ISSN : 2456-3307

NEW HORIZON COLLEGE OF ENGINEERING

IJSRCSEIT

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)

Organised by

Department of Electrical and Electronics Engineering

New Horizon College of Engineering, Ring Road,

Bellandur Post, Bengaluru, Karnataka, India

UGC Approved Journal [Journal No : 64718]

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN COMPUTER SCIENCE, ENGINEERING AND INFORMATION TECHNOLOGY

Volume 4, Issue 5, March-April-2018

Email: editor@ijsrcseit.com

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)

13th April 2018

In Association with

International Journal of Scientific Research in Computer Science, Engineering and Information Technology

ISSN : 2456-3307

Volume 4, Issue 5, March-April-2018

International Peer Reviewed, Open Access Journal

Organised by:

Department of Electrical and Electronics Engineering

New Horizon College of Engineering, Ring Road, Bellandur Post, Near Marathalli, Bengaluru, Karnataka, India

Published By

Technoscience Academy

(The International Open Access Publisher)

Email: info@technoscienceacademy.com

Website: www.technoscienceacademy.com

HON. CHIEF PATRON

Dr. MOHAN MANGHNANI, CHAIRMAN, NHEI

PATRON

Dr. MANJUNATHA, PRINCIPAL,NHCE

HON. CHIEF GUEST

Dr. P.S RAMKUMAR

FOUNDING DIRECTOR OF APPLIED COGNITION SYSTEMS

AND SOWKHYA CARENET PVT LTD EX DIRECTOR OF

INNOVATION AND RESEARCH PROGRAM AT INTEL CORP.

EX CENTER DIRECTOR OF VXTEL-INC. USA,EX CTO AT SRIT,

MEMBER EXPERT AT ITU WING OF UNITED NATIONS

ORGANISING CHAIR

Dr. R.ELUMALAI, HEAD/EEE,NHCE

ORGANISING SECRETARY

Dr. S SUJITHA, PROF/EEE, NHCE

Dr. K MAHESH ,PROF/EEE, NHCE

COLLEGE ADVISORY BOARD

Dr. PRASANTH ,DEAN ACADEMICS, NHCE

Dr. M.S. GANESH PRASAD,DEAN,STUDENT AFFAIRS AND HEAD/MECH,NHCE

Dr. K GOPALA KRISHNAN, DEAN,R&D,NHCE

Dr. RAJALAKSHMI,HEAD CSE,NHCE

Dr. JITENDAR RAO,HEAD ISE ,NHCE

Dr. SHRIDHAR KRUSE,HEAD AUTOMOBILE,NHCE

Dr. ANANDHA VARDHAN,HEAD,BIO TECHNOLOGY,NHCE

Dr. NIRANJAN,HEAD,CIVIL,NHCE

Dr. REVATHY,HEAD,PHYSICS,NHCE

Dr. SRINIVASA,HEAD,MATH,NHCE

Dr. ANUSHYA,HEAD, CHEMISTRY,NHCE

Dr. ANITHA RAI,HEAD,LIBRARY

NATIONAL ADVISORY BOARD

Dr. K.VINOTH KUMAR,ABB INDIA LTD CHENNAI

Dr. NAGANA GOWDA,NTCST,BENGALURU

Dr. NAGARAJ,PRDC, BENGALURU

Dr. NATARAJAN,MSRIT, BENGALURU

Dr. SUBBAREDDY,HONEYWELL BENGALURU

Dr. LUMANAND IISC, BENGALURU

Dr. P RAJA,NIT,TRICHY

Dr. K. VIJAYAKUMAR,NIT,JAIPUR

Dr. T.SURESH KUMAR,VIT,VELLORE

Dr. M.YUVARAJU,ANNA UNIVERSITY, COIMBATORE

Dr. S KUMARA VEL,NIT,CALICUT

INTERNATIONAL ADVISORY BOARD

Dr. BHEKISIPHO TWALA, UNIVERSITY OF JOHANNESBURG, SOUTH AFRICA

Dr. SISIL KUMARA WADU, UNIVERSITY OF MORATUWRA, SRILANKA

Dr. AHMED ZOBAA, BRUNEL UNIVERSITY LONDON

Prof. AKHTAR KALAM, VICTORIA UNIVERSITY AUSTRALIA

Dr. G. MOHAN KUMAR, DONGGUK UNIVERSITY, SEOUL, REPUBLIC OF KOREA

Dr. ABDUL RAZZAK, BITS, DUBAI

Dr. S SURESH KUMAR, GT-CNRS-UMI LAB,FRANCE

Dr. V.RAMAN,JAPAN, INSTITUTE OF TECHNOLOGY,JAPAN

Dr. S NAGARAJAN, TOKYO INSTITUTE OF TECHNOLOGY,JAPAN

Dr. GUNASEKARAN THANGAVEL, HIGHER COLLEGE OF ENGINEERING MUSCAT

Dr. X.Z GAO,AALTO UNIVERSITY,AALTO,FINLAND

About College

NEW HORIZON COLLEGE OF ENGINEERING IS AN AUTONOMOUS COLLEGE AFFILIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY(VTU), APPROVED BY THE ALL INDIA COUNCIL FOR TECHNICAL EDUCATION(AICTE) & UNIVERSITY GRANTS COMMISSION(UGC). IT IS ACCREDITED BY NAAC WITH 'A' GRADE. THE DEPARTMENTS OF COMPUTER SCIENCE, ELECTRONICS & COMMUNICATION, MECHANICAL, CIVIL,AND BIOTECHNOLOGY HAVE BEEN ACCREDITED BY THE NATIONAL BOARD OF ACCREDITATION(NBA). IT IS AN ISO 9001:2008 CERTIFIED INSTITUTION. NEW HORIZON COLLEGE OF ENGINEERING IS LOCATED IN THE HEART OF THE IT CAPITAL OF INDIA,BANGALORE. THE COLLEGE CAMPUS IS SITUATED IN THE IT CORRIDOR OF BANGALORE SURROUNDED BY MNCS AND IT GIANTS SUCH AS INTEL, ACCENTURE, CAPE GEMINI, ARM,SYMPHONY, WIPRO, NOKIA, JP MORGAN AND CISCO TO NAME A FEW. NHCE HAS A SCENIC AND SERENE CAMPUS THAT PROVIDES AN ENVIRONMENT WHICH IS CONDUCIVE FOR PERSONAL AND INTELLECTUAL GROWTH. THE INFRASTRUCTURE ACTS AS A FACILITATOR FOR THE EFFECTIVE DELIVERY OF THE CURRICULUM. NHCE BOASTS OF STATE – OF - THE - ART FACILITIES FOR ITS STUDENTS. THEY ARE GIVEN UTMOST ENCOURAGEMENT IN THEIR AREAS OF INTEREST BY PROVIDING HI-TECH FACILITIES BACKED BY FACULTY SUPPORT. THE INSTITUTE PLACES HIGHEST PRIORITY ON INNOVATIVE PROGRAMS OF INSTRUCTIONS THAT INCLUDE BOTH TRADITIONAL CLASS ROOM THEORY AND PROFESSIONAL SKILLS TRAINING. THERE IS A STRONG IMPETUS ON OVERALL

About Conference

International Conference on New Horizons in Science Engineering and Technology is a global event organized by New Horizon College of Engineering, Bangalore. This conference provides an internationnal forum for Reasearchers, Developers, Engineers and Practitioners who are involved in real time projects that provides solutions to exchange thier valuable ideas and showcase the ongoing works which may lead to path breaking foundation of the futuristic Engineering. It accentuates indispensability of

interdisciplinary and cross-linked thinking with respect of innovation and market opportunities. All the accepted paper willl be published International Journal with ISSN & Conference proceeding All the accepted papers will be published in the proceedings of international conference and in associated international journal with ISSN.

Objectives

The objective of the conference is to help the participants understand ,learn and appreciate, explore the new advances in Science Engineering and Technology.

About Conference

1. To focus upon advances/innovations and emerging trends in the above said fields.
2. To present an experience the upcoming and exotic trends in the field of Science Engineering and Technology.
3. To disseminate expert knowledge to research scholars and student community.

CONTENTS

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Solar Pv System By Grid Connected To Droop Control Strategy For Shunt Active Power Filter Application

P. Lakshmipathi[1], P. Ramalingaiah[2], T. Muni Prakash[3]
Asst. Prof. EEE Dept. Sir Vishveshwaraiah Institute of Science & Tech., Madanapalli , Karnataka, India [1]
Asst. Prof. EEE Dept. Sir Vishveshwaraiah Institute of Science & Tech., Madanapalli , Karnataka, India [2]
Sr.Asst. Prof. EEE Dept. New Horizon College of Engg., Banglore, Karnataka, India[3]

ABSTRACT

Solar energy technologies are need of the hour due the depletion of the existing conventional energy resources. The major advantage of solar energy is the eco friendly nature and abundant availability. The problem of harmonics persists everywhere in the power system whenever non linear load or static devices are involved. The ultimate goal of the power system to deliver quality power to the consumer. The paper describes the novel method of using Shunt active power filter in gird interfaced PV system in presence of static loads which exhibit non linearity between voltage and current. This system provides VAR compensation and also takes care about harmonics using droop control technique. The solar module is connected the power filter, where the DC-DC converter acts an interfacing medium.The solar module is combined with an appropriate power tracking algorithm which surpases the disadvantages of the usual traditional method. The simulation study shows the effectiveness of the proposed system. MATLAB Simulink platform is utilized to demonstrate the uniqueness of the proposed system

I. INTRODUCTION

The power demand is always behind the electric power supply in ever growing and developing country like India. This calls for the essence of the non conventional energy sources like solar, wind ,hydro etc. The conventional methods of power generation are taking backstage due to depleting nature and preference is given by the Indian government to promote new and alternate energy generation methods in sustainable manner. The growth and development of SCR in thyristor family generally accounts for extensive use of static equipment. This also leads of the problem of harmonics or distortions in the voltage and current waveforms. Another major problem at the load side is the watt-less power requirement. The shunt active power filter is generally used in the power system as it takes care of both these problems. The main aim of this equipment is that it supplies a current which is same as harmonic distorted current in terms of value but anti parallel in direction in order to nullify the effect of harmonics. There are various names for Shunt active power filter such as active power filter, power filter, active filter, SAPF, APF are predominantly used in this paper. The system

considered here is the solar system connected the gird and SAPF mitigates reactive power requirement as well as harmonic content.

The AC supply is fed the static load; in this case, it is the diode-based rectifier with resistive and inductive load,

I_S–current of the AC source

I_L - current of the static load

I_C– current fed by the shunt active filter for harmonic reduction

L_S–inductance of the source

L_L – inductance of the load

L_1 –inductance of the coupling between load and source.

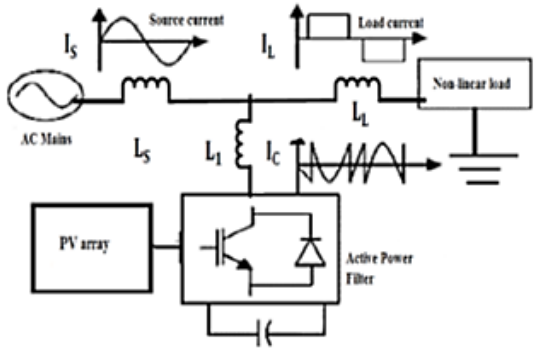


Fig.1 Schematic diagram of active power filter

Here, the shunt APF produced compensating currents of equal in magnitude however contrary in-segment to those harmonics which are present because of non-linear masses which leads to mitigation of harmonics at load modern. Typically, the voltage source inverters (VSI) are used to transform the power of the PV device to inject it to the distribution device. However here, the VSI act as a multifunctional device that is used for power conversion and also for harmonics elimination in addition to reactive electricity repayment simultaneously. This control strategy contains p-q answer as in shunt active electricity clear out technique. This control approach is identical as method utilized in shunt filter out to reduce harmonics in the distribution network due to non-linear loads inside the system.

This paper is prepared as follows phase II presents evaluation on PV cell, its primary principle, connections modeling and effect of temperature and irradiation on PV panel. Segment III defined mppt p & o algorithm and its implementation for max power extraction from a PV device linked to a DC/DC improve converter and its need in PV energy technology in conjunction with its waveforms.Segment IV offers shunt APF design and its manipulate set of rules with implementation of shunt APF control method for inverter control. Phase V describes the received simulation outcomes and its discussions section VI presents the conclusion along side scope for further work.

II. PHOTOVOLTAIC SYSTEMS

PV cells are made of semiconductor materials, for example, silicon. For sun based cells, a thin semiconductor wafer is uniquely treated to shape an electric field, positive on one side and negative on the other. At the point when light vitality strikes the sun-based cell, electrons are thumped free from the molecules in the semiconductor material.

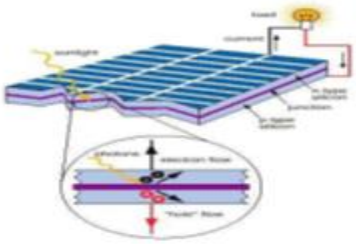


Figure 2 Basic Structure of PV Cell

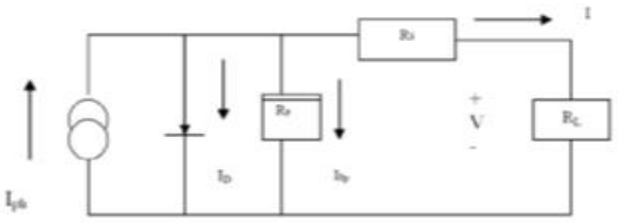


Figure 3 Equivalent circuit of a PV cell

In the event that electrical transmitters are connected to the positive and negative sides, shaping an electrical circuit, the electrons can be caught as an electric current - that is, power. This power would then be able to be utilized to control a heap. A PV cell can either be roundabout or square in development.

A. Modeling of PV Array

The building piece of PV exhibits is the sun based cell, which is essentially a p-n intersection that straightforwardly changes over light vitality into power: it has a comparable circuit as appeared underneath in Figure 3. The present source Iph speaks to the cell photograph current; Rj is utilized to speak to the non-straight impedance of the p-n intersection; Rsh and Rs are utilized to speak to the natural arrangement and shunt protection of the cell individually. Normally the estimation of Rsh is substantial and that of Rs is little, subsequently they might be fail to disentangle the investigation. PV cells are assembled in bigger units called PV modules which are additionally interconnected in arrangement parallel design to frame PV clusters or PV generators[3].The PV numerical model used to disentangle our PV exhibit is spoken to by the condition:

$$I=n_pI_{ph}-n_pI_{rs}\left[\exp\left(\frac{q}{KTA}*\frac{V}{n_s}\right)-1\right] \quad (1)$$

where I is the PV cluster yield current; V is the PV exhibit yield voltage; ns is the quantity of cells in arrangement and np is the quantity of cells in parallel; q is the charge of an electron; k is the Boltzmann's consistent; An is the p-n intersection ideality factor; T is the cell temperature (K); Irs is the cell invert immersion current. The factor An in condition (3.5) decides the cell deviation from the perfect p-n intersection attributes; it extends between 1-5 however for our case A=2.46 [3].The cell turn around immersion current Irs shifts with temperature as indicated by the accompanying condition:

$$I_{rs}=I_{rr}\left[\frac{T}{T_r}\right]^3\exp\left(\frac{qE_G}{KA}\left[\frac{1}{T_r}-\frac{1}{T}\right]\right) \quad (2)$$

Where Tr is the cell reference temperature, Irr is the cell turn around immersion temperature at Tr and EG is the band hole of the semiconductor utilized as a part of the cell. The temperature reliance of the vitality hole of the semi conductor is given by [20]:

$$E_G = E_G(0) - \frac{\alpha T^2}{T+\beta} \quad (3)$$

The Iphcurrent which majorily depends on the irradiance factor and temperation of PV cell is given by:

$$I_{ph} = [\, I_{scr} + K_i(T - T_r)] \frac{S}{100} \quad (4)$$

Where Tr is the cell reference temperature, Irr is the cell turn around immersion temperature at Tr and EG is the band hole of the semiconductor utilized as a part of the cell. The temperature reliance of the vitality hole of the semi conductor is given by [20]:

$$P = IV = n_p I_{ph} V[(\frac{q}{KTA} * \frac{V}{n_s}) - 1] \quad (5)$$

The current to voltage graph for a sun based cluster is non-straight, which makes it hard to decide the MPP. The Figure underneath gives the trademark I-V and P-V bend for settled level of sun powered light and temperature

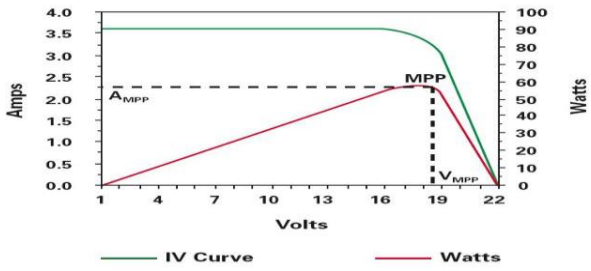


Figure 4 I-V and PV curves

III. MAXIMUM POWER POINT TRACKING SYSTEM

Most extreme power point following is a basic piece of a photovoltaic framework. Photovoltaic frameworks have a particular working point that gives greatest power. A MPPT effectively looks for this working point. Most extreme Power Point Tracking, regularly known as MPPT, is an electronic game plan that discover the voltage (VMPP) or current (IMPP) routinely at which a PV modules should work to accomplish the greatest power yield (PMPP) under quickly changing ecological conditions. It works the PV modules in a way that allows the modules to produce all the power they are prepared to do.

Sunlight based light that hits the photovoltaic modules has a variable character contingent upon the scope, introduction of the sun oriented field, the season and hour of the day. Over the span of a day, a shadow might be thrown on the cell that might be predicted, as on account of a working close to the

sun based field or unforeseeable as those made by mists. Likewise the vitality delivered by each photovoltaic cell relies upon the light and temperature. From these contemplations, the need to distinguish moment by moment that specific point on the V-I normal for the PV generator in which there is the greatest measure of energy exchange to the matrix happens. The created vitality from PV frameworks must be amplify as the proficiency of sun oriented boards is low. Hence to get the most extreme power, PV framework is more than once furnished with greatest power point (MPP) tracker. A few MPP interest procedures are proposed and executed as of late.

In light of the approach utilized for age of the control motion and in addition the PV framework conduct around the enduring state conditions, they are generally ordered into the accompanying gatherings:

1. Offline methods
   - Open circuit voltage (OCV) method
   - Short circuit current method (SCC)
   - Artificial intelligence
2. Online methods
   - Perturbation and observation method (P&O)
   - Extremum seeking control method (ESC)
   - Incremental conductance method (Inc Cond).
3. Hybrid methods

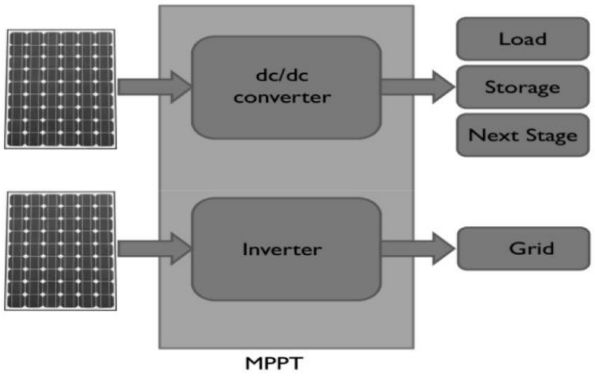


Figure 5 Need of MPPT

A. Perturb and Observe (P&O)

The most generally utilized MPPT calculation is P&O strategy. This calculation utilizes straightforward criticism course of action and minimal measured parameters. In this approach, the module voltage is intermittently given a bother and the relating yield control is contrasted and that at the past irritating cycle. In this calculation a slight irritation is acquaint with the framework. This annoyance causes the energy of the sunlight based module different. In the event that the power increments because of the annoyance then the irritation is proceeded a similar way. After the pinnacle control is achieved the power at the MPP is zero and next moment diminishes and henceforth after that the irritation inverts.

At the point when the steady condition is arrived the calculation wavers around the pinnacle control point. Keeping in mind the end goal to keep up the power variety little the annoyance estimate is stay little. The strategy is progressed in such a style, to the point that it sets a reference voltage of the module relating to the pinnacle voltage of the module. A PI controller at that point demonstrations to exchange the working purpose of the module to that specific voltage level. It is watched some power misfortune because of this bother additionally the neglects to track the most extreme influence under

quick changing barometrical conditions. However, remain this method is exceptionally well known and straightforward.

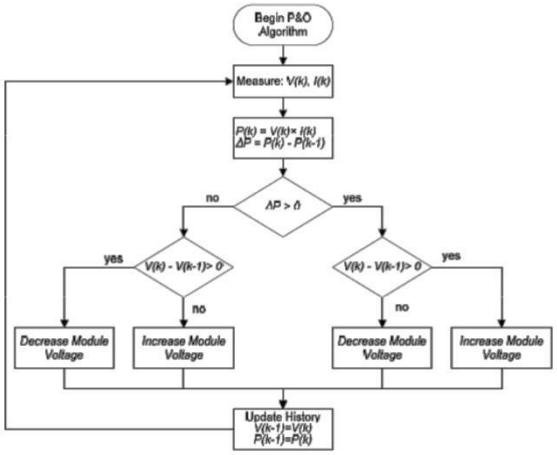


Figure 6. The flow chart of the P&O algorithm

IV. SHUNT ACTIVE POWER FILTER WITH PV SYSTEM

A Shunt Active Filter (SAPF) is the bidirectional current converter with six switches having mix of both exchanging system and channel parts. Structure of this power channel is reliant on the control system of VSI having a capacitor with the end goal of DC vitality stockpiling and the inverter yield has been associated with Non-direct load having diode rectifier connect with a RL-stack. In each of the switches the diodes are associated in against parallel game plan with the IGBTs to allow current stream in either bearing. For pay of responsive power the PV interconnected shunt APF infuses genuine PV energy to a conveyance line at PCC and furthermore diminishes symphonious in stack streams caused by nonlinear loads by infusing repaying current. This channel is associated in shunt that implies in parallel with the nonlinear load. This dynamic channel has capacity of distinguishing the consonant streams caused by the nonlinear loads and after that infuses a current of equivalent greatness and inverse in stage with the non-direct load current which is called remunerating current to diminish the music show in stack ebbs and flows because of Non-straight load. Subsequently, the subsequent current is in type of a basic recurrence sinusoidal current which is attracted at PCC conveyance nerwork.

A Shunt APF generally consists of the following Blocks:

i) IGBT based voltage source inverter (VSI)

ii) DC energy storage

iii) Active control unit

1*p*–*q* theory Based Control

Akagi et al in 1983 [3] created P-Q hypothesis or "immediate active-reactive Power hypothesis" for controlling the dynamic channels. This can be accomplished by changing the voltage and load current into α-β co-ordinates.

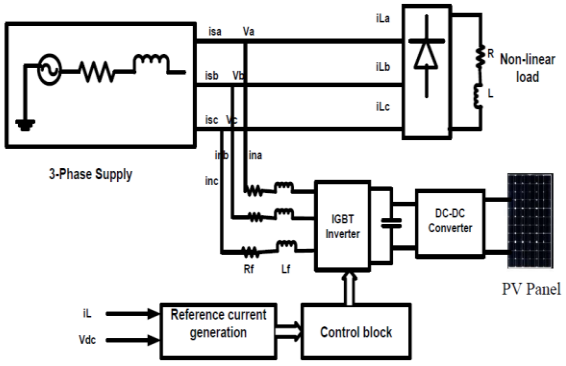


Fig.7 PV system connected to a Shunt APF

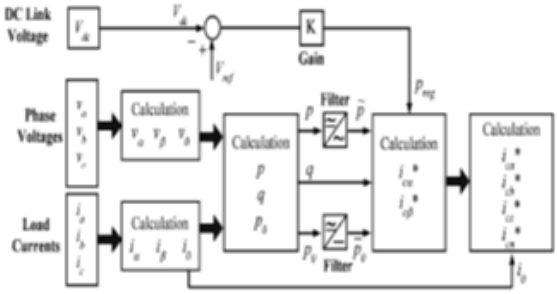


Fig.8 Block diagram of p-q compensation theory

V. SIMULATION RESULTS

A. Conventional Simulation Circuit

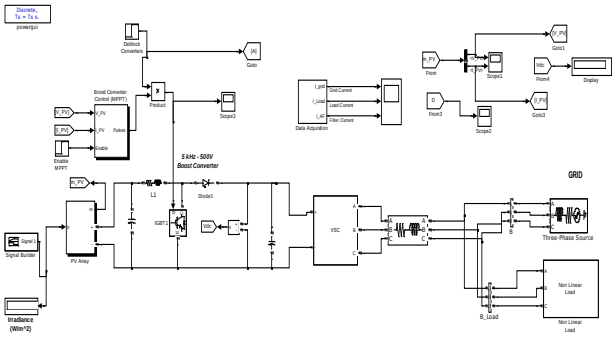


Fig 9 Conventional Simulation Circuit

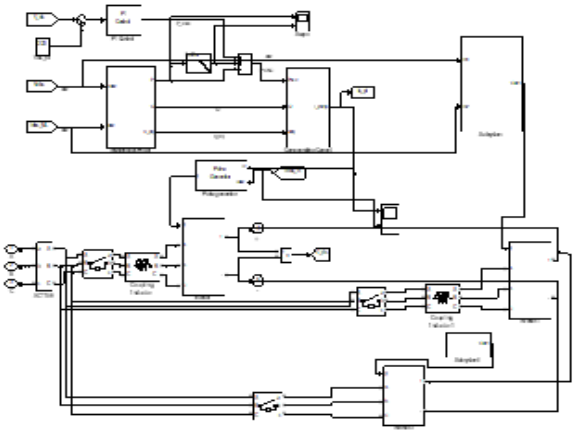


Fig 10 VSC with Filter

(i) Case Study for Balanced and unbalanced load:

To analyze the performance of the proposed system under balanced and unbalanced load conditions, source voltage as well as source current is set as sinusoidal but not in phase. The SAF is required to compensate the reactive power only. At t=0.05 to 0.4, the inverter is switched on. At this instant the inverter starts injecting the compensating current so as to compensate the phase difference between the source voltage and current. The supply current is the sum of load current and injected SAF output

current. During the initial period, there is no load deviation in the load. Hence, the programmable three-phase AC voltage source feeds the total active power to the load. Figure 7.shows the waveforms of (a) Grid Current, (b) Load Current, (c) Inverter current. The real power generated from PV system is supply to the load required demand.

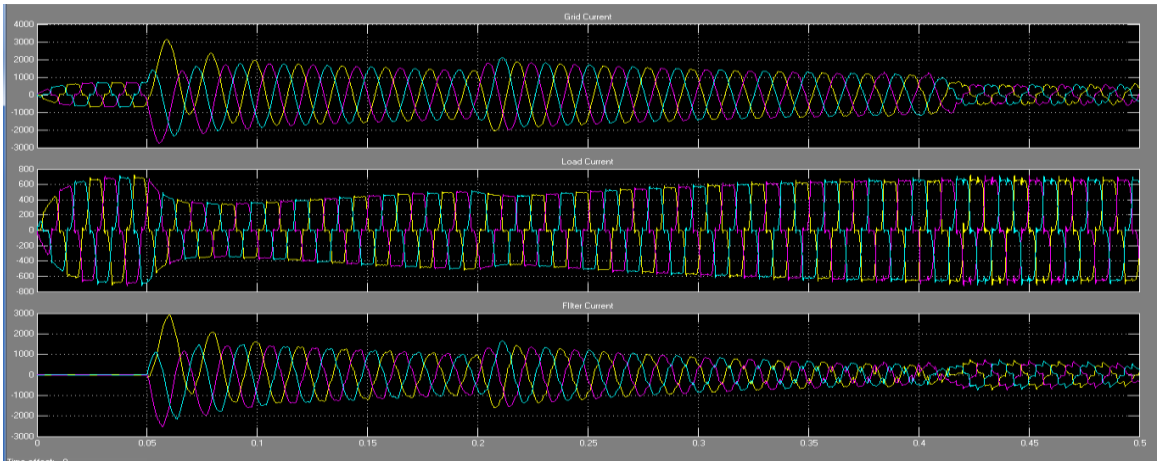


Fig 11 Grid, Load, Filter Current waveforms (Filter on from 0.05 to 0.4)

Amid the uneven load condition, the transient load current changes happen. The Active Power channel is exchanged on at time between t = 0.05 to 0.4. From figure 11 it is watched that the Grid current is twisted from t= 0 to 0.05. At 0.05 channel is exchanged on then the current wavers at 0.05 and it balances out at 0.1 and again the network current gets mutilated because of the turn off of channel at 0.4

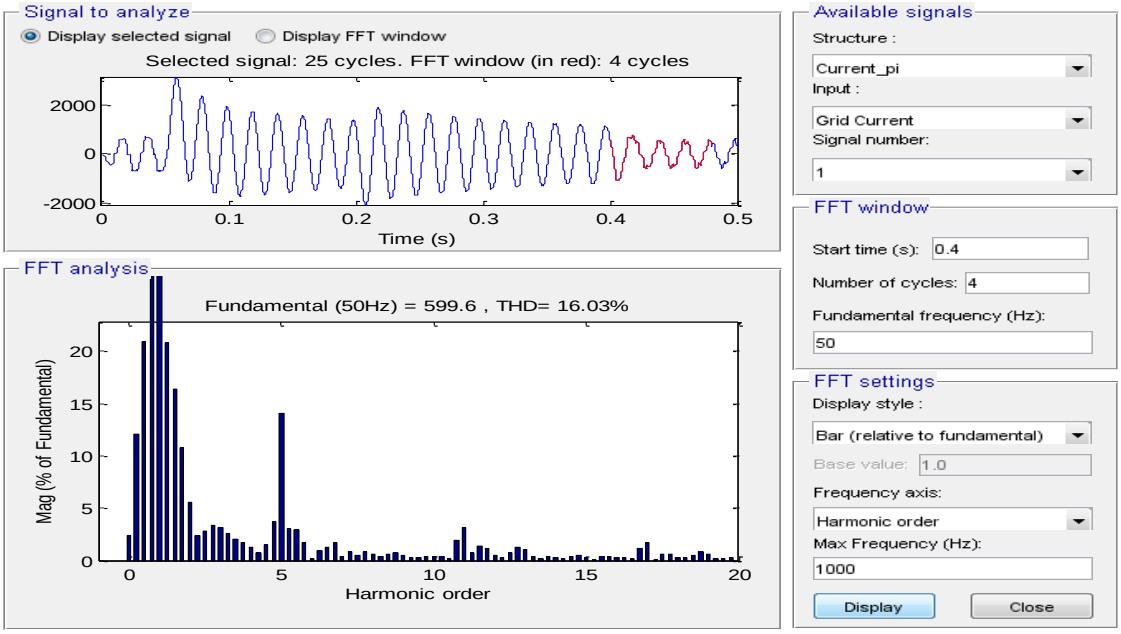


Fig 12 Conventional Circuit THD analysis without filter (16.03%)

The Active Power channel reacts to the present transient and infuses a responsive energy of to reestablish the receptive energy of the heap. The outcomes affirm the great dynamic execution of the APF for a fast change in the heap current. The FFT of the matrix current prior and then afterward pay is done. The present THD is decreased from 16.03% to 2.93% as appeared in Fig.14.

