High Cost

Cost of buying EV is quite high when compared to that of an ICE vehicle i.e., the average cost of electric cars in India is around 13 Lakh (INR), which is much higher than the average INR 5 Lakh for economical cars run on traditional fuel. These are mainly due to the lithium import for battery making and since batteries make up to about 50% cost of the vehicle therefore EVs are costlier. Lithium is a rare metal which has its high reserves in countries like Chile, Australia, and Argentina.

B. Lack of charging infrastructure

The main hindrance behind commercial viability of EVs in India is inadequate charging infrastructure. India only had 650 charging stations in 2018, whereas China had over 456K charging points in the same year. Other reason creating anxiety is charging time. Battery charger efficiency according to the present available technologies all over the world varies in percentage from low 70s to high 90s [12].

C. Range anxiety

Range anxiety is one of the most significant roadblocks to EV adoption. EVs generally have shorter range which causes charging fear in consumers mind. At present longest range EV available is Tesla's model S which has a range of 370 miles per charge. But since Tesla is not entered the Indian market so Indians do not have reach to this high range vehicle. EVs available in India do not have range more than 500 km per charge. This is deeply associated to the lack of charging infrastructure in the country, and while conventional vehicles can be refueled at petrol stations, such is not the case when it comes to EVs.

V. OPPORTUNITIES AHEAD

The electric vehicle market is set to expand owing to the ambitious plans and initiatives of the government. The government has taken a number of steps to incentivize and promote the deployment of electric vehicles and public charging infrastructure to achieve significant electrification by 2030. India is targeting to reduce its excessive oil imports and curb pollution levels across cities in the coming years.

Electric vehicles will play an important role in achieving this target.

VI. INDIA'S POLICY ON ELECTRIC VEHICLES

In 2012, the National Electric Mobility Mission Plan (NEMMP) 2020 was established, under which an incentive scheme, Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME), was launched in 2015 to reduce the cost of hybrid and electric vehicles and to encourage their penetration in the market. The FAME scheme offers a subsidy on the retail price of passenger cars. These subsidies range from INR 11,000 – 24,000 for mild hybrids, from INR 59,000 – 71,000 for strong hybrids; and from INR 60,000 – 1, 34,000 for electric vehicles. Subsidies are also available for two-wheelers, three-wheelers, light-commercial vehicles and buses.

The subsidy from the FAME scheme is not the only incentive mechanism that impacts the market for hybrid and electric vehicles in India. The Central Government of India and some state governments, such as the Government of National Capital Territory of Delhi (NCT of Delhi), provide tax incentives that treat hybrid and electric vehicles preferentially over conventional technologies. As per the recent announcements made by finance minister Nirmala Sitharaman, during the union budget 2020 presentation, the government has increased the import duty on electric vehicles to promote make in India.

VII. LITHIUM RESERVES REVOLUTIONISE EV SECTOR IN INDIA

Reserves of lithium, a rare metal critical to build batteries for electric vehicles, have been discovered in Mandya, 100 km from the Bangalore. This will be the breakthrough in local manufacturing of EV batteries. Researchers at the Atomic Minerals Directorate, a unit of India's Atomic Energy Commission, have estimated lithium reserves of 14,100 tonnes in a small patch of land surveyed in the Southern Karnataka district. Among the other countries, Chile is estimated to have lithium reserves of up to 8 million tonnes while 2.8 million tonnes have been found in Australia. Argentina is reported to have lithium reserves of up to 1.7 million tonnes. According to the data, Portugal also has 60,000 tonnes of lithium reserves, which are substantially higher in number when compared to the lithium reserves in India. The details of lithium ion battery have been given in [13].

VIII. CONCLUSION

One of the factors deterring customers from purchasing electric vehicles is their high cost. To address this, the government has offered subsidies to commercial vehicles in an effort to encourage a wider adoption of EVs. But imported batteries continue to drive up the cost of electric cars by at least 30 percent. Subsidies for electric commercial vehicles were made available as part of the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) program that the Center launched in 2015. The EV industry faces a number of obstacles, including a lack of charging infrastructure and a reliance on imported components and batteries, according to experts. But all of that could change in 2020. Cost of battery imports will come certainly descended because of the disclosure of lithium holds in Bangalore.

Manufacturers have introduced a number of new EV models in the last quarter that claim to have a longer range, some significantly longer than the current 80-90 km. Electric vehicles are unquestionably the standouts even at this year's Auto Expo in Greater Noida. The Futuro-e from Maruti Suzuki and the Nexon EV and Altroz EV from Tata Motors are among the electric vehicles that have caught everyone's attention at the expo. The Ora R1 from Great Wall Motors in China won the competition. Inadequate charging infrastructure is yet another significant obstacle that EVs in India face. India's 2,636 charging stations necessitate immediate attention to the charging infrastructure. Rishabh Jain, manager of the CEEW, Centre for Energy Finance, a public policy think tank, asserts that India has ample electricity generation capacity to power these automobiles. According to the analysis, passenger and commercial four-wheelers used 21.3 million tons of gasoline and diesel between 2017 and 2018. It is estimated that nearly 50 billion units of electricity would have been required to charge these vehicles if the distance traveled by these vehicles was equivalent to EV-km.

estimated that nearly 50 billion units of electricity would have been required to charge the EVs.

This amounts to 3.2% of the electricity produced during the same monetary year. According to the Central Electricity Authority, India's solar power generation capacity is 31 GW. This indicates that EVs can use enough electricity. However, all that is required is a policy for the installation of charging stations, and power distribution companies, for instance, would need to upgrade their transmission infrastructure in order to meet the demand for EVs. In this segment, experts point to the business opportunity. Power and battery players can take advantage of a number of opportunities. Even charging stations for electric vehicles offer small-scale business opportunities. This could help the Make in India initiative and provide Indian businesses with opportunities. India can reduce its reliance on imported oil and gas by developing these segments. Storage of excess solar power in electric vehicle batteries, which can then be sold back to the grid, is another excellent opportunity.

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ICEEE004

A Novel Design Hybrid Controllers To Electric Vehicles

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Abstract—**The Duling IVECO vehicle was equipped with the ISG electrical propulsion system as part of the development of IVECO ISG hybrid electric vehicles (HEVs). So, along with another controller, the ISG electrical propelling system controller built the distributed control system. Field bus, however, is a crucial tool in the distributed control system. ISG controller hardware and software were both designed in a modular fashion after first presenting a CAN communication protocol for ISG controller based on the SAE J1939 CAN bus standard.**

Keywords hybrid electric vehicle controller; integrated starter/generator; CAN bus; SAEJ1939protocol; design

I. OUTLINE OF SAEJ 1939 CANBUS

The field bus with the highest level of credibility is the CAN bus (Field Bus). One of CAN protocol's key features is the replacement of the conventional station address coding with communication data block coding. It is possible to avoid the point-to-point restriction and have several distributed measure and control systems thanks to this coding style, which also enables multiple nodes to receive the same data at the same time. In addition, by using communication data block coding, the network's node count can potentially be unrestricted, which is crucial for distributed control and measurement systems. The maximum data segment length in the CAN protocol is 8 bytes, which can satisfy

The validity of data transmission can be ensured by the CAN protocol's CRC check and support for erroneous processing. Two lines are all that are required for the CAN bus to communicate with the outside world due to its simple design. Every node in the network has the ability to continuously broadcast information to the other nodes thanks to the multi-master bus known as the CAN bus. In conclusion, because to its high credibility, vividness, real-time, anti-interference ability, and straightforward structure, CAN bus is regarded as the most promising field bus...

The SAE J1939 protocol, which targets trucks and large passenger buses, is an applied layer protocol built on CAN bus 2.0B. The SAE J1939 protocol must use the expand message format even though the CAN 2.0B protocol supports both standard frame and expand frame message formats. The SAE J1939 protocol, based on CAN bus 2.0B, provides the Further definition of 29 arbitration field identifiers in expand frame message. Being compatible with the standard message format, the standard message is allowed to use in the local area network (LAN) of SAEJ 1939 protocol.

In the SAE J1939 protocol, the Protocol Data Unit (PDU)is used to pack the delivered data. PDU is packed in one or more CAN data frames, and delivered to the other network devices through a physical medium. The format of PDU is show non TABLEI.
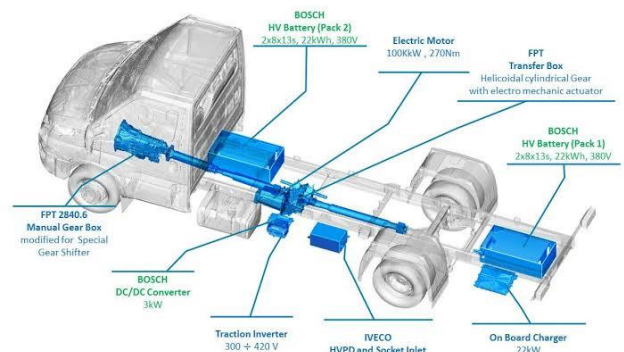
TABLE I: SAEJ1939PDUFORMAT

P	PGN	SA	DF			
P	R DP	PF	SA	DF	PS	SA

3 bits, 1 bit, and 8 bits, 8 bits, respectively

0-64 bits

II. CAN BUS COMMUNICATION PROTOCOL OF ISG CONTROLLER

CAN communication protocol of ISG (Integrated Starter/Generator) controller is one part of the distributed control system protocol of IVECO hybrid electric vehicle,Fig.1is the structure of the system protocol.

According to the actual circumstance, the communicationprotocolofISGcontrollerisdrawnupbythefollowingsteps:

a) Group the Messages. When the parameters including in the node message is less, the message can be transmitted by the single data frame. But, if the parameters including in the node message is more, the single message can't meet the demands, soit's needed to classify the parameters and input them into various data frames based on their significance. The rotating speed of the ISG motor, estimated torque, most usable torque, power of the ISG motor, mechanical power, direct voltage, direct current, temperature of the motor and inverter, over current and over-voltage signal, etc., are the main message parameters that the ISG controller sends to the network. It is necessary to group and code these parameters before sending them to the network. Four groups have been created from the messages..

3.b) Message Priority Selection. They take up the first three positions out of a total of eight priorities; the highest priority is 0, and the lowest is 7. All control messages have a priority setting of 3, while other messages, such as defined messages, request messages, and answer messages, have a priority setting of 6. The ISG node message's priority is set to 3 because the message that the ISG controller broadcasts to the network is crucial to the VCU control decision.

c. Choose the Network Node Address. In the CAN network, the node address is unique. An address is correspondent to the particular device's node in the network. The network address recommended in the SANE J1939 protocol is chosen as the network node address in this paper, the ISG controller node address is defined as 31.

d) Select the Method for Sending the Message. The CAN message can be transmitted in a variety of ways, including point-to-point, broadcast, time-based, and request-based. Through the network, the ISG controller's data is sent to the VCU node. The transmitting method of point to point is selected in this case taking into account the control function between the VCU and the ISG controller.

e. The message frame of the ISG controller can be coded using the J1939 frame format once the aforementioned stages have been finished.

The PDU code, the communication period, and the packed data are the three areas where the ISG controller messages differ in coding when it comes to IVECO hybrid electric vehicles. 4 groupings of messages' PDU codes are 0xcffl01F,0xcffl11F, 0xcffl21F and 0xcffl3F.

III. THE MODULARIZATION STRUCTURE ANALYSIS OF ISG CONTROLLER

The function of ISG controller mainly includes: receive and transmit data; compute control instruction; drive ISG motor; over current protection; produce multiple insulating power; acquisition and processing of sensor signal etc.Fig.2is the main function modules and signal-flow diagram of ISG controller.
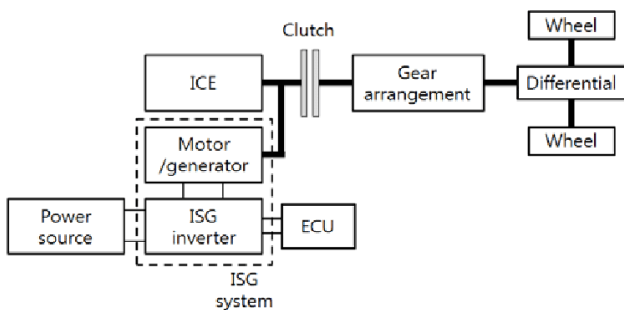
ISG Controller Hardware's Modularization Design, Chapter Four

The ISG controller's primary modules include a micro-controller module, CAN bus communication module, signal adjusting and A/D sampling module, power module, PWM drive module, rotor position measuring module, and multiple insulating power module, among others. Due to space constraints, only two of these primary modules are discussed here in relation to CAN bus communication.

A. The Microcontroller's Design Module

The unavoidable development of the vehicle's electrical system is the digitalization and bus construction of the ISG controller. The DSP technique is employed in this research in account of low cost, credibility, small physical volume, bus communication, etc. Only the motor control chip, produced by TI, AD, MITSUBISHI and Microchip Company, is suitable for the motor condition and has development potential.

There are many different types of DSP or MCU chips, and their differences are significant. The main microcontroller module is the dsPIC30F6010A from Microchip.

B. CAN Bus Module Interface Design

The interface circuit of the CAN bus adopts photo electric isolation and uses it to enhance the signal in accordance with the design philosophy of improving anti-interference ability. Between the physical bus and the micro controller's CAN module, the PCA82C250 transceiver is employed. It provides the physical bus with differential sending and receiving capabilities.

IV. THE MODULARIZATION DESIGN OF ISG CONTROLLER SOFTWARE

The ISG controller software's primary duties include initializing variables, chip functional module initialization, I/O initialization, interruption treatment, PWM motor drive, current measurement, voltage measurement, chopping control, position catch, rotating speed calculation, over current protection of power transistor, receiving VCU orders, and transmitting ISG state information, among other things. The software structure of the ISG controller employs coordination work between the main programme and interruption handling programme for the sake of processing events efficiently. The primary programme is primarily in charge of initialising the software, calculating the motor speed, displaying the status, etc. The interruption handling programme is in charge of the remaining occurrences. As a result, there are 5 interruption management programmes and a main programme in the ISG controller software. Programs according to the demands, the software structure is shown as Fig.3
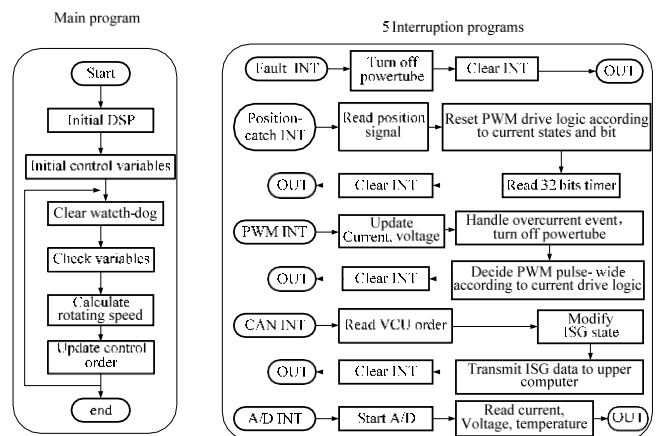
Figure3.SoftwarestructureandflowofISGcontroller

V. THE PROTOTYPE MACHINE OF ISG CONTROLLER

The ISG controller's hardware and software have been created in accordance with the SAE J1939 communication standard, and the associated control circuit boards have been manufactured. ISG controller and circuit boards are

shown as Fig.4 and fig 5
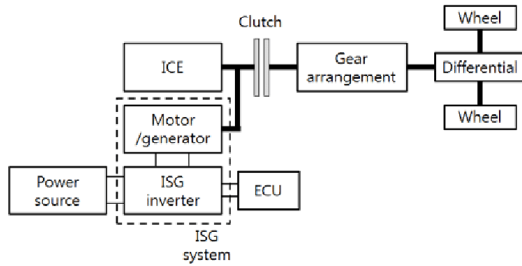
Figure4.AppearanceofISGcontroller

Figure5.CircuitboardofISGcontroller

VI. CONCLUSIONS

ISG controllers that comply with SAE J1939 CAN protocol are created for ISG electric driving systems after function modularization of ISG controllers in hybrid electric vehicles is examined. This controller offers full functionality and consistent performance during rack testing and entire car debugging..

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Dynamic Modeling of Battery system to Solar Power plants using BuckConverter

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Abstract: **photovoltaic power age framework executes a compelling use of sun oriented energy, yet has extremely low change proficiency. The main issue with solar photovoltaic systems is keeping the panel's DC output power constant. The panel's output power will be affected by two factors: irradiation and temperature. This report demonstrates that the perturb and observe algorithm can be used to achieve MPPT when charging lead acid batteries from a solar panel. In photovoltaic systems, MPPT is used to control the output of the photovoltaic array. The charge controller gets its DC-DC conversion from a buck converter. To maximize power, it matches the impedance of the solar panel and battery. The solar panel's voltage and current are detected, and the algorithm adjusts the duty cycle of the gating signal accordingly in order to maximize power transfer.**
Photovoltaic (PV), Buck converter, MPPT, P&O algorithm, Battery, MATLAB, Simulink.

I. INTRODUCTION

The field of renewable energy is getting more and more attention. Clean, cost-effective, and efficient energy sources are being developed. Solar energy research has been important for a long time, and it is getting more advanced. Although Lithium ion batteries are also being tested, the cost is the determining factor. Lead acid batteries are still in style. A standalone photovoltaic PV system uses solar energy. Solar energy is converted into electrical energy by photovoltaic panels. Internally, a PV system has nonlinear characteristics. The solar PV system's voltage and power characteristics will be affected by irradiation and temperature. Maximum power point tracking (MPPT) is required to track maximum output power due to the high cost of the PV panel. The PV panel and the battery communicate with the DC to DC converter.The wide operating temperature range, low self-discharge, long service life, and lack of maintenance make lead acid batteries the most popular choice. The establishment cost of the battery is low contrasted with PV board. However, due to the battery's short service life, its lifetime cost is higher than that of a PV installation. Battery life is reduced when improper charging and discharging, prolonged low PV energy availability, or both are present.To achieve a high State of Charge (SOC) and extend the battery's life, the charging process needs to be controlled. For long battery duration legitimate battery charging is required.The primary function of the battery charging controller in a standalone PV system is tocharge the battery without over charging, preventing reverse current flow and deep discharge under load conditions. The buck converter-designed battery charging system, PV model, and system are all put into action in this proposed system. The power flow from the PV panel to the battery and load is controlled by a buck converter, which is also used for battery charging. The MPPT control algorithm is needed to measure the PV panel's power.MPP tracking makes use of the perturb and observe algorithm, or P & O. MATLAB-SIMULINK was used to simulate the entire system, and the results are presented in this report.

II. OVERVIEW OF THE SYSTEM
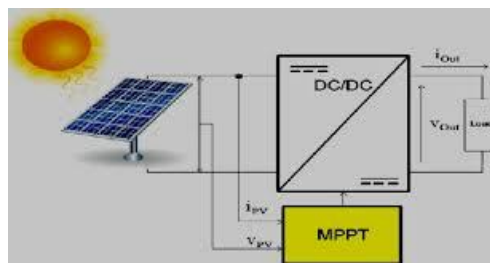
Fig. 1: Block diagram of the system

Demonstrates the approach taken in this report to measure the charging current of batteries in order to charge them.MPP tracking systems are used to boost the solar panel's maximum power output. despite variations in temperature, radiation, and load characteristics it aids in maintaining the constant output of the solar PV panel. A buck converter is used to transmit DC-DC power from the PV panel's output for increased efficiency[2].Buck converters are efficient for battery storing and dc-dc step down operation in stand-alone PV systems.3].Step down converters offer improved efficiency for battery charging applications, and numerous MPPT techniques, such as perturb and observe and the incremental conductance algorithm, are available for tracking solar power from PV panels. The P&O algorithm is the most widely used control algorithm and performs better than a simple control algorithm. P&O is an efficient, adaptable, and early control algorithm that can solve the temperature and insolation issues[7, 8], 9], and 10].A measurement of the amount of solar radiation energy received on a specific surface area and recorded over a specific time period is known as insolation, which is abbreviated as incident or incoming solar radiation .Watts per square meter of irradiation (W/m2).In photo voltaics, the reflectivity of the object determines how much of the radiation is absorbed or reflected. When a surface is in direct sunlight, its insolation is greatest. The buck converter performs buck operation, where voltage is stepped down, which can be utilized for low-power applications and battery charging.[3] The insolation decreases in proportion to the cosine of the angle as the angle between the direction at a right angle to the surface and the direction of the rays of sunlight increases.

III.   CHARACTERISTICS OF PV PANEL

A solar panel is made up of individual cells that are large-area semiconductor diodes that allow light to enter the p-n junction area. The photovoltaic effect and diode characteristics are controlled by the junction between the n-type silicon wafer and the p-type surface layer. Light is caught up in the silicon, producing both abundance openings and electrons. In order to generate power, these excess charges can pass through an external circuit.

PV panels are non-linear sources of power. Fig. 2 output voltage and current (I-V curve) for a specific amount of light hitting the PV panel. Po=Vm*Im is the product of the power output at Pm. The goal of MPPT is to locate the maximum power output point. This normally occurs on the knee of the curve. Fig. 3 shows how the I-V curves vary with the intensity of light falling on the panel.
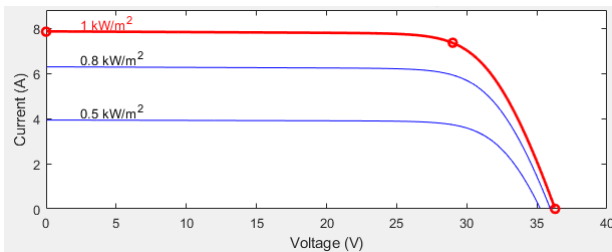
Fig. 3: Variation in I-V curves.

Because the solar panel's I-V curve and the load applied determine the operating point of the solar cell, a DC-DC converter is required to regulate the solar panel's load and maintain the panel's maximum power point. The solar panel's I-V curves can be used to create a P-V characteristic curve. The P-V curve for various irradiation levels is shown below. The MPPT approach continues to perform the operation at the peak of this curve.
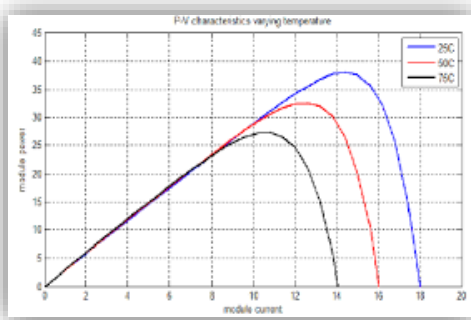
Fig. 4: Variation in P-V curves.

IV. MPPT ALGORITHM

When it comes to controlling the MPPT algorithm for the PV generator, the perturb and observe (P&O) algorithm is typically the one that is used the most frequently.It has a straightforward structure, is inexpensive, is simple to implement, has fewer parameters, allows for improvements, and has the potential to achieve top-level efficiency [13].The investigation of the relationship between the voltage and power output from a PV module is essential to this algorithm. Figure depicts the MPPT and operating principle of the solar panel's behavior.5 indicating that the following change in PV power can be observed as a result: At the point when the PV module working point is on the left half of the bend ($\Delta P/\Delta V$ is positive), and that implies the PV module yield power expands, the irritation of the PV module voltage ought to be expanded toward the MPPT.

The PV module voltage should be perturbed less toward the MPPT if the module's operating point was on the right side of the curve (P/V is negative).

Fig. 5: Behavior of solar panel indicating MPPT andoperating principle

Fig. 6: Flowchart of P&O algorithm.

The PV array's voltage and current are initially measured. From that point onward, the result of voltage and current gives the genuine force of PV module. After that, it will check the status to see if P = 0 or not. The MPPT serves

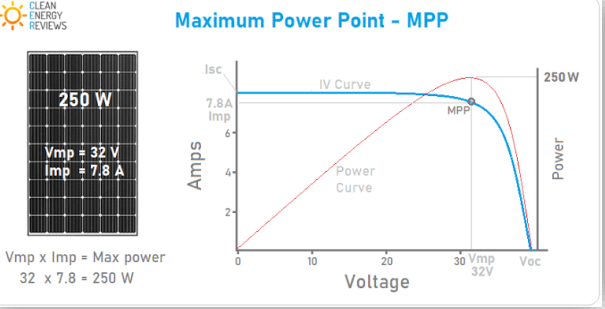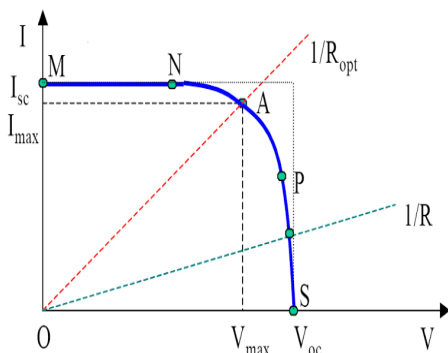as the operating point if this condition is met. It will perform a second status check to ensure that P is greater than 0.If this status is met, it will verify that V is greater than 0.The operating point is located on the left side of the MPP if it is satisfied. The operating point is on the right side of the MPPT if the "V > 0" status is not met. Until it reaches the MPPT, this procedure is repeated repeatedly. Therefore, the P&O algorithm always finds a middle ground between increments and sampling rate

V. DC-DC BUCK CONVERTER

The DC input voltage source is transformed by the DC-DC converter into either a higher or lower DC output voltage.A buck topology is typically chosen for solar PV charge controller applications because the voltage of the PV array is higher than the voltage of the battery [14].As a regulator, the buck converter reduces the PV array's input voltage while maintaining its ability to charge the battery.By decreasing the input voltage and increasing the output current that is delivered to the battery, this can be accomplished
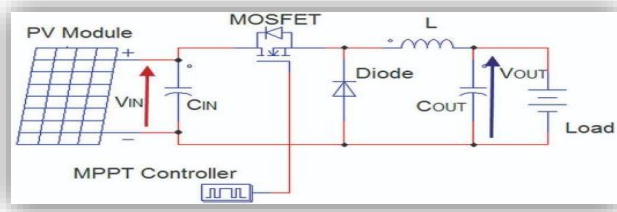

Fig. 7: Buck Converter.
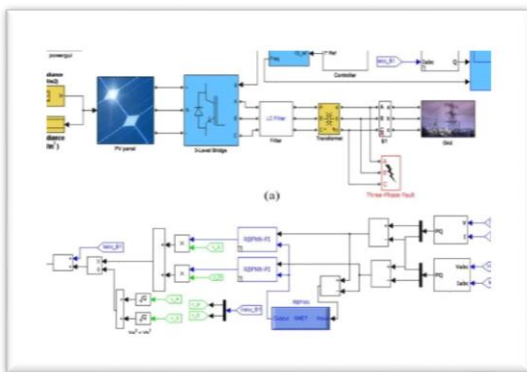

Fig. 8: Simulink Model
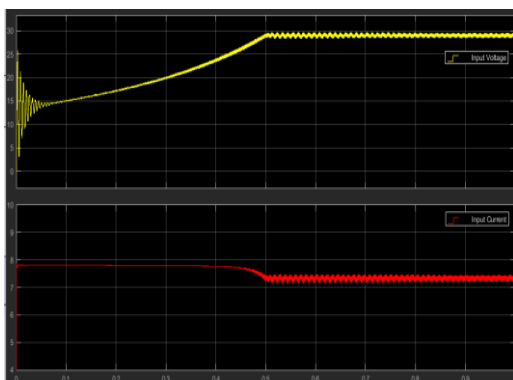
VI. SIMULATION AND RESULTS
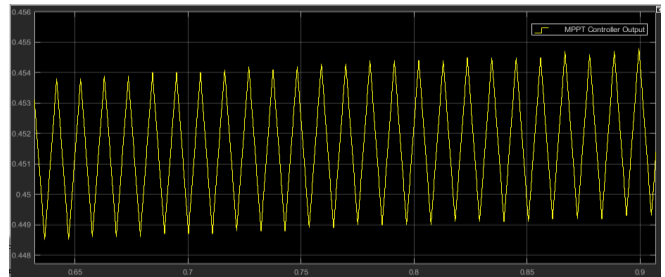

Fig. 9: Voltage & Current of PV array

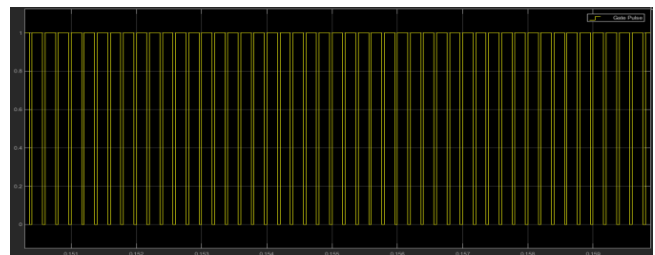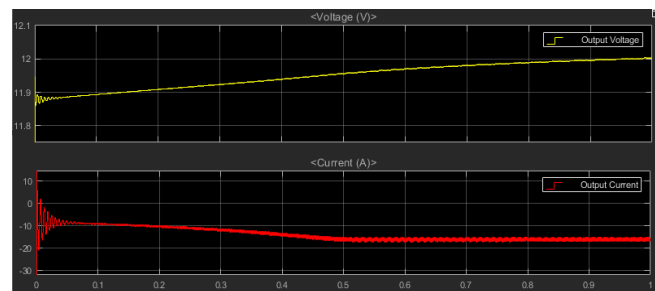Fig. 10: MPPT Controller output

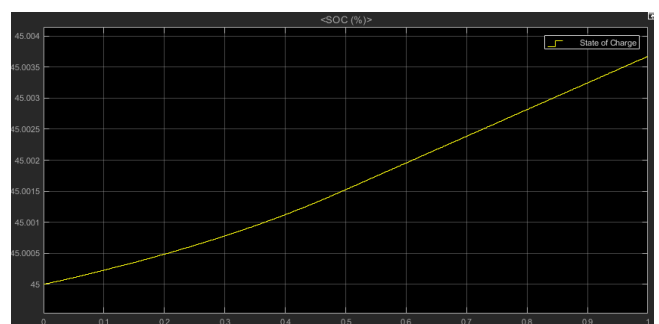Fig. 11: Gate Pulse

Fig. 12: PV Power

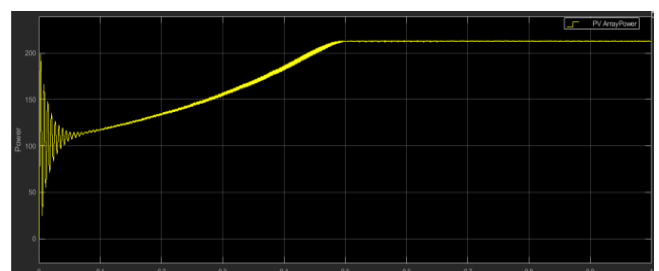Fig. 13: Output Charging Voltage & Current Of battery

Fig. 14: Battery state of charge

VII. SIMULATION ANALYSIS

The entire system is simulated with the help of MATLAB/Simulink. Using the P&O algorithm, the maximum power that solar PV can produce is determined here. The algorithm known as MPPT—also known as Maximum Power Point Tracking—is incorporated into charge controllers and is utilized to extract the maximum amount of power that can be obtained from a PV module under certain conditions. The term "maximum power point" (also known as peak power voltage) refers to the voltage at which a PV module can generate the most power. Solar cell temperature, ambient temperature, and solar radiation all affect maximum power. The solar array has a rated power of 210W, the solar input voltage ranges from 28V to 36V, the battery voltage is 12V, the switching frequency is 5KHz, the current ripple is 10%, the voltage ripple is 1%, the output current = (rated power/output voltage) = (210/12) =17.5A, so the current ripple is 10% of 17.5A, which is 1.75A, the voltage ripple is 1% off 12V, which is 0.12V, the value of this model can be used to test any PV module or PV array-based power system under any temperature and irradiation conditions because it has been simulated for a set of levels of temperature and radiation. The array's power will decrease, as will the output charging current, and vice versa, if the level of irradiation is decreased.

Again if the temperature level is increased then the power of the array will go down similarly the output charging current will also go down and vice versa. Also, if the number of parallel strings increases both the power and charging current increases. From fig. 13, it is seen that the SoC of the battery varies from 45% to 45.004% in one second.

VIII. CONCLUSION

Our primary objective is to charge batteries securely using solar energy. A Solar PV MPPT battery charge controller model is modeled using .Simulink in this report. A buck converter that converts power and supplies the battery so that it can function at 12V.The perturb and observe algorithm, which is coded in MATLAB, is the maximum power point tracking algorithm. The buck converter's switching is controlled by the amplitude of the reference current. The current's amplitude also changes as the irradiation changes. By varying the duty cycle of the MOSFET in the buck converters, the algorithm would control maximum power point tracking. The solar array's output power and current are shown in the Simulink model. The output power and current are also affected by the temperature and variation in solar irradiation. Based on the power obtained from the PV system, a buck converter is utilized for controlling the charging current supplied to the battery. Using an inverter circuit, this proposed work can be connected directly to loads or even to appliances. The pollution caused by burning the will be reduced as a result of this.The load can recive constant power and the battery life can be extended. The battery life can be improved and constant powercan be supplied to the load.

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Modified UIPC for Power Flow Control of Interconnected AC-DC Micro grids Using ANFIC in a Grid-Connected Smart Grid

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Abstract: **The adaptive neuro fuzzy inference controller (ANFIC) concept is used on this observe to offer a singular technique for working the changed unified interphone electricity controller (UIPC). This painting's preliminary contribution is to adjust the same old UIPC shape in order that coping with strength trades throughout wise grids may be finished with fewer strength converters than the 3wanted in every region of the traditional UIPC shape. A bus strength converter (BPC) and a line strength converter (LPC) for every segment make up the brand-new shape's strength converters. DC machine voltage is managed by the ultimate power engine. LPCs are used to connect AC micro grids to the primary grid and have DC cars that can operate in both inductance (IM) and capacitance (CM) modes. The neurophagy adaptive exit regulator is used by the control mechanism of LPC (ANFIC). The ANFIC tool is optimized using the H∞ filter mode to eliminate format errors in class functions. In terms of system engineering, the DC micro grid supplies the LPC's DC voltage through the BPC. Due to the LPC's changing DC link voltage, DC micro grid strength is provided by a series of PV arrays. To stabilise oscillations in the DC-link, a cutting-edge nonlinear disturbance bystander grounded absolute strong multiple grounded adaptive control control method (NDO-MS-SMC) is offered. Simulation effects demonstrate the effectiveness of the proposed intensity together with the flow control approach for smart grids within advanced UIPCs. The UIPC transformer is controlled by the Adaptive Neuro fuzzy Follower Controller (ANFIC) system. This is also proposed as an extension of this observe.**

Key word: UIPC, power converter (LPC, BPC), disturbance observer, multi-surface SMC, hybrid micro grid, adaptive neuro fuzzy inference controller (ANFIC).

I. INTRODUCTION

Due to the Smart Grid revolution, which ensures to provide the grid extra ideal intelligence and flexibility, flexible alternating modern transmission systems (FACTS) are increasingly extra regaining prominence. This is necessary, for instance, to enable the complete integration of renewable energy sources, which may be unpredictable and extremely variable by nature [1]– [3]. The unified inter phase energy controller (UIPC) is the most in experienced FACTS device because of the reality it is able to Permit controlling voltage, compensating series, regulating sections, and controlling active or reactive energy sequentially or selectively [4]. For conventional software program period UIPCs to acquire their needful VA ratings and shield isolation, they want immoderate voltage, immoderate energy inverters and complicated zigzag transformers. Due to highly-priced installation and strolling charges, UIPC applicability is therefore limited.

The most effective sensible inverter approach to acquire immoderate voltage levels without transformers, several semiconductor devices (diodes), or numerous capacitors is the cascade multilevel inverter (CMI) [5-9]. A UIPC with face-to-face associated CMIs modified into created in [10] to clear up the fee trouble thru manner of approach of having rid of the zigzag transformers wanted for traditional multiple inverters based totally definitely UIPC. These however wanted an isolation transformer, though. A idea for a transformer-loose has been made UIPC based totally mostly on a completely unique affiliation of CMIs, regardless of the reality that this does not lower the inverter charges. These investigations are complete dusing normal country assessment, it is appropriate for planning, growing, strolling, and analysing protection in energy systems. On the opportunity hand, dynamic assessment is wanted for the actual-time deployment of UIPC, which necessitates the creation of a reliable control strategy. In earlier literature, many UIPC control strategies had been suggested. To lower control charges and decorate energy grid resilience, a transient energy function-based totally definitely PI control technique for UIPC is developed [11]. However, it suffers from a stability trouble, and if fine contingency conditions are met, the system can also diverge. To decorate the transient usual overall performance in [12], a fuzzy proper judgment-based totally definitely UIPC controller is created. A UIPC control system based totally mostly on FLC has been provided in earlier research to deal with troubles with the triumphing UIPC controllers and to offer flexible control over energy flowall through transmission lines.

FLC has an advantage over standard PI controllers when the strength machine is moving dynamically in that it can respond quickly without needing a special mathematical version of the machine. The fuzzy right judgment controller has a chattering hassle that reduces the controller's accuracy within side the direction of disruptions within side the strength machine [13].The determined on club talents for those strategies (the usage of fuzzy right judgment) aren't adjusted according with the machine on foot situation, regardless of the qualitative technique's capacity to offer

short response and ordinary operation. The UIPC with ANN is usually recommended in historical literature for the transmission community of strength systems. To cope with problems like controller tuning, method identification, sensor validation, monitoring, and fault diagnosis, similarly to safety assessment, load identification, load modelling, and forecasting promising Artificial Neural Networks (ANN) strategies have these days been developed. When it consists of data processing, neural networks behave in a manner this is similar to the manner the human mind does [14-17]. The ANN, however, suffer from the following shortcomings. Fashions are introduced empirically, which results in a higher computing rate and a propensity for over fitting [18]. The inclinations of logistic regression and neural networks are defined in general. To acquire higher traditional general performance, Furry's qualitative approach and neural networks' adaptability are combined in an adaptive neurofuzzy inference system (ANFIS) [19]. A manipulate machine primarily based totally absolutely really in this concept can be taught with lots a lot much lesson table professional information than a ordinary fuzzy-right judgment controller and ANN controller.

The UIPC is modelled for this observes as managed voltage sources. The real and reactive power move with the transmission's drift line is one after the other regulated via way of technique of the use of orthogonal additives from every source, which can be hired to perform the UIPC. A neurofuzzy adaptive inference controller is utilized by the LPCs' manipulate mechanisms (ANFIC). The H filtering approach is used to optimise the ANFIC gadget and get rid of layout problems in club abilities. Using a DC micro grid strategy, the BPC supplies the LPCs' DC voltage. Since a PV device is used to supply the DC micro grid power in this location, the LPCs' DC hyperlink voltage changes. A cutting-edge nonlinear disturbance observer-based totally completely in fact strong multiple-floor sliding mode control (NDO-MS-SMC) method is provided to stabilise the DC link fluctuations.

II. MODELING AND PROPOSED UIPC BASED SMART GRID STRUCTURE

The suggested smart grid topology for the UIPC is demonstrated in this study. This part also covers the dynamic UIPC model. Figure 1 displays a diagram of the smart grid that is being examined. One AC and one DC microgrids that might be connected to the resource of the use of the UIPC are validly included in the grid-associated smart grid.
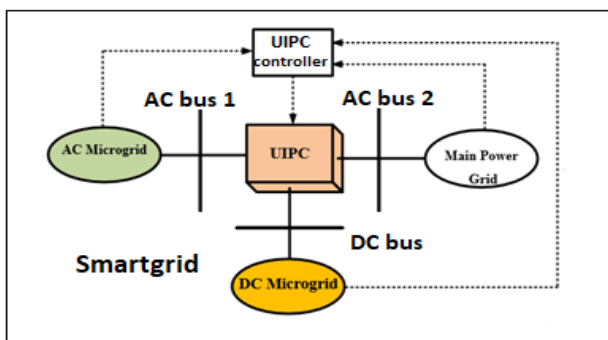
Fig. 1 In a smart grid that is connected to the grid, UIPC is utilised to link AC-DC microgrids.

The diesel generator and related AC and DC loads make up the AC micro grid. The AC and DC hundreds, as well as a battery, make up the DC micro grid, and a PV system. The solar panel system, batteries, and hundreds are all connected by a same DC bus (DC link). First, the topology of the standard UIPC will be altered, as described in this section. The modified UIPC's manage strategy will subsequently be shown in the component that follows. Both the original and modified UIPC shapes, as visible in Fig. 3(a) and (b), every gives the benefits and downsides indexed below. - The layout is pretty high priced seeing that linking 3stages of AC buses calls for9 VCSs and 9energy transformers due to the fact every segment utilises 3 VSCs.

Each segment's VSCs' DC links are connected together in tandem. When the machine model is disturbed or when the output powers of VSCs vary, consisting of an extrude in a machine parameter, as specified in [20, 23], the common place DC hyperlink voltage is susceptible to oscillation. In VSCs with a shared DC connection, voltage fluctuation within the DC hyperlink is the main issue. [22] no longer dealt with this inconvenience. The enhanced UIPC model, as shown in Fig. 3 (a), is offered to circumvent the aforementioned challenges. Every segment contains the same energy converter, known as LPCj.
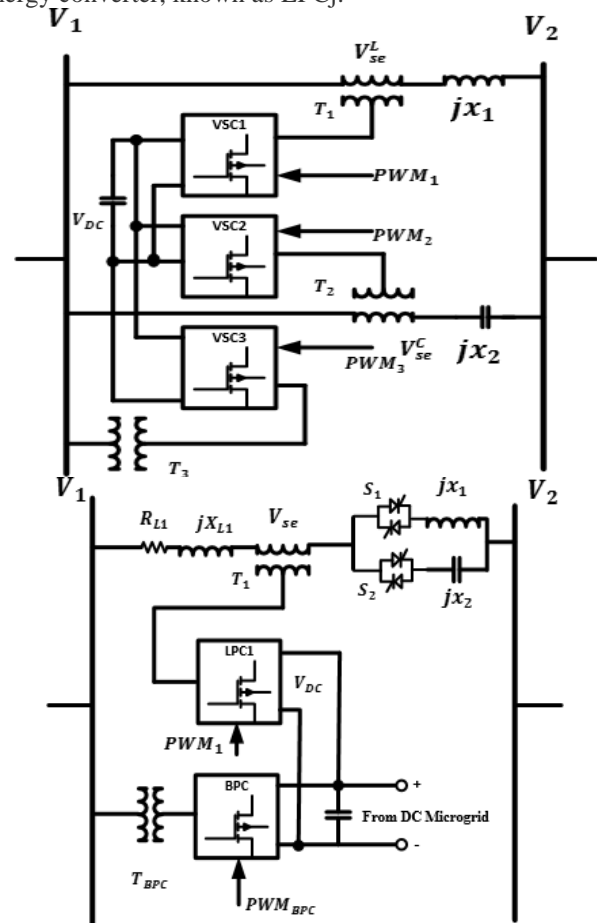
Figure 3.(a) Conventional structure of UIPC with three power transformers for each phase (24). (b). Proposed UIPC topology.

To remove the above obstacles, an improved UIPC model is presented as shown in Fig. 3(a). As demonstrated, only one electric motor, called LPCj, is installed in each segment. $j \in$ is a house number. These current transformers regulate the current collection voltage Vsese = Vser jVse I to each line through mils Tj. where Vs r and Vse I are the real and imaginary complements of the adjusted collection voltage. ZLj = RLj jXLj is the road impedance. The segment-by-segment form of the proposed UIPC primary-grounded full-reference microgrid is evidenced in Fig. 4 of the clever grid. A typical management scheme of the proposed UIPC is also shown in this figure. Management gadgets include subsystem collection VSC management and NDO-MS-SMC, which are primarily fully grounded DC hyperlink controls.
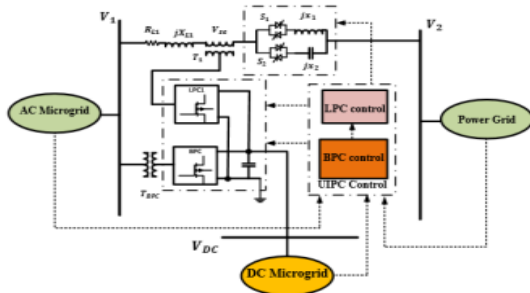
Figure 4. UIPC and UIPC control system-based phase-by-phase model of AC-DC microgrid connectivity

The VSC series control subsystem uses switches S1 and S2 plus a superior H ∞ primary-grounded fully adaptive neurofuzzy termination regulator (ANFIC) to regulate the regulated voltage. This manipulation subsystem will be discussed in detail in the next phase. SMC's primary grounded, fully grounded DC hyperlink control subsystem uses a unique disturbing bystander - primarily fully grounded, multi-floor, sliding mode operation techniques to stabilize the not uncommon DC hyperlink voltage version at each step Let - A maximum of 1 BPC is required for a 3-line configuration. Therefore, the full version requires 3 power mills and 4 VSCs. A DC microgrid is used to supply the DC hyperlink voltage. This feature allows AC and DC microgrids to be connected via UIPC. - To reduce losses, LPC's form of operation uses a clever adaptive neurofuzzy termination controller (ANFIC). - A predominantly grounded disturbance bystander is used that is stronger than the lower sliding mode operation method to degrade the DC link voltage performance.

III. CONTROL STRATEGY FORLPCS AND BPCS

The VSC series control subsystem uses switches S1 and S2 plus a superior H ∞ primary-grounded fully adaptive neurofuzzy termination regulator (ANFIC) to regulate the regulated voltage. This manipulation subsystem will be discussed in detail in the next phase. SMC's primary grounded, fully grounded DC hyperlink control subsystem uses a unique disturbing bystander - primarily fully grounded, multi-floor, sliding mode operation techniques to stabilize the not uncommon DC hyperlink voltage version at each step Let - A maximum of 1 BPC is required for a 3-line configuration.

Therefore, the full version requires 3 power mills and 4 VSCs. A DC microgrid is used to supply the DC hyperlink voltage. This feature allows AC and DC microgrids to be connected via UIPC. - To reduce losses, LPC's form of operation uses a clever adaptive neurofuzzy termination controller (ANFIC). - A predominantly grounded disturbance bystander is used that is stronger than the lower sliding mode operation method to degrade the DC link voltage performance.

Fig. 5. Proposed LPC control method

The now no longer unusual place The LPC and BPC's DC links are connected together with of the DC micro grid, the DC bus. Due to the output active power change of the power converters, loads, or PV unit inside the DC microgrid, the DC link voltage is most likely unstable as was before described. As a result, in this take a look at the entirely unique NDO-MS-SMC, the intended UIPC's DC link voltage is regulated. Fig. The suggested BPC control strategy is shown in Figure 5(b). The suggested NDO-MS-SMC method is used with the BPC because, as was previously stated, the BPC is now in charge of managing the DC link.
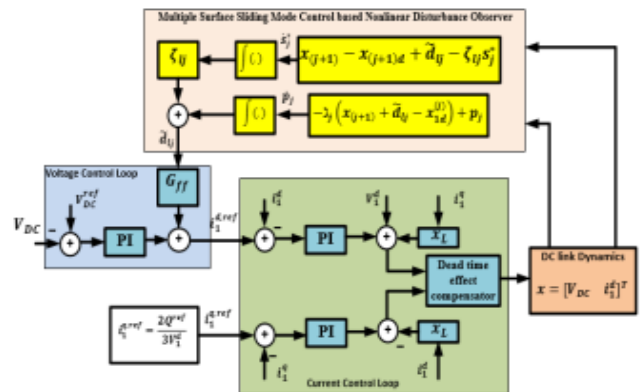
Fig. 5(b) (b). The DC link of the BPC is managed by a brand-new NDO-MS-SMC method.

The three elements of the suggested control mechanism are shown in Fig. 95(b): voltage control circuit, to start. 2. The present control cycle. 3. NDO. The DC micro grid's ambiguity and energy fluctuations must be evaluated using the NDO. A reference signal is additionally provided by the NDO for the

dead-time compensation unit and the contemporary control loop.

In order to pick up on the constitutional disposition of contained withinside dynamics of the proposed disturbance and the current feedback control system Observer, the feed-forward energy disturbance is controlled by closed proportional-integral (PI) controllers in the voltage control loop. Both voltage control loops and modern control loops use the evolutionary algorithm (GA) to optimise the PI controllers. For IM mode, enter +2/2, and for CM mode, enter -2/2. Additionally, depending on the operation modes, the switches S1 and S2 are both active or inactive. The closing ANFIC is provided using the H-filtering format technique, which has been thoroughly defined and proven in this work. As depicted in Fig. 5, each LPC's controlgadget receives a DC link voltage signal for coordination (a). Then the defective signal is sent to the excellent ANFIC. Thus, using the one's indicators, the control signal (reference) for use inside the PWM unit is produced. Using a PWM approach, the injected voltage's amplitude is controlled. ANFIS supervisor Fuzzy commonplace placefeel controllers are essential in many real-world circumstances. However, the method of adding human expertise The fuzzy inference machine's rule base does not follow a set standard. This method has traditionally been used to identify the size, kind, and characteristics of the input and output membership capacities through trial and error. For fine-tuning membership operations and distilling the rule of thumb of thumb base to the bare minimum vital rules, there is a solid demand for inexperienced procedures. To deal with the aforementioned problems, the ANFIS was created. ANFIS makes it possible to train a machine without requiring the extensive amount of specialised knowledge frequently needed for fuzzy, daily place feeling by combining fuzzy qualitative methodology combined with neural networks' capacity for adaptive learning. As a result, the rule base can be smaller. Figure 6 depicts a fuzzy machine with two inputs (x, y) and one output that represents the median format for an ANFIS that is entirely based on the first-order Takagi-Sugeno model (f). The architecture develops in the phase that follows.

Rule ij :

$$if (x\ is\ A_i) \text{and} (y\ is\ B_j) \text{then} (f_{ij} = g_{ij}x + h_{ij}y + r_{ij})$$

The location and the corresponding enterclub functions' language variables are (MF). The input membership functions' arguments are gij and rij. The entry and output club functions' parameters are chosen during the educational process. ANFIS is composed of five layers, each of which includes an inference device, as well as either constant nodes Fig. 6 illustrates adaptive nodes (parameters to track at some time in education) as squares and nodes (no parameters to modify) as circles (a). The five layers, which resemble stairs when building fuzzy systems, produce the following output:

$$O_{1i} = \mu_{A_i}(x) \quad \text{or} \quad O_{1j} = \mu_{B_j}(y) \tag{1}$$

$$O_{2_{ij}} = W_{ij} = \mu_{A_i}(x)\mu_{B_j}(y),$$
$$i = 1, 2, \dots N, \quad j = 1, 2, \dots M \tag{2}$$

$$O_{3_{ij}} = \bar{W}_{ij} = \frac{W_{ij}}{\sum_{\forall i,j} W_{ij}} \tag{3}$$

$$O_{4_{ij}} = \bar{W}_{ij} f_{ij} = \bar{W}_{ij}(g_{ij}x + h_{ij}y + r_{ij}) \tag{4}$$

$$O_5 = f = \sum_{\forall i,j} \bar{W}_{ij} f_{ij} = \sum_{\forall i,j} \frac{W_{ij} f_{ij}}{\sum_{\forall i,j} W_{ij}}$$
$$= \frac{\sum_{\forall i,j} W_{ij} f_{ij}}{\sum_{\forall i,j} W_{ij}}. \tag{5}$$

The analysis algorithm controls each of these factors solely for the purpose of making sure the ANFIS output closely mimics the educational data. The network parameters can be determined using the hybrid analysis techniques of gradient descent (GD) and least squares estimation (LSE). Utilizing the GD method, the succeeding parameters are identified, and the antecedent membership function parameters are modified. Figure 6 depicts the ANFIC's most efficient model, which only supports one output and is entirely dependent on the Takagi-Sugeno model of first order. Professional gain-scheduling controllers for energy systems have been developed using ANFIC.

IV.   SIMULATION RESULTS

This part employs simulations in MATLAB that could be entirely or mostly based on comparative research to show the viability of the encouraged electricity waft technique. The proposed approach is also used to contrast the AC micro grid's electricity-waft regulation with the main grid. While the 2dexample looks into the control of electricity The 1/three example demonstrates electricity's ability to move from the DC micro grid to the AC micro grid. The fourth segment looks at the stability and disturbance rejecting homes of the advised UIPC. The AC microgrid is made up of four 50 kW diesel generators, a 100 and 50 kW DFIG-based absolutely completely wind turbine tool, and more. Battery, PV equipment, AC and DC loads are all components of the DC microgrid. In this study, the PV tool and battery parameters were determined from, and their corresponding ratings are 250 kW and 50 kW. The too-linear state of affairs to collect the counselled observer has been set to zero in this study because
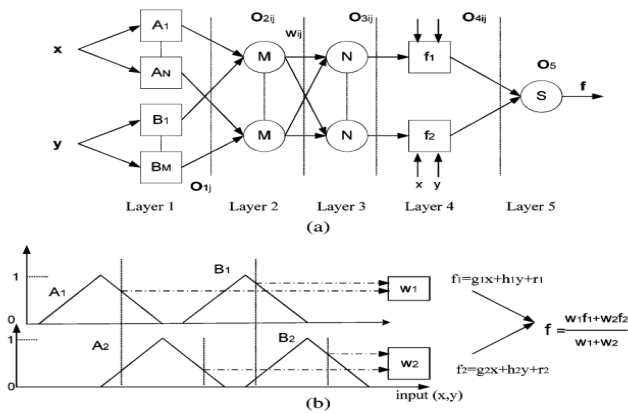

Fig.6. the arrangement of the ANFIC (a) The organisational structure of ANFIS. Fuzzy inference using Takagi-Sugeno

the switching gain is zero.7, the linear gain is zero.7, Q is an excessive first-rate arbitrary matrix, and P is an excessive first-rate matrix. As a result, the following limitation is is = 1.2. Additionally, is now equal to zero.001.