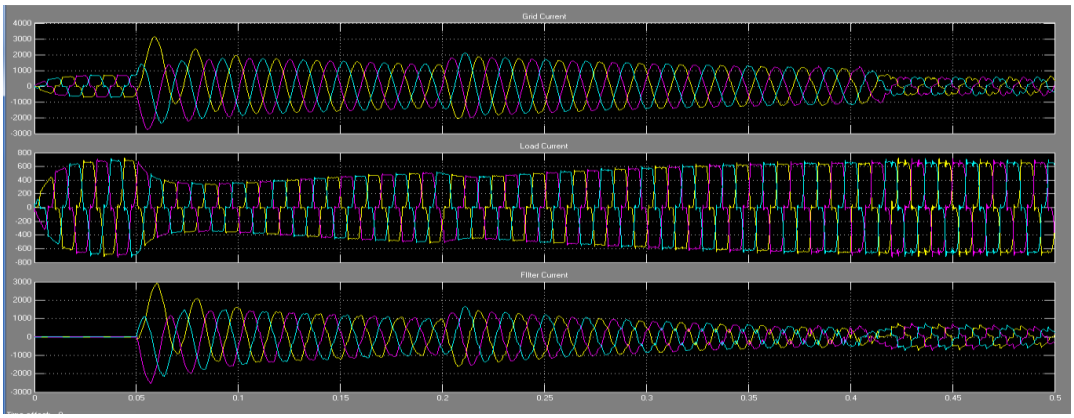


Fig 13 Grid, Load, Filter Current waveforms (Filter on from 0.05 to 0.4)

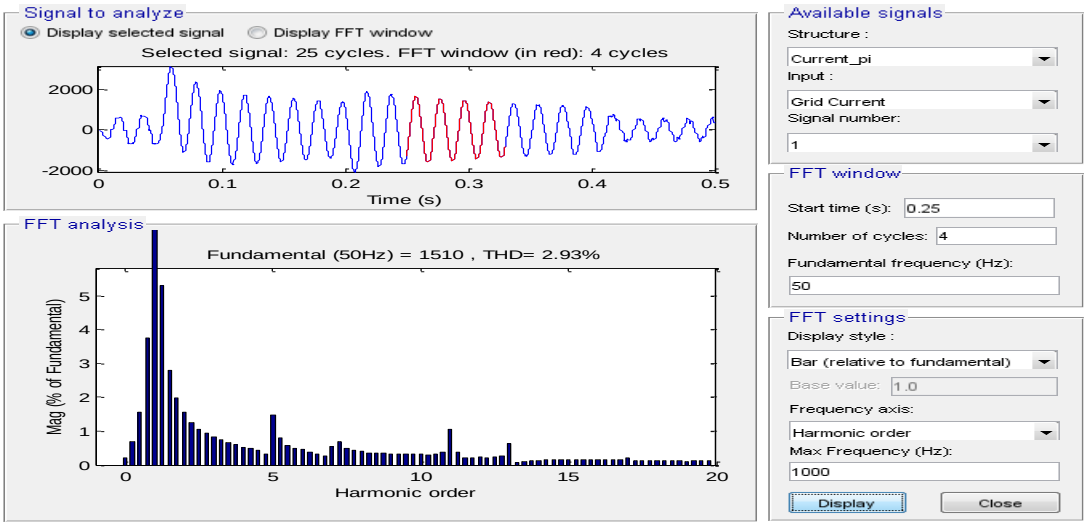


Fig 14 Conventional Circuit THD analysis with filter (2.93%)

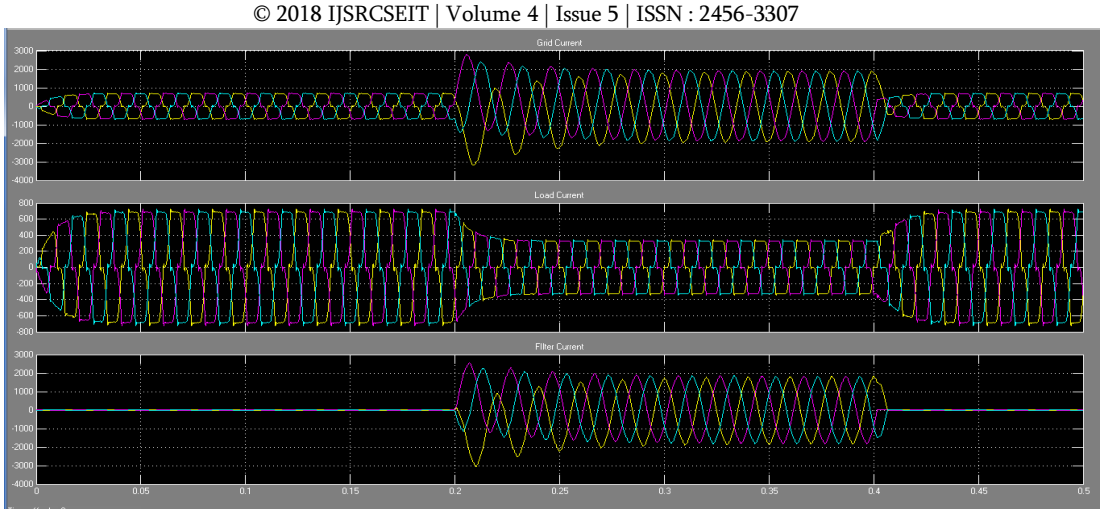


Fig 15 Proposed Method Grid, Load, Filter Current waveforms (Filter on from 0.2 to 0.4)

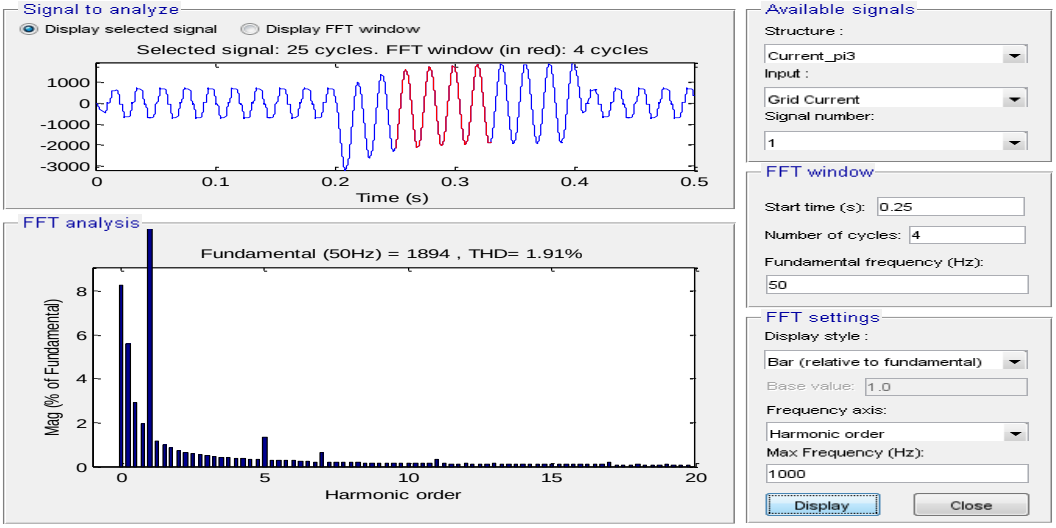


Fig 16 Proposed Circuit THD analysis with filter (1.91%)

It is watched that it demonstrates a decent powerful reaction of APF when a hang control technique is connected to it. The FFT of the matrix current with traditional and proposed strategy is completed. The present THD is lessened from 2.93% to 1.91% as appeared in Fig.16.

Comparison Table

	THD Value
Without Filter THD	16.03
Conventional circuit THD	2.93
Proposed circuit THD	1.91

VI. CONCLUSION

In this paper the Simulink usage of gird associated inverter control strategy has done where the inverter control includes the P-Q compensation hypothesis and hysteresis control for pulse

generation for the VSI. This inverter control is connected at the PCC to get the sinusoidal load current. The load current previously, then after the fact inverter control application is finished by Simulink and the waveforms demonstrates the impact of inverter control, where the outcome after inverter control is practically sinusoidal with less harmonic percentage. For the THD examination of load current prior and then afterward the inverter control method application, on the SIMULINK page FFT investigation alternative in the powergui is picked which brings about THD level of the load current previously, then after the compensation. Subsequently, it is seen that in the event of inverter control method add up to consonant mutilation in stack current is 13.69% preceding inverter control and it diminishes to 2.86% after inverter control and furthermore network current is in same stage with gird voltage that is solidarity unity power factor(UPF) happens. So inverter assumes a novel part to control the harmonics and VAR compensation to give just real power at the PCC of the distribution framework. Consequently, it can be inferred that by utilization of Shunt APF the sounds due to a non-linearity of load is remunerated to an extensive incentive to give sinusoidal yield current of various of sinusoidal in nature and furthermore VAR compensation is achieved to give just real power at the distribution system framework.

VII. REFERENCES

[1] B. Subudhi, R. Pradhan, " A Comparative Study on Maximum Power Point Tracking Techniques for Photovoltaic Power Systems" IEEE Transactions on Sustainable energy, vol. 4, no. 1, January 2013.

[2] H. Akagi, "Instantaneous Power Theory and Applications to Power Conditioning", February 2007, Wiley-IEEE Press.

[3] R. Panigrahi, B. Subudhi and P. C Panda, "Model predictive-based shunt active power filter with a new reference current estimation strategy", IET Power Electron., 2015, Vol. 8, Iss. 2, pp. 221–233.

[4] H. Akagi, Y. Kanmwva, K. Fujiia, A. Nabae, "Generalized Theory of the instantaneous Reactive Power and its Application", Trans. IEEE Vol. 103-H, No. 7. 1983.

[5] J. Harada and G. Zhao, "Controlled power-interface between solar cells and ac sources,"in IEEE Conf., 1989, pp. 22.1/1-22.1/7.

[6] Moleykutty George and Kartik Prasad Basu "Three-Phase Shunt Active Power Filter "American Journal of Applied Sciences 5 (8), 2008 pp.909-916.

[7] Ayman Blofan, Patrice Wira,"PV energy generation for an autonomous shunt active power filter", 2011.

[8] H. Akagi, "New Trends in Active Filters for Power Conditioning," IEEE Trans. on Industry Applications, 1996, vol. 32, no. 6, pp. 1312-1322.

[9] Hiren Patel and Vivek Agarwal, "Maximum Power Point Tracking Scheme for PV Systems Operating Under Partially Shaded Conditions", IEEE Transactions on Industrial Electronics, Vol.55, No.4, pp 1689-1698, 2008.

[10] T. Esram and P. L. Chapman, "Comparison of photovoltaic array maximum power point tracking techniques," IEEE Trans. on Energy Conversion, vol. 22, no. 2, June 2007.

[11] M. C. Benhabib and S. Saadate, "New Control approach for four wire active power filter based on the use of synchronous reference frame," Elsevier Electric power systems Research 73, 2005, 353-362.

[12] Eswaran Chandra Sekaran , "Analysis and simulation of a new shunt active Power filter using cascaded multilevel inverter" Journal of electrical engineering, vol. 58, no. 5, 2007, 241–249.

[13] B. Boukezata, A.Chaoui, J P. Gaubert and M. Hachemi, "Active Power Filter in a transformer-less Grid Connected Photovoltaic System" Balkan Journal of electrical & computer engineering, 2014, vol.2, no.3.

[14] M. Park, N.G. Seong and I.K. Yu, "A Novel Photovoltaic Power Generation System including the Function of Shunt Active Filter," KIEE International Transactions on EMECS, Vol. 3B-2, pp. 103- 110, June, 2003.

[15] M. Elshaer, A. Mohamed, and O. Mohammed, "Smart Optimal Control of DC-DC Boost Converter in PV Systems" IEEE Transmission and Distribution Conference and Exposition Latin America, 2010, pp. 978-1-4577-0487-1/10.

[16] Zulkifile Ibrahim, "Performance investigation of photovoltaic grid connection for shunt active power filter with different PWM generation" 20th November 2013. Vol. 57 No.2.

[17] Ahmed M. Atallah, "Implementation of perturb and Observe MPPT of PV system with direct Control method using buck and buck-boost Converters Emerging Trends in Electrical", Electronics & Instrumentation Engineering: An International Journal(EEIEJ), Vol. 1, No. 1, February 2014.

[18] Ayman Blorfan, Patrice Wira, "A three-phase hybrid active power filter With photovoltaic generation and Hysteresis current control" 2011 IEEE.

[19] RachidBelaidi, "Shunt active power filter connected to a photovoltaic array for compensating harmonics and reactive power simultaneously" 4th International Conference on Power Engineering, Energy and Electrical Drives Istanbul, 13-17 May 2013 IEEE, Turkey.

[20] A.S. Abu Hasim, "Photovoltaic System Connected to Three Phase Grid Connected System Incorporating With Active Power Filter" Australian Journal of Basic and Applied Sciences, 345-353, 2012 ISSN 1991-8178.

[21] Jeevananthan K.S, "Designing of Single Phase Shunt Active Filter Using Instantaneous Power Theory" International Journal of Electrical and Electronics Research Vol. 2, Issue 2, pp: (1-10), Month: April - June 2014.

[22] T.Chaitanya, "Modeling and Simulation of PV Array and its Performance Enhancement Using MPPT (P&O) Technique" International Journal of Computer Science & Communication Networks, Vol 1(1), September-October 2011.

[23] Thomas Geury,"Three-phase Power Controlled PV Current Source Inverter with Incorporated Active Power Filtering", 2013 IEEE.

[24] Remya A.V, "Grid interconnection of PV system for 3 phase 4 wire Distribution system with power-quality improvement" International Conf. on Electrical, Electronics, Mechanical & Computer Engineering, 06th July-2014, Cochin, India.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Network Detector

[1]A. Sekar, [2]R.Geethanjhali, [3]K. Varssini, [4]M. Vishnu Lal
[1,] Assistant Professor, [2]Student, [3]Student, [4]Student
[1,2,3,4,]Knowledge Institute of Technology Salem, Tamil Nadu, India

Abstract
Students use smart phones to search the Internet for answers during exams and of using it to send pictures of tests to friends scheduled to take the same class later in a day. Usage of internet in the classroom includes supervision issue since students often get lasted in social media such as chatting during class times. The above mentioned problem can be overcome by internet detecting device which detects the internet usage in the examination centre and class room and intimate it to the respective supervisor or faculty immediately by giving an alarm sound.

Index terms - Automation, Embedded Technology, Internet Usage , Examination Safety, Class-time Safety.

I. INTRODUCTION

Fig. 1 Internet

Students use smart phones to search the Internet for answers during exams and of using it to send pictures of tests to friends scheduled to take the same class later in a day. Usage of internet in the classroom includes supervision issue since students often get lasted in social media such as chatting during class times.

The above mentioned problem can be overcome by internet detecting device which detects the internet usage in the examination centre and class room and intimate it to the respective supervisor or faculty immediately by giving an alarm sound [4].

II. APPLICATION

- Educational sector

- ✓ Examination hall
- ✓ Lecture hour
- ✓ Seminar hall

Fig. 2.1 In Educational sector

- Government sector

  - ✓ Monitoring of government exam
  - ✓ Conference

Fig. 2.2. In Government sector

III. Benefits of Network Detector

- In educational field, when the student use the mobile phones while the lecture begins this detector can indicate by an alarming sound to the particular lecturer. Not only during the lecture but also while the examination time, by which the forged can be reduced[9].

Fig. 3. Benefits of Network Detector

IV. HARDWARE REQUIREMENTS

1. Detector
2. Movable laser light
3. Battery
4. Cooling fan
5. Alarm
6. Danger light

4.1.Detector

The detector that detects ultra-weak radio waves in an entirely new way. Their new box of tricks converts radio waves into light signals, which can then be transmitted and analyzed using standard optical tools. “Our work introduces an entirely new approach to all-optical, ultralow-noise detection of classical electronic signals,” they say.

The new approach is simple in principle. Their device consists of a thin membrane of silicon nitride coated with a mirror-like layer of aluminum. This Nanomembrane is suspended above an electrode forming a capacitor which is it part of a standard LC-circuit that picks up radio waves at its resonant frequency.

When this happens, the resonating circuit causes the Nanomembrane to vibrate.

Fig. 4.1. Detector

The trick that Bagci and co have pulled off is to bounce a laser beam off the Nanomembrane causing an optical phase shift that they then measure using standard optical techniques.

The result is that the Nanomembrane converts the faint radio waves it picks up into optical signals.

This approach has significant advantages over traditional radio receivers. The big problem with current methods for detecting faint radio waves is that noise generated by heat can swamp the signal. The only way to get around this is by cooling the detection equipment, a process that significantly increases the complexity, size and cost of the job.

The big advantage of converting the radio signals into a resonant mechanical vibration is that the random effect of heat becomes negligible. That's the beauty of resonant systems. So the reflected light picks out the radio signal with little of the noise that swamps conventional radio receivers.

The numbers are impressive. The new device has a room temperature sensitivity of 5 Pico volts per (Hz)^1/2 at a frequency of 1 Mhz. In other words, it does the same job at room temperature that physicists could only dream of doing at the temperature of liquid helium.

And this is only a proof of principle device. It has the potential to get even better with a little optimization

That's likely to have a significant impact in a number of areas that rely on cooled amplifiers to pick up faint radio signals. For example, nuclear magnetic resonance imaging relies on the detection of faint radio signals generated by protons processing in a magnetic field. And radio astronomers rely on cooled amplifiers to pick up the faintest radio signals in the cosmos. "The usually required cryogenically cooled pre-amplifiers might be replaced by our transducer[2]".

4.2. **Movable laser light**

A **laser lighting display** or **laser light show** involves the use of laser light to entertain an audience. A laser light show may consist only of projected laser beams set to music, or may accompany another form of entertainment, typically musical performances.

Laser light is useful in entertainment because the coherent nature of laser light allows a narrow beam to be produced, which allows the use of optical scanning to draw patterns or images on walls, ceilings or other surfaces including theatrical smoke and fog without refocusing for the differences in distance, as is common with video projection. This inherently more focused beam is also extremely visible, and is often used as an effect. Sometimes the beams are "bounced" to different positions with mirrors to create laser sculptures[7].

Fig. 4.2. Laser

4.3. BATTERY

An electric **battery** is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell[3].

Fig. 4.3 Battery

4.4. Cooling fan

A **computer fan** is any fan inside, or attached to, a computer case used for active cooling, and may refer to fans that draw cooler air into the case from the outside, expel warm air from inside, or move air across a heat sink to cool a particular component. Generally these are found in axial and sometimes centrifugal forms. The former is sometimes called a "electric" fan, after the Rotor Vertical line, while the latter may be called a "biscuit blower" in some product literature[6].

Fig. 4.4 Cooling Fan

4.5. Alarm

An **alarm device** or system of alarm devices gives an audible, visual or other form of alarm signal about a problem or condition. Alarm devices are often outfitted with a siren. In our product the alarm which is used to indicate that the students use the mobile phone during the lecture[1].

Fig. 4.5 Alarm

4.6. Danger light

This is called fluorescence, and has many practical **uses**. Black **lights** are required to observe fluorescence, since other types of ultraviolet lamps emit visible **light** which drowns out the dim fluorescent glow. Black **light** is commonly used to authenticate oil paintings, antiques and banknotes[5].

Fig. 4.6 Danger light

V. Architecture of network detector

The particular radio wave which falls on the mirror the mirror, frequency while the student use the mobile phones can be detected by the detector and which stimulates the alarm to ring on which further stimulates the danger light to indicate that the candidate use the mobile phone.

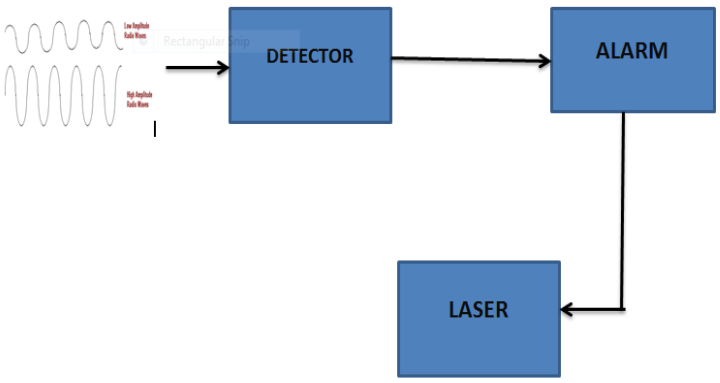


Fig. 5 Architecture of network detector

VI. Needs

- To prevent the usage of mobile phones in lecture hours
- To prevent the usage of phones in government exams
- To prevent the leakage of important information in government meeting
- To avoid the malpractice during the examination.

VII. Implementation

The radio wave which makes to fall on the mirror, the mirror was coated by silver nitrate and above the silver nitrate aluminium was coated after the radio wave is converted into optical light signal, then it is detected by optical tools. If the usage is detected it further intimated to the alarm it stimulates it to ring on. Then the laser limit will emit and it indicates the particular user who used the mobile phone during the class hour[8].

VIII. Conclusion

Our project is mainly designed to reduce the malpractice and to prevent the usage of mobile phones in lecture hour and to prevent the usage of phones in government exams and to prevent the leakage of important information in government meeting.

XI. Reference

[1]https://www.cisco.com/web/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf
[2]https://www.sciencedirect.com/science/article/pii/S138912861000156
[3]https://www.cs.bham.ac.uk/~garciaf/publications/Attack.MIFARE.pdf
[4] https://oauth.net/

[5] https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml
[6] https://mqtt.org/
[7] https://tools.ietf.org/html/draft-ietf-core-coap-18
[8] https://www.oasis-open.org/committees/mqtt/
[9] https://tools.ietf.org/html/rfc6455

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018IJSRCSEIT | Volume 4 | Issue 2 | ISSN :2456-3307

Comparitive Analysis of Induction Motor Drive with Vector Control

Sarin MV
Assistant Professor, EEE, MVJ College of Engineering Bangalore, , Karnataka, India

Abstract

Induction machines are the most generally utilized machines for commercial applications. They are mainstream for utilization as modern drives on account of its high efficiency, great power factor and greatly rugged nature. In this paper, voltage source inverter and multilevel inverter are utilized to excite drives. Here multilevel inverter gives about sinusoidal voltage with less harmonic distortion in voltage and current waveforms compared with voltage source inverter. The advancement of vector control methods upgraded the execution the performance and speed control in motor drives. Here we propose IFOC control for the induction motor drive. The rotor flux and torque producing current parts are decoupled by conversion to d-q reference edge and controlled utilizing a PI controller. A SPWM based inverter topology is utilized for VSI and for MLI, SPWM with Phase Disposition PWM system is utilized to encourage the induction motor drive. In this paper we have classified and analyzed distinctive parameters of Multi level inverter and Voltage source inverter encouraged IM drive with vector control. The execution of the machine is examined by plotting the aspects under distinctive working conditions.

Keywords : Voltage source inverter, multilevel inverter, Indirect field oriented control, Induction motor, Sine PWM, D-Q axes

NOMENCLATURE

i_α,i_β, i_d, i_q	: Currents in α-β and d-q reference frame.
i_a, i_b, i_c	: Currents in abc reference frame.
V_α, V_β,V_d, V_q	: Voltages in α-β and d-q reference frame.
K_s	: Transformation matrix.
λ_d, λ_q	: Flux in d-q reference frame.
ω	: Speed of machine.
R	: Resistance of machine.
L	: Inductance of machine.
T_{em}	: Electromechanical torque.
P	: Power output of machine.
J_{eq}	: Moment of Inertia of machine.
p	: No. of poles.

I. INTRODUCTION

Induction machine is a rotating electrical machine designed to operate from a three phase source of alternating voltage. The extreme simplicity and ruggedness of this machine makes it most popular among other machines. The

scalar v/f control [1] is able to provide is able to provide speed variations but it does not give good control in transient conditions and it is operating only in steady state conditions. Indirect field oriented control (IFOC) [2] gives a high performance in induction motor drives by decoupling rotor flux and torque producing current components of stator current. In vector control or field oriented control [3] the dc machine like performance is attained by orienting the stator current with respect to the rotor flux in a way that independent control flux and torque is established. Thus with field oriented control the induction machine acquires every advantage of a dc machine control structure that is a very accurate steady state and transient control behavior with good dynamic performance.

Inherently voltage source inverters are used to feed induction motor drives for enhancing the drive performance. Voltage source inverter has less number of power electronic switches when compared with multilevel inverters. Multilevel inverters [4] are majorly different from the voltage source inverter where only two levels are generated. Multilevel inverters [5] have been widely used in the drives industry to run induction machines for high power configurations. Multilevel inverters classified into three types: Cascaded H Bridge [6], Diode clamped, Flying Capacitor. Cascaded MLI is the most important topology among the above three. It requires least number of components compared with the other topologies. It has modular configuration with less number of switches and also it requires less space. Sine PWM pulses are used here to drive the gate of power electronic switches. The transformation from abc reference frame to dq reference frame is controlled by PI controller. PI controller can drive the induction motor system more effectively with faster response, speed, shorter settling time and also it has simple structure and stable performance.

II. INVERTERS

A. Voltage source inverter

The function of an inverter is to change a dc input voltage to a symmetric ac output voltage of desired magnitude and frequency. If the dc input voltage is fixed and it is not controllable, a variable output voltage can be obtained by varying the gain of the inverter, which is accomplished by pulse width modulation (PWM) control [2] within the inverter. The output waveforms of ideal inverters should be sinusoidal. However in practical the output waveforms are non-sinusoidal and contain certain harmonics.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018IJSRCSEIT | Volume 4 | Issue 2 | ISSN :2456-3307

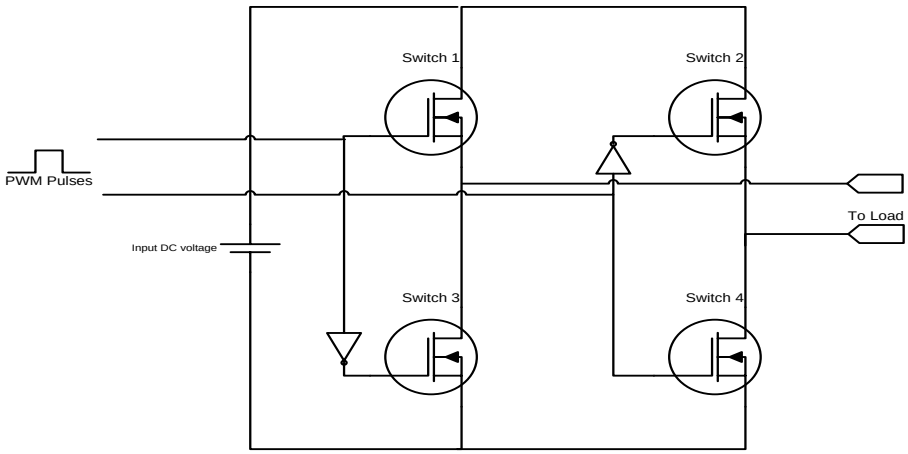


Figure 1: Basic diagram of Voltage source inverter

B. Multilevel inverter

This paper used a cascaded three phase seven level inverter to feed the induction machine. Each phase of the inverter contains three H Bridges. Each H bridge produce three different voltage levels +Vdc, 0,-Vdc by the operation of power electronic switches. Each H Bridge contains four switches and is supplied from a separate DC source. The output of the each H bridge is connected in series to obtain the stepped output waveform. PWM techniques are used to give gating pulses to the H bridges. Popular PWM techniques are Sine PWM, Space vector PWM, Selective harmonic elimination etc. In this scheme, Sine PWM technique is used to give gating pulses to the cascaded H bridge inverter. The multicarrier PWM technique for generating SPWM is of three types namely Phase Disposition (PD), Phase Opposition Disposition (POD) and Asymmetric POD (APOD). In this scheme, PD technique is used. In this technique, all the carrier waveforms are in phase with each other. The reference sine wave for PWM pulse generation in open loop is provided by a sine wave generator and in closed loop it is generated by the controller. The basic block diagram of a cascaded H bridge MLI for is shown below.

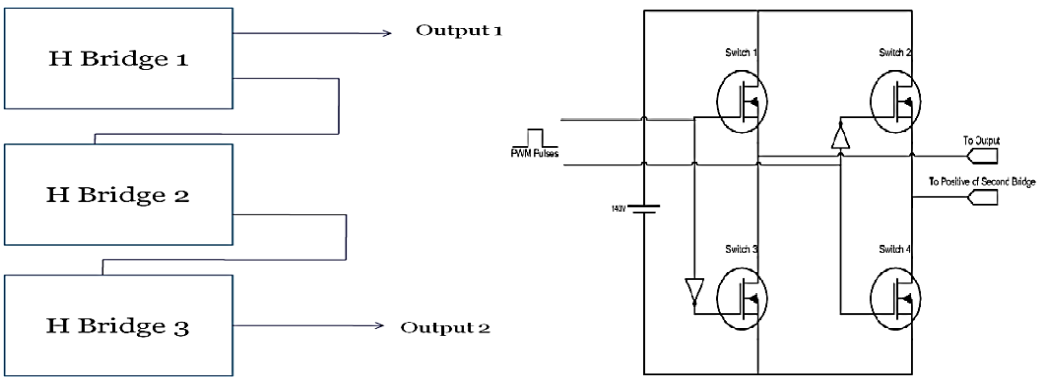


Figure 2: Multilevel inverter

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018IJSRCSEIT | Volume 4 | Issue 2 | ISSN :2456-3307

III. VECTOR CONTROL

Induction motor is an asynchronous machine that can run at different speeds. Different techniques are available for the speed control of induction machine. One of the speed control strategies is vector control. Unlike scalar control it can be controlled both magnitude and direction. The vector control technique [10] which is known as field oriented control (FOC), allows an induction motor to be driven with high dynamic performance that is comparable to the characteristics of dc motor. In vector control, an induction motor is controlled under all operating conditions like a separately excited dc motor. The induction motor behaves like a dc motor in which the field flux linkage and armature flux linkage created by the respective field and armature currents. In induction machine, change of any specific quantity results in the change of the other. It is very difficult to achieve effective speed control by conventional methods. The modelling of three phase induction machine parameters are done by Clarke's and Park's transformations to a two axis reference frame - αβ or dq. The dq reference frame is mainly used for control purposes and αβ reference frame is used for modelling purposes. In vector control, the flux and torque components of the induction machine are decoupled by the Park's transformation to a two phase synchronously rotating dq reference frame from three phase ABC reference frame. In synchronously rotating dq reference frame, it provide independent control of flux and torque. The Q axis component control the speed of the motor and D axis component controls the flux of the machine. Thus, we can achieve a separately excited DC motor like speed control for AC machines. The FOC scheme is divided into Direct field oriented control (DFOC) and Indirect field oriented control (IFOC).

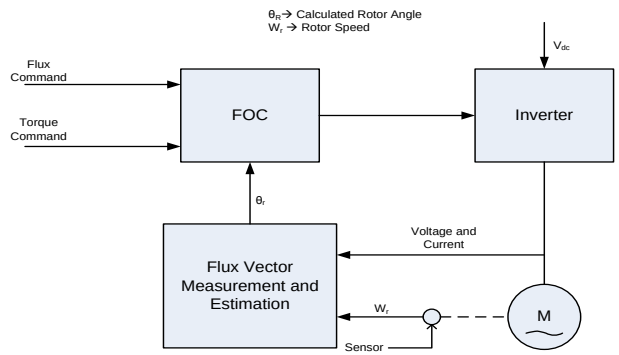


Figure 3: DFOC basic model

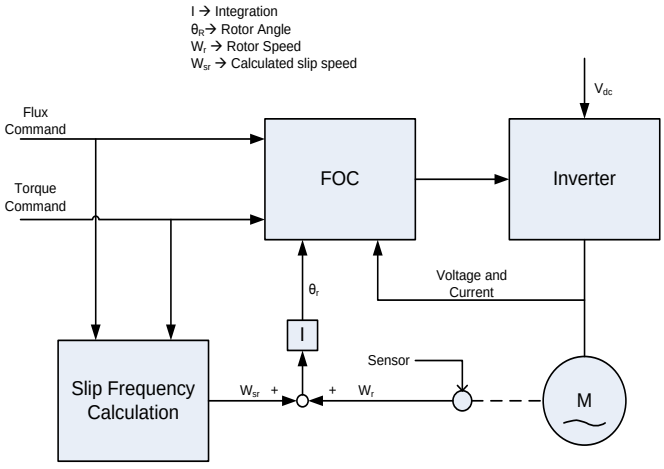


Figure 4: IFOC basic model

In the DFOC strategy rotor flux vector is either measured by means of flux sensor or by using voltage equations. It is not suitable for high speed applications because sensors make the circuit more complex. Flux and angle feedback is calculated by voltage and current equations. In IFOC strategy rotor flux vector is calculated using the field oriented control equations requiring a rotor speed measurement. Here flux is derived from the measured value of stator current. IFOC can exhibit high performance in induction motor drives by decoupling rotor flux

and torque producing current components of stator current. It gives good dynamic performance and efficient operation with induction motor drives.

The calculation of flux from measured value of stator current is little bit complex but the total performance given by the system is high compared with any other method. Thus it is best suited for asynchronous machines. Besides, by the use of DSP and microcontrollers computational complexity can be minimized.

A. IFOC Scheme

In the IFOC strategy [10] the torque control is able to get it from speed error signal since the developed electromagnetic torque decides the speed dynamic. For finding the current components apply PI controller between reference and measured or calculated speed and flux. Here the speed is compared with the reference value and error signal is generated. The error signal which generated is then fed to a PI controller H2(s) that generates the reference torque TE*. The reference Q axis current IQS* is obtained from the reference torque by machine equations. The error signal which produce when comparing IQS* and IQS is fed to a current controller H4(s) generate the reference voltage VQS*. IQS* and IQS are obtained from converting stator current IS to IDQ. By comparing desired rotor flux and calculated flux an error signal is generated that is fed to the flux controller H1(s) that generates ID*, it is compared with ID, and error is fed to the current controller H3(s) that generates the voltage reference VD*. Finally, the reference voltages are changed to ABC reference (VABC) that is used as reference voltage for PWM generation

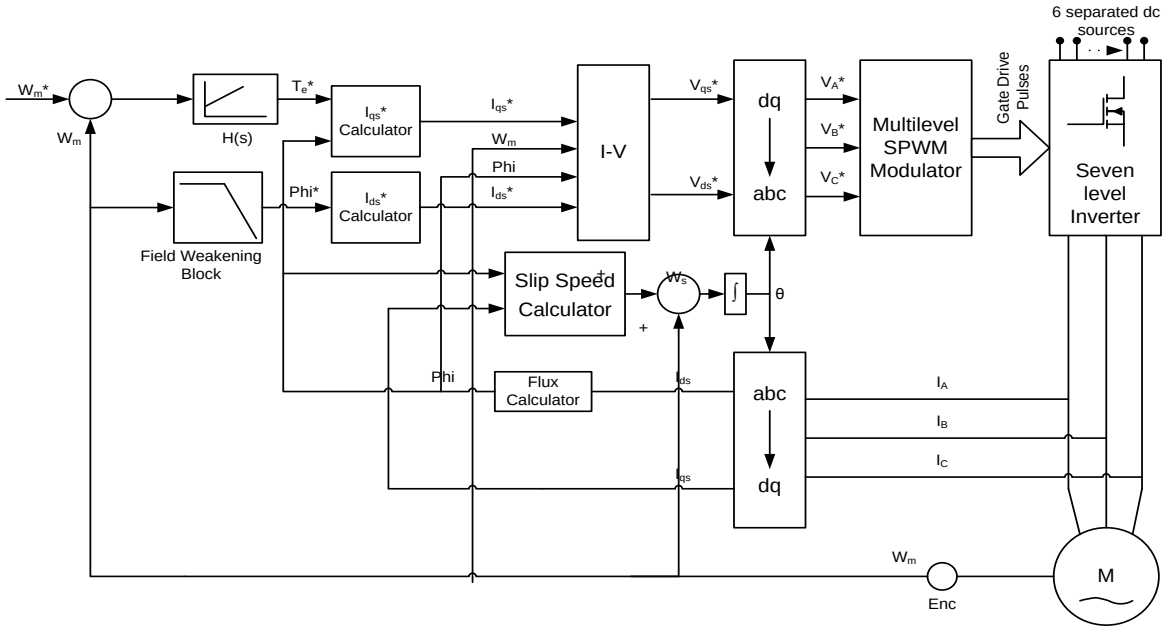


Figure **5**: Indirect field oriented Control Block Diagram

B. Induction Machine Mathematical Model

The mathematical model of induction machine is developed in synchronously rotating reference frame:

Transformation Matrices:

Clarke's Transformation matrix for three phase reference frame to two phase stationary reference frame α-β.

$$\begin{bmatrix} i_\alpha \\ i_\beta \end{bmatrix} = \frac{2}{3}\begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{\sqrt{3}}{2} & -\frac{\sqrt{3}}{2} \end{bmatrix}\begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix}$$

$$(i_{qd0s})^T = \begin{bmatrix} i_{qs} & i_{ds} & i_{0s} \end{bmatrix}$$

$$(i_{abcs})^T = \begin{bmatrix} i_{as} & i_{bs} & i_{cs} \end{bmatrix}$$

$$V_\alpha = V_m \cos\theta$$
$$V_\beta = V_m \sin\theta$$

$$K_s = \frac{2}{3}\begin{bmatrix} \cos\theta & \cos(\theta - \frac{2\pi}{3}) & \cos(\theta + \frac{2\pi}{3}) \\ \sin\theta & \sin(\theta - \frac{2\pi}{3}) & \sin(\theta + \frac{2\pi}{3}) \\ 0.5 & 0.5 & 0.5 \end{bmatrix}$$

$$i_\alpha = i_m \cos(\theta - \varphi)$$
$$i_\beta = i_m \sin(\theta - \varphi)$$

$$V_{ds} = R_s i_{ds} + \frac{d}{dt}\lambda_{ds} - \omega_d \lambda_{qs}$$

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018IJSRCSEIT | Volume 4 | Issue 2 | ISSN :2456-3307

$$\begin{bmatrix} i_d \\ i_q \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} i_\alpha \\ i_\beta \end{bmatrix}$$

$$V_{qs} = R_s i_{qs} + \frac{d}{dt}\lambda_{qs} - \omega_d \lambda_{ds}$$

$$i_{qd0s} = K_s i_{abcs}$$

The equations used for the purpose of modeling the machine are obtained from their equivalent circuits (Fig.6 and Fig.7) as follows:

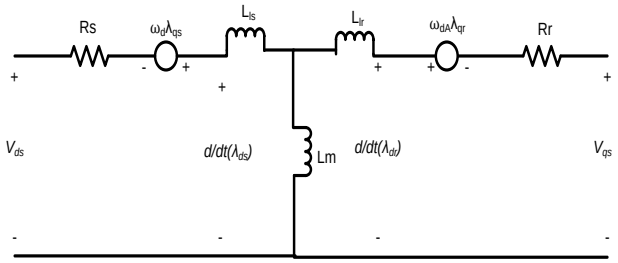


Figure 6:D Axis Equivalent Circuit

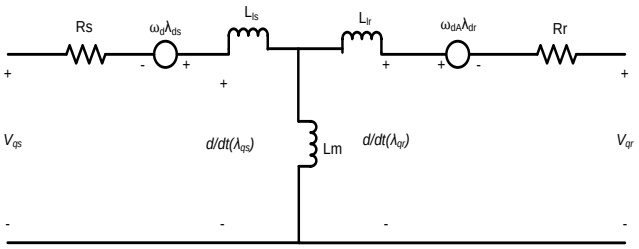


Figure 7: Q Axis Equivalent Circuit

$$V_{dr} = R_r i_{dr} + \frac{d}{dt}\lambda_{dr} - \omega_{dA}\lambda_{qr}$$

$$V_{qr} = R_r i_{qr} + \frac{d}{dt}\lambda_{qr} - \omega_{dA}\lambda_{dr}$$

V_{ds}, V_{qs}, V_{dr} and V_{dr} are respectively the stator and rotor voltages in dq axes. The flux linkage equation is given by,

$$\begin{bmatrix} \lambda_{ds} \\ \lambda_{qs} \\ \lambda_{dr} \\ \lambda_{qr} \end{bmatrix} = \mathrm{M} \begin{bmatrix} i_{ds} \\ i_{qs} \\ i_{dr} \\ i_{qr} \end{bmatrix}$$

$$M = \begin{bmatrix} L_s & 0 & L_m & 0 \\ 0 & L_s & 0 & L_m \\ L_m & 0 & L_r & 0 \\ 0 & L_m & 0 & L_r \end{bmatrix}$$

Where,

Where, I_{ds}, I_{qs}, I_{dr} and I_{qr} are the current, L_s is the stator inductance, L_r is the rotor inductance and L_m is the mutual inductance between stator and rotor

$$\begin{bmatrix} i_{ds} \\ i_{qs} \\ i_{dr} \\ i_{qr} \end{bmatrix} = \frac{1}{L_m^2 - L_r L_s} \times \left(A \begin{bmatrix} i_{ds} \\ i_{qs} \\ i_{dr} \\ i_{qr} \end{bmatrix} + \begin{bmatrix} L_s & 0 & L_m & 0 \\ 0 & L_s & 0 & L_m \\ L_m & 0 & L_r & 0 \\ 0 & L_m & 0 & L_r \end{bmatrix} \begin{bmatrix} V_{ds} \\ V_{qs} \\ V_{dr} \\ V_{qr} \end{bmatrix} \right)$$

$$T_{em} = \frac{P}{2}(\lambda_{qr} i_{dr} - \lambda_{dr} i_{qr}) = \frac{P}{2} L_m (i_{qs} i_{dr} - i_{ds} i_{qr})$$

$$\frac{d}{dt}\omega_{Mech} = \frac{T_{em} - T_L}{J_{eq}} = \frac{\frac{P}{2} L_m \left(\lambda_{qs} i_{dr} - i_{ds} i_{qr}\right) - T_L}{J_{eq}}$$

$$\begin{bmatrix} [P(\theta_s)]^{-1} \begin{bmatrix} \lambda_{s_{dq0}} \end{bmatrix} \\ [P(\theta_r)]^{-1} \begin{bmatrix} \lambda_{r_{dq0}} \end{bmatrix} \end{bmatrix} = \begin{bmatrix} [L_s] & [M_{Sr}(\theta)] \\ [M_{sr}(\theta)] & [L_r] \end{bmatrix} \begin{bmatrix} [P(\theta_s)]^{-1} \begin{bmatrix} i_{s_{dq0}} \end{bmatrix} \\ [P(\theta_r)]^{-1} \begin{bmatrix} i_{r_{dq0}} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \begin{bmatrix} \lambda_{s_{dq0}} \end{bmatrix} \\ \begin{bmatrix} \lambda_{r_{dq0}} \end{bmatrix} \end{bmatrix} = \begin{bmatrix} [P(\theta_s)][L_s][P(\theta_s)]^T & [P(\theta_s)][M_{sr}(\theta)][P(\theta_r)]^T \\ [P(\theta_r)][M_{sr}(\theta)]^T[P(\theta_s)]^T & [P(\theta_r)][L_r][P(\theta_r)]^T \end{bmatrix} \begin{bmatrix} \begin{bmatrix} i_{s_{dq0}} \end{bmatrix} \\ \begin{bmatrix} i_{r_{dq0}} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \begin{bmatrix} \lambda_{s_{dq0}} \end{bmatrix} \\ \begin{bmatrix} \lambda_{r_{dq0}} \end{bmatrix} \end{bmatrix} = \begin{bmatrix} [L_{ps}] & [M_{pSr}] \\ [M_{sr}(\theta)] & [L_{pr}] \end{bmatrix} \begin{bmatrix} \begin{bmatrix} i_{s_{dq0}} \end{bmatrix} \\ \begin{bmatrix} i_{r_{dq0}} \end{bmatrix} \end{bmatrix}$$

C. Controller design

The controller parameters were designed based on trial and error. It gives torque reference from speed error. In order to obtain the flux reference, a field weakening block was used. The speed error converted into torque reference that was converted into corresponding q axis current by the following equations (20):

$$i_{qs}^* = \frac{L_r}{pL_m}\frac{T_{em}^*}{\lambda_r^*} \qquad (20)$$
$$i_{ds}^* = \frac{1}{L_m}\left(T_r \frac{d\lambda_r^*}{dt} + \lambda_r^*\right)$$

The reference current converted to reference voltage by using the following equations (21) and (22):

$$\omega_s^* = \omega + \omega_{gl}^*; \omega_{gl}^* = \frac{L_m}{T_r}\frac{i_{qs}^*}{\lambda_r^*} \qquad (21)$$

$$V_{ds}^* = R_s i_{ds}^* - \omega_s^* \sigma L_s i_{qs}^*$$
$$V_{qs}^* = R_s i_{qs}^* + \omega_s^* \sigma L_s i_{ds}^* \qquad (22)$$

For flux control, the reference flux is generated using a field weakening block. In field weakening, till the base speed is achieved the flux reference is kept constant and above base speed, the flux is weakened gradually. This was implemented using a lookup table. By using the above equations the flux reference is converted to the corresponding d-axis current and also the current reference to voltage reference.

IV. RESULTS AND OBSERVATIONS

The simulations were carried out using Simulink for change of load torque as well as change of reference speed. The vector controlled drive was found to get responses very quickly and precisely. The initial transients are the result of applying full terminal voltage to the machine. In practical cases, the voltage will be increased gradually by means of a starter and the initial high transients can be eliminated.

A. Speed waveform of VSI and MLI fed IM

The speed reference given for both VSI and MLI fed IM is 80rad/s. Compared to VSI fed machine MLI fed machine initial peak value is less that is shown in figure 8 and figure 9.

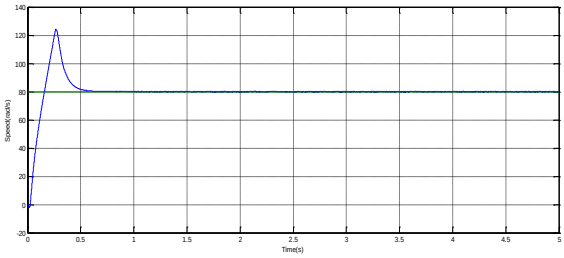


Figure 8: Speed waveform of VSI

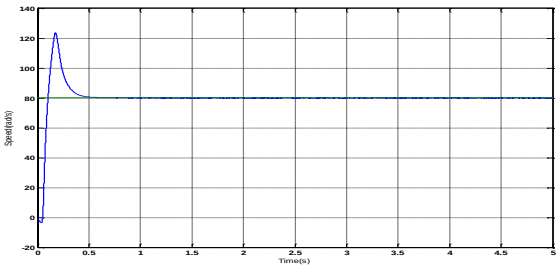


Figure 9: Speed waveform of MLI

B. Case 1: Change of reference speed

The change of reference speed here taken from 70rad/s to 90rad/s at a step time of 3seconds. Figure 10 and figure 11 gives visual display of it.

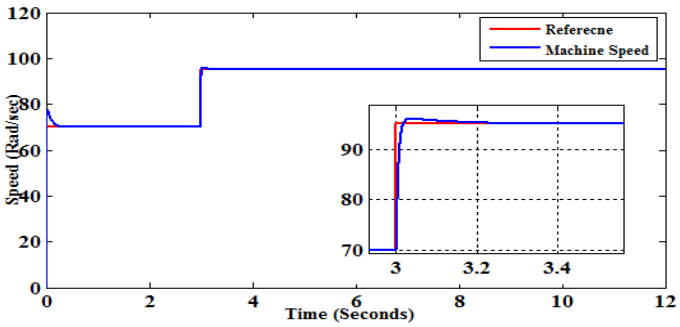


Figure 10: Speed waveform for VSI fed IFOC (change of speed given at t=3s)

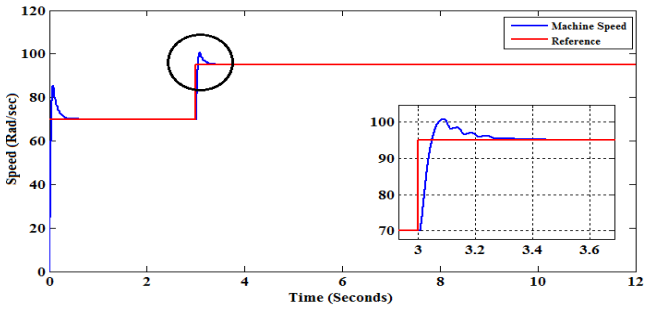


Figure 11: Speed waveform for MLI fed IFOC (change of speed given at t=3s)

C. Case 2: Torque waveform for Change of speed reference

The speed reference applied here is changed from 70rad/s to 90rad/s at a step delay of 3s. Due to sudden change in speed causes a peak in the torque waveform for both VSI and MLI then it stabilized.

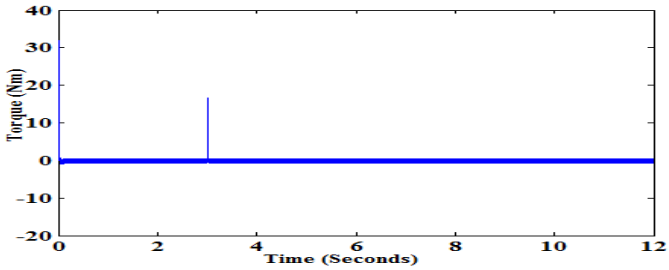


Figure 12: Torque waveform for VSI fed IFOC

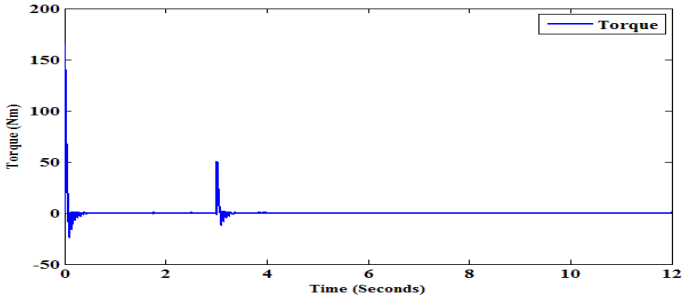


Figure 13: Torque Waveform for MLI fed IFOC

D. Case 2: Speed waveform for Change of load torque

When load torque is applied the torque magnitude increases from 0Nm to 8Nm at t=3seconds. In VSI fed machine the change in speed is high compared to MLI fed machine showing in the figure 14 and figure 15.

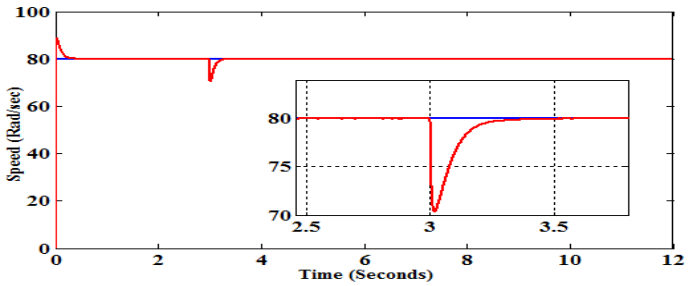


Figure 14: Speed waveform for change of load torque for VSI fed IFOC from 0Nm to 8Nm at t=3s

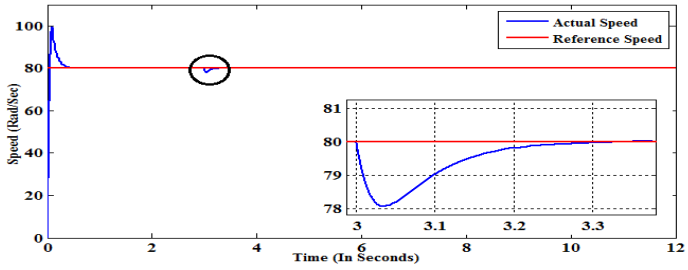


Figure 15: Speed waveform for change of load torque for MLI fed IFOC from 0Nm to 8Nm at t=3s

E. Case 2: Torque waveform for Change of load

Similarly the load change given here from 0Nm to 8Nm at step time of t=3s. Corresponding change can be seen from following figure 16 and figure 17.

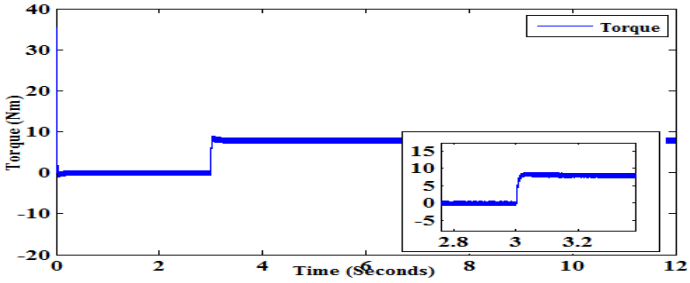


Figure 16: Torque waveform for change of load torque for VSI fed IFOC from 0Nm to 8Nm at t=3s

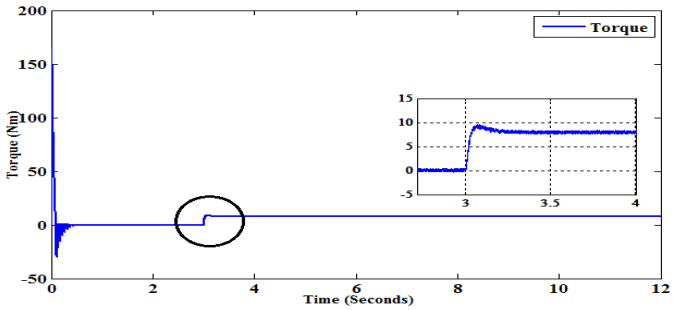


Figure 17: Torque waveform for change of load torque for MLI fed IFOC from 0Nm to 8Nm at t=3s

TABLE I. COMPARISON OF VSI & MLI

Sl. No	Performance Analysis with IFOC and VSI				
	Parameter	MLI		VSI	
		Load Change	Speed Change	Load Change	Speed Change
1	Settling Time(Sec)	0.1	0.1	0.5	0.23
2	Peak Overshoot or Undershoot (%)	2.5	5.26	12.5	3.15
3	Steady State Error (%)	0.05	0.021	0.05	0.042
4	Torque Ripples	Less		More	
5	Complexity	High		Less	

V. CONCLUSION

This report has presented the comparison and analysis of voltage source inverter and multilevel inverter fed induction motor drive with sine PWM technique. The IFOC scheme for speed control of voltage source inverter and multilevel inverter fed induction motor was simulated in MATLAB/Simulink. The dynamical requirement of IFOC is achieved by applying PI controller in transient and steady state voltage source inverter fed drive has more initial transients, overshoot, settling time and multilevel inverter gives nearly sinusoidal output voltage with less harmonic distortion in voltage and current waveforms.

The IFOC model is validated by changing reference speed and load torque dynamically. From the comparison it is seen that for MLI fed drive, the settling time is reduced by 0.4s in case of load change and 0.13s in case of speed change, as compared with the VSI fed drive. Peak overshoot is reduced by 10% in case of load change. For speed change overshoot is less for VSI fed drive. Though the steady state error remains the same in case of load change, it is reduced by 0.021% in case of speed change for the MLI fed drive. It was observed that the torque ripples were less for MLI fed drive as compared with VSI fed drive. The complexity of the MLI fed drive is much higher as compared with VSI fed drive but it gives better performance and is suitable for industrial applications.

VI. REFERENCES

[1] M. Baba, C. Lasku, I. Boldea, Z converter control of a V/f induction motor drive,IEEE 2012, pp 529-534.

[2] S. Grouni, R. Ibtiouen, M. Kidouche, and O. Touheemi, “Improvement Approach on Rotor Time Constant Adaptation with Optimum Flux in IFOC for Induction Machines Drives”, World Academy of Science, Engineering and Technology, pp. 356-360, 2008.

[3] K T D Temberkar : Improvement and analysis of speed control of three phase induction motor drive including two methods; Second Intnl. Conf. on Emerging Trends in Engg & Tech., ICETET-09, pp736-741

[4] António P. Martin, Emmanuel C. Meireles, Adriano S. Carvwalho, PWM-Based Control of a Cascaded Three-Phase Multilevel Inverter.

[5] S Albert Alexander and T Manikandan: Analog Control Scheme for Cascaded Multilevel Inverters Based on Multiple Carrier PWM Technique, International Conference on Recent Advancements in Electrical, Electronics and Control Engineering, 2011 pp57-62

[6] S Khomfoi, N Praisuvana : A Hybrid Cascaded Multilevel Inverter for Interfacing with Renewable Energy Resources; The Intnl. Power Electronic Conf.,2010, pp2912-2917.

[7] Muhamed Jemli , Hechmi Ben Azza, Moncef Gossa,Real-time implementation of IRFOC for Single-Phase Induction Motor drive using dSpace DS 1104 control board,Simulation Modelling Practice and Theory 17 Science Direct,2009, pp 1071-1080

[8] Omar Ellaban, Joeri Van Mierloe and Philippe Lataire, A Comparative Study of Different Control Techniques for an Induction Motor Fed by a ZSource Inverter for Electric Vehicles,Proceedings of the 2011 International Conference on Power Engineering, Energy and Electrical Drives

[9] F. Z. Peng, A. Joseph, j. Wange, M. S. Shen, L. Chen and Z.G. Pan, "ZSource Inverter for motor drives," IEEE Trans. on Power Electronics, vol. 20, no. 4, 2005, pp. 857-863.

[10] P.C.Krause ; Analysis of Electric Machinery And Drive System

[11] A.Kusaeguer, Dr. S.F.Kodad, Dr.B.V.Sankar ram : Modelling of induction machine and control of speed using hybrid controller technology; Journal of Theoretical And Applied Information Technology; 2005-2009

[12] Malinowski M., Gopkumar K., Rodriguez J., Pérez M. A.: A survey on cascaded multilevel inverters, IEEE Transactions on Industrial Electronics, vol. 57, nº. 7, , Jul. 2010pp. 2197-2206.

[13] Chee Muun Ongi ; Dynamic Simulation of Electric Machinery Using MATLAB/Simulink

[14] Mr.Darsan Patel,Dr.R.Saravanakumar,Dr.K.K.Ray,Mr.Ramesh.R, Review of Various Carrier based PWM Methods for Multilevel Inverter

[15] Serwet Tunser and Beir Dandil : Four quadrant control of multi-level inverter induction motor drives;, Journal of Scientific and Industrial Research Vol. 67, September 2008 pp 688-696.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technolog
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Electric Power theft detection and location Tracking using IOT

Ajay Mahato, Abhishek Nanda, Ajay Kumar Pal, Chandan Kumar Singh
Electrical and Electronics Department, MVJ College of Engineering, Bangalore, Karnataka, India

Abstract
Ever since the advent of electricity it has become an integral part of our life. From the first ever electric bulb by Edison to the Tesla coil we humans have come a long way. In todays present world every little appliance works on electricity from the electric toothbrush to huge motors. Life without electricity is unimaginable today. With the advancement of technology huge amount of electricity is generated today. This electricity can be transmitted to far away remote places to be used by the people. The high demand of electricity has made it a multi-billion dollar industry. It is the largest industry in the entire world with an interconnection of appliances like none other.

Keywords : Arduino, IOT, ESP8266, GSM, ThingsSpeak.

I. INTRODUCTION

Of all the inventions made by mankind electricity is the most important one. Today's life is impossible to imagine without electricity. With the increase in use of electricity the immoral practices against it has increased. According to a survey conducted by **Outlook in 2015** the world loses about 81$ Billion to theft of electricity. The highest electricity theft occurs in India of about 19$ Billion followed by Brazil 15$ Billion. This huge amount of electricity theft considerably affects the growth of a country specially a developing country. In India 30% of the total power transmitted is lost to AT&C (Aggregate technical and commercial) loss the highest in the world. Due to all this losses India is not able to meet the electricity demand and there are frequent power cuts.

II. PRESENT SYSTEM

A. Literature review

In the system proposed by R Giridhar Balakrishna, P Yogananda Reddy, M L N Vital [1] the IOT technology is used to detect the theft of electricity. The power transferred and the power consumed is measured and the difference is used to detect the theft of power.

In the system proposed by Anshu Singhal, Anupriya Tomar, Neha Kumari, S Hena Kauser, Mrs. Savitha. S.C. [2] the theft of power and location is also determined in this system. This system uses IR sensors and camera to detect the theft of power. The theft is detected when the IR sensor is tripped when a person approaches the electric pole. The camera can take pictures of the thief when the theft is detected

In the system proposed by N Kunan, Poornima BK [3] real time power transfer data is stored in an online database which can be viewed by logging in the website. The detection of power theft is by finding the difference of power transferred and power consumed.

B. Problem in the present system

[1] In this system power theft detection is not real time and also the location of theft is not determined.

[2] In this system the use of IR sensor causes improper detection as any heat signal can trip the IR sensor causing the camera to take pictures. Also this system is not feasible as it is not possible to install a camera in every electric pole.

[3] In this system the location of the theft is not determined.

III. PROPOSED SYSTEM

A. Description of System

Our proposed system claims to detect power theft in real time, along with location of theft. The system will have an online database which store all the data related to the distribution system along with the time and date. This data include power dispatched, voltage consumed at a pole and the serial no of the electric pole. The voltage value will be plotted against time. The pole number gives us with the location of the theft of power.

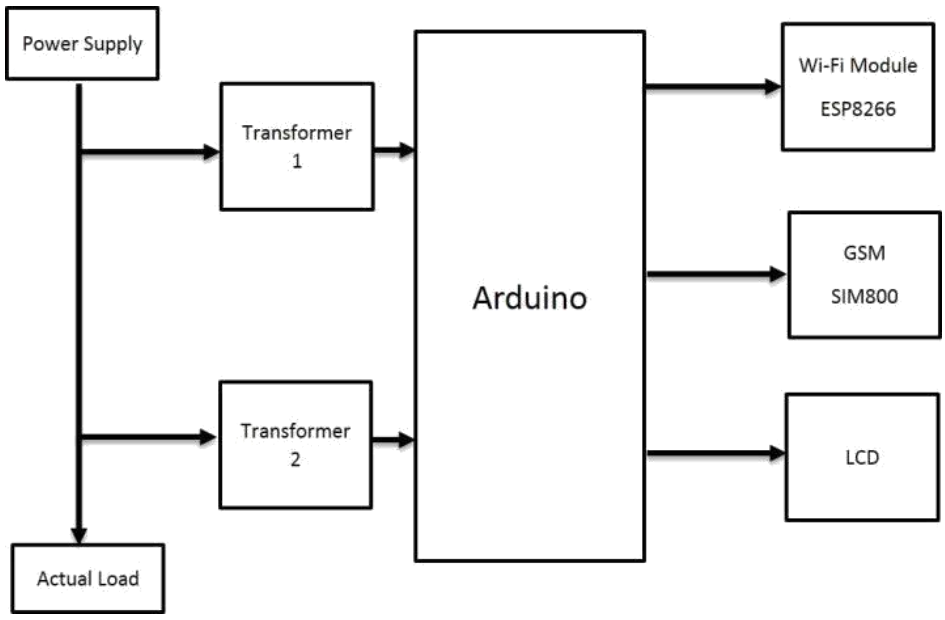


Fig. 1

The system will tabulate and form a statistical data for monitoring voltage levels in area where theft is taking place for a period of time, the authorities can closely monitor the area and conduct a survey to find out where power theft occurs. We will compare the sending end and receiving end voltage levels, see demand of load if the difference is more than permitted value then a close check must be scheduled to look into abrupt rise of power demand. The authorities can use this to find the regions where there is really rise in power consumption and where power theft is occurring.

B. Working

The circuit consists of Arduino, LCD, GSM, ESP8266 module, Energy meter, 2 transformer and loads. Energy meter is used to measure the input power supplied by the source. Two transformer are used to measure the voltage consumed in two different areas.

The heart of this project is Arduino Uno controller.