V. VALIDATION AND CONTROL OF POWER FLOW BETWEEN THE AC MICROGRID AND MAIN GRID USING A MODIFIED UIPC MODEL

ANNs, ANFICs, and fuzzy desirable judgement controllers are a few of the controllers included in the UIPC's suggested topology. ANFIC is superior to the one, two, and three controllers. A 2 km distribution line with impedances of RL = 0.01 ohm and XL = 5 mH in phase connects the AC microgrid to the larger grid. There have been investigations into the energy flow from the main grid to the microgrid. Since no series voltage can be injected because the UIPC is off, the system is in steady state. In the AC microgrid, AC/DC loads are connected to 135 kW of the shared AC bus. The diesel generating devices are operational. Initially turned off is the wind turbine as well. Fig. 7 shows the typical overall performance of traded energy control at the same time that the proposed and gift UIPCs are finished.
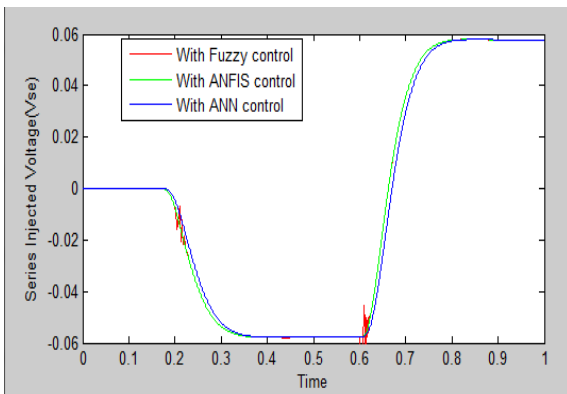
Fig. 7. Using proposed and existing UIPCs, two AC micro grids exchanged power (absolute value) control.

The BPC's AC system is connected to what is known as a delicate system known as an AC microgrid. As seen in Fig. 7, the AC micro grid receives 115 kW from the number one strength grid up to t = 0.2s, during which time one of the diesel devices becomes operational. The voltage is now present as a result of the distribution line with 0.1/2 pu of collecting voltage after the UIPC switches to inductive mode. As can be seen in Fig. 7, Until the wind turbine and the final piece of diesel equipment are turned on at time t = 0.6s, the traded power is reduced to roughly 65 kW. The distribution line receives 0.063 pu of collecting voltage from the UIPC as it switches into capacitive mode in a total of 185 kW of transmitted power (absolute value) to the primary grid. According to Fig. 7, even if the current UIPC settles in around four seconds, the suggested UIPC settles in considerably less than two seconds, which is more than 50% faster. When the proposed UIPC is utilised, there is no overshoot, but when the traditional UIPC is employed, there is a 37.14% overrun +.
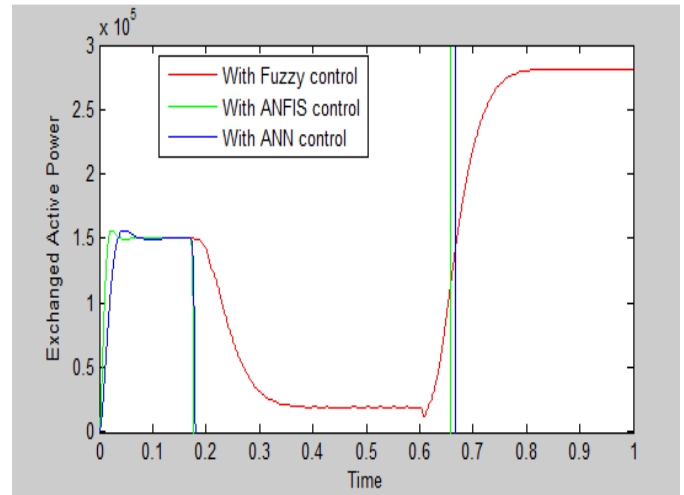
Fig. 8 shows how proposed and current UIPCs are used to share power (absolute value) control between two AC microgrids.

The generation in each microgrid is depicted in Figure 9. The proposed UIPC and its control mechanism make it simple to transfer power from the smart grid to the utility.

regulating the electricity's transfer from a DC microgrid to an AC microgrid

The simulation results for a case where power is moved from a DC micro grid to an AC side are displayed in Figures 8 to 9. The AC micro grid needs 40 kW at time t = 0.42 seconds, as shown in Fig. 9, in order to maintain a constant strength change with the primary grid. Internally, 240 kW are utilised with the help of the DC micro grid. As illustrated in Figure 9, the DC link's energetic capacity will increase to 280 kW in order to transport the AC component. The suggested NDO-MS-SMC technique is then used to regulate the BPC's DC connection, as depicted in Fig. 5. (b).
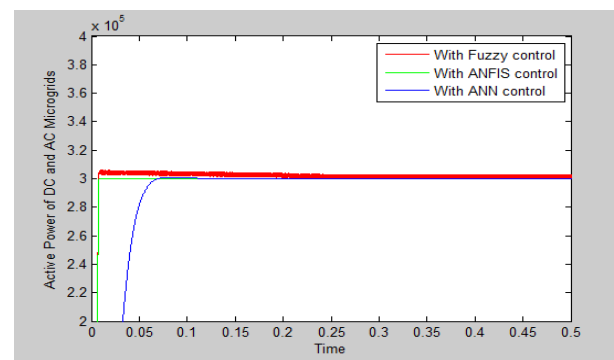
Fig.9. demonstrates each micro grid's creation.

VI. CONTROL OF POWER TRANSFER FROM AN AC MICROGRID TO A DC MICROGRID

In Fig. 10, during The final simulation results are shown along the energy glide path from the AC microgrid to the DC microgrid. The typical AC bus energy is depicted in this diagram. As can be seen in the diagram, the AC microgrid initially supports 240 kW neighbourhood masses up until t = 0.42 seconds, at which point a 40 kW DC load is needed. With a response time of about 0.023 seconds, the energy of the AC facet has been boosted to 280 kW. It has been demonstrated

that the recommended UIPC can gently regulate the energy transmitted between AC and DC microgrids when employed with the cautious control technique.

VII. PERFORMANCE AND STABILITY EVIDENCE FOR DISTURBANCE REJECTION

The gadget model considers the time variable sign as a disturbance in order to test for strong balancing and disturbance rejection. The contemporary running through the aggregated DC loads is the reason for this disruption. There are also 10% variations within the AC facet voltage. The main issue in these situations is the balancing of the UIPC's DC connection. Figure 11 provides evidence in compared to the traditional UIPC, regarding the simulation outcomes for the proposed UIPC. The standard UIPC causes a number of oscillations and overshoots, however the modern manage strategy-based entirely enhanced UIPC-ANFIC plays higher and keeps the device stable.
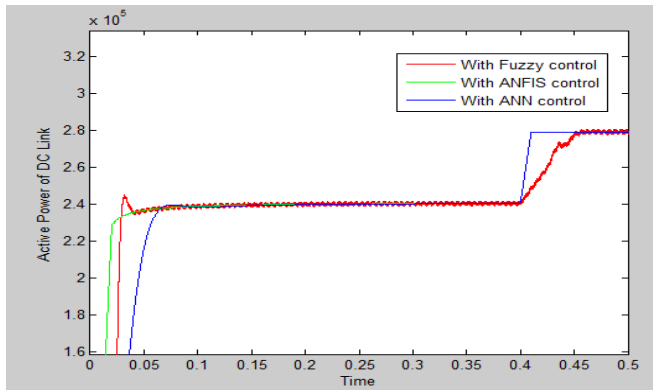
Fig.10. shows the DC link's active power when 40 kW are required from the AC side.
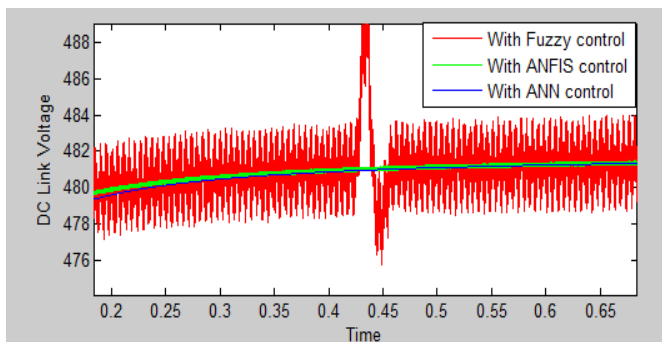
Fig. 11 The suggested UIPC's-ANFIC performance when the system model is disturbed

It is advised to select the best controller using the ANFIC controller from a variety of sophisticated grid energy-changing options based solely on the operating point of the current device. For the interpretation of the simulation results, the ANFIC is an advanced controller to the bushy common sense controller (FLC) and synthetic neural network (ANN).

VIII. CONCLUSION

Two orthogonal elements from each deliver rectangular degree want to regulate the UIPC and they rectangular degree

want to control the vital and reactive electricity waft in the cable in various ways. The LPCs' control systems employ a neurofuzzy adaptive summary idea controller (ANFIC). The ANFIC device is optimised using the H filtering method to help discourage fashion blunders during club functions. The LPCs receive the required DC power from the DC micro grid via the BPC. Because a PV device is supplying the DC microgrid electricity under this circumstance, the DC association voltage of the LPCs fluctuates. A current robust multiple-floor sloppy mode control (NDO-MS-SMC) approach is intended for the DC aspect control of the BPC in order to stabilise the DC hyperlink fluctuation. According to the simulation results, the updated UIPC's intentional electricity shift control method is effective for grids with realistic topologies. The UIPC converters are controlled by the adaptative neuro fuzzy summary idea controller (ANFIC), which is recommended as an additional improvement for the duration of this endeavour. The ANFIC controller is instructed to select one controller from a variety of actual grid electricity-changing options in accordance with the existing rules of the device's operation. The ANFIC may be a superior controller to all symbolic excellent judgement controllers (FLC) and artificial neural networks once it incorporates perceptive the results of simulations (ANN).

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Multilevel DC-Link Converter-Based Photovoltaic System with Integrated Energy Storage

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ABSTRACT- This research proposes a new boost DC-link integrated multilevel inverter (BDIMLI) topology that emphasises boost factor optimization primarily to improve the efficiency of solar energy harvesting. The globe should begin turning away from traditional energy sources for energy generation, such as coal, nuclear energy, etc., and moving toward renewable energy sources instead in order to increase the boost factor of inverters. Solar energy
Keywords: Boost DC-link integrated multilevel inverter (BDIMLI), boost factor, two level boost DC converter, cascaded multilevel inverter, switched capacitor MLI and high switching frequency.

I. INTRODUCTION

We can see multilevel inverter implementation in every field of electrical engineering such as grid-tie system of renewable energy, electric drives, and electric vehicles and so on. MLIs give a best-standard output voltage, low filter size, less switching frequency, decreased dv/dt and decreased common-mode voltage (CMV). Basically, MLI networks are categorized as neutral-point-clamped MLI (NPCMLI), flying capacitors MLI (FCMLI) and surged H-bridge MLI (CHBMLI). MLIs are acquired by electric drives and power quality associated industries because of significant performance. NPCMLI and FCMLI networks need a better component count (diodes, capacitors and rectification circuitry describes unbalance in voltage), during the requirement of the various isolated voltage sources. A few MLI topologies are reported with reduced switch count and voltage sources [6–11] to improve compactness and efficiency. New pulse-width modulation (PWM) techniques [9] are presented to maintain constant CMV and reduce leakage currents in cascaded half-bridge MLI topologies. Also, fault-tolerant methods [10] are incorporated for reduced switch count SCMLI (RSCMLI). However, none of these topologies offers high gain boost factor, which is essential in renewable energy applications. Further, similar structures with large capacitor size for power frequency applications are adopted. The SCMLI topologies presented in [16] use parallel charging and series discharging of the capacitor. Hence the size of the capacitor is a function of frequency and load resistance. Modified H-bridge based SCMLI topologies similar to [9] are reported to further reduce the switch count. These SCMLI topologies provide high modularity and reliability, but the absence of the charging path and elongated discharging time intervals may lead to adverse drooping of capacitor voltage.

Two-level boost DC-link converter (TBDC)

Figure 1 illustrates the Two-level Boost DC link converter (TBDC) circuit diagram, comprising a couple of converters. First converter which is named as Conv-1 is a modified version of boost converter, which comprises of capacitor, boost switch, voltage source, inductor and diode D. Converter-2 which has two switches named as S_L and S_U, is used as a level selector which makes the voltage across the load resistance equal to V_i when the level selector operates at level-1 and $(V_i + v_c)$, when the level selector is operating at level-2.
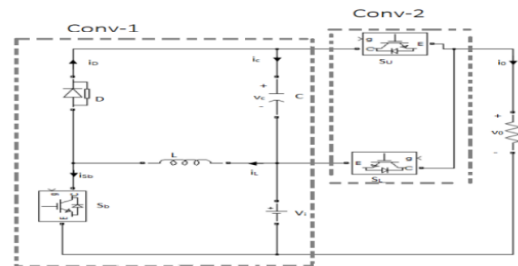
Figure 1: Schematic diagram of TBDC Unit
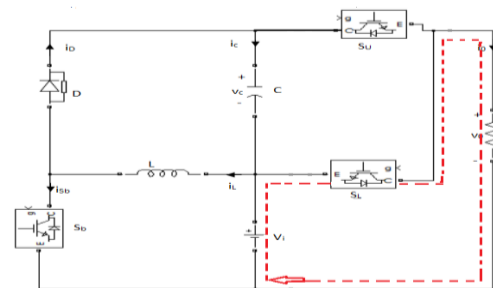
Figure 2: Circuit path for level-1 operation
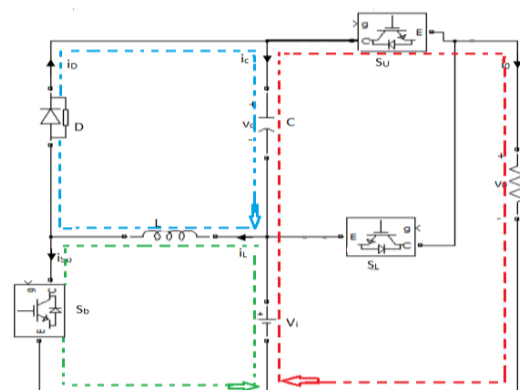
Figure 3: Circuit path for level-2 operation
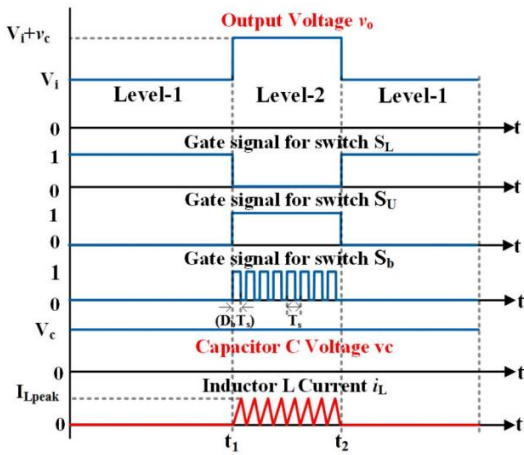
Figure 4 : Characteristics of level-1 and level-2 operation

Figure 2 and 3 illustrates the equivalent circuits for level one and level 2 operations correspondingly. Figure 4 elucidates the working principle, control operation and the waveforms represents the output parameters.
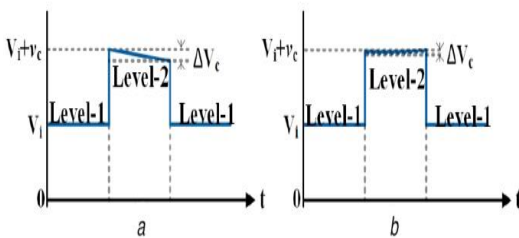
Figure 5: (a) SCMLI, (b) Two level Boost DC converter unit

Figures 5a and 5b delineates the operation of switched capacitor multi-level inverter through respective waveforms. Through these various waveforms we can observe there is a dropping voltage or voltage drop during the level 2 operation of the MLI. The operating modes of converter-2 are described as follows:

Mode of operation for Level-1: The corresponding equivalent circuit can be seen in figure 2a. Considering the time intervals of (0 to t_1 and $t > t_2$), during this period, the IGBT S_L conducts while IGBTs S_U and S_b do not conduct.

Therefore, the path for load current is $V_i \rightarrow S_L \rightarrow R_0 \rightarrow V_i$ and the output voltage across the load resistor v_0 will be equal to V_i, as it is a closed path with a voltage source.

Mode of operation for Level-2: Level-2 (t1 → t2): the corresponding equivalent circuit can be seen in figure 2b. Now consider the time interval t_1 to t_2, during this period the IGBTs S_U and S_L turns on and off simultaneously. Required capacitor voltage V_c will be maintained by the duty cycle and switching frequency of IGBT S_b. So during this operation, if S_b starts to conduct, the diode D starts to operate in reverse bias condition and magnetization of inductor L take place. In this interval, the current flowing through the inductor is shown by green line and the blue path will be disabled.

Similarly when S_b stops to conduct, the diode D starts to operate in forward biased mode and the capacitor starts to charge as shown in figure 2b represented by blue line and the green path will be inactive as the diode starts to conduct. The load current takes the path $V_i \rightarrow v_c$
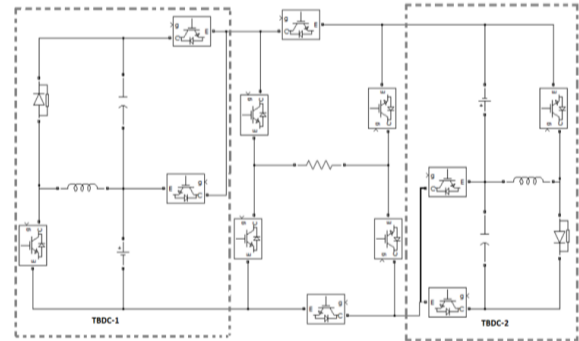
Figure 6: Circuit Diagram for the proposed Boost DC link Integrated Multi Level Inverter Design and operation of BDIMLI topology

The representation of the suggested BDIMLI is delineated in fig. 4. It comprises a couple of TBDC converters and a cascaded H-bridge formed by six switches $(S_1 - S_6)$. C_1 and C_2 are charged to the voltages V_{c1} and V_{c2} simultaneously, where Vc1 is n1V1 and Vc2 is n2V2. The output voltages of TBDC-1 are V_1 and $V_1 + V_{c1}$ for the specific conduction of S_{L1} & S_{U1}. As well as, the output voltages of TBDC-2 are V_2 and $V_2 + V_{C2}$ for the specific conduction of S_{L2} & S_{U2}. The gate pulses of S_{U1} and S_{U2} are synchronized with the gate pulses of switches S_{b1} and S_{b2} and their logical realization is shown in figure 7.

Here, D_{b1} = Duty cycle of S_{b1}

D_{b2} = Duty cycle of S_{b2}
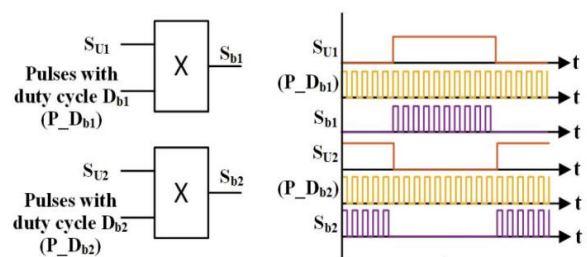
Figure 7: (a) Logical realization of gates S_{U1} and S_{U2}, (b) waveforms for the respective gate pulses.
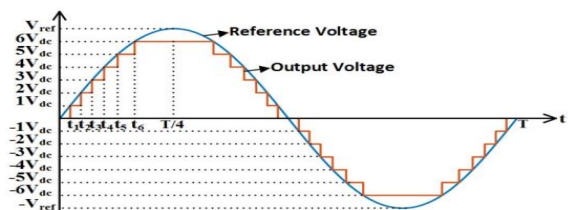
Figure 8: Waveform depicting actual and assumed output voltages
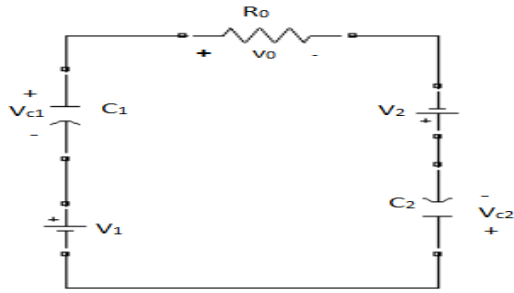
Figure 9: Circuit for peak output voltage

The BDIMLI (Boost DC-link Integrated Multilevel Inverter) accomplishes at 9 or 11 or 13-level output voltage waveform by absolute choice of V_{c1} and V_{c2}. Table 1 gives the particular capacitor voltages and step-up ratios (n_1 and n_2) for 9, 11 and 13 level operations of BDIMLI sequentially. The Table 2 shows the switching states for 13th level operation. The fig 8 and the table2 shows the output voltages of the 13th-level of the switching states and the timing sequence.

The corresponding output voltages of 9th and 11th-level can be realised by the timing sequence & switching states. 13th level operation of the MLI is shown in figure 7.

The topologies TBDC-1 and TBDC-2 are outlined to function in BCM mode and their individual basic inductor values L_{B1} and L_{B2} of L_1 and L_2 are obtained by observing the largest output voltage level.

While feeding the load is fed at power frequency C_1 and C_2 capacitors are charged at a high switching frequency. From (17)-(20), C_{1min} and C_{2min} characteristics taken as a function of R_o and P_o with frequency f_s=10 kHz for 9-level and 13-level operations which are represented in figures. 8b, 8c, 9b and 9c and it can be deduced that the minimum capacitor value will be sufficient even for a higher power rating.

II. RELATIVE ANALYSIS WITH EXISTING TOPOLOGIES

The qualified analysis of suggested BDIMLI with various existing MLI topologies while considering number of components, capacitor capacity, boost factor and total switch voltage (TSV) is presented as follows.
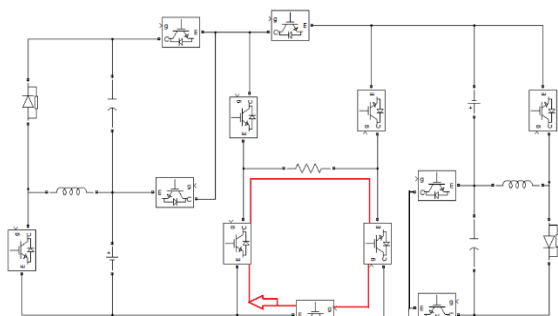
$V_0 = + 0\ V_{dc}$
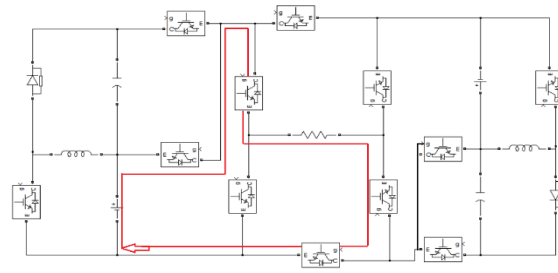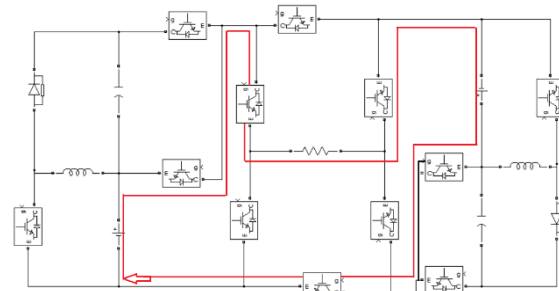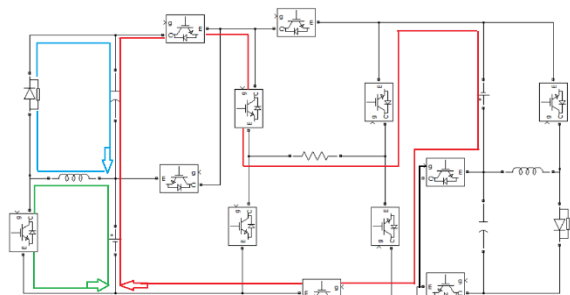
$V_0 = + 1\ V_{dc}$

$V_0 = + 2\ V_{dc}$

$V_0 = + 3\ V_{dc}$

$V_0 = + 4\ V_{dc}$

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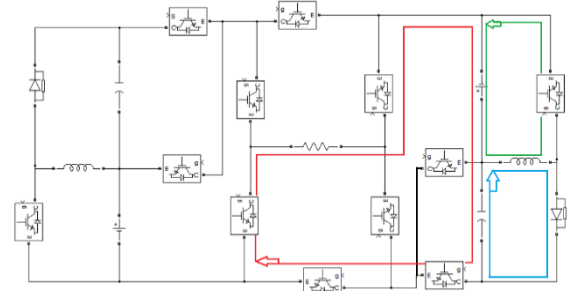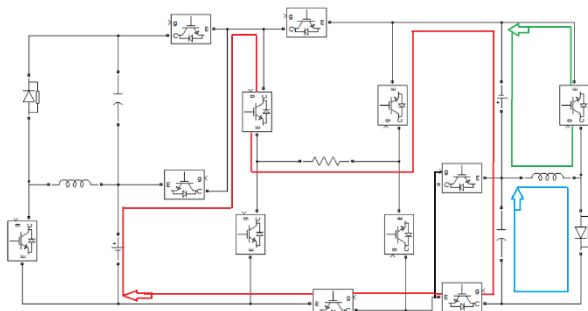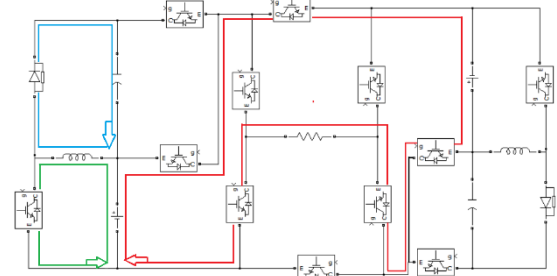
$V_0 = + 5 V_{dc}$

$V_0 = + 6 V_{dc}$

$V_0 = - 0 V_{dc}$

$V_0 = - 1 V_{dc}$

$V_0 = - 2 V_{dc}$

$V_0 = - 3 V_{dc}$
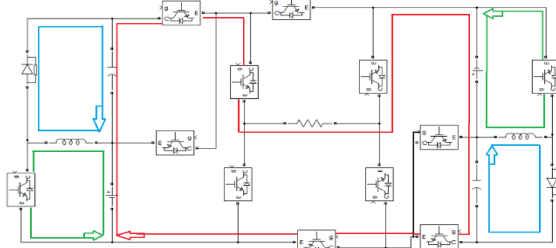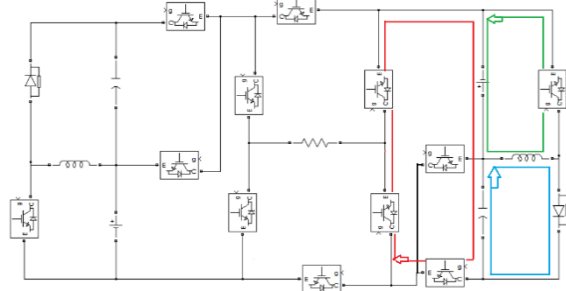
$V_0 = - 4 V_{dc}$
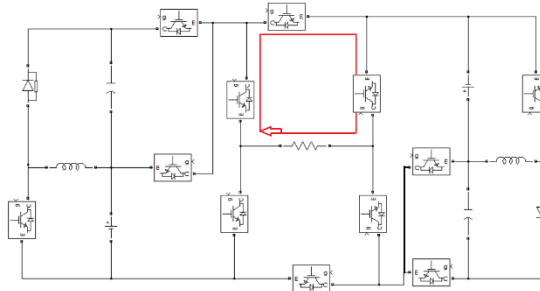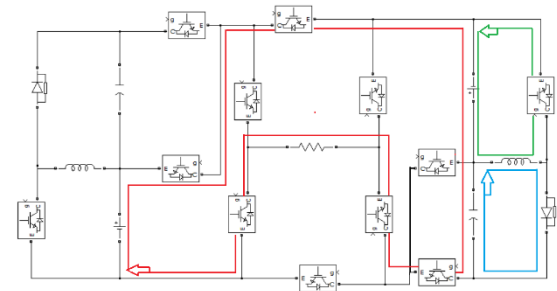
$V_0 = - 5 V_{dc}$
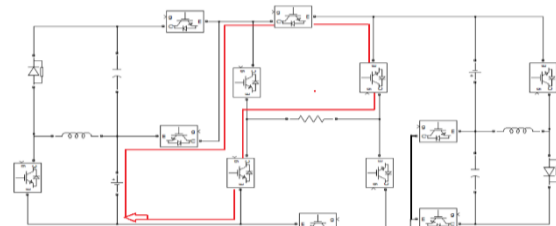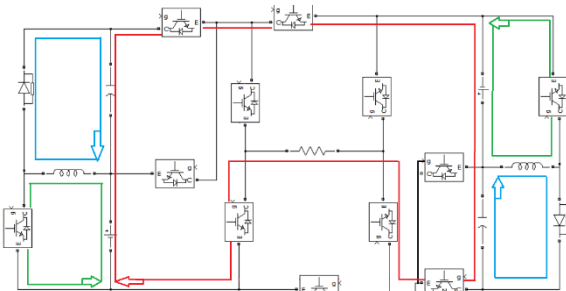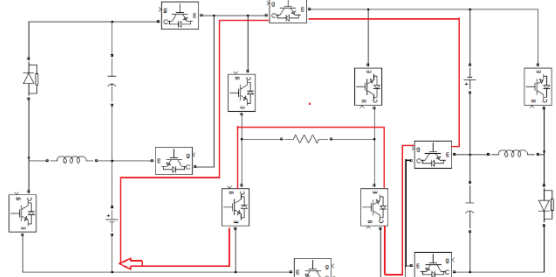
$V_0 = - 6 V_{dc}$

Figure-7: step by step modes of 13 level operation

Boost-factor and number of components

Different key parameters of suggested BDIMLI and the over dwelling novel Switched Capacitor MLI topologies are qualified at proportioned voltage sources. For a specific output power of 1KW and at the frequency of 50Hz, all the topologies are analyzed. The proposed

novel boost DC link integrated MLI operate at the switching frequency of 10 KHz. By assuming the voltage ripple at 5%, the capacity of the capacitors in each topology are calculated. The calculated data for the 9-level output and the 13-level output are depicted in the tables 3 and 4. The expression for boost factor is given as

Boost factor calculation:

The boost factor calculations for the 9-level operation and 13-level operation are as shown below respectively.

9-Level operation:

Value of Input DC voltage Sources = 50 V

Peak Output Voltage across the load = 150 V

$$Boost\ Factor = \frac{150}{50 + 50} = \frac{150}{100} = 1.5$$

Table-3: relative analysis of proposed BDIMLI with conventional MLIs for 9-level operation

13-Level operation:

Value of Input DC voltage Sources = 50 V

Peak Output Voltage across the load = 230 V

$$Boost\ Factor = \frac{230}{50 + 50} = \frac{230}{100} = 2.3$$

Efficiency

Power losses should be taken into account to estimate the efficiency of the proposed MLI. By using PSIM software several power losses of the proposed MLI have been presented in the table 5 for 9-level operation and 13-level operation respectively. Based on the results from the PSIM, it is lucid that with the increase in output power, the efficiency of the proposed also rises. But in the existing topologies, this is not the case as their efficiency drops while the output power is being increased.

III.   SIMULATION RESULTS

The practical model for the proposed MLI has been constructed in the MATLAB/SIMULINK and has been simulated. The achieved results are shown below for both the 9-level operation and 13-level operation. The power loss calculations that are estimated from PSIM software are shown below in the table-5 above. It can be observed from the table-3 and table-4 that the boost factor calculations for the 9-level and 13-level model have been done and we can observe a significant increase in the boost factor values for both 9-level and 13-level models when compared to the existing topologies. As the 13-level model has a higher boost factor when compared to the 9-level even when using same number of components for both models suggests that the 13-level

model has higher efficiency and it is a lot cheaper than the existing topologies.

9-level operation:
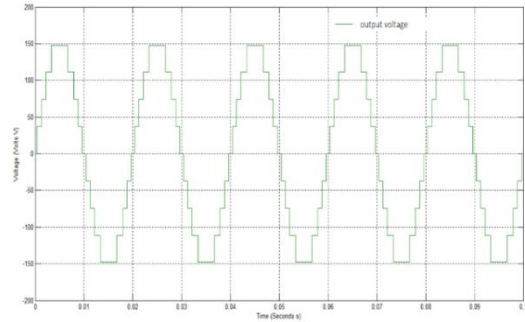
Figure-8: Output voltage or load voltage for 9-level operation
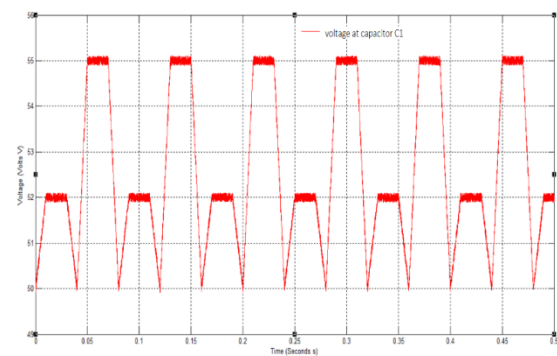
Figure-9: capacitor voltage v_{C1} for 9-level operation
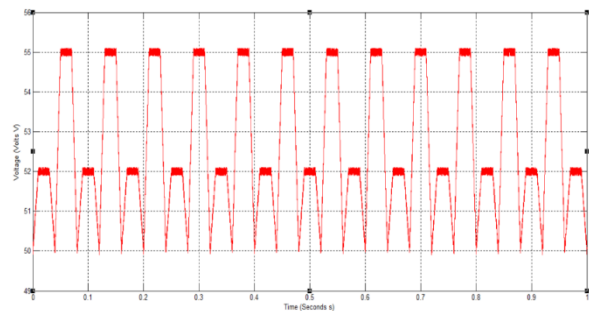
Figure-10: capacitor voltage v_{C2} for 9-level operation
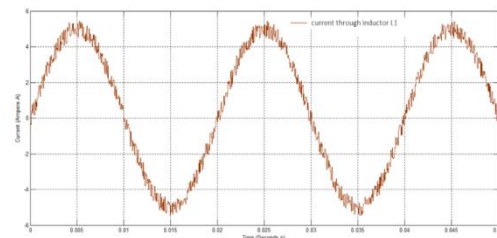
Figure-11: inductor current i_{L1} for 9-level operation

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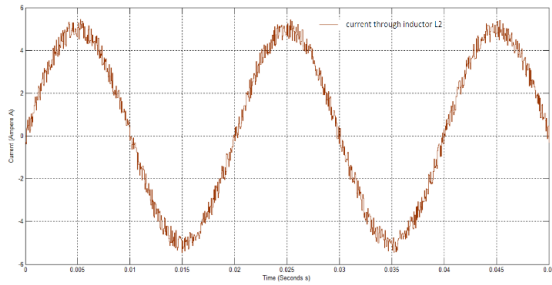
Figure-12: inductor current i_{L2} for 9-level operation

13-level operation:

Figure-13: Output voltage or load voltage for 13-level operation
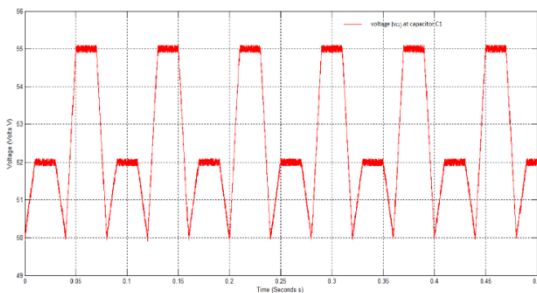
Figure-14: capacitor voltage v_{C1} for 13-level operation
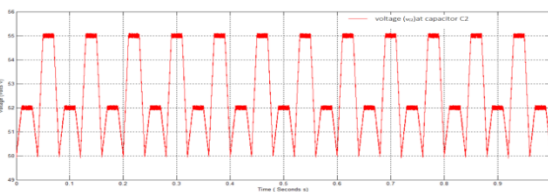
Figure-15: capacitor voltage v_{C2} for 13-level operation
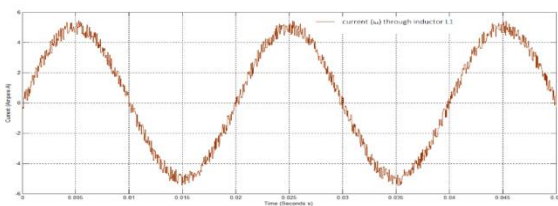
Figure-16: inductor current i_{L1} for 13-level operation

Figure-17: inductor current i_{L2} for 13-level operation

IV. CONCLUSION

Through this paper, a novel BDIMLI is proposed. This MLI provides several critical advantages over the current topologies, including a higher boost factor, a smaller component count, a decrease in the amount of capacitor capacity needed, and, most crucially, a lower cost. A thorough examination of the MLI's related parts has revealed an improvement in the necessary capacitors. Even with changes in load, the voltage drop across the capacitor and the charging currents remained constant. With the help of this study, it is evident that the proposed MLI offers a large increase .

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Evolution and Optimization, Cost of Power Transformer

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department of the non-linear mathematical

Abstract -**Transformer design is a difficult technical process where it is necessary to harmonise many physical domains in order to meet the intended standards. This task is challenging, thus it can be divided into a number of smaller issues. Calculating the cost-optimal essential design parameters during the pre-concept stage of the transformer design is the first sub problem, where not only the technical but also the economical elements must be taken into account. The most broad category of non-linear mathematical optimization problems includes this sub problem. The important developments and trends in the design of power**

I. INTRODUCTION

The design process of a power transformer is a com-plex task, wherein not simplest the technological requirements but also the have an impact on of the monetary feasi ability have to be considered. Moreover, the layout method-ology might also vary appreciably in keeping with the transformer type (e.g .: core or shell shape, device transformer) and the applied manufacturing technology[1].

To create a competitive layout, many non-linear con-straints have to be considered concurrently to fulfill the imposed specs. The searched design parameters can have interaction with each different and belong to specific physical domains– such as electrical, thermal, mechanical, and so on. Therefore, the design of electricity transformers generally leads to a coupled, multidisciplinary optimization problem, wherein the hassle isn't simplest to find a feasible solution but also the cost-optimal solution[2].

Because of the complexity of the trouble, classically, the design manner of a energy transformer is divided into the following three sub problems[3-5](Fig.1):

•Pre-concept stage:

The cost optimization of a transformer design is made in the initial (pre-concept, gentle) design stage. There sultisa design study, as amplified

Fig.1The classical transformer design partitions[2,6].
Layout, that is generally sufficient for the proposition and astateo
frequisition.Thedesignvariablesorparametersofthisconceptstud yiscalledthekeydesignparameters.

- Final design stage:

  The final design is essentially the refinement of the preliminary design to the most minute and completedetails.Itsoutputisthefinaldesignengineeringre cordandthedraftingandmanufacturinginstructions

- Checking stage:

  Checking of the final design, usually by another designer.

  this paper makes a specialty of the optimization techniques T and approaches used in the

Pre-Concept stage:

The mathematical representation of this transformer design optimization sub problem belongs to the most general
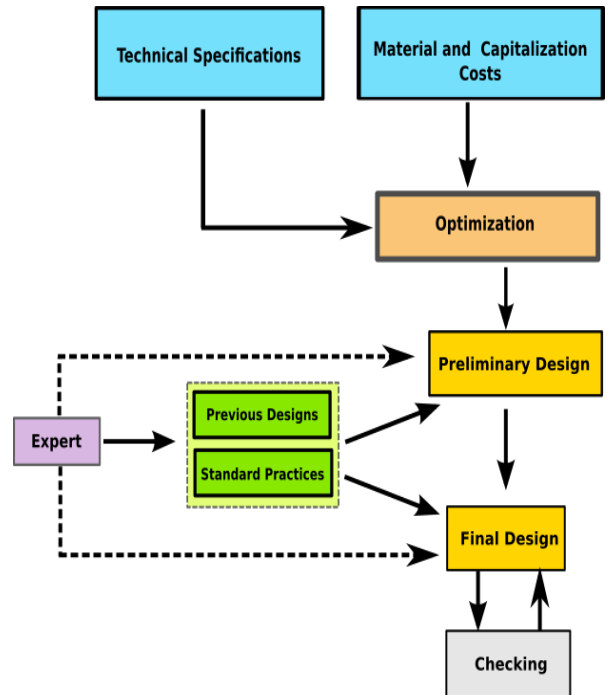
Optimization methods [7-9]. The primary analytical methods have been introduced at the start of the 20th century [10] – only some years later than the primary energy transformers were produced [11] – showing the significance of the subject. Oneof the first application of the virtual computer systems inside the trans-former
Industry is an iterative answer for this layout optimization sub problem[2,3,8].

Over the past century no longer handiest the applied methods have been advanced, however additionally the transformer enterprise, the manufacturing methods, the construction of the transformers and the applied substances had been evolved loads. The primary analytical methods just taken into consideration over simplified model consisting of only the active materials, such as the middle and the windings. Those model submitted the impact of neglecting the cooling, the insulation system or other non-linear factor at this pre-idea design phase[7,12-14].

This paper presents an outline from the evolution of these cost optimization techniques, based totally on great number of publications.

trends in transformer technology

A extensive variety of transformer sorts exists from the small electronic device still the largest components of the power transmission network. Although these devices are based on the equal bodily precept, viz.Theelectromagneticinduction.Theycanbecategorizedi nseveraldifferentways: via their rated power (Fig. 2the kind of the application, manufacturing technology etc. This paper focuses on the evolution of the preliminary

design methods, which relates with large power transformers (LPT). LPT is a large, custom-built equipment in the majority transmission grid. LPTs are very steeply-priced, unique machines, tail ored to the customers 'necessities

Fig.2 Categorization of different transformer types by the irnominal power and possible categorization of power transformers.
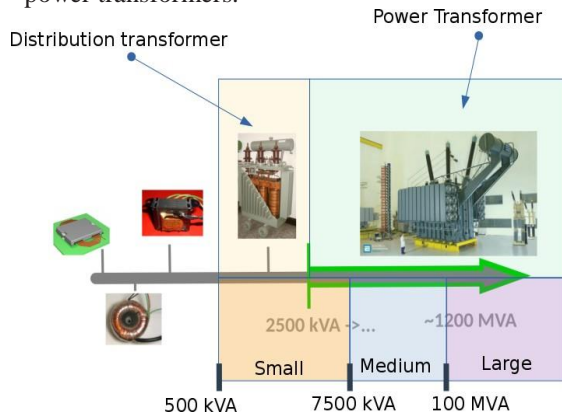
In keeping with character factors along with voltage, power, cli-mate, system topology, sound level and others. Therefore these machines are usually now not interchangeable, accordingly the ratability is a key factor[15].

The power rating level of this transformer category has been advanced lots over the last century due to the advancement so applied materials and manufacturing technology [7, 9, 16-20]. The primary electricity transformer was shipped on September sixteen, 1884 with the aid of manner of Ganz & organization. This first unit became a one-segment, shell-shape transformer with the following specs: 1400 W rated power, 40 Hz net-work frequency, a hundred and twenty/72Volts,11.6/19.4Amperes,and1.Sixty seven:1turn ratio [11, 21-24]. The number one three-phase unit developedsoonattheAllgemeineElektricitäts-Gesellschaft('GeneralElectricity employer') in 1899 [25]. The rated energy of the above mentioned first center-form electricity transformer units was lesser than 10 kVA (Fig. Three) [11, 26]. Interestingly, this power rate would not be considered as a power transformer according to the now a days classification.

The need for growing grid power and massive distances

induced the usage of larger power transformer units and

Fig.3Theleftsideofthepictureshowsoneofthefirstcoretypepowertransformers,manufacturedattheGANZfactoryin1886,ratedpowerwas7.5kW[27].Ontheright-sidethesizeofthistransformeriscomparedwithamodernlargepowertransformer.

The usage of larger voltage levels due to economic area-sons [18]. Nowadays, the nominal electricity of the largest transformers reaches the 1500 MVA and the extra than 1000

kV [20, 28, 29]. The trans-former commercial enterprise and the load of a transformer design hasdoubled in each 11 years till 1945 whilst standardized, repetitive transformer designs were introduced from 500 to ten thousand kVA to reduce the engine. Ering paintings and the shipment times[2Nowadays, the time period LPT refers to the ones strength trans-formers that have more than 2,500 kVA rated strength anddo no longer include a winding supposed for connection to thelow-voltage distribution network (Fig. Three) [16, 17, 30]. The common in the big electricity transformers from the different decade soft the due to the increase of the rated electricity the weight and theno-load losses are multiplied as nicely. Inside the case of large power transformers the sum of these losses can be hundreds of kilowatts. For this reason, the diversion of heat is challenging engineering mission. Distinctive winding and cooling[16].

Due to the increase of the rated energy the load and then load losses are accelerated as properly. Inside the case of large power transformers the sum of those losses may be hundreds of kilowatts. As a result, the diversion of heat is challenging engineering mission. Distinct winding and funking systems with direct and herbal oil go with the flow has been introduced to clear up this problem [17, 18, 31, 32].

Stems with direct and natural oil flow has been introducedto resolve this problem [17, 18, 31, 32].

Last century is that they applied high voltage stage is stems with direct and natural oil flow has been introduced to remedy this problem [17, 18, 31, 32].

Last century is that they applied high voltage level is more than one thousand kV [20, 28, 29]. The trans-former business and the weight of a transformer layout has doubled in each eleven years till 1945 whilst standardized, repetitive transformer designs were introduced from 500 to 10000 Kva to lessen the engineering work and the shipment times [2Nowadays, the term LPT refers to those energy trans-formers that have extra than 2,500 kVA rated power and do not consist of a winding meant for connection to thelow-voltage distribution network (Fig. Three) [16, 17, 30].The common inside the large power transformers from the different decade soft the last century is that they are too largeor too complex for bulk production. As a consequence, those machines are designed custom for the particular necessities of the application, for example 15] states that approximately 1.3 than 1000 kV [20, 28, 29]. The trans-former business and the weight of a transformer layout has doubled in every 11years until 1945 while standardized, repetitive transformer designs were introduced from 500to ten thousand kVA to lessen the engineering paintings and the shipment times [2Nowadays, the term LPT refers to the ones power trans-formers that have greater than 2,500 kVA rated strength and do not encompass a winding supposed for connection to the low-voltage distribution network (Fig. Three) [16, 17, 30]. The common in the big power transformers from the variant decade soft the

Last century is that they are too large or too complex for bulk production. Hence, these machines are designed custom for the specific necessities of the application, for example [15] states that approximately.

Due to the increase of the rated power the load and then load losses are accelerated as properly. Inside the case of large power transformers the sum of those losses may be hundreds of kilowatts. Thus, the diversion of heat is challenging engineering mission. Exceptional winding and funking structures with direct and herbal oil waft has been introduced

to remedy this problem [17, 18, 31, 32].

One of the principal challenges in insulation system design is that the insulation system has to with stand the surge phenomena and the over voltages in all likelihood occur to its operation[7,9,18,33].Toachieveanadequateinsulationsystem,th eelectric area distribution at some point of a lightning or a switching impulse check designed by substantial utilization of the numerical methods[17,34-37].A fur there exceptionally challenging project is to version the frequency based behavior of the insulation gadget, due to the fact the value of the dielectric model parameters are strongly dependent from the frequency [37. On top of this, the calculation of the breakdown phenomenon in the transformer oil is so complex that there is no a widely accepted model exist [28,42-44].

Due to the increment inside the nominal voltage levels and the issue of the cost effectiveness there's a deep interest to discover insulation materials with better dielectric right-ties. The premise of the insulation oils hasn't been changed significantly from the first transformer oil, which became patented by Thompson in 1892[9]. However, there was a huge envelopment in side the cleansing and the manufacturing processes of the oil sand in the applied additives [9, 18, 45 - 47]. Essentially, two types of mineral oil based transformer oil dielectric properties of the paper.

One of the key achievements of these research works was the craft paper based insulation system and the press board which was patented by Weidman .These novelties made it possible to drastically increase the voltage and the power level so of the electric grid in the 40's[24].

A small progress can be noticed in the development of the synthetic insulation materials and the epoxy based insulations structural parts. The improvements in the enamel technology leads to the application of the continuously transposed cables (CTC), which has better filling factor and can reduce the stray losses due to their better electrical parameters . papers have been improved a lot in the70's,the den is on Paper Company introduced the crep paper, which has 20 % greater elasticity than the normal papers, besides the thermal upgraded papers were introduced in the second half of the century [24, 58]. A lotof attempts were made to chemically modify the cellulose molecules. The most important result of these attempts is the Nomex, which can be used in the case of higher load temperatures at 220 °C instead of 105 °C as the normal papers [24,28].

The electrical steels have the biggest improvement in the transformer industry at the last century (Table1).At the beginning of XX century, soft magnetic steel was used as an iron core. At the Ganz factory, these steels were replaced by 2 % of aluminum alloyed steels to reduce the hysteresis and the eddy current losses in iron cores[27]. Because of the other outcome of the high core losses was a high temperate gradient near the transformer core, which increased the aging processes. The average life-time of the transformers was 8-10 years at the beginnings of the industry when soft magnetic steels were applied inthe transformer cores [27]. The aluminum alloyed materials solved this issue. After a few

years, the silicon alloyed steels were quickly spreaded around the industry as a better alternative.

Due to the inventions in the metallurgical technologies, grain oriented silicon steels have been processed already in the 1930s(Table1).Where the direction of the grains is as the same as the rolling direction. This can be significantly decrease the hysteresis losses in a specific direction. In the 1970's Japan was taken the lead in the steel manufacturing also in the case of the electrical steels. Because, with the application of new metallurgical technologies the magnetic losses of the electrical steels have been reduced significantly. These new materials are calledHi-B (Table 1) and produced in several countries around the world by the same license. In the 80 'almost of the

Table1Development of the magnetic steels[17, 27]

First application	Material
1885	Soft magnetic steels
1890-1900	Soft magnetic steel with a aluminum alloy
1900	Si alloyed steels
1935	Grain oriented Si alloyed steels
1970	Hi-B
1980	Thin Hi-B
1983	Domain refined grain oriented electrical steels
1990	Very thin electrical steels

Table2Loss of some electrical steel sheet sat1.7 T.[17]

	Type	Losses-50Hz 1.7T[W/kg]
Conventional	M111-35N	1.41
	M097-30N	1.30
	M089-27N	1.23
Hi-B	M117-30P	1.12
	M105-30P	1.00
	M100-23P	0.92
Laserre fined Hi-B	27-ZDKH	0.92
	23ZDKH	0.84

steel manufacturers have started to produce thinner steel sheets. The average steel sheet thickness was 0.35 mmin the 1960's.Atthe80's they reduced to a thickness of 0.05mm. The

advancements in the insulations has an important contribution to the reduction of the lamination thickness [59, 60]. However, working with these thin steel sheets is expensive as it requires special tools.

The core loss reduction is achieved by alternative, more economical methods (Table 2). Most likely, laser scribing of the grain oriented steel sheets is used to break up the long grains in the 'Hi-B' steels to allow easier rotation of those grains in a magnetic field making the steel much easier to magnetize [17]. Other advantage of these methods is there induced noise level (reduction by 2-3 dBA).

The achievements of the last decades have unexpected twists in the direction of the transformer development. For example, there are comprehensive researches are in progression the application of super conducting materials in power transformers [61-69].

II.ANALYTICAL COST OPTIMIZATION METHODS

Transformer design engineers have long strived for a theoretically confirmed and practical method to reach the cost optimal key-design parameters in the. As early as 1909 the Ganz & Co factory produced transformers with different core and copper ratios for the fossil fuel and hydroelectric power plants. In spite of the fact that the concept of capitalized losses is not known at this time to consider the lifetime losses they have intui-tively discovered that the optimal transformer design is different in the case of the different power plant types [12,27].Them a in difference between the se two plant types that there are no fuel cost in the case of a hydro-electric plant and these plants generates consistent power during the whole year contrast to the fossil fuel power plants, which generate their maximal power at winter

intheirpeakseason.Toconsiderthedifferencesbetweenthesechar acteristicsoft the two power plant types they have produced transformers with larger iron cores, smaller no-load losses and higher efficiency for the hydro-electric plants. These designs were more expensive than the others designed for steam power plants. The economic collapse after the First World War had changed the established manufacturing and design practices. Instead of minimizing the lifetime cost of an electrical machine, the designer shad striven to minimize the mass soft the transformers active part. Hence, these machines has high load and core losses, thus the cooling of the transformers were the main design problem in this stage[14,70].The first analytical methods were published a long time ago at the dawn of the transformer industry [10]. The construction of transformers has been improved a lot, parallel with these preliminary optimization methods [71]. Gisbert Kapp [10] demonstrated a relationship between the volume of the iron core and the power of the power transformer in as early as 1900. In 1906 Bohle has already created a simple model, where he already considered the impact of the economic environment on the optimal dimensions of an electrical machine. He assumed that the material cost of the transformers active part (P) can be expressed as a function of the transformers efficiency(η):

$$P=f(\text{h}). \quad (1)$$

Then had divided the total cost of the transformer into two Parts: the cost of the active and the in active(orfix)parts:

$$P_t=pc+pfc(\text{h}), \quad (2)$$

Where C and c are empirical constants, with values are selected between 0.5P and 1.5P, considering applied technology and financial environment [72], and p is an economical consistent that is calculated from amortization and investment. He extended the above cost feature with the losses as a feature of efficiency (F(η)), consequently he searched for the minimum of the following function:

As early as 1909 the Ganz & Co. Factory produced transformers with distinctive middle and copper ratios for the fossil gas oline and hydroelectric power vegetation. Notwithstanding thefact that the concept of capitalized losses isn't recognized atthis time to don't forget the lifetime losses they've intitively found that the top-quality transformer design is different in the case of the different power plant types [12,27].The main difference between these two plant types that there are no gas price within the case of a hydro-electric powered plant and these vegetation generates constant power during the whole 12 months assessment to the fossil gas oline power plants, which generate their maximal strength at wintry weather in their peak season.To consider the differences between these characteristics of the two power plant types active part. Therefore, these machines has high load and middle losses, for this reason the cooling of the transformers were the main design problem in this aera. They have produced transformers with large iron cores, Smaller no-load losses and better performance for the hydro electric plants. These designs were more expensive than the others designed for steam power plants.

The monetary disintegrate after the first international battle had changed the set up manufacturing and layout practices. Instead of minimizing the lifetime price of an electrical machine, the designer shadstriv ento minimize the mass of the transformers.

As early as 1909 the Ganz & Co. Factory produced transformers with exceptional middle and copper ratios for the fossil fuel and hydroelectric electricity plants. Not with standing the fact that the concept of capitalized losses isn't always regarded atthis time to remember the lifetime losses they've intuitively determined that the most efficient transformer design is different in the case of the different power plant types [12,27].The main difference between these two plant types that there are no fuel fee in the case of a hydro-electric powered plant and those plants generates regular power during the whole assessment to the fossil gasoline power plants, which generate their maximal

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They have produced transformers with larger iron cores, Smaller no-load losses and higher performance for the hydro electric plants. These designs were more expensive than the others designed for steam power plants. The monetary disintegrate after the primary global conflict had changed the established manufacturing and layout practices. In preference to minimizing the lifetime cost of an electrical machine, the designers had striven to minimize the mass soft the transformers.

These methods generally model the transformer only by the energetic element neglecting the cooling machine and the structural additives, which collectively constitute approximately the half of the whole production fee [17, 78]. Those active part model suse only at two winding modeling lecting the effect of the regulating winding on the important thing-design parameters [13]. Other not unusual assumption of those analytical strategies is they neglect the insulation materials and us the minimum insulation distances as constraints. However, the residences of the dielectric substances have a complex non-linear behavior and the concept of the minimization of the insulation can not guarantee that we discover the most economic also solution[13,14].
The application of these oversimplified analytical models effortlessly results in erroneous layout guidelines and practices which can easily misleads the non experienced designer in the case of a unique software or produces non economical designs after the changing of the conditions.

Different side of the iron curtain [82]. However, the original approach became no longer taken into consideration the material and the capitalization expenses. With the attention of the lifetime expenses, the solution of this transformer optimization problem is a lots extra complex problem as illustrated in the 50's and 60's the desired transformer designmethods has been determined the product charge (P) andnominal electricity (S) – consequently the most appropriate core and copper ratio – as a feature of the middle geometry. Those geometrical shape features(f1,f2, f3) wascalculated from the core
Dia meter (Do),the length of the yoke and the legs(lj,lo).
One of the today's algorithm from this design philosophy was published by Bulgakov[102]:

The interest for fast and accurate analytical methods is 1

Now not reduced after the spreading of the computer based numerical solutions[79].
The first laptop aided layout technique for electrical machines turned into one published via Abetti in 1953 [3]. Then Sharpley and Oldfield [80] in 1958 and Williams et al. In1958 [81] published the first research papers from the computer aided transformer design. These method shave us simple new release to find the most advantageous key-layout parameters in the pre conceptional design

phase. The computers goto around the transformer industry in the50's.They

It possible to apply new, advanced numerical methods, that is required by using the new upgrades on the voltage level and the better reliability necessities. Because of the increased accuracy, the proper answer of the different bodily fields ends in remedy elliptic integrals, second order Bessel-capabilities and many others. Those partial differential equations may be solved with the aid of numerical methods in reason able time and accuracy[1,82-101].

The solution of the preliminary design tasks were one of the primary application area of the computer systems in the transformer enterprise. Due to the fact the speedy answer of those optimization duties ensured a full-size benefit in the competing marketplace [82]. The primary systematic method for the computer aided layout of electrical machines turned into given byAbetti et al. [2]. This design method has no longer been obsolete till today, this method is described and illustrated in Fig.1.There are many similar methods in the industry. Dicső and Petras published a similar method on the
In the starting of the 60's, Csikós [103] recommended a new system, which in assessment to The solution of the preliminary design tasks were one of the first application discipline of the computer systems in the trans-former industry. Due to the fact the speedy answer of those optimization tasks ensured a sizeable advantage inside the competing marketplace [82]. The first systematic method for thecomputer aided design of electrical machines became given byAbetti et al. [2]. This design approach has now not been obsolete till today, this method is described and illustrated

inFig.1.Therearemanysimilarmethodsintheindustry.Dicsőand Petraspublishedassimilarmethodonthe
Operation. Corresponds with the producing facts. But,the know-how of those parameters does not helps the design process. Further more, it indirectly proves that the manufacturing prices in particular rely on the magnetic flux,modern density and the losses instead of these newly introduced(Do,x,y)quantities[103].
The solution of the preliminary design tasks were oneof the first software subject of the computers within the trans-former enterprise. Because the rapid solution of those optimization duties ensured a vast benefit inside the competing market [82]. The first systematic technique for thecomputer aided layout of electrical machines became given byAbetti et al. [2]. This layout method has now not been isolated till today, this method is described and illustrated inFig.1.There are many similar methods in the industry. Dicso and petras published a milar method onto big forth is technology.
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preliminary design tasks were one of the first software subject of the computer systems inside the trans-former industry. Due to the fact the fast solution of those optimization duties ensured a significant advantage within the competing market [82]. The first systematic method for the computer aided design of electrical machines changed into given byAbetti et al. [2]. This design method has no longer been obsolete till today, this method is described and illustrated inFig.1.There are many similar methods in the industriveo. Dicső and Petras published a similar method on the Operation.

Of the manufacturing cost. There commended formula was the following:

$$K = pk100 + tW, \tag{1}$$

where p means the percentage value of the sum of the acquisition, maintenance and installation costs, the annual loss in kWh and t is the unit price of the electricity. However, this formula was not considered the lifetime of the machine, and the inflation and rate of interest duringthe life cycle of the machine. This formula was not differentiate between the load and the no-load losses, there-fore it was not considered the annual load (Eq. (10)) of thetransformer. Moreover, the applied analytical model used that design directive as anaxiom [45],which states that the insulation system of an electrical machine is properly designed, if the applied safety factor is close to the
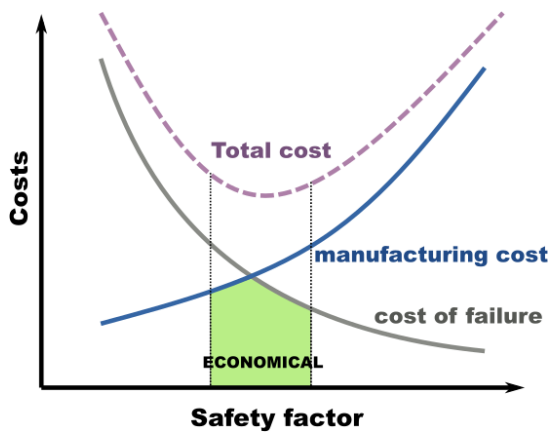
Fig.4 Aproperly designed insulation system ensures continuous operation during the planned life time of the electrical machine.

Otherwise, the cost of the operation ailure can significantly increases the life time costs. The classical design rules assumes that the

Minimum of the resultant curve(E

Recommended a new procedure, which in contrast to The solution of the preliminary design tasks were one of the first application field of the computers in the trans-former industry. Because annual loss in kWh and t is the unit price of the electricity.However, this formula was not considered the lifetime ofthe machine, and the inflation and rate of interest duringthe life cycle of the machine. This formula was not

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Following this axiom, the application of larger main gap will increase the price of the active part of an electrical machine. Due to the non-linearity of the electric machine design hassle this layout precept does now not corresponds with the practice, where the cost optimal transformers, auto transformers have larger foremost hole than the required minimum [5, 8, 13, 14, 104]. Csikos has already confutedan other old design rule [103], which states that if the trans-former designed for maximal efficiency with as same load as no-load losses. Because the selection of the geometrical and the electric parameters aren't the identical in thecase of the two different goal functions: the maximal efficiency or the minimum losses .[105]. He rejected to use the manufacturing cost as the objective function, instead of this he was proposed to apply the sum of the manufacturing and the running charges as the objective.

Optimal insulation system can be found near the minimum of the resultant function of the manufacturing cost and cost of failure functions, when (Eload=Eallowed)[45].

Windings and just calculated by means of the sum of the Excitation and the filling factor of the windings [70].Újházy has posted an set of rules, which calculates the detailed winding parameters from the important thing-design parameters,e.g. There sults of the sepreliminary optimization solvers [12, 70]. This approach become based totally on the assumption that the transformer optimization procedure can be separated into two unbiased optimization duties: the optimization of the center and the windings. The final results of this assumption is that the aforementioned method does now not consider the retraction of the most useful key-layout parameters of the winding son the core parameters.

Újházy has posted an algorithm, which calculates the detailed winding parameters from the important thing-design parameters, e.g. The result of these preliminary optimization solvers [12, 70]. This approach turned into primarily based at the assumption that the transformer optimization process may be separated into two unbiased optimization responsibilities: the optimization of the core and the windings. The final results of this assumption is that the aforementioned approach does no longer consider the retraction of the top of the line key-design parameters of the windings on the core parameters.

Andersen has evolved a Monte Carlo technique based transformer optimization code (MONICA [118]) to dis courage mine the optimal key-design parameters. This method was published already in1967 and extended for electrical device optimization, due to the simplicity and robustness of the code. Sarovalac [120] introduced a method, which similarly to MONICA–generated a set of feasible designs and search the minimal cost design as a continuous mathematical optimization problem.

Judd and Kessler [121] posted a mathematical programming based totally set of rules, which determines the winding geometry with the maximal load capability for an existing iron core geometry. Poloujad off and Findlay [122]made a simple iterative solver to research the sensitivity of the input parameter so the key design variables.

On the stop of the 20 th century, most of the publishedmethodshaveusedthelifetimecostofthetransformertod eterminethecost-optimal key-layout parameters [1, 14, 91]. A variety of papers and a standardized methodology[123] has been posted at that time which deal with the greater complex and correct assessment of the capitalization factors [91, 97, 103, 124-128]. The modern day methods take into consideration not handiest the monetary but the environmental aspects as nicely [91, 126, 128]. Severa FEM based optimization techniques were advanced during these years to make a greater correct set of rules which can take more aspects into consideration at the beginning of the layout procedure [9, 7, 17, 129-132]. Majority of these methods integrate the FEM method with a historical orma the matical programming based optimization technique [30,91,133-137].Most of these method shave searched the global cost optimum for a power transformer[33,138-141]. The others have calculated the finest winding distribution orano ther optimization sub problem[142],like[12].

Numerous new transformer optimization methods has been published in there cent decades, which methods applied the parameters.

Latest improvements of the numerical computing methods: such as neural networks [143, 144], nature inspired evolutionary, genetic algorithms[143-157]and metalstic kind optimization methods blended with FEM [148].Because of the problem of the cost optimization problem, beside the numerical methods, the analytical transformer models was developed further[4,149-151].However, most of these analytical techniques optimizes for the manufacturing not the lifetime fee of the transformer [148], or solves some smaller sub-optimization task[152-154].

The transformer optimization problem belongs to the most general branch of the non-linear, mixed integer mathematical optimization problems. Majority of the optimization methods combines FEM and analytical calculation techniques with a met heuristic, branch and bound method technique [154-157]. One of the first application of the geometric programming was the cost optimization of energy transformers [8, 158]. In 2005, Jabr [159] made a transformer optimization algorithm with a modern, interior point method solver. The main advantages of the geometric programming formalism are the following: the formal is guarantees that the obtained solution is the worldwide answer and comparatively large inequality systems can be solved in a small laptop in very brief time[158-161]. However, because it changed into proved through [5] the geometric programming formalism cannot be used for center- form power transformers, due to the fact the fast-circuit impedance constraint cannot be formulated within the required polynomial shape [78]. Combining the geometric programming with the method of branch and sure, a brand new methodology istic solver became published [5]. This new solver is relatively fast and robust compared too there methods[4] and it can be extended to take into account the impact of the outer cooling system [78] and the effect of the faucet-changing method on the cost optimal design[13].

III. CONCLUSION

An analysis of the literature on preliminary layout optimization strategies for power transformers has been performed within the modern-day paper. A extensive variety of engineering and numerical methods are included in

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pertinent papers from international journals. The severa articles indicate how intensively explored this area is. Together, the method and transformer construction are converting. Extra sophisticated transformer models and present day developments in optimization principle are taken into consideration through the radical transformer optimization strategies. There had been enormous changes made to each the optimization elements and the transformer fashions. These models are ordinary in that they ignore the impact of the insulating gadget and instead derive the energetic part parameters with the aid of their lively additives

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Layout Plant Process to Produce Electricity From Solid Waste

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Abstract: **Waste-to-energy (WTE) is playing a crucial role in the production of renewable energy from discarded Municipal Solid Waste (MSW) in order to meet the power needs of city dwellers and free up space for new land fills.The utilization of municipal solid waste has made waste-to-energy a promising approach to addressing these issues. The advanced MSW management technology, which has the advantage of recovering energy from solid waste, is a promising alternative for resolving the country's waste disposal complexity. MSW is a viable source of energy for the generation of electricity and the reduction of greenhouse gas emissions. This paper aims to show a plant process layout, discuss emission control strategies, and evaluate the promising electricity sources from municipal solid waste (MSW).The chemical compositions of the solid waste influenced the material properties and energy conversion potential of the MSW.. Likewise Conceivable energy recuperation from strong squanders delivered in Rajshahi City Partnership has been calculate in this paper, a schematic outline of a power plant has been planned which is completely worked by MSW. All burning cycle, sifting process, wastage the board is portrayed in this paper.**

Keywords: Municipal solid waste management, waste to electricity production, power plant layout, oxicemission control.

I. INTRODUCTION

(i) Municipal solid waste is a significant social and environmental problem in Bangladesh. Every day, a lot of solid waste is produced in municipal areas, and unfortunately, solid waste management is getting worse. The nation has experienced a severe power outage. Nowadays, load shedding is a major impediment to socioeconomic growth. There has been an increase in interest in developing renewable energy sources from organic solid wastes due to their significant energy content. The vent gas produced by the cremation of MSW is enormous. That remains from incomplete combustion and contains a wide range of pollutants. The pollutants and their concentration are determined by the conditions of combustion and the compulsion of the incinerated waste. There are different measures of debris, weighty metals, and natural and inorganic mixtures. The majority of pollutants are HCL, HF, SO3, NOx, mercury, dioxin, and others. Bangladesh is the 12th most populous country in the world, with an average annual value of at least 12 MJ/kg and an efficiency of approximately 25%.Bangladesh produced approximately 22.4 million tons of waste in 2021, or 15 kg per capita, and had a nominal waste collection coverage, so 58% of it was dumped on the roadside and in open spaces, putting human health and the environment at risk. The waste

stream's composition was approximately 74% organic matter, 9.1% paper, 3.5% plastic, 1.9% textile and wood, 0.8% leather and rubber, 1.5% metal, 0.8% glass, and

8% other waste[2].We can generate electricity by incinerating these solid waste (SW).Sweden has 32 waste-to-energy (WTE) plants. These plants provide 260,000 homes with electricity and nearly one million with heating. Sweden burns over two million tons of trash each year, which results in the production of approximately 670,000 tons of fuel oil energy[3].Waste is fed into a combustion chamber to be burned after SW is unloaded from collection trucks at waste incinerators. This method boils water, resulting in steam that is used directly in a heating system thanks to the heat it generates. Normally, the steam is utilized to turn a turbine-generator to create power. Matter that is both organic and inorganic can be found in municipal solid waste (MSW).Utilizing appropriate Waste Processing and Treatment technologies, the organic fraction's latent energy can be recovered for profitable use. The following are a few additional advantages of recovering energy from wastes: The total quantity of waste gets reduced by nearly 60% toover 90%[4] depending upon the waste composition and the adopted technology.

There is less demand for land filling land, which is already scarce in cities. A Proportional reduction in the cost of transporting waste to distant landfills. Net reduction in environmental pollution. to figure out how much energy comes from the incineration process. SOURCE SOF MUNICIPAL SOLID WASTE (MSW)

A) Municipal Waste

Municipalwastemaycoveronlyresidentialandcommercialnon-hazardouswaste,and may also include industrial and agricultural non-hazardous waste. This has to be defined based on the existing regulations and practices within the specified geographic location. Usually, the municipality -responsible for the collection and disposal of municipal wastecollectsresidentialwastewhileothersectors(commercial,industrial, and agriculture), if they are allowed to dispose their waste at municipal facilities, make their own arrangements to transport their waste to the municipal disposal sites (land fill and incineration plants) and pay disposal charges. Different types of solid wastes are found from municipal services these are street sweepings, landscape and trimmings, general wastes from parks, beaches, and other recreational areas, sludge.

B) Residential Waste

Residential waste generated by house holds which may contain organic waste (eg; from the kitchen and gardens such as food wastes, household hazardous wastes), recyclable waste (eg;plastics, paper, cans, cardboard, textiles, leather yard wastes wood, glass, metals ashes etc.), non-recyclable waste(that has no

recycling value), and hazardous waste (batteries, some oils, etc.).

C) Commercial Waste

In many places, non-hazardous commercial waste generated by the businesses is considered as municipal waste. Different commercial wastes are paper, cardboard,

plastics,wood,foodwastes,Glass,metals,specialandhazar douswastesfound from stores, hotels, restaurants, markets office buildings etc.

D) Industrial waste

Industrial waste is categorized as hazardous waste and non-hazardous waste. It includes housekeeping wastes, packageing food wastes, construction and demolition materials hazardous wastes, ashes, special waste found from Light and heavy manufacturing, Fabrication, construction sites, power and chemical plants etc.

E) Agricultural Waste

Agricultural wastes are the wastes produced from agricultural land. Different wastes found such as spoiled food wastes, agricultural wastes, hazardous waste (e.g.. pesticides)from the fields of crops, dairies feedlots, farms etc.

F) Medical waste

Different types of waste were generated from all the 44hospitals/clinics/diagnostic centers in Raj shah city. These were gauge/bandage, syringe, saline bag, papers, medicine packet and rapping, food waste, urine, placenta, ampoule, sanitary pad, cotton, etc. According to Raj shahi City Corporation(RCC) data all hospitals/ clinics/diagnostic centers together generate 22 kg pathological waste, 30 kg plastic waste, 20 kg soft waste,7kgsharp wasteand320kggeneral waste per day.

However, baseline survey measured 349 kg of medical waste per day from 44 hospitals/clinics/diagnostic centers. It was found that most of the clinics/diagnostic centers generated 0.5to5kg waste perday. Few small hospitals and clinics generated 6-10 kg waste, and six hospitals generated 11-60 kg waste per day. Only Raj shahi Medical College Hospital(RMCH) generated the largest amount of waste compared to other hospital sand clinics.

Elements	Percentage of Weight
Carbon	26.34
Nitrogen	1.9
Sulphur	.03
Hydrogen	3.01
Oxygen and Ash	68.72

G)Hazardous waste (industrial, health care and laboratory, and C&D)

Hazardous waste is generated by different sectors including industries, healthcare facilities, laboratories, construction and demolitions, sludge and urban agriculture. Some hazardous waste Is also generated by residential sector.

H) Electronic Waste

The term "e-waste" is applied to consumer and business electronic equipment that is near or at the end of its useful life. Computers, televisions, mobile phone, laptop, tablet computer, CD/DVD player, copiers, and fax machines are common electronic waste products.

II. COMPOSITIONSOF SOLID WASTEIN PIECHART

This pie chart shows the composition of solid waste in percentage basis in residential, commercial and industrial area where average values are used for constructing pie chart.
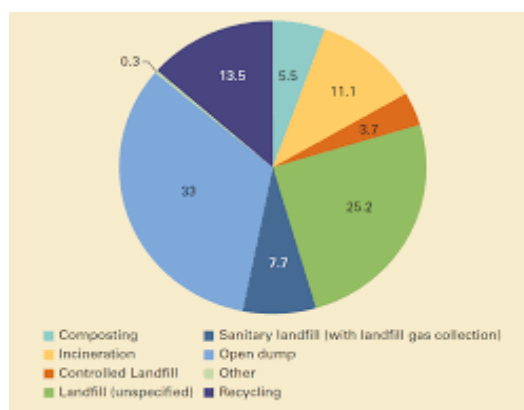
Fig.1.Averagevalueofcompositionofsolidwasteinresidential area[5]
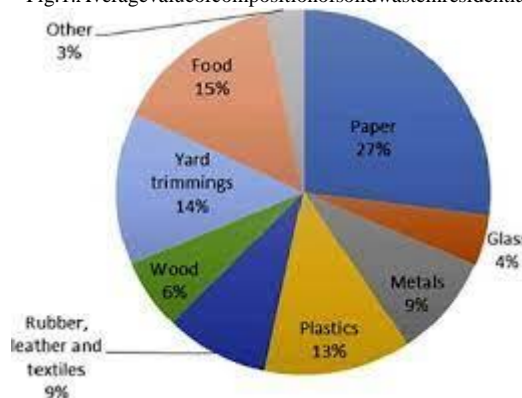
Fig. 2.Total average value of composition of solid waste in commercial area[5]

CHEMICAL COMPOSITION OF SOLID WASTE[5]

III. WORKING PROCEDURE

At waste in cinerators, Solid Waste is unloaded from collection truck sand then waste is fed into a combustion chamber to be burned. The heat produced by this process boils water & resulting steam is used directly in a heating system. Usually, the steaming used to turn turbine-generator to produce electricity. Water is fed into the boiler and heated bythefurnaceheatandsteamisproduced.Inboilerthesepara tionlineseparatesthesteamfromthewater.Waterevaporate s through natural circulation with down comer. Then steam is superheated and passed through the high pressureturbine(HPT).AfterdischargingfromHPTthetem

peratureandpressure decreases. Then it is again reheated to get proper temperature. Then it passes through the intermediate and low pressure turbine (LPT).The steam rotates the turbine at a high speed. The shaft of the turbines is coupled with the shaft of the generator. Since the turbine rotates, the generator shaft also rotates and produces electricity. After heating air pre heater flue gases pass through electrostatic precipitator, scrubber (wet &dry), chamber with NAOH chamber with CuCl2 & HCL and water for toxic filtering. An electrostatic precipitator(ESP)[6]isahighlyefficientfiltrationdevicethatremovesfineparticles,like dust and smoke, from a flowing gas using the force of an induced electrostatic charge minimally impeding the flow of gases through the unit. A wet scrubber issued to clean air, fuel gas or other gases ,various pollutants and dust particles. Dry scrubbing systems are used to remove acid gases (such as SO2 and HCl) primarily from combustion sources[7].Chamber with CuCl2 &HCL is used for separating CO2 [8] & water used for absorbing olid carbon from the flue gas.
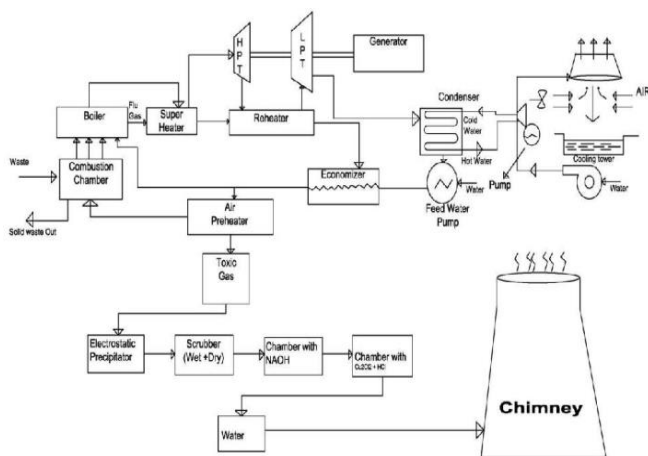
Fig. 3.Power plant layout

POSSIBLE ENERGY RECOVERY FROM SOLID WASTESIN RAJSHAHI CITY CORPORATION (RCC)

The potentials of energy have been calculated from their calorific value. The calorific value of solid waste is determined by the combustion of solid waste. We have determined the calorific value of solid fuel from Bomb calorimeter by burning of the fuel and the average value is 22.512 MJ/Kg. The daily waste generation in Rajshahi city is about 400 ton/day[9]. Sothetotalwastegenerationinayearisabout146000tons. Calorific value of solid waste (food waste) in Rajshahi City=22.512MJ/kg
=22512MJ/ton
=6253.33kWh/ton
Specificpoweroutputpertonofwasteatathermalefficiency 25%[10]
=25%efficiency×CalorificvalueofsolidwasteinkWh
=0.25×6253.33
=1563.33kWh/ton
Potential of electric power plant capacity from solid waste in Rajshahi city
=

(totalwastegeneratedannually×Specificpoweroutputfromwasteperton)×calorificvalueofsolidfuel
= (146000×1563.33)×22512kW
=10.14MW

IV.   CONCLUSION

Worldwide, approximately one hundred thirty million lots of municipal stable wastes are combusted yearly in WTE centers that produce electricity and steam for district heating and additionally get better metals for recycling [5]. In Bangladesh 58% of waste are dumped at the roadside and in open areas that generating negative effect on environment. By right control we will produce power and if this power is amassed in countrywide grid then electricity disaster may be minimized. Approximately, 4.482MWh/day electric electricity has been observed from the stable waste of RCC relies upon at the bodily and chemical traits of stable waste. In conclusion, a 5- 10 MW electricity plant may be established primarily based totally on the prevailing technology of stable wastes in RCC to provide power in addition to to lessen negative effect of stable waste on environment.

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Optimization of Size and Location of the Solar Power Plant

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***ABSTRACT-* The solar power plant's structure is described. Consideration is given to optimization and object placement on the ground. On internal lines, estimated electricity losses were**

Keywords: Solar power plant, Inverter, Step-up transformer, Electric generation center, Losses of electrical energy.

I. AN ANALYSIS OF THE ISSUE

There are trends in the transition from carbon-containing fuels to renewable energy sources (RES) in the global energy sector [1]. The government of the Russian Federation in 2021 published a number of orders suggesting the transition to the "Green Economy". This is a set of measures aimed at reducing greenhouse gas emissions, subsequent waste recycling and the transition to renewable energy sources. The lack of experience in practical use and the imperfection of legislation in the field of renewable energy led to mistakes of designers and ineffective use of generation facilities based on renewable energy sources. The use of solar panels for electric power generation requires fundamentally different approaches in the design of solar power plants. [2].

In world practice, there is a sufficient experience in the use of renewable energy sources both in large solar power plants (SPP) and in distributed generation (DG). DG in a local area with a large number of consumers and RES facilities provides opportunities to use surplus generated electricity for distribution to energy-deficient areas of the country.

The installation of group converter substations is proposed for the efficient use of DG capacities and the power supply of consumers of scarce areas. Power flows within such areas will be minimal. The simultaneous generation of SPP and power consumption will allow to align daily load schedules and increase the efficiency of renewable energy use. The installation of one high-power inverter converter for a group of renewable energy facilities will reduce the cost of the solar power plant and the cost of electricity.

II. RESEARCH

Wind and solar power plants belong to DG. The unit power is small, so a distinctive feature of RES is the location of generating equipment in a significant area. Grouping of solar panels and sectioning of sources at different voltage levels are used to generate high power. Figure 1 shows the structural diagram of the solar power plant.

The scheme of the solar power system is built according to the hierarchical principle with the direction of power transit from the bottom to the top. Electricity is generated by solar panels with a nominal voltage of 40 V [3]. Transit through the territory of the solar power station is conducted on power lines (transmission lines). Direct current makes it easier to connect a large number of sources to the common bus of the converter station. Solar panels are grouped into modules. Solar panels are connected in series and in parallel inside the module, thus the voltage at the pins of the line and the output current increase. When using a large number of renewable energy facilities at large solar power plants, solar panels are grouped into modules and modules into clusters. Each cluster has several inverters and a transformer substation (TS). To reduce the number of inverters, their power is increased to values limited by the maximum currents of thyristor switches.
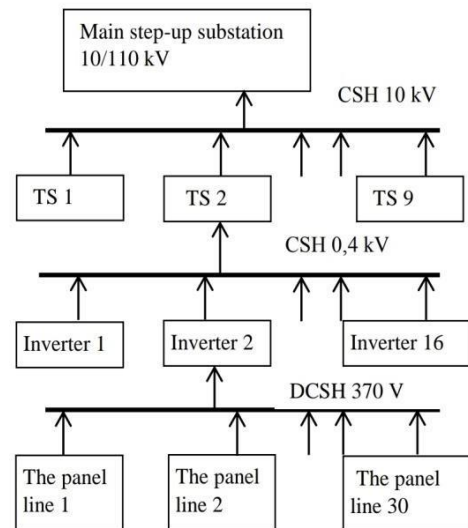
Figure 1 Structural diagram of the SPP.

The amplitude of the phase voltage is 310 V in 0.4 kV distribution networks. Conversion of direct current to alternating current is performed by inverters with six thyristor switches [4]. A throttle is sequentially connected to the circuit of each phase to obtain a sinusoidal form of voltage. Into account the voltage losses at the throttle, it is required to obtain a voltage at the output of the modules and DC buses equal to about 360 V.

The module includes 270 panels. The module in DC mode produces a peak power of 108 kW. When working together with an inverter, the current of one module is distributed into three phases and will be less than the current in the transmission line. As a result, the amplitude of the current in one wire is 150 A, the electric power drops to about 73.6 kW at the output of the converter. These data relate to peak loads, which are observed no more than 1–2 hours per day. The rest of the daylight hours the power of the sun is less and the electrical power of the module decreases.

As the experience is gained in design and practical application, the main problems and solutions are identified. Often the adopted design solutions do not correspond to the technical characteristics of the modern element base and need to be improved [5]. Optimization of the solar power plant structure includes the following stages:

1. Designing of the main scheme of the SPP.

2. Designing of TS and main step-up substation.

3. Designing of modules and clusters.

4. Location of TS and main step-down substation on the ground.

The selection of the voltage is performed according to traditional methods at which the power output is carried out. The nominal voltage depends on the transit power and the length of the power lines. As a rule, the output of power up to 1 MW is carried out at a voltage of 10 kV over a distance of several kilometers. [4]. Transit power up to 10 MW is carried out at a voltage of 35 kV, and the transmission of higher power at a distance of up to 100 km requires a voltage of 110 kV.

The main scheme of the SPP is determined by the installed power. The number of conversion stages and TS depends on the peak power of generation and the voltage of the district networks to which the SPP is connected. An inverter is required to produce alternating current. An increasing TS of 0.4/10 kV is required to supply local consumers at a voltage of 10 kV.

Power delivery in the trunk lines is carried out through the main step-up substation, which are connected to power lines with a voltage of 110 kV. The power supply of the main panel of SPP is performed by direct current. An alternating current with a nominal voltage of 0.4 kV is required to supply auxiliary electric receivers. Some of the SPP receivers can operate at a generator voltage of direct current 360 V.

It is necessary to increase the transit voltage to reduce the current in the transmission line. A single- transformer TS is installed in each cluster for this purpose. The use of 0.4\10 kV serial transformers allows you to apply standard designs, solve problems with the supply of components at the construction stage and problems of spare parts during operation. The capacity of the SPP depends on the area, which it

occupies. For example, for modern solar panels "Silasolar-400vt," the peak specific power reaches 200 W/m2 [3]. For middle latitudes compared to the south of our country, solar activity decreases and the peak power decreases to 100 W/m2. The average specific power in the central part of Russia does not exceed 60 W/m2 taking into account the structural installation of panels, transport corridors and the placement of facilities on the territory of the solar power plant.

An increase of the capacity of the solar power plant requires to increase the area and the distances from the converter substations to the transformer substations also increase. This leads to an increase in the total length of indoor transmission lines. An increase in the active resistance of the transmission line leads to an increase of electric power losses for its transmission inside the SPP. The power of thermal losses in the transmission line depends on the line resistance and the current squared.

The cost of electricity generated by SPP does not include fuel costs. The price of electricity losses for transit will be significantly lower than the cost of cable products. You can use cables with an oversized section of current conductors to reduce the active resistance of power lines. This dramatically increases their cost and leads to an increase of the capital costs. On the contrary, a decrease in the current in the power transmission line, for example, by a factor of 2 leads to a decrease in the losses by a factor of 4. This way of reducing electricity losses for transit is economically justified

The design of the SPP «from scratch» allows you to apply typical projects, maintain the topology, select rectangular sections, and place objects in the geometric centre of the areas. This approach minimizes the length of transmission lines and reduces the consumption of cable products. In turn, the total active resistance of the lines and the loss of electricity for transit is reduced.

In classical generation, the unit power of the units is concentrated in the local volume and it is considered a point. Renewable energy sources are used according to DG technology and the capacity is distributed over the territory. The use of solar panels of the same capacity, the same manufacturer or compatible in technical characteristics allows you to deliver the same power from 1 m2 of surface.

However, such favorable design conditions are almost never realized in practice. Standard projects of power plants based on RES have to be adapted to local conditions. It is necessary to take into account the terrain, riverbeds, flooding zone, forests, swampy soils, steep slopes of mountains. Renewable energy facilities often combine with agricultural land and solar power plants place on pastures [5].

SPP should be located as close as possible to consumers of electricity – large cities and industrial enterprises. But there are no free land plots inside the cities. Placement of solar panels on the walls and roofs of buildings does not give the required power and solves the problem of power supply only for low-power receivers. In the industrial area there are often emissions of dust, soot, moisture, aggressive substances, which negatively affect the performance of the SPP.

III.   SIMULATION RESUITS

The task of calculating electricity losses for transit on internal lines, the consumption of electricity for their own needs, the optimization of the structure of the SPP becomes invariant. The authors propose to introduce the concept of the centre of electric generation (CEG) to determine the optimal location of the main step-up substation, inverter and transformer substations.

The CEG is the point on the plan of the power plant where the total capacity of all sources located in the allocated area is concentrated. The coordinates of the CEG at a given time of day are found by the formula:

$$X_c = \frac{\sum P_j \cdot t_j \cdot X_j}{\sum P_j \cdot t_j} \qquad (1)$$

where P_j – average power of generation of the j-th source at a given time, kW; t_j – duration of the time interval, h; X_j – coordinates of the j-th source, m.

The CEG is not constant and it can also shift over time of day or time of year. Changes in the power output of different modules, their operating time, emergency shutdowns of modules and power lines lead to drift ofthe DER within the dispersion ellipse. Here you can see an analogy with the centre of electrical loads (CEL), which is used in the design of power supply systems. The installation of inverters and step-up transformers in the CEG will reduce the length of transmission lines and minimize losses during power transmission inside the SPP.

Analysis of the methods for determining the CEL allows us to conclude that they can be used to determine the CEG. It is enough to replace a group oflow-power sources – solar panels, distributed over the area with points of single generation. When we consider a specific SPP, in the most cases single generation elements of one particular type are used [5]. This means that the same weight coefficients of the single generation will be used in determining the CEG.

An even more complex picture appears when solar panels with different technical characteristics are used in neighbouring areas. The construction of large objects is divided into stages and at each stage the contractors and equipment suppliers may change. During the process of ongoing repair or reconstruction of objects panels are also replaced with more modern, with improved characteristics.

In this way, the definition of the CEG for the SPPis reduced to the solution of the classical transport problem. This technique can be successfully applied to find the location of the TS on individual areas and for the location of the main step-up substation on the territory of the solar power plant. Today the most widespread method for determining the CEL is the method described in [6].

Recently, the method of distributed specific capacities has become widespread in the practice of designing power supply systems of districts. This method is based on the representation of distributed loads by figures of rotation of a certain function around an axis passing through the point with the coordinates of a particular equivalent load. The change of the parameters of specific power distribution at the considered site allows to determine both local and global CEL [7].

The basic function has the form:

$$p_{y\delta}(x, y) = P_i \frac{1}{2\pi\gamma^2} e^{-\frac{(x-a)^2+(y-b)^2}{2\gamma^2}} \qquad (2)$$

where руд (x, y) – specific power at each point of the considered area with load distribution Pi , kW/m2;Pi –active power of the load or unit of the single generation; a, b – coordinates of the object of the single generation (axis of rotation), m Y- characteristic of the distribution of specific capacities on the considered area, m

The appearance of the figure of rotation is shown in Figure 2. The volume of the figure under the curved surface is equal to the total installed power of all sources installedon the territory of the SPP [7]. The volume of the figure with the unit area of the base is equal to the total power of generation on the area in the given coordinates.

The characteristic of the distribution γ – it is the distance from the axis of rotation to the surface of the figure, determined at the point of the inflection of the surface. It is the larger the area, the more power and volumeof the figure. The characteristic of the distribution allows you to select the unit capacities of power equipment – transformers, located in the TS.
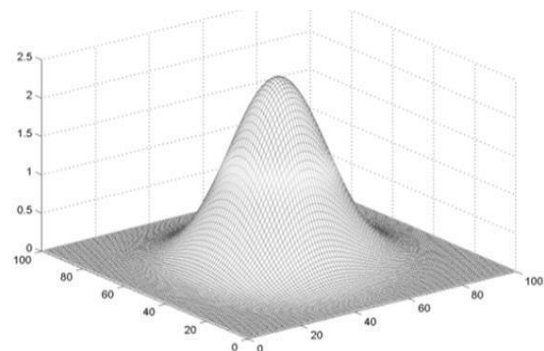
Figure 2 The dependence of the specific power of loadson the coordinates.

We consider a general case where unit powers of distributed generation objects are not equal to each otherand they have an uneven distribution over the territory. Let's simulate the SPP of 9 clusters located in an area of 1000x1000 m in arbitrarily selected climatic conditions. Forthe daily peak the distribution of the specific power over theterritory at γ = 6 m will take the form of Figure 3
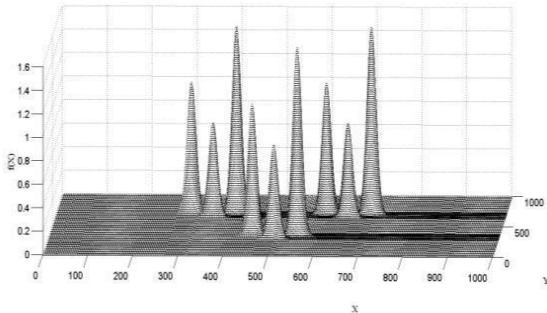
Figure 3 The distribution of the specific generationcapacity over the territory of thepower plant at γ=6

In the graph of Figure 3, the coordinates of the peaks coincide with the CEG of the clusters and the height of the peaks depends on the total power of the modules combined in the cluster. You can equalize their powers by changing the boundaries of the cluster. In this case, the coordinates of the peaks will also shift. This optimal connection of the modules allows to unify the power equipment.

The use of the same transformers, inverters, switches facilitates the solution of various problems during the operation. If it is not possible to select transformers for the power values of the clusters, you can change the parameter γ and get another distribution surface with a lower peak height and a lower power value of the converter substations, but a larger number of them.

An increase of the distribution characteristic γ up to 70 m gives a new distribution of the specific power, the graph is shown in Figure 4. The coordinates of the new peaks can be considered as local centres where inverter converters and step-up transformers of higher power can be installed. A further increase in the value of the characteristic γ will give the distribution of the specific power in the form of a single-vertex surface (Figure 2). The vertex coordinates and will be the coordinates of the CEG SPP and the main step-up substation 10/110 kV should be located as close to the CEG.

Figure 4 The graph of the specific power of the powerplant generation at γ = 70.
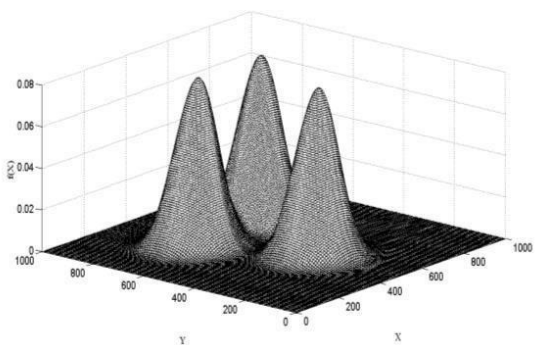
If the SPP has a large area and significant capacity, the distribution in Fig. 3 and the coordinates of the CEG vertices show that the power of the clusters is too high. The values of currents and distances from the extreme modules to the TS will be large and the length of the transmission line willincrease. The model calculations show that the transition from the distribution of Fig. 3 to the graph in Figure 4 will lead to an increase on the internal line currents and a sharp increase of the thermal losses.

For the SPP with a capacity of more than 100 the distribution in Figure 4 gives reason to conclude that the optimal solution for such SPPs would be the introduction of three main step-up substations in the structure. The coordinates of the placement of the main step-up substations coincide with the tops of the peaks inFigure 4. The output of the electrical power to the main and regional distribution electric networks will be carried out through spikes from the main 110 kV transmission lines to the 10 \ 110 kV main step-up substations.

Table 1. The power losses of electricity in the transmission lines

№	U	I	L	R	P	N	Ptotal	P/Ptotal
	kV	A	km	ohm	kW	pc.	kW	%
1	0,36	50	0,48	1,5	3,8	384	1459	50
2	0,4	300	2,64	0,61	54	24	1310	46
3	10	60	18	35,6	128	1	128	4
						Total	2900	

The main step-up substation in the standard SPP projects, as a rule, is located on the border of the SPP land plot. We can conclude that its location is not optimal. The relocationof the substation to the CEG (Figure 2) due to the decrease of the total length of 0.4 kV power lines for the considered example will reduce the losses for the transmission of energy through the SPPterritory by 16 %.

The application of both methods for the global CEGgives the same results. However, only the second method allows you to define the local CEG without performing additional calculations for dividing objects of the single generation into groups. [7].

The value of the losses is determined by the current in the transmission line. It is possible to reduce these losses by reducing the current in the transmission line by increasing the transmission

voltage from the TS to the main step-up substation. To that end, TPs with a capacity of 1 MW are included in the structure of the SPP together.

The transmission of electricity from modules to inverters is carried out at a constant current of 360V and the maximum current in the transmission line is50 amps. The dimensions of one module are 30 x 30m. Theinverters are connected to the DC buses and the output voltage is 0.4 kV. The current in the nominal power mode reaches 300 amps. This distance does not exceed 160 m.

The transmission of the power from the TS to the main step-up substation is carried out on alternating current with voltage of 10 kV. The current in the transmission line reaches 60 A. The transmission distance does not exceed 1 km for SPP with a peak installed capacity of 24 MW.

The transit of electricity through the territory of the SPP at 10 kV voltage will reduce the losses of energy transmission by another 42 % as compared to direct current lines. The total transit losses are 3 MW and the peak output power will be 21 MW. The relative value of losses is 13.8 %, of which half is provided by DC transmission lines.

IV. CONCLUSION

We can do the following conclusions from the above material: There are 2, 3 or 4 voltage levels in the SPP structure depending on the total installed capacity of the modules. The optimal number of conversion stages is determined by the parameters of the power equipment.

The main step-up substation should be located in the CEG to reduce transmission losses in the power plant. The coordinates can be calculated by the methods for determining the CEL.

The method of distributed capacities allows to determine the unit capacity of power equipment - transformers, inverter converters and circuit breakers installed on the intermediate transformer substations and the main substations.

The use of the distributed power method allows you to determine the coordinates of both global and local CEG, which can be used to install inverter converters and TS.

The SPP of the high capacity has a large territory and significant distance of sections from the route of regional distribution networks. The SPP may have several main step-up substations, which are several kilometres away. on the basis of the local CEGs it is possible to construct a complex system of the connections in the SPP, which can be represented as a non-directional graph. Such a system will reduce the power losses in the SPP and use the capacities of the single generation facilities as efficiently as possible.

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PV-Wind-Diesel Hybrid System With Bess For Energy Generation

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Abstract—**An energy system that includes a diesel generator (DG), a wind energy conversion system, and a solar photovoltaic (PV) system is proposed in this paper. With the use of wind energy conversion systems (WECS) and SPV systems, the proposed power system regulates the loading of DG to achieve a low specific fuel consumption. The WECS system uses a doubly fed induction generator (DFIG). Two voltage source converters (VSCs) are used in the WECS system to control the system. The rotor side converter (RSC) is one converter that aids in wind turbines tracking their highest power point. Another is the generator side converter (GSC), which assists in controlling DG generation while keeping the balance or unbalance of the currents from WECS and diesel generators.**

Index Terms— **Brushless generator, compositeobs erver, power quality, standalone microgrid, voltage regulation, voltage source converter(VSC).**

I. INTRODUCTION

Wind turbine power drives the PMBLDC generators. Through a boost converter and a diode rectifier, the WECS is connected to the DC link of the VSC. Due to trapezoidal back emf, PMBLDCG is best suited for an uncontrolled rectification. The machine runs smoothly and produces a low ripple torque if the winding currents are likewise designed to be quasi-square waves. This feature is not present with PMS Gas the EMF generated is sinusoidal, resulting in a fluctuating torque from the quasi square wave currents. Additionally, the PMBLDC machine has a high energy density and is modest in size, making it a viable candidate for poles. installation use.

An evaluation of a wind-diesel-battery-based system's reliability is described, with wind energy conversion system reliability determined by taking component failure and wind fluctuations into account. Additionally, the dependability analysis of the entire system is carried out while considering diesel, wind, and battery. The control of a PMSG (Permanent Magnet Synchronous Generator) based WECS (Wind Energy Conversion System) connected to an inverter with battery acting as grid is presented. The SOC of battery is managed by the electricity produced by

WECS. In most of the systems, described in the literature, variable speed wind energy conversion system operates to extract the maximum power from the wind. It is advantageous to extract the most power possible from wind energy and to improve its efficiency and use of WECS since wind energy is free energy when it is operational.

Although there is anup front capital investment, gasoline

is free. Different approaches to MPPT in WECS are suggested.
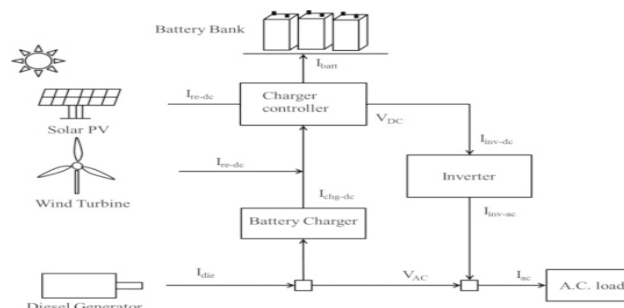
II. HYBRIDSYSTEM

Hybrid Energy Systems are created through the interconnection of two or more renewable energy generation sources, such as photovoltaic power, electric cells, microturbine generators, and wind power. The electric power generation of the PV array and the wind turbine is corresponding to their liability of combined power generation, which is substantially larger than the power created by an individual supply due to the features of solar energy and wind energy. For load, an adaptable battery bank is required so that wind and solar panels can supply the majority of the energy. Due to the development and utilisation of renewable DC power sources, as well as the benefits of using DC loads in commercial,
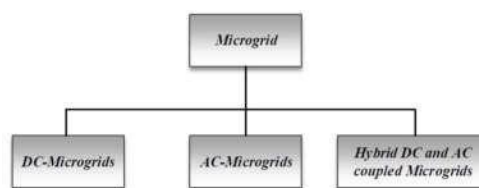
Fig2:Threetypesof grids

Harmonics, voltage and frequency fluctuations, and stand-alone systems with weak grids all suffer from serious power quality difficulties. By using proper architecture, modern rapid response control systems, and hybrid system optimization, this can be resolved to a considerable extent.

A novel idea in electricity generating is the microgrid. The idea behind a microgrid was a collection of loads and microsources working together as one controllable system to provide both heat and electricity. A Micro grid's parts could be described by some models.

III. SYSTEMMODELING

The proposed system is a diesel-wind solar PV based

stand alone microgrid with the battery energy storage to feed the local loads. The complete system topology is shown in Fig.4. ASyRG is utilized as a wind generator and as a DG. These generators were chosen on purpose for the reasons listed below. Compared to brushed generators, both of these brushless generators have lower maintenance costs. For a DG, SyRG is utilized rather than a typical synchronous generator, eliminating the need for a speed governor and AVR while still maintaining VSC control over the system's voltage and frequency. A wind turbine drives the PMBLDC generator. As shown in

Due to the rapezoidal back EMF, PMBLDCG is best suited for an uncontrolled rectification.
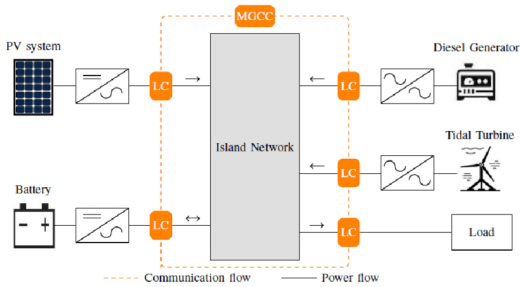
Fig.4 Proposed single VSC and the brushless generation-based stand alone microgrid system.

The machine runs smoothly and produces a low-ripple torque if the winding currents are likewise designed to be quasi-square waves. This feature is not present with PMSGas the EMF generated is sinusoidal, resulting in a fluctuating torque from the quasi-square wave currents. Additionally, the PMBLDC machine has a high energy density and is modest in size, making it a viable choice for polemounting applications. The suggested topology also includes a solar PV system, which is connected to the VSC's dc link for the purpose of transferring power to an area with loads. As was said previously, the battery energy storage device is necessary to maintain the power balance and dependability of the supply. Consequently, a battery bank is also set up at the VSC's DC link.

The suggested system architecture comprises numerous sources, thus an operating plan is created to maximise the extraction of free energy and to optimise fuel economy. The system and the load end frequency are connected since the DG is the only ac source in the system.
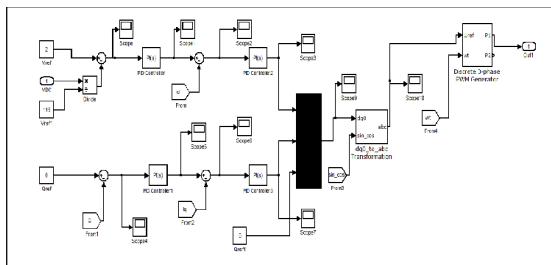
Fig.5 Control strategy for VSC.

The WECS consists of a PMBLDC generator, three-phase diode bridge rectifier (DBR)and a boost converter. An inductor is used after theDBR to make the dc current almost constant which reflects as quasi-square waveform of current on the ac side which is beneficial for the operation of PMBLDCG as discussed earlier. The

operation of the WECS is simplified by eliminating the need of any mechanical sensor for MPPT. An MPPT algorithm is used which requires only sensing of vdcandidc. This MPPT algorithm is the same as perturb and observe, which is used for maximum power extraction in solar PV system.

IV.SIMULATION RESULTS

The complete system is simulated using MATLAB/SIMULINK and from simulation results the MPPT of WECS is verified. The DG is operated under specified power range. The wind and solar systems are operated always at MPP.

The corresponding performance of the MPPT algorithm under variable wind operation is shown in Fig. 6. The results with constant wind speed are shown in Fig. 6 until $t=$ 0.05s. The windspeedischangedfrom7to12 m/sat$t$=0.05s.Thedynamic behavior of the system is demonstrated during such variation in wind speed. From these results, it is seen that with an increase in the wind speed,the power output of the WECS increases and also it can be seen that the PMBLDCG current has also increased.
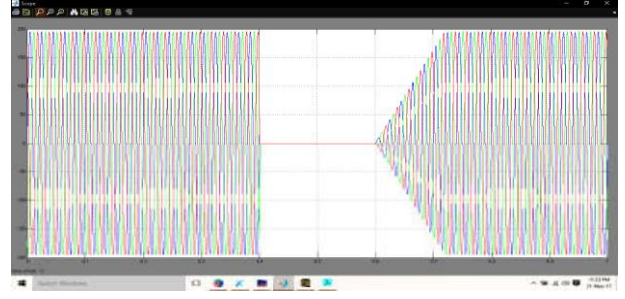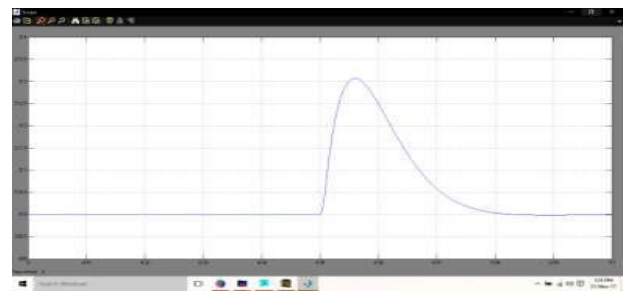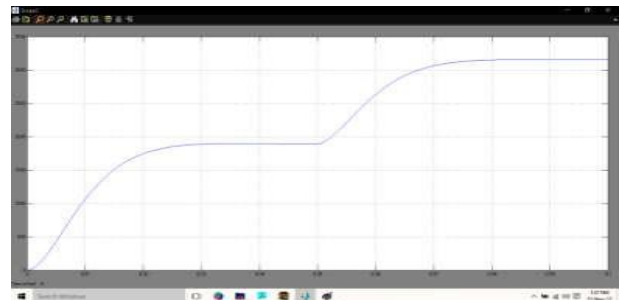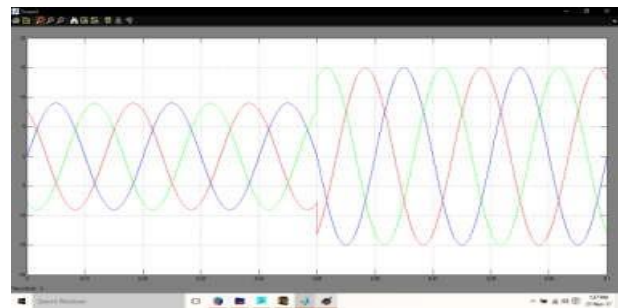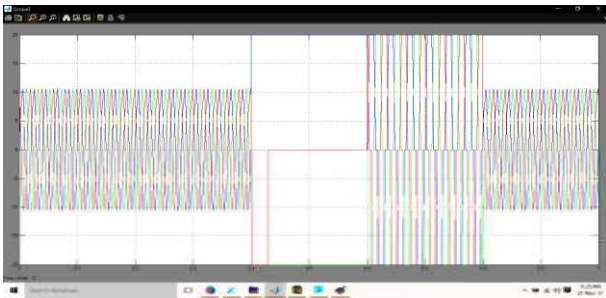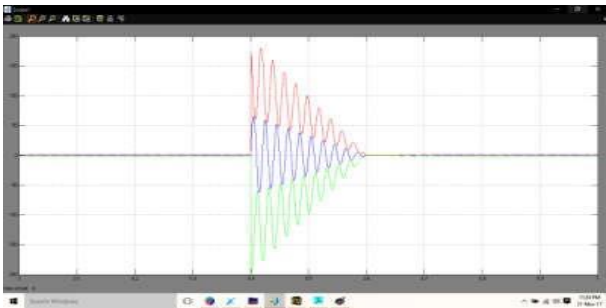
suitability of this topology for rural/isolated areas as the topology is simple and cost effective.