It receive voltage signal from two transformer by means of bridge rectifier. Than it compares the voltage magnitude with the voltage drop anointed for that locality .If there is no theft, than the voltage drop will be very low so there is no theft in the system. If theft occurs then the voltage drop will be high. The bridge rectifier is used to convert the AC to pulsating DC then the capacitor based filter circuit smoothens the DC power. Potentiometer and resistors are provided to reduce the voltage level and set it to 5volt.

The voltage given by the transformer is multiplied by a value to represent the real voltage value being supplied. If the voltage shown by the transformers drops below a particular value mentioned, it means the load in the area has increased and so there is theft occurring. Than the control moves to the alert function such as SMS and email.

An online database is created by making use of THINGSPEAK server where the data of voltages of different areas are stored and updated automatically. In it the analysis of data can be done by MATLAB and the location of monitoring can also be done. It gives us a graphical view of the change in voltage in an area.

LCD is used to display the load voltages of different areas.

The ESP8266 module allows the Arduino Uno board to connect to the internet, so that monitoring authority can get the information through the internet. The exact location of the power theft is determined by placing multiple transformers in load line at a specified distance by which monitoring authorities will be in a state to take legal action against the culprit.

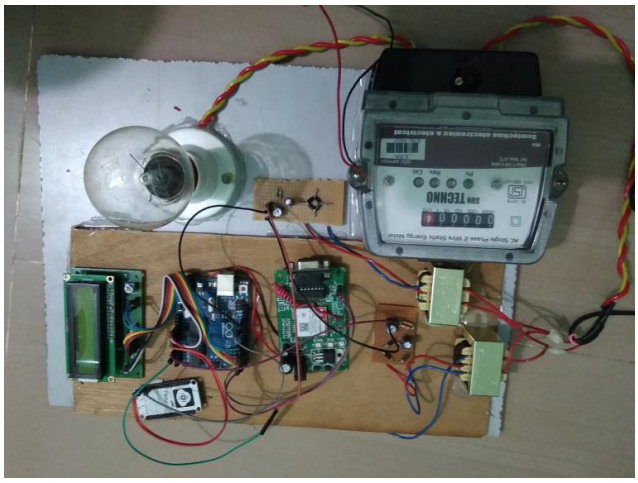


Fig. 2

C. Components

- Arduino UNO
- ESP8266
- GSM SIM800
- LCD (16x2)
- Transformers
- Bridge Rectifier
- Energy Meter
- Load
- Resistor
- Capacitor

Equations The circuit consists of Arduino, LCD, GSM, ESP8266 module, Energy meter, 2 transformer and loads. Energy meter is used to measure the input power supplied by the source. Two transformer are used to measure the voltage consumed in two different areas.

The heart of this project is Arduino Uno controller.

It receive voltage signal from two transformer by means of bridge rectifier. Than it compares the voltage magnitude with the voltage drop anointed for that locality .If there is no theft, than the voltage drop will be very low so there is no theft in the system. If theft occurs then the voltage drop will be high.

The bridge rectifier is used to convert the AC to pulsating DC then the capacitor based filter circuit smoothens the DC power. Potentiometer and resistors are provided to reduce the voltage level and set it to 5volt.

The voltage given by the transformer is multiplied by a value to represent the real voltage value being supplied. If the voltage shown by the transformers drops below a particular value mentioned, it means the load in the area has increased and so there is theft occurring. Than the control moves to the alert function such as SMS and email.
An online database is created by making use of THINGSPEAK server where the data of voltages of different areas are stored and updated automatically. In it the analysis of data can be done by MATLAB and the location of monitoring can also be done. It gives us a graphical view of the change in voltage in an area.

LCD is used to display the load voltages of different areas. The ESP8266 module allows the Arduino Uno board to connect to the internet, so that monitoring authority can get the information through the internet.

The exact location of the power theft is determined by placing multiple transformers in load line at a specified distance by which monitoring authorities will be in a state to take legal action against the culprit.

In this project we are making use of very simple equation of power to find the theft of power. The equation are

Power theft= power supplied- power used
Power supplied - The power supplied from distribution station.

Power used - It is the actual load of the users.

E. Future Scope

This system can be further be improved in future because of its high usage factor. For instance a system can be designed in which instead of knowing the consumers load beforehand we can install smart energy meter in the consumer premises so that we can know the real time load of the consumer. With this

Fig. 3

We can detect the theft of power more precisely. GSM modules can also be interfaced with the circuit to determine the exact location of the theft instead of just the street name. The use of current sensors can give us the exact value of the power being theft at any moment.

IV. References

[1] IOT based Power Theft Detection. R Giridhar Balakrishna, P Yogananda Reddy, M L N Vital.. International Journal of Innovations in Engineering and Technology (IJIET) ISSN: 2319-105, Volume 8, Issue 3, June 2017

[2] A Survey Of IOT For Power Theft Detection, Fault Identification And Location Tracking. Anshu Singhal, Anupriya Tomar, Neha Kumari, S Hena Kauser, Mrs. Savitha. S.C. International Journal of Science, Engineering and Technology Research (IJSETR) Volume 5, Issue 5, May 2016 I.S. Jacobs and C.P. Bean, “Fine particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[3] IOT Based Power Theft Detection and Monitoring System. N Kunan, Poornima BK. IJIREEICE. Vol. 5, Issue 5, May 2017

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Tensile and Impact Properties Evaluation of Eutectic, Hypereutectic and Special Eutectic Aluminium Alloys under Various Heat Treated Conditions By Experimental Approach

K. A. Jayasheel Kumar[1], Dr. C. M Ramesha[2]

1Assistant Professor, Dept of Automobile Engg, New Horizon College of Engg, Bengaluru , Karnataka, India

2Associate Professor, Dept. of Mechanical Engg., M.S.Ramaiah Institute of Technology, Bengaluru , Karnataka, India

ABSTRACT

The study deals with the evaluation of tensile properties of eutectic, hypereutectic and super eutectic aluminium alloy under various heat treated conditions. Pistons are produced from cast or forged, high-temperature resistant aluminium silicon alloys. There are three basic types of aluminium piston alloys. The standard piston alloy is a eutectic Al-12%Si alloy containing in addition approx. 1% each of Cu, Ni and Mg. Special eutectic alloys are also evaluated for improved strength at high temperatures. Hypereutectic alloys with 18 and 24% Si provide lower thermal expansion and wear, but have lower strength. The tensile and impact properties are evaluated for all the conditions of eutectic, hypereutectic and special eutectic aluminium alloys. The experimentation is carried on a bench tensometer and on Izod and Charpy Impact testing machine. The properties are evaluated for various heat treated conditions like operating temperature, quenching conditions, annealing conditions. It is concluded that based on the impact and tensile properties, type of material can be selected as the piston material.

Keywords : Eutectic, Hypereutectic and Special Eutectic Al Alloy, Heat treated, Wear properties

INTRODUCTION

Pistons are produced from cast or forged, high-temperature resistant aluminium silicon alloys. There are three basic types of aluminium piston alloys. The standard piston alloy is a eutectic Al-12%Si alloy containing in addition approx. 1% each of Cu, Ni and Mg. Special eutectic alloys have been developed for improved strength at high temperatures. Hypereutectic alloys with 18 and 24% Si provide lower thermal expansion and wear, but have lower strength (see tabled property data on the following pages). In practice, the supplier of aluminium pistons use a wide range of further optimized alloy compositions, but generally based on these basic alloy types. The majority of pistons are produced by gravity die casting. Optimized alloy compositions and a properly controlled solidification conditions allow the production of pistons with low weight and high structural strength. Forged pistons from eutectic and hypereutectic alloys exhibit higher strength and are used in high performance engines where the pistons are subject to even high stresses. Forged pistons have a finer microstructure than cast pistons with the same alloy composition. The production process results in greater strength in the lower temperature range. A further advantage is the possibility to produce lower wall thicknesses - and hence reducing the piston weight. Also aluminium metal matrix composite materials are used in special cases. Pistons with

Al_2O_3 fibre reinforced bottoms are produced by squeeze casting and used mainly in direct injection diesel engines. The main advantage, apart from a general improvement of the mechanical properties, is an improvement of the wear behaviour [5].

Depending on the silicon concentration in the alloy and the cooling conditions, the structure of the casting will essentially comprise mixtures of aluminium grains, silicon crystals and aluminium silicon eutectic as well as various intermetallic phases formed from other alloying additions (Mg_2Si, $CuAl_2$). The aluminium grains can grow very large however, under slow cooling conditions, such as in sand castings or heavy sections, and this can lead to poor casting and mechanical properties.

The system Al-Si alloy

Among commercial aluminium casting alloys those with silicon as the major alloying element are the most important, mainly because of their excellent casting characteristics. Additions of Si to pure aluminium impart high fluidity, good feeding characteristics, low shrinkage and good hot cracking resistance [1]. The properties of aluminium-silicon alloys make them very popular in various applications including the automotive, aerospace and defence industries. The high strength to weight ratio is one of their most interesting characteristics [2].

As the density of Si is 2.3 g/cm3, it is one of the few elements which may be added to aluminium (2.7 g/cm3) without loss of weight advantage [3]. Aluminium-silicon alloys that do not contain copper additions are used when good cast ability and good corrosion resistance are needed. Magnesium can act as a substitute for copper. Magnesium and silicon can form the intermetallic hardening phase Mg2Si which precipitates in the α-aluminium matrix and increases the yield strength [4].

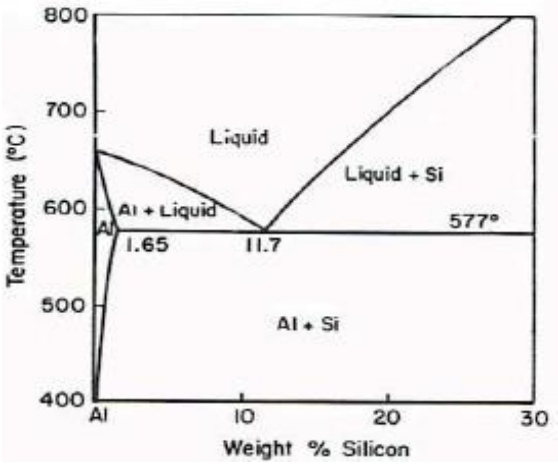


Fig.1-Equilibrium binary Al-Si phase diagram

Wear is related to interactions between surfaces and more specifically the removal and deformation of material on a surface as a result of mechanical action of the opposite surface. The need for relative motion between two surfaces and initial mechanical contact between asperities

is an important distinction between mechanical wear compared to other processes with similar out come [5].

Additionally, most modern pistons contain a large amount of silicon. Silicon is added to the aluminum because the resulting alloy is more resistant to wear and expansion than an alloy that doesn't contain silicon.

Heat Treatment is often associated with increasing the strength of material, but it can also be used to alter certain manufacturability objectives such as improve machining, improve formability, restore ductility after a cold working operation. Thus it is a very enabling manufacturing process that can not only help other manufacturing process, but can also improve product performance by increasing strength or other desirable characteristics. [6][7]

The specific amount of silicon added to the aluminum ranges from 9-18%. At percentages below 12%, whatever silicon that is added to the aluminum dissolves into the solution. Once you reach 12% (or thereabouts), the aluminum alloy become saturated with silicon. This specific point is called the saturation point, and any silicon added after the saturation point will not dissolve in the finally aluminum alloy [8]. Instead, this excess silicon will form a hard precipitate that remains separate from the aluminum.

An aluminum alloy that is sutured with silicon is known as "eutectic." When the alloy contains silicon at a percentage that is less than saturated, it's called "hypoeutectic." When the alloy contains more silicon that then saturation limit, it's called "hypereutectic."

The characteristics of pistons in each of these categories are very distinct. Hypereutectic alloys are stronger, resist scuffing and seizure, and reduce groove wear and cracking of the crown at extremely high temperatures. They're also very resistant to expansion, because the high percentage of silicon essentially "insulates" the piston from the effects of heat.

Hypereutectic designs also allow for decreased distance between ring grooves, which improve the "seal" between the rings and the cylinder wall and improves efficiency. Finally, because hypereutectic pistons don't expand or contract, they're ideal for modern engines with tight clearance requirements. Generally speaking, modern engines use pistons made from a hypereutectic aluminum alloy.

If there is a downsides to hypereutectic pistons, it's that they're brittle compared to forged pistons. Therefore, forged pistons are more forgiving of extreme conditions (like those found in a race car), and they give you a greater margin of error when dealing with timing problems, as detonation is less likely to destroy a forged piston than a hypereutectic cast piston.

Table 1 shows the mechanical properties of piston alloys at various temperatures and table 2 shows the physical properties of piston alloys [9].

Table-1 Mechanical properties of piston alloys

	Eutectic Alloy AlSi12 CUMgNi		Hypereutectic Alloy AlSi18CuMgNi		Special Eutectic Alloy AlSi12Cu4Ni2Mg
	cast	forged	cast	forged	cast
Yield Strength $R_{P0,2}$ (MPa) at Temperature					
20°	190 – 230	280 – 310	170 – 200	220 – 280	200 – 280
150°	170 – 220	230 – 280	150 – 190	200 – 250	–
200°	120 – 170	–	100 –150	–	150 – 200
250°	80 – 110	90 – 120	80 – 120	100 – 140	100 – 150
300°	50 – 80	–	60 – 80	–	85 – 100
Ultimate Tensile Strength R_m (MPa) at Temperature					
20°	200 – 250	300 – 370	180 – 230	230 – 300	210 – 290
150°	180 – 230	250 – 300	170 – 210	210 – 260	–
200°	160 – 200	–	160 – 190	–	170 – 210
250°	100 – 150	110 – 170	110 – 140	100 – 160	130 – 180
300°	80 – 100	–	90 – 130	–	100 – 120
Elongation to Fracture A_5(%)					
20°C	0,3 – 1,5	1 – 3	0,2 – 1,0	0,5 – 1,5	0,1 – 0,5
Hot Hardness after 200 hours at temperature: Hardness ($HB_{5/50/30}$)					
20°C	90 – 125	90 – 125	90 – 125	90 – 125	100 – 150
150°C	80 – 90	80 – 90	80 – 90	80 – 90	80 – 115
200°C	60 – 70	60 – 70	60 – 70	60 – 70	60 – 75
250°C	35 – 45	35 – 45	35 – 45	35 – 45	45 – 50
300°C	20 – 30	20 – 30	20 – 30	20 – 30	30 – 40
Fatigue Strength σ_w (N/mm^2)					
20°C	80 – 120	110 – 140	80 – 110	90 – 120	90 – 120
150°	70 – 110	90 – 120	60 – 90	70 – 100	90 – 120
250°	50 – 70	60 – 70	40 – 60	50 – 70	60 – 80
300°	–	–	–	–	45 – 60

Table-2 Mechanical properties of piston alloys

	Eutectic Alloy AlSi12 Cu MgNi		Hypereutectic Alloy AlSi18CuMgNi		Special Eutectic Alloy AlSi12Cu4Ni2Mg
	cast	forged	cast	forged	cast
Density (kg/dm^3)					
at 20°C	2.70	2.70	2.68	2.68	2.80
Linear thermal expansion coefficient (1/K)					
between 20° and 200°C	20.5 - 21.5	20.5 - 21.5	18.5 - 19.5	18.5 - 19.5	20.5 - 21.5
Thermal conductivity (W/cm · K)					
at 20°C	1.43 - 1.55	1.47 – 1.60	1.34 - 1.47	1.43 - 1.55	1.30 – 1.40
Specific heat (J/g · K)					
at 100°C	0.96	0.96	0.96	0.96	0.96
Youngs modulus (MPa)					
at 20°C	80.000 - 81.000	81.000	83.000 - 84.000	84.000	82.000
at 200°C	73.000 - 74.000	-	75.000 - 76.000	-	78.000
at 250°C	68.000 - 72.000	74.000	-	76.000	72.000
at 300°C	-	-	-	-	70.000

EXPERIMENTAL DETAILS

Tensile Test

A tensile test also known as tension test is the fundamental type of mechanical test that can be performed on material [18]. The specimen is subjected to a continuously increasing tensile force while simultaneous observation is made on the elongation of the specimen. The maximum conventional stress that can be sustained by a material is called tensile strength.

The test was conducted on the Bench Tensometer. A Tensometer is a device used to evaluate the Young's modulus (How much it stretches under strain) of a material and other properties of materials, such as tensile strength [12]. It is loaded with a sample between 2 grips that are either adjusted manually or automatically to apply force to the specimen. The machine works either by driving a screw or by hydraulic ram. The latter have the great advantage of being able to create much more complex loading patterns, such as the cyclical loads needed for measurement of fatigue strength. Figure 2 shows the bench Tensometer. The tensile specimen is as shown in figure 3.

Fig.2 Bench Tensometer

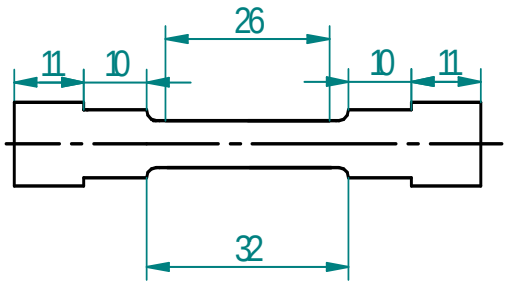


Fig.3 Tensile specimen

Impact Test

Impact test is a standardized high strain rate test which determines the amount of energy absorbed by a material during fracture. The absorbed energy is a measure of a given material toughness and acts as a tool to study temperature depended brittle-ductile transition. It is widely applied in industry, since it is easy to prepare and conduct, and hence results can be obtained quickly and cheaply. But the major disadvantage is that all results are only comparative.

Impact resistance is one of the most important properties for a part designer to consider, and without question, and the most difficult to quantify. The impact resistance of a part is into many applications, a critical measure of a service life.

Types of impact tests

The two basic impact tests are:

1. Izod (Cantilever) Test
2. Charpy (Beam) Test

Izod (Cantilever) Test

Izod impact strength testing is an ASTM standard method of determining impact strength. A notched sample is generally used to determine impact strength. Izod test specimens vary depending on the type of material being tested. Metallic samples tend to be square in cross section, while polymeric test specimens are often rectangular, being struck parallel to the long axis of the rectangular [7]. Izod test sample usually have a V-notch cut into them, although specimens with no notch is also used on occasions.

Charpy (Beam) Test

The charpy test is also known as charpy V-notchtes, is standard high strain rate test which determines the amount of energy absorbed by a material during fracture. This absorbed energy is a measure of given material's toughness and acts a tool to study temperature -dependent brittle-ductile transition. It is widely applied in industry, since it is to prepare and conduct and results can be obtained quickly and cheaply. But a major disadvantage s that all results are only comparative.

The test was developed in 1905 by the French scientist Georges Charpy. It was pivotal in understanding the fracture problem of ship during the Second World War. It is used in many industries for testing and building construction materials used in the construction of pressure vessels bridges and to see how storms will affect materials used in buildings. Figure 4shows the Charpy Impact tester. Figure 5 shows the impact specimen.

The specimens of the required dimensions are prepared as per ASTM standards and a V-notch is made in the center. The specimen is placed on the Charpy impact tester. The pendulum is made to fall from the required height and the specimen is fractured. The angle of pendulum travel is noted down. The impact strength is calculated.

Fig.4 Charpy Impact tester

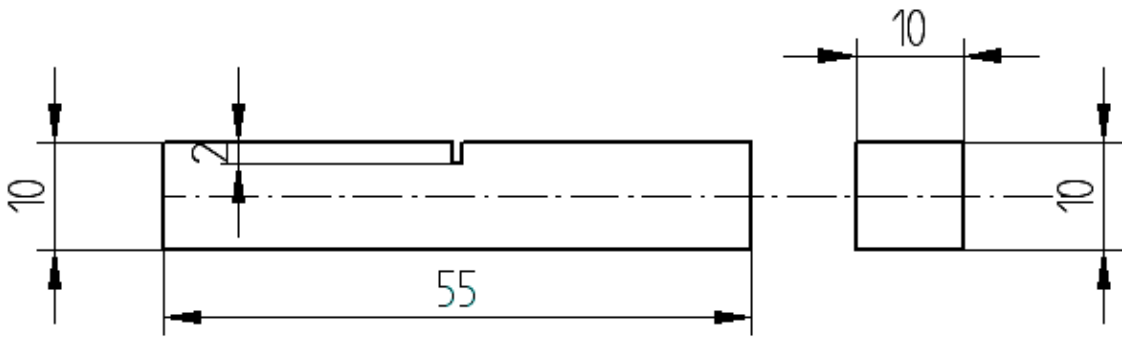


Fig.5 Impact specimen

RESULTS AND DISCUSSION

The tensile test is carried out on a bench Tensometer. The specimens are loaded onto the Tensometer. Firstly the elongation gauge used to measure the percentage elongation was set according to the gauge length of the specimen.

Before pulling the test piece, it is laid in the cradle, the pivoted arm is moved to the left slide before the arm reading is zero. The left slide is then locked.

The specimen is held using specified shackles and the test is conducted until failure of the specimen. The load reading is noted down from the scale. Figure 6 shows the graph of ultimate tensile strength. Table 3 shows the UTS values. As the solution temperature is increased above the saturated solution temperature, the material losses its ductility, hence the UTS values decreases as the temperature variation is carried out and also decreases as aging time is varied and also same as in the case of quenchant variation.

Table 3 The Ultimate Tensile Strength

Variations	UTS (MPa)
A	75.8
H1	237.9
H2	214.3
H3	186.3
G1	222.3
G2	192.2
G3	217.3
J1	187.9
J2	171.7
J3	89.4

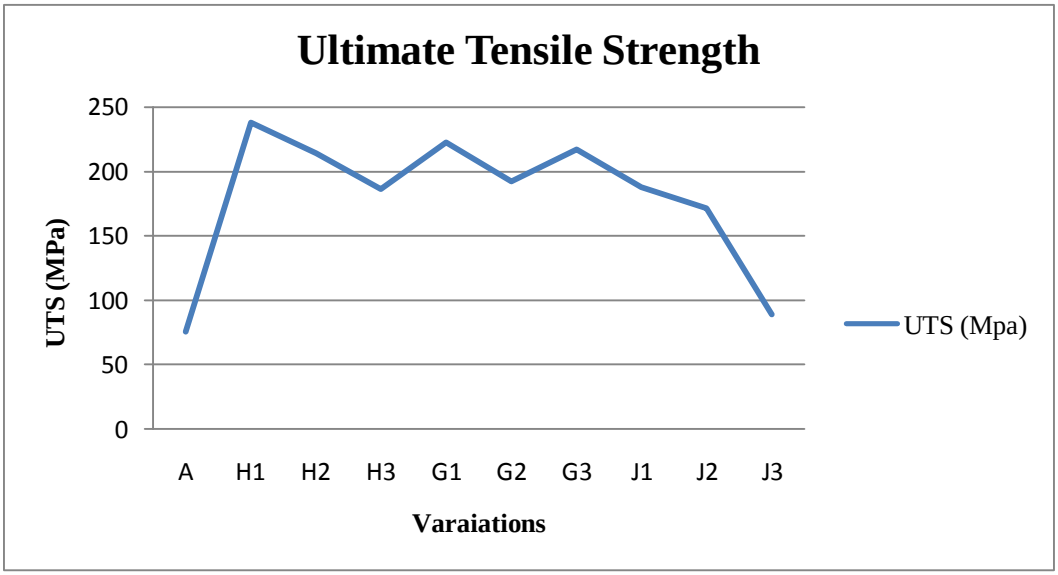


Fig.6 Graph of ultimate tensile strength of AA 7075 alloy

The impact test was carried out using Charpy Test. The pendulum is lifted to its upper position, and the pointer is made to touch the pendulum. The initial reading is set to zero. The specimen is mounted on the anvil using the template with the notch facing away from the striker edge of the pendulum. The specimen is fractured by the releasing of pendulum. Table 4 shows the values of fracture energy and impact strength.

Length of the pendulum – r- 0.825ms
Angle of fall - α- 160°
Weight of the pendulum - w- 91.875N
Impact velocity – sqrt (2*g*r (1- cos (160))) - 6.169m/s
Area – 96mm^2

Table 4 The values of fracture energy and impact strength

Variations	Angle of rise, β°	Fracture energy, U=w*r (cosβ-cosα) N-ms	Impact strength, K=U/A
A	126	26.67	48.84E3
H1	118.3	35.29	64.63E3
H2	115	39.19	71.77E3
H3	123.3	29.61	54.23E3
G1	126.3	26.35	48.26E3
G2	125	27.75	50.82E3
G3	124	28.84	52.82E3
J1	127	25.61	46.90E3
J2	125	27.75	50.82E3
J3	123.3	29.61	54.23E3

As the solution temperature is increased above the saturated solution temperature, the material losses its ductility, hence the impact strength values decreases as the temperature variation is carried out and increases as the aging time is varied and also same as in the case of quenchant variation.

Figure 7 shows the graph of impact strength of AA 7075 alloy.

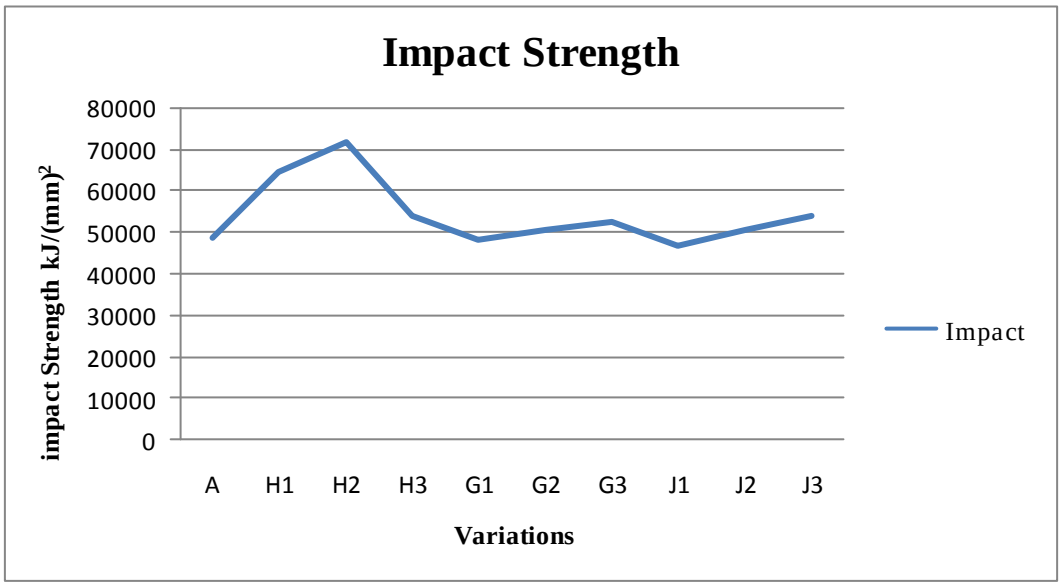


Fig.7 Graph of impact strength of AA 7075 alloy

REFERENCES

[1] "Properties and Selection: Non ferrous Alloys and Special-Purpose Materials", 1990, ASM Hand Book, Vol.2, Tenth Edition, pp 39-40.

[2] "Properties and Selection: Non ferrous Alloys and Special-Purpose Materials", 1990, ASM Hand Book, Vol.2, Tenth Edition, pp 511-514.

[3] L.F.Mondolfo, "Aluminium alloys structure and properties," First publication 1979

[4] K. Srinivasulu Reddy, G. Ranga Janardhana, "Developing a neuro fuzzy model to predict the properties of Al-Si12 alloy," vol. 4, no. 10, december 2009

[5] Shivanath R, Sengupta PK, Eyre TS, "Wear of aluminium–silicon alloy", Br Foundrymen 1977; 79:349–56.

[6] ASM heat treating hand book, Vol.4- Heat treatment of non- ferrous alloys, ASM international, 1991, pp 842-879.

[7] Metals hand book, Vol.8- Mechanical testing: ASM international 10th edition. 1990, pp 20, 74-75

[8] J. Gilbert Kaufman, FASM, Properties of aluminium alloys, ASM international 3rd edition, 2002, pp 206-217.

[9] http://european-aluminium.eu/media/1570/aam-applications-power-train-1-pistons.pdf

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Patient Monitoring And Women Safety System Using Iot

Dr. M. Yuvaraju. M.E, Ph.D.,
Assistant professor, Department of EEE,
Anna University Regional Campus,
Coimbatore,
TamilNadu,India.

M.C.Kalaiselvi
PG Scholar, Department of EEE,
Anna University Regional Campus,
Coimbatore,
TamilNadu, India.

ABSTRACT

The design of proposed system is based on embedded real time system to monitor the patients suffering from blood pressure, chronic diseases and for aged people who resides in their home. In this system is mainly to eliminate the need of a Personal Computer and to develop the system probably to reduce the cost. The smart phones create many opportunities to improve health monitoring and many technologies are developed every year with large scale adoption. The system was developed to monitor the non-invasive signs such as temperature, blood pressure, heart rate, and to detect smoke in atmosphere. The gas sensors used and if the patient fallen down to detect fall detection accelerometer. The proposed system consists of an Arduino controller, acid sensor, GSM 900A, android application. The acid sensor is a switch type that will detect the presence of water or battery acid if any portion of the rope becomes wet. The monitored values are always sent through the smart phones and it detects the normal and abnormal state. The buzzer indicates it when it is abnormal state and can be passed to particular member through mobile android application by using Global Positioning System/Global System for Mobile Communication module. The patient can be monitored through mobile phones by doctor and need not to visit to home place for the monthly check-up. The doctor monitors the patient health condition through the android application.

Keywords-Arduino Uno, Global Positioning System, Global System for Mobile Communication.

1. INTRODUCTION

The global population is growing and aging in every year. In this demographic change chronic age related diseases increase correspondingly, such as dementia, diabetes, cancer, heart failure, and chronic obstructive pulmonary diseases. Injured related and chronic condition type of disabilities affect lot of peoples. Healthcare costs are increasing, quality of life and productivity are reclining, family members serve as primary are assistants, and in many cases. So many ways problem come from any direction such as women walking on the road after the work, going to outing or many other reasons for which they go alone. The most violent crimes against women is acid attack and sexual harassment. Main advantage of this project is two different types of problem is rectified. To overcome this problem we can use patient monitoring and womens safety system using IOT. This simple gadget designed to serve the purpose of providing security for ill patient and womens.

2. EXISTING SYSTEM

In previous system wearable health monitoring systems (WHMS) and women safety systems are separate project to solve the own problem. Such as biosensors it detect the vital signs and patient physiological parameters and the emergency situation the patient can be treated with medical equipments with real time monitoring. Optical pulse oximetry sensor is design a software algorithm. The photoplethysmographic signals were extracted for the saturation of oxygen and pulse oximetry sensing the pulse transits time users fingertip and palm. ECG wave form are generated for doctor reference. Experimentally to detect the normal condition values to target the success rate attained 94.3%. And also intelligent safety system to prevent acid attacks method is used to detect the acid, alarm is turned on during the attack time, the message is send to control room, attacker image is captured and send to control room, and to measure heart beat and temperature measure the person and send to the guardian mobile number with location of the person which contain a secret password. Also contains a shock mechanism to produce non-lethal electric shock in emergency situations to the attacker.

3. PROPOSED SYSTEM

From the above section, the existing system technologies manage the health monitoring in so many ways. But in this system we combine two different area problems. It is mainly used for security purpose for people. Patient may easily understand their own health condition without doctor. Also doctor observes the patient health condition through sensor. In women safety acid level is detected before the attack.

The proposed system Fig-1 consists of arduino microcontroller is a heart of the basic building block, MEMS 3- axis accelerometer, acid detection sensor, heart beat sensor, temperature sensor, vibration sensor, buzzer, gps/gsm module, lcd.