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This section provides a brief under standing of how the system will behave under some fault conditions. The fault situations are created and analyzed using simulation tool.
First case is taken where the fault is created at the ac bus.
Current through the converter is controlled within the control algorithm. As the currents are non sinusoidal, a hard current limit is used to protect the devices and the system. If the switching devices have their own protection system (like de saturation for IGBTs),then an indirect current control can be used, which requires only source currents. But those protections are latch able(shut down the system),so it is better to limit the current without disrupting the operation. That is why a direct current control in corporating compensator currents isused. There sults are shown in Fig. 7. As shown in Fig. 7, the reactive power support to the generator is mostly provided by the converter and with the fault on the a cline, there active power diverts to the low-impedance fault path and the generator's voltage collapses. But as soon as the fault is cleared, the generator picks up again. Another advantage of this system is that it isa machine-based system and hence the generator majorly contributes to the fault current, which has a large short circuit rating compared to the semiconductor devices.

V. CONCLUSION

The proposed microgrid topology with a single voltage source converter and brushless generators has been implemented under various operating conditions. An integrated operation of control algorithms is also tested for system's voltage and frequency control, mitigation of power quality issues, power balance in the whole system under various disturbances ranging from large load variation to renewable energy supply uncertainty. Some idea of battery charge discharge control and fault analysis is also discussed. Test results have confirmed the

The Design Of The Lead Display Based On Solar Energy

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Abstract—The design of intelligent solar charging system, through the solar panel to convert solar energy into electrical energy, through DC/ DC motor circuit processing, charging the battery. The entire system consists of DC/ DC conversion circuit, a processor module, A/ D slice circuit, palpitation range modulation regulator, a display circuit and a battery group. The process of charging the battery is controlled by palpitation range modulation, thereby affair power of the solar cell and battery life are bettered, extend the battery service life.

Keywords—Solar energy; intelligent charge; CUK converter; SCT12C5A60S2

I. INTRODUCTION

Because of the increasing depletion of fossil fuels, humans emphasis on environmental troubles is also rising, seeking out smooth alternative energy is becoming an increasing number of pressing. Solar electricity as a

renewable energy it has inexhaustible and clean safety features, has broad software prospects. While using the solar mobile daylight because of the massive changes in the inner resistance and relatively high, so the output voltage is unstable, the output modern-day is small, which want to be furnished with a charge manipulate circuit converts the DC voltage regulator after the solar panels output battery. When the mild conditions are appropriate

To take in sunlight through solar panels, convert mild strength into electrical energy. In view that the usage of high-cutting-edge charger brief charge technique, the battery is complete, if not stopped in time cause the battery warm, excessive charging will severely damage the battery existence, which requires a complicated control system. The machine makes use of STC12C5A60S2 MCU as Controller charging circuit so as to lower the cost easily implement complex intelligent charge control

II. OVERALL SYSTEM DESIGN

The overall design of the system is shown in figure 1, through solar panels convert solar energy into electrical energy, achieved by the microcontroller programming PWM wave Manipulate transfer in order to achieve the output voltage and current's, exchange the output state is displayed via the display circuit and sizes, from the STC12C5A60S2 with the ad converter to achieve acquisition and conversion facts, and make a judgment process, making sensible output and manage circuit[1][2].The system includes DC/DC converter circuit, the processor module, A/D sampling circuit, PWM pulse width modulation controller, display circuit and battery components. Fig.1   the overall
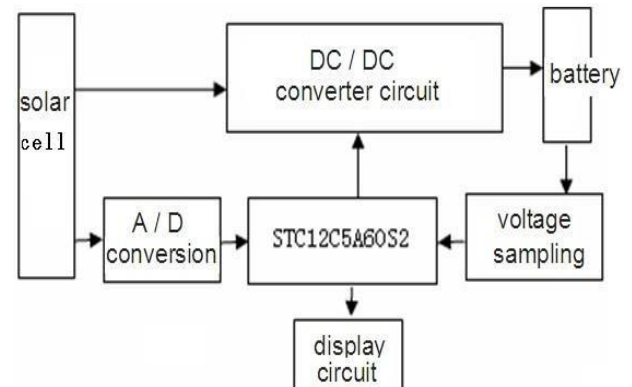
III. THE MAIN CIRCUIT DC/D C CONVERTER CIRCUIT

Switching operation of the semiconductor switching devices, the dc voltage is transformed dc / dc converter circuit is to rely upon the into a dc voltage to any other circuit. prepare dinner (cuk) conversion circuit belongs to the greenback-improve dc / dc converter circuit proven in parent

2. the parent for the inductor l1 and l2, d is the quick recovery freewheeling diode, c1 is transferring strength coupling capacitor, c2 clear out capacitor. feature of this circuit is that the output voltage to the input voltage polarity is reversed, the enter terminal of the current ripple, output dc voltage stable, reducing external filtering requirements.

Output voltage and input voltage relationship of the circuitry is indicates the output voltage and the input voltage is inverted. To output a certain voltage U0 value ,must be given the duty ratio D corresponding value depending on the value of the supply voltage U d of sampling[3].
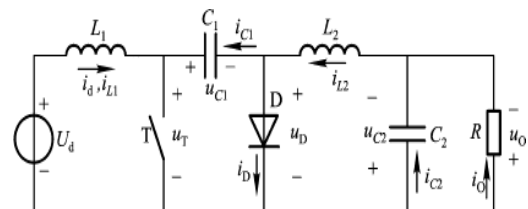
Fig.2 the CUK circuit diagram

IV. THE MAIN PROCESSING MODULE

This design uses STC12C5A60S2 as the main processingchip. STC12C5A60S2 / AD / PWM MCU is a macro crystal technology production of single clock / machine cycle (1T) of the microcontroller, the instruction code is fully compatible

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with the traditional 8051, but the speed 8-12 times faster. Dedicated internal integration MAX810 reset circuit,2PWM,8-wayhigh speed 10A/Dconverter (250K/S,or25milliontimes/sec), for motor control, strong interference occasions.

V. ADC SAMPLING CIRCUIT

STC12C5A60S2 MCU ADC is a successive approximation type A DC. Successive approximation type ADC includes a comparator and D / A converter constituted by successive approximation good judgment, from the most significant bit (MSB) starts sequentially for each of the input voltage and the built-in D / A converter output compare, after several contrast, so the resulting digital converter successive approximation analog input corresponding value. Successive approximation kind A / D conversion rate of as much as 250K / S (in keeping with 250,000). 10 precision A .DC, a total of eight.

$$U_0 = -\frac{D}{1-D}U_d$$

MCU in the control variable duty cycle PWM wave output, with solar panel output voltage to match the original, is determined by the formula there fore, the controller needs to
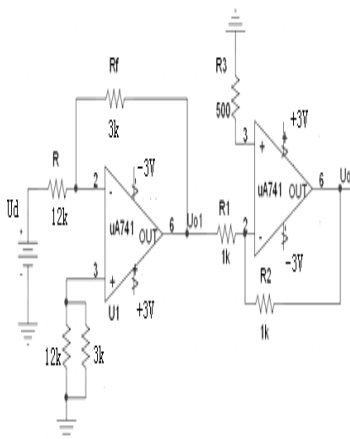
Determine the original value Ud, which must be A/D sampling. As the device working voltage of 5V, and output from the sun panel voltage zero-20V, it may exceed burned chip, so before the A / D sampling, the need for accurate blood pressure to sampling[1][2]. The design Uo=1/4Ud. Proportional arithmetic circuit is as shown in figure 3.

Fig.3theproportionalamplifier sampling circuit diagram

Buck ratio arithmetic circuit can be accurately obtained by the single-chip sampling results of the exact value of the original solar panel output voltage, thereby controlling the duty cycle of the output voltage original PWM wave.

VI. DISPLAY CIRCUIT DESIGN

LCD display with its micro-power consumption, small size, display rich content, ultra-thin lightweight many advantages, more and more widely used in the pocket instrumentation and low-power applications. Character LCD module is a dedicated display symbol s dot matrix LCD, according to the capacity of the display can be divided into one line of 16characters, 2 lines of 16 characters, 2 lines of 20 characters, etc., the design uses two rows *character LCD1602 LCD display with backlight 16, showing the charging process and sunlight intensity[4].

VII. SYSTEM SOFTWARE DESIGN

The SCM machine is the main mission of technique manipulate facts acquisition, and facts gathered after the analysis process generates a PWM signal controlling the switch is turned on and off to manipulate the output length. Particular paintings manner is strength-on reset, first detecting the intensity of daylight whether the charging requirements, reached the selection after charging via comparing the detected voltage and modern-day signals, after which transferred to the ideal recurring analysis to calculate the PWM duty cycle, the output of current or voltage, and the display records to the display circuit. In the course of the microcontroller output timer detects the output contemporary or voltage, compare with the set value adjusted PWM duty cycle, the output has a tendency to set fee. In the battery charging method, the current size is decided with the aid of detecting how a whole lot rate the battery, thereby converting the charging mode or decide whether to stop charging[5][6][7].
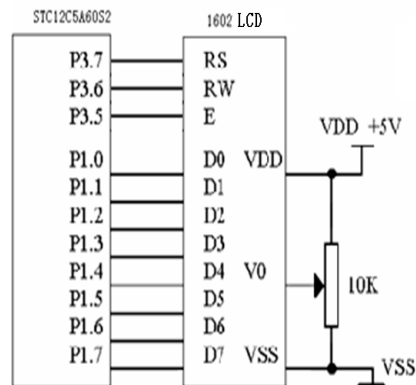
Circuit starts off evolved Initialization. Initialization is to set the initial running surroundings for the MCU operation, mainly to complete the following tasks: internal clear sheet, initial parameter

Settings, A D set, set the time and interrupt settings. show routines. Display application development display for showing the charging process, as from the start to input the charging device and the stop of the interactive interface, the use of theLCD1602 liquid crystal display module, it may only display letters, numbers and unique symbols. such as whether the display intensity of sun light charging requirements, the charging process and the end of chargingin English.

LCD wiring diagram shown in figure

Data Acquisition and Analog to Digital Conversion Process. data acquisition and analog-digital conversion data initialization procedure completed, transmit start conversion command, wait for the end of conversion, data is received, processed and stored in the cache.

Rate Subroutine layout. The charging procedure is divided into two phases, the first phase of a constant current, the charging current can be set into the second one level while the charging voltage reaches 4V,4.2 V constant voltage charging modified, the constant charging current overtime goes gradually decreased till the charging current is reduced to 0.1mA,

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indicating that the battery charge will steadily be decreased to 0, the battery is completely charged. At some stage in charging, the LCD display "charging"; while complete, the lcd display screen show "fee completed", if now not enough light intensity is displayed "Sun intensity in sufficient"

VIII. CONCLUSION

Layout of the solar charging system is split into address layout and software program layout in two hall, the tackle circuit is finished by the STC12C5A60S2 MCU control and layout of the primary circuit and the determination circuit schematic design and parameters. Software design is modular programming gadget, it is divided into primary segment, assertion motor and PWM palpitation accession module signal generation module. According bowl experimental sample design made via setting parameters and micro regulator programming, had been examined. Experimental consequences display that the bowl is the good overall performance, in step with the layout conditions, has a easy structure, low value and high trust ability.

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Fall Detection System Identification Using Embedded Systems

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Abstract—**Elderly Due to fractures brought on by collisions with the ground or other hard objects, falls are one of the leading causes of fatalities. In order to identify a user fall and alert the caregiver for a prompt reaction, this research article attempts to design an intelligent fall detection system. The person will have a good chance of survival if the caregiver reacts quickly to the signal. The wearable, inexpensive fall detection and warning device for the elderly has been suggested in this work. The number of false-positive fall alarms has been decreased using an innovative strategy. Utilizing a sophisticated orientation detection module, the user motion was monitored to determine the user's orientation in several output formats. The system will notify the caregiver through Wi-Fi and GSM of any aberrant orientation data values of the user and send an alert message in that situation. The system design takes into account a straightforward, inexpensive, and power-efficient design. The system is made up of a GSM module, two orientation detecting modules, and a Wi-Fi-based microprocessor. The system is intended to be worn around the waist by the user and installed with a waist belt. The system's power source was a pin-type, rechargeable lithium-ion battery.**

Keywords— *Fall Detection; Wearable Device; Orientation Detection; Internet of Things; Embedded System.*

I. INTRODUCTION

One of the leading causes of mortality for elderly individuals is falling incidents. According to the WHO website, falling is the second leading cause of mortality for more than 640000 people each year. Elderly people who sustain an unintentional injury from a fall accident require prompt treatment to prevent complications that might end in death. Adults over the age of 65 make up the largest share of the casualties in the aforementioned data. [1]

Since many older people live alone across the world, the risk of suffering a fall or other mishap is quite real. The worst case scenario was when no one was aware of this serious mishap since the person was weak and would pass out or be.

Camera-based systems mainly used multi-cameras in a specific location to capture the user motion. The captured image will be processed by an image processing algorithm to detect and recognize the fall condition. Most of the camera-based systems have the problem of the user privacy obtrusion.

Fouzi Harrou et al., proposed a camera-based fall detection system. A statistical approach has been used for classified and detected the fall event using the generalized likelihood ratio (GLR) and support vector machine (SVM). The used strategies increase the accuracy of correct fall detection and reduce false-positive fall detection with the limitation of using in the indoor environment. [2]

Erik E. Stone et al., Proposed Kinect camera-based fall detection system. The system has two stages to detect a fall accident. the first stage collects the depth user information collected by the Kinect camera over time and characterize the vertical state of the user. The second stage uses a decision tree algorithm to recognize the fall on the ground event. [3]

Another group of researchers used an ambient sensor-based fall detection system. In this method, a sensor network has been used to collect the fall information without attached the sensors to the user body.

Xiuyi Fan et al., proposed an infrared array sensors-based fall detection system. The system using some deep learning methods such as gated recurrent unit models and long-short-term-memory to enhance the performance compared with previous work using the same sensors type. [4]

Liang Liu et al., proposed a doppler radar sensor-based fall detection system. The system used a data fusion algorithm between the motion sensor and doppler radar to enhance the detection of fall accidents and reduce the false-positive error. [5]

A wearable sensor has been used to implement a fall detection system. Several approaches using different types of wearable sensors attached to different body parts such as head, waist, chest, and foot used to acquire the required motion information that used to recognize the fall condition [6-11]. Most of the wearable sensor-based systems used accelerometer, gyroscope, and magnetometer individually or combined to acquire user motion information. [12-13]

In this paper, the design, implementation, and testing of smart wearable fall detection and alarming system have been proposed. The system design takes into consideration the parameter of low cost, small size, and lightweight. A novel approach based on using two orientation detection sensors with OR-AND logic algorithms for the wearable sensor-based fall detection system has been successfully used. The system processes the orientation data from two different orientation

detection modules which are BNO055 and BMI 160. The fall case will be tracked by both modules. The combination of the two different orientation sensors with the OR-algorithm enhances the performance of the system and reduces false-negative errors (the system does not recognize the fall condition). The use of the AND-algorithm will reduce the system accuracy but at the same time, it reduces the false-positive error hardly.

The system built in a simple three layers construction. The first layer is the input layer which is responsible for the data acquisition from the user body. The second layer is the main processor which is responsible for data processing and decision making. And the third layer is the output layer which is responsible for sending the alarm to the caregivers. The following sections will explain the system design and components in detail.

II. Implementation

The input layer, the processing layer, and the output layer are the system's three primary layers. Fig. 1 displays the block diagram of the system. The user body's orientation data collection is within the purview of the input layer. Sending the collected data and information to the main processing unit will enable categorization and the development of the best possible decisions. Then The information will be sent to the output layer if the main unit determines that a scenario necessitates alerting the carer. The caretaker phone via SMS message and the caretaker email are the two separate receptors to which the output layer will deliver the warning information. In the sections that follow, all system levels and the sensors and modules that make up each layer will be described in depth.
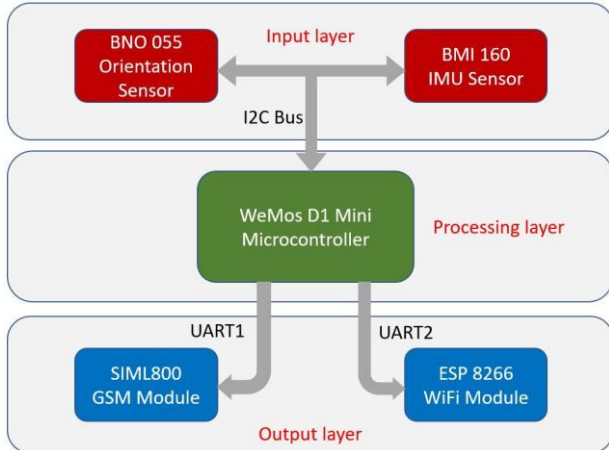
Fig. 1: Block Diagram

A. The Input layer

The input layer consists of two orientation detection modules. Both of them used the MEMS sensor to detect body orientation. The first unit is the Atmel BNO055 Xplained Pro module which is built based on the Bosch BNO055 System in Package (SiP). It consists of three triaxial MEMS sensors which are, an accelerometer, a gyroscope, and a magnetometer

combined with a 32-bit ARM microcontroller. The BNO055 can communicate with any host processor using the I^{2}C or UART bus. The body orientation can be provided in several forms like Euler angles, Quaternion, Linear acceleration, and Gravity vector. In the proposed system the I2C bus has been used for communicate between the BNO055 and the host processor and the Euler angles have been used for representing the body orientation in the form of pitch, yaw, and roll Euler angles. Fig. 2 shows the used BNO055 module.[14]

Fig. 2: Atmel BNO055 Xplained Pro module

The second module is the BMI160 from Bosch sensor technology, Germany. It is an Inertial Measurement Unit IMU that provides real-time accurate sensor data for body orientation. It is consisting of an accelerometer, and a gyroscope, and communicating with a host processor using the I^{2}C bus. [15]. Fig. 3 shows the Bosch BMI160 IMU unit.
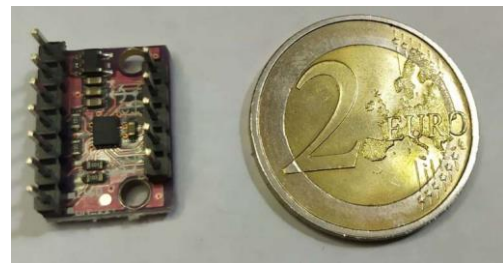
Fig. 3: Bosch BMI160 IMU unit

B. The Processing Layer

The processing layer of the system is the low-cost WeMos D1 Mini IOT microcontroller. It is an ESP8266-based microcontroller with a Wi-Fi facility. The WeMos uC has the required I2C and UART communication buses to communicate with input and output layers. Also, it is allowing the system to have wireless communication with the available Wi-Fi network. Fig. 4 shows the WeMos D1 mini microcontroller.

Fig. 4: WeMos Esp8266-based microcontroller

C. The Output Layer

The output layer consists of two units which are the Esp8266 Wi-Fi module and the SIM800L GSM module. The output layer is responsible for receiving the alarm message from the processing layer and send it to the caretaker. The output of the Esp8266 is a message to the caretaker Email. The message will be sent via a full TCP/IP stack. The second form of alarming will be an SMS message to the caretaker mobile via the SIM800L GSM module. Fig. 5 shows the SIM800L GSM module.

Fig. 5: SIM800L GSM module

The System components are powered by a 3.7V, 5.1Wh lithium-ion battery. The battery used is sufficient to operate the device efficiently for one day. Fig. 6 shows the used battery.

Fig. 6: System battery

III. SYSTEM DESCRIPTION

The user body movement is tracked by the input layer. To achieve this purpose, two-directional tracking units were used from the Bosch Sensortec, Germany, and they were BNO055 and BMI160. Both modules have a triaxial accelerometer and triaxial gyroscope which have been used by the processing layer algorithm to detect the fall accident. The data is captured by these two units and sent to the processing unit using the I2C bus. The BNO055 module has the I2C address (0x69) and the BMI160 has the I2C address (0x68) and the data from each unit acquired by the processing unit using I2C read function for a specific I2C address.

The processing unit (WeMos D1 Mini microcontroller) received the acceleration data and the angular orientation from both BNO055 and BMI160 registers, and calculate the acceleration and body orientation for each sensor. The decision for sending an alarm to the caregiver is depending on the values

of the acceleration vector and the orientation vector of both sensors and can be calculated as:

$$Acc_1 = \sqrt{ax_1^2 + ay_1^2 + az_1^2} \qquad \dots(1)$$

$$Acc_2 = \sqrt{ax_2^2 + ay_2^2 + az_2^2} \qquad \dots(2)$$

$$G_1 = \sqrt{gx_1^2 + gy_1^2 + gz_1^2} \qquad \dots(3)$$

$$G_2 = \sqrt{gx_2^2 + gy_2^2 + gz_2^2} \qquad \dots(4)$$

Where Acc_1, Acc_2, are the acceleration vectors of the BNO055, and BMI160 sensors respectively, and G_1, G_2, are the orientation vectors of the BNO055, and BMI160 sensors respectively.

The output layer will send an alarm SMS message and an email to the carers' phones and computers when the processing layer detects a value of acceleration above the designated programmed threshold. If both acceleration and body orientation are above the threshold, an alarm SMS message and email will be issued.

As the WeMos D1 Mini has only one hardware serial port, the soft serial library has been used to send the SMS message and the Email to the Esp8266 and SIM800l modules. Fig. 7 illustrates the procedure of system activation.
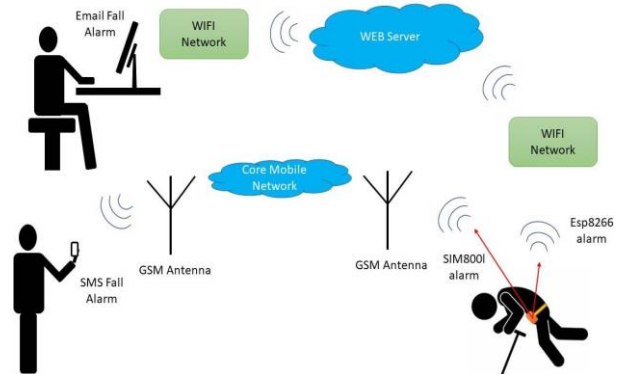
Fig. 7: Procedure of system activation

1) System algorithm:

The proposed system has a novel implementation by using two orientation detection sensors instead of one in most previous works. The advantage of this addition is to give the system the chance of cancellation of false-positive errors (false alarm). The algorithm starting by initialized the registered of the two orientation modules BNO055 and BMI160. In the next step, the host processor read the acceleration values from the specific accelerometer register of both modules to calculate the acceleration vector Acc1 and Acc2. Then the same procedure repeated with the gyroscope registers to get the rotation angles gx, gy, and gz to calculate the orientation vector G1 and G2. If the magnitude of the acceleration vector Acc1 and Acc2 are

bigger than the lower and upper thresholds then the algorithm checks if the orientation has been changed at the past 500ms, and if all these conditions have been achieved then the algorithm will send the alarm message via the SMS and email facilities.

The programme begins to take both sensors' data, including acceleration and body direction. When employing two orientation sensors, there are two possible situations. The first uses an OR logic condition, in which case the algorithm will activate the alert status whenever any one of the orientation sensors crosses a threshold. The likelihood of a false-positive mistake will be higher and the success rate will be higher in this circumstance. The second scenario is the use of AND logical condition, and in this case, the system will activate the alarm status only when both orientation sensors pass the fall thresholds. In this case, the false-negative errors will be increased and the chance of false alarm, as well as the false-positive error, will be hardly eliminated and this is very important in biomedical and rehabilitation systems. [16-18]

When the system detects fall conditions, the processing layer will send two kinds of alarm. The first alarm is an SMS message sent to the smartphone of the caregivers. The caretaker has already stored the number of his patient so he can direct response to the fall alarm. The system can send a message warning of the patient falling to several recipients according to the user's desire. Fig 8. Show a screenshot of the caretaker phone alarm message.

Fig. 8: SMS alarm message screenshot

The second type of alarm is done by sending an Email via the WIFI network using the SIM800l GSM module. The system sends the email request to the WEB server which sends the Fall-alarm email to the caregiver. The system can send multiple Fall-

alarm emails to several caregivers according to the user's desire. Fig. 9 shows a screenshot of the caregiver PC includes the fall-alarm Email.
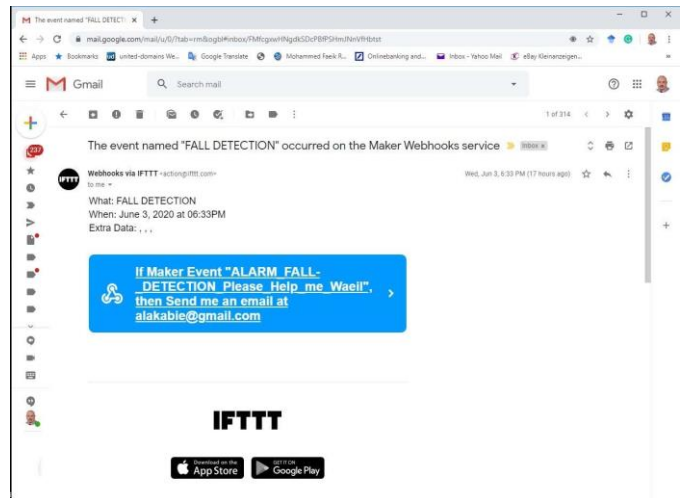
Fig. 9: Email alarm message screenshot

IV. RESULTS

All the system component has been assembled in 10cm×5cm holder which is designed to fix on the waist belt. The orientation sensor has been tested individually and with AND-OR algorithms. Because of the spread of the Corona pandemic, the art of testing the device was conducted at home by only three people as a preliminary test. A twenty-five-centimeter squishy mattress is used to protect users from the risks posed by a fall. Each person has performed a fall test ten times for each sensor individually and with both sensors (AND-OR logics) in 4 fall situations which are, fall-forward, fall-backward, fall-left side, fall-right side. Table 1 explain the test result for the BNO055, BMI160, and both with AND-OR algorithms.

Table 1: Test of the system

Sensor	User	Front	Back	Left	Right
BNO055	1st user	7	9	8	9
	2nd user	8	10	9	9
	3rd user	10	9	9	8
BMI160	1st user	8	10	9	10
	2nd user	9	9	9	8
	3rd user	8	8	9	9
AND	1st user	8	9	8	9
	2nd user	8	10	8	9
	3rd user	8	8	8	9
OR	1st user	10	10	10	10
	2nd user	10	10	10	10
	3rd user	10	10	10	10

The results in table 1 revealed that the BNO055 module test has an accuracy of 87.5%, and the BMI160 module has an accuracy of 88.4%, and the test of the AND-algorithm has the accuracy of 85%, and the last OR-algorithm test shows 100% of success fall alarm. The result shows that the use of two orientation detection sensors can improve the accuracy of the system up to 100% present which is ideal for the required goal.

V. CONCLUSIONS

The design and first testing of a fall detection system based on an IoT controller have been proposed in this study. The system design used two orientation sensors to detect the fall condition rather than the typical single sensor used in a system. Utilizing two sensors and the OR algorithm results in a 120/120 success rate for alarm triggers, as compared to 105/120, 108/120, and 102/120 for tests using just one sensor and the AND method. This was demonstrated in the system testing. The preliminary studies show that the OR- algorithm can improve the system's accuracy by combining the two orientation sensors with OR-logic conditions and responding when any one of the orientation sensors detects a fall scenario. The system is designed to be affordable and usable by a range of users. The system's design considers user friendliness and comfort throughout lengthy usage. A new GPS module will be added to the system, which is now undergoing testing, to provide the carers the ability to pinpoint not just the fall event but also the exact location of the fall victim..

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ICECE02

Smart Street Light System using IOT

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Abstract: *An IoT-based smart street light system aims to reduce both human and electrical waste in order to preserve energy. The energy that is conserved can be used for both domestic and commercial purposes. To do this, an LDR sensor is employed. Using an LDR sensor, the street light is here switched ON or OFF depending on the level of ambient intensity. It is a simple switch that is actuated by light and dark and has a relay at its output. An inexpensive Wi-Fi module known as the ESP8266 may carry out this switching after reading the LDR value. Anyone, anyone may view the street light's ON/OFF status in real time over the internet. It ensures excellent dependability and outstanding long-term stability. This endeavour is completed.*

1. INTRODUCTION

One of a city's major energy expanses is the street lighting. Municipal street lighting costs can be reduced by 50% to 70% using a street lighting system. The smart street lighting system automatically distinguishes between pedestrians, cyclists, and vehicles in order to change light output accordingly to usage and occupancy. The project employs sensors to detect the light intensity, and it uses a wireless system to regulate energy usage as well as energy-saving techniques including power conditioning and control. The street light (ON/OFF Status) will be accessible over the internet at any time and from any location using a real-time system. The NodeMCU ESP8266 street controller has to be put on the pole light. Wireless technology may be used to transport data from the street light controller to the base station so that the system can be monitored. The control system will turn the lights on and off at the appropriate times and may adjust the street light's intensity as needed. The system can be operated in both automatic and manual modes. Literature Survey

The project is typically a multi-functional prototype with the potential to replace the manual operation of the outdated street lighting system using a self-automation technique [1]. It intends to create and implement cutting-edge embedded system development for energy-saving street lighting and their upkeep at lower cost with contemporary development. A peculiarity of the street lighting system is that it uses two sensors: a passive infrared sensor (PIR) to detect movement on the road and a light dependent resistor (LDR) to indicate whether it is day or night..

The ESP8266 is one of the best integrated Wi-Fi chips in this IoT context and a reasonably priced Wi-Fi module. It features

an inbuilt 32-bit Tensilica Xtensa L106 micro-controller. Low noise, smaller RF balun on PCB

Front end modules with little external circuitry include receive amplifier, power amplifier, filters, and power

management modules [3].

In [4] Automatic Street Light Control System is not only easy but also the powerful technique. Relay uses a automatic switch in this system. It releases the manual work almost up to 100%. As soon as the sunlight goes under the visible region of our eyes this system automatically switches ON lights. Light Dependent Resistor (LDR) is a type of sensor which actually does this work and senses the light as our eyes does. As soon as the sunlight comes, visible to our eyes it automatically switches OFF lights. Such type of system is also useful for reducing energy consumption.

In [5] this project is designed to detect the vehicle movement on the highways to switch ON only a block of the street light ahead of it and switch OFF the trailing light to save energy. During the night all the lights on the highways remain ON for the vehicle, but loT of energy is wasted when there is no vehicle movement on the highways.

The Wi-Fi ESP8266 MODULE is employed to upload to the important time information on the cloud through IOT panel [6].Providing a street lightning is one in every of the foremost important and expensive responsibilities of a city. Lightning can account for 10-38% of the overall energy bill in typical cities world-wide [7].

2. DESIGN IMPLEMENTATION

This project's goal is to educate people about the IOT Smart Street Light System. In order to have better control over the street lights, we have chosen the THING SPEAK technology. We are integrating a NODEMCU ESP8266, relay, and LDR sensor in this project.

The upkeep of street lighting is one of the key issues that India is now experiencing. India's street lights are maintained manually, and it has been discovered that doing so results in power loss when the lights are turned on.at day time. To reduce the manual errors by controlling, implementation is done using Thing speak for effective communication.

Block Diagram
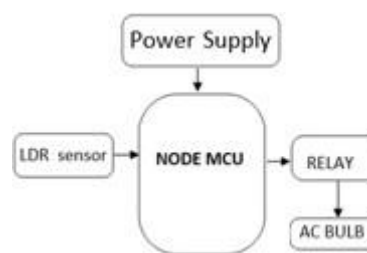
Figure 1: Block Diagram

Equipment used

- Power supply
- LDR sensor
- NODEMCUESP8266
- Relay
- Bulb

Power Supply

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the main is 230V/50Hz which is an AC voltage, but the required is DC voltage with the amplitude of +5V and +12V for varies applications.

NODEMCUESP8266

The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. And, you have to program it in low-level machine instructions that can be interpreted by the chip hardware.

The ESP-8266 may be a low-cost Wi-Fi microchip with full TCP/IP Transfer control protocol/ Internet protocol). It makes the web connectivity possible for the IOT panel. ESP8266 offers a whole and self-contained W-Fi.
- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).
- General-purpose input/output (16 GPIO).
- Inter-Integrated Circuit (I²C) serial communication protocol.
- Analog-to-digital conversion (10-bit ADC).
- Serial Peripheral Interface (SPI) serial communication protocol.
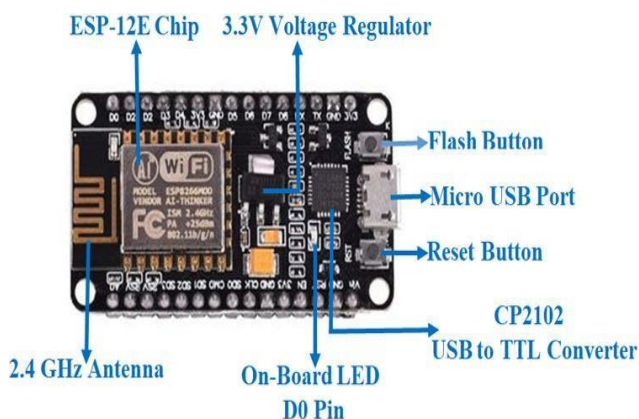
Figure 2: WiFi module ESP8266

LDR sensor

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. The sensor that can be used to detect light is an LDR. Since the LDR gives out an analog voltage, it is connected to the analog input pin on the Arduino. The Arduino, with its built-in ADC (analog-to-digital converter), then converts the analog voltage (from 0-5V) into a digital value in the range of (0-1023).

Figure 3: Light Dependent Resistor (LDR) sensor

Relay Board for iot

Relay boards are computer boards with an array of relays and switches. They have input and output terminals and are designed to control the voltage supply. Relay boards provide independently programmable, real-time control for each of several onboard relay channels.

A relay is an electrically operated switch that can be turned ON or OFF, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the NodeMcu pins. Controlling a relay module with the NodeMcu is as simple as controlling any other output.

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches and are used in many applications because of their relative simplicity, long life, and proven high reliability. Although relays are generally associated with electrical circuitry, there are many other types, such as pneumatic and hydraulic. Input may be electrical and output directly mechanical, or vice versa. Relays are mainly made up for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

BULB

LEDs use much less energy than incandescent bulbs because diode light is much more efficient, power-wise, than filament light. LED bulbs use more than 75% less energy than incandescent lighting. Another advantage of LEDs is the "hassle factor." LEDs last a lot longer than a regular bulb.

Figure 5: Bulb

3. SOFTWARE REQUIRED

Arduino IDE

The Arduino Software (IDE) is an open-source software and it makes easy to the code and upload it to the board. I t runs on the different plant from Windows, MAC OS, Linux. The environment is written in Java and before running the IDE Java software to be installed on the machine this software can be used with any Arduino board.

Thing speak

ESP8266 Thing speak is an analytic IoT platform service that allows you to aggregate, visualize and analyse live data streams in the cloud.

Thing Speak is an open wellspring of web of things (IoT) utility and API to purchase and recover records from issues abuse the hypertext move convention and MQTT convention over internet or through a near to space organize.

Thing Speak licenses the presentation of detecting component work programs, area following bundles, and an informal community of things with standing updates.

5. ADVANTAGES

- Maintenance cost reduction
- Reduction of light pollution
- Energy saving
- Lightning system also reduces crime say murder, theft and plenty of more to a great- extend.
- Reduction of man power
- Major advantages of street lightning include prevention of the accidents and increase in the safety

6. WORKING

Internet of Things is a term of opening new possibilities of interacting with electronic devices by digitally interfacing them possibly providing information in a very simple user-

friendly format to a smart device and connected to the same network as the rest of the system. In this system, every device is required to be operate in the basis of IoT, are connected to each other on the same network.

The system architecture is adaptive system and it consists LDR sensors, NODEMCU ESP8266, relay, Bulb. In this system NODEMCU microcontroller acts as the brain of the entire system. All the sensors used in this system are connected to micro controller. LDR is light dependent resistor. When the day time sunlight falls on it, its resistance decreases and makes the light to switch off. When the night time, light do not fall on the sensor, so its resistance increases and triggers the light to switch On.

Relay acts an automatic switch and electromagnetic switch it is connected to the micro controller by relay driver. It is highly reliable and automatically switches ON and OFF the lights.

6.1 Flowchart of working system
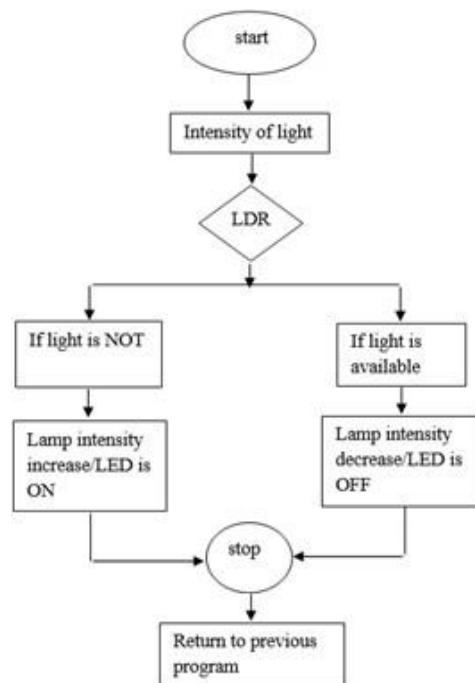
Figure 6: Flowchart of working system

7. RESULTS AND ANALYSIS

Figure 7: Prototype of the IoT based smart street lightsystem

Scenario during Day under Full Brightness

No LEDs are ON during the day because of the ambient brightness, and the LDR value stays essentially constant. Brightness has an impact on intensity.

Scenario during Night under Full Darkness

Since there is no ambient light during the night, all LEDs are on at maximum intensity, and the LDR value also stays nearly constant because there is no ambient light to detect. Table 1 displays the LDR value, also known as external brightness, as well as the intensity value. With the aid of Table 1, we were able to create the graph in Figure 7. By examining the graph, we may deduce that as external brightness rises, LED intensity reduces, and as external brightness falls, LED value rises. The intensity is at its height when it is completely dark outside.

Table 1: External Brightness vs Led intensity

External Brightness	LED Intensity
62	514
54	534
51	542
210	119
211	117
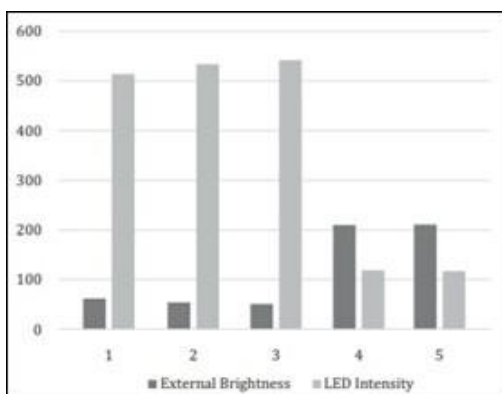
Figure 8: Brightness Vs Intensity

8. CONCLUSION

Comparatively speaking to the already in place system, the suggested solution is simpler to instal and maintain. By adding logic to the code, it is possible to further improve the system by automating the process of turning on the street light at sunset and turning it off at sunrise by retrieving information about the time of sunrise and sunset from a trustworthy weather reporting source. This further reduces the need for human involvement since only in the event of a fault would a manual visit to the position of the street lights be necessary. Compared to manual procedures, automated systems are more efficient. These gadgets may also be reprogrammed to suit our requirements.

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IOT Based Finger Print Scan for class room monitor Using Zig bee .

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I. ABSTRACT

Abstract— **Current business and industrial networks incorporate resource-constrained Internet of Things (IoT) devices like smart outlets and smart sensors in addition to standard networking hardware (such gateways and firewalls). In these conditions, hackers are able to get beyond conventional security measures and impersonate real IoT devices to break into the networks. As a result, IoT device-class identification is essential for preventing illegal access to vital networks. Using ZigBee and Z-Wave protocols, we introduce Z-IoT in this study as the first fingerprinting framework for identifying IoT device classes. Z-IoT tracks idle network activity among IoT devices to build techniques for fingerprinting devices based on signatures. Z-IoT identifies various types of IoT devices while ensuring the anonymity of the network data by utilising passive packet collecting techniques, the best selection of filtering criteria, and machine learning algorithms. To evaluate the effectiveness of Z-IoT, we set up a number of testbeds with a total of 39 common IoT devices that interact via the ZigBee and Z-Wave protocols. The outcomes of our experiments demonstrated exceptional performance in classifying various IoT devices, with average precision and recall of over 91%. The suggested approach also causes no additional burden *Index Terms*—Internet of Things, device-class fingerprinting,
ZigBee, Z-Wave.**

II. INTRODUCTION

A survey from the McKinsey Global Institute estimates investments in the Internet of Things (IoT) to be over $11 trillion by 2025 [1]. Indeed, the use of IoT devices in corporate and industrial environments is currently skyrocketing. In most cases, these IoT devices, which have limited computing resources and diverse communication capabilities [2], share access to sensitive information with other networking devices (e.g., servers and gateways) present in corporate networks and critical systems [3]–[8]. In these settings, hackers can impersonate legitimate IoT devices via spoofing attacks and gain unauthorized access to the networks. For instance, using a spoofed device, the attackers can steal sensitive information, inject illegitimate data to the system, or implement targeted attacks over other devices, while mimicking legitimate device operations [9]–[12]. The high diversity of devices and com- munication protocols (e.g., Internet Protocol (IP), ZigBee, Z-
Wave) present in IoT devices makes defending against spoofing attacks extremely difficult.

Passive device-class fingerprinting techniques can be used to identify the type of resource-limited devices present in the network and detect unauthorized devices. Although there is a substantial amount of research in fingerprinting techniques for IP- and Bluetooth-enabled IoT devices, there exist no solutions to identify IoT devices that communicate via ZigBee or Z-Wave, which are very popular in current smart office and home settings [13], [14]. Since different communication protocols typically implement a unique protocol stack and network architecture, IP- and Bluetooth-based identification solutions would not effectively fingerprint ZigBee- or Z-Wave- enabled devices.

III. LITERATURE SERVIEW

In this section, we discuss the Z-based (i.e., ZigBee and Z-Wave) communication protocols used in modern IoT devices and network architectures.

A. Z-based Network Protocols

We present details of ZigBee and Z-Wave network protocols that are used to further develop Z-IoT

1) ZigBee: Figure 1(a) details the stack representation of the ZigBee protocol. In this work, we focus on the specific characteristics of the ZigBee Network and MAC layers to build signatures and fingerprinting mechanisms capable of identifying different types of ZigBee IoT devices. Although ZigBee adopted the IEEE 802.15.4-2006 standard for Physical (PHY) and Medium Access Control (MAC) Layers for personal area networks (PAN), it implements a specific Network (NWK) Layer and provides an application framework for developing for the Application Layer.The MAC layer in IEEE 802.15.4- 2006 allows for devices to either be a Full Function Devices (FFD) or a Reduced Function Devices (RFD).ZigBee builds upon the MAC layer with its network layer and defines three device types and network topologies: (1) end device, (2) ZigBee router, and (3) ZigBee coordinator.

2) Z-Wave: Figure 1(b) shows that Z-Wave's protocol stack consists of five different layers. Z-Wave implements a specific Transfer layer responsible for managing the communications between different network nodes. This layer implements four different frame types: Singlecast, ACK, Broadcast, and Mul- ticast.Singlecast frames are for transmitting data to a specific node. Then, destination nodes use ACKs to notify the received the data. A Broadcast frame sends the data to every node on the network. Finally, in cases where a node sends data to multiple nodes, a Multicast frame is used. In this work, we focus on the specific characteristics of the Z-Wave Transport layer to build signatures and fingerprinting mechanisms capable of identifying different types of Z-Wave IoT devices.

IV. PROPOSED METHOD

In this section, we discuss the related work and highlight how our work is different from other works.

exploited for Radio Frequency (RF) emitter fingerprinting. Similarly, Bluetooth and Wi-Fi emitter fingerprinting utilize the variations of electromagnetic characteristics of radio frequency emitters; however, these techniques require expen- sive hardware to be effective. Other works propose passive methods to fingerprint the devices connected to a WLAN, . Also, Kurtz et al. study the feasibility of mobile device fingerprinting based on the user's personalized config- urations, including Wi-Fi. Their technique requires the active involvement of users and does not apply to the devices that do not support user-customized configurations like Fitbit.

IoT Sentinel, one of the first frameworks for device-type fingerprinting for IoT devices that are talking over IP, is presented by researchers in []. IoT Sentinel tracks the network activity of IP-connected devices and generates signatures based on the communication protocols and IP header fields. Furthermore, Miettinen et al. suggest DOT, a different device-type fingerprinting framework. Based on IoT Sentinel, D ot continually examines network traffic to see if the network behavior of devices still corresponds to their associated signature. The study in also suggests a Bluetooth-based framework for fingerprinting wearable device kinds. Some specific efforts concentrate on Z-based IoT fingerprinting**.** devices. In, the authors propose the use of non- parametric RF signals to extract features to fingerprint ZigBee specific devices. Similarly, the authors in fingerprint ZigBee hosts using multiple discriminant analysis (MDA). RF signals are also utilized to authenticate ZigBee devices. Here, characteristics of the ZigBee physical layer are combined with statistical analysis and ML techniques to improve precious authentication

enabled devices, or specific Z-based hosts, Z-IoT is the first fingerprinting framework that passively uses network dynamics to fingerprint different types of ZigBee and Z-Wave based IoT devices.

V. PROBLEM DEFINITION

In this section, we define the problem as well as the type ofthreats Z-IoT attempts to solve.

Problem Definition. We consider an IoT network containing various types of devices (e.g., Smart Locks, Motion Sensors,

Consecutive packet of the same type received by the packet capture module. The use of inter-arrival-time has provento be a useful feature for the identification of different device-types via passive fingerprinting [26]. The *Signature Generator* module then uses the collection of IAT values to create a

B. Z-IoT Modules

As shown in Figure 2, the main modules of Z-IoT are (1) Packet Capture, (2) Packet Filtering, (3) Feature Extractor, (4) Signature Generator, and (5) Classifier. We detail these

mechanisms. Finally, the work proposed in reduces the number of physical layer's features used to fingerprint ZigBee and Z-Wave devices while keeping good classification performance.

Distinctions from earlier works. Although Z-IoT monitors network traffic for fingerprinting reasons as well, the proposed architecture does not analyse packet header or payload data, protecting the privacy of users and sensitive network data. Additionally, Z-IoT functions on a separate device outside the network, whereas other IoT fingerprinting frameworks run on the gateway devices. As a result, no burden is placed on the crucial network traffic. Additionally, some frameworks that have been suggested concentrate on recognizing IP/Bluetooth-
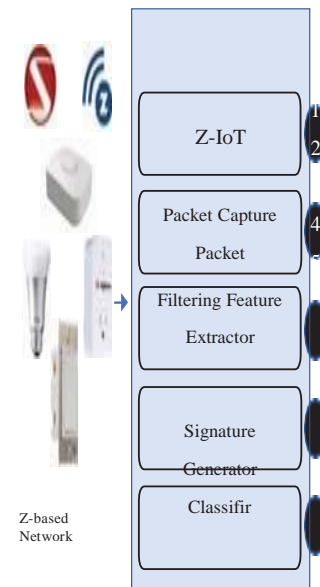
Fig. 2: Overview of Z-IoT architecture.

modules below.

1) Packet Capture: Z-IoT performs passive device-type fin- gerprinting with minimal overhead to the IoT devices Water Sensors). However, an attacker has gained physical unauthorized access to the network and has placed an unknown device to the network. The unauthorized device is capable of remaining hidden in the network by impersonating a legitimate device via spoofing while performing malicious activities. Z-IoT allows network administrators to detect unknown device-types hiding in the network by identifying the legitimate device-types using network-based fingerprinting mechanisms.

Threat Model. In this work, we consider an attacker that adds Unauthorized IoT devices into a network. We only consider unauthorized devices that can mimic authorized devices' func-tonalities. We assume that unauthorized devices try to perform malicious activities while remaining undetected. To do so, the malicious devices spoof legitimate devices in a network.

These spoofing devices may steal sensitive information, inject false data, attack other devices, or place back-doors in a system for future attacks [32]. Z-IoT does not consider devices that are clones or counterfeits of authorized devices, as well as authorized devices that have been compromised.
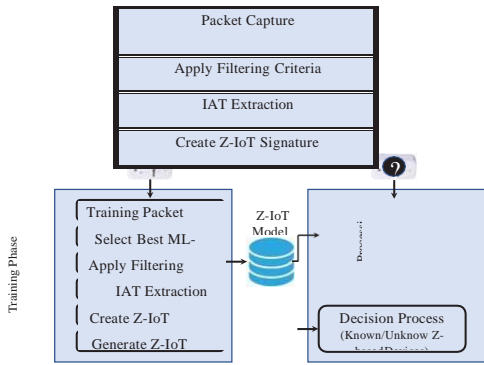
Fig. 3: Detailed representation of the Z-IoT device-type fin- gerprinting framework during both the training and processing phases.

Equation 1). The proposed fingerprinting framework assumes that different types of Z-based IoT devices incur in values of IAT different enough that can be used for classification purposes. It is possible, however, to find IAT variations between similar types of devices. These variations are generally due to small differences in circuit design and imperfections in circuit modules (e.g., clock). We assume these IAT differences between the similar type of devices to be small enough so our classifier may be able to still achieve high accuracy in classifying different device-types.

$$IAT = \Delta t_{arr} = t_{pk\,i} - t_{pk\,i} - 1 \qquad (1)$$

The use of IAT provides specific advantages over other features used in the literature to fingerprint devices. First, as explained before, IAT values are specific to the different classes of devices and should not vary significantly among devices from the same type group, making the device-class fingerprinting possible. Second, the use of network dynamics such as IAT permits the generation of device-type signatures without the need to analyze network packet content, preserving the sensitive network information and the privacy of users. Finally, we measure the ITA to an external monitor Z-IoT device that is independent of the ZigBee or Z-Wave networks. Keeping Z-IoT outside of the Z-based network allows for a passive approach that does not impose additional traffic overhead to critical Z-based networks.

2) Signature Generator: The Signature Generator module utilizes a device's IAT values to generate a specific signature for the device type. First, it builds a density distribution from a device's IAT values, representing the probability that a network packet received at some specific time *t* was generated by some specific device. Next, the Signature Generator splits the density distribution into *n* bins and calculates the area under the curve for each bin. The collection of *n* area values a_i constitutes the final feature values included in every device's signature (see Equation 2).

$$s_{type} = \{a_0, a_1, ..., a_n\} \qquad (2)$$

As we monitor the Z-based devices in idle state, we guaran- tee generating the signature from data collected during periods of low network traffic. Lower traffic allows for signature features that are less impacted by random network dynamics and for higher classification performance.*Classifier:* We design Z-IoT, assuming multiple different classes of Z-based IoT devices. Moreover, we use a multi-class classification approach in our analysis. The Classifier module is responsible for classifying unknown devices by their type. It takes an unknown device's signature as an input and runs it against a collection of multi-class models generated during training. Z-IoT applies an efficient approach that allows using the best model for every specific communication

protocol. For instance, for ZigBee-based devices, Z-IoT selects a model capable of handling ZigBee-generated network packets that guarantees the best filtering criteria and ML algorithm for the highest accuracy results. We trained the classifier via a supervised approach, using labeled signatures from pre-selected known devices. In addition to unique filtering settings for ZigBee and Z-Wave, a multi-class classifier was created for each of the communication protocols and trained only with their associated network traffic.

between different types of devices, we found that packet length only cannot be effectively used as filtering criteria. Finally, as in the ZigBee case, we obtained the best performance results after combining both type and packet length as filtering criteria. The IAT density distributions curves for each type of device in the Z-Wave testbed is shown in Figure 4(b). Next, we evaluated which classifier performs the best for the Z-Wave case. Results from Table II list Random Forest as the best classifier for identifying Z-Wave enabled devices.

A. Classification Performance

We also evaluated the effectiveness of Z-IoT in fingerprinting different Z-based IoT device types. Table III details Z-IoT's performance for the models combining the best filtering criteria and ML algorithms.

In the case of ZigBee IoT devices, Z-IoT identifies different types of devices with an average accuracy, precision, and recall of of 91.0%, 91.2% and 91.1%, respectively. During the evaluation analysis, we also noticed that out of all different device-types considered, the smart locks and the smart buttons were the ones more susceptible to errors of type *false positives*. That is, a higher amount of devices were misclassified as locks and buttons compared to the other types. Figure 5(a) depicts the confusion matrix after applying the selected filtering criteria and the Bayes Net algorithm to classify the different types of IoT devices included in the ZigBee testbed.

Finally, for the case of Z-Wave devices, Z-IoT achieved an average accuracy, precision, and recall of 93.25, 93.6%, and 93.3%, respectively. This time, the device types that prompted the highest false-positive rate were the one of type smart windows/door sensor and smart switch. Figure 5(b) depicts the confusion matrix after applying the selected filtering criteriaand the Random Forrest algorithm to classify the different types of IoT devices included in the Z-Wave tested.

VI. CONCLUSION

IoT devices that may be fooled by attackers are integrated into modern business and industrial networks. There are systems in place to detect unlicensed Internet of Things devices interacting over IP networks, but none exist for ZigBee or Z-Wave networks. As a result, we presented Z-IoT in this study, the first device-class fingerprinting framework for Internet of Things (IoT) devices using the ZigBee and Z-Wave protocols. Z-IoT employs passive packet capture technologies, optimum filtering, and machine learning algorithms to passively monitor idle network traffic and identify various IoT device types based on the inter-arrival periods of packets. With a total of 39 ZigBee and Z-Wave IoT devices, we evaluated the effectiveness and reliability of Z-IoT. Our findings show that Z-IoT performs better than other IoT platforms, recognising various ZigBee and Z-Wave IoT device types with an average precision and recall of over 91%. Finally, Z-IoT produced no overhead for the network or IoT

devices.

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To Design and Accessible Smart Buildings Using IOT

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Abstract— **Moving is one of the most crucial concerns when it comes to freedom while carrying out everyday tasks in both indoor and outdoor settings. In order to enable and assist their integration and independence, this is thought to be especially true for individuals with disabilities and should be ensured. In this situation, IoT may be a way to specify and acquire smarter, more accessible buildings. In this article, we introduce UniSAS, a system that makes use of a Raspberry Pi-based architecture and mobile devices to increase building accessibility. We constructed a prototype, which is described in the article together with the system architecture. In order to explain the viability of our method, certain user scenarios are depicted.**

Index Terms—**smart buildings, IoT, accessibility, users with disabilities**

I. INTRODUCTION

The journey that leads individuals throughout the world to independence is difficult. As a result, they must handle their funds, take responsibility for their own actions legally, and generally act independently in daily life. Time, experience, and support from peers, family, and the community are all necessary throughout this transition process. For those who have impairments, this process is undoubtedly more difficult since it is impacted by the nature of the disability and how it is treated [1]. communicating, and learning are considered among the most crucial issues at the basis of daily activities for people with disabilities. Such kinds of activities are considered essential to improve the quality of life of disabled citizens. Moving is an important theme as regards both independence and completing activities of daily living, both indoor [2] and outdoor, in urban and extra-urban environments [3], [4], [5], [6].

Summing up, mobility is a key aspect for independence, as well as learning [7]. People with mobility difficulties can suffer from different diseases that can vary from mood disorders, like depression, to anxiety. Thus, they tend to be impoverished, poorly educated, and unable to work. Furthermore, they often live alone even though, on average, they are much less able to perform routine daily tasks, like preparing meals. The combination of all these factors has a huge impact on the quality of their life [8].

Basically, there are two main approaches to reduce the impact of disabilities on people's capability of performing Routine daily tasks and other activities: personal assistance and technological assistance [9]. The first one simply regards the help received by disabled people from others. However, it does not enhance people's independence as opposed to technological assistance. In fact, this second approach consists in the use of equipment's, such as white canes or wheelchairs, to reduce the experienced difficulty in such activities.

In this context, it is particularly significant the Internet of Things paradigm (IoT). The concept behind is based on the pervasive presence all over the environment of different things, objects or devices, like Radio-Frequency Identification (RFID) tags, sensors, actuators, smartphones. Any of them can interact each other and can cooperate with their neighbors to reach common goals, through unique addressing schemes [10]. Currently, this paradigm is widespread used in different domains [2], starting from transportation and logistics to health-care, through smart environments (just to cite few examples).

In particular, as regards assistive technologies, the IoT has given rise to many research project that exploit its enabling technologies. Their main purpose is to improve the accessibility of the environment where the user lives and works at different levels, meeting the needs of people with different disabilities, supporting them in enhancing their independence while they conduct their daily activities. This can be strategic in enhancing their inclusion in social and in professional contexts, fighting their exclusion [11].

In this paper, we propose *UniSAS*, a system thought to improve the accessibility of buildings. Taking into account accessibility and mobility issues, the proposed system helps people in accessing structures. Even though anyone can use this system and can benefit from it, it has been thought considering people with disabilities (e.g., blind people or wheelchair users) or with physical impairments.

The rest of this paper is structured as follows. Section II briefly describes the background, by presenting some related work. Section III illustrates the system overview, while the system architecture is detailed in Section IV. Section V describes a prototype implementation. Some users' scenarios are discussed in VI, and, finally, Section VII concludes the paper with some final remarks and future work.

II. RELATED WORK

The Internet of Things (IoT) is a technological phenomenon that extends the idea of Internet to the world of concrete objects and places, which is associated with concepts like the following ones:

- *Ubiquitous Communication/Connectivity;*
- *Pervasive Computing;*
- *Ambient Intelligence.*

Considering pervasive computing, the possibility of adding computation capabilities to almost everything has brought to a transition process from objects to smart objects. Obviously the most striking case is the mobile phones one. Today smartphones, thanks to their computational capabilities and their sensors allow to develop a wide range of application. Bujari et al. [12] use smartphone accelerometer to recognize when a pedestrian stops crosses a street ruled by a traffic light. Aiolli et al. [13] developed ClimbTheWorld, a smartphone application that exploits data coming from smartphone sensors and a machine learning technique, being able to recognize single stairstep. The aim of such an application is persuading people to use stairs instead of elevators or escalators.

This transition process regards also other devices. For example, Leaman and La [14] provided a comprehensive review of wheelchairs technologies. In their work, starting from a review of power wheelchairs, they highlight the features of new smart wheelchairs. Finally, they present some considerations of the future direction of such a technology. Thus, new smart objects has been developed with different aims.

As concerns ambient intelligence paradigm, researchers have studied and developed a large variety of assistive technologies. Assisted living technologies based on ambient intelligence are called ambient assisted living (AAL) tools. AAL are used to prevent, cure, and improve health conditions of disabled people and older adults [15], [16]. In the last few years, several technological areas are advanced improving AAL methods. These technologies include (but are not limited to) Smart Homes (as described in SubSection II.A) and Mobile and wearable devices and sensors (presented in SubSection II.B).

A. Smart Homes

A smart home can be defined as an environment provided with computing and information technologies, which responds to the needs of the tenants. Its goal is to create and guarantee security, entertainment, comfort through the direction of technologies within the home and the world around it. We can find an excellent example of a smart home in the "Aging in Place" project, at the University of Missouri [17]. Experiments have been performed in an apartment of residents at Tigerplace. Researchers used passive sensor networks in order to detect changes in health status and eventually proceed with medical care. The main idea aims to provide a long-term care model for seniors as supportive health.

A similar approach is described in [18], an assisted living facility provided with sensors to monitor user's activities and characteristics, such as sleeping and bodyweight.

Another approach consists in using probabilistic models to recognize activities of daily living (ADLs). Wang et al. [19] developed a multi-modal, wearable sensor platform to collect sensor data in order to recognize multi-users activities. To model interacting process, they studied two temporal probabilistic models: Coupled Hidden Markov Model (CHMM) and Factorial Conditional Random Field (FCRF). Another different approach is related to video-based systems, as described in [20]. The authors developed a sensor network to detect events such as indoor falls and eventually generate an alert. They took advantage of different types of sensors, including accelerometers and cameras.

B. Mobile and wearable sensors

Nowadays, smartphones and mobile technologies have become irreplaceable items in our daily living activities. These objects, also thanks to recent advances in MEMS (Microelectromechanical systems) technology, are provided with several sensors such as accelerometers, gyroscopes, magnetometers, brightness sensors, proximity sensors, heart rate monitors and global positioning systems (GPSs). Such sensors can be used to detect user's activity and mobility.

An example is [21], which presents a wayfinding system that uses a range camera (Kinect 3D sensor) and an array of vibro-tactile elements placed into a helmet in order to manage collision avoidance for blind or visually impaired individuals. Another example of ambient assisted living in wearable and mobile context regards an approach based on SVM (Support Vector Machine) algorithm, like in the project described in [22]. It was used a wearable tri-axial accelerometer with the aim of capturing data related a human body movements and of proposing new fall detection method based on one-class support vector machine (SVM).

Another approach integrates electronic circuits and sensors within textile, like in SensFloor [23]. The authors proposed a large area capacitive sensor floor that is able to detect people moving across the floor, to calculate their trajectories and to distinguish between foot steps and falls.

UniSAS is a system thought to improve the accessibility level of any building. The basic idea behind it, is to develop a system able to help people in accessing structures. Such a system could be useful for people with accessibility and mobility issues, such as people with disabilities (e.g., blind people or wheelchair users) or with physical impairments. Even if it was originally though for this target, anyone can use it and can benefit from it, as a curb cut effect. An example is a student that must open the door of the main facility of the university with his badge. If he forgot it, he can use this system to be able to open the door by simply using a smartphone application.

Furthermore, this system can act also as an access controller so as to manage access privileges. In fact, all the rules related to places and rooms accessibility can be managed, by using a dedicated tool.

Focusing on the building management processes and analysis, *UniSAS* can be used to collect and manage data so as to improve all the maintenance actions and processes. This capability has a primary role in modern solutions, because all the processes are managed through specific data analysis.

Therefore, *UniSAS* can:

1) **Control and Manage Accesses**: it acts as an access controller, so as to allow and guarantee the access only to those people who are authorized.
2) **Automatic Move of Access Structures**: when an authorized user has been detected near an access structure (e.g., a door), this will be opened in order to allow the access to that user.
3) **Monitor the Accesses**: all the accesses can be registered and logged with the aim of collecting statistics and data, so as to support the building management processes.

All the *UniSAS* main characteristics and capabilities are not related to specific access structures, because they can be fitted for any structure.

A system with the features of UniSAS should take into account many and different issues. In particular, we would like to focus on the following ones:

- **Generated Data Issues**: it generates a large amount of data due to its objectives and capabilities. Furthermore, these data could have many types, structures and formats, hence the related complexity will be greater than in other contexts. This can be linked to the *Big Data* context.
- **Scalability and Performance Issues**: it requires a high scalable platform due to its distribution level. It should be extremely performing, because data and interactions management have to be done in a reduced amount of time (e.g. just like in a real time system). These issues can be connected to the *Cloud* context.
- **Devices Interaction Issues**: it requires an extended pool of devices that have to interact and communicate with other system entities. This can be related to the *Internet of Things* context.

Figure 1 shows a high level overview of the UniSAS system. The main actors of the system are:

- Access structure: basically, it is the door that the user wants to open.
- Proximity device: device (e.g., beacon) that it is used by the smartphone application to detect which structure the user wants to access.
- Smartphone application: once it detects a device, it sends an access request to the UniSAS Core Service.
- UniSAS Core Services: they are the core of the UniSAS system, they manage access privileges and all the system logic.
- Single Board Computer: device that opens the door, once it receives an access accorded response from the Core Services (if the user has the needed privileges to access to that room or local).
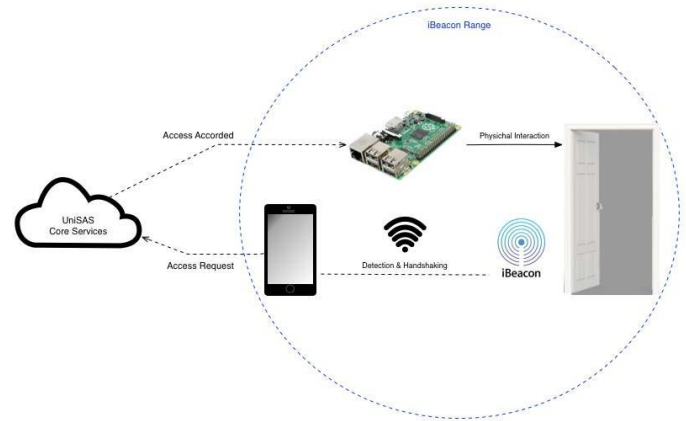
Fig. 1. UniSAS System Main Overview.

III. Design and Architecture

The architecture of UniSAS, shown in Figure 2, has been designed focusing on the *Multi-Tier Architecture* (or *Multi-Layered Architecture*) in order to improve the solution maintainability and updatability. The main layers of this architecture are the following ones:

1) **Data Management Layer**: tier to manage the data storage, related components and entities so as to control the data flow in the treated system. This level manages all the features and capabilities related to the data storage, information flow, and access store and management. Given the nature of the data, between SQL or NoSQL databases, we decide to use a relational database.
2) **Backend Business Logic Layer**: tier to manage and support the system business logic in order to provide its features and capabilities. This layer manages all the system logic complexity and its work flow, so as to centralize it and to manage it in a feasible way.
3) **Web Services API Layer**: tier to provide system capabilities, features and properties as Web services in order to provide them to the target layers. Furthermore, this layer manages the data flow between the system tiers.
4) **Web Application Layer**: tier to support and manage the system capabilities as concerns the end users interactions and management through the target Web application. In fact, this layer will be used by the end users to manage the system and the provided features by using a Web browser.
5) **Mobile Applications Layer**: tier to support and manage the system capabilities as concerns the end users interactions and management through the target mobile devices applications. In fact, this layer will be used by the end users to manage the system and the provided features by using a target application on their mobile devices.

Furthermore, the internal architecture of the *Web Application*, the *Web Services* and the *Mobile Applications* has been designed on the basis of the *Multi-Tier Architecture*, in order to achieve the related advantages.
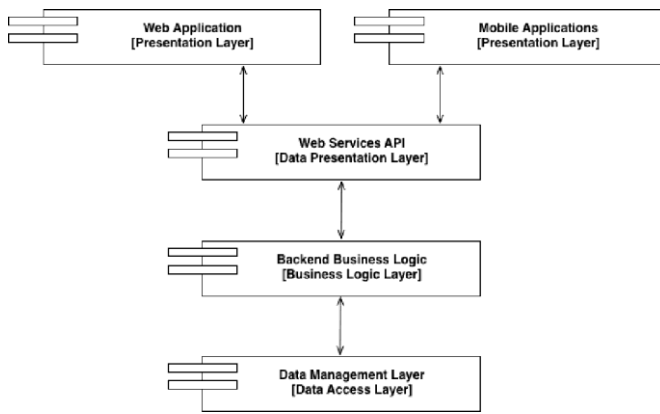
Fig. 2. UniSAS Architecture.

IV. A PROTOTYPE IMPLEMENTATION

The implementation of a first prototype of the *UniSAS* system has been realized by exploiting Web technologies. All the system components have been developed by using frameworks and technologies so as to avoid vendor lock-in, obtaining an heterogeneous solution. By adopting this strategy, evaluation and selection of the most feasible technologies can be done, with the aim of developing each component so as to improve the overall quality of the system.

The implementation of *UniSAS* is composed mainly by the following parts:

- **Web Application**: it provides capabilities and features to the advanced users (e.g., system administrators: it allows to manage user profiles privileges and configurations) and end users (e.g., it can manage the access structures opening).
- **Mobile Applications**: if provides all the *Web Application* features and capabilities as concerns the administrators and the end users profiles through *Mobile Devices* (e.g. they have been implemented for *Android* and *iOS* devices). Thus, the detection of the beacon is provided, so as to request the access through a specific door.
- **Web Services**: these services provides all the capabilities and features required by the *Web* and *Mobile Applications* in order to centralize the system business logic in this pool of entities.

This system has been implemented with a specific prototype, which has a University building as a target. In particular, we have taken into account the building where the Master Degree in Computer Science and Engineering has placed (University of Bologna, Campus of Cesena). In this prototype implementation, we have exploited the following technologies:

- In order to develop the Data Management Library and the Backend Business Logic we decided to use .NET Framework and ADO.NET Entity Framework. The Entity Framework allows to model the business domain through objects, leading to a neater separation of concerns, and it raises the level of abstraction. Given this implementation

choice, the use of Microsoft SQL Server as relation database becomes natural. In particular, we used Microsoft SQL Server 2014.
- Web Services API layer has been implemented by using Microsoft ASP.NET Web API 2.
- The Web Application has been designed with the mobile-first approach, given the increasing number of people who access the Web through smartphones. In addition to HTML5 and CSS3, AngularJS has been used to implement a Single Page Application.
- As proximity devices, beacons have been used so that smartphones can perceive structures in the neighborhood through BLE.
- Since the Mobile Application uses Bluetooth to detect beacons, we decided to develop a hybrid application, which means that it is an application simply composed by a Web view and a communication layer between the Web view and native services of the application. In such a way, it has been possible to use a single code base of a Web application to provide both iOS and Android app.
- The door is equipped with a Raspberry Pi. The Mobile Application communicates with such Raspberry Pi by means of BLE. In our prototype development, we have exploited a led and a relay so as to simulate the operation of unlocking the door, with the aim of testing its feasibility, taking into account similar projects that can be found in literature [24].

The availability of our prototype on different systems, like Android and iOS smartphones or laptops, demonstrates the possibility of using *UniSAS* on many platforms.

V. Methodology

The contexts related to the proposed architecture are manifold. *UniSAS* has been designed following the guidelines previously introduced in order to equip users with an easy way to access to a structure. The prototype described in the previous section consists of a solution that fits to a University context mainly for the following reasons:

- There are people, like students, professors and administrative staff, that have, by nature, different access rights to different places. For example, students must be able to get into classrooms or laboratories where a lesson takes place. But they should not be able to step into a professor's office or in specific labs used mainly for research purposes. However, there could be exceptions, such as a student that should have temporary access to a specific lab, while he is doing his thesis.
- Students are usually a very heterogeneous population, that may include people from different countries and with many backgrounds, and it can include people with disabilities.

With the aim of defining scenarios exploiting different characteristics of our system we designed the following three personas:

- Alice is an English Erasmus student, living in Cesena for 9 months to complete her bachelor thesis. She is studying

Biomedical Science at the University of Brighton. She loved staying in Cesena in the second semester of the last year and she decided to do her thesis there. She loves riding bicycle so she bought a mountain bike from one of her classmates as soon as lessons start. As well as to go to lesson and move across the city, she also uses it on the weekend to go to the hill near Cesena.

- Enrico is a blind since birth guy who has always lived in Cesena. He is a technology fan and he loves PCs and programming. So, once he graduated, he enrolled in the first cycle degree in Computer Science and Engineering, which is based at the same street where he lives with his parents. In his free time, Enrico works as web developer, along with his friend Eugenio, that is a graphic designer.

- Caterina is part of the administrative staff of the campus of Cesena. Among other things, she takes care of access management through the UniSAS system. She is married with Alfonso and they have two children, Elena and Francesco, who are respectively 9 and 7 years old. She loves art, especially opera, and she often goes to theater with her husband.

Caterina has an Administrator role in UniSAS so she can access data related to any user. She can add, update or delete every data related to every user that uses *UniSAS* inside the University. This way, an Administrator can control the access and can let the system be used by people who really needs it.

Being Enrico a blinded student, even if he is able to recognize facility access systems, he may need some help. So Enrico has to have all the privileges require his situation. They may be different from a wheelchair man that has different difficulties. The first time Enrico was at the University, he went to Caterina's office so that she can give him all the grants. After that, Enrico could use *UniSAS* thanks to Text-To-Speech technologies like Apple VoiceOver and a studied front-end application design.

Enrico has to go to the toilet. Since he is with Alfred, his guide dog, he wants to go to the disabled one. Once he arrives near the toilet, he opens *UniSAS* application. The application senses the beacon associated with the toilet door and sends an access request to the core system. The system verifies that he has enough privileges to access the toilet and then sends an access accord to the Raspberry Pi, that actually opens the door.

Since Alice has not disabilities, she has the default privileges for students. In this case, UniSAS could be used also for security purposes. For example, if a professor, called Dean for simplicity, has an access to a restricted laboratory, he could give an access to it to someone else. It is the same thing happened with Alice. In fact, her thesis advisor gave her the rights to access his laboratory at the first floor of the building, where she can work at her thesis.

Unfortunately, during her stay, Alice has an accident and she breaks her leg. For this reason, she goes to Caterina and she requests her to grant permissions to elevators. Obviously, Caterina allows her to use the buildings lifts, given her the access that usually only administrative staff and students with disabilities have. Permissions are related to a specific type of structure inside a building. For example, when Caterina granted Alice the permission to elevators, Alice was able to take every elevator. This policy restricts the access to the platform only to those people who really need it.

UniSAS has also the feature to collect all the access to a facility. So it is possible to a professor to check who enters inside a structure at a given hour of the day. For this reason, it has been created another role that could be used from professor for authentication purposes. The scenario is a university that has not a security service inside laboratories with restricted access and provides only a physical key for open the door. Such a feature improves facility access and security, avoiding to copy the original key, just registering all the access inside the facility.

Administrator are able to revoke permissions and reset passwords to a user. This feature has been developed in order since a user could lost his phone.

VI. CONCLUSION

This paper presents UniSAS, proposing a system based on the use of IoT to enhance accessibility of smart building, equipping the doors with Raspberry Pi boards and exploiting users' mobile devices. The architecture of the system has been detailed in the paper and a prototype implementation has been described, together with main design issues and functionalities, taking into account different users' roles. Some users' scenarios have been illustrated, with the aim of discussing the feasibility of the proposed approach. At the end, *UniSAS* could be an interesting approach to monitor, control, manage and support the access to a building in order to improve the overall mobility in smart buildings, as a means of enhancing users with disabilities independence while they are conducting their daily life indoor activities.

As a future work, it would be interesting to extend this system in order to use also smart watches and other similar wearable devices as devices that let the user interact and exploit the proposed UniSAS system. Moreover, security issues, together with privacy ones, should be taken into account and adequately investigated.

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Eye Blinking Control the Wheelchair using IOT

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Abstract— **Making decisions while taking eye blinking indications into consideration is not a simple procedure; if the wrong decision is made, it might lead to a person going in the wrong path and not solving their problems. A microcontroller with integrated Internet of Things hardware and software is used in the actual inquiry. Different actuators and sensors can be used as inputs and outputs by this device, accordingly. The raspberry pi 3 was selected since it is a single-board computer with wireless LAN and Bluetooth Low Energy (BLE) built in. Before selecting whether to move a model wheelchair forward, the built system distinguishes between low motion purposeful blinking and involuntary blinking. The position and instructions are delivered to an IoT platform to store wheelchair mobility data.**

Index Terms—**COTS, Eye blinking commands, IoT device, IoT platform, Rehabilitation.**

I. INTRODUCTION

In May 2019, the National Institute of Statistics and Censuses (INEC, for its acronym in spanish) and the National Council of People with Disabilities (Conapdis, acronym in spanish), presented the general results of the first National Survey on Disability 2018 (Enadis). This research is a project that is part of the Costa Rican System Information on Disability (Sicid), which is the official platform of coordination, institutional linkage and sectorial articulation of the Costa Rican government to facilitate the management and distribution of knowledge and national information on disability, as well as the rights of People with disabilities [1].

As first step of this research, some terms related to people with disabilities have to be defined:

1) Disability (general definition): as part of the understanding of disability and evolution of the concept, the transition from the traditional model is identified biomedical, up to a model consistent with the rights approach human, that recognizes disability as the result of the interaction of a person with a health condition and environmental barriers, and that these barriers translate into restrictions on the participation of these people with equal opportunity than others.
2) People with disabilities (specific definition): are those people who present restriction on their participation as a product of the interaction between their health condition

(disease, disorder or deficiency) and barriers contextual, attitudinal and environmental.
3) People without disabilities: they are those who do not see each other restricted in their participation, that is, without disability. Does not mean that these people do not experience difficulties in their operation or They are not at risk of being in a situation of disability.
4) Degrees of disability: is the division of people in situations of disability according to grades: mild to moderate and severe, which They respond to the difficulty of daily activities.
5) Accessible infrastructure: are those spatial conditions that allow the displacement of the general population, such as ramps for people using wheelchairs or others, doors with lever handles, wide doors and aisles for wheelchairs or other products of support, elevator or elevator (when it owns more than one floor), lights of visual alert and audio alarm, grab bars or stands with handrail and adapted furniture (sinks, batteries, shower, furniture, toilet or others).

According to the final results of Enadis survey, 18.2% of people aged 18 and more that are Costa Rica residents are in a situation of disability, this represents approximately 670640
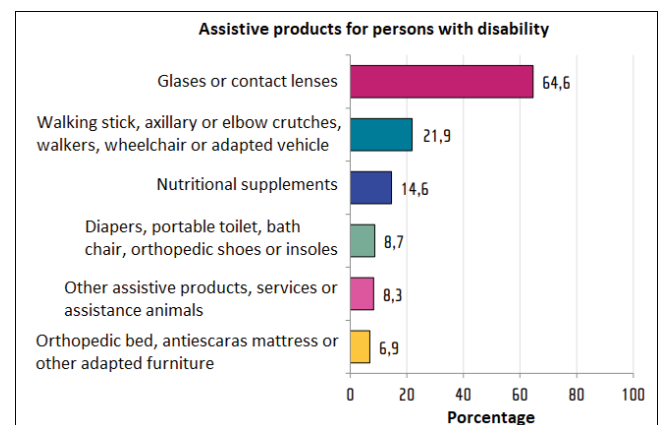
Fig. 1. Costa Rica: Percentage of the population aged 18 years and over in a situation of disability, taking in consideration different assistive products that they use according to their health condition, october and november, 2018 [1].

people. In the same survey was presented the percentage of the population aged 18 and over that require assistive products to interact with their surroundings in order to allow the displacement and interaction in similar or approximately similar to people without disabilities. In Figure 1, are shown the percentage distribution of assistive products considering their use, the second line presents 21,9% for walking stick, axilary or elbow crutches, walkers, wheelchair or adapted vehicles, which in numbers is around 146870 people with mobility disabilities. In this project we are concerned with people that requires a wheelchair and that does not have the physical capacity to control the wheelchair as desired.

II. PREVIOUS WORK

In general, several different approaches have tried to solve the problem regarding a wheelchair mobility and control with eye movement for people with quadriplegia; for example, in [2], [3] are presented two different researches but with some similarities, in Shinde 2018 eye movement is the main interactive human part for decision-making and in Garg et.al the design and implementation of an smart wheelchair for quadriplegia patients using IOT was proposed.

With this in mind, the first approach to solve the mentioned problem was presented in 2014 as a poster in the international workshop on Wearable Robotics (WeRob) in Baiona, Spain, specifically the following devices were used: Arduino and bluetooth communication board, MindWave mobile 2 EEG headset from NeuroSky provider. MindWave headset can read EEG signals from concentration, meditation, but the main problem here was to be able to acquire an appropriate concentration EEG signals to give the required commands. EEG stands for Electroencephalography, EEG is an electrophysiological monitoring method to record electrical activity of the brain. It is typically noninvasive, with the electrodes placed along the scalp. In 2017, also in a WeRob conference a second approach was presented but this time a first attempt with blinking commands was introduced. Some hardware limitations and slow data processing were the main issues that forced a change towards a computational platform with better performance, details will be mentioned in results section [4].
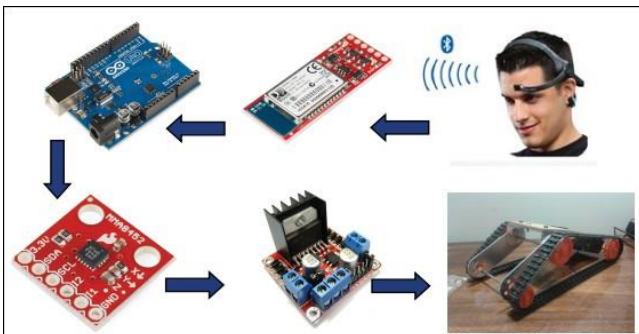
Fig. 2. MindWave mobile EEG concentration signals sent to a Bluetooth communication board [4]
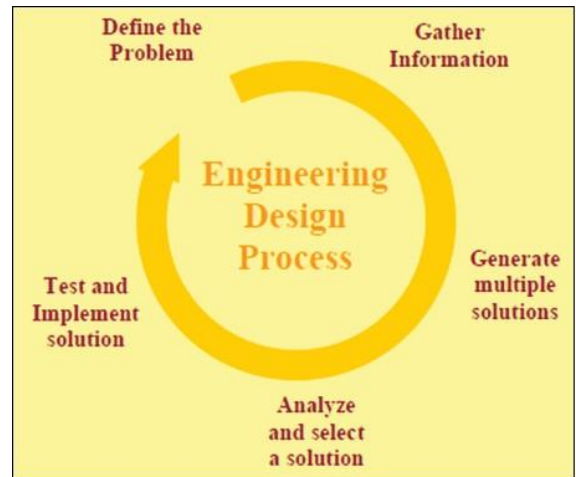
Fig. 3. Engineering design process, methodology to fulfill the aim of the project. [5]

III. DESIGN METHOD

To fulfill the aim of the project the engineering design process was followed (see figure 3) which as first step includes the definition of a clear problem statement, then pertinent information was gathered in order to generate multiple solutions. As fourth step, the information was analyzed, a solution was selected and finally, the proposed solution was tested and implemented. As shown in figure 3 the engineering design process is completely iterative.

A methodological process was followed, each one of the five steps of the engineering design process were completed or at least analyzed:

1) Define the problem.
   - Identify and establish the need
   - Develop a problem statement
   - Establish a criteria for success
2) Gather pertinent information.
   - Search for information resources
3) Generate multiple solutions.
4) Analyze and select a solution
   - Functional analysis
   - Ergonomics
   - Product safety and liability
   - Economic and market analysis
   - Mechanical/strength analysis
5) Test and implement the solution
   - Prototyping
   - Concurrent engineering
   - Documentation
   - Applying fro patents
   - Testing and verification

A. Control components

The control components are an important piece of the IoT system for controlling the movement of a wheelchair.
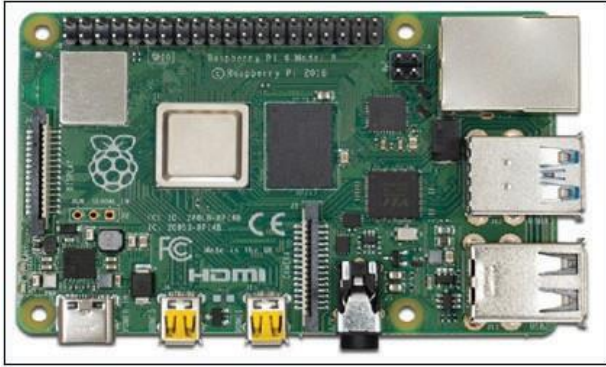
Fig. 4. Raspberry Pi 3, single-board computer with wireless LAN and Bluetooth Low Energy (BLE) on board.

Fig. 5. Raw signal for a voluntary blinking [6].

Fig. 6. Raw signal for an involuntary blinking [6].

It allows the local and remote access to the sampling and analysis component where blinking commands are received, as well as the data transfer to the cloud storage in a IoT platform, ThingSpeak platform was evaluated for this project. The following specific components were evaluated for the this prototype:

1) CPU - Control Processin Unit - computational platform
   - Raspberry Pi 3 controller (see figure 4)
2) Servomotor controllers
3) IoT communication board
   - Raspberry Pi SIM900 GSM/GPRS Add-On
4) Mecanum wheels
5) Cloud Storage component
   - ThingSpeak IoT computational platform
6) Data processing software component
   - Python programming - blinking detection and filtering

IV. RESULTS

As mentioned in the previous work section, some hardware limitations and slow data processing were the main issues that forced a change towards a computational platform with better performance. In order to solve this issue a Raspberry computational platform was analyzed and selected. To detect

Tests were run to determine the loss of data in the communication between the Raspberry Pi 3 and the Mindwave EEG headset and also between the Rasp and the IoT platform. A function with an expected response was executed 1000 times in order to determine the amount of errors in the communication. It called for a response from the device and expected a value of 1. The error value for this test was of 0%.

In figures 6 and 5 are shown the raw signals for slow involuntary and voluntary blinking, respectively. Both signals are noisy and require a statistical median filtering process in order to be able to effectively distinguish between a involuntary and a voluntary blinking. Figures 7 and 7 show the same signals after applying a statistical median filter [6].
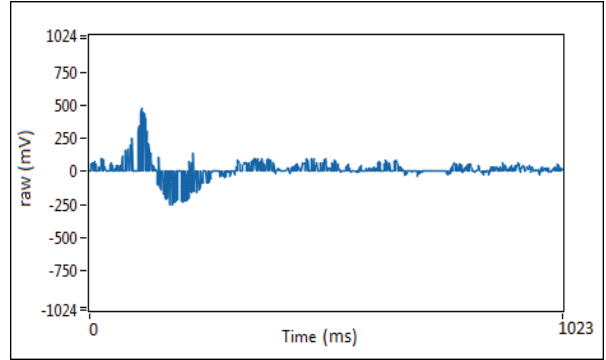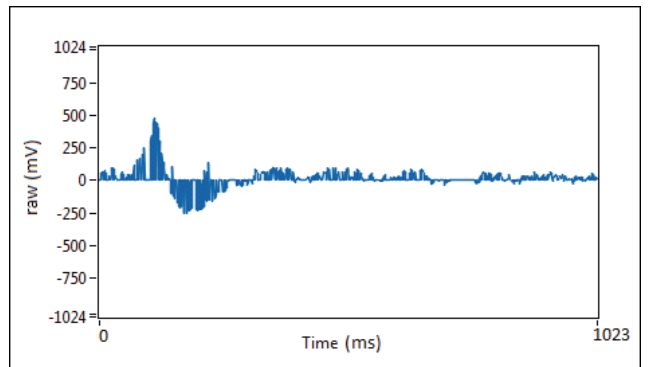
V. DISCUSSION

This system to control a wheelchair is a prototype considering slow voluntary blinking detection in order to take decision about displacement of a wheelchair. All commands are processed by a Raspberry computational platform, saved locally and also stored in a IoT platform. ThingSpeak IoT platform was tested and all commands were received without errors.
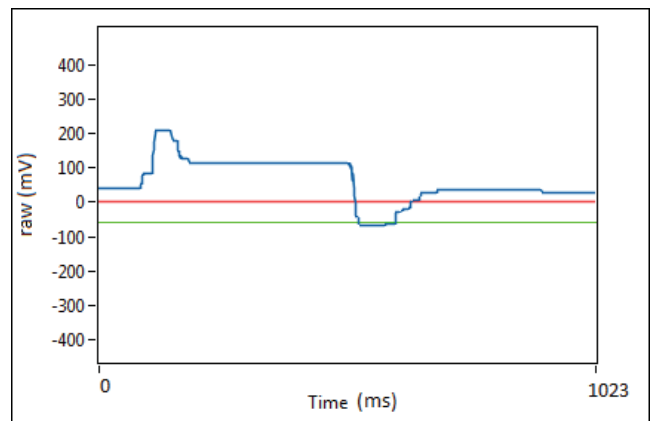
Fig. 7. Involuntary blinking signal after applying a statistical median filter [6].
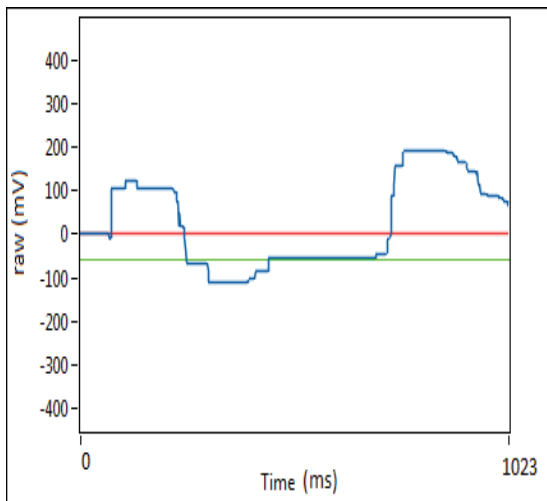
Fig. 8. Voluntary blinking signal after applying a statistical median filter [6].

IV. CONCLUSION

The device was able to perform the desired functions and movements with zero error percentage in its calculations and communication between each system. The results suggest that this prototype has a promising future once implemented with a real wheelchair. The prototype device is fully functional and can be controlled locally or remotely using the IoT dashboard. The given commands of movement work according all settings parameters. This proposed method .It was possible to obtain a reliability of 100 % in the measurements of the position and movement of a simulated wheelchair. The communication between the Raspberry and the IoT was successful and the IoT Thing Speak platform worked following

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Smart Child Safety Digital System Architecture using IOT

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Abstract-Concerns regarding a child's safety during a huge public gathering are shared by parents and event organisers. By outlining an architecture paradigm for an Internet of Things-enabled smart kid safety tracking digital system, this essay addresses this pressing problem. The location of a kid on an event map may be determined using an IoT-enabled digital system design, which blends Cloud, Mobile, and GPS technologies. The complex people, information, process, and technology architectural features of the advanced IoT-enabled smart kid safety tracking digital system are defined, along with their interactions, in the recommended architecture model. The suggested architectural model may be used as a reference or a manual for the secure architecture driven development of the many kid tracking digital systems for diverse public events.

Keywords – Digital Architecture; Internet of Things; Salesforce; GPS Tracking; Android Application.

I. INTRODUCTION

Public community events has always attracted children of all age groups. While these events have been entertaining to children, parents must be on a close look-out so that they don't miss out on their child's whereabouts in crowded places. It is a common practice to attach paper label, with their contact information, on the child's wrists or provide the child a cellphone to contact in an emergency [1]. Despite these measures, keeping children safe in a public event is extremely challenging and is one of major concern for event organizers and parents. The research question is:

In order to help ensure a kid's safety at public events, this article tackles the crucial research topic described above and suggests an architecture model for an IoT-enabled [2] smart child tracking digital system. A variety of digital ecosystem technologies, including IoT (Internet of Things), Cloud, Mobile, and GPS (Global Positioning System), are included in the suggested paradigm The structure of this paper is as follows. Firstly, it discusses the research background and related work. Secondly it discusses the research method applied in this paper. Thirdly, it presents the proposed smart child tracking digital system architecture model. Finally, it concludes with a discussion on further work in this important area of research.

II. Research Background and Related Work

This section provides the research background and discusses the integrated digital ecosystem of Internet of Things (IoT), Cloud, Mobile and GPS technologies followed by the design science method applied for this research.

A. IoT and Cloud Technology

The concept of IoT is getting significant attention from both researchers and practitioners [24]. The history of IoT can be traced back to 1990s, when Kevin Ashton

projected the idea of "network of objects" (to be Internet of Things) and mentioned that "Things" are

Interconnected to the "Internet" with minimal or no human interference [2][25]. Once things are connected to the Internet, data can be collected through sensors and labels based on the certain constraints. The collected data then cab be processed and analyzed for extracting useful information or insights, which can then be delivered to interested stakeholders or users or systems [3][26].

Cloud computing provides a platform to accommodate virtual infrastructure that allows necessary computing along with the integration of IoT devices [21]. Cloud computing offers a range of software, platform and infrastructure services that can be provisioned on demand for the collection, storage, processing and visualization of the IoT-enabled smart system data.

B. Mobile and GPS Technology

Modern digital systems go beyond traditional computing and include a number of portables and smart mobile phones, with WiFi and 4G Internet access, for souring, processing and disseminating data. There is constant increase in the use of smart mobile phones, which allow the availability of various mobile applications that can be connected to a range of IoT devices, cloud for real-time situation awareness and analysis [4].

A range of digital technologies have been proposed for estimating the position of an object, which is known as a location based services (LBS). GPS is one such service that is offered to determine the geographical location of an object. An important aspect of GPS is its ability to accurately determine an object ranging from 15 –
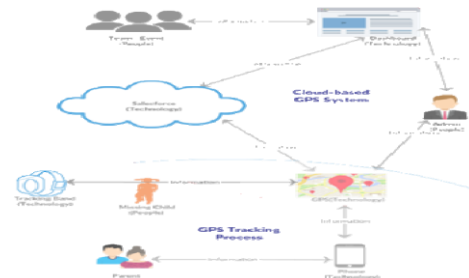
100 meters [7]. There are a number of use case of GPS such as GPS is used in Fleet management, scientific research, navigation, law enforcement, health and fitness [8]. Cars have been designed with in-built GPS devices that assist the driver in finding the best route from location A to point B. Scientists use GPS to measure earth's atmosphere, monitor volcanic activities as well as calculate the movement between arctic sheets and tectonic plates [9]. GPS can be used to monitor the movements of people who suffer from Alzheimer's and dementia [10]. Offenders released on parole can be also be monitored with the use of ankle monitors that determine their geographical position [5]. GPS can be used as a performance appraisal tool in sports that can closely monitor the movements of a player in game [

Location tracking of the child in a large public event is one of the key aspect of this research. We propose that GPS technology can be used for child tracking as well [1]. When children are outdoor, there is a natural drive to freely move around. This free-spirited behavior will provide room for safety concerns. It's a natural tendency for parents to feel that their children need to be safe. Thus, we can use GPS technology to track the location of a child in a large public event [5]. Location data can be collected, stored, processed and shared via integrated cloud and mobile applications.

III. RESEARCH METHOD

The purpose of this research paper is to develop an architecture model to support the situation-specific development of the various smart child tracking digital systems that ensure the safety of a child in a large public event. Design research (DR) method [6] has been applied here to develop the proposed architecture model [7]. DR method is considered appropriate when the research is about generating an artefact, which is the proposed architecture model in our case. DR method covers both the development and evaluation aspects of the artefact.

IV. SMART CHILD TRACKING DIGITAL SYSTEM

An architecture model for a smart kid tracking digital system has been created based on past work by James Ward [18] in order to solve the issue of child safety. The focus of James' work is a multisensory application that helps track rental bikes. However, in this case, the context is distinct and the child tracking is the main concern. James's work gave us a basis and starting point to improve his

work and build the proposed architecture model, which has following major elements:
- People
- Information
- Process
- Digital Technology

Figure 1 provides an overall integrated view of these four elements in a conceptual architecture model.

FIG. 1 CONCEPTUAL ARCHITECTURE MODEL FOR THE SMART CHILD TRACKER DIGITAL SYSTEM

A. People

Figure 2 details the key people or stakeholders of the system. Parents are the smartphone users who can monitor their child's activity. This is supported with an android application - that maps out their child's geographical location in an event. Children are the point of interest and wear the tracking device during the event. Event Organizers are the tracking service providers who can be further categorized based on their role and involvement with the system and event, i.e. Salesforce Admin, Event Staff and Volunteers.

B. Information

Digital technology connects people with the information. Information is a key element in our proposed digital system architecture. Figure 3 presents the data model that was created in the Salesforce cloud for capturing the relevant information. Master-detail and look-up relationships for various data objects are discussed below:

Master-detail relationship created between:
- Child Information and Child Registration.
- Child Information and Parent.

This master-detail relationship is more of a parent-child relation. For instance, if the record of a child registration is deleted, then the corresponding records related to it are also automatically deleted.

Look-up relationship created between:
- Tracker inventory and Smart Child Tracker.
- Child Registration and Smart Child Tracker.
- Event and Contact.
- Staff and Contact.

Unlike the master-detail relationship, a look-up relation has no effect on the deletion of a record. Thereby, allowing the admin to retain certain sensitive information.

Fig. 2 Data Model

C. Process

Figure 4 presents the process element details of the proposed architecture. Process element demonstrates the necessary steps that need to be considered for child tracking. This process and related stapes are created based on first-hand observations and experience during a missing child situation while volunteering for VIVID Sydney-festival of lights in 2016.
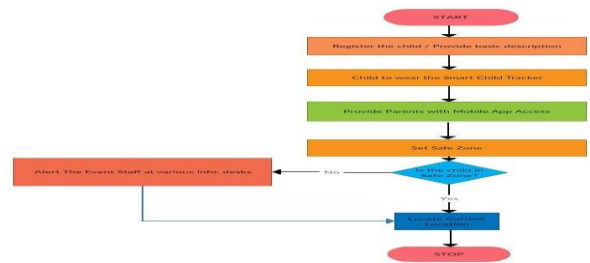
Fig. 4 Process

Step 1: Events need to hold a registration desk that will allow children to be registered. A record is created on a Salesforce cloud application that holds the child's personal information along with the child's picture (see Figure 3 for data model).

Step 2: Upon successful registration of a child, a GPS tracking band is placed on the child's wrist.

Step3: Parents are provided an access to an android application which is installed over their smartphones.

Step4: Based on the activities offered in the public event a desired safe zone is set. The purpose of constructing this safe zone is to closely monitor a child's activity. If the child is in the safe zone the real-time tracking would continue to return the current location of the child.

Step 5: But if the child gets off the safe zone, an alert needs to be sent to the event staff at various information desks who can accordingly to retrieve a missing child.

A. Digital Technology

Digital technology is the key enabler of the proposed smart child tracking digital system. The technologies opted for the proposed architecture are:

- Salesforce Cloud (IoT-based cloud platform)
- Android Mobile Application
- GPS Technology

Salesforce: An important aspect to be considered is the data storage. These days, cloud technology has been widely accepted for remote data storage. Cloud's data storage has been selected because it is more appropriate to address the concern in hand in contrast to the locally relied data storage. Cloud

platforms such as Salesforce cloud allows scalability for data

storage and its access via Internet. This enables the Internet connected devises and applications to easily access and share the data about the child location from anywhere [19-20]. Real-time GPS information about the child location is transmitted to the Salesforce cloud, which is monitored by a system admin as well as by other employees.

Android Mobile Application: An android application has been included in the proposed architecture. This would allow parents to closely keep a track of their children's activities during the whole time they are present in the event. Figure 5 shows the screens that can be designed and developed to deliver a simple, yet a very useful android application and user experience. Including the application screen, a total of seven screens are listed. Login Screen allows the user to enter the login credentials, which is provided at the time of child registration. Home Screen contains two main icons

GPS Module: Adafruit released a version 3 of ultimate GPS breakout. Based on our research, we found that this GPS chip (shown in Figure 6) would be appropriate for child tracking because of its low – power consumption, high- sensitivity receiver of-165 dB, built-in antenna - that allows up to ten location updates [18]. While this powerful chipset costs only
$39.95, event organizers can have a bulk purchase discount from economy scale perspective.
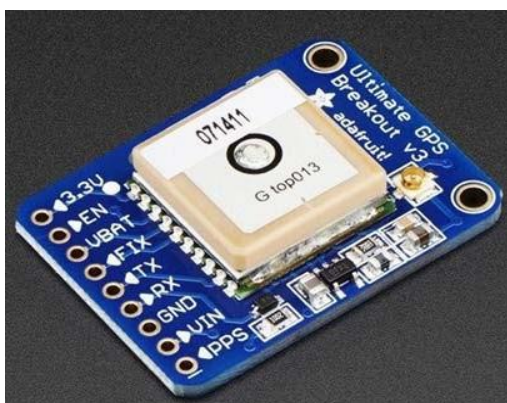
Fig. 6 Adafruit's GPS Breakout V3

V. CONCLUSION

a walkthrough and peer testing of the proposed architectural model's four integrated components—people, information process, and digital technolog Based on this first assessment, it can be concluded that the suggested architectural model is straightforward in its construction, making it simple and affordable to expand upon and execute in accordance with the requirements of many stakeholders.

The Salesforce cloud, mobile applications, and GPS are among the integrated digital technology architectures that are projected to make it simple to find a missing child in an emergency. This effort is the first step in creating a Smart Child Tracker that actually works. The use of tracking pins, which are simple to attach to the child's clothing, is one alternative for personalising the architecture. Future study can thus be done to examine other monitoring methods and architectural design patterns that could replace GPS with inexpensive RFIDs or iBeacons. RFID tags, for instance, can be a great choice for active tracking.

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A Study on Tress Related Problems among Police Personnel

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Abstract-Police men are working hard for the safety and welfare of all people in the society but they are facing so many issues. This paper is focused on studying the factors affecting the stress level among police and the methods to reduce.

I. INTRODUCTION

Police personnel are very important to maintain systematic order in the society in terms of law and order even though there are many constraints for them in terms of training, infrastructure facilities, etc., Police people are working round the clock to ensure the successful implementation of all the criminal laws without any break creating tremendous mental pressure and physical exertion on them. As a result a few of them may have violent outbursts. This psychological and physical pressure is on every policeman in the world. For every 1000 population 100 police personnel are necessary, where as in India for every 1000 population only 8 police personnel are performing their responsibilities. According to National Police Suicide Foundation, every 22 hours, one policeman in USA is committing suicide concluding the fact that the policemen are not coping with the stress in their jobs. In India since the ages, working as a police man is a concept of not only responsibility but also pride. It is one of the best armored organizations of the world, however, a different view shows that it is not really attractive as it seems to be. Literature review presented that police job is highly stressful occupation. (Hall et al., 2010), thus the initial inspiration to join the force often results in depression at some point, which is caused by acute stress prevalent in the work environment inside the department (Keyes et al., 2011).

The studies revealed the complexities in the police service. According to the studies, the police get exposed to external and internal factors. The external factors are the risk and danger involved in the job and the internal factors are the ones within their jobs like superior domination, strained professional relationships, role conflicts, and job environment. This study is focused on creating an awareness for the stress related aspects of the job for policemen.

II. OVERVIEW OF LITERATURE

The studies on police stress started in the middle of 1970s. the main stressors are dangerous crime scenes and their arrests. And most importantly the unpredictable crime environment is one of the reasons (He, Zhao & Archbold, 2002). The stress in the police job is also due to Physical threats involved in the job, and dealing with shift works are also observed. (Brown & Campbell, 1994; Hart, Wearing & Headey, 1995).
A study by Buker & Weicko (2007) studied about estimating the common stressors for Turkish National Police revealing that the job satisfaction is mainly affected due to the attitude of the supervisor. The remaining factors were insufficient staff, improper policy system, and redtapism. Along with them, unethical practices at work (Ayres & Flanagan, 1994), no involvement in decision making (Morash et al., 2006; Slate, Johnson & Colbert, 2007) are also considered as stressors for police. The policemen also suffer from lack of recognition and lack the support from administration (Ayres & Flanagon, 1994).
Morash & Harr (1995) studied about the stressors at work place and identified that status quo was a serious problem, practice of bias and physical harassment. Furthermore, Morash et al. (2006) conducted empirical study and observed that bias among fellow-workers highly predicted stress.
Another literature review conducted by Bano (2011) observed that police people does not have time for their families, they have a negative image in the public in the present days and also low salaries. This study was conducted on policemen in Uttar Pradesh. At the same time Selokar et al. (2011) observed that in Wardha, Maharashtra, most of the police were in stress due to different reasons like criticism by public and also their superiors, continuous work shifts without proper rewards, and lack of job satisfaction.

III. RESEARCH QUESTIONS OR HYPOTHESES

i. To measure the job satisfaction of police personnel in prakasam district.
ii. To analyze the work related factors leading to stress among the police personnel in Prakasam district

IV. RESEARCH METHODOLOGY

The study is based on Secondary data collected from Journals and various authorized reports.

V. DISCUSSION

A). Factors affecting Stress: Policemen are suffering from stress due to following factors:

a) Long Working Hours
b) Work Overload
c) Job Insecurity
d) Lack of participation in Decision Making
e) Lack of Facilities for Investigation
f) Poor compensation and Benefits.

B). Consequences of Stress: Policemen are suffering from stress and as a result they are exhibiting the following consequences:

i. Cynicism and suspiciousness: They are in suspicion about everyone and everything in life.
ii. Emotional detachment from various aspects of daily life: Because of their busy life they are being detached from

different aspects of daily life. They don't have time to spend quality time with family and children, even for the auspicious occasions also they have to be on duty.

iii. Reduced efficiency: The higher stress levels are reducing the efficiency of their work and productivity levels.

iv. Absenteeism and early retirement: The policemen are retiring early from their jobs and are also frequently absent for their duties.

v. Excessive aggressiveness (which may trigger an increase in citizen complaints): The policemen are becoming aggressive and people are becoming afraid of the policemen.

vi. Alcoholism and other substance abuse problems: The police men are getting addicted to alcohol and other habits to recover themselves from the stress, but are actually getting absorbed into it.

vii. Heart attacks, ulcers, weight gain, and other health problems

viii. Suicide

C). Methods to be adopted to reduce stress: The policemen should adopt various methods to improve their physical and psychological health.

1) Meditation and Yoga
2) Policy Initiatives should be taken to reduce the stress levels among Police.
3) Compensation and Promotions should be given appropriately for Policemen.

V. CONCLUSION

Police are very important element of a society. They strive to protect all the people and also help us to live a peaceful life. Thus it is very important that they should live happily and deliver their responsibilities properly.

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ICMBA02

"HRM Practices And Employees Satisfaction Towards Selected Public And Private Banking Sector In Andhra Pradesh"

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Abstract:

Enter the epidemic, and people challenges remained — on with a waterfall of new bones , from COVID- related safety protocols for essential in- person staff to remote work programs for others. After the bouleversement of the last two times, workers are tired. " Now may be a good time for companies in the fiscal services assiduity to take the occasion to rethink their programs and practices to determine what's working and what might not be working, because the work terrain and how work is done has changed, " Dramatic advances of data and Communication Technology(ICT), changing blend and private values of the pool, emergence of the knowledge frugality and adding global competition have created enormous challenges on associations. To deal with the challenges efficiently, Human resource has been considered together of the most important factors in moment's hypercompetitive request place. The main target of this study is to gain an sapience into the current HRM practices and its impact on hand's satisfaction on the private banking sector in Andhra pradesh. The study reveals that each one HRM confines exercised in the private banking sector of Andhra pradesh doesn't satisfied to the workers inversely. Utmost of the workers are displeased with compensation package followed by price and provocation, career growth, training and development, operation style, and job design and Responsibilities.

Key Words : COVID- 19, Financial Services, Banking system, workers.

I.INTRODUCTION

Dramatic advances of data and Communication Technology(ICT), changing blend and private values of the pool, emergence of the knowledge frugality and adding global competition have created enormous challenges on associations. To deal with the challenges efficiently, Human resource has been considered together of the most important factors in moment's hypercompetitive request place. within the environment of a developing frugality like Andhra Pradesh, where the necessity for conformation of capital is pressing, where developments within the field of artificial and bank operation are dynamic, and where fiscal heads accompanying stings of profitable

process are frequent, the challenges posed by HRM are great significance; and, as a effect, exploring the chances of the operation of HRM becomes a veritably applicable field of enquiry and exploration. Human resource dimension is about valuing the donation people make to the success of a pot, and thus the term ' Human capital ' describes the donation made by Human chops and knowledge to the product of goods and services(Becker, 1993). From these delineations, it's clear that effective HRM practices are ineluctable factor in determining the growth and prospects of any association. Human resource is that the most precious asset and delicate factor of product. Due to lack of effective HRM practices reduces hand's satisfaction towards their association and eventually that affects their commitment to the association.