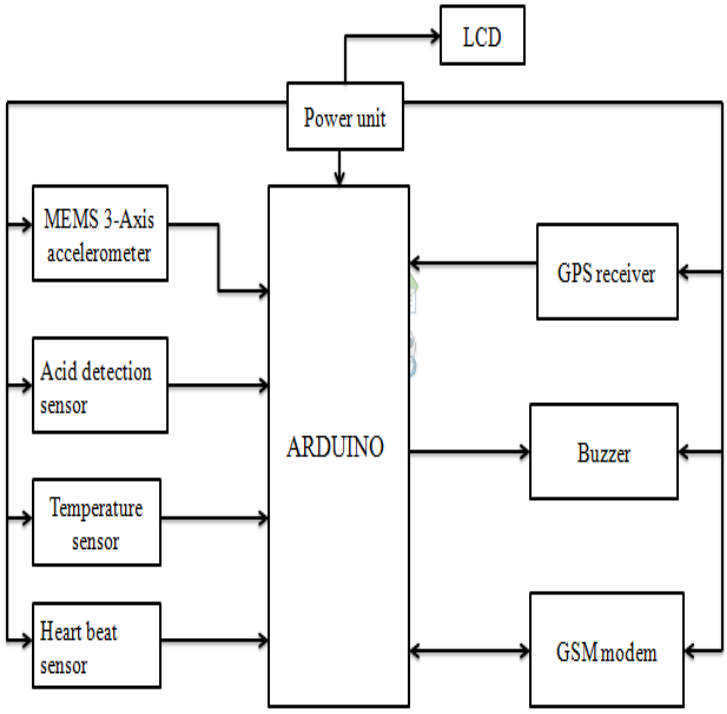


Fig-1: Block Diagram

3.1 WORKING PROCESS

This system it detects the fall detection accelerometer, temperature, acid gas detection and heart beat in both normal and abnormal conditions of the patients. In mobile screen both normal and abnormal values are displayed. Aurdino microcontroller compares the maximum and minimum values and if the patient is in abnormal condition then abnormal values are detected and the buzzer indicate a beep sound and the data are sent through the gsm/gps module always the mobile receives the data. The doctor / relatives receive the data and if the patient is in critical condition by their turn can send an ambulance to the patient location.

4. HARDWARE COMPONENTS

It is consists of arduino, varies sensors of heart beat sensor, acid detection sensor, fall detection sensor and temperature sensor with GSM/GPS module.

4.1 ARDUINO

Basic building block of propose system is arduino. It is AT mega 32 bit microcontroller also a 8 bit AVR RISC based microcontroller. Operating voltage is 1.8 volts to 5.5 volts. Input from all sensor to the arduino and compare maximum and minimum value sent through the GSM/GPS.

4.2 HEART BEAT SENSOR

In this sensor TCRT1000 is used to continuously monitor patient heartbeat every sec. it is non-invasive method is using a light source and detector to measuring variation in blood volume in tissues. The pulse rate is a heart rate and measurement of number of times the heart beats per minute. The normal pulse rate for adults is 60 to 100 beats per minute. Pulse rate is increase when accident ,sudden shock also running. When cardiovascular condition heart rate is 40 beats per minute in running.

4.3 FALL DETECTION SENSOR (ADXL345)

ADXL 345 is a complete 3-axis acceleration measurement system. It is User selectable resolution. It is used to detect patient fall or not with each second. It is used to gaming, handset, medical instrumentation. This device is allowed to detect the patient fall in 3 axis position and ouput of the sensor interferce into arduino.

4.4 LM35

LM35 is used to measure the body temperature. Temperature varied due to food, atmosphere and stage of menstrual cycle. Minimum temperature range is 97.8 degrees Fahrenheit and maximum range is 99 degrees Fahrenheit. Temperature sensor measure the value and when the temperature reach above threshold value to give alarm.

4.5 BUZZER

It is indicate audio signal when patient is abnormal state. The other types of buzzers has alarm devices with timers. 5 Volts buzzer is used.

4.6 GSM/GPS

Global system for mobile communication (GSM) and Global positioning system (GPS) is a modem built with dual band GSM/GPS engine SIM300A. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command.

5.WORKING FLOW

The Flow chart is as shown in Fig-2. The main purpose of the monitoring system is used to detect the abnormal condition of the patient by continuous monitoring of the vital signs. First the system is initialized and by using the sensor unit the vital parameters such as temperature, BP, pulse rate, gas, fall detection of the patient is recorded and sent through ADC channel to the Arduino controller.

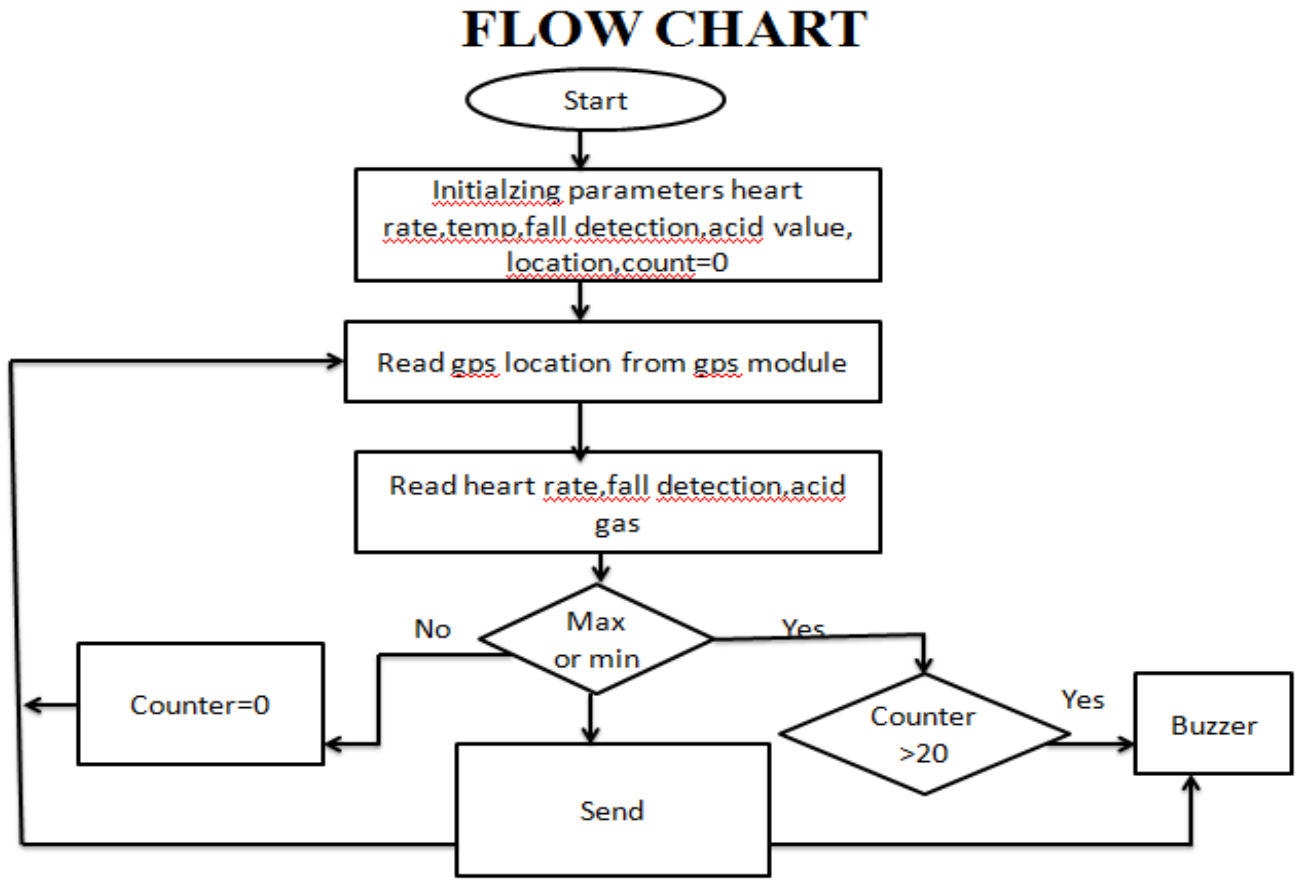


Fig-2 Working Flow

6. SOFTWARE

Arduino 1.7:

It is a open source software system and combine the hardware and software. It is easy to understand also when error detect is not affect whole product and immediately change the error.

Software output:

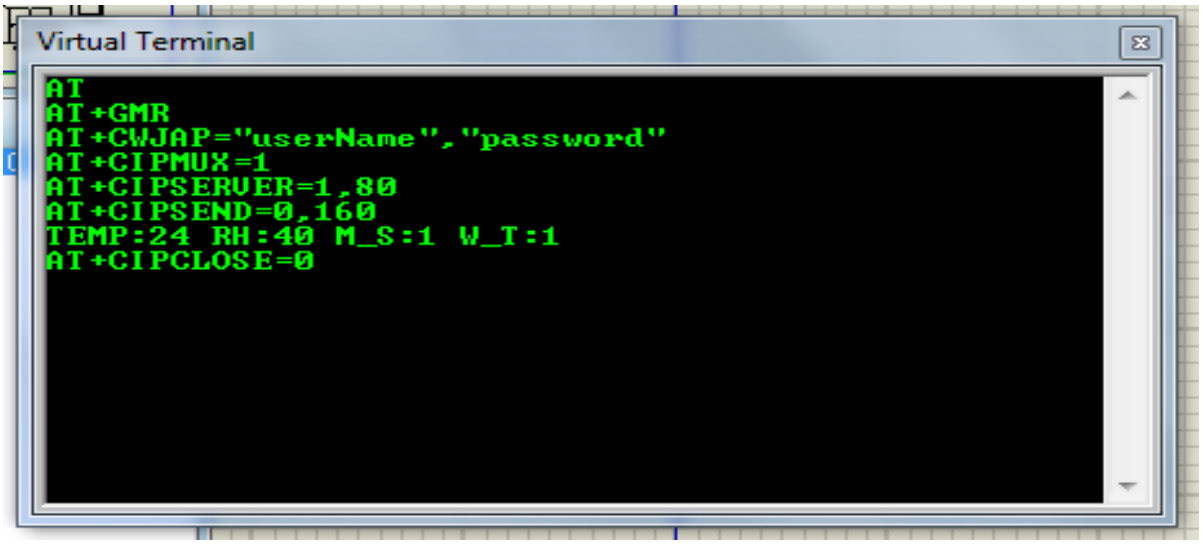


Fig-3 Output

7. HARDWARE MODULE

The hardware module Fig-4 detect the abnormal and normal value of the patient using arduino, gsm/gps and sensors.

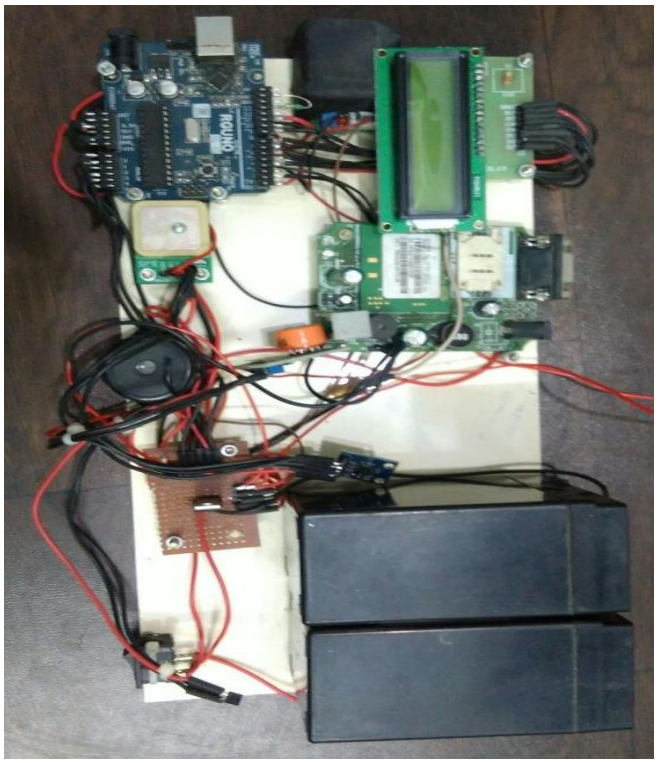


Fig-4 Hardware Module

8. CONCLUSION

The indoor health monitoring system which is effectively used in real time medical applications is developed. This system monitors the vital signs of the patient in the home and there is no need to

visit the hospital often. It uses the ARDUNIO UNO controller to receive input and transmit to external devices. It uses the GSM 900A modem which transmits the messages and it automatically monitors the respective parameters to transfer.

This system is designed to reduce the work and it can be implemented with the low cost and for the daily usage to save life in emergency condition. The simulation for the whole model is designed and tested.

9. FUTURE WORK

The health monitoring system can be extended for monitoring some more vital signs such as cholesterol, sugar, etc. This can also be extended by introducing immediate vaccination for the patients that are identified as in critical position.

10. REFERENCES

[1] Bani-Hasan, M., Kadah, Y., El-Hefnawi, F., "Identification of cardiac arrhythmias using natural resonance complex frequencies," Int. J. of Biological and Life Sciences 6:3, Biomedical Department, Faculty of Engineering, Cairo University, Egypt, 2010.

[2] Braunwald, E., Zipes, D.P., Libby, P., et al., "Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine," 2007.

[3] Chazal.P.D, Dwyer.M.O, and Reilly.R.B., "Automatic classification of Heart beats using ECG morphology and heartbeat interval features," IEEE Trans. Biomed. Eng., Vol. 51, no. 7, pp. 1196–1206, Jul. 2004.

[4] Gatzoulis.L and Iakovidis.I., "Wearable and portable ehealth systems," IEEE Eng. Med. Biol. Mag., Vol. 26, no. 5, pp. 51–56, Oct. 2007.

[5] Gupta .S. K. S., Mukherjee .T. and Venkatasubramanian .K.K., "Body Area Networks: Safety, Security, and Sustainability," Cambridge University Press, 2013.

[6] Hao.Y and Foster.R., "Wireless body sensor networks for health monitoring applications," Physiol. Meas., Vol. 29, pp. R27–R56, Nov 2008.

[7] Joseph.M, Bagade.P, Banerjee.A, and Gupta .S. K. S., "bHealthy: A physiological feedback-based mobile wellness application suite," in International conference on Wireless Health. ACM, Nov 2013.

[8] Lin, C.-T., "An intelligent tele cardiology system using a wearable and wireless ECG to detect atrial fibrillation," IEEE Trans. Inf. Technol. Biomed., 14, (3), pp. 726–733,2010.

[9] Liu, B., Liu, J., Wang, G., et al., "A novel electrocardiogram parametrization algorithm and its application in myocardial infarction detection," Comput. Biol. Med., 1, (61), pp. 178–184,2015.

[10] Lymperis.A and Dittmar .A., "Advanced wearable health systems and applications, research and development efforts in the european union," IEEE Eng. Med. Biol. Mag., Vol. 26, no. 3, pp. 29–33, Jun. 2007.

[11] Nabar.s , A. Banerjee, S. K. S. Gupta, and R. Poovendran, "Resource efficient and reliable long term wireless monitoring of the photoplethysmographic signal," in Wireless Health, pp. 1 –6, October 2011.

[12] Pacelli.M, Loriga.G, Taccini.N, and Paradiso.R., "Sensing fabrics for monitoring physiological and biomechanical variables: E-textile solutions," in Proc. 3rd IEEE-EMBS Int. Summer School Symp. Med. Dev. Biosens., pp. 14 2006.

[13] Pantelopoulos.A and Bourbakis.N., "A health prognosis wearable system with learning capabilities using NNs," in Proc. 21st Int. IEEE ICTAI, pp. 243–247 ,2009.

[14] Pantelopoulos.A and Bourbakis.N., "A survey on wearable sensor based systems for health monitoring and prognosis," IEEE Trans. Syst., Man Cybern. C, Appl. Rev., Vol. 40, pp. 1–12, Jan. 2010.

[15] World Health Organization, "From burden to 'best buys': Reducing the economic impact of NCDs in low- and middle-income countries," 18 September 2011.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

An IOT Based Automatic Agricultural Monitoring and Irrigation System

Dr. M.Yuvaraju[1], K. J. Priyanga[2]
[1]Assistant Professor, [2]PG Scholar
Electrical & Electronics Engineering, Anna University Regional Campus, Coimbatore, India

ABSTRACT

Agriculture is the basic source of food supply for all countries in the world. Water is the Essential resources for agriculture. The automated irrigation and crop field monitoring system is used to optimize the use of water resource for agriculture. The system consists of sensor network for humidity, temperature, soil moisture, colour and water level sensors. soil moisture, temperature, water level ,colour sensor are placed in the root zone of the crops. The microcontroller of the controller unit is programmed with threshold values of the temperature and moisture content. The controller unit is used to control the irrigation motor thereby controlling the water flow to the field. In addition to that water level sensor is placed in this field, if it is excess water the motor gets automatically pumps the water into the outer area. Colour sensor provide the appropriate colour of leaf and the user give the pesticide before destroying plants. Field measure data about paddy plants. Raspberry pi is used in the controller mode. Internet of the things(IOT) is an ecosystem of connected physical objects that are accessible through the internet. Real time monitoring data can be utilized and the performance can be tracked. Hence high yield can be achieved. This project is mainly focused on improving the agricultural fields yield by providing a monitoring system with effective and efficient usage of water resource. Thus further development in this project will lead to a greater efficiency in the field of agriculture.

Keywords : Internet of things, water level, temperature, humidity, soil moisture, colour sensor.

1.INTRODUCTION

Agriculture is one of the most important components of our society. Farmers produce a food everyday. Water is the critical part of successful agriculture. Technology has played a big role in developing agriculture. Agriculture sector uses maximum water in world. Indian economy mainly based on agriculture field and water is vanishing day by day due to its immense use. Irrigation is one solution to this problem because in drip irrigation water is supplied to plants. Irrigation saves a large amount of water.

Water feeding to the agricultural field has to be done regularly with continuous monitoring. Manual irrigation is traditional method in the world for water supply in agriculture form. So it is hard to take decision to save water and get maximum profit from field. For sensor based networks are making huge process in agriculture and networks ,varieties of terminologies now in use like Precision Agriculture, crop monitoring, automated irrigation system etc.

Agriculture in India has a significant history. India is ranking second in farm output. monitoring and controlling the agriculture is an important task for the farmers as they have to regularly feed water days and nights. Sensors are used to collect the data from environment like soil moisture, temperature, humidity, water level,colour etc. Different communication technology has been developed for communication between network and element.

Sensor node, base station and sensor are elements of WSN application. . Internet of the things(IOT) is an ecosystem of connected physical objects that are accessible through the internet. Real time monitoring data can be utilized and the performance can be tracked. Hence high yield can be achieved.There is an urgent need to create strategies based on science and technology for efficient use of water, Including technical, managerial agronomic and institutionally improved technology. The implementation involves use of water management system using a microcontroller based board. PC based software is used to interface the board and control the motor on/off timings. It uses high speed of transmission of the data from controller.

2. EXISTING SYSTEM

In an existing automated water management system we cannot take decision at that instance by taking different attribute of agriculture soil. Current automated irrigation system only works on one parameter at one time. Soil have different attribute like soil moisture and temperature, humidity etc. Soil moisture is below threshold value then water valve is open for water supply and after proper water supply if it goes above threshold value water valve is get close. Existing system does not concern about available water in reservoir and requirement of water to particular crop. So system does not have decision power. It only works on one condition at one time. In the system send the information about the growth of paddy plant and sugarcane in the field. The data are send details about the every stage in the plant growth in the field.

3.PROPOSED SYSTEM

In this work, the automated irrigation system based on low power microcontroller was developed and deployed. To overcome the drawbacks of existing system like high cost, difficult in maintenance and wired connection , we introduce a new system which will have wireless connection between server and nodes. We introduce a new design of embedded web server making use of raspberry pi technology and internet of things . The automated irrigation system consists of distributed sensor network built using soil moisture sensor, temperature sensor, humidity sensor and water level sensor and colour sensor. Water level sensor senses the excess water in the field and the motor automatically pumps the water to the outer area.. Irrigation system uses valves to turn irrigation ON and OFF. The colour sensor is is placed in the field is used to know the perfect colour of leaf and provide the pesticide before destroying the plants. Earlier, farmer faced the problem of sending SMS and making calls, overcoming which we are designing an Desired application which does the work by button clicks, here the hardware works in three modes of operation viz.

4.BLOCK DIAGRAM

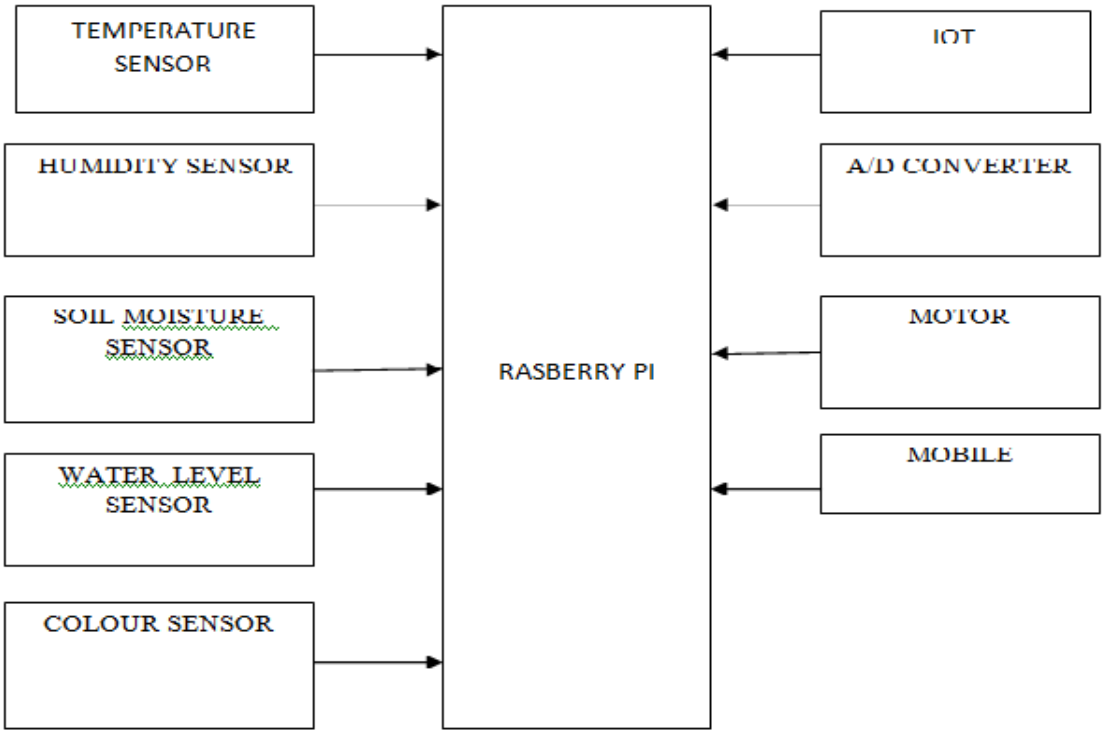


Fig-1 Block Diagram

5.HARDWARE SECTION

5.1 RASPBERRY PI

The Raspberry Pi-3 is used in my model .Raspberry Pi is a single board computer with Linux or other small operating systems. It was developed by Raspberry Pi foundation in UK for the use of computer science education. The second version of the Raspberry Pi is used in my project. This part describes models of Raspberry Pi is available. This report will not attempt to provide full specifications but an overview in order to help in making decision as to which device it is required to accomplish the objectives in question. Currently, five Raspberry Pi model do exists. They are: Model B+, Model A+, Model B, Model A and the Compute Module(currently only available as part of the Compute Module development kit).All these models use the same SoC (Sytem on Chip combined CPU & GPU),the BCM2835,but other hardware features differ.

The raspberry pi board is consists of HDMI port is connected to monitor.usb1 is connected to keyboard and other usb2 is connected to mouse. The board that has power supply port and insert memory card.

5.2 SENSORS

The distributed sensor network that consists of soil moisture sensor, temperature sensor, humidity sensor, colour sensor and water level sensor. There are different types of soil sensor technologies and measurement techniques that have been developed for the measurement of soil moisture content. The commonly used soil sensors are based on frequency domain reflectometry (FDR), which uses capacitance probes to measure the dielectric permittivity of the soil.

In this work however, we used a resistive soil sensor, which was developed using two probes to pass electrical currents into the soil and reads the response or resistance to get the moisture content of the soil. The resistive sensor works on the principle that the more moisture we have in the soil makes the soil to conduct electricity easily due to lower resistance while dry soil conditions makes the soil conducts electricity poorly due to higher resistance. Water level sensors detect the level of water. The colour sensor is used to measure the perfect colour of the leaf.

5.3AUTOMATIC MOTOR CONROLLER

This module is used to control **3**the pump automatically. The maximum soil moisture state reaches it automatically goes minimum soil moisture state. The watering is on when the soil get dry, when the watering will be stop when the soil is wet. The pump will be turned on automatically every day at a particular time for an certain soil , immediately the pump will turns off. led is acts as motor.

The turning on and off of the pump will work regardless of the moisture rate around the field area. This automatic mode can be set by sending an data to monitor and mobile.

6.SOFTWARE REQUIREMENTS

THE ARDUINO IDE

When working with the InduinoR3 Board, select the board as Arduino UNO from the Tools-> Boards List and Select the Appropriate Com Port.

SIMULATION MODEL

The simulation work on the project has been done in PROTEUS PROFESSIONAL software. The following image shows the monitoring and the displaying process in LCD.

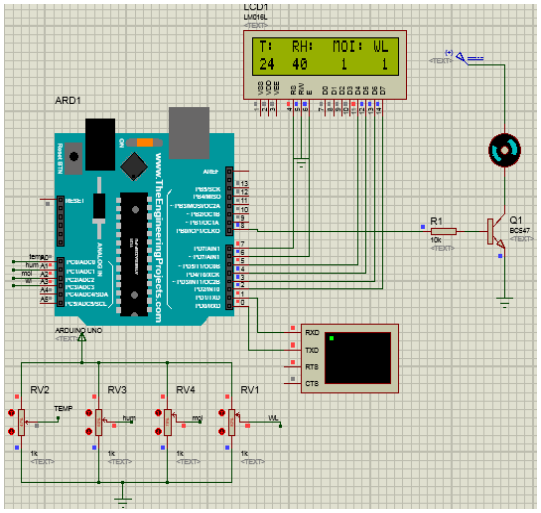


Fig-2 Schematic Diagram

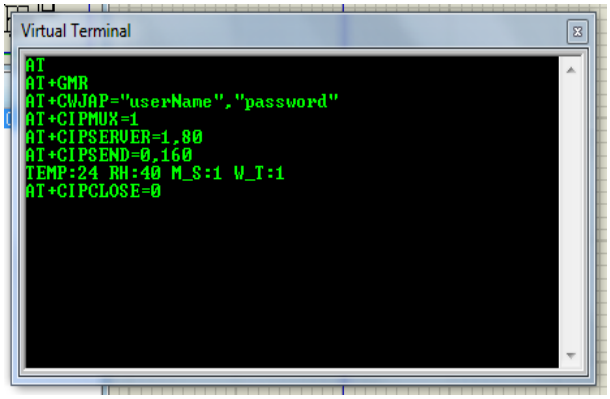


Fig-3 Simulation Output

Fig-3 shows the monitoring condition simulated in Proteus Professional software version 8. The virtual terminal represents the functional status of the sensors connectivity.

HARDWARE OUTPUT

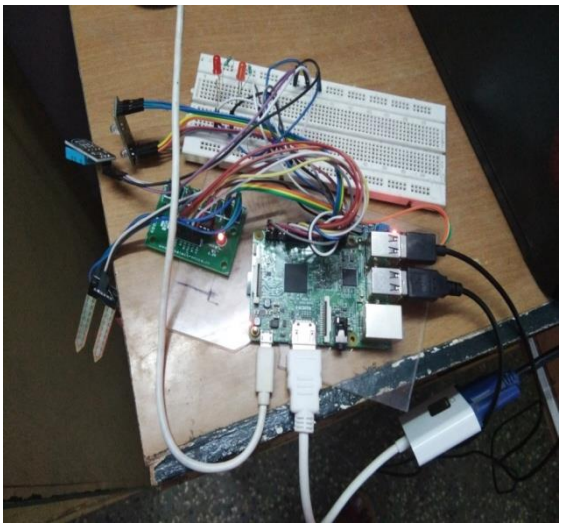


Fig-4 Hardware Module

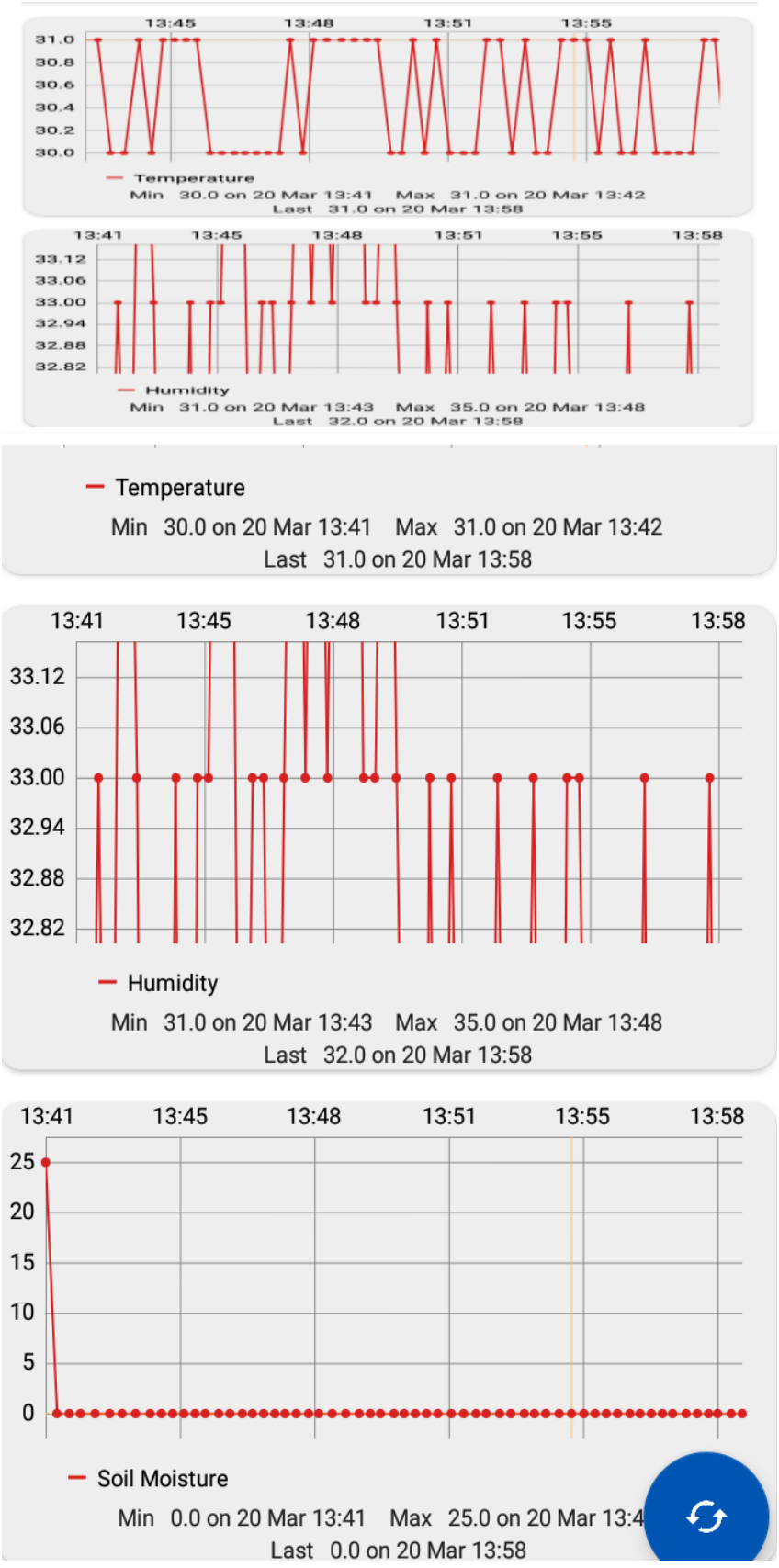


Fig-5 Output Chart

Fig-6 Software Output

CONCLUSION

Thus monitoring process in agricultural fields will be an effective method that will be useful in situations where usage of water resources is limited. By implementing this project, there will be an effective and efficient usage of water resources. It will be an indirect mean for the proper development of agricultural yield. The performance measures obtained can be maintained in database which will be useful for comparing different yields at different climatic conditions.