Objectives of the study: The Objects of the study are to live workers ' satisfaction on the HRM practices of private banking sector in Andhra Pradesh.

a)   To concentrate the size of HRM practices.
b)   To propose a test for measuring hand's satisfaction by HRM practices;
c)   To give some suggestions for perfecting HRM practices and hand's satisfaction
d)   To examine weak points of HRM practices which affects workers ' satisfaction;

II.LITERATURE REVIEW

Human Resource Resource(HRM) is taken into account a critical organizational resource that helps an association sustain its effectiveness. It's one important area that influences a number of employee attitudes and behavior similar as intent to leave, situations of job satisfaction, and organizational commitment (Lee & Heard, 2000). Harmonious with Mackey & Box all(2007), the scientific literature assumes a unproductive link flowing from HRM practices to organizational performance via the responses of workers. Organizations that do not pay equitably compared to others may lose their hand's because of the non-competitive compensation package(Adams, 1965). Harmonious with Lawler(2005), society has entered a relief period in the

relationship between associations and their workers. During this new period, people are the first source for a company's competitive advantage and organizational substance and survival depends on how workers are treated.

The ' Human ' aspect of HRM is bothered with the relationship between employer and hand and it associated with the Human relations movement and the conception of high commitment work practices developed by(Walton, 1985). The stylish Human Resource practices areas are reclamation and selection, socialization, job design, training, communication/ participation, career development, performance operation, hand price and job security(Huselid, 1995). The provocation and occasion concentrated packets of Human Resource practices appreciatively associated with affective commitment and negatively affiliated to development(Gardner et.al., 2007). Wayne et.al.(1997) suggested that HRM practices that gestured the association's intentions to take a position in workers(similar as experimental gests and training) produced advanced situations of affective organizational commitment. HR practices like pay, benefits and training are negatively associated with development because they motivate workers and" cinch" them to their jobs(Lazear, 1986; Madrian, 1994; Gruber & Madrian, 1994).

III.METHODOLOGY OF THE STUDY :

This paper is rested on both primary and secondary data. Primary data were collected through a structured questionnaire which was administered tête-à-tête to the bank workers. Accessible sample fashion has been used to solicit the workers. The target population of this study was workers in Vijayawada who are serving as a banker of colorful private banks. Among colorful banks, this study only considered 20 private marketable banks. For conducting this exploration, 100 bank workers are named from the chosen banks and out of this 88 workers responses duly, the response rate is 88 percent.

The questionnaire consists of colorful questions on nine HRM confines similar as reclamation and selection systems, compensation package, job security, career growth, training and development, operation style, job design and liabilities, price and provocation and dealing terrain. The questionnaire was developed by employing a five point Likert scale, whereas 1 = displeased, 2 = some how satisfied, 3 = satisfied, 4 = relatively satisfied, 5 = largely satisfied. But some secondary data are used in the study. The secondary data employed in the study have been collected from affiliated journals, books, journals and internet,etc.

IV.HYPOTHESES DEVELOPMENT:

On the idea of the colorful factors affecting on HRM practices, the posterior suppositions are developed for the study-
H1 workers ' are satisfied on " Reclamation and selection systems ". H2 Employees ' are satisfied on " Compensation package ".
H3 workers ' are satisfied on " Job security ". H4 workers ' are satisfied on " Career growth ".
H5 workers ' are satisfied on " Training and development ".
H6 workers ' are satisfied on " operation style ".
H7 workers ' are satisfied on " Job design and liabilities ".
H8 workers ' are satisfied on " price and provocation ".
H9 workers ' are satisfied on " Working terrain

V.ANALYSIS AND FINDINGS :

H1: Employees ' Are satisfied on " Recruitment and selection systems " : It's assumed from the thesis that workers are satisfied on the current reclamation and selection systems of their bank i.e. the reclamation system is fair and applicable for the appointment to the work. Table 1 shows that at0.05 position of significance(two tagged test), table value(1.96) is bigger than advised value(Z = 0.55). So, the null thesis is accepted and hence, we conclude that workers are satisfied on reclamation and selection systems of their bank.

H2: Employees' Are satisfied on "Compensation package": This hypothesis indicates that employees are satisfied with present salary, increment allocation method and other compensation packages. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is a smaller amount than calculated value (Z =8.82). So, the null hypothesis is rejected and hence, we conclude that employees aren't satisfied on compensation package of their bank

H3: Employees' Are satisfied on "Job security". It's assumed from this hypothesis that employees are satisfied with security to their job. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is bigger than calculated value (Z =0.25). So, the null hypothesis is accepted and hence, we conclude that employees are satisfied on job security of their bank.

H4: Employees' Are satisfied on "Career growth". This hypothesis indicates that employees are enjoy enough space for his/her career growth. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is a smaller amount than calculated value (Z
=8.7). So, the null hypothesis is rejected and hence, we conclude that employees aren't satisfied on career growth of their bank

H5: Employees' Are satisfied on "Training and development". This hypothesis indicates that training and development program are available within the bank and employees are

Employees Satisfaction Dimensions	N	Mean	Standard Deviation	Standard Error	Z Value (Calculated value)	Mean Rank
Recruitment and Selection Systems	88	3.06	0.99	0.11	0.55	1
Compensation Package	88	2.03	0.99	0.11	8.82	9
Job Security	88	3.03	1.17	0.12	0.25	2
Career Growth	88	2.13	0.98	0.1	8.7	7
Training and Development	88	2.3	1.03	0.11	6.36	6
Management Style	88	2.49	1.03	0.11	4.64	5
Job Design and Responsibilities	88	2.54	1	0.11	4.18	4
Reward and Motivation	88	2.1	1.03	0.11	8.18	8
Working Environment	88	3.02	1.13	0.12	0.17	3

.

Table 1 shows that at 0.05 level of significance (two tailed test), table

	RSS1	CP2	JS3	CG4	TD5	MS6	JDR7	RM8	WE
1 = Dissatisfied	7.95	32.95	9.09	30.68	22.73	13.64	11.36	31.82	9.09
2 = Somehow Satisfied	17.05	40.91	19.32	37.5	42.05	45.45	43.18	38.64	22.7
3 = Satisfied	43.18	19.32	39.77	22.73	22.73	25	29.55	20.45	36.3
4 = Moderately Satisfied	25	3.41	22.73	6.82	7.95 1	0.23	11.36	5.68	20.4
5 = Highly Satisfied	6.82	3.41	9.09	2.27	4.55	5.68	4.55	3.41	11.3
Totals	100	100	100	100	100	100	100	100	100

Table 2. Percentage of employees on different levels of Satisfaction of HRM dimensions

value (1.96) is a smaller amount than calculated value (Z =6.36). So, the null hypothesis is rejected and hence, we conclude that employees aren't satisfied on training and development of their bank.

H6: Employees' Are satisfied on "Management style". This hypothesis indicates that management style is extremely flexible for employees and they involved with the managerial decision making. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is a smaller amount than calculated value (Z =4.64). So, the null

hypothesis is rejected and hence, we conclude that employees aren't satisfied on management style of their bank.

H7: Employees' Are satisfied on "Job design and responsibilities". The hypothesis indicates that job is correctly designed and employees are easily performed their task. Employees receive fair treatment, recognition and overall quality supervision from boss. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is a smaller amount than calculated value (Z =4.18). So, the null hypothesis is rejected and hence, we conclude that

employees aren't satisfied on job design and responsibilities of their bank.

H8: Employees' Are satisfied on "Reward and motivation". The hypothesis indicates that various financial and non-financial reward and motivation system is present in their bank, employees are satisfied there on system. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is a smaller amount than calculated value (Z =8.18). So, the null hypothesis is rejected and hence, we conclude that employees aren't satisfied on reward and motivation of their bank

H9: Employees' Are satisfied on "Working environment". This hypothesis indicates that the physical working environment is extremely conducive for satisfaction at large. Table 1 shows that at 0.05 level of significance (two tailed test), table value (1.96) is bigger than calculated value (Z =0.17). So, the null hypothesis is accepted and hence, we conclude that employees are satisfied on working environment of their bank.

From the above hypotheses testing it shows that employees are satisfied on some dimensions of HRM practices like recruitment and selection systems (mean rank-01), job security (mean rank02) and dealing environment (mean rank-03).The hypotheses test also shows that employees aren't satisfied on some dimensions such as job design and responsibilities (mean rank-04), management style (mean rank-05), training and development (mean rank-06), career growth (mean rank-07), reward and motivation (mean rank-08) and compensation package (mean rank-09).Therefore, it's clear that all dimensions are not equally satisfied to employees. It's also very clear from the Table 2 which dimensions highly satisfied or dissatisfied to employees.

RSS 1 = Recruitment and Selection, Systems CP2 = Compensation Package, JS3 = Job Security, CG4 = Career Growth, TD5 = Training and Development, MS6 = Management Style, JDR7 = Job Design and Responsibilities, RM8 = Reward and Motivation,WE9 = Working Environment.

Table 2 shows percentage of employees on different levels of Satisfaction of HRM dimensions. The table indicates that the very best 43.18 per cent employees are satisfied on recruitment and selection systems followed by 39.77 per cent on job security, 36.36 per cent on working environment, 29.55 per cent on job design and responsibilities, 25 per cent on management style, 22.73 per cent on career growth also as training and development, 20.45 per cent on reward and motivation and therefore the lowest 19.32 per cent on compensation package.

Table 2 also shows that the very best 11.36 per cent employees are highly satisfied on working environment and therefore the lowest 2.27 percent on career growth. The study also indicates that the very best 32.95 per cent of employees are dissatisfied on compensation package followed by 31.82 percent on reward and motivation, 30.68 percent on career growth, 22.73 per cent on training and development, 13.64 per cent on management style, 11.36 percent on job design and responsibilities, 9.09 per cent on job security also as working environment and the lowest 7.95 per cent on

recruitment and selection systems. Therefore, the analysis shows that employees aren't fully satisfied on any HRM dimensions of their bank.

IV.CONCLUSION AND RECOMMENDATIONS

Bank should give various financial and non-financial benefits to employees consistent with their performance. This may make them more devoted to the work and their satisfaction will be definitely high.

a) Andhra Pradesh economy allows the importation of latest technologies to enhance HRM, but training remains a bit slowly, thus employment of expatriates to handle such remains encouraged.

b) The cooperation and coordination between management and employee should be developed because it's crucial for effective and efficient functioning of an organization.

c) Attractive compensation package should tend to the employees.

d) Management should make a transparent cut career advancement path.

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The Factors Of Employer Branding Values And Their Effect On Employee Productivity

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ABSTRACT:
Managing an employer brand is unquestionably important in this competitive labour market. Hence this study seeks to ascertain the direct and indirect effects of Employer Branding Value on Employee Productivity in the Banking Industry. There were 92 respondents in this study, and all of them were workers of private banks in the Guntur district. A descriptive quantitative methodology was used to conduct this study. The findings demonstrated that Employer Branding Value significantly affected employee productivity.
Keywords: Employer Branding Value, Employee Productivity, Banking Industry.

I. INTRODUCTION

Employer branding is a highly intricate idea. A company's culture and brand are expressed through its employer brand. Managing the awareness and impressions of employees, future employees, and relevant stakeholders with reference to a certain organisation are called employer branding. It is a planned, long-term approach. The tactic can be adjusted to support initiatives for productivity management, recruitment, and retention." (MENON, 2014)

In order to manage the company's reputation as an employer, The Author defined employer branding as the act of establishing an identity. Both customers and staff are always thinking about an organization's brand. With the intention of attracting new and present employees, employer branding is described as a strategy of internal and external communication of the distinctive features that build the identity of the company as an employer and what sets it apart

from others. (Backhaus & Tikoo, 2004) Studied that Productivity is increased by a commitment to the company and loyalty.

According to (Beck, 2008), It is most important for retaining personnel, increasing their productivity, and strengthening their ties to the company they work for. The phrase "Employer of Choice" refers to a candidate's positive selection of an Employer during a difficult selection and decision-making process. It also refers to a candidate's differentiation from

competitors and emotionalization of the employer brand, which will increase candidate loyalty to the employer brand.

II. RESEARCH METHODOLOGY

Employer branding value is an organization's attempt to market a clear understanding of what makes it unique and appealing as an employer. In this regard, a well-structured questionnaire was used as the main instrument for data collection. Respondents

Were asked to respond to the statements using a five-point scale where 1 represents strongly disagree and 5 represents strongly agree. There were 92 respondents in this study, and a descriptive quantitative methodology was used to conduct this study. The study focuses mostly on the employer branding value processes, particularly in the private banking sector in the Guntur district.

III. OBJECTIVES

To know how Employer Branding Values affect Employee Productivity in the private banking sector.

IV. REVIEW OF LITERATURE

The author (Matin, 2012) showed that psychological pressure and work stress had a direct impact on the development of behavioural problems. To increase productivity and job satisfaction in the workplace, managers must ensure that staff members are in good physical and mental health, are in decent working conditions, and have access to strong organizational strategy, organizational structure, and work environment amenities that indirectly effects Employer Branding Value.

The author (M., 2014), looked at how an employee's job affects their interests and plays a significant role in their lives. Because of the heavy workload, lofty goals, lack of job satisfaction, pressure to meet the goal, lengthy workdays, and demanding schedules, employees are under a lot of stress in their jobs. Job stress has an impact on the productivity and operation of businesses. Productivity and stress levels are inversely correlated. Therefore, management

should be concerned about the physical and mental health of employees in order to achieve maximum profit, which creates Employer Branding Value.

According to the Author (Prakash Singh, 2015), a badly implemented performance management system does have an

impact on employee job behaviour and performance (PMS). With the help of the PMS they have deployed, managers make sure that employees' outputs are in line with corporate goals, which creates Employer Branding Value. When employees are dissatisfied with their jobs, it has a detrimental effect on their self-esteem, level of productivity, and production. Poor PMS makes it difficult for a firm to motivate its people. If an employee's expectations aren't satisfied, poor job behaviour and performance can prevent the firm from reaching its goals.

According to the Author (Roberto Luna-Arocas, 2015), job satisfaction, performance, and talent thinking proficiency are all correlated. Talent Mind-set ability is comprised of the following elements:
a.   Value and objective position with the organisation,
b.   Manager's Talent Mentality at work,
c.   Talent Importance in everyday behaviours,
d.   Independence with Talent, and
e.   Progress of Talent in an organisation.
The results from a series of path studies on a data set of 92 employees from the public and commercial sectors indicate that Talent Management Techniques have an impact on job performance, but through job satisfaction, which serves as an intermediary. Therefore, it is not assumed, that job contentment must be practised as a key essential contributor to job performance. Instead, it is assumed that if we institutionalise and grow an inclusive Talent System, this will have an impact on both job satisfaction and performance, which also creates Employer Branding Value.

V. DATA ANALYSIS AND INTERPRETATION
5.1.   Demographic Characteristics Of Bank Employees:

Demographic factors		frequency	percentage
Gender	male	52	0.57
	female	40	0.43
	total	**92**	1.00
Marital status	married	54	0.59
	unmarried	38	0.41
	total	**92**	1.00
Age	20-25 years	39	0.42
	25-30 years	48	0.52
	> 30 years	15	0.16
	total	**92**	1.00
Qualification	B.Com	12	0.13
	B.B.A	36	0.39
	B.C.A	6	0.07
	M.Com	12	0.13
	M.B.A	20	0.22
	M.C.A	4	0.04
	others	2	0.02
	total	**92**	1.00
Work	0-2 years	22	0.24

experience	2-5 years	38	0.41
	5-10 years	20	0.22
	> 10 years	12	0.13
	total	**92**	1.00
Designation	internal auditor	4	0.04
	data processing officer	20	0.22
	bank manager	6	0.07
	loan officer	10	0.11
	bank teller	14	0.15
	marketing representative	36	0.39
	others	2	0.02
total	**92**	1.00	

INTERPRETATION: Employees of Guntur's private banks served as the study's target population. A total of 92 respondents have been contacted for the data collection, of which 40 are women and 52 men. More than 50% of the responders are plainly married, according to the data. Over half of the respondents (50%) are between the ages of 25 and 30 and have between 2 and 5 years of banking industry experience, while 13% have more than 10 years of experience. The majority of respondents fall under the category of marketing representatives. The responses are taken into account while analyzing the results, and the non-probabilistic sampling methodology employed for data collecting called convinced sampling.
5.2 Factors Affecting Employer Branding

Employer Branding Value significantly affected employee

Factors affecting Employer Branding Value	1	2	3	4	5
1. Scope of work-life balance	68	12	12	0	0
2. Work environment relationship	60	14	18	0	0
3. Job safety and security	14	64	14	0	0
4. Recognition of employee potential	13	17	50	12	0
5. Moral values of managers	52	26	14	0	0
6. Transparent company policies	50	15	0	15	12
7. Continuous training and development	52	40	0	0	0
8. Organization Commitment	42	40	10	0	0
9. Scope of diversified learning	40	41	11	0	0
10. Hierarchical position	28	28	16	10	10
11. Scope of employee contribution	27	26	12	15	12
12. Flexible hours	28	28	16	10	10
13. Career growth	26	25	27	14	0
14. Emotionally connected with the job	28	12	28	10	14
15. Competitive remuneration	24	35	23	10	0
16. Challenging and interesting work	22	26	23	21	0
17. Organizational brand	11	27	22	20	12
18. Organization growth	59	23	10	0	0
19. Employee Recognition policy	10	42	30	5	5
20. Office Infrastructure	12	40	30	7	3
21. Emotionally connected with the Organization	22	20	10	25	15
22. Job transferability	31	41	20	0	0
23. Nature of job advertisement	62	22	6	2	0
24. Challenging and interesting work	70	22	0	0	0
25. Organizational brand	34	22	12	14	10
Total	**35.4**	**28.32**	**16.56**	**7.6**	**4.12**

Interpretation:

Respondents were asked to respond to the statements using a five-point scale where 1 represents strongly disagree and 5 represents strongly agree. There were 92 respondents in this study, and a descriptive quantitative methodology was used to conduct this study. The above data clearly shows that

productivity.

V. CONCLUSION

A nation, a group, an employee, and an organization all view productivity as a major concern. The efficacy and efficiency of an employee are measured by their productivity. Only an

employee who produces is able to change a loss-making organization into a profitable one. If the productivity of the workforce is valued within the company, globalisation could benefit. Low staff productivity is another result of poor control inside a business. If the causes of low employee productivity are consciously managed, a number of advantages can be realised, including increased customer interest and satisfaction, improved competitiveness, improved job satisfaction, a strong sense of accountability, higher levels of morale and happiness, and a strong sense of belonging. The findings demonstrated that Employer Branding Value significantly affected employee productivity. Future studies can focus on branding in highly professional businesses. Other industries can also conduct this kind of research.

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A Perspective Study on the Impact of Business Analytics in Innovations

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Abstract-Innovation prospects for enterprises have never been greater because to developments in Big Data and Business Analytics. Businesses can create new goods and services or enhance current ones thanks to the fresh insights provided by Business Analytics. The method through which business analytics support a firm's innovation success has however, received little attention from research. To close this gap, this study is being conducted. A research model is put out and empirically confirmed with data gathered from a survey of Indian firms from the standpoint of information processing and usage. The results of the survey give evidence in favour of the research methodology, which offers a focused and verified perspective on the role of business analytics in innovation. The most important findings indicate that business analytics immediately enhances environmental scanning, which in turn helps to increase a company's innovation in terms of new product uniqueness and significance. The firm's data-driven culture will play a key role in mediating how business analytics will affect the organisation, increasing its impact. The originality of new products is directly impacted by data-driven culture, while environmental scanning indirectly influences the product's significance. Furthermore, the results support the idea that environmental scanning directly adds to the originality and significance of new products, both of which strengthen competitive advantage. The outcomes of the model testing also show that a variety of additional elements, which should be taken into consideration in addition to the business analytics applications, might affect the success of innovations.

Key words: Innovation, Analytics, Big data, Data-driven culture.

I. INTRODUCTION:

The process of translating data into insights to better company choices is known as business analytics. Some of the methods used to generate insights from data include data management, data visualisation, predictive modelling, data mining, forecasting simulation, and optimization.

Due to the rate of technical innovation and globalisation, businesses are experiencing increased rivalry and volatility in their markets. Because of this, businesses are under additional pressure to match the market's growing desire for creative and customised solutions. Information technology now plays a crucial role in all facets of innovation, even though innovation has become the dominant competitive landscape characteristic (Aleksic, 2019) in most sectors and effective innovation is essential for company survival. In the recent years, the "big data" space has emerged as the newest frontier in the vast array of IT-enabled breakthroughs and possibilities made possible by the information revolution. Businesses have created inventive

methods to intelligently gather data from both internal and external sources because of advancements in new digital technology. To use the data effectively for innovation and economic advantage, however, presents unprecedented problems due to the proliferation of data. Companies are investing more in business analytics to transform large data into significant commercial value. They are also keen to comprehend the potential effects of business analytics on their innovation and company success. (Ajah, 2019)

There are several circumstances in which the phrase "business analytics" has been employed, but there doesn't appear to be a consensus on what it exactly means. Business analytics is described as "the comprehensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to guide choices and actions" (Bag, 2016). Business analytics may be defined as the methods and procedures used to analyse data to provide knowledge and information that can be used to obtain a competitive edge. (Bendoly, 2009)

The distinction between conventional and new business analytics is necessary because of the difficulties and opportunities presented by big data, even though the notion of business analytics has been around for many years. Based on the evolution of business analytics, it is possible that business analytics has progressed from analytics 1.0, the era of "business intelligence," to analytics 2.0, the era of big data, and eventually towards analytics 3.0" when the emphasis shifts to building analytical capability into client goods and services," (Vetrivel, 2016) the era of data-enriched offerings. According to Davenport's theory of evolution, this study focuses on the usage and effects of analytics 2.0 and 3.0. (Asamoah, 2013)

Even though business analytics are being utilised by enterprises more and more, no empirical research has been done to determine how business analytics affects innovation. The ways in which corporate analytics might promote innovation are poorly understood. Despite a compelling argument that business analytics might boost innovation by leveraging big data to differentiate goods and services, there is no conceptual framework or empirical support for the association between business analytics and innovation. The inability of businesses to fully realise the advantages from their investments in business analytics is a natural consequence of the lack of such awareness. (Gillon, 2014) It should come as no surprise that many companies are still having trouble determining how, when, and where to employ business analytics to provide a reasonable return.

Realizing the intended results, such as innovation, remains unknown until the processes underpinning business analytics and their contributions to company performance are well understood. (Ajah, 2019) Therefore, it is crucial to ascertain whether, how, and the degree to which business analytics helps to innovation.

To close this research gap, the study proposes and validates a model to explain the connections between business analytics, data-driven culture, environmental scanning, new product/service innovation and meaningfulness, and competitive advantage. (Bag, 2016) This study offers numerous hypotheses that are combined into a research model to explain how business analytics, in conjunction with a data-driven culture and environmental scanning, promotes the development of new products, which in turn results in competitive advantage.

II.   THEORETICAL BACKGROUND

The purpose of this study is to investigate the contributions of business analytics to innovation from the standpoint of information processing and utilisation. As a result, i draw on significant ideas and findings in these fields. (Aleksic, 2019)

According to the perspective on information processing that is supported by contingency theory, the main responsibility of organisations is to manage uncertainty by implementing information processing mechanisms, such as managing task complexity and the rate of environmental change. (Bendoly, 2009) According to the perspective on information processing, it's critical to match information processing requirements with information processing capabilities since the amount of information that must be processed increases with job uncertainty. As a result, organisations ought to be built to make it easier for information to be processed, allowing decision-makers to analyse more data and gain a competitive edge. (Chan, 2006)

Scholars contend that the information offered by information systems is a crucial resource for firms looking to acquire a competitive edge and foster innovation. Recent research that stated "knowledge has become the fourth production element and important to competitive differentiation" supports this point of view. (Davenport, 2007). The importance of information, information usage, and information management in businesses has been highlighted in several studies. Glazer, for instance, makes the case from the standpoint of marketing that companies must go beyond technology and concentrate on information management to achieve a competitive edge. empirically investigate how companies' usage of various forms of enterprise information affects their strategic success in terms of operational excellence, customer intimacy, and product leadership. Point out that information is crucial in reducing management ambiguity when analysing the performance of high-tech service innovation from a decision-making standpoint. They contend that the perspective on information processing works well as a

framework. They discover that knowledge collection, dissemination, and usage all increase the chances that a service innovation will be successful. In their study on innovation in conservative and entrepreneurial organisations make the case that a firm's information processing capabilities has an impact on innovation.

The information processing and use perspective is helpful in the context of innovation because it helps us to concentrate on the important information factors, such as: business analytics applications that show an organization's information processing capabilities, data driven culture, and environmental scanning that are connected to the information use in the organisation. Studying the relationship between business analytics and innovation from the information processing and use perceptive deems to be a plausible direction because the core purpose of business analytics is to transform the enormous amount of raw data into meaningful information, but it doesn't appear that any such attempt has been reported in the literature.

III.   HYPOTHESIS DEVELOPMENT

Innovation performance

The multifaceted nature of innovation success makes it impossible for anyone innovation assessment to adequately capture it. A few studies have looked at perceived performance in comparison to rival research, while others have utilised more objective metrics like the quantity of patterns created, etc. to assess the overall performance of innovation. In the context of our research, the primary issue of our interest is how businesses may utilise business analytics to obtain increased insights and intelligence from data and then use those insights and intelligence to build new products/services or improve the ones they already have. The success of a product, according to Cooper (1979), is the result of two processes: the ability to effectively produce new goods and the gathering of knowledge. Environmental scanning is used to gather information for their study, and innovativeness measures how well they understand the new product creation process.

the pertinent literature and use a two-dimensional approach on product creativity that is made up of novelty and meaningfulness in their investigation of the effects of different knowledge kinds and strategic orientation on the innovation and competitiveness of new products. According to their definitions, (Higgins, 2002) the novelty of a new product is determined by how original and distinctive it is, while its usefulness is determined by how well it meets the needs of its intended market.

A detailed assessment of the literature is conducted on the components of new product invention by Stock and Zacharias (2013). They discover that both product innovation and significance have been frequently employed. In the present study, i adopt new product/service novelty and meaningfulness as in the innovation studies by van riel (2004) and stock and zacharias (2013). The next section

provides an explanation of the specific novelty and meaningfulness assessment items. In the article, the phrase "new products" refers to both new goods and services.

Business analytics and innovation

Data-survey firms are allegedly adopting analytics to innovate and to achieve a competitive edge more and more, according to a recent paper titled "Innovating with Analytics" that was published in the mit sloan management review. (Krasavac, 2019) Business analytics seems to have been acclaimed as an efficient way for companies to obtain deeper insights and knowledge from several data types to find hidden patterns, unseen connections, and other relevant information in the age of digitalization and big data. With the use of this knowledge, firms may get a competitive edge over their competitors and enjoy commercial advantages including the development of new goods and services. (Rothleder, 2002)

The goal of business analytics, which is based on statistics, prediction, data mining, and modelling approaches, is to provide new insights and understandings of company performance through data. Software developers and IT firms are promoting business analytics applications and stating that big data and analytics can provide a variety of business benefits, such as: increasing information transparency, creating more precisely tailored goods or services, creating the next generation of goods and services, etc. (Gillon, 2014) For instance, it is asserted that business analytics combined with big data promotes competitive difference and large innovation. The success of a corporation depends increasingly on innovation.

Information technology has, in most enterprises, served as a catalyst for innovation and is an essential tool for the twenty-first century. (Sharda, 2013) Businesses should turn extensive information into business because business analytics can transform enormous amounts of raw data into usable information. Innovation in goods and services using fresh information and insights is one approach to do this. I hypothesise that business analytics will improve the company's innovation through a variety of organisational characteristics that are explored in the following sections, drawing on earlier research on innovation success from the standpoint of information processing and usage.

Business analysis, Data-driven culture and new product novelty and meaningfulness

Innovation is not a solitary endeavour; it requires participation and communication with people both inside and outside of the company to gather the ideas and materials required for its growth.

Prior studies have emphasised that to use business analytics to obtain a competitive edge, a firm must create a data-driven culture where management choices are more heavily influenced by data-based insights. A data-driven culture is defined as "a pattern of behaviors and activities by a group of individuals who share a view that having,

comprehending, and utilising specific kinds of data and information plays a significant part in the success of their business." This basically implies that clear organisational goals, policies, and procedures must be formed to direct business analytics operations, and that clear organisational structure and business processes must be in place to allow for the coordination of business analytics activities.

As a result, I suggest:

H1: A data-driven culture benefits from business analytics.

Norms and values establish "what is important around here" and "how i do things around here," and organisational culture is the pattern of shared values, norms, and practises that set one company apart from another. Over the last several decades, there has been a lot of research on the connection between organisational culture and innovation, and its significance for this process has been thoroughly examined. According to Lau and Ngo, a certain culture is required to bring about changes in companies and promote creative and entrepreneurial behaviour. Data driven culture, which was previously described, is one specific facet of organisational culture that I concentrate on in the context of big data and business analytics from the standpoint of information processing and utilisation. (Vetrivel, 2016)

As a result, it is expected that new product originality would benefit from H2a-data-driven culture.

The significance of new goods is positively impacted by the H2b - data-driven culture. (Sharda, 2013)

Environmental scanning, business analytics, and innovative product development originality and significance

Any organization's fundamental procedure for gathering information from the outside world for use in issue characterization and decision-making is called environmental scanning. Environmental scanning's main objective is to offer a thorough knowledge of the state of the many environmental constituents—both now and in the future and to utilise this information as a guide for developing new products and services. Environmental scanning describes the efforts a company engages in to learn more about its surroundings. As a result, information processing and utilisation contribute to insights into a firm's changing environment, particularly the need for innovation, which may be brought on by shifting customer preferences, shifting consumer behaviour, or emerging rivals. (Kenny, 2006)

As a result, i suggest:

H3: Environmental scanning benefits directly and positively from business analytics.

I employ a mediation approach and construct our hypotheses based on the premise that information technology can play a significant role in determining organisational strategy, culture, processes, and/or structure regarding how business analytics should be integrated with

a data-driven culture to affect environmental scanning. (Mcguire, 2012) I hope to get a better understanding of the mechanism by which business analytics could influence innovation by examining whether a data-driven culture might mediate the interaction between environmental scanning and business analytics. The following is what i have created as a result:

H4: The use of a data-driven culture, business analytics has a favorable and indirect impact on environmental scanning.

According to Keller, Holland, and Tushman, a firm's ingenuity is primarily constrained by its capacity to use environmental scanning to identify the requirements and needs of its external environment. According to research by baker et al., for instance, 75% of innovation ideas were motivated by perceived market demands. One of the key

factors in their analysis of innovation in both conservative and entrepreneurial organisations included environmental scanning. I suggest the following links since previous innovation studies have demonstrated the benefits of environmental scanning for new product invention and competitive advantages:

H5a - environmental scanning is beneficial to the uniqueness of new items.

H5b - Environmental scanning improves the significance of new items.

The novelty of a new product is positively correlated with competitive advantage (H6a).

H6b - The significance of a new product is positively correlated with competitive advantage. (Miller, 1982)

RESEARCH MODEL

Several constructs and the corresponding measurements have been identified to test the theoretical concept. I have created new constructs and measures for business analytics by drawing from the literature in the field of business analytics because this burgeoning business analytics is a new study topic and there aren't many empirically verified measurement items. (Mikalef, 2019) The idea of analytics, which has its roots in the ongoing development of tools to support decision-making, has been around for a while, but our attention is on the more recent applications of business analytics combined with big data, or analytics 2.0/3.0. (Krogstie, 2019) Business analytics, often known as analytics, is the "in-depth use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to guide choices and action" or "the development of information and intelligence to support strategic objectives." (Mcguire, 2012) Business analytics has been used in the field as a catch-all phrase for a variety of business applications of analytical techniques and procedures. I categorise business analytics into three categories: descriptive analytics, predictive analytics, and prescriptive analytics as i describe business analytics as the

procedures and methods of data analysis for the creation of knowledge and intelligence. (Gillon, 2014)

Descriptive analytics employs tools like business intelligence and data mining, for instance, to answer questions about what has happened and what is happening by providing context and trending information on previous or present occurrences. Prescriptive analytics, on the other hand, makes recommendations for one or more courses of action and illustrates the likely results of each choice, answering the question of what i should do. Predictive analytics uses statistical models and forecasts to provide an accurate projection of the future happenings and the reasoning as to why. (Perrow, 1967)

Business analytics solutions that demonstrate a firm's capacity to analyse multiple forms of data to identify hidden patterns and trends for descriptive, prescriptive, and predictive purposes can showcase information processing skills. According to our conceptual definition of business analytics, (Krogstie, 2019) the construct entity is the organisation represented by its decision-makers; the general property is data analysis techniques and processes; the

conceptual theme is characterised by systematic data analysis for identifying valuable business insights; its dimensions include descriptive analytics, predictive analytics, and prescriptive analytics; and it is expected to be broadly applicable across diachronic contexts. (Nichols, 2013)

Another new concept that must be articulated is data-driven culture. used data-oriented or fact-based culture to mean "data and information were part of the intrinsic value system" that "values data-based decision making," while right culture meant "a companywide respect for measuring, testing, and evaluating quantitative evidence" and defined data-oriented culture as (Rana, 2014)"a pattern of behaviors and practises by a group of people who share a belief that having, understanding, and using certain kinds of data and information play a role". Several additional studies have adopted this or a similar idea of a data-driven culture. Other notions, such as new product originality and meaningfulness, as well as environmental scanning, are adapted from innovation literature to the current study setting and experimentally confirmed by earlier investigations. (Sable, 2020).

I assess competitive advantages based on the manager's view of whether his or her firm has been more profitable, has increased sales and market share faster, and has had a higher return on investment than its significant competitors. Prior research frequently employed these subjective metrics. (Rao, 2013)

Business Analytics
Indicators
How much your business uses each of the following types of business analytics:
• Badesc: descriptive analytics give context and trends for past or present events.
• Bapred: predictive analytics accurately predict future events and explain why.
• Bapres: prescriptive analytics suggest one or more actions and illustrate the likely results of each choice.

Data Driven Culture
Indicators
The degree to which you agree or disagree with the following statements about your company's culture:
• Ddcbeli: i believe that having, understanding, and using data and information is critical.
• Ddcopen: i are open to new ideas and approaches that challenge current practises based on new information.
• Ddcdep: i rely on data-based insights to support decision making; and

IV. CONCLUSION

The study seeks to comprehend the methods through which business analytics leads to innovation in terms of information processing and utilisation. Several researchers tested a study methodology to assess the impact of business analytics. A large body of empirical evidence supports the suggested hypothesis. Except for the influence of data-driven culture on new product meaningfulness, most of the research hypotheses are validated. The research' major findings indicate that business analytics immediately

• Ddcuse: i use data-based insights to create new services or products. (Mcguire, 2012)

Environmental Scanning
Indicators
How much of the following activities were carried out in the previous five years to gather information about its environment:
Esrou: routine client opinion gathering.
Esspe: specialised market research studies.
Escom: explicit competitor tracking.
Esfor: forecasting sales, customer preferences, technology, etc. (Miller, 1982)

New product/service novelty
Indicators
Please rate the following claims regarding your company's product/service innovation during the previous five years on a scale of 1 to 7:
Npnrd: 7- there had been a strong emphasis on research and development, technical leadership, and innovation. 1- there had been a strong emphasis on the marketing of tried-and-true products and services.
1- Npndra: 1: Most product/service modifications were of a small nature. 7: Product/service changes.
Had primarily dramatic in nature
Npnman: One was that i had not promoted any new product or service lines, and seven was that i had promoted numerous new product or service lines. (Mikalef, 2019)

New product/service meaningfulness
Indicators
The new goods or services i provided in the last five years were superior to those of our main rivals because they were:
• Npmrel: relevant to consumers' wants and expectations
• Npmuse: beneficial to clients.
Npmsui deemed appropriate for meeting consumer requirements and expectations. (Sharda, 2013)

Competitive Advantage
Indicators
The degree to which you agree or disagree with the following statements about your company's performance over the last five years:
• Capro: i are more profitable than our key competitors
• Casal: our sales increased faster than our key competitors
• Camar: our market share increased faster than our key competitors

• Caroi: i had a better return on investment than our key competitors

(Sable,2020)

enhances environmental scanning, which in turn helps to increase the company's innovation in terms of new product uniqueness and meaningfulness. However, the impact of business analytics would be substantially enhanced by the mediation function of data-driven culture in the enterprise. Business analytics have a big impact on the data-driven culture, which has an impact on the innovation and significance of new products. It is interesting that a data-driven culture correlates with "novelty" in new products but not with significance. In other words, while the data-driven culture has sped up the development of new products, it

hasn't helped businesses produce goods that better meet the needs of their customers, even though statistically speaking, the data-driven culture indirectly influences product significance through environmental scanning. Additionally, it should be mentioned that business analytics, rather than the data-driven culture, improves environmental scanning, which results in new products that are more significant. The results show that environmental scanning directly contributes to the uniqueness and significance of new products, which in turn strengthen competitive advantage. The findings of the model testing also show that there are several other elements that need be taken into consideration in addition to the business analytics software to increase innovation success.

V. SUGGESTIONS

Many factors contribute to a firm's innovation success. Knowledge and information have long been regarded as the key ingredient and catalyst for successful innovation. With the widening availability of data and increasing use of analytics, companies are now expected to harness the data with analytics to gain new insights and knowledge to improve innovation. Therefore, there is an emerging need to establish if, how and to what extent business analytics contributes to innovation and competitive advantage.

The most significant findings unequivocally show the significance of culture more particularly, a data-driven culture in supporting the effect of business analytics. Organizations should foster a data driven culture in order to maximise the commercial value of business analytics in light of the development of big data and the accessibility of business analytics tools and approaches. Installing business analytics technologies in a corporation would not, however, be sufficient to boost innovation or provide new insights and information on its own.

The claims are unsupported by any theoretical understanding or empirical data. By tying business analytics to innovation, our study aimed to close a research gap. More study is needed to understand how to develop and maintain a data driven culture in businesses given the mediating role of data driven culture in supporting business analytics influence on innovation. It's possible that using business analytics alone won't have a significant impact on how well a company innovates. An integrated and coherent business strategy and approach should always be taken into consideration for the success of innovation because other factors must also be considered.

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ICMBA05

A Study On Customer Satisfaction Of Furniture And Fittings Products Special Reference With Prakasam District

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ABSTRACT: Furniture are considered as movable assets and it is devised for the purpose to support various activities of the people. The purpose for the usage of the furniture is as follows; ie, chairs for seating, tables for eating and beds for sleeping etc. It also includes desks, cupboards and benches etc. The usage of furniture starts from home and find its place everywhere including offices, industries, commercial space like banks, malls etc. Earlier furniture are non-branded products. But nowadays people are looking for branded items. So we can understand people's desire for quality furniture. Wood and steel furniture are finding their space everywhere and those who are looking for low price furniture are met with PVC furniture. Based on the requirement of the furniture by the consumers more companies are entering into the market of furniture with specific brands along with the factors such as price, style, colour, comfort and durability etc and they attract the customers through various advertisements. So it tends the customers to go for a particular brand. This study indicates that, most of the customer were satisfied towards branded furniture.

KEYWORDS: Furniture, Manufacturing, Marketing, Consumer behaviour towards the furniture

I.INTRODUCTION

As You Know, Furniture Is Important to People Because It Is Designed to Do Various activities Such As Sitting, Eating And Sleeping. Consumers Play An Important Role In Finding, Buying, Using, And Evaluating Different Types Of Furniture Through Their Choices, Tastes And Preferences. Consumers' Attitude Toward Furniture Has Positive Aspects Such As Brand, Quality, Durability, Style, Color, Price, And Convenience, And Payment Methods And Discounts When Purchasing Furniture Directly From Furniture Stores Are Also Attracting Consumers. Satisfied. Consumers Are Happy With The Purchase Of Wooden Furniture Such As Plywood, Teak, And Rosewood, And It Has Been Shown To Make Their Homes, Offices And Other Places More Beautiful. As Our Needs And Living Conditions Change, So Do Our Furniture.

The Purpose Of This Study Is To Learn Furniture And Consumer Behavior Related To Furniture. Analysis of Customer Satisfaction For Furniture And Interior

a) Limitations of Weighted Average Studies.

II.REVIEW AND LITERATURE

Chen Et Al. (2016) A Mixture Of Modern Furniture Planning And Hui Architecture Incorporates The Traditional Social Constructs Of Certain Architectures Into Some Of The Shapes, Surfaces, And Developments Of Furniture Design. The Smooth And Adaptable Plan Is Introduced By The Hui-Style Colby Step Sofa Backrest And The Jiangnan-

Items. Research Purpose) Marketing Mix Analysis of Furniture Industry.

Understand Consumer Behavior With Respect To Furniture And Interior Items. Information on Study Design Was Collected From both Primary and Secondary Sources. Primary Data Were Collected Using Structured Questionnaires Completed By Respondents. Secondary Data Sources Include Websites, Journals, And Research Articles. A Quick Sample was taken for a Sample Design Study. The Sample Consisted Of Consumers Who Purchased Furniture Industry Products. The Sample Size Is 135 People. Data Collection Methods Survey Methods Are used To Collect Data from Respondents.

III.DATA SOURCES

This Study Uses both Primary and Secondary Data. Primary Data Were Collected from Respondents Using Questionnaires, And Secondary Data Were collected From Articles, Books, Magazines, and And Newspapers. Tools Used In the Study for the Purposes of the Study, The Following Tools Were Used.

a) Simple Percentage Analysis.

b) Chi-Square Test

c) Average Rank Analysis

In The Consumer Decision Process, The Consumer Goes Through Five Stages For Each Purchase. However, Consumers Often Reverse Or Skip Some Of These Steps When

IV.CONSUMER DECISION PROCESS

Making A Recurring Purchase. Understanding These Stages Can Help Companies Understand Why People Buy Products And Services And Why They Don't. Businesses Can Also Learn What They Can Do During These Stages To Get People To Buy More Of A Particular Product Or Service.

Style Carved Windows, Which Can Be Seen As Summarizing The Progress Of Chinese Furniture And The Demands Of The Times. . Consumer Characteristics Consumer Characteristics Are Key Factors Influencing Consumer Perceptions And Re sponses To Incentives. Consumers Are Shaped To Some Extent By The Environment In Which They Live, And Consumers Continue To Influence The Environment Through Their Actions.

A) Simple Percentage Analysis

B) Rating Analysis
C) Weighted Average Analysis
D) Chi-Squire. Analysis
Simple Percentage Analysis

IV.RANKING ANALYSIS

In this method, respondents are asked to rate their choices. This method is easier and faster. In this survey, a respondent was asked to rate various factors that influenced her initial choice of medical center, and respondents were used to rank 1, 2, Her 3, 4 and 5. It doesn't matter how points are ranked. 1st place can be the highest or the lowest.

BUY WOODEN FURNITURE PURCHASE FURNITURE ON THE BASIS OF WOOD

INTERPRETATION

The above table shows the purchase furniture on the basis of wood that are ranked based on the return by the

Weighted Average $= \dfrac{\sum f(x)}{n}$

Factors Deciding Purchase Of Furniture Directly From Furniture Stores

INTERPRETATION

The above table shows the factors deciding purchase of furniture directly from furniture stores. The highest mean score is 4.044 for the price of the furniture.

Chi-Square Analysis.

Chi-square is a test of statistical significance based on frequency of occurrence. It applies to both qualitative and quantitative variables. Among its many uses, the most common are testing probabilities or hypothetical probability distributions, statistical dependence or independence, and the general population. Chi-square test is a statistical hypothesis test in which the test statistic has a Chi-square distribution if the null hypothesis is true. To find out the association between marital status

and place of purchase of respondents, Chi-Square test was used and the results are given below.

respondents. Ply wood are ranked I by the respondents. Teak wood are ranked II by the respondents. Imported wood are ranked III by the respondents. Rosewood are ranked IV by the respondents. Mahogany are ranked V by the respondents.

Weighted Average Analysis:
In this method, respondents are asked to rate their choices. This method ranks the specified items. To get the rankings of all related items, the researchers add up the weights assigned to each item. The score with the highest weight comes first. Other points are indicated accordingly.

s.no	Buy Furniture From	No Of Respondents	Percentage
1	Showroom	74	54.8%
2	Small workshop	32	23.7%
3	Road side furniture shop	19	14.1%
4	Direct from manufacturer	10	7.4%
	TOTAL	135	100

Table 1 Buying the Furniture By The Respondents

RELATIONSHP BETWEEN MARITAL STATUS AND PURCHASING PLACE OF FURNITURE
HYPOTHESIS :

There was no significant relationship between marital status and place of purchase of respondents.

CHI-SQUARE:

Factor	Calculation value	Df	Table value	Remarks
Marital status	2.304^a	3	7.82	Accepted

INTERPRETATION :
It is clear from the table above that the calculated value of chisquare at 0.05% is greater than the value in the table.
The hypothesisis therefore accepted. Therefore, there is no relationship between marital status and place of purchase.

V.RESULTS
A. SIMPLE PERCENTAGE ANALYSIS:

The Majority (54.8%) Of Respondents Made A Purchase At A Showroom.

B. RANKING ANALYSIS:

From Analyzing Furniture Purchase Ratings On The Basis Of Wood Types, We See That Plywood Is Ranked 1st, Teak Is Ranked 2nd, Imported Wood Is Ranked 3rd, Rosewood Is Ranked 4th And Mahogany Is Ranked 5th.

C. Weight Avg. Analysis: The Table Above Shows The Determinants Of Buying Furniture Directly From Furniture Stores. The Highest Average Score Was 4,044 For Furniture Prices.

D. Check Analysis: There is no significant relationship between the respondents' marital status and the place of purchase

VI.SUGGESTIONS

a) Most people research an online business before shopping in a store. That means it's more important than ever that your interior e-commerce website be attractive, optimized, and user-friendly.

b) Customer retention is essential for furniture store marketing. The cost of acquiring new customers far outweighs retaining existing customers, so it's important to keep customers engaged with your brand.

c) One of the most important keys to furniture store marketing is to define your audience and where to attract them. You need to be able to contact them instead of trying to invite them to join you as they most likely won't. Not by themselves.

VII.CONCLUSION:

This study will be beneficial for furniture manufacturing and retail companies in Ongole to understand the customer decision-making process. Customer behavior and factors influencing customer decisions. This research will help companies be more competitive in the furniture market. Once the product is manufactured according to the customer's wishes, sales will increase and eventually trigger the GDP of the country.

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First Author Photo

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ICMBA06

A Study On Marketing Strategies Of Mobile Industry In India

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Abstract: The mobile industries are the growing industries in the 20th centuries, innovation in product, new product design, improved software, better performance and feature the industries is growing continually. After China, India is the second largest market globally for smar tphones. The marketing strategies are the key element to industries to handle and achieve the target to improve sales. In 2017 around 124 million smart phones were sold which after increased more than 191 million in 2022. In this research paper we are analyzing different marketing strategies of different companies.

Keywords- Mobile, marketing strategies, marketing, strategies, quarterly analysis, Apple, Samsung, Xiaomi, Oppo, Vivo, Realme, Nokia.

I. INTRODUCTION

Marketing strategies are one of the important strategies for company to success in the market. Company can achieve its target by using proper marketing strategies. Company such as Apple use their product unique design, distinctive style and better performance to promote their product to the consumers. Nokia with a new start in 2017 they have used a nostalgic marketing strategy to launch new products. In this research paper we are analysing the marketing strategies of different mobile phone manufacturer companies.

Literature review

For apple's marketing strategy product is the main factor. To gain market share, brand values, brand awareness and brand loyalty, product is the main factor. For distinctive style and unique design of product, new techniques of marketing and for excellence in communication apple are well known. A combination of upgraded hardware, unique design, performance makes a consumer to buy the product (A).Nokia re-enters in the market in 2017. Nokia mobile phones were popular because of their navigation software, easy to make and end the call, better battery performance. After 3 decade Nokia had a nostalgic marketing strategy. Nostalgia had low effect and success rate people tend to stick with the updated technology and no one like to use old technology, But Nokia has more advantage on battery performance on heavy application use. People might be interested in purchasing the Nokia phone as a second alternative to their primary smartphones (B).

Xiaomi the new company rose with the excellent marketing strategies. The main aspects of the Xiaomi marketing's are advertising, promotion, online promotion and distribution, product, pricing and channel strategy.

The mobile industry is a very innovative; despite of all competition it is a largely innovative in terms of new

product and variety of design. Collaboration between hardware manufacturers and software developers allows industry address different market segments and attract different types of users worldwide (D).

The main focus is on the customer satisfaction, customer brand loyalty, service quality, commitment and customer retention. Brand loyalty is the most important factor so companies are working to attract customers by introducing more innovative and attractive products as to attract the customers. Consumer attitudes differ across countries toward mobile advertising. Due to advertising factor the demand of mobile is increasing in younger generation (E).

Creating, delivering, capturing and sustaining the customer value are important factors for successful marketing plan. It reveals that conclusive reads of top managers and organizational members play a very important role in strategy marketing. The suitability of marketing strategy would be strategy's impact on company's performance (F).

II. OBJECTIVES:

1. To study different types of marketing strategies of mobile industries.

2. To study marketing strategies used in India by mobile industries.

Methodology: This research paper is based on desk research, the analysis is descriptive type. We have gathered information from published papers, journals and online websites of different companies like Samsung, Apple, Counterpoint etc. we also used some published articles.

Marketing strategies

Xiaomi is the world's 4th largest smart phone maker. It designs, develops and sells smart phones, mobile apps and laptops. On August 16 2010, it developed the MIUI firmware, and released the MI1 in 2011. Its powerful configuration and attractive prices made it a sensation among mobile phone enthusiasts. It followed with M2, M3 and Redmi to be a frontrunner in the market. Xiaomi's brand influence and awareness has reached a peak in mobile industry. Its marketing strategy is highly innovative and can be comparable to Apple. Xiaomi's marketing strategy mainly focuses on six aspects: advertising strategy, promotional strategy, online promotional distribution strategy, product strategy, pricing strategy and channel strategy. Xiaomi consider Appeal point, the name and the logo provide a very friendly and easy-going appeal. Their phones always include the latest features in the market at a very affordable price as an advertising strategy. Consumer's views and attitudes: 66.67% think Xiaomi is a high-end and

low-cost smartphone, 11.9% think it is exaggerated and though looks impressive is worthless. When it came to consumers replacing their current phone with Xiaomi 80.85% was in favour of it. It used rumours and mobile phone enthusiasts' feuds to create an air of mysteriousness around the smart phone. The co-founder Lei Jun made the release very 'Apple-esque'. They held a conference in Beijing for the release. The hunger marketing tool indicates releasing with surprising price, attracting potential customers; limit supply thus creating demand exceeds supply hot sell illusion. This created a huge buzz among potential customers. They used this tool in subsequent phones releases thus creating dedicated fan base. Xiaomi created an official website creating a corporate image and frequent internet surfers browsing the page for updates. They also created a lot of promotional offers to gain more potential customers. Xiaomi adopted a flexible production to adjust production network according to the customer requirements and personalization. They also set-up offline outlets in major cities as a direct marketing strategies.

Samsung mainly uses the skimming price strategy. It releases a phone into the market with high features and USP's. Once the competitors catch up or the phone gets old it drops the price thus still keeping its phones as the frontrunner. Samsung uses promotions to pull the customers towards the product and also uses strong strategies to push the product to the consumers. They depend on promotions on festive and non-festive seasons. On the other hand, it gives many offers and discounts to trade partners to motivate them to sell their products over their competition. Samsung uses a mix of print and media advertising. They use top rated talk shows to advertise their products. They also have a partnership with FOX to advertise 30 second clips during main pay-per-view events to get maximum coverage. Samsung covers major newspapers, magazines and journals for its advertisements. They also use direct attacks as an advertising strategy mainly attacking Apple feeding the feud between enthusiasts of both the companies. Samsung was once known to be a low-quality service provider, now is considered to be one of the leading mobile companies of the world. Though it had their own booms and slumps, Samsung focused on ideas that were customer focused and innovative in order to establish a strong brand image. Samsung doesn't target any specific segment of the market but can give an image of targeting the high-end society. Vivo made sure they provided phones with high specifications within an affordable price range. They focused on providing good battery life and high built quality. By doing so Vivo created a sense of trust among its customers. They used all kinds of traditional and conventional advertising like ATL, BTL, print media, celebrity endorsements etc. They had made a 200 cr. investment in the Indian Premier League in 2016 for the promotion of its brand. They also roped in Ranveer Singh and Aamir Khan as the face of their brands. Realme 1, Realme's first smartphone product, launched in second quarter of 2018 in India. Realme never have any marketing or sales strategy they have a product-driven strategy and also they are focused on building community. While launching in India for all online major heavy brands the main contributor of sales is south followed by west. Realme established itself in Eastern and Central regions gaining the maximum of its sales. Company also has a 'low-

margin, high-volume' strategy for which company has kept its profit margin around 4% to 5%. A data shows that the company policies are helping them to improve their sales from 1% in Q2 2018 to 9% in Q2 2019 in India.