FUTURE WORK

This Agricultural monitoring process can be developed under the concept of Distributed database. It will enhance the performance measure and will be used for improving the crop quality and health of the plant.

REFERENCES

(1) "A Crop Water Stress Index For Accessing Irrigation Scheduling Of Drip Irrigation Brocoli" by Erdem,L.Arin,T.Erdem,S.Polat in the year 2013.

(2) "A Comparative Study Of Wireless Protocols : Bluetooth, Zigbee and WIFI" by J.S. Lee, Y.W.Su, and C.C. Shen in the year 2007.

(3) "A Survey Of MAC Protocols For Mission-Critical Applications In Wireless Sensor Networks" by P. Suriyachai, U. Roedig and A. Scott in the year 2012.

(4) "Automatic Irrigation System Using a Wireless Sensor Network and GPRS Module" by Joaquin G2utierrez, Juan Francisco Villa –Medina , Alejandra Nieto- Garibay in the year 2014.

(5) "Energy Management is Wireless sensor Networks with Energy-Hungrysensor" by C. Alippi, G. Anastasi, D. Francesco in the year 2010.

(6) "Irrigation scheduling and Irrigation system: Optimising Irrigation container Ornamentalshrubs" by O.M. Grant,.M.J. Davies, H.I. ongbottom in the year 2009.

(7) "Microcontroller Based Drip Irrigation System Using Smart Sensor" by Nilesh, R. Patel, Rahul B. Lanjewar in the year 2013.

(8) "PC-Based Automatic Drip Irrigation System" by M. Guerbaoui in the year 2013.

(9) "Remote Sensing And Control of An Irrigation System Using a Distributed Wireless Sensor Network" by Y. Kim, R.G. Evans, and W.M.Iversen in the year 2008.

(10) "Wireless Sensor Network for Conservation And Monitoring Cultural Assets" by M.C. Redriguez, S. Borromeo and J.A. Hernandez - Tamames in the year 2011.

(11) "Wireless sensor Forin-Site Monitoring of Debris Flows" by H.C. Lee, Y-M. Fang, B-J Lee and C-T. King in the year 2012.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

A Novel Data Auditing Approach to Achieve Data Privacy and Data Integrity in Cloud Computing

Soumya Shinde, Ramya V. Shinde, Priyanka Kamadhenu
Department of ISE, SKSVM Agadi College of Engg. & Tech, Laxmeshwar, India

Abstract
Cloud computing is a general term for the delivery of hosted services over the internet. Using the cloud services saves both users time and money. However, there are some security issues to be solved for personal users and enterprises to store data in the cloud. The fact is that users will not have any physical control over the outsourced data. The cloud user is concerned about the integrity of his data stored in the cloud as it can be attacked by attacker. The purpose of this paper is to suggest an efficient public auditing technique using Third Party Auditor (TPA) to verify the integrity of data stored in the cloud. The proposed auditing scheme makes use of AES algorithm for encryption and Secure Hash Algorithm (SHA-2) algorithm to generate verification metadata or message digest for data integrity check. The analysis shows that the proposed scheme is provably secure and TPA takes a constant time to audit files of different sizes.

Keywords : Cloud Computing, Public Auditing, Cloud Service Provider (CSP), Data Integrity, Third Party Auditor (TPA)

I. INTRODUCTION

Cloud computing is a new computing paradigm in which resources are shared as a service over the internet. Cloud data storage is one of the service provided by Cloud computing in which data is maintained, managed, backed up remotely and made available to users over a network (typically the Internet) [1]. Moving data into the cloud offers great convenience to users since they don't have to care about the complexities of direct hardware management. The pioneer of Cloud Computing vendors, Amazon Simple Storage Service (S3) and Amazon Elastic Compute Cloud (EC2) [2] are both well-known examples. These internet-based online services do provide huge amounts of storage space and customizable computing resources. This computing platform eliminates the responsibility of local machines and users can be relieved from the burden of local data storage and maintenance.

Even with these many benefits of cloud computing, previously mentioned, users are reluctant (hesitate) to adopt this technology because of security threats [3].There are many threats facing the cloud not only from an outsider but also from an insider which can utilize cloud vulnerabilities to do harm. These threats may harm data confidentiality, data integrity, and data availability. Some untrusted providers could hide data breaches to save their reputations or free some space by deleting the less used or less accessed data [4]. Hence for sensitive and confidential data, there should be some security mechanism to provide protection for cloud data. To keep away from the security risks, concept of cryptography and audit services are significant to make sure about the confidentiality and integrity of outsourced data.

Data auditing is introduced in Cloud computing to deal with secure data storage. Auditing is a process of verifying the users data carried out either by the client or by a Third Party Auditor (TPA). Auditing helps to maintain the integrity of client's data stored in the cloud. The auditing process can be categorized into two types: first one is private auditing where client or data owner is allowed to check the integrity of the stored data. But it increases verification overhead of the client. Second is public auditing, which allows anyone, to challenge the cloud server and performs data verification check with the help of TPA.

TPA is the third party auditor who will audit the data of data owner or client. The TPA has expertise and capabilities that users do not. It is necessary that TPA should efficiently audit the cloud data storage without requesting for the local copy of data.

II. RELATED WORK

Different factors such as confidentiality, data integrity etc. affects the performance of cloud data storage. There has been a lot of development in this field and lots of algorithms have been proposed by various researchers. Here we are presenting the related work that are found to be useful.

TABLE 1 represents the comparison done by considering different factors such as methods used, supports public auditing, supports privacy preserving, maintaining data integrity and data confidentiality.

TABLE I. COMPARISION OF EXISTING PUBLIC AUDITING SCHEMES

Research Work	**Methods Used**	**Supports Public Auditing**	**Supports Privacy Preserving**	**Maintaining Data Integrity**	**Maintaining Data Confidentiality**
Privacy Preserving Public Auditing for Secure Cloud Storage[5]	HLA with BLS Signature	Yes	Yes	Yes	No
Privacy-Preserving Public Auditing In Cloud Using HMAC Algorithm[6]	HMAC	Yes	Yes	Yes	No

Privacy-preserving Public Auditing for Data Storage Security in Cloud Computing [7]	HLA with Random Masking	Yes	Yes	Yes	No
Privacy Preserving and Public Auditing Service for Data Storage in Cloud Computing [8]	RSA and MHT	Yes	Yes	Yes	Yes
Towards Secure and Dependable Storage Services in Cloud Computing [9]	Homomorphic Tokens and Erasure code	Yes	Yes	Yes	No
Secure and Efficient Privacy Preserving Public Auditing Scheme for Cloud Storage [10]	HLA with BLS Signature	Yes	Yes	Yes	No

Swapnali Morea et al. [1] proposed a secure and efficient privacy preserving public auditing scheme. It achieves privacy preserving and public auditing for cloud by using a Third Party Auditor (TPA). The data owner or the user is responsible for splitting the file into blocks, encrypting those using AES algorithm, generating a SHA-2 hash value for each, concatenating the hashes and generates a RSA signature on it. In the Verification process, the signature generated by TPA and the one stored in the TPA which is provided by the data user are compared by the TPA. If both matches, then data is intact and if mismatch occurs then it indicates that the data integrity has been affected or tampered.

Ezhil Arasu et al. [6] has proposed a method that uses the keyed Hash Message Authentication Code (HMAC) with homomorphic tokens to enhance the security of TPA. It is a technique for verifying the integrity of a data transmitted between two parties that agree on a shared secret key. HMAC's are based on a key that is shared between the two parties, if either party's key is compromised, it will be possible for an attacker to create fraud messages.

Cong Wang et al. [7] proposed a secure cloud data storage system supporting privacy-preserving public auditing. In this paper, they utilized the homomorphic linear authenticator (HLA) and random masking technique to guarantee that the TPA would not learn any knowledge about the data content stored on the cloud server. They further extend their protocol into a multiuser setting, where the TPA can perform multiple auditing tasks in a batch manner for better efficiency. Even though this scheme provides efficient privacy preserving and public auditing, it lags in security concern. Less security is provided to data when compared to the systems that used encryption/ decryption algorithms.

Tejaswani et al. [8] has achieved integrity of data using a Merkle Hash Tree by Third Party Auditor and confidentiality of data is achieved using RSA based cryptographic algorithm. From the table 1, it is clearly seen that different methods have been implemented to check the integrity of the data. But each method has some issues connected with it. The existing methods succeeded in providing privacy preserving along with public auditing but failed to maintain the confidentiality of data. Therefore it is necessary to develop an efficient and secure auditing scheme which has to perform the public auditing effectively by maintaining both the integrity and confidentiality of cloud data.

III. PROPOSED SYSTEM

This paper mainly focuses on security issues of cloud data storage. We consider the cloud data storage service involving three different entities, as illustrated in Figure 1. The proposed scheme consists of three basic entities, they are cloud user, Third Party Auditor (TPA) and cloud server.

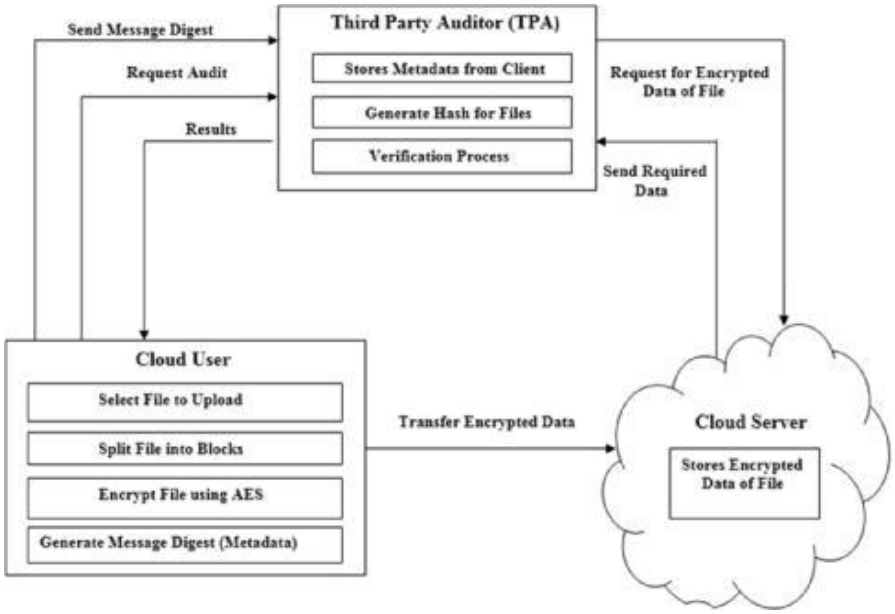


Fig. 1. Architecture of Proposed System

Once the data owner authenticates cloud server by providing his password, the data owner selects the file to be uploaded in cloud and splits the file in to blocks. The blocks are encrypted using AES algorithm followed by generating message digest using Secure Hash Algorithm (SHA-2). A copy of encrypted file is transferred to cloud for storage purpose. Later the message digest is sent to TPA. TPA uses this digest to check the integrity of data stored in the cloud server storage. Since metadata is sent to TPA, TPA will not get enough information about users actual data thus achieves user's data privacy.

In the proposed scheme, TPA is used to perform the task of data auditing. TPA performs data auditing on demand by the client. On receiving the auditing request from cloud user or data owner, the TPA challenges cloud server to send the encrypted data of files that are stored in cloud. After getting the encrypted data from cloud server the TPA follows the same process performed by data owner such as generating message digest for encrypted blocks of data using SHA-2 algorithm.

The working of the cloud user in our proposed system is illustrated in figure 2 and figure 3.

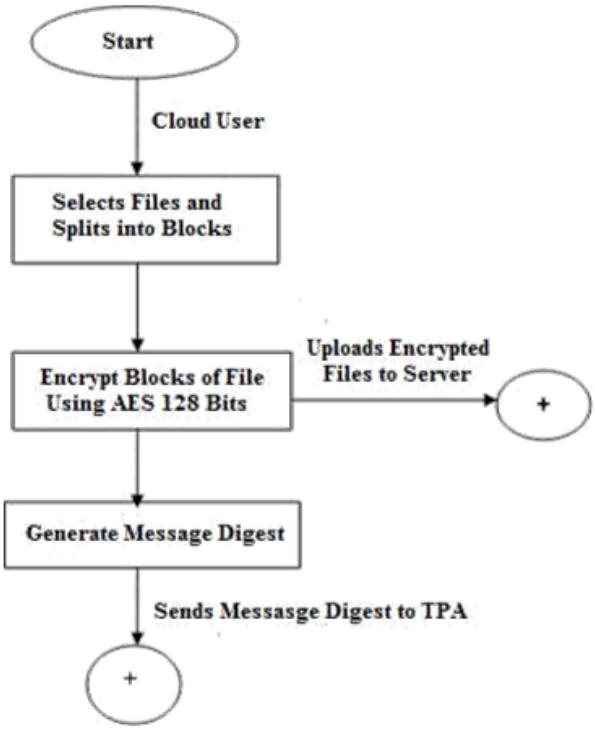


Fig. 2. Working of Cloud User

Later in verification process, it compares the newly generated message digest value with the earlier message digest sent by client. If both the values are matched then it indicates that the integrity of data is maintained. If there exists a mismatch, indicates that data is altered and integrity is not maintained. Finally the TPA will send auditing results to the data owner indicating the status of file. The figure 2 and figure 3 shows the working of the TPA in our proposed auditing scheme.

The cloud server is used to store the encrypted data of files. When it receives request from the TPA, the cloud server will send required encrypted blocks of data to TPA. In the proposed scheme cloud users can upload files to cloud server and can rely on TPA to check the integrity of data stored in cloud server.

IV. IMPLEMENTAION AND RESULTS

The proposed scheme is implemented using python programming on a system with Intel core i3 processor running at 2.9 GHz and 3GB RAM. HTML5 and CSS3 are used to develop front end. AES 128 bit encryption algorithm is implemented using python language and it is used for encrypting blocks of data. Secure Hash Algorith-2 (SHA-256 bit) is also implemented in python by using Hashlib module/library. The Hashlib module is used to implement a common interface to various secure hash algorithms and message digest algorithms.

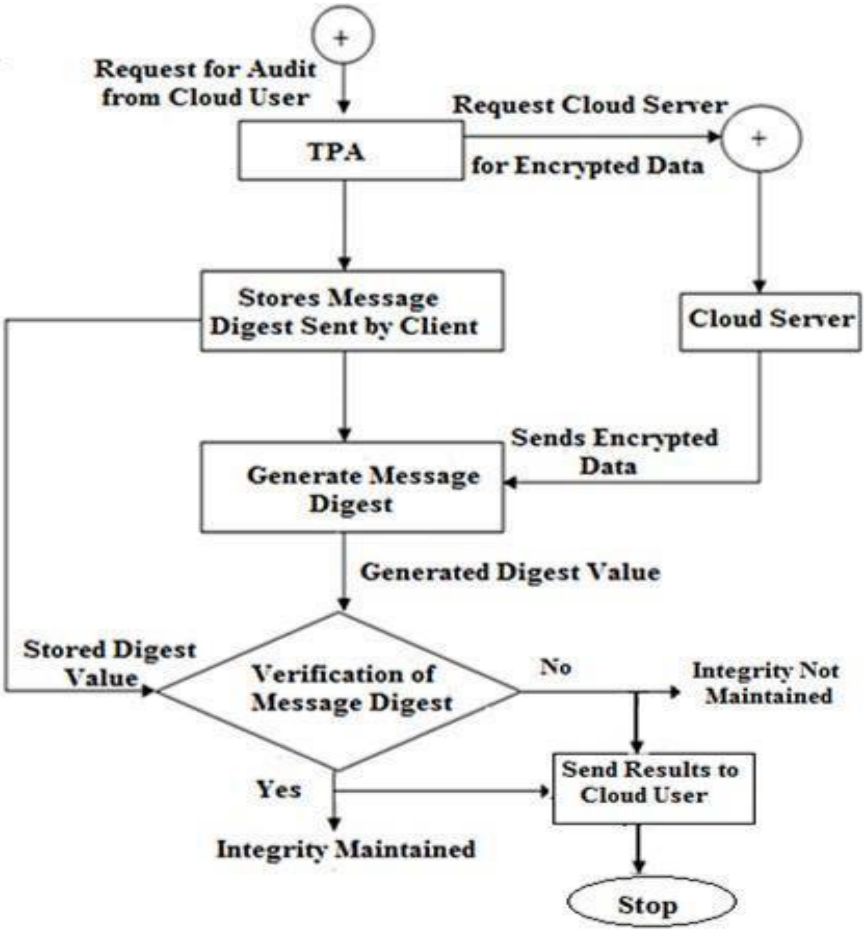


Fig. 3. Working of TPA

SHA 2 is used to generate verification metadata or a digest for a given data. It generates an almost-unique 256-bit (32-byte) cryptographic hash or digest for a text. The following are some of the 32 byte (256 bits) digest we obtained during the analysis of our proposed scheme.

1. 837c8ab3afaa0d10c1a58902d58d46a41085e03650

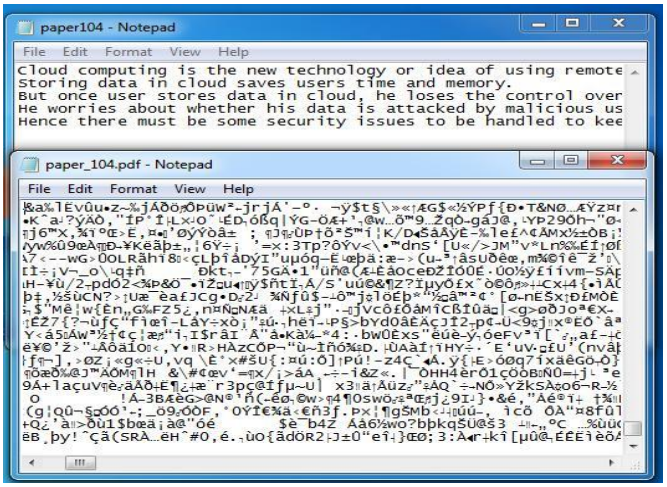
6092134d3fffb97c4507bf.

2. d3bdb4bb29c8e29be3f64f23d4df4673fd2a2f29c39

986933502e8f0465daee3.

3. 410486d8537970d628271a02776c0fdd5dbd14259 581fa53a53677f6ee9cdff5.

The snapshot of encrypted data file stored in the server is shown in figure 4



The figure 6 represents the time taken by TPA to audit the files ranging from 100KB to 1000KB. In our observation we find that TPA will take almost constant time to audit the files of different file sizes.

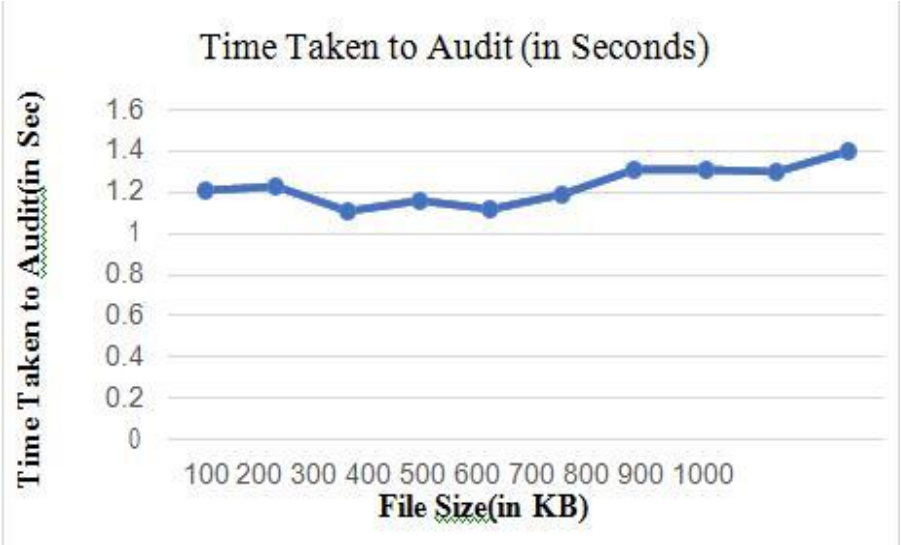


Figure 4 : Sample of Encrypted File

The figure 5 represents the time taken by our system to generate message digest for the encrypted data of different file sizes. From the observations it is seen that our system is approximately 60 percent better than the paper proposed by Abhishek Mohta et al [5].

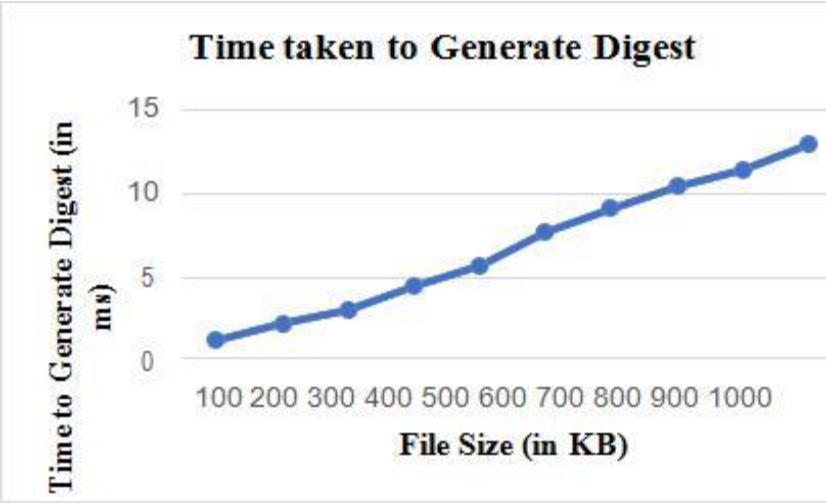


Figure 5: File Size vs. Time to Generate Digest

V. CONCLUSION AND FUTURE WORK

In the cloud storage, users place their data in the cloud and no longer retain the data locally. One of the key issues is to detect the integrity of cloud data. In this paper, we proposed a privacy preserving public auditing system for data storage security in cloud. TPA will perform auditing task without retrieving the data copy of a cloud user, thus achieves privacy preserving. Before uploading any data in cloud, the user's data is encrypted first and then stored in the cloud storage in encrypted form, thus achieving the confidentiality of data. The integrity of data is evaluated by TPA by verifying both the message digest. In the proposed system, TPA checks whether the data stored in cloud is tampered or altered and later intimates the same to the cloud user. All the modules in the system are implemented to develop an effective auditing scheme. In future, we would like to perform data dynamic operations such as updating, deletion and insertion of data.

VI. REFERENCES

[1] Swapnali Morea, Sangita Chaudhari , "Third Party Public Auditing Scheme for Cloud Storage", International Journal of Procedia Computer Science, Volume 79, pp. 69-76, 2016.
[2] Amazon.com, "Amazon Web Services (AWS)," Online at http://aws. amazon.com, 2008.
[3] W. A. Sultan Aldossary, "Data Security, Privacy, Availability and Integrity in Cloud Computing", International Journal of Advanced Computer Science and Applications,Volume 7, Issue 4, pp. 485-498, 2016.
[4] N. K. Yang and X. Jia, "Data Storage Auditing Service in Cloud Computing: Challenges, Methods and Opportunities", World Wide Web, Volume 15, Issue 4, pp. 409–428, 2012.

[5] Abhishek Mohta, Ravikant Sahu, Lalit Kumar. " Robust Data Security for Cloud While Using Third Party Auditor". International journal of Advanced research in CSE (IJARCSE), Volume 2, Issue 2, February 2012.

[6] S Ezhil Arasu, B Gowri, and S Ananthi. "Privacy-Preserving Public Auditing in cloud using HMAC Algorithm". International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277, 3878, Volume 2, Issue 1, pp. 149-152, March 2013.

[7] Pratiksha M, Roshani T, Rajesh B. "A System of Privacy Preserving Public Auditing for Secure Cloud Storage System". International Journal of Engineering Research and Technology (IJERT), Volume 3, Issue 8, pp. 1031-1035, August 2014.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Real Time Object Classifier

Hemaanand M, Sanjaykumar V
B.Tech, ECE, Amrita University, Coimbatore, Tamil Nadu, India

ABSTRACT:

In this paper, the new surveillance system has been presented using the mobile net Single Shot multibox Detector - SSD and You Only Look Once -YOLO, a modern technique to object detection and classification and feature analysis. Nowadays there are many security breaches happening around us, which causes a great loss to the victims. In order to avoid this discrepancy, we came up with a smart solution that is to develop a security system which can avoid these kinds of security breaches and intrusion or trespassing. Using the YOLO, it is possible to detect to identity of the objects and classify them based on the inserted modules and trained data-sets. Our main objective is to create a smart surveillance system which can predict the intruders or even vehicles, objects and create a way more powerful security system.In this process we have considered two methods for the surveillance, both YOLO and mobile net SSD.The mobile net SSD is used to define and train the classes and set the range of accuracy and YOLO for additional features thus making the YOLO learn general representations of objects. It outshines other detection algorithms, including Deformable Part Models (DPM) and Regional-wise convolutional Neural network (R-CNN), when generalizing from natural images to other domains like surveillance and security.

Keywords: Classification, Detection, Neural networks, Surveillance.

INTRODUCTION:

In today's world, Object identification is required to be fast, accurate and be able to identify a wide variety of objects. With the upcoming of neutral networks, detection frameworks have become increasingly fast and precise. However, most detection techniques are confined to a small circle of objects.

The entire process works on the probability of classes to which the objects belong. ASingle neural network has the ability to predict bounding boxes succeeded by class probabilities directly from the images with a single evaluation. While these results are captivating, Object classification and identification is far simpler than the complexity[1][2].

The working of this system is similar to that of normal surveillance systems but it also offers a wide range of additional features that includes the object recognition and feature classification that includes vehicles, objects and even animals

It can be used both indoor and outdoor areas whereas the classification occurs based on the predefined data that has been already set to the algorithm the functionality requires data from the

users as it trains the data more than twice the mean average precision of other real-time systems. First of all the mobile net SSD performs the overall convolutional scheme on the live-stream video obtained Secondly, YOLO works on global reasoning about the image during predictions.

Unlike, the sliding window and the regional-based proposal techniques, YOLO sees the entire image during training and test time so it implicitly encodes contextual information about the classes as well as their appearances.
When the program in encoded in any of the live-streaming devices such as cameras or a pi-cam connected to a raspberry pi which acts as an individual operating system Then the system undergoes the critical phase of deploying the models that has been trained by the user Enables the live video stream through the camera obtains the data and process a set of convolutions that has been given through the code Initializes the open cl run time

FUNCTIONAL BLOCK DIAGRAM OF ALGORITHM:

This result accords with the that tasks with long execution time are harmful to the schedulability of data short processing data must me faster since the output is functioning with live-stream data classification .The above program, we can expect that the test conditions proposed in this paper, especially the improved test conditions, have a significant performance improvement.

MOBILE NET SSD:
Processing layers of the mobile net SSD

And diversity of visual understanding for computers which leads the breakthrough for futuristic technologies. The Computer vision gets complicated with multiple overlapping objects and different backgrounds and we humans not only classify these different objects but also identity the relations to one another. Hence it depends on how we train them with the modules. YOLOproves to be a promising object detection technique since we frame detect as a regression problem replacing thecomplex pipeline[3].

Surveillance is not just about securing a confined or a particular area. This idea of object detection can be programmed into robots to make them secure not just a building but a perimeter around it. This technology can also be embedded in CCTV cameras and vehicle collision technology. The object detection technique is generally confined to specific modules but can be widely used if a huge variety of modules are trained using the Mobile net SSD[4][5].

EXPERIMENT:

We need to first either choose an image or to be more applicative can also live stream a video to detect the objects inside, where they are, and how much percentage they match with the trained modules.Unlike the other traditional classifier, the combination of YOLO and Mobile SSD divides

the image into 13 by 13 cells. Each of these cells can predict 5 bounding boxes.

After the image is captured, the process of convolution occurs which is followed by max pooling. During convolution, the image is convolved with a mask. The mask is also a signal. In order to perform the process of convolution on an image, different values of masks are used by sliding or superimposing the mask on the image and then multiplying the corresponding elements and then max pooling is carried out. Max pooling is a process that uses the maximum number of value of a pixel in the default dimensions used in the convolution process. This process is repeated again and again in order to find the features.

In Mobile net SSD, we usebatch normalization which performs feature scaling in neural networks for the data between the different layers. It normally occurs after the convolutional layer and basically computes the features for the image.

ALGORITHMS USED:

The most common detection techniques are the DPM (Deformable parts models) which uses a sliding window approach, where the classifier is run at evenly spaced locations over the entire image, then the R-CNN (Regional-wise Convolutional neural network) which uses regional proposal technique to first generate potential bounding boxes in an image and then run a classifier on these proposed boxes. These techniques exhibit the post processing delay i.e. the post-processing is used to refine bounding boxes and eliminate the duplicate detection's and re score the boxes based on the other objects in the scene. These complex pipelines exhibit significant delay and are difficult to optimize since the components need to be trained individually[6].

Whereas, YOLO (You only look once) proves to be a better alternative as it mainly focuses on reducing the delay i.e. fast and accurate. It's relatively a simpler model than the other detection techniques. A Single Convolutional network simultaneously predicts multiple bounding boxes and class probabilities for those boxes. YOLO trains on full images and directly optimizes detection performance. This combined model as several merits over the other techniques.

Basically, YOLO is all about speed, it is fast and highly accurate. As prescribed earlier, it doesn't have complex pipelines. Furthermore, YOLO achieves. Speaking of applications, Image recognition and classification is a problem that has been around for a long time and many pragmatic applications. Our aim is to use the YOLO technique for surveillance and security[7].

OBJECT DETECTION:

MobileNet can also be deployed as an effective base network in modern object detection systems .In this SSD is evaluated with 300 input resolutions (SSD 300) and Faster-RCNN is compared

with both 300 and 600 input resolution (Faster RCNN
300, Faster-RCNN 600). The Faster-RCNN model evaluates 300 RPN proposal boxes per image. The models are trained on caffe model. When the convolution has been successfully finished then the detected output get bounded by a box[8].