India Smartphone Shipments Market Share

Smartphones	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4	2019 Q1	2019 Q2
Xiaomi	13%	16%	22%	25%	31%	28%	27%	27%	29%	28%
Samsung	27%	23%	23%	23%	26%	28%	23%	20%	24%	25%
Vivo	12%	13%	9%	6%	6%	12%	10%	10%	12%	12%
Realme	–	–	–	–	–	1%	3%	8%	7%	9%
Oppo	10%	10%	8%	6%	6%	9%	8%	7%	7%	8%
Others	38%	38%	38%	40%	31%	22%	29%	28%	21%	18%

India Smartphone Market Share: By Quarter
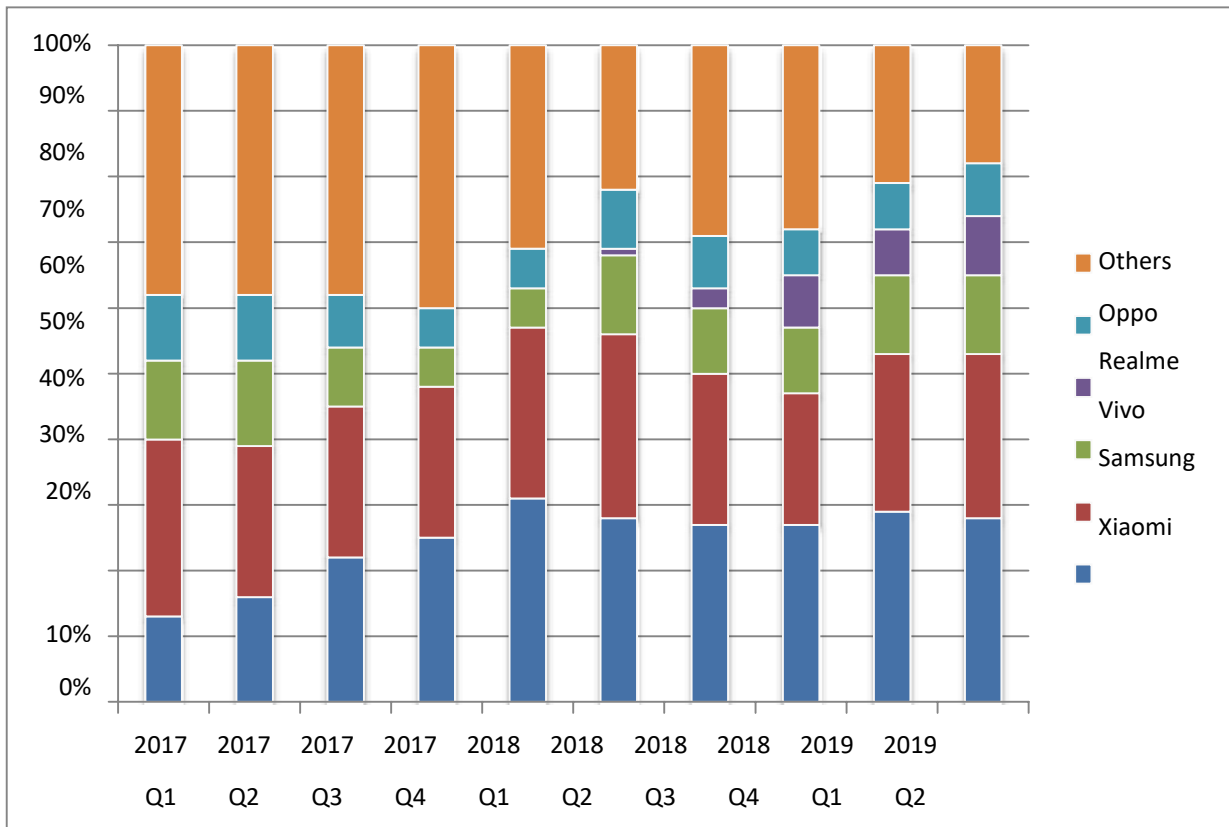
III. CONCLUSION

In mobile industries different marketing strategies are used by different company to achieve one goal and that is to increase their sales which results into increase in revenue of a company. Apple uses its product as a marketing strategy, nokia is coming up with new models but while entering into the market they have used the nostalgic marketing strategy. While realme also use the product driven strategy. Companies like Samsung mainly use the skimming price strategy. Segmentation, targeting, positioning used in marketing strategy are used by Oppo. Companies are trying to acquire more customer using different marketing strategies and while doing that they are also creating the value of their product in the market.

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Best Behavior Which Leads To A Successfully Manager

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Abstract-Organizational behavior is related to individuals, group of This paper focuses and provides and insight into the meaning, various business prospects of organization people working together in teams. The study becomes more challenging when situational factors interact. The study of organizational behavior relates to the expected behavior relates to the expected behavior of an individual in the organization. Researchers, management practitioners, psychologists, and social scientists must understand the very credentials of an individual, his background, social framework, educational update, impact of social scientists must understand the very credentials of an individual, his background, social framework, educational update, impact of social groups and other situational factors on behavior

This paper focuses and provides an insight into the meaning, various business prospects of Organization behavior, opp.
Managers play an important role in the overall success of a company. They are responsible for leading a team of employees to meet goals and achieve performance metrics. If you want to become a manager, it's helpful to understand what the job is like and a career path you can take. In this article, we explore the answer to 'What is a manager?' along with information about the various types of managers, and how to become one.

I. INTRODUCTION:

A manager's daily responsibilities may vary depending on the industry where they work. However, some common responsibilities of managers across different sectors can include leading a team, training employees, making decisions, managing conflicts, managing their department's budget, conducting performance of reviews, hiring new employees.

WHAT IS A MANAGER?

A manager is a professional who takes a leadership role in an organization and manages a team of employees. Often, managers are responsible for managing a specific department in their company. There are many types of managers, but they usually have duties like conducting performance reviews and making decisions. Managers are often the line of communication between a company's employees and its high-level executives.

8 BEHAVIORS OF THE WORLD'S BEST MANAGERS

1. Connect Company Purpose To Individual And Team Action.

Nearly every organization today is going through massive change, from regulatory changes to new competition to technological disruption. One manager in the healthcare industry explained how she leads during change:
"If everybody understands why we need to do this -- not just because our leaders say we need to do this or that -- they are more willing to make that change."

Only four in 10 U.S. employees strongly agree that the mission or purpose of their company makes them feel their job is important. This means that most employees are at least a little unsure about how their work fits into the "big picture." So, when big changes are required, many employees lack motivation. It's the manager who is ultimately responsible for making that connection.

2. *Shine A Light On The Opinions Of Others And Make Them Count.*

Change requires innovation. But how can managers inspire more innovation from their workers?
"If you know the people on your team, you know who the creative thinkers are. You have to get everyone to speak and voice their opinion."
New managers often feel like they ought to be the ones with all the answers. But asking for ideas to help solve problems and improve performance is actually a sign of manager confidence.

3. Coach Your Team In A Way That Allows For Genuine Candor.

One manager described how they developed a culture of safety at his workplace:
"Every morning we have a safety huddle. I ask, 'Has anything happened?' We created a culture where it's OK to say we messed up. Everybody knows we're a team, and we are going to work together to fix it."
Continual improvement can only be achieved through honest conversation. On a related note, great managers ask questions that lower defenses. When dealing with a low-performing employee, a manager may ask, "What's fun for you at work right now? And what's not really that fun?"

4. *Commit To One Meaningful Conversation A Week With Each Team Member.*

Most managers realize that communication matters. But how does that work when your team is mostly remote or often traveling? One sales manager described her routine:
"I speak with them over the phone if not daily, weekly. It's a very hard job we're asking our sales reps to do, so we have to make sure they are staying engaged."
Other managers agreed that they connect with team members on a daily or weekly basis. That's surprisingly rare in most workplaces. Gallup finds that only 20% of U.S. employees strongly agree that they have had a conversation with their manager in the last six months about the steps they can take to reach their goals.

5. Unlock Human Motivation By Connecting Work To A Person's Innate Tendencies.

One manager, who works in engineering, describes what he loves about being a manager:

"I really think when you get to the right spot with an individual, you find out what trips their trigger, what gets them excited -- getting the next order, beating the competition, solving a hard problem -- that lets you light the fire in them."

Exceptional managers are curious about the inner motivations of their employees because it's the key to high performance. Does your employee enjoy meeting new people? Mastering new skills? Bonding with a team? Working in the background?

To motivate your employees, figure out how to reframe projects in a way that is uniquely compelling for an employee.

6. Recognize And Reward Excellence.

One manager described what she did when she first started leading people to manage change in the workplace:

"I started as a supervisor in our billing department. A lot of people in the company did not look at them as an important aspect of the company, but they really are. I went in and showed them how important they are and the role they have in the company. And within three to four months I had employees come in my office to tell me what an impact that made."

How many employees show up to work for years and never feel like they matter? Only three in 10 U.S. employees strongly agree that in the last seven days they have received recognition or praise for doing good work.

7. Care About Your Employees As Real People.

Several managers mentioned that being successful as a manager means thinking beyond the workplace:

"You're there for them if they have a sick child or a sick parent. I think a lot of people outside of management don't realize the impact we make on their lives, dealing with all the experiences beyond the job."

Another sales manager described her vision when she started:

"I committed to my team when I started … I want to help you build the best life that you can."

Life happens. And life also impacts work performance in a huge way. For this reason, managers need to understand their employees as people with full lives. Managers should know, at an appropriate level, what's going on in an employee's life. Are they buying a house? Adopting a child? Cleaning out a flooded basement?

Ultimately, the manager's job is to get the most out of their people. But great managers find ways of adapting, adjusting and individualizing roles to fit the needs of employees. Small tweaks can make a big difference in how much an employee loves their job. And simply knowing that your manager cares about you has a strong correlation with engagement at work.

8. Make Your No. 1 Job The Development Of New Stars.

When we asked great managers what their top priorities were for the coming year, several mentioned:

- "succession planning"
- "promoting others"
- "developing other managers"
- "identifying people who can take over"

Clearly, their minds were on these questions: Who has potential for future leadership, and how do I prepare them to get there?

Bad managers focus on the past -- what can't be changed. Average managers focus on the present -- the issue at hand. But the best managers focus on the future -- what does future success look like?

Great managers see themselves as coaches, developing players to maximize their potential over the long term.

II. CONCLUSION

SUCCESSFUL MANAGERS are made, not born. They are self-made, through continuous and never-ending work on themselves. Everyone starts at the bottom and then works his or her way up through hard, hard work, sustained over a long period of time.

You can become an excellent manager when you learn and practice the behaviors, methods, and techniques of other successful managers. If you do what other successful people do, you will soon get the results that other successful people get.

The ideas and strategies contained in this book are based on more than thirty years of research and experience in large and small companies.

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Capital Budgeting & Managerial Empire Building - A Theoretical Approach

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ABSTRACT:
I inspect how a company's headquarters use an empire-building manager's report about decisionrelated private information to make capital budgeting decisions and to compensate the manager. To this end, I construct a model comprising the headquarters (principal) and the manager (agent), who reports on the investment project's expected profitability. I identify the optimal investment sizes and compensation payments, where the headquarters trade off managerial information rents – arising from empire-building benefits inducing the manager to favour overinvestment – for investment efficiency. The headquarters counteract the manager's desire for overinvestment with investment distortions in the form of underinvestment (or overinvestment) for a high (or low) expected profitability. Due to these distortions, the expected compensation is not monotone in the level of empire-building benefits. Unlike previous capital budgeting studies, in this study, I show that managerial empire-building benefits can multi-directionally affect companies' optimal capital budgeting decisions and related compensation schemes.

Keywords: Capital Budgeting, Empire Building, Compensation, Over investment, Under investment

I. INTRODUCTION:

Capital has the ability to generate value.Capital helps us to increase our financial assets in business.Actually, capital in business means financial assets held by our company that we can easily use instability in financial sector and growth in leverage.

Capital and cash are not equal. Capital is used to generate income and revenue like investments. So, Capital is stronger than cash. We can use capital to make money, that is the reason why we consider capital as an asset in our records.

Let us discuss how the capital uses in the business. Companies can use capital to invest anything to increase value for their business. "When starting out, ensure your business has adequate capital for growth."

The different types of capitals are discussed below:

Working Capital

- This capital is used to pay for day-to-day business operations
- It converts cash quickly when compared with other investments.

Debt Capital
- Capital a business earns from taking out loans and debt

Equity Capital
- This capital comes from several forms, likepublic and private equity

Trading Capital
- Amount of money available to a company for purchasing and selling assets
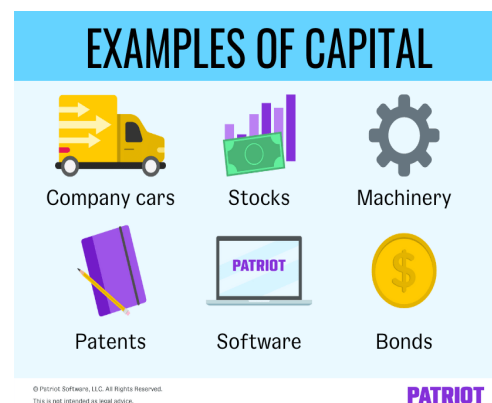
II. BUDGETING

Budgeting in business is a process of looking at a business' estimated incomes (the money that comes into the business from selling products and services) and expenditures (the money that goes out form paying expenses and bills) over a specific period in the future. It allows a business to see if they will be able to continue operating at their expected level with these projected incomes and expenditures.

A budget is often drawn up for a financial year and contains information about anticipated sales and associated business costs within that period. By using this budget a business can see how well they are expecting to perform within the year and actual performance can be monitored against this original proposed plan.

Capital Budgeting:

Capital budgeting is the process a business undertakes to evaluate potential major projects or investments. Construction of a new plan or a big investment in an outside venture are examples of projects that would require capital budgeting before they are approved or rejected.

As part of capital budgeting, a company might assess a prospective project's lifetime cash inflows and outflows to determine whether the potential returns that would be generated meet a sufficient target benchmark. The capital budgeting process is also known as investment appraisal.

III.   UNDERSTANDING CAPITAL BUDGETING

Ideally, businesses would pursue any and all projects and opportunities that enhance shareholders value and profit. However, because the amount of capital or money any business has available for new projects is limited, management uses capital budgeting techniques to determine which projects will yield the best return over an applicable period.

Furthermore, if a business has no way of measuring the effectiveness of its investment decisions, chances are the business would have little chance of surviving in the competitive marketplace.

Businesses (aside from non-profits) exist to earn profits. The capital budgeting process is a measurable way for businesses to determine the long-term economic and financial profitability of any investment project.

A capital budgeting decision is both a financial commitment and an investment. By taking on a project, the business is making a financial commitment, but it is also investing in its longer-term direction that will likely have an influence on future projects the company considers.
Importance

Different businesses use different valuation methods to either accept or reject capital budgeting projects. Although the net present value (NPV) method is the most favorable one among analysts, the internal rate of return (IRR) and payback period (PB) methods are often used as well under certain circumstances. Managers can have the most confidence in their analysis when all three approaches indicate the same course of action.

IV.   CAPITAL BUDGETING WORKING

When a firm is presented with a capital budgeting decision, one of its first tasks is to determine whether or not the project will prove to be profitable. The payback period (PB), internal rate of return (IRR) and net present value (NPV) methods are the most common approaches to project selection.

Although an ideal capital budgeting solution is such that all three metrics will indicate the same decision, these approaches will often produce contradictory results. Depending on management's preferences and selection criteria, more emphasis will be put on one approach over another. Nevertheless, there are common advantages and disadvantages associated with these widely used valuation methods.

V.   MANAGERIAL EMPIRE BUILDING

Implementation of profitable investment projects is crucial to a company's success, and the investment scale is considerable. This significance makes capital budgeting a substantive managerial task. Informational asymmetries and agency problems associated with the management are pervasive and important factors that can influence the investment efficiency. Agency problems are often caused by empire-building benefits.[1] For example, by emphasizing that empire-building benefits lead to excess investment and output, Jensen claims that 'Managers have incentives to cause their firms to grow beyond the optimal size. Growth increases managers' power by increasing the resources under their control'.

To steer managers' behaviour, companies can use performance-based compensation. The G20/OECD principles of corporate governance particularly consider as performance-based on managerial compensation in a good corporate governance practice. As we demonstrated in survey evidence by Libby and Lindsay and Shastri and Stout, companies often connect budgeting with performance evaluations and, thus, managerial compensation.

While empirical evidence shows that managerial empire-building exerts a significant impact on internal decision-making, its impact on capital budgeting in relation to compensation schemes remains largely unexplored. This omission restricts scholars' understanding of how companies incorporate managerial empire-building benefits in their investment and compensation decisions. I examine how a company's headquarters use an empire-building manager's report about decision-relevant private information to make capital budgeting decisions and compensate to the manager.

Owing to empire-building benefits and private information, I show that the manager can obtain information rents. By distorting the investment sizes, the headquarters curb the information rents and, thus, the expected compensation, so that the headquarters trade off the information rents for investment efficiency. The

extent of the distortions depends on whether the level of the empire-building benefits is in one of three ranges – low, medium or high.

Impact of the Contribution Margin m on the Ranges of Low, Medium, and High Empire-BuildingBenefits.Values: $\tau H=0.7\tau H=0.7$, $\tau M=0.5\tau M=0.5$, $\tau L=0.4\tau L=0.4$, $p1=0.25p1=0.25$, $p2=0.5p2=0.5$, and $m\in[100,165]m\in[100,165]$.
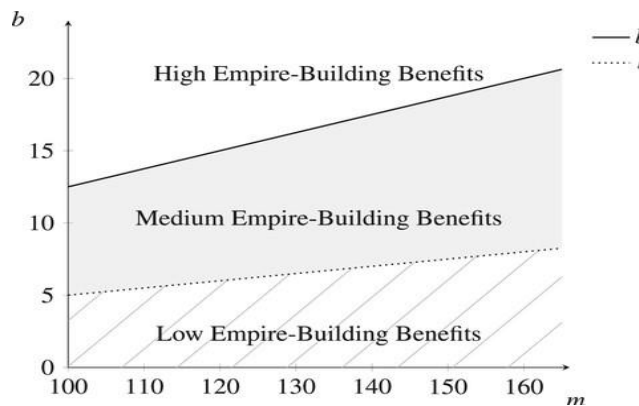
VI. CONCLUSION

Budget in capital investment process generally helps the company in taking two types of decisions: Investment decisions and financing decisions. When we don't have proper planning regarding the project development, there is always the risk of the sudden cost increase, delay in the development of the project, regulatory complications, etc. Thus, every company should have the proper capital budgeting processes taken place well in advance before initiating any large investment capital project. Apart from the above risks, the budgeting processes helps to evaluate the growth and project profitability. This can also help to compare the profits in different projects to be carried out by the company and in prioritization of one project over the other. Also, the company will come under safe conditions in terms of the regulatory requirements which results in the boost up of the various shareholders' investment in thecompany.

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Customer Perception towards Service Quality in Indian Telecommunication Industry With Reference To Prakasam District

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Abstract: Customers are the hearts of any industry. Telecommunication being a service oriented industry always puts priority to find ways of making customers happy and satisfied. Sensing this importance, this study was conducted to determine what makes customers perception towards service quality of Telecommunication Industry. Researchers confined the study within Ongole in Andhra Pradesh. A structured questionnaire developed based on previous works was distributed among 100 customers who were selected conveniently
for the study. A customer perception model was developed including variables taken from the extensive review of previous literature. Those variables are responsiveness, reliability, assurance, tangibility, empathy, perceived network quality. Model was tested using SPSS, statistical software package, and found personal and market factor, perceived quality, perceived value and company image statistically significant.

Keywords: Telecommunication Industry, Customer perception, service quality for the study. A customer perception model was developed including variables taken from the extensive review of previous literature.

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I.INTRODUCTION

This is the age of globalization, the age of competition. Businesses here are fighting for survival as well as success. In this struggle for survival, today's companies put their customers before their shareholders. Moreover, satisfying existing customers and keeping the company long-lasting was much more difficult than attracting new ones. On the other hand, competition is not the same in all industries. Few industries have faced such fierce global competition in recent years as the telecommunication industry. Although more and more people use telecommunications services in different ways every day, the number of service providers is also increasing, presenting innovative ideas that further increase competition (Malik et al., 2012). Currently, the telecommunications industry plays a very important role in emerging markets and developing countries

(Arokiasamy & Abdullah, 2013). India is a very lucrative market for telecom operators. India's telecommunications industry is the 5th fastest growing industry in the world with 110.01 million connections. The subscriber base grew 40% in 2013 and reached an estimated 250 million in 2016. They use their mobile phones for a variety of value-added services, such as messaging, video calling, entertainment, and financial services, rather than just making phone calls. services, medical services, e-commerce and web browsing. . The telecommunications industry has a significant impact on India's growth prospects and the government is also driving the industry expansion. For Indians today, mobile communication is a necessity, not a luxury. As a result, it has been very difficult for operators in this industry to attract and retain customers, but it has been very difficult for the opportunity. Indian Telecommunications Industry General Information. As of 31 August 2016, India's telecommunications network had 1.53 billion subscribers and ranks second in the world in terms of number of phone users (both landline and mobile). This is the ranking. It has one of the lowest call rates in the world, which is made possible by the huge operators and the fierce competition between them. India has the second largest number of Internet users in the world. As of March 31, 2016, the number of domestic Internet subscribers was 34.265 million. The main segments of the Indian telecom industry are domestic telephony, internet and television, digital telephone exchanges, mobile switching centers, media gateways and key signaling gateways. They are interconnected by various transmission systems using fiber optic or microwave networks. The access networks that connect subscribers to the core vary widely, with a variety of copper, fiber and wireless technologies. A relatively new transmission technology, DTH is becoming very popular in the television sector. The introduction of private FM has increased broadcasting in India. Indian telecommunications companies have benefited greatly from India's INSAT system, one of the world's largest domestic satellite systems. India has a variety of communication systems that connect the whole of India via telephone, internet, radio, television and satellite communications.
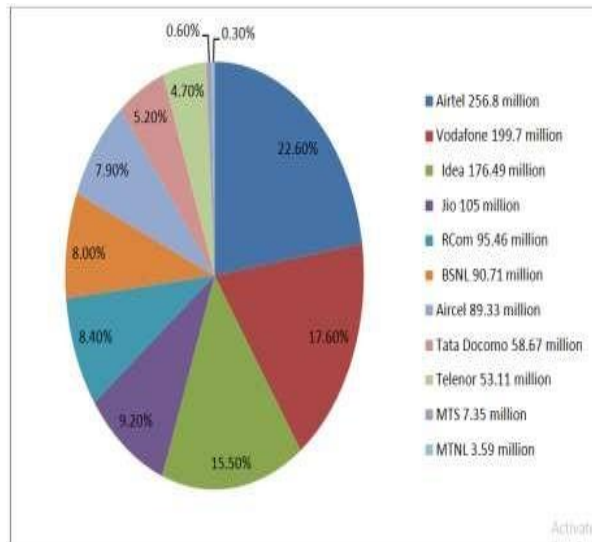
METHODOLOGY

	Frequency	Percent	Valid Percent	CumulativePercent
Reliance Jio	8	7.9	7.9	7.9
Idea	3	3.0	3.0	10.9
Vodafone	24	23.8	23.8	34.7
BPL Mobile	2	2.0	2.0	36.6
Valid Tata Indicom	9	8.9	8.9	45.5
Airtel	21	20.8	20.8	66.3
Aircel	25	24.8	24.8	91.1
Bsnl	9	8.9	8.9	100.0
Total	101	100.0	100.0	

	Frequency	Percent	Valid Percen	Cumulative Percent
Postpaid	27	26.7	26.7	26.7
Valid prepaid	74	73.3	73.3	100.0
Total	101	100.0	100.0	

This study was conducted based on customer feedback. All subscribers of mobile

operators operating in the Ongole area were participants in this study. The estimated number of respondents was selected as a sample of the population using the bias sampling method. Initially, 100 subscribers from PACE Institute of Technology and Science , Ongole were selected and interviewed to ensure the reliability of data collection. A total of 100 respondents were interviewed using a structured questionnaire. Building on previous research, a structured questionnaire was created using a 7-point Likert scale. This study was tested using a correlation method to find answers to research questions. The statistical software package SPSS was used for data analysis. Theoretical setup of the model The variables selected for this study were selected through a substantive review of previous studies. The variables are responsiveness, reliability, empathy, confidence, type, type, perceived network quality, age, income, occupation, and

aircel are having highest number of subscribers. Some of the close relationship found between the variable like assurance with tangibility, responsiveness with assurance, tangibility and empathy, closeness with assurance and tangibility indicate Retailer network of service provider is easily located, Service provider's physical facilities are visually appealing, Contact employees appear neat, Materials associated with the service (such as pamphlets etc.,) are visually appealing. Sufficient geographical coverage, minimum premature termination of calls during conversation, clear and undisturbed voice, and call gets connected to the called person during first attempt most of the time, able to make calls at the peak hours. Another highest factors which determines the customer perception are Contact employees perform the service right the first time, Provides the services at the promised time , employees are kept well-informed about the progress of the complaints ,Billing system is accurate and error free , Bills are received in time.

II.CONCLUSION

This study was designed to figure out what determine perceptions of customers in Telecommunication Industry taking data from Ongole. A causal model was developed and implemented collecting data from the customers. This study has found variables are positively related with customer perception .various factors from different dimensions has positive influence on the customer perception, factors like resolving complaints , behavior of employees , fulfilling specific needs , location of retail shops physical facilities and material associated , call connection during peak hours are give highest priority by the customers. It seem to be like telecommunication industry is tae only a baby steps in delivering service quality when compared to offering value-added services . These are the areas where tremendous improvement is required, investing in manpower and physical facilities are

to be made in future, if the companies want s to withstand the competition in future. customer services provided by the companies have found not to be that much influential to the customers. Findings of these aspects in this study have a great importance to the overall success of the telecom service providers in India. It is because; by concentrating on the specific aspects that positively influence customer satisfaction, companies can attract new customers, retain the existing ones and make them loyal. Besides, they can save costs and efforts by not focusing much on less important one. As the research have found that market factors with perceived quality have a great impact on customer satisfaction, companies should try to improve their service quality and develop new services to augment customer's satisfaction. Moreover, companies should spot the light to the value addition to different customer segments in their marketing and advertising strategies.
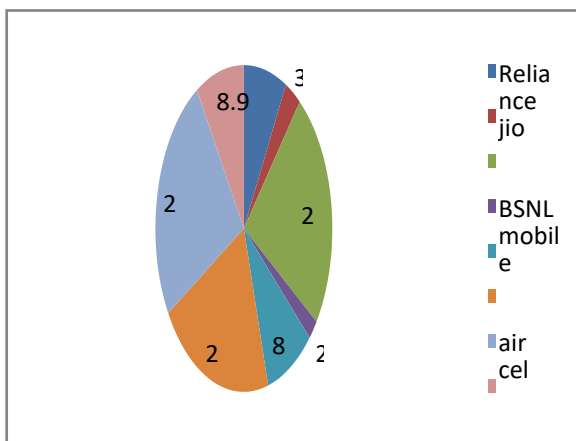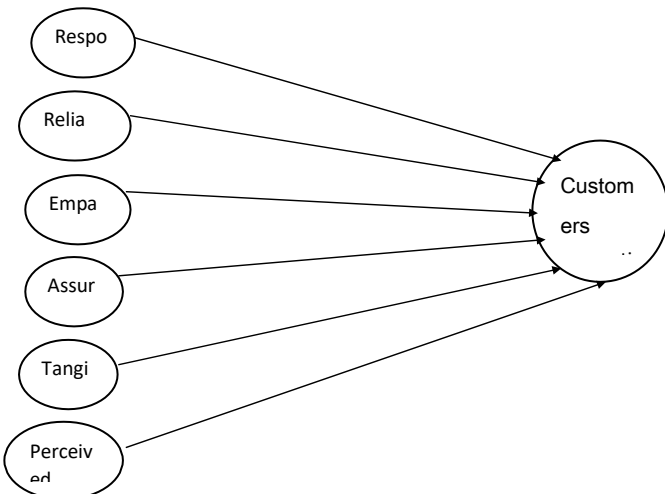
Percentage analysis indicates that there are highest number of prepaid subscribers than post paid , Vodafone , airtel and
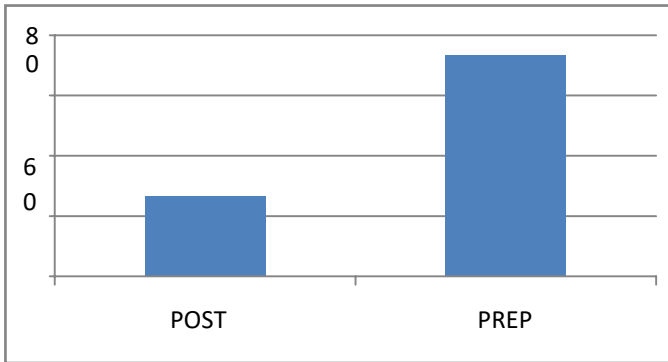
First Author Photo

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Entrepreneurship Education A Student Perspective

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ABSTRACT: Entrepreneurship education is believed to provide students with understanding of concepts of entrepreneurship, train and motivate them to indulge into entrepreneurial activities in future. This is an empirical study to explore the student perceptive in engineering discipline from the perspective of students. The study about unearth the factors that motivate them to take entrepreneurial activities and their perceived hurdles. Data about the opinion of students regarding a student perceptive collected from 168 students. The data has been analyzed using various statistical tools. It is found that the students are highly interested in starting their own business. They consider that decision making skills, risk taking capacity, creativity, communication skills and ability to prepare business plan are the most important skills for a successful entrepreneur. They feel motivated to start their own business because of intrinsic factors like being their own boss, chasing their dreams. Lack of experience and lack of funds are the most deterring factors.

Keywords: Higher education, entrepreneurship education, entrepreneurial intention, self efficiency of entrepreneurial decision making.

I. INTRODUCTION

As such, age is not a bar to initiation of an entrepreneurial venture. These are different successful ventures that have been launched at different age profiles by entrepreneurs. However, it is said that students is more suitable for taking up an entrepreneurial activity. In the present era, more and more student are more funding to be getting attracted towards entrepreneurship either immediately after students are after acquiring some experience in the corporate world. Student are getting exposed and also gaining knowledge in the class as well as outside in the class on. An entrepreneurship and make up their mind to venture into it. Some of the significant factors that increase the chances of youth succeeding in entrepreneurship are as follows:

II. TECHNOLOGICALLY PRECOCIOUS

– youth in the present era are technologically precocious as they interact and work with technology at a very early stage of growth and realize potential of technology to respond to pain points. They do not have any inhibitions to try out new and update technology in their daily use. Because of their upbringing in the family and school student develop greater maturity and in particular mental aptitudes towards technology-driven solutions. They are much more advanced, forward and progressive as regards technology applications in daily use. In general they are exceptionally smart and ahead in understanding new developments taking place in their surroundings. This facilities them in looking at technology as a solution provider to respond to problems and challenges faced in different walks of life.

Not Fearful of Challenges and Failures – The youth are generally opened to taking risk and quick adapt to changes fear of failure is biggest block in starting a venture is about 95 percent of business fail with in the first five years. The list of 'what if' s is endless such as 'am I cut out for entrepreneurship?', 'if the venture fails, what would happen?' and 'what if I lose everything in a process and become bankrupt?'. In general, it has been found that student are such fearful to great uncertainties and willing to respond to changes quickly. this act as a great strength in their favour to launch and passionately lift the business. Studies show that 'fear of failure' is one of the major reasons for not taking up entrepreneurial venture. As such , learnig from failures so as to convert bad luck into good luck is the greatest lesson that has led to successful ventures.

III. THINK DIFFERENTLY-

Students have great potential in terms of thinking differently and seeing things differently, which is basic prerequisite for innovation. It is this quality in them that inspires them makes them good entrepreneurs to continuously be on the innovative path.

IV. ISTREET SMART

- students with a typical family background and educational system are street smart and sharp in their observation. Paul hawken describes it as 'trade skill' in his excellent book growing a business, published by simon & sehuster. Call it common sense, instinct or whatever else you want. Successful entrepreneurs to seem have intuitive good judgement when making complex business decision. They have the knack of 'getting things done' against all odds. They have an a instinct to know customers and how excite then towards this product or service street-smart people have a sixth sense for competitors' weakness. They see opportunities everywhere that have not been respond to an develop and design products to meet those needs.

V. PASSIONATE, INQUISITIVE AND CHALLENGING

innovation is a hall mark of entrepreneurship, which requires creation and building of an eco-system wherein academic structures gives freedom to youth to unfold a creativity and tryout new ideas, the environment – social, economic, technological legal and cultural- is changing fast. This, in turn, is providing great opportunities. Organization- corporate and non-corporate- or focusing on innovation for their survival and growth. Youth are fare more suited because of their entrepreneur acumen. Picasso 'every child is an artist. The problem is how to remain an artist as we grow.

VI. CONCLUSION

Results from this study support the effect of entrepreneurship education in the context of Chinese

higher education. First, the more entrepreneurship education college students have in colleges and universities, the stronger their entrepreneurial intention is (H1 could be supported). Entrepreneurship education in the format of course-taking appears to have more considerable influence on student entrepreneurial intention than participation in practicum. Second, the more entrepreneurship education college students have received in school, the higher self-efficacy of entrepreneurial decision-making the students have (H2 could be supported). Entrepreneurship-related course taking has a broader positive influence on student self-efficacy than participation in practicum. Third, student self-efficacy sub-scales such as goal setting, self-appraisal, and problem-solving are significantly and positively related to entrepreneurial intention. Student self-efficacy in entrepreneurial decision-making plays a mediating role between entrepreneurship education and entrepreneurial intention (H3 could be supported). There is little effort to empirically study the educational reform in entrepreneurship education in Chinese. Thus, this research bridges this gap and enriches the literature of the entrepreneurship education research in the eastern context. It can enrich literature of entrepreneurship education in three aspects: (1) the situation and effectiveness of the entrepreneurship courses; (2) the relationship between the implementation effects and different types of entrepreneurial education activities; (3) how entrepreneurial education activities affect students' entrepreneurial decision-making, self-efficacy and entrepreneurial intention.

Many other findings are worth mentioning. Students in economics and management and

humanities and social sciences tend to take more courses related to entrepreneurship education than those in the STEM fields in Chinese colleges and universities. It may not be so surprising about students in economics and management because of the relevance of those major fields to the business world. Still, it is somewhat unexpected concerning the students in humanities and social sciences at the first blush. However, due to the increasing pressure on obtaining employment opportunities upon graduation, particularly for students in humanities and social sciences, departments in humanities and social sciences in China have paid a lot of attention to provide classes that could make their students more marketable. There are similar efforts for less prestigious colleges and universities. Thus, we also see that students in the less prestigious colleges and universities have a higher level of engagement in practicum activities and take more classes related to entrepreneurship education than those in research universities. Compared to the previous studies, these findings are novel research outcomes in the entrepreneurship education research field.

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Human Capital Management: Economics Of Psychological Perspective

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Abstract-HCM is one of the dynamic approaches to maintain various sources in industrial improvements, workforce. For achieving industrial goals, are crucial role for hc effectiveness to improve skills, efficiency and values but fuse methodologies are not accepted yet. When the universities are dealing with new and modern themes, they need a specific teaching session. The goal of our paper is to discuss about some criteria also the efficiency of HC also to solve practical examples to find out the possible implementation in teaching offers the economic subjects addressing the diploma thesis.

The main highlights for the study are to increase efficiency in every single employee about the HC and its management. Increase. These approaches are identified and applied in the study, to finding its root in business economics theory which when effectively applied, to the capacity then act as change agent for the performance of employees. Popularizethe industrial success. The study also reveals the management principles as embedded in management dynamic systems itcan't be ignored by industries. The improversare mainly based on primary result, definitions in human resource and the expo of approaches for understanding the nature, status in all aspects of life.

Key words: Human capital, industry, improvement, employee, management.

I. INTRODUCTION

HC is one of important aspect in economic science improvement. The explanations in Kucharcikova (2011) economists highlight and draw attention to find the ability of workers to do their work with machines. Some designs are enables to do hard work for world work for enabling humans. HC mostly requires progress for organization to increase human's creativity and ability, skills individually for our society. Most of the problems occurred in hr, finding and investing, in explanatory words, there is no consensus defining the HCM as today survey. According to author at still a scientific issue in understanding system, status, and purposeof human capital. But thehuman capital nature and goal mainly understand with two approaches.In present situations HC works may highlight the past works and scholars to nearer fields. The human capital investments of approaches would be adopted for work and highlight for dynamic managements. This is made easier since, concept of HC can be used almost in all endeavours.

II. DEFINITIONS OF HUMAN CAPITAL

The human capital history mostly works within Chicago school where economists improve with new ideas for HR, such as T.W. Schultz and G.S. Becker in the 1960s.Even if it has some new ideas and plans to motivating the new theories and scholars in human resource theory. This would be changing the attention of every single member in organization levels on every day. HC mostly increasing the assets for training and education purpose. Abilities of individual person requires to build-up a business administration journal. It would be giving more job performances at Marshal (1998) suggest that HCfor every worker in the organisation. Human Capital means the "processes relate to education, training and other professional initiatives to increase the levels of skills, knowledge, values, abilities and social assets to an employee that may lead to the employee's job performance and satisfaction" it is defined by Mari Muthueltal (2009).Now a days the most common theory "proponents of human capital" is defined by Gary Stanley Becker in USA. One of his famous books "Economic Improvement with Unlimited Supply of Labour", he mostly explains about the importance of education, skills, values in human beings, investment in training and health. The main importance of economics human capital written by Becker is emphasized below:

III. APPROACHES TO HUMAN CAPITAL

Human capital takes two approaches from economics theory they are:

(1) Macroeconomic approach.

(2) Microeconomic approach as identified by Kucharcikova (2011).

These economics are divided into several basic approaches for business improvements. The scholars and the approaches of economists to understanding of human capital are however applied in this work. The goals of human capital economic approach, according to ndinguri, Prieto, match ets, (2012) aim to improve values, like team work, consciousness among individual employees and overall employees' performance. the microeconomic aspect has two approaches to and are classified under business economics. According to him, in business economics, human capitals has been considered to production of factors. Kucharcikova (2011) further managerial are added to view, human capital it like to seen business resource or asset which are arraigned a part of market and value of the company, while in macroeconomic approach, human capitals also one of the production of factors, and the rise of the economic growth (Kucharcikova, 2011).

IV. INTELLECTUAL CAPITAL VIEW

This is the sum of human and structural capital. These are experience, organizational technology, customer relationships, and professional skills (Kucharcikova, 2011). Human capital is a knowledge of combined, skill,

innovativeness, and ability of the organization to meet the task at hand. Therefore, human capital cannot be maintained by the organization. Structural capital some they are like hardware, software, databases, organizational structure, patents, trademarks, and else of organizational capability that supports those employees' productivity – in other words, when employees existing the office to arrive home. Structural capital also assigns customer capital, the relationships improved with consumer (Bonta's, 2001). Organizational capital is the systematised knowledge possessed by an organization, which is stored in databases, and manuals. It is often called structural capital (Edvin son, Malone, 1997) but the term "organizational capital" is preferred. (Kucharcikova, 2011). In the views of Davenport, Prusik, (1998) quoted in Kucharcikova (2011), organization is said to use different plans for accumulating and utilizing their knowledge, and these approaches present themselves as different aspects and thoughtful of capital, i.e., human organizational, and social capital. According to Kucharcikova (2011) the concept of intellectual capital is based on the trust. the main resources for building competitive advantage are spiritual in nature. But he support the point further when he quoted Edinson and Malone (1997) who had used the word "intellectual capital" for the first time in their work instead of the common calculating term "intangible assets." Armstrong (2006), Kucharcikova (2011), Edinson and Malone (1997) had agreed to the concept of human, intellectual, organizational and social capital. According to their dispute, it is the individuals that generate, retain, and used knowledge and skill (human capital) to create intellectual capital in that their knowledge is enhanced by the cooperation between them (social capital) and generate the institutionalized knowledge expert by organization (organizational capital) Kucharcikova (2011).

V. MACROECONOMIC APPROACH TO HUMAN CAPITAL

Everywhere, the economic growth is the main objectives of the economic policies of government. Macroeconomic is a large term and also the Economic growth can only be achieved through intensive and extensive use of production factor which is usually enclosed in the gross domestic products (GDP) of a nation. According to Kucharcikova (2011) intensive and extensive economic growth are remarkable. He thought the extensive economic growth as the result of increasing the quantity of used production factors, basically, land, labour and capital. These are some of the basic factors of production in economics. Land as a factor of production, hold of its natural environment. Kucharcikova (2011) has argued that this source is often used to mark natural resources however some industrial have connected the factor with capital. He said that it is the conclusive factor of production to achieve growth, He argued that when economic growth is too high there will be expanding in natural resources. Hence the talk about sustainable growth that will not lead to decline. Therefore it is necessary to increase the labour force qualification through training and retraining (Kucharcikova, 2011). Capital is a rare resource. In economics the term "capital" is

wide and capital in economic growth involves such things as buildings, machinery, equipment and technology to bring about the desired result. In accounting principles are created for savings of capital investments. product factors depend on capital growth. Capital growth increasing the educational research Business analyst finding the divergence of physical capitals in the 80s of the 20th centuries. For this purpose, UNICEF proposed to ensure that 26% of the nation's budget. human capital ensures that initiative the abilities, knowledge, talent also inventiveness. In these characteristics of components are creation, effectiveness of HC and increasing the value, for future benefits. HC increases values of science, health, safety, research and education.

Intensive economic growth highlighting the improvement in the inputs per unit production. By Becker, the financial situation is influenced by the efficiency, quality and manner of combining manufacturing factors. By the above factors we can see the growth of efficiency, improvement manner of combining catalogue production factors:

(i) Organizational work levels,

(ii)Educational levels, technology, technical support,

(iii)Increasing employee performance, and motivation.

(iv) Technical innovations

It requires knowledge to adapt the present needs and possibilities of similar firms. In economics it would be moderative and creative way. This economist mostly depends on economic growth and its acceleration of data gathering starts at 50s, 60s in 20th centuries.

VI. CONCLUSION

Human capital would be efforts on individuals and other that means who interested to improve their values and work force. The study about HC finding economics roots, performance of employee capacity. This study helpful for organizational growth reveals the management principles. It should maintain some principles as embedded, dynamic features to overcome by serious and poised situations in business. From this study mostly helpful for organisations and business improvements of some principles, approaches of this nature. Study result will become an exposition of investments appearance, activities, dimensions of life.

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Managing Stress to Improve the Quality of Students Life

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Abstract-Stress has recently become most important aspect in these present days. It greatly affects the people and also organizations. Over these, years it has been explained in number of the ways. The most common quotes are "You must learn to let go. Release the stress. You were never in control anyway." Because of their needs students spend a half of the day or even more at work and that is why work became stressful factors. Students is on the one hand an important source of situational issues like prestigious issues, competition issues which cause stress and on the other hand offers social resources to counteract with stress. Therefore it is very important to prevent and handling stress and also we have to maintain well-being of students. Individuals can manage stress by following two main groups of approaches: the organizational and individuals. Individual approaches are the easiest way of managing and preventing stress. They should aim to change the individual's skills and resources and help the individual to change his situation. Organizational approaches can help students with stress management in two main ways. The first way is the introduction of strategies for controlling stress.

Keyword: students, Organization, stress, Individual approaches to overcoming stress, organizational approaches to overcoming stress.

I. INTRODUCTION:

STRESS: Stress is a part of life, wherever and whatever you are doing. We have so many changes such as going to schools, college, getting married, children, or illness—are frequent changes of stress. Moving away from home to attend college, for example, creates personal-development, opportunities—new challenges, friends, and living arrangements. So, we have to cross check ourselves with the symptoms of stress. Even though it may takes time when we learn to maintain the stress, this may lead the good news is minimization of harmful effects of stress such as depression. This may develop the awareness of leading situations.

II. DEFINITION OF STRESS

Stress can be defined as any type of change that causes physical, emotional, or psychological strain. Stress is your body's response to anything that requires attention or action. Stress can be experienced in different ways in different situations. If we see the situation negatively then it is called "distress" and when you feel it positively it is called as "Eustress". Eustress helps you rise to a challenge because it is focused on energy. Most of the people are fear of stage fear and flight journey, that may increase the loss of appetite and heart rate.

CAUSES OF STRESS

The main three categories that causes stress are:

1Sudden change that may cause us unemployment.

2. The challenging or competitive or threatening events from the outside areas.

3. Personal loss of friends and family.

Mainly, the causes of stress in our personal lives are unemployment, death of near ones in family or friends.

You enter in to the college with full of happiness and dreams, but unfortunately, we may face lot of stressful situations in the college life due to demands and discipline culture.

THE NATIONAL INSTITUTE OFMENTAL HEALTH (NIMH) NOTES STRESS REASONS FOR COLLEGE STUDENTS:

• Increasing demands in academic study
• Being on our own in an environment
• Financial responsibilities
• Changes in family relations
• Changes in your social life
• Exposure to new people, temptations and ideas.
• Preparing for future plans.

DISTRESS SYMPTOMS

stress symptoms fall into three generals—physical, emotional and mental. Study the list carefully. If you are affecting to these symptoms, you are in the starting stage of distress:

- Hypertension (high blood pressure)
- Fatigue
- Heart problems, such as palpitations
- Gastrointestinal problems
- Headaches
- Sleep disturbances
- Inability to focus/lack of concentration
- Anxiety
- Sweating palms/shaking hands
- Sexual problems.

We have to realize that stress can cause a critical physical disorder. It increases hormones such ascorti coster one and adrenaline, which affects the immune reactions, metabolism and other stress responses. This may increase blood pressure, heart rate, physical demands and respiration on our internal organs.

Some of the expressions for behavioral changes in stress. They are:

• Irritability
• Undisciplined patterns in eating.
• Not respecting others
•Consumption of alcohol and smoking.
• Isolation
• Uncontrollable shopping.
Stress can affect every area ofour lifeproductivity in the workplace, classroom, health relationships,and risks, tojustify a few sustained high levels of stress is no laughing matter.

III.   MANAGING STRESS

From the introduction, stress management is one of the important factors to finding the causes to manage stress.In this first understand stress and how would be manage by humans. If you understand to find the causes of stress steps:

Set up the priorities. Manage the time to learn the new things. Make a list out for the things to do immediately and the things can wait. It gives the clarity to work done and don't have to be feel stress according to the work.

Practicing to face stress things in the life. For example, when you are presenting a theme in the seminar, practice before Infront of your friends, this may decrease your stress level and if you are attending to any online exam revise it before the exam as taking as the book test to reduce the pressure.

Analysis your progress to reach expectations. Try to dream reachable goals. When you have realistic expectations then try to achieve those expectations with perfection.Don't think that your friends are best than you. Be satisfied with your own work. Everyone in their lives do mistakes, but recognizing those mistakes and changing that mistake become a good teacher for them.

Make sure that our lifestyle should be rest with relaxation, and also eat healthy food by doing exercises. Enjoy your life with pleasant and humor. Doing yoga's and meditation may control our emotions and feelings.

Accept all the changes in the life. Nothing remains the same. U can talk to your friends and family to get relief from stress and reduce depression. Believeyourself and stable your emotional balance. Remember the many people from different backgrounds are getting their life settle and molded their situations according to their problems.

Some of the activities like drinking alcohol, drugs, smoking, using narcotics says that they can reduce stress but those activities increase the stress levels of human. Mostly, these activities are mostly attracted by boys and may changes their lifestyle.

Some of the strategies to reduce stress:

• Adjust your time in vacation and trips with your friends in your day-to-day life style.

• Spend your quality time with your family and friends and also do meditation for increase in concentration.

• Ignore many appointments and back-to-back classes to maintain stress level. Whenever you feel low, then take a deep breath and concentrate on your quality life.

• We have to manage our time to view spiritual or any peaceful videos, andRead books also attendseminars on time management.

• We can help others to fulfill their priorities but, it should be with some extent only. Mainly, we have set right with our priorities and responsibilities in our life.

• Exercise regularly for maintaining physical and mental fitness.

• When you are in stressful then spend your quality time with your family and friends.

IV.   DEPRESSION

Actually, if a person is not able to deal with stress,this may also call as clinical depression. People in depression have familiar symptoms on stress, except the symptoms are permanent. The effect on the behaviour, body, and mood is often more serious than temporary stress.

Depression can have severe effects on your relationships, your ability to work and study, you'reeating habits, and how you think and feel. Millions of Americans, including many workers and college students, suffer with clinical depression.

It is must to know the clinical depression is a real thing. It is not a temporary feeling or a sign of individual illness. If they get the correct treatment, they can cure within in few weeks. The following are the major symptoms for depression:

• Anxiety or Sadness
• Being "slowed down", losing of energy.
• Lack of interest in day-to-day activities
•Sleeping disturbances(waking much earlier than usual, insomnia and oversleeping)
• Weight changes (either gain or loss)
• Feelings of guilt, hopelessness, and worthlessness
• Thoughts of suicide attempts
• Difficulty in making decisions
• Maintaining more aggression or excessive crying
We may get symptoms of stress some of the time. But the health institutes says that if anyone has stress symptoms for three weeks or more, or suffering changes in normal activities, that person must go to a mental health hospital for general checkup. Depressed people cannot think properly and may there fore did not seek to take help on their own. Depressed people frequently require support from others that they "need help to get help."

Mental health professionals explains that depression for college students may cause a serious problem. The National

Mental Health Association(NMHA) reports that more than 30% of college freshmen report feeling over whelmed a great deal of the time.

You have to meet the qualified health professionals when we feel that you are getting depressed. There are several treatments to cure our stress and to get rid of depression. But all individuals respond differently in the treatment.

Suicide:

As we discussed above, somany depression thoughts like suicide, hanging and so many other deaths possible. So many people are fear of hearing death, so that they can save the lives of others. The NIMH reports that in 2000's suicide was the 11[th]leading cause of death for all western countries and the 3rd leading cause of death for those15 to 25 aged adults. While women are having high chances of suiciding as men's (mostly 3 times higher) .

Some of the common myths discussing about suicide:

• Everyone believes a false statement "If someone wants to die, nobody can stop that person". But actually, the person can stop the suicide only when they get the help.

• Giving help after committing suicide than, when we care the person by offering comfort to the person before getting the thought of suicide.

• Everyone thinks that suicide comes "out of the blue." But actually, the person can feela greater number of warningsigns.

V.   CONCLUSION

Stress has a temporary pressure in our life. Whileyou can't avoid stress, by this we can learn to be strong at the time when we feel stressful.When we learn to be strong at the times of stress, then share with your depressed friends, family and who are going to be depressed.

In this uncertainty of era, it seems that everyone in today's workplace is under more pressure. Study after study shows that managing stress is a growing challenge. People usually think of stress as something entirely negative, but as we have seen, stress has tangible benefits when managed properly.

Again, the critical task for managers is to gain a better understanding of stress in the workplace, in their organizations, and in their teams and employees. Anyone in a position of organizational or team leadership should be tracking the issue of stress. In general, good management practices will likely reduce unhealthy stress by improving employee autonomy, training, working conditions, schedules, career development, support systems.

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Micro Small and Medium Enterprises (Msmes) In India - Its Scopes and Challenges

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Abstract-The Micro Small and Medium Enterprises (MSMEs) sector plays a crucial role in economic development of the nation. Growth cannot be inclusive unless and until the fruits of the growth is percolated to the bottom of pyramid. Specifically in a developing nation like India where inequality in distribution of wealth and income is significantly high, sustained increase in per capita income cannot be translated automatically to sustained increase in standard of living. In order to alleviate the curse of poverty, inequity, unemployment and underemployment, adequate employment opportunities should be created for the poor mass which will facilitate them to meet their subsistence level of consumption demand. The MSMEs players can discharge the responsibility of adequate employment creation provided major impetus is provided by the Government to boost the sector through appropriate policy prescriptions. The objective of the proposed research paper is to analyze the current status of MSME in India, to determine the extent of funding the sector receives from different sources, to identify various risks and challenges that the sector is facing across the nation and to develop the strategies for the MSMEs players so that they will be able to provide maximum benefit to the maximum number of stakeholders of the nation. The methodology of the proposed work consist survey of existing literatures from different scholarly research articles available in several reputed national and international journals and analysis of secondary data. The paper will focus on an alternative economic model where adequate impetus will be given to the small scale entrepreneurs instead of providing excessive leverage towards large corporate players. The paper will add a new dimension in the sphere of distributive justice.

I. INTRODUCTION:

MSME stands for Micro, Small, and Medium Enterprises. In tendering with the Micro, Small, and Medium Enterprises

Development (MSMED) Act in 2006, the enterprises are classified into two divisions.

1. **Manufacturing enterprises** – engaged during the manufacturing or production of goods in any industry
2. **Service enterprises** – engaged in providing or rendering services

Features of MSMEs:

Essential elements of the MSME:

1. MSMEs work for the security of the workers an artisans. and also they can help them by giving

   Employment and providing loans by banks and other service sectors.
2. MSME is to provides to credit limit or sponsors

the support to the banking sector, and other sectors etc.

3. They promote the development of entrepreneurship as well as up-gradation of skills by launching specialized training centers for the same.
4. They support the up-grading of developmental technology, infrastructure development, and the modernization of the sector as a whole
5. MSMEs are known to provide reasonable assistance for improved access to the domestic as well as export markets.
6. They also offer modern testing facilities and quality certification services.
7. Following the recent trends, MSMEs now support product development, design innovation, intervention, and packaging.

II. MAJOR ROLES OF THE MSME IN THE

INDIAN ECONOMY

The MSME sectors has to demonstrate to be a highly dynamic factor in the forecasting of the Indian economy. Since MSME construct and manufacturing the some other new variety of products for both domestic as well as international market also, It also helps to advance in MSME enterpreneur to growth and development of the various product segments and industries

MSME have played an crucial role to on condition that the employment opportunities in underprivileged areas. They can also helped the industrialization areas where the low capital cost differentiate to the larger industries in cities. MSMEs have also contributed and played a key role to the development of the countries growth in the differnt areas like rural and urban areas and its like to the requirement of low rate of investments and imports, the ability to a produce a product in differnet ways, and it has a high contribution of the domestic production.

III. REGISTRATION OF THE MSME IN INDIA

- Bank Loans (Collateral Free) ...
- Subsidy on Patent Registration. ...
- Overdraft Interest Rate Exemption. ...
- Industrial Promotion Subsidy Eligibility.
- Protection against Payments (Delayed Payments) ...
- Fewer Electricity Bills. ...
- ISO Certification Charges Reimbursement.

IV.   INDIAN ECONOMY OF THE MSME:

Across the world, MSMEs are accepted as the world economics with a vast and increment for promoting equitable objectives. They are known to production factors for the highest rate of the growth in the economy.MSME have driven to vast changes in the industrial growth sector through requirements of low investment and flexibility activities and the   storage or capicity to develop appropriate native technologies

- In the investigation of MSMEs employs around 120 million entrepreneur persons , and it is becoming the second-largest employment sector after the agriculture sector.
- With approximately 45 lac units throughout th country, it contributes about 6.11% of GDP fro manufacturing and 24.63% of the GDP fror service activities.
- MSME ministry to increasing the benefaction ε regards of the GDP by up to 50% as the India moves and ahead of a $5 trillion economy wealt growth.
- 45% contribution to around and overall the expor of the Indian
- MSMEs promote all-inclusive growth by providing employment opportunities, especially to peopl belonging to weaker sections of the society in rur areas.
- MSMEs in Level-2 and level-3 where the upp cities to help in creating opportunities for small an middle class entrepreneur peoples to providing an use the banking services and products, where the amount is less for their new business and economic wealth growth.
- MSME to promotes the new innovations an inventions by providing to an opportunities t encourage the entrepreneur to help them an building their creatives products and there ar boost up their competitions in this business and t fuel to the growth on that field.

There Are Some Major Challenges Faced By The Msm Sector

1. Financial issues: In the Indian economy, access t finance has always been an issue for smaller firr and businesses.
2. Regulatory issues
- Infrastructure
- Low productivity
- Lack of innovation
- Technical changes
- Competition
- Skills
- Lack of professionalism
- Lack of standardized policies

V.   CONCLUSION

MSMEs face a number of challenges, but the government is doing its best to ensure that the MSME sectors to remains competitive. The cost of funding is gradually decreasing, and both public and private sectors are working towards developing better products that can be competitive in terms of quality and price. Perhaps, if we get rid of dishonest dealing and focus more on quality, then MSME will be able to beat bigger firms.

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Supply Chain Management and Logistic Management

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Abstract-Supply Chain Management (SCM) remains heavy value for various sectors as well as managers, researchers and educators. This concept explains the four unique

Perspectives regarding Relationship between Logistics and Supply Chain Management. Next, the results of an various surveys led to final conclusion that is Logistics=SCM experts are reported. Over 200 questionnaires were framed to leading logistics educators in Northern countries, and Eastern countries such as Europe, South America and Asia.

Depending on the various aspects of under following perceptions, cluster analysis confirms the existence of the four Activities on logistics versus SCM Relabeling, Traditionalist, unionist and inter-The paper closes and discusses on various aspects with average surveys made under the vigilance of the several practitioners on implications of the two perspectives for

Educators, researchers etc..

I.   INTRODUCTION

For many logistics educators, researchers and practitioners, surveyes led to following scenarios.

Management (SCM) has been the ''Grande passion'' of recent times. Academic

Journals have been introduced for several studies made on that. (e.g. Supply Chain Management: Led with International Journal)

Or renamed (e.g. Journal of SCM), SCM degree and certificate

Programmes have been created, professors and managers have been retitled, and

Researchers eventually have been shifted to SCM. But, LaLonde (1997) asked: ''does

Supply Chain Management really exists?'' Other authors caution that SCM may

Become just another management fad (Burgess, 1998), or even a ''parochial arena for a guild of specialist researchers'' (New, 1997). Amid this confusion, Skjoett-

Larsen (1999) noted that the SCM ''concept is not well defined''. According to

Cooper et al. (1997), ''research is needed to define and expand the boundaries of

Supply chain management''.

The unclear conceptual borders of SCM make it difficult to design educational and research programmers in SCM without large comparison with other fields

Which includes logistics, marketing, operations management and purchasing. Moreover, it

is difficult if not impossible to implement SCM unless it is well defined. Where are

the conceptual boundaries to be drawn in conducting research on or implementing

SCM? Can research be done directly on SCM, or must the concept be broken down,

For focus on its features? This paper attempts to put limits on the SCM concept,

Using logistics SCM experts' ratings of key concepts, topics and techniques. This

Facilitates understanding of the features of SCM and its conceptual boundaries.

The paper is organised as follows. Following the Introduction, The Second concept Briefly discusses definitions of SCM from the literature, and develops four perspectives on the fit between SCM and logistics. The third concept reports results of a regarding study of international experts. The paper relays with a discussion on applications of the study for logistics activities, Educators, Researchers and Practitioners.

II.   OVER VIEW

- In 1986 THE LOGISTICS MANAGEMENT COUNCIL (LMC) The leading edge professional organization with a current member ship of over 13,000 defined logistics management as:

"The process which includes the activities such as planning, implementing, and controlling the efficiency, cost-effective passage and warehouse activities, services, and related information, from point of origin to point of end user consumption, for the purpose of conforming to customer requirements."

WHAT IS "SCM"?

- From various statements it appears that SCM is logistics taken across inter organizational boundaries
- A study that enables to know how organization should handle their supply chain to achieve strategic advantage.
- The objective is the process of synchronization requirements of the end customer with the transportation of materials and information along the functions or personnel involved in supply chain
- The goal is to eliminate variability and reach a balance between greater efficient customer service and low cost.

III. DEFINING SUPPLY CHAIN MANAGEMENT

- Complexity and structure of supply chains vary depending on the industry and the organization's size,
- In a nutshell this can be defined as supply chain management encompasses the entire process from raw equipment to the end customer.
- Effective SCM involves oversight and management of suppliers, buyers, vendors, customers, and any others on whom the organization depends on to deliver a product or service.

IV. METHODS OF SCM

1. COST BENEFIT TRANSACTIONAL ANALYSIS

- A method based on financial models, Cost Benefit Transactional Analysis(CBTA) essentially looks at prices to determine whether or not goods were bought at affordable prices and sells at a mostly high price. This study is generally performed over a particular period of time.
- When applied to supply chains, Cost Benefit Transactional Analysis determines whether equipment or products were fair prices well when the end customer purchased and sold and, if not, how to find better prices.
- Consider an E-Commerce company that wants to stock goods for the busy holiday season. CBTA would look at previous data to determine affordable prices at which scale to purchase and sell goods for end consumer. Supply chain holders can then apply this eventual concept to make better decisions for warehouse stocking.

2. Co Ordination Of Channel Activities

- Most of the supply chain and logistics companies assemble the supply chain management for several businesses as well. As a result, it is often applicable and used in everyone's best interest to look future individual channels and manage to reduce overall costs to efficient costs and it would lead to save time.
- Channel coordination deducts the manual practice. A logistics company could watch several aspects that realigning some channels can help in achieving the objectives of multiple consumers. Channel Coordination is mostly used and applied to Inventory Management and Ordering.

3. Network Stance

- Sometimes, it takes a other private parties to enhance some perspective ways.
- Some of the third-party logistics provider are working with various companies while comparing with others. Unfortunately, there are some aspects that can be used as mandatory to save everyone's money. This is derived through Network Perspectives.
- The Network Perspectives hierarchy always approaches through an existing network of business and looks at initial connections that can existed previous beyond what is currently happening. These Network Perspective connections are considered less formal because they are not traditional business deals or agreements.

V. SUPPLY CHAIN MANAGEMENT - FIVE FUNCTIONS

The Five Functions of Supply Chain Management are defined as below:

1. Purchasing Function

The initial function of supply chain management is purchasing function. In the production process, equipments are required to manufacture goods and end products. It is mandatory that these materials are procured and delivered on time so that manufacturing can begin. For this to appear, Coordination with retailers and production companies will be required to avoid any potential delays.

2. Operational Activities

Operational Activities and Demand Forecasting are usually required before equipments can be produced, as the demand market will dictate how many units to be produced and how much equipments are required for production. This function is important in logistics as organizations must apparent and forecast demand to avoid having too much or too little

inventory that will lead to losses in revenue. Therefore, demand planning and management, production, and shipping to avoid such mistakes.

3. LOGISTICS FUNCTION

Logistics is the word derived from Logistique word that defines part of Supply Chain Management that coordinates all aspects of Planning, Purchasing, Production, warehousing stocking, and Transportation so that the end products will reach the end-consumer without any problems. It is helpful to have proper communication between various departments must be maintianed so that products can be supplied to customers quickly and at the lowest cost.

4. RESOURCES INVOLVED IN SCM

Not only production consumes raw materials, technology, time, and labor, but also the resources involved in almost all the aspects through which the Resource management ensures that the correct resources are alloted to the correct activities in an organized manner. This will make ensure that an optimization of production scheduled is created to maximize the efficiency of the operations and also end user satisfaction. When calculating the available capacity, you should consider the capabilities of every resource and determine whether they can perform the work that is enabled and perfectly elapsed with particular actions on it. This will ensure that you are not over confidence on orders, promotional activities and that your production schedule is mostly feasible, efficient and accurate.

5. WORKFLOW OF INFORMATION

Sharing of Information and supplication is what keeps all of the other activities of Supply Chain Management efficiently if their leading aspects led on this concept. If the information workflow and communication are poor, it would also could break part the entire chain. Many destructions that would have to rise in supply chains can be prevented by increasing vision and long term goals and communication. Having a consistent system and accuracy that is used by all departments will enhance that everyone is working with the same set of data that will led to prevention of miscommunications and Time spent updating everyone on new employments.

VI. PRO'S OF SUPPLY CHAIN ACTIVITIES

AFFORDABLE COST

Supply Chain Management assist in attaining cost efficiency within the organization. It aims at optimizing all process of business which brings down the production cost, packaging cost; warehousing and transportation cost and avoids any wastage of goods by facilitating timely delivery. It minimizes the overall operating expenses and enhances the overall profitability.

VII. OUTPUT ENHANCEMENT

The concept of supply chain management aims at maximizing the overall productivity of business. Supply managers monitor all production processes and manage the most efficiently utilized. Any wastage of resources is avoided which lead to maximize the overall output.

VIII. AVOIDS DELAY IN PROCESS

Preventing any delays of business process is one of the major advantages of supply change management. Supply chain manager ensure that all materials are timely acquired for facilitating uninterrupted production of products. Also, they regulate all delivery and logistics services of business which promote delivery at right time at right location thereby avoiding any delays.

IX. EASILY IDENTIFY PROBLEM AREAS

Supply Chain Management enables business in recognizing its issue that is adversely affecting its reputation and profitability. Managers can easily track the performance of every department and identify which one is lacking in delivering its duties. In absence of this concept, this would be difficult to detect the issue and every department may transfer to others with would become a silly reason to any problem that erupts.

X. BETTER COLLABORATION

Process of supply chain management brings better collaboration among distinct parties of business. It focuses on developing a proper communication channel within the business for avoiding any confusion or disputes. Smooth flow of information among all stakeholders like employees, customers, suppliers and distribution enhance understanding which leads to create a better collaboration.

XI. CON'S OF SUPPLY CHAIN MANAGEMENT

MOST EXPENSIVE

Major limitation of process of Supply Chain Management is that it is quite expensive to implement. It requires large investment in terms of time, money and other resources that become unaffordable for small businesses.

XII. COMPLICATED

Process of supply chain management involves numerous complexities as it involves several departments within the organization. It may lead to create confusion and hamper the normal functioning of business. Employees may feel hesitant and demotivated to accept this concept as it is new to them thereby giving rise to several other difficulties.

XIII. LACK OF CO-ORDINATION AMONG DEPARTMENTS

The determination of supply chain management functions properly only if there is better coordination among departments of departments. Establishing the various coordination's among several departments within the big corporate is a quite difficult task where this concept may eventually fail to perform.

XIV. REQUIRES TRAINED AND PERSONALIZED STAFF

Supply chain management requires qualified and trained personnel for its effective executive within the company. Company need to incur heavy expenses for acquiring such taskforce that is professional and highly skilled. Small companies may find it unfavorable for their implementation.

XV. DEFINING LOGISTICS MANAGEMENT

- Logistics Management can be defined in plain speak as the movement of products from beginning to end, and encompasses the activities involved along the way.

- This includes the planning, implementing and control of the such activities(both forward and backward) that include the various processes such as storage of goods, services, and related information between the origin to the end consumer requirements.

- Logistics management begins with the creation of strategies to maintain the most cost effective service levels.

- As supply chains continue to change and evolve with regards to specific product lines to impact service levels, customer and market segments, so do the logistics strategies.

The Five Elements Of Logistics

- Storage, warehousing and materials handling.
- Packaging and unitization.
- Inventory.
- Transport.
- Information and control.

Methods Of Logistics

- Supply Management and Logistics
- Distribution and Material Movement
- Production Logistics and Management.
- Reverse Logistics and Product Return
-

XVI. ADVANTAGES OF THE LOGISTICS SECTOR

The truth is that the logistics sector has many advantages, including:

- **A better use of the distribution network**: When you have a good logistics system, with different logistics operators, you can optimize the times, along with the distribution chain. There would be a different companies dedicated to logistics and distribution that are fundamental at a national and international level.

- **Costs reduction**: This is possible thanks to the different globalized distribution systems, since they reduce transport costs. A more efficient logistic chain: If it possible to convert a more efficient logistic management, getting to improve both the final consumer satisfying and the services.

- **Transportation and express delivery:** Today more than ever, systems that allow urgent transport are being implemented. In this way, orders will attain their final destination in much less time than a few years ago.

- **Information technology:** Technology is helping to evolve the sector itself, improving times and processes.

XVII. DISADVANTAGES OF THE LOGISTICS SECTOR

The truth is there will be some disadvantages that would be considered into account, including:

- Coordination**:** Especially in cases of international logistics, there may be some failures in international coordination, usually the most frequent problems are: language, schedule, cultural change …
- **Multinationals and large companies:** The usual thing with this sector is covered with very large companies. Both medium and small companies have very difficult access.
- **Cost of transport:** The greater the distance to travel, the greater its cost. This makes it difficult to get a competitive price.
- **Legality:** In logistics, the legislation has much to say both at the level of laws, customs policy, and the entry and exit of product.

XVIII. SCM VS LOGISTICS

- Logistics is the Regulation and Superintendence of the flow of physical materials.

- In the Description of various marketing channels, physical distribution and logistics would be used rather than the traditional methods, with the understanding that only finished goods are part of distribution and the proper concern of a marketing channel manager.

This, and many other ideas about channel logistics, has changed radically since the 1980s.

- Logistics has metamorphosed into which in turn has come to implicate every element of the Value-Added Chain.

- Going backward, or upstream, this means channel logistics encompasses not only inventories of final products but also present work in progress for and raw materials.

- Indeed, SCM at its fullest goes back not only to the factory floor for also to the suppliers.

Is This Sufficient??

- Even with these differences it is clear that logistics areas often cut across supply chain functions and **vice versa**.
- But do really VICE VERSA???
- To get into a more clear image of this complex interconnection, definitions of SCM and LM might clear the in depth interconnection.

The Verdict…
1. The verdict is clear.
2. Given common concerns between the two, as well as the clear overlaps seen time and time again as logistics and SCM cross paths, it should be expected that SCM and logistics will both remain intrinsically intertwined and essential to organization success.
3. So, analyse your need and problem and give preference to two
4. But still for final success use BOTH!

XIX. CONCLUSION

Results of the survey provide support for the four perspectives model, i.e. logisticians can be clustered into four groups on the logistics versus SCM issue.

The final section builds on this empirical finding, with implications for Logistic Educators Researchers and Practitioners.

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DEVELOPING KNOWLEDGE BASE SYSTEM FOR COMMON CROPS DISEASE DIAGNOSIS: THE CASE OF EAST HARARGHE ZONE, ETHIOPIA

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Abstract— Agriculture is the main way of livelihood for 85% of people in Ethiopia. It is a single but the largest sector area, so far exceeding all other sectors and industries. Different crop types are being produced in different ecological and agronomical cultivation areas throughout the country. However, crop production in Ethiopia is influenced by different natural and human made constraints. Among the factors which are influencing agricultural crop production in Ethiopia, crop diseases are the major affecting factors. This problem needs efficient and sufficient agricultural domain experts. To overcome the problems, Successful crop disease diagnosis needs sufficient and knowledgeable agricultural experts to identify the diseases for describing the methods of treatment at early stage of infestation. However interested they are, domain experts, never seem to be able to cover the whole agricultural sectors. Hence, this study conducted to develop knowledge base system for crop disease diagnosis in order to identify and diagnosis the disease timely and effectively. For development of the system, data were acquired from different documents and agricultural domain experts. The collected data then, modeled by using rule based decision tree structure that represented as premises-conclusion chains. To determine system"s significance in the agriculture sector area, the prototype has been evaluated by the agricultural extensions and domain experts through visual interaction based on the criteria of easiness to use, time efficiency, accuracy in diagnosing crop diseases and providing right conclusion and recommendations. According to the evaluation through visual interaction 92% system performance was achieved. The system has a computational solution to overcome problems addressed and bring the Ethiopian precision agriculture one step forward. In order to have more feasibility and acceptance the system was done as to support English and Afan Oromo languages, and this increases its feasibility to East Hararghe agricultural sector areas.

Keywords: Decision tree, Knowledge base system, Crop disease diagnosis.

1. INTRODUCTION

Agriculture is one of the broad sectors that are spine and have a great role in Ethiopian economic issues. The expansion of all other sectors, and hence the overall economic growth of the country, depends up on this particular sector. As it is estimated by Diriba Welteji [1], 85% of the Ethiopian people are participating and engaged directly or indirectly in the agriculture sector area for their social life. Ethiopian agricultural facilities are controlled by small scale farmers who practice traditional farming methods and experienced with low input and hence low output and productivity. The cultivation land controlled by the Ethiopian small scale farmers cover about 95% of the entire cultivation area under agricultural use, and these farmers are expected to earn around 90% of the entire agricultural output of the country [2].

Ethiopian agricultural sector is producing different crop categories which are cultivated in different regions and land topographies throughout the country. The cereals namely; teff, wheat, maize, sorghum, and barley are the common and dominant crops of Ethiopia"s agriculture and food economy in terms of the cultivation area they covered throughout the country. The cereal crops cover 75% (3/4) of the total cultivation area (10.22 million hectare out of total cultivation area) in Ethiopia. Around 16.24 million smallholder farmers, in Ethiopia, are suggested to be participating in cereal crop production for their livelihood, and economic importance with respect to food security [3].

In Ethiopia, Cereals crop production is widely distributed in different regions and zones based on their ecological placement. Starting from sea level to as high as 3000 meters above sea level are the possible land levels which highly producing the cereals. Ethiopia is known to be a center of production for teff, sorghum, barley and wheat. These crops due to their earlier adaptation in different agricultural zones of the country have been widely produced by the farmers. As a result, they are the major crops of large majority of Ethiopian population and cover the largest portion of cultivated land and the highest portion of annual grain production in the Ethiopia [4]. The second most dominant crop group in terms of acreage in Ethiopia, after cereals, is pulse that covers about 12.4% of total area cultivated. Around 6.4 million people in Ethiopia are estimated to be growing the pulse crop. The total pulse production is about 1.5 tons per year and this is expected to be 8% of the total production.

The third most dominant crop group in terms of acreage in Ethiopia is oilseeds that cover about 6.9% of total area cultivated by around 3.1 million farmers. The total oilseeds production is about 0.5 tons per year and this is expected to be 3 percent of the total production per year. Coffee, khat, fruit crops, vegetables and root crops are also the important categories which cover the rest percentage of agricultural land in Ethiopia. These crops are basically important for economic development. For instance, coffee is common crop in which Ethiopia known by exporting the seed to the neighbor and other foreign countries. Some of the most significant reasons which directly affect crop production are traditional crop disease diagnosis methods, low human and natural resource utilization, less technology supported farming tools, low pest and fertilizer utilization, unrecognized techniques for soil and water utilization, ecological degradation of potential arable lands, and scarcity of skilled agricultural experts. Ethiopian agricultural sector area and farmers are challenged by climate change, misidentification of the variety of the crops they grow and problem of early crop disease diagnosis [5][6].

The rain fed based crop production adapted in Ethiopia, with no additional alternative, is demonstrated to be highly influenced by the climate change. In addition to climate change, unsuccessful crop disease diagnosis can affect crop productivity. Farmers need to have some know how about favorable crop growth conditions variety selection. In addition to this extent, farmers and agricultural extensions are not able to identify the disease which infects their crop. This turns to low productivity of most common crops [7].

Our research has been conducted in East Hararghe zone of Oromia regional state in Ethiopia. The East Hararghe zone is one of the eleven administrative zones of Oromia regional state and has twenty different districts under its administration. Harar and Dire Dawa cities are the most well-known business centers in the East Hararghe zone. Those cities are the main export destinations of agricultural products from the area to Djibouti, the Middle East and European countries. The districts currently administrated by East Hararghe zone agricultural office are Kombolcha, Jarso, Gursum,

Babile, Fedis, Haromaya, Aweday, Kurfa Chele, Kersa, Meta, Goro Gutu, Deder, Melka Belo, Bedeno, Midega Tola, Chinaksen, Girawa, Golo Oda, Meyu and Kumbi.

The purpose of the research is to acquire the necessary knowledge from experienced experts and develop knowledge base system for common crops disease diagnosis that can advise farmers and extensions. The purpose of the knowledge base system to diagnosis the disease of the common crops cultivated and customized in East Hararghe in case where experienced person are not available. The most common crops which are highly customized and cover large amount of cultivation area are wheat, barley, coffee, sorghum, maize, potato and groundnut. Hence, this research is helpful especially, for rural area societies which are far from urban areas where the agricultural experts and specialists are mostly found.

2. STATEMENT OF THE PROBLEM

Agriculture facilities require more information and application of knowledge from different respected fields of science, engineering and technology to make a convenient decision making that can bring a sustainable agricultural development [8]. This needs agricultural specializations and human experts to help small scale farmers in decision making practices and issues. However, in Ethiopia agriculture domain experts are not always available, may not be accessible to every cultivation area due to different reasons. Developing knowledge base system for plant disease diagnosis can be an alternative solution in cases where the domain experts are not able to avail themselves in cultivation field [9].

Crop disease diagnosis needs high level domain experts and agricultural specialists. In East Hararghe, Agricultural Domain Experts (ADEs) are often in great demand but there no full chances to cover the whole agricultural cultivation area. The major reason why these domain experts are not reaching the whole agricultural fields is that they are small in number and less proportional relative to the cultivation coverage area. Even though their availability in the field has a great role in high productivity, extension workers are responsible to transfer the knowledge to small scale farmers. However, there is a challenge on the communication ways and knowledge transfers to farmers. The existential of ADE that can help farmers directly is rare. This leads to mismatch of agricultural experts to the total cultivation area. Different expert systems can be efficiently deployed for different cases in the agricultural sector [10].

As it is observed through physical movement to different worodas in East Hararghe, most farmers are performing their activity in traditional way. There is no any agricultural system that can help agricultural development agents and farmers. The ADEs are small in number and located at Haramya University, and are not enough to cover all the farming land. The thesis, therefore, intends to assess the existing crop disease diagnosis practices and the development of a knowledge base system which can be used for crop disease diagnosis in the case of East Hararghe, Ethiopia. The system can obviously help to transfer the knowledge from domain experts to the development agents as well as to the small scale farmers. The system has been made to support two languages namely; the international language, English, and the most Ethiopian Eastern Hararghe zone people local language, Afaan Oromo. The reason why those languages were selected is that most of the farmers in East Hararghe speak and understand the local language, Afan Oromo. English was selected because any one who cannot communicate with Afan Oromo could have a chance to interact with the system in English. This can solve language limitations of agricultural extensions and farmers as well.

Basically, this study was conducted to answer the following research questions:

RQ1: How can knowledge base systems are used for crop disease diagnosis?

RQ2: What are the common diseases that damage most common crops (wheat, barley, coffee,   potato, groundnut, sorghum, maize) in Eastern Hararghe zone, Ethiopia?

RQ3: What measures can be taken by experts to diagnosis the crop diseases?

RQ4: How to design and implement knowledge system for crop disease diagnosis and treatment?

RQ5: How knowledge base system for crop disease diagnosis helps for the agricultural sector?

3. SIGNIFICANT OF THE STUDY

The stakeholders and beneficiaries of the study include commodity producers, individual farmers, environmental groups, government agencies, researchers and agricultural extensions. The findings of this study have a great role for agricultural researchers or domain experts in such a way that experts and researchers can get easily and timely access to disease identification and diagnosis. Commodity producers and individual farmers are beneficiary of the study because they can use the system directly or indirectly, for crop disease diagnosis processes which are helpful for high productivity. Moreover, the study has the following major significant:

a) It can benefit, directly or indirectly, farmers and different agricultural stakeholders by making easy and timely access to crop disease identification, diagnosis and treatment methods.

b) It can help non domain experts in disease identification and diagnosis tasks. Non domain experts can improve their knowledge and be effective in the crop disease identification and diagnosis task as expert knowledge is readily available.

c) It can help domain experts and researchers to transfer their professional skill and knowledge to development agents easily. In this way domain experts can be accessible for all farmers indirectly with low cost, and their idea is shared throughout cultivation area.

d) It can help agricultural extensions to envelop their field matter knowledge.

e) It can also help to implement precision in East Hararghe zone.

4. REVIEW OF RELATED WORKS

Knowledge based systems can be used for different purposes in different perspectives. Crop disease diagnosis is common application of knowledge based systems. Jain and Renu [11] developed a knowledge based system for the purpose of diagnosis and control of pulse crops. The system was referred to be PulsExpert since it can make the operation of pulse disease diagnosis and control easy that helps farmers and extensions to identify disease of major pulses including chickpea, pigeonpea, mungbean and urdbean. The knowledge acquisition from primary and secondary resources was performed to get and acquire the required knowledge. PulsExpert diagnosis the pulse crop diseases and suggests most appropriate control measures which are composed of cultural practices as well as chemical controls. PulsExpert was evaluated by a team of field farmers and State agriculture officers and it was considered good with an average rank of 2.745 by farmers and 2.075 by State agriculture officers with a statistic mode ranking 3 in both the cases. From this it is in sighted that knowledge based can be used for crop disease diagnosis.

In the same case, KBS was developed for tomato disease diagnosis with special reference to pesticides. The research was aimed to design and develop prototype KBS to suggest pesticides for tomato farmers and users. The researchers have tried to develop KBS to identify the pests and to suggest pesticide treatment. The knowledge based developed was considered as rule based ES. The

rules were developed by considering different growth stages of tomato, symptoms of disease, insect-pests attacks on crop. In this system farmers have choice of selecting pesticide by considering different companies and their prices so that farmers can select pesticides which is affordable. The developed KBS is helpful to farmers to take decision related to pesticides of tomato. As pesticide treatment, this system suggests different pesticide to control single pest [12].

Moreover, a knowledge base system prototype for diagnosis of fruit plants was developed by Satrio Dewanto and Jonathan Lukas [13]. The purpose of the system was to develop knowledge base system that can help farmers and extensions for early diagnosis of fruit disease and recommending the management principles. Rule base reasoning approach was used to represent the knowledge acquired from experts and different documents from literatures. The system was developed using software Corvid Exsys developed by Exsys Company. The UI designed is based on console process. The system gives choice about the type of plants the users want to diagnose. Fruit species that are listed are durian, mango and oranges. Next a successive question about the symptoms occurs in the leaves are provided for the user. Users are expected to answer by saying yes or no principle. Finally, the system provides a conclusion and recommendation based on the symptoms. The results showed that this expert system can be used to advise users in identifying the type of pests and diseases on fruit plants.

When we come to our country, different knowledge base systems were developed for different purposes and applications. Bethlehem Asferi [14] tried to explore pest management practices and development of knowledge base system for pepper disease diagnosis. The study was aimed to survey results of current pest management practices and corresponding challenges. A rule based knowledge expert system using PROLOG shell was developed in the case of agricultural sectors for pepper disease diagnosis and treatment in her study. The researcher explained that Ethiopian agriculture is basically dependent on its agricultural productive. The researcher mentioned that major crops produced in Ethiopia include cereals, roots and tubers, pulses, oilseeds, vegetables like tomatoes, onions, shallots and pepper, fruits and cash crops like khat. As per the researchers idea pepper is one of the productive crops in Ethiopia, but it constantly shows severe disease symptoms throughout Ethiopia and in the rift valley districts particularly. It is also recommended by the researcher to develop as such knowledge base system for other crop categories.

A rule based KBS for selected cereal crops diagnosis and treatment was also developed by Ejigu Tefera [15]. The study area used was at Kulumsa agriculture research center. Cereal production and marketing are the means of livelihood for millions of households and farmers in Ethiopia. However, cereal crops can be suffered from different diseases like bacteria, virus, and fungi. For this reason, it is important to diagnose and treat cereal crops in their early stage for quality and high productivity. Early of diagnosis and treatment of crops needs agricultural specialization and technical knowledge and awareness. These and other problems have initiated the researcher to develop KBS which assists both research experts and development agents in diagnosing and managing cereal crops to make quality decision on daily needs of farmers. The proposed solution is relevant for agricultural infrastructure in Ethiopia because there is a shortage of agricultural experts in the field. The researcher developed a Knowledge base system for common cereal crops; namely wheat and barley disease diagnosis and treatment.

In the same way, study on development of knowledge base system for sugarcane diseases diagnosis was carried out. In order to remain competitive modern farmers often rely on agricultural specialists and advisors to have information for decision making. Always, human experts are needed to provide the diagnostic knowledge; however, pest management experts are not readily available to carry out disease diagnosis identification, even if available consultation may be very expensive in most Ethiopian agricultural cases. In order to overcome this problem, knowledge base systems were identified as a powerful tool with extensive potential in the agriculture sector. The researcher explained that, a knowledge base system is a computer program that reasons with the knowledge of a specialist subject with a view to solve problems or can act as an advisory system on behalf of domain experts [16].

Furthermore, a research involved the design of an expert system which helps farmers and specialists diagnose and provide appropriate advice on banana diseases was developed [17]. One of the key elements of this research was to find the appropriate knowledge to diagnose the disease and the current situation in the knowledge base. Expert systems enable effective consultation through console based user interface. Production rules were used to represent the acquired knowledge. The expert system was developed using CLIPS with the Delphi 10.2 as user interface. The expert system shows good results in diagnosis of different cases of banana disease and enabling the system to determine the correct diagnosis in all cases.

As per the current information found, no knowledge base system was developed for East Hararghe zone agricultural sector area. In addition, no knowledge base system was developed still that can support Afaan Oromo language. All most all researchers, who developed knowledge base system, recommended that formulating knowledge base system that can support local Ethiopian languages has great role for easily and relevant use. Hence, the research has been conducted to solve crop diagnosis problems on East Hararghe zone of Oromia region, Ethiopia, by participating domain experts and agricultural extensions in the zone.

The research incorporates the crop disease diagnosis services as per required. Based on the domain experts suggestion the main focus of the research was on crop disease diagnosis based on users and experts reflection. Developing the system as to support both English and Afaan Oromo also makes the research unique from other researchers study. Some of the crops considered for disease diagnosis purpose have not been considered in other researches. This indicates the research intends to incorporate more common crops for early diagnosis of disease and giving the right recommendation that ought to be applied after a disease is identified. The insight here is that, system advises farmers and extensions for diagnosis and treatment of the most known and common crops in East Hararghe zone.

5. Knowledge Engineering Methodology

Knowledge engineering process is the most significant stage in knowledge base systems development. It deals with acquiring explicit data from different primary and secondary resources. Mainly, it focuses on the three key activities; namely knowledge acquisition, knowledge verification and KM and KR. Knowledge engineering tasks were done in utterance way to produce successive implementation of the knowledge base system. The knowledge engineering outputs were input for system engineering tasks, for the development of the actual KBS.

a) Knowledge Acquisition

Knowledge acquisition, the significant knowledge engineering stage, is considered to be the preponderance of the knowledge base system development process. The process of knowledge acquisition in this research work includes acquiring the required knowledge from the expected materials and respected persons, analyzing the acquired knowledge and finally preparing the knowledge for the next step which is KM and representation. In order to acquire the required knowledge for this study both secondary and primary sources of knowledge were used. By interviewing agricultural experts the primary data was acquired. To extract the relevant knowledge from secondary resources reviewing different books, articles and manuals was performed as data gathering technique.

b) Knowledge Verification

The acquired data has to be verified before it is going to be implemented as a set of rules. The data verification plays a vital role in KBS development and implementation. The more the data is verified, the more accurate knowledge can be represented and

therefore, the more accurate and consistence system can be developed. The data acquired from different domain experts may not be always consistence due to different reasons. Multiple experts" conflict resolution and review every phases are commonly used ES verification and validation techniques [18]. In the former technique the knowledge engineer can solve the issue by coming up with multiple domain experts to discuss on their ideas. Due to different reasons, multiple domain experts" conflict resolution knowledge verification technique was not used in this research study. It was unable to come up with multiple domain experts together. This was because the knowledge experts contacted were in different working places, and communicating together was not suitable. The technique used to validate the data acquired from both primary and secondary data sources was review procedure in each and every phase of the knowledge engineering process. In the first round every knowledge expert sampled was interviewed depending on their specialization and field of interest. The data acquired is then checked and verified again in the second round.

6. KNOWLEDGE REPRESENTATION METHODS

The study is carried out to develop a knowledge base system for crop disease diagnosis. It starts with the most general hypothesis, backward chaining, and ends with the diagnosis of the disease. In many knowledge based systems (expert systems) development, decision tree is one of the most important algorithms [19]. This because of its structure that built a classification in the form of tree by breaking down a dataset into a small subset, as it is indicated in Figure 3.2. The final result of a decision tree is easily to transform to a rules by mapping from a root node to leaf node one by one.
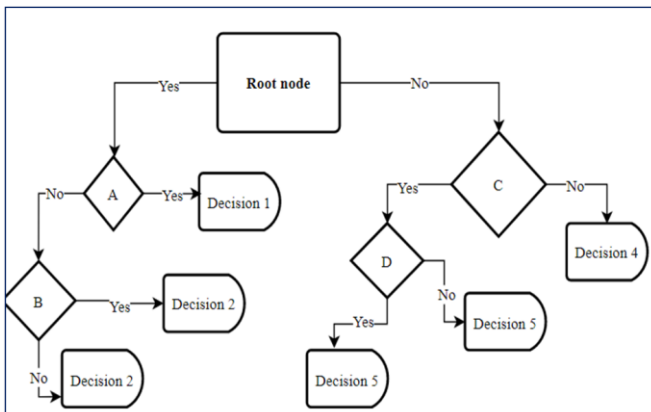

Figure 1: Decision tree based knowledge modeling

The knowledge acquired and verified from agricultural domain experts and document analysis was represented using Production Rules (PRs). The PRs are most commonly used KR techniques in knowledge based systems development [20]. Rules in rule based systems represented in the IF – THEN forms are said to be production rule or just rules. The term „rule" in AI and ESs is defined as an IF – THEN structure that relates given information or facts in the IF part to some action in the THEN part. Relative to other techniques PR are easy to create and use. These rules represented by production rule were implemented with appropriate knowledge base system development programming language. In the case of this study, the knowledge acquired from primary and secondary sources of data described after analyzed and represented using decision tree conceptual KM.

7. The Knowledge Modeling and Representation

For this study decision tree was used for knowledge modeling purpose. The knowledge which acquired has been formulated and modeled as a decision tree format after complete the formulation of the knowledge in the form of factor table. The importance knowledge was acquired from ADEs and lab technicians who have been engaged in plant disease diagnosis for a long period of time.

The decision tree based knowledge modeling for each CDD are shown in the following Figures, see Figures 2 – 8.
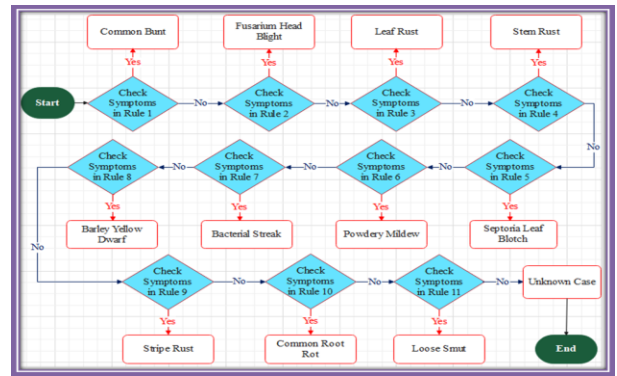

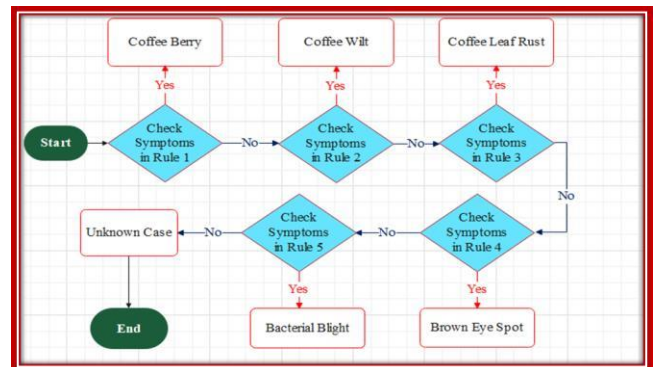Figure 2: Decision tree modeling for wheat crop disease diagnosis

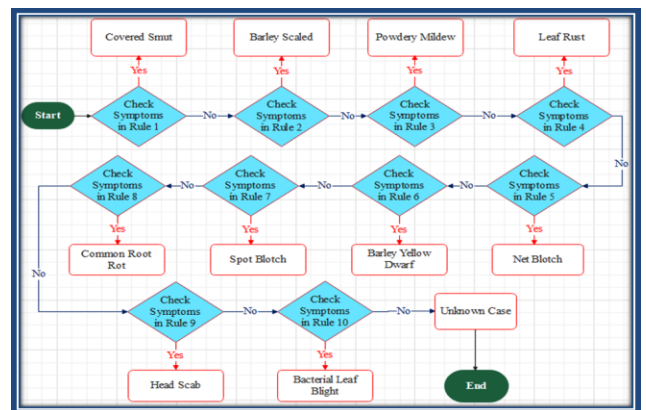Figure 3: Decision tree modeling for coffee crop disease diagnosis

Figure 4: Decision tree modeling for barley crop disease diagnosis
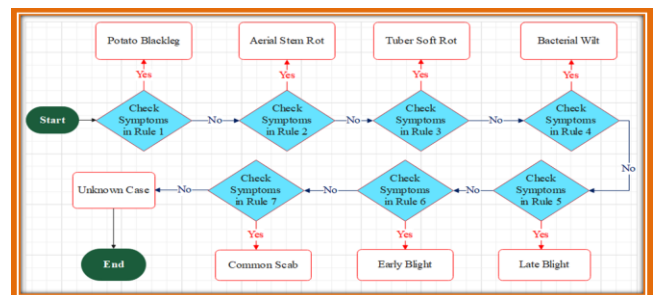

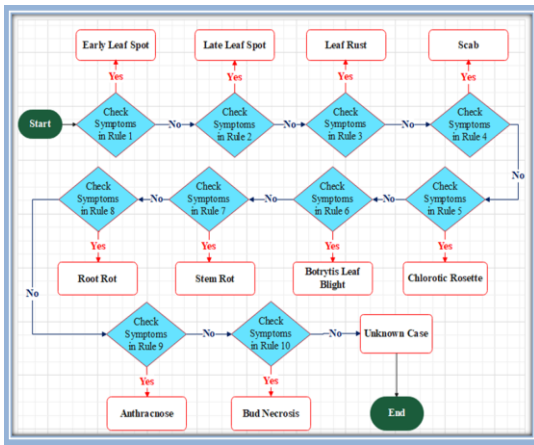Figure 5: Decision tree modeling for potato crop disease diagnosis

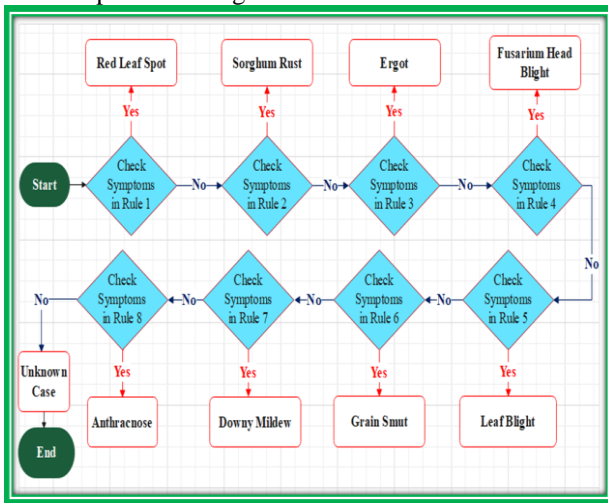Figure 6. Decision tree modeling for groundnut crop disease diagnosis

Figure 7: Decision tree modeling for sorghum crop disease diagnosis
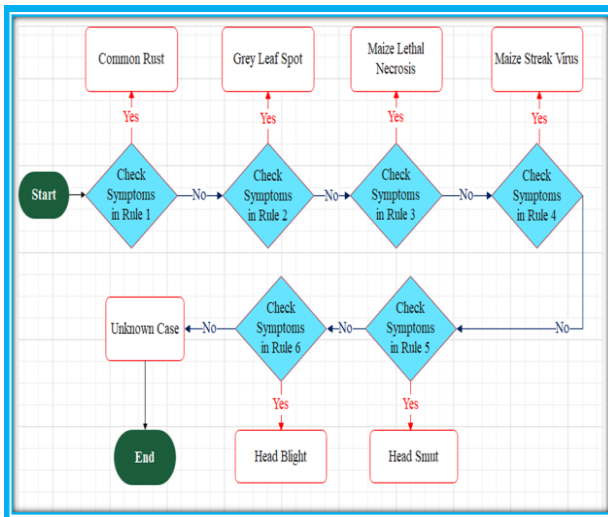

Figure 8: Decision tree modeling for maize crop disease diagnosis

The knowledge which is acquired from ADE, after modeled using decision tree, is then represented in the form of PR. Production rule based KR method is an If – then algorism that can contain different premises and corresponding conclusions and actions. Depending on the aim of the rules constructed, premises are checked and if all the premises are to be correct, then a conclusion is to be

drawn. The reason for PR, in this study is being used as KR technique is possibility of formulating the knowledge base easily. The produced PR look like the following samples. The presented KRs are only the sampled rules, because if we include all the PRs, they will take many spaces.

Sample barley disease diagnosis PRs:

Rule 1:
  If
    ('The head of infested barley shown as tall and/or have compact smutted'), **AND**
    ('The spike lets of infected plants replaced by masses of dark brown smut spores'), **AND**
    ('The black powdery spores blow away to leave a bare stalk'), **AND**
    ('There are smut sori development in leaf blades, where they appear as long streaks'), **AND**
    ('Kernels replaced with grey fungal masses'),
    Then   ('Covered Smut disease will be diagnosed').

Rule 2:
  If
    ('The leaves of barley show pale gray color'), **AND**
    ('There bluish gray lesion on barley leaves'), **AND**
    ('The centers of lesion dry out and/or become bleach'), **AND**
    ('There is any dark brown color with tan margin formation on the edge of barley leaves'),
    Then   ('Barley Scaled disease will be diagnosed').

Figure 9: Sample barley disease diagnosis PRs:

8. KNOWLEDGE BASE DEVELOPMENT

The development environment used for implementation the KBS was SWISH-SWI-PROLOG. SWISH-SWI-PROLOG is free source online PROLOG compiler designed for educational purpose. The knowledge represented using production if - then rules in the KR was used to develop the knowledge base of the system. The if - then rules were converted to PROLOG code so that they can be easily inferred by the ES shell (SWI-PROLOG). The KB was formulated to integrate different rules that can be inferred based on specific conditions. Let's take the rules which are used to check whether the sorghum crop is infected by a certain disease or not. The red leaf spot, sorghum rust, ergot, Fusarium head blight, leaf blight, grain smut, downy mildew and anthracnose are the commonly sorghum affecting diseases identified during the knowledge acquisition stage.

```
/*Rules for checking up sorghum disease*/

checkforSorghumELU('Red Leaf Spot'):-srlsELU.

checkforSorghumELU('Sorghum Rust'):-srELU.

checkforSorghumELU('Ergot'):-seELU.

checkforSorghumELU('Fusarium Head Blight'):-sfhbELU.

checkforSorghumELU('Leaf Blight'):-slbELU.

checkforSorghumELU('Grain Smut'):-sgsELU.

checkforSorghumELU('Downy Mildew'):-sdmELU.
```

Figure 10: Sample Prolog Code for checking sorghum disease

```
/*Sorghum diseases symptoms*/

srlsELU:-

checkSymptomELU(' Do small red coloured spots appear on leaf'),

checkSymptomELU(' Do whitish center encircled by red, purple or brown margin appear'),

checkSymptomELU(' Do small black dots seen on the white surface of the lesions'),

checkSymptomELU(' Do elliptical, red or purple regions with black acervuli formed),

checkSymptomELU(' Is there development of circular cankers on stalk),

checkSymptomELU(' Do infected stems when splited and opened shows discoloration'), nl.
```

Figure 11: Sample Prolog Code for Sorghum diseases symptoms

9. SYSTEM PROTOTYPE DEMONSTRATION

To use the knowledge base system the UI is needed. Normally, UI is a bidirectional communication protocol between the system and the end user. It is the window which allows the user to respond the questions and return information back to the user. Once the system is opened, the end users can see the welcome window which is displayed along with the menu containing choices.

The system requests end-users to choose the language he/she needs to use throughout. If the user responds „elu" in the reply box, he/she argued to continue with English language, similarly if the user responds „olu" in the reply box, he/she argued to continue with fan Oromo language. But if the user"s response out of „elu" and „olu", then the reply is not supported and a chance will be given to re-enter a correct response. Here is a sample prototype demonstartion captured from the system, Figure 12 shows the system prototype for presenting symptoms and accepting responses where as Figure 13 shows system prototype for presenting the final output.
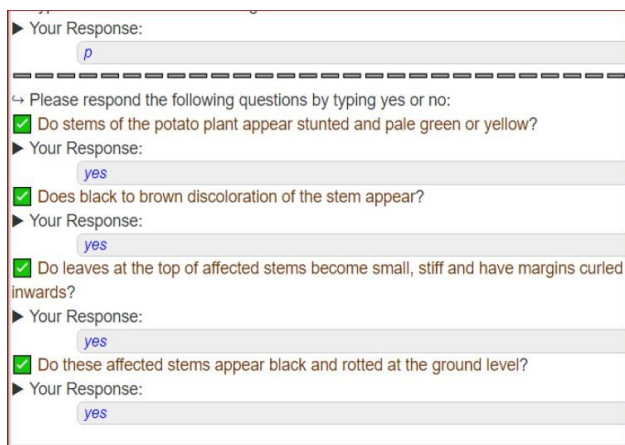

Figure 12: system prototype for presenting symptoms and
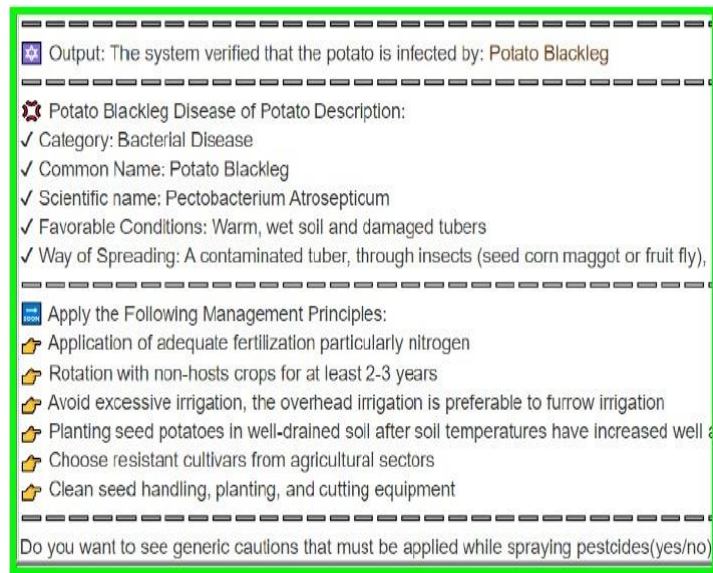
accepting responses

Figure 13: shows system prototype for presenting the final output.

10. SYSTEM PROTOTYPE EVALUATION

The system performance evaluation helps to know the level and ability of system applicability in the case of real world implementation. In this study, user visual interaction method of evaluation was used to assess the applicability and significance of the system for agriculture domain area. Based on the evaluation results obtained from visual interaction with closed ended questionnaires none of the respondents rated the system as poor or even as fair. For both respondent categories the system prototype got excellent as highest percentage. The overall performance of the system prototype is indicated in Table 1, it shows the overall system performance and the percentage of respondents who rate the prototype of the system as excellent, very good, good, fair or poor. The overall system performance was calculated by taking the average of the performance values of the two categories.

Table 1: Summary of system prototype evaluation

Category of respondents	Rate	Number of respondents	Respondents (in %)
Agricultural extensions	Poor (1)	0	0
	Fair (2)	0	0
	Good (3)	7	5.19
	Very good (4)	36	34.81
	Excellent (5)	65	60
	Average (in scale value)	4.58	
	Average (in %)	91	
Agricultural domain experts	Poor (1)	0	0
	Fair (2)	0	0
	Good (3)	3	5
	Very good (4)	19	29
	Excellent (5)	58	66
	Average (in scale value)	4.61	
	Average (in %)	93	
Overall average		**4.6**	**92**

In addition to the closed ended questions, agricultural experts also asked their suggestion and opinion. Based on their recommendation, the system has a great role for agricultural crop growth and management process. They believed that, if the system is going to be implemented successfully un-experienced persons and not experts can be easily access it. This facilitates the overall agricultural crop growth issues where even domain experts are not available.

11. CONCLUSION

In Ethiopia, agriculture is the backbone and the base the economic growth. Ethiopia's economy is dependent on agriculture, which accounts for 40 percent of the GDP, 80 percent of exports, and an estimated 75 percent of the country's workforce. Modernizing agriculture has its own positive role in improving crop productivity as well as crop quality. Ethiopia is currently in the way of implementing precision agriculture which is helpful in enhancing the crop productivity and hence helping small scale farmers by making cluster farming.

East Hararghe zone, where the study was conducted, is one of the broad zones found in Oromia region, Ethiopia. It contains a lot of small scale farmers who do not have enough economy and knowledge in crop disease diagnosis activities. Agricultural services are reaching to the small scale farmers through agricultural extensions also called agricultural development agents. Agricultural extensions are peoples who are engaged in agricultural sectors to help small scaled farmers in every aspect of crop production and harvesting. But the problem is that the agricultural extensions have knowledge gap to diagnosis disease infecting crops.

The overall finding of preliminary assessment on knowledge of agricultural extensions and farmers in East Hararghe zone, indicates that there is a huge problem on how to diagnosis crop diseases and make right recommendation of treatment mechanisms. From the preliminary assessment, it has been identified that there is no knowledge based system that can help East Hararghe agricultural extensions and farmers. To reduce this gap knowledge base system that can recommend best crop favorable for a cultivation area and that can diagnosis crop disease was developed successfully.

For the purpose of feasibility analysis assessment was conducted from ADAs, which indicates integration of ADEs, ADAs and farmers is limited. Thus, developing knowledge base system for CDD could be a solution for the current problem faced by farmers and extensions. A rule based approach was used for development of the knowledge base system after all stages needed for knowledge based development have been addressed. The research used knowledge engineering methodology, performing tasks like knowledge acquisition, knowledge modeling, knowledge representation with appropriate technique and system evaluation one after completion of the other task. Especially, the knowledge acquisition stage takes a lot of time and different disease diagnosis processes were identified. For crop diseases diagnosis process ADEs who specialized in crop plant protection, crop breeding, genetics and pathology were contacted. Thus, the role ADEs in this research was consulting on how the crop disease diagnosis can be performed and what measure treatment mechanisms must be applied based on their experience.

For crop disease diagnosis issue the most customized crops in the East Hararghe zone such as sorghum, maize, potato, groundnut, wheat, barley and coffee were considered. After successful completion of knowledge acquisition, a rule based KBS was designed and developed. Finally, after development of the system, KBSCDD, which supports both English and Afaan Oromo languages, performance was evaluated by ADEs and ADAs. The average performance of the system with respect to ADAs was to be 91% while the system performance with respect to ADEs was 93%. The overall performance of the system, which is the average of both domain categories, was then 92%.

From the finding of the performance analysis, it can be conclude that the system, KBSCDD after full implementation, can be used in rural areas where shortage of agricultural domain experts is observed. Since the system supports Afaan Oromo language in addition to English, it is very helpful to the East Hararghe zone. The system, KBSCDD, helps agricultural extensions directly and for farmers directly or indirectly in crop disease diagnosis processes and activities.

In addition to agricultural extensions and farmers, the KBSCDD can be very helpful for researchers who are engaged in agricultural research institutes and agricultural sector areas. This is because the system was developed based on the effort of many experienced and specialized agricultural experts who are currently engaged in crop breeding and crop disease diagnosis researches. Therefore, based domain experts" opinion the system has its own positive role in implementation of precision agriculture in East Hararghe zone of Oromia region, Ethiopia. From the finding of this research, it can be conclude that KBSs have a great and feasible role in precision agriculture implementation.

12. RECOMMENDATIONS

Due to time and other constraints, the following points were not covered in this research work. Thus, the researchers would suggest and forward these areas and future research directions to be considered for the future in case of knowledge base system for crop disease diagnosis.

✓ Crops are not only infected by diseases but also by insect pests. Hence, developing knowledge base system for crop insect pests management and control is recommended for future research work in the area of knowledge based systems in agriculture.

✓ Nutrient deficiencies of crops are also critical cases in crop growth, based on experts saying during system evaluation. Thus, developing and implementing of knowledge based system for nutrient deficiencies management and control is also recommended as a future work.

✓ For users who are not familiar with English and Afaan Oromo languages, developing knowledge based system that can support other local languages like Somali, Amharic and Aderie in the case of East Hararghe is also recommended again for future work.

✓ In case where enough images can be found, developing knowledge based system by integrating both rule based reasoning and deep learning based approaches can be under taken in the future research works.

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