FUNCTIONAL BLOCK DIAGRAM:

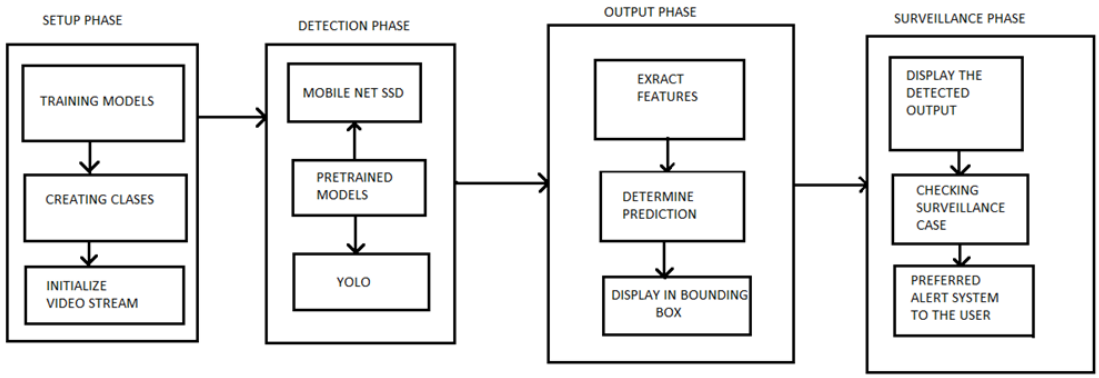


Fig. 1 Flow of Work WORKING:

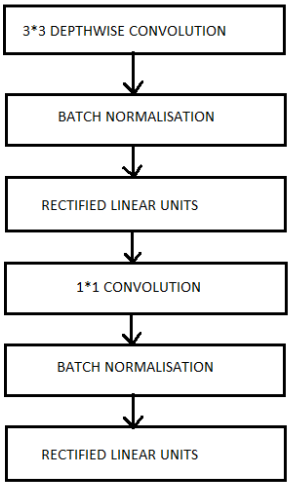


Fig. 2 Processing Layers of mobile net SSD

YOLO:

Different layers of the processing parts YOLO and the convolution layers

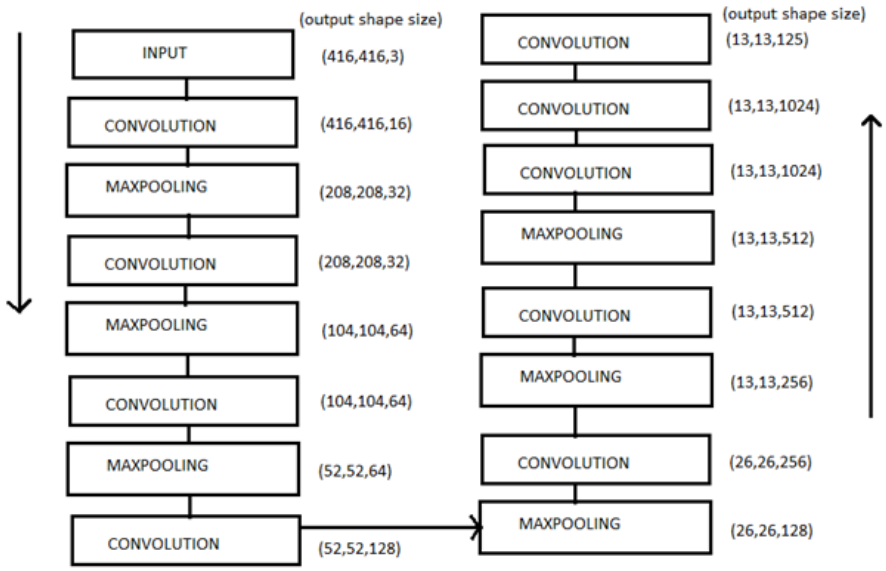


Fig. 3 Layers of YOLO and Convolution Layers

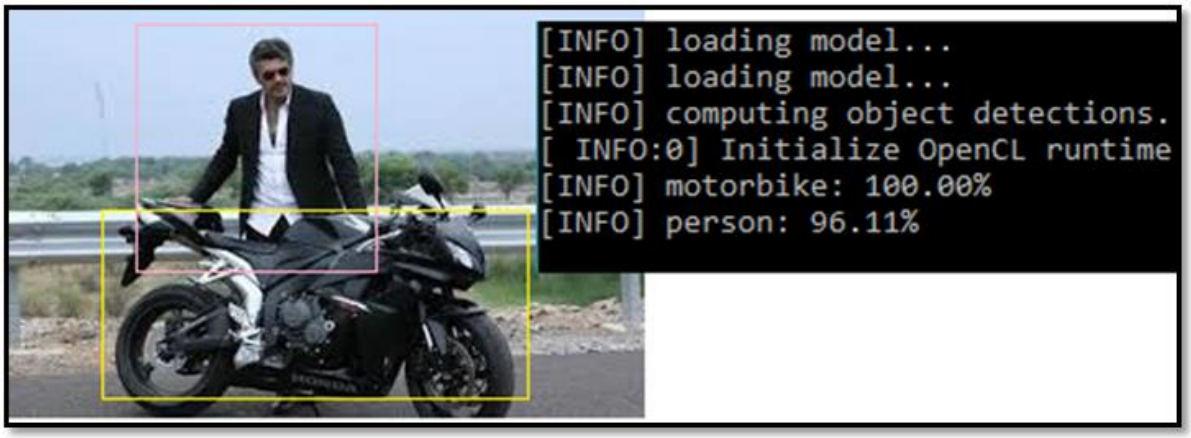
RESULTS:

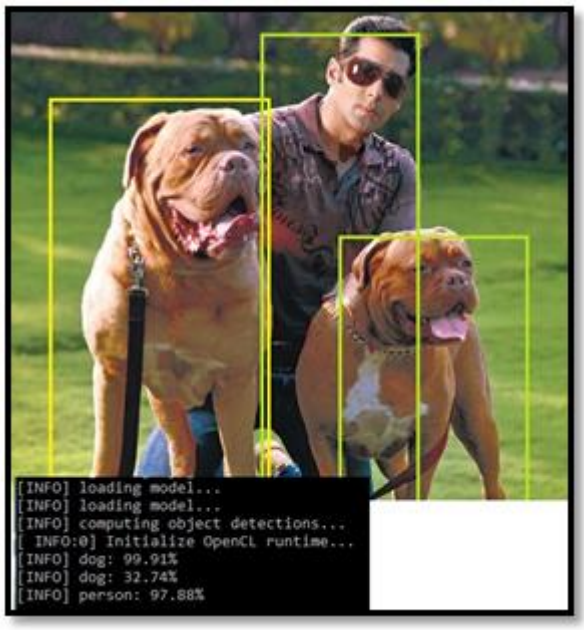
The object detection of YOLO is a quick and accurate technique for ideal computer vision applications. We can verify its real-time performance by connecting it to the webcam and analysing its fetching and displaying time. YOLO generally bounds images individually but when connected to the webcam, it can track down multiple images.

Now comparing the YOLO with the other object detection techniques, YOLO proves to be a promising method as it shows a 53.3% average precision while the DPM and RCNN show 37.8% and 10.4% precision respectively. YOLO has a recall efficiency of 54% while the DPM and RCNN have a recall efficiency of 47% and 18% respectively. This analysis is made with respect to the Picasso Dataset precision-recall curves. The comparison of these techniques with respect to other data sets is also been done:

Table 1. Comparison of the Techniques

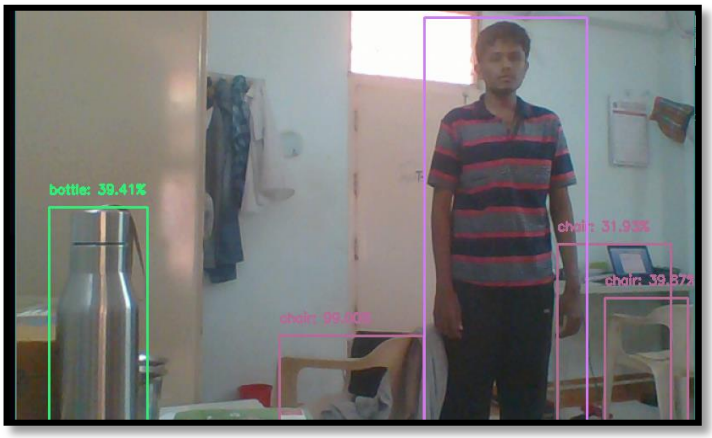
TECHNIQUES	**Visual Object classes 200**	**Picasso**	**People-art**
	Average precision	**Average precisi**	**Average precision**
D&T (Detection and tracking)	-	1.9	-
Poselets	36.5	17.8	-
DPM (Deformable parts models)	43.2	37.8	32
R-CNN (Regional-wise Convolutional Neural network)	54.2	10.4	26
YOLO (You only look once)	**59.2**	**53.3**	**45**


[INFO] loading model...
[INFO] loading model...
[INFO] computing object detections.
[INFO:0] Initialize OpenCL runtime
[INFO] motorbike: 100.00%
[INFO] person: 96.11%


[INFO] loading model...
[INFO] loading model...
[INFO] computing object detections...
[INFO:0] Initialize OpenCL runtime...
[INFO] dog: 99.91%
[INFO] dog: 32.74%
[INFO] person: 97.88%


person: 99.55%
chair: 99.69%


[INFO] loading model...
[INFO] loading model...
[INFO] computing object detections...
[INFO:0] Initialize OpenCL runtime...
[INFO] chair: 31.98%
[INFO] person: 71.49%
[INFO] sofa: 94.60%


bottle: 39.41%
chair: 31.93%
chair: 39.87%


[INFO] loading model...
[INFO] loading model...
[INFO] computing object detections...
[INFO:0] Initialize OpenCL runtime...
[INFO] person: 93.44%
[INFO] person: 89.10%
[INFO] person: 85.94%
[INFO] person: 83.83%
[INFO] person: 75.71%
[INFO] person: 72.48%
[INFO] person: 43.69%
[INFO] person: 35.83%
[INFO] person: 33.04%
[INFO] person: 32.96%
[INFO] person: 30.27%
[INFO] person: 29.91%
[INFO] person: 29.57%
[INFO] person: 28.56%


[INFO] loading model...
[INFO] loading model...
[INFO] computing object detections...
[INFO:0] Initialize OpenCL runtime...
[INFO] chair: 60.00%
[INFO] tvmonitor: 35.34%

CONCLUSION:

Hence, the combination of Mobile net SSD and YOLO is a unified model of object detection and identification. Our objective is to construct a Mobile SSD algorithm along with YOLO to exhibit extra features mainly for the surveillance system. These algorithms can be extended to various domains based on the applications. Unlike the other techniques, Mobile SSD along with YOLO shows extreme performance in object and detection process.

With various data-sets like the VOC (Visual object classes), Picasso and the People-art, our technique shows a relatively higher performance both in average precision and recall. As of today, YOLO is one of the fastest artificial intelligence algorithms to run object classification. The Mobile SSD and YOLO algorithm have been trained with many modules on the python platform for the surveillance purposes and its overall performance can be enhanced if more and more modules are trained so as to detect a wide range of objects

REFERENCES:

[1] J. Dong, Q. Chen, S. Yan, and A. Yuille. Towards unifiedObject detection and semantic segmentation. In Computer Vision–ECCV 2014, pages 299–314. Springer, 2014.
[2] S. Ren, K. He, R. B. Girshick, X. Zhang, and J. Sun. Object detection networks on convolutional feature maps. CoRR, abs/1504.06066, 2015.
[3] C. P. Papageorgiou, M. Oren, and T. Poggio. A general framework for object detection. In Computer vision, 1998. Sixth international conference on, pages 555–562. IEEE, 1998.
[4] D. Erhan, C. Szegedy, A. Toshev, and D. Anguelov. Scalable object detection using deep neural networks. In Computer Vision and Pattern Recognition (CVPR), 2014 IEEE Conference on, pages 2155–2162. IEEE, 2014.
[5] P. F. Felzenszwalb, R. B. Girshick, D. McAllester, and D. Ramanan. Object detection with discriminatively trained part based models. IEEE Transactions on Pattern Analysis and Machine Intelligence, 32(9):1627–1645, 2010. 1
[6] P. Sermanet, D. Eigen, X. Zhang, M. Mathieu, R. Fergus, and Y. LeCun. Overfeat: Integrated recognition, localization and detection using convolutional networks. CoRR, Abs/1312.6229, 2013.
[7] P. Viola and M. Jones. Robust real-time object detection. International Journal of Computer Vision, 4:34–47, 2001.
[8] S. Gould, T. Gao, and D. Koller. Region-based segmentation and object detection. In Advances in neural informationprocessing systems, pages 655–663, 2009.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Calculation of bone Disease using Image Processing

Dr. M. Yuvaraju[1], R. Haripriya[2]
1 Assistant Professor, 2 PG Scholar
Electrical & Electronics Engineering, Anna University Regional Campus, Coimbatore, India

ABSTRACT

The designed system used to measure the bony fracture by using image processing and it also detects the bone tumor of the person. Every human has a variousossein length so by applying imageprocessing it also give the length of the bony. The bony tumor is not a cancer it just form like a tissue formed over the osseous matter it reduce the bony strength. It very useful in real time.This mainly contribute about the bone density and it also checkoutwhat are all the causes for bone weakness. It also gives the 3 dimensional view of the density distribution in the human body. And it gives the visage like height, weight of the human. The system contributes on estimation of lower limb kinematic analysis. It finds the GRF between the human body and ground

Keyword: GRF, Ossein Length, Kinematic Analysis, Osseous

I.INTRODUCTON

Bones are the solid organs in the human body defensive many significant organs such as brain, heart, lungs and furtherinterior organs. The human body has 206 bones with various shapes, size and structures. The largest bones are the femur bones, and the smallest bones are the auditory ossicles. Bone fracture is a familiartrouble in human beings. Bone fractures can occur due to accident or any other case in which high pressure is applied on the bones.Bone density is an important feature to humans bone health and measuring it is an important ask in medical image processing area. The mathematical models of bone density have direct consequences in possible predictions and making important diagnostics in terms of bone related treatments. Bone density is define as the quantity of bone tissue in aassuredcapacityof bone. The strength of a bone is believed to be related to and can be determined by thedensity of the bone structure. Moreover, bone density also measures the amount of bone masspresent. It predicts fracture risks, observes the usefulness of treatments, and measures the amount of calcium in a specific region of the bone.A bone tumor, (also spelled bone tumour), is a neoplastic growth of tissue in bone. Anomalousgrowth found in the bone can be either benign (noncancerous) or malignant (cancerous). Bone tumors may be classified as "primary tumors", which originate in bone or from bone-derived cells and tissues, and "secondary tumors" which originate in other sites and spread (metastasize) to the skeleton. The survival of bone cancer patients is related to the extent of their disease at the time of diagnosis. In the absence of distant metastases, the spread of tumors to the mediastinal lymph nodes is a major determinant of both the prognosis and the therapeutic approach. Proper staging is important for selecting patients who may benefit from

surgical resection and for defining the treatment modalities of patients who will undergo radiotherapy.The strength of a bone can be determined based on BMD. In addition, BMD measures the amount of bone mass, predicts fracture risks, observes the usefulness of treatment, and measures the amount of calcium in a specific region of the bone. This process used to detect the bone fracture in step by step process input as bone image, and the preprocessing helps to improve the image data, edge processing used to find the boundaries of an image, and the segmentation used for partitioning and then it classify the images

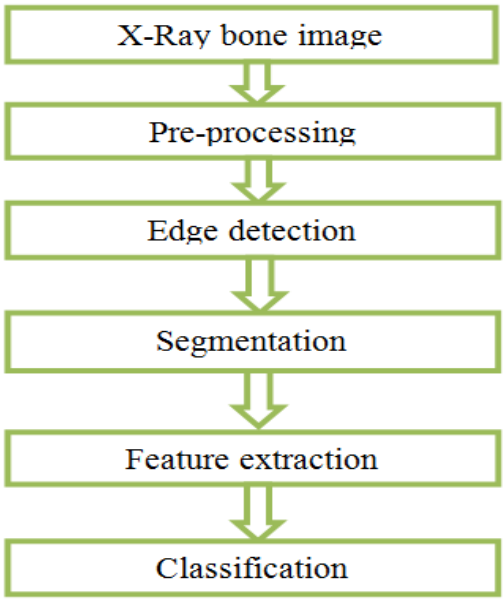


Fig 1 : The flow diagram of steps in detecting the bone fracture in X-ray/CT images

II.NOISE REMOVAL

In computer-aided analysis of the medical imagery, image processing tools for noise removal, image segmentation and characteristic removal play a important role in the achievement of such systems. The X-ray/CT images are obtained from the hospital that contains normal as well as fractured bones images. In the first step, apply preprocessing technique such as RGB to grayscale exchange and take out the noise from the image by via the median filter.

Noise can be defined as unwanted pixels present in the image that degrade the quality of the image. It can be written as:

$f(x, y) = g(x, y) + \eta(x, y)$

Where f (x, y) is the noisy image, g (x, y) is the original image and η (x, y) is the noise present in the image. There are different types of noise present in the image are Gaussian noise, Salt and pepper noise etc. Salt and pepper is one of the common types of noise current in x-ray images. This is generally caused by a failure in capture or transmission that is appearing in the image as light and

black dots. It can be detached by apply mathematical conversion on the images. It conserve the boundaries while remove noise. The median filter is a nonlinear digital filtering technique, used to remove noise such as salt and pepper noise.

III. RELATED WORKS

In 2014 Elyse passmore and morgan sangeux proposedthe 3D gait analysis system that has been used to improving volume origin and coordinate system and 3D system improvise the system performance.
In 2014 Gennady and yu.Kulikova has been Accurate Numerical implementation of continuous-discrete kalman filter that used to involve the activity of coordinate system performance and it develops the improved gait analysist.
In 2009 J.Favre and R.Aissaoui develops the system for 3D knee joint angle that used to perform functional calibration and joint angle description .
In 2011 Zhi-Qiang Zhang, Wai –Choong Wong has been used for upper-motio estimation analysis used to analysis the interactive gait rehabilitation

IV. PROPOSED METHOD

In proposed system used to extract the features of bone and it used to increase the resolution and efficiency level of an input. Here, the dicom used to view the 3 dimensional view of bone density it gives the exact level of a density in fig1 and it also finds the all supplements in bone. To find a bone cancer and fracture itgives high resolution to find level of a cancer and fracture in the bone. It is the combined process of a bone feature extraction.

Edge Detection

Edge detection issignificantprocess in image processing, that decrease the number of pixels and save the arrangement of the image by decisive the boundaries of objects in the image. Edge detection is the method of identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. There are two general approaches to edge detection that are commonly used are: gradient and Laplacian. Gradient method use the first derivative of the image, and the Laplacian method use the second derivative of the image to find edges. In our method use sobel edge detector and it is a gradient family.

Segmentation

Segmentation is the process of dividing the given image into regions homogenous with respect to certain features as color, intensity etc. It is an essential step in image analysis and locates object & boundaries (lines, curves etc). The K-means clustering technique is used in this work. The purpose of this algorithm is minimizing an objective function, which is absolute difference function. In this

algorithm distance is squared or absolute difference between a pixel and cluster center is calculated. The difference is typically based on pixel intensity, color, texture and location. The quality of the solution depends on the initial set of clusters and value of k. After the segmentation crop the image and the area of fracture with some limitation.

Feature Extraction

Feature extraction is the main step in various image processing applications. Gray-Level Co-occurrence Matrix is used for feature extraction and selection. GLCM was defined by Haralick et al. in 1973.GLCM is main tool used in image texture analysis. Textures of an image are complex visual patterns that are composed of entities or regions with sub-patterns with the characteristics of brightness, color, shape, size, etc. GLCM is a statistical way to indicate image texture structure by statistically sampling the pattern of the grey-levels occurs in relation to other grey levels. We use the Gray Level Co-occurrence Matrix (GLCM) method to extract textural features such as entropy, contrast, correlation, homogeneity.

V.BONE DENSITY

It finds by, The T-score is the standard deviation (SD) of the patient's BMD above or below the mean for the Young-Adult normal reference population. The Z-score is the SD of thepatient's BMD above or below the mean of the Age-Matched

$$\text{T Score} = \frac{\text{(BMD of patient - Average BMD of Young-Adult)}}{\text{SD of Young-Adult}}$$

$$\text{Z score} = \frac{\text{(BMD of patient - Average BMD of Age-Matched)}}{\text{SD of Age-Matched}}$$

V.RESULTS

The result of bone density in 3D view

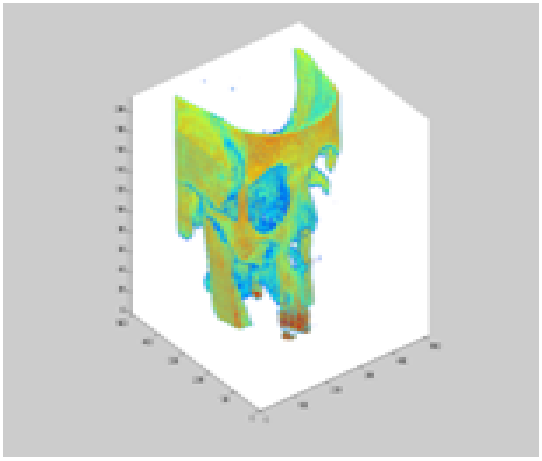


Fig1: bone density

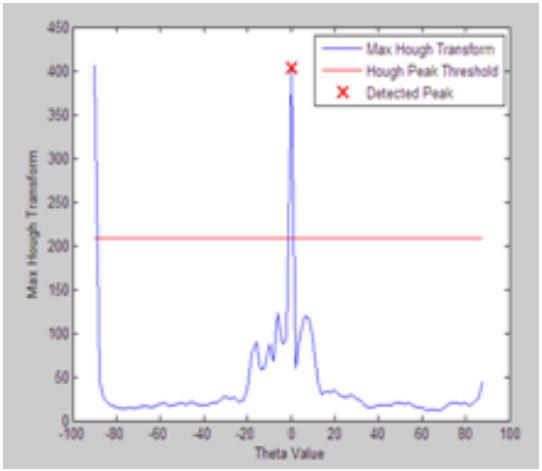


Fig2: bone fracture

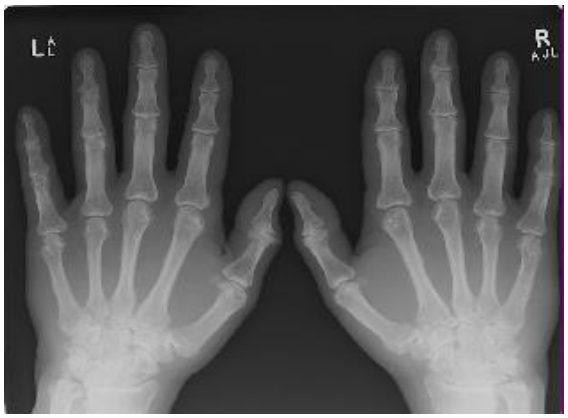


Fig3: bone density detection

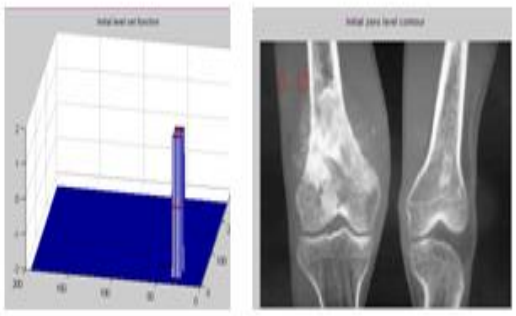


Fig4: bone cancer detection

VII. CONCLUSION

Here, we can able to predict the disease of bone density ,bone cancer and other bone diseases, The given image processing increase the saturation level of an output. So we can able to identify the exact level of an disease. It increase the output efficiency of an given input.

VIII. FUTURE WORK

Hardware implementation for bone density calculation

REFERENCES

[1] Elyse Passmore, Morgan Sangeux,"Improving repeatability of setting volume origin and coordinate system for 3D gait analysis," Gait & Posture, vol. 39, pp. 831-833, 2014.
[2] L. Tesio, V. Rota, C. Chessa, and L. Perucca, "The 3-D path of body center of mass during adult human walking on force treadmill,J. Biomechan., vol. 43, no. 5,
[3] Arnaud Faivre, Marc Dahan, Bernard Parratte, GuyMonnier, "Instrumented shoes for pathological gait assessment," Mechanics Research Communications, vol. 31, pp. 627-632, 200[4] S.S. Galen, C.J. Clarke, D.B. Allan, B.A. Conway, "A portable gait assessment tool to record temporal gait parameters in SCI," Medical Engineering & Physics, vol. 33, pp. 626-632, 2011.
[4] Ruth E. Mayagoitia, Anand V. Nene, Peter H. Veltink, "Accelerometer and rate gyroscope measurement of kinematics: an inexpensive alternative to optical motion analysis systems," Journal of Biomechanics, vol. 35, pp. 537-542, 2002.
[5] E.C. Wentink, S.I. Beijen, H.J. Hermens, J.S. Rietman, using EMG and kinematic P.H. Veltink, "Intention detection of gait initiation data," Gait & Posture, vol. 37, pp. 223-228, 2013.
[6] F.J. Lopez-Sanroman, R. Holmbak-Petersen, I. Santiago, I.A. Gomez de Segura , E. Barrey, "Gait analysis using 3D accelerometry in horses sedated with xylazine," The Veterinary Journal, vol. 193, pp. 212-216, 2012.

[7] Jan Rueterbories, Erika G. Spaich, Ole K. Andersen, "Characterization of gait pattern by 3D angular accelerations in hemiparetic and healthy gait," Gait & Posture, vol. 37, pp. 183-189, 2013.
[8] Cola G., Avvenuti M., Vecchio A., etc., "An On- Node Processing Approach for Anomaly Detection in Gait," IEEE Sensors Journal, vol. 15, pp. 6640-6649, Aug. 2015.
[9] T. Liu, Y. Inoue, K. Shibata, K. Shiojima, M.M. Han, "Triaxial joint moment estimation using a wearable three-dimensional gait analysis system," Measurement, vol. 47, pp. 125-129, 2014.
[10] Jingyuan Cheng, Amft O., Bahle G., Luckowicz P., "Designing Sensitive Wearable Capacitive Sensors for Activity Recognition," IEEE Sensors Journal, vol. 13, pp. 3935-3947, April 2013.
[11] Orengo G., Lagati A., Saggio G., "Modeling Wearable Bend Sensor Behavior for Human Motion Capture," IEEE Sensors Journal, vol. 14, pp. 2307-2316, March 2014.
[12] Tao Liu, Yoshio Inoue, Kyoko Shibata, "A wearable force plate system for the continuous measurement of triaxial ground reaction force in biomechanical applications," Measurement Science and Technology, vol. 21, no. 8, pp. 085804, 2010.
[13] Tao Liu, Yoshio Inoue, Kyoko Shibata, K. Shiojima, "A mobile force plate and three-dimensional motion analysis system for three-dimensional gait assessment," IEEE Sensors Journal, Vol.12, No. 5, pp. 1461-1467, May 2012.
[14] Guangyi Li, Tao Liu, LinyiGu, Yoshio Inoue, HaojieNing, and Meimei Han, "Wearable gait analysis system for ambulatory measurement of kinematics and kinetics," in Proc. 2014 IEEE Sensors, Valencia, Spain, 2014, pp. 1316-1319.
[15] Nikhil Raveendranathan, Stefano Galzarano, VitaliLoseu, etc., "From Modeling to Implementation of Virtual Sensors in Body Sensor Networks," IEEE Sensors Journal, vol. 12, no. 3, pp. 583-593, March 2012.
[16] Zhou H, Stone T, Hu H, Harris N, "Use of multiple wearable inertial sensors in upper limb motion tracking," MedEngPhys, vol. 30, pp. 123-133, 2008.
[17] Amini N, Sarrafzadeh M, Vahdatpour A, Xu W, "Accelerometer-based on-body sensor localization for health and medical monitoring applications," Pervasive Mobile Comput, vol. 7, no. 6, pp. 746-760, 2011.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Energy Conservation and Management with Power Conversion Techiques

Kaleeswari M[1], Madheswaran M[2], Vijaykumar K[3]
[1,2]Department of Electrical and Electronics Engineering, Mahendra Engineering College, Namakkal, India
[3]Department of Electrical Engineering, NIT, Jaipur, India

Abstract
In this paper, we will try to understand the effectiveness and potential of power electronics technology in the field of energy conservation. We will discuss the effect of power electronics control mainly in following four areas: (1) Buildings and lighting (2) power supplies (2) smart electricity grid (4) Industrial drives. European Union is hopeful of reducing their consumption of energy (mainly electricity) as much to 25%. To achieve this aim, we require removing technological challenges in these four areas and encouraging use of efficient and latest technology available in the market. Power electronics plays a key role in area of energy saving and should promote use of information technology techniques in making buildings and electricity grids smart.
Keywords : Power Electronics, Energy Savings,Smart Grid, Indistrial Application.

I. INTRODUCTION

Today the topic related to energy savings and efficient use of energy is trending resulting in global awareness. We all know that there is a shortage of main energy sources like coal and petroleum and we are trying to shift from conventional energy sources to renewable energy sources. It will lead to reduction of carbon emission and other pollutants produced from thermal power plants and vehicles using petroleum as a fuel. To cope with ever increasing demand of energy, we need to identify opportunities where we can conserve energy rather than increasing number of power plants. Many governments have developed programs to increase awareness among the public. They are promoting the policies regarding use of high efficiency technologies as they provide good energy saving potential especially in fans, refrigerator, and variable speed drive and lighting systems. They have made standards like THD should be less than 15% in the source current. European Union has developed energy conservation plans which will lead to reduce the greenhouse gases, the consumption of energy by 20% each. They have also included plans to increase use of renewable energy sources by 20%. By promoting distributed generation, the carbon emission will also reduce. US government has increased the share and investment in programs related to research and development in manufacturing clean energy technology, distributed generations. They have developed policies to reduce the greenhouse gases emission by 28% in 2020. The developed countries are also promoting to use public transport facilities rather than using individual vehicles using petroleum as source of fuels. They are also using CNG gases or natural gases in the transportation. Use of Electric vehicles (metros) wills also reducing environment pollution. The program named “Cool Earth-Innovative Energy Technology Program” is revolutionary. It aims to reduce the greenhouse gases by half by year 2050 [1].

There are two challenges mainly for the governments (1) the increasing energy demand and shortage of fossil fuels (2) the climate change. To solve these challenges, we require innovative technologies, interdisciplinary research

and develop solutions like sustainable energy sources. Government has formed energy management teams and environment control department to ensure the industries following the standard measures. This team will audit and measure the energy use patterns and the carbon emission.

The use of electricity is increasing at an accelerating rate and will be doubled in coming 10-15 years. The use of energy per capita is also related to economy and GDP of the country. The power electronics control like variable speed drives and higher star domestic equipment (fans, refrigerator, heating appliances, and compressors) should be promoted. The power electronics converters can be used to control and condition the energy to load for better performance. Research is going in the field of power electronics field to improve the efficiency and time of response of converters by opting different topologies. The power ratings and speed of power electronics switches have been considerably improved by development of IGBTS, MOSFET, PUT (Programmable unijunction transistors. The PWM techniques are used to control the output voltages in inverters are latest advancement. These technologies are very much required to extract energy from renewable resources efficiently as they are intermittent in nature [1].

The energy saving capabilities of power electronics is very less known, so each industry employ energy managers to conserve and identify opportunities[2]-[8]. In this paper, we have presented what are the opportunities to conserve energy in four key areas where energy saving potential is high. By measuring the performance of these technologies will also provide data to detect faults and further development. As electricity is the most usable form of energy, we are trying to save electrical energy. We will try to see the energy consumption in these areas, what are technologies used to conserve energy and try to find the technological gaps and challenges.

II. BUILDINGS AND LIGHTING SYSTEM

We have selected the following four areas on the basis of share in energy consumption and large potential of energy conservation.

A. ENERGY CONSUMPTION PATTERN AND INTRODUCTION

Buildings are major share-holder in energy consumption as it consumes 40% of total energy. The buildings can be further classified as commercial, domestic and industrial. The examples of commercial buildings are banks, shops, and IT sector company buildings, schools, universities and government offices. The residential and commercial buildings account for more than 65% energy consumption. The cost of electrical energy (lighting, heating and air conditioning) during the life cycle cost is more than the construction cost invested and it is 40% of the total life-cycle costs. In residential and commercial buildings, fans, room cooling and heating, refrigerators and lighting are major components of energy consumption [1]. The characterization of different buildings can be formulated by these given formulas:

Domestic end use characterization for different segments as

$E_{bc,eu} = (HH_{bc})\ (SAT_{bc,eu})\ AEC_{bc,eu})$

E=energy consumption in kWh

HH=number of households

SAT=fraction of households owning end use

AEC=average energy consumption

Commercial consumer end use

$E_{bc,eu}$ =(SM_{bc}) ($SAT_{bc,eu}$) ($EUI_{bc,eu}$)

Industrial consumer end use

$E_{it,eu}$ = (TC_{it}) ($SAT_{it,eu}$)

TC=specific total sector energy consumption

It=type of industry

B. ENERGY SAVINGS TECHNOLOGIES

As the largest consumption of electricity is lighting, we will see how to use technological advancement in the field of lighting to conserve energy. Initially Incandescent lights are used in residents but they are not efficient. So, the European Union replaced these Incandescent lamps by more efficient bulbs which are Compact Fluorescent Lamps and incandescent lamps with halogen technology. Fluorescent lamps are 7-10% efficient in comparison to 1.5-2.5% efficiency of incandescent lamps.

In case of hospitals, we require higher density or high lumens like 5000 lux for operation purpose. The value of car parking system lumen is 5lux and 1500 lux will be required for fine industrial work. The development of HID (high-intensity discharge) lamps like high pressure sodium lamps can be used where we require large lumens in a large area of operation. Invention of LED light is revolutionary as it is considered green lighting system but provide harmonics in supply system. The next generation lighting system will be dominated by LEDs. These new technologies like HID lamps and fluorescent lamps have to be used in series with current controlled ballasts.

In LEDs, MIT is trying to use Ga-N in silicon semiconductors so that the current will flow more efficiently. They are also trying new magnetic structure to cut the cost to 50% of earlier cost.

C. ENERGY SAVINGS POTENTIAL

The technologies to control the flow of air and water rates in different pumps and fans applications should be replaced by use of Variable Speed Drives as it is the most energy efficient control technique. The use of control strategy with variable speed drives provides less power consumption and will match to actual requirement by condenser pumps. The load will be predicted by intelligent control by comparing with seasonal data like room temperature, quality of air and user behavior. The intelligent control can be wireless so less cost and no maintenance. Intelligent home system should use sensors to see when to switch on light, the level of air conditioner and refrigerator by inspecting the surrounding temperature [1].

Traditionally hydraulic lifts are used. It can be replaced with the help of electric traction with speed control can save 50% energy. The motors used for the purpose should of high ratings and efficient. The power consumption should be controlled by amount of load present.

III. POWER SUPPLIES

A. ENERGY CONSUMPTION PATTERN AND INTRODUCTION

First of all, we try to know what power supplies are. Power supplies include the converters like load converters, source converters and distribution line converters [1].

1) Source Converters: examples can be cited as voltage source converters or current source converters used to improve the performance of the system and according to type of load, they feed the system. They can be employed for control purpose to get maximum efficiency out of the system. Typical examples are MPPT in solar panels and battery power management in case of stand-alone PV system.

2) Power Distribution Converters: A reconfigurable power topology has been chosen which normally works as a series voltage conditioner and a parallel current conditioner linked by a common DC bus. In case of a line outage, the current conditioner acts an an inverter which is able to feed 30% of the nominal load during 200 ms. It is considered that this short storage time can eliminate more than 90% of the line outages.

3) Load Converters: It can improve the performance and avoid faults by fulfilling the requirements of load. The conditioning of voltage and current reaching the load according to requirements will improve the efficiency of the system. Example: electric traction will receive as much level of current and voltage as the percentage of load is present.

To obtain higher efficiency, it is advisable to design the power supplies at different levels and according to their role designated in the system. Example of lift can be given where source power must be extracted as function of load. As today it is era of power electronics control, it will be great step in energy conservation plan.

B. ENERGY SAVING TECHNOLOGIES

Data centers are huge potential of energy savings in case of power supplies [1]. In European Union It is predicted to have an increment to 104Twh till 2020. The main load in data centers are computers which consist of hard disks, microprocessors, UPS and CPU. The main cooling system and conversion system also consume a considerable amount of power. The desired result of better of efficiency can be obtained power management as function of load. The microprocessor and power electronics intelligent control interface helps in power management which provides the facility to prioritize the features and application to be used during low power supply. The power consumed in a microprocessor is dependent on its voltage and frequency. So by modifying the frequency and voltage level with the help of power electronics converter as function of load, overall improved efficiency is obtained. The improved efficiency can be up to 24%.

A radio base station with an output voltage 120W has a overall efficiency of less than 1.5% as shown in fig.1.

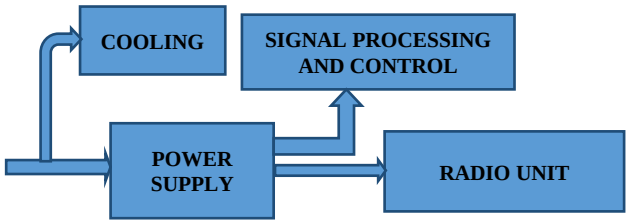


Fig. 1: Radio station block diagram

More than 40% of total power consumption is consumed by the power amplifier and in performing signal processing, DSP unit also consume 2.3kW. These two units uses power electronics switches but lesser efficiency. The ac power is rectified to feed to the radio station at poor efficiency (about 85%).

GaN High electron mobility transistor devices can be used in the place of silicon transistor so that the conduction losses will reduce. GaN can be used at microwave frequency at better efficiency in comparison to other technologies.

C. ENERGY SAVINGS POTENTIAL

The integration of microprocessor with advanced and fast power electronics devices will lead to reduction in energy losses by at least 14%. The proposed new DC distribution architecture, advanced power electronics devices (efficient) and adaptation of pulse frequency modulation will provide good opportunities of energy conservation in this area.

IV. SMART GRIDS WITH ELECTRIC VEHICLE INTEGRATION

A. ENERGY CONSUMPTION PATTERN AND INTRODUCTION

We are expanding the plan related to electrification of the whole nation. We will see the increasing trend of electricity as it will be used in all segments of life and integration of vehicles to grids is also proposed. In the next decades, we will witness at least 70-80% increase in electricity consumption. The share of renewable energy sources will increase as shown in Fig.2 but conventional energy sources will continue to be the major contributor [1].

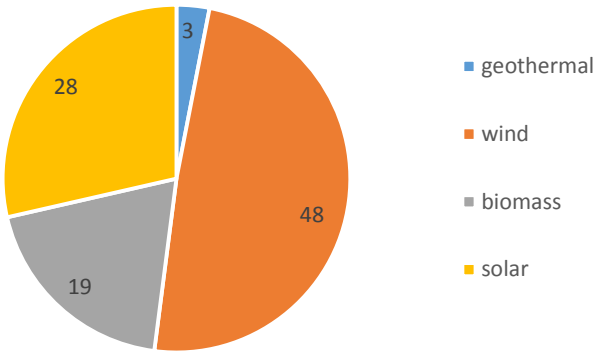


Fig. 2 Percentage share of different renewable energy source

The total energy contributed by these renewable sources is 600TWh which is 3-4% of total energy consumption. The shortage of fossil fuels and environmental conditions are pushing us for opting less concentrated sources like wind energy conversion system, photo-voltaic cells. These energy sources are clean but the efficiency of these sources are quite less. In wind energy conversion system, we are making advancement by adaptation of power electronics control and better efficient generators. The different topologies are proposed for WECS. The MPPT algorithms for extracting the maximum energy from both PV cells and Wind energy system require the use of power electronics semiconductor devices and microprocessors. We are putting steps forward for a smart grid with IT technologies and distributed power generations systems.

The smart grids will be promote the idea of distributed generations. The integration of renewables sources and adding the Information technologies and net metering system will provide efficient and reliable smart grids. The integration of large scale public transport (electric vehicles) is also a feature of smart grids. It provides solution to ever increasing fuel prices and the climate situations. The developed countries are investing a lot of money in the area of plug-in electric vehicles on the road by year 2020.

B. ENERGY SAVING TECHNOLOGIES

The key features of Smart Grids are (1) Integration of distributed generation system (2) improvement in index like reliability and efficiency (3) Demand Response (4) Plug-in Electric vehicles

Power electronics will play a crucial role in the Wind Energy Conversion Systems integration to the grid [2-8]. It is an intermittent source of energy and variable speed generators like squirrel cage induction generator or wound rotor induction generator can be employed [5]-[8]. Power electronics will required for the matching purpose (characteristics of grid and wind turbines). For applying the MPPT algorithm, we require the use of power electronics converters like chopper or rectifier. Power electronics can also be used to control frequency, active power and reactive power control [1].

Photo-voltaic cells require the converters for converting the DC output of cells to AC to feed the AC grids or utility. MPPT algorithms can be employed to extract maximum power from the solar arrays. For using MPPT algorithms, there are different topologies in application like centralized technology, Multi-string technology; string technology and latest one are AC modules technology. In these all technologies, we are using inverter and chopper for better control of power and efficient conversion of power. It is also seen that by using the MPPT, the effect of shading can be reduced to 50%.

The latest technology in EHV transmission is HVDC. In this HVDC, we are using high ratings converter station. The latest technology in FACTS devices are STATCOM and SVC. The government is planning for the Electric vehicles but that will require charging of EVs [1]. Batteries are crucial part of these plug-in Electric Vehicles. So, we can try to adopt the demand side management to charge the batteries during night hours at which surplus energy can be provided to them by the grids. The EHVs are quite large loads, so to maintain the reliability of the grids, we need to exchange information and bi-directional energy flow between the EVs and grids. It can be enabled by use of power electronics devices.

C. ENERGY SAVINGS POTENTIAL

The consumption pattern in city and highway for a mid-size Sedan passenger vehicle is provided in the fig. 3. Here a comparison is shown between diesel and petrol engines with corresponding hybrid vehicles are also presented in fig. 4. About 50% reduction in fuel consumption is achieved in city areas [1].

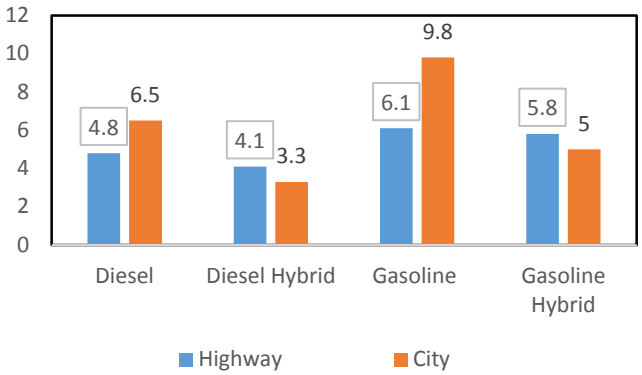


Fig. 3 Energy consumption pattern of vehicles in city and highway

The efficiency of ICE (Internal Combustion Engines) car is given only 12% as it uses inefficient mechanical motors. The ICE has an efficiency of 35% in case of highways and less than 20% in case of city. When It comes to clean source of energy, one will also side-line the convention mechanical vehicles and accepts electricity [1].

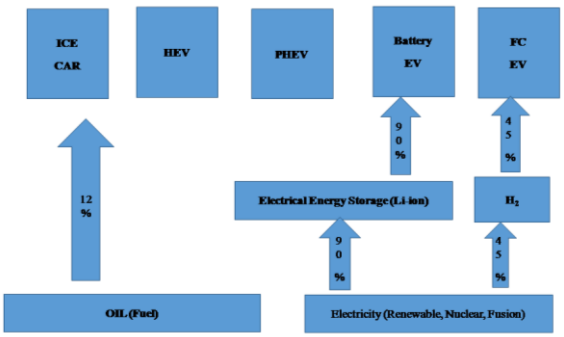


Fig. 4 Various transportation vehicles comparison

V. INDUATRIAL DRIVES

A. ENERGY CONSUMPTION PATTERN AND INTRODUCTION

The industrial drives are with electric motors with its control equipment and energy transmitting component is the backbone of our industrial development [1]. The low power industrial drives like fans, compressor and mixer, medium level industrial drives like traction and lift, large power rating drives used in cranes, trains and ships. It may be said that almost 65% of industrial electric energy is consumed by motors only. In residential sector, Industrial drives uses almost 13.2% of total energy and in commercial sector, it is about 11.3% which shows the importance.

B. ENERGY SAVING TECHNOLOGIES

Use of variable speed drives will be more efficient if it replaces fixed speed drives according to load. Automation and advanced control system is now replacing the unintelligent drives. The main components in a variable speed drives are power electronic converters that is able to supply variable frequency input voltage to the motor to adjust or regulate its speed. These VSDs are economical as free maintenance, auto-adjustable and reduced operational cost (energy). In variable torque loads, if the speed is cut-down to 50%, the energy demand will go down to 12-15%.

C. ENERGY SAVINGS POTENTIAL

If VSDs will replace 40-50% of all motors used in industrial domain, the total energy saving potential is predicted is about 30-40% which is quite significant amount. As VSDs also reduce the operational energy costs, Its life cycle costs is also reduced. Energy saving potential for different segments have presented in table 1 [1].

Table 1: Energy saving potential across different segments

Application	Electricity Consumption(in Terms of % of total)	Electrical Energy Saving Potential	Energy Saving Potential as % of total energy
Motor Control Industrial Application Appliances, Lifts Traction Drives	50%	30-40%	5-6%
Lighting	21	>70%	>14%
ICT Data Centers Radio Base Station Standby Consump	 2% 1% 4%	 50% 30% 80-90%	 1% 0.3% 3.6%

VI. CHALLENGES AND TECHNOLOGY GAPS

A. BUILDINGS AND LIGHTING

A number of solution and advancements are made in lighting systems but here are some barriers to which engineers should surpass to penetrate market for new efficient technology [1].

- The latest bulbs must be available at low price, so that people can afford them.
- LEDs are best among all lighting bulbs. People must be able to use them without cooling system.
- Building must be according to government policies or we should promote green building or smart buildings. Companies should reduce the maintenance and installation cost.
- We should promote high efficiency LEDs drivers, solid state lighting, and electric actuators.

B. POWER SUPPLIES

The main challenge in this case to develop technology such that it can adapt according to the mode of operation and should supply voltage and current level according to function of load.

- Try to develop chips in which local power management (power supply on the same chip) is possible.
- To reduce the standby losses, it requires to perform research work in the field of circuit and technologies which provide low leakage.
- The development cost associated with efficient power modules is quiet high. To follow the communication protocols and proper utilization of space, R&D should be engaged in this field.

• Automation should be applied in distribution field. Auto correction of system after detection of fault will be required for better reliability.

C. SMART GRIDS WITH ELECTRIC VEHICLE INTEGRATION

Replacement of unidirectional grids with centralized power system with bi-directional grids with distributed power system (renewable resources) needs a complex control facility as any components failure will assure the system failure. This is actually a step forward to smart grids but it will take long time as integration of large grids, thermal power plants, wind power generation farms, PV cells is not a handy task.

• As the number of intermittent renewable sources will added up to the existing system and there is no correlation between the load and generated power will create transmission and distribution problems.

• Load sharing, supplying surplus energy to batteries, demand response and balancing the load and generation will be a quite tough as number of loads is increasing.

• Integration of Electric vehicles and plug-in EVs will be an additional load to distribution systems. It will affect the reliability and power quality of the supply system.

The development of low loss transmission lines over long distance will be a challenge. Introduction of HVDC is a solution but we need further developments.

Bidirectional energy flow should need latest measuring equipment [1]. Management and control of super-grids and micro-grids, control of power flow from generating plants located remote and far from local population and loads. Electric vehicles charging management and integration to grids are also a big challenge. We require multi-level power conversion for HVAC systems and soft switching topologies (solid state transformers) for higher efficiency distribution purpose.

D. INDUSTRIAL DRIVES

• Development of new solid state materials like GaN, SiC that will allow less losses and are able to withstand higher temperatures. Development of new insulation materials and power capacitors goes with high operating temperatures. Thermal management leads to control over heating losses, cost.

• Development of wireless communication with self-powered sensors will help in identifying the load, intelligent control for drives.

• In industrial drives, avoiding the use of gears, transformers and filters are main challenges.

• Redundancy concepts and analyzing the system reliability and robustness including the design for reliability are under development and main challenges.

VII. CONCLUSION

In this paper, we have dealt with the energy saving potential with the help of power electronics system in four key areas. As the application of power electronics devices goes wider, we will see the effect of these devices. In the area of renewable energy, we need power electronics devices for better control and enabling the maximum power extraction from source. The converters are quite important in the field of power system and should be replaced by efficient power electronics devices to save the energy. The new integration of control system with the help of microprocessor, digital sensors with power electronics is a major challenge to us. However, only by

implementation of these latest power electronics technologies, will not lead to sustainable energy. The economy, policy and customer acceptance will also require. The government and international agencies are working in formulation of standard and policies to reduce the environmental effects and preserve the ecological balance. The cost of purchasing and installation is also a major drawback in adaptation of latest technologies. The presence of economic barriers, still these technologies have shorter payback period. Public acceptance and attitude towards the utilities are crucial factors. Media campaign and effect of service will be able to change the mind-set of consumers.

VIII. ACKNOWLEDGMENT

The paper was supported by Science and Engineering Research Board (SERB), Department of Science and Technology (DST).

IX. REFERENCES

[1] Popović-Gerber, J., Oliver, J. A., Cordero, N., Harder, T., Cobos, J. A., Hayes, M., ... & Prem, E. " Power electronics enabling efficient energy usage: Energy savings potential and technological challenges"' IEEE transactions on power electronics, 27(5), 2012, 2338-2353.

[2] Kaleeswari M, Madheswaran M., Binshad T and Vijayakumar K., "A modified power electronic converter topology for stand-alone photovoltaic power generation system," 2016 6th International Electric Drives Production Conference (EDPC), Nuremberg, 2016, pp. 158-163

[3] T. Binshad, K. Vijayakumar, M. Kaleeswari, "PV based water pumping system for agricultural irrigation", Front. Energy, vol. 10, pp. 319-328, 2016.

[4] K. Vijayakumar, R. Karthigaivel, N. Kumaresan and A. Arjun, "A Simple Feed Forward Controller for Stand-Alone Wind-Driven Permanent Magnet Synchronous Generator," 2009 Annual IEEE India Conference, Gujarat, 2009, pp. 1-4.

[5] K. Vijayakumar, N. Kumaresan and N. Ammasai Gounden, "Speed Sensor-Less Maximum Power Point Tracking and Constant Output Power Operation of Wind-Driven Wound Rotor Induction Generators", IET Power Electron., 8, (1), pp.33- 46, 2015.

[6] Vijayakumar, K., Kumaresan, N., Ammasai Gounden, N.: 'Operation of Inverter Assisted Wind-driven Slip Ring Induction Generator for Stand-alone Power Supplies', IET Electr. Power Appl., 7, (4), pp.256-269, 2013.

[7] Vijayakumar, K., Kumaresan, N., Ammasai Gounden, N., Tennakoon, S.B.: 'Real and reactive power control of hybrid excited wind-driven grid-connected doubly fed induction generators', IET Power Electron., 6, (6), pp.1197-1208, 2013.

[8] Vijayakumar K, Kumaresan N, Bhagavan KA, Gounden NA. 'A DSP Based Closed Loop Controller for Power Smoothing Operation of Wind-Driven WRIG Systems', International Review on Modelling and Simulations. 2012;5(1):185-92.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Optimal design and development of heat tracing systems for enhancement of energy saving

Kaleeswari M[1], Madheswaran M[2], Vijaykumar K[3]

[1,2]Department of Electrical and Electronics Engineering, Mahendra Engineering College, Namakkal, India

[3]Department of Electrical Engineering, NIT, Jaipur, India

Abstract:

Because rapid rise in the consumption of energy due to growing demand, there requires a need for the effective use of energy resources as the cost of energy has been rising due to growing demand. In addition to industries are being strictly regulated by the government in terms of the reduction of the carbon dioxide emissions ,so all the industries are striving towards the most energy efficient solutions. In this report, the trace heating system of the petrochemical industry has been discussed which explains about the optimal design and the usage of the technologies of trace heaters towards an energy efficient solution. Here the proper selection of insulation system and the trace heater technology and its electrical distribution resulted in an energy saving of 37% where the control and monitoring strategies resulted in 91% savings. Here the evaluated results can be applied to the new installations in the trace heating so that the installation cost will be saved.

1 Introduction

To meet the required energy conservation goals there are many resources available in petrochemical industry. The United Nations industrial has given a benchmark for energy consumption for many processes by publishing a paper which estimates that the 26% energy saving be there if all are operated according to the given benchmark. The tern heat tracing refers to the applications of heat continuously or intermittently to pipes, vessel or a tank in order to replace the heat lost to the surroundings. Heat tracing is very much useful in cases of protection from being frozen, thawing, in maintaining the temperature of fluids at required point, prevention of condensation of gas and prevention of components separation in fluids[1].

There are two types of heat tracing systems which are electric and fluid. In fluid heat tracing systems, the fluids flowing the small pipeline or tube are used to transfer the heat the process materials at a very high temperatures. These fluid tubes are generally attached to the tubes which transport the process materials. We use either steam or organic heat transfer for the tracing of heat through fluids. Waste from the process steam, fossil fuel burning or steam or electricity can be used to provide these fluids for heat tracing.

Now, the other type of heat tracing other than fluid is the electric heat tracing where the heat transfer is done through the conversion of electric power into heat using the dissipated energy from the resistances. Most of the electric heat tracing systems employs the resistances which are run through the cables and are placed on the surface of the pipe for the heat transfer. These cables are connected to the voltage source and the current starts flowing through these cables where the resistances present in the cables dissipate the heat proportional to the square of the current and the resistance of the elements where the current flows [1]-[5]. Other than this type of electric heat tracing, there is skin conduction effect and impedance induction is also used to produce the heat to transfer to the process materials of the pipelines.

Now the energy saving of the trace heating systems can be done by using many tools of which the fluid or the steam trace heating system has the energy conservation opportunities by improving the insulation of the pipes to reduce the heat loss to the ambient and by improving the steam traps and its monitoring and maintenance, repair of leakage, recovery of flash steam and return of the condensate. Now in this paper, the major focus is on the application of heat tracing systems optimally to conserve energy so the reduction in the consumption of energy or saving of energy can be done by improving the heat tracing technologies used by the systems and by proper controlling and monitoring the trace systems and by proper selection of insulation and cladding and by proper placement and rating of the power distribution systems [5].

The different areas of engineering includes the what is required to be heated to what amount of temperature which gives the process involved and the type of insulation to be used to hold the cable as well as pipe which gives the mechanical construction of the system, proper placement of the circuit breakers and proper ranges of voltages and junction boxes and termination ends which involves in electrical configuration of electric heat trace system. Other field of engineering includes are instrumentation and piping engineering [2]-[4]. Among all these different areas of engineering disciplines, there are lot of opportunities involved which provides a tool for the proper management and saving of energy throughout the whole process.

Through different examples, the energy saving can be observed in the heat tracing system by the usage of improved technology which involves in proper selection of the insulator by improving the insulator technology, proper control of the system and the better strategy for monitoring the different aspects of the system, optimized distribution of power alternatives, good selection of trace heaters which can have a performance which is optimized.

2 Methodologies

The optimal placement and application of trace heating system using resistance has led to the efficiency of the system through energy savings and the conservation of energy is also done. In addition to these above methods used there are other factors involved in leading the trace heating design to become optimal. These factors can be proper man force to correct the deficiencies occurred, acceptable span of temperature, proper maintenance and improving the flexibility of operation and recovering the cost involved the production which lost due to the faults or losses. All these requirements of the user who uses in the end can be met for this principle design with the lowest operating, running and installation cost. Here we will observe the impact of different parameters which are associated with the design of the system on the usage of the energy and the costs incurred to it.

2.1 Considerations of insulation system

The insulation system is one of the main important factor of the trace heating system as it prevents from heat loss to the surroundings. The heat loss can be reduced by the appropriate choice of the insulator which has low K-factor i.e; low thermal conductivity. Here insulation and the K-factor are inversely related. Other than this the choice of insulation also depends on the insulation material's thermal characteristics, resistant to the moisture, range of temperature, resistance to fire, chemical compatibility, resistant to the smoke, toxicity tolerance, cost of the insulation and the maintenance of the insulation.

we can state the different insulation materials has diversified characteristics as the materials like Mineral wool and polyiscocyanurate are resistant to the moisture in the atmosphere and have good thermal conductivity with a limited temperature exposure. Expanded perlite and Calcium silicate can found to be having higher thermal conductivity and shows rigidity with high temperature exposures. Some insulation are used under stress so that they can be compressed under load and are found to be soft mechanically. These types of insulators are fiber glass and mineral wool. For the insulation optimization there are various parameters which are to be considered such as thickness of the layer, manylayered insulation usage and the type of insulation. Resistance towards moisture, maximum exposure temperature limit and rigidity are also included. For the energy saving an insulation type with low K-factor has to be chosen if that can be availed so that the costs can be reduced. Depending on the availability of the space inside the cable and the cost incurred in the insulation material the insulation can be made multilayered to reduce the heat loss and energy usage.

Now analyzing the given case study by using different insulation technologies provides us with an optimized insulation system which is either calcium silicate or mineral for the above given case. As we can observe from the table, polyurethane and polyiscocyanurate are not considered even though they are rigid because of the low maximum exposure temperature. Here we are observing the difference by using different thickness of the insulation and obtain an optimized solution. From the table we can observe that the mineral wool is the better system as save 37% of the energy with insulation of 3" thickness and calcium silicate gives 14% with 3" thickness. Even though if we use 2"

thickness of mineral wool it gave 22% savings which is still better than the rest of the systems. In this case the cable used is mineral-insulated (MI) cable. In addition to the conservation of the energy it helps in the optimization of the whole design of the trace heating system with fewer circuits and long length of circuits. This analysis shows that the insulation optimization is one of the major key factor of the optimized design of trace heating as it involves in saving of many millions of dollars.

2.2 Trace heaters and different considerations of power distribution

2.2.1 Self-regulating heaters

Self-regulating heaters are one of the most popular and the most effective form of electric heat-tracing and are mostly used by all the industrial users for the heat tracing systems. Self-regulating heat-tracing stand out to be different because of the parallel resistance technology which accounts for an advantage as compared to the other trace heat technologies by eliminating the burning of the heater cables internally due to the increase in dissipation occurred through the overlapping of the resistance. Self-regulating tracers has a heating cable run alternatively between line and neutral so giving an advantage to be cut to any desired length and field-installed within the limitations of the voltage drop on the bus wires. They have good impact resistance and are routinely handled in the field. Its feature provides in reduction of operating and installation costs and provides an increase in reliability. Because of its parallel-resistance feature, It provides an element of safety unlike any other form of electric resistance tracing product because the heater cannot be destroyed by its own heat output. The only disadvantage is its limited operating temperatures 366°F (186°C) for constant exposure and 420°F (215°C) for intermittent exposure.

2.2.1 Zone Heaters

In the beginning of the trace heating systems zone heaters were the most used technologies by the industries because of its parallel resistance of the heaters in the cable so gradually they have started to substitute the self regulating heaters. The major advantage of zone heaters is that they can be cut to any desired length which gives a constant wattage output as the power output obtained by these heaters is independent of the circuit length. Along with this advantage is another incentive in terms of cost reduction in operation and installation of this technology. The parallel design of the circuit of zone heaters accounts for a major advantage as there won't be any heat out because of the excessive voltage unlike series configuration as the resistance used are also thin and are fed with the standard voltages. These are less damage prone and are subjected to moisture and can withstand an with an exposure temperature up to 1000°F (538°C) which accounts for the use of Fiber glass-insulated cables. The presence of a fluoro-polymer jacket on the insulation, the rating of the temperature exposure is got down to 545°F (285°C) by giving the moisture protection. The main disadvantage of the zone heaters is that they are subjected with the excessive heat and there happens a burnout internally which results in the damage of the zone heaters.

2.2.2 Mineral-Insulated Cable Heater

Mineral-insulated (MI) cable is a different but another most employed technology which has constant-wattage characteristic, and have a configuration of series resistance design which consists of a thick resistance wire running across the length of the pipe and cannot be cut to the required length but can withstand a very high temperature range. By using the good conductor sheaths made of conductive alloys it can withstand a temperature of 1500°F (800°C).Because of its distinct features of high resistance and its tolerance to high temperature it can be used ruggedly. The important key drawback of MI is that they cannot be varied according to the pipe length during the process as they cannot be cut down. So it becomes difficult in designing length as it has to be predefined before the installation and its requires an special designing of these cables. Here in these kind of cables make use of the variable control of voltage at different positions along the pipe which are distributed for short lengths. Because of its series configuration, even if anyone part or the piece of resistance is failed it results in the failure of the whole heat tracing system which also accompanies with a draw of excessive heating and less conductivity due to its thickness.

3 Control of the trace heating system and strategy of monitoring

The control and the monitoring of the trace heating system is very important to maintain the temperature and can be used for the reliability of the system as it senses the deficiency and immediately alarms the operator. With the use many temperature sensors placed across the pipe and the indicators using an light circuits in the end can help in improving the flexibility to maximum by detecting the very low temperature, failure of any sensors like thermostat, ground faults, low line current etc. For the implementation of these control and monitoring methods the temperature of the process has to be maintained at Maintenance temperature (70°F) and the parameters present in the given case other than maintenance temperature are same.

Proper software installation and control architecture, proper communication and the networking between many components and the placement of equipment also accounts to the total costs greatly in addition to control and monitoring methods. Controlling defines as the system ability to find and the control the deficiencies and to restore them within the safe range so that the energy will be saved.And monitoring can be defined as the operating status indication through the use of some sensors.

4 Various control methods

4.1 Uncontrolled or Self-Regulating Control

Here the system is not controlled and is continuously given with full power supply by using self regulating and constant wattage heaters; the heater has been controlled for different applications of

heat. Here the energy usage is more as it is fully supplied all the time with 8-10% for freeze protection and 15-20% for maintaining the temperature.

4.2 Ambient-Sensing Control

In this type of control we use a temperature sensor like thermostat to measure the temperature and it will turn on the heater below the ambient temperature and it will be above ambient temperature. Here the thermostat is set to all the temperatures below the maintenance temperature.

4.3 Line-Sensing Control

It measures the maintenance temperature only and the heater circuit will be on or off or controlled according to this temperature. It is used for wide ranges of temperature and the most energy saving control.

4.4 Proportional Ambient Sensing

In this control method, the heater sets its control between the minimum ambient temperature and the maintained temperature and the heater is initially set at the minimum ambient temperature. Here the power output is decreased as the actual ambient temperature reaches the required maintenance temperature. This control is also a energy saving control used frequently.

Out of all these control methods it is observed that the line-sensing control is the most energy saving control with an energy saving of 91% with 70°F maintenance temperature. Here the heater is chosen with respect to the minimum heat loss produced by the cables at the minimum ambient temperature.

5 Discussion

It is observed that the proper implementation and design of the application and technologies of heat tracing system have resulted in the conservation of energy greatly. With the help of the mentioned case studies it is observed that the savings can be done to a maximum of 91% with proper monitoring and the control technology and has an energy reduction resulted in a savings of 37% using proper insulation system and the trace heating technology and its electrical distribution. Overall the optimal usage of the resources available in this technology can result in a millions of savings in cost. Here the end user has to choose the technology optimally which can result in an overall best performance of the system. So that's why the user has to test these independently resulting in an optimized solution. Then there has to be holistic view taken for the whole system and decide the proper system for the most energy savings. In addition to these technologies are the different other parameters which result in a great costs reduction are the proper networking facilities and infrastructure of the system, proper sensing and alarming equipments, appropriate software implementation for control and monitoring strategies.

6 Conclusions

From the usage of the energy efficient technologies of the heat tracing system has resulted in a great amount of energy savings in many industries which has also resulted in the reduction of the carbon footprints. By using these methods it is very easy to save overall energy to 50%. But the appropriate design of this whole heating system is a very tedious and complex method. It requires an in-hand experience and knowledge about the different components used in the system which also includes various parameters like the process temperature and the flow of the material passages and the other performance affecting parameters. In a single facility it requires a customized solution of each and every circuit as every circuit has different application. So application of different solution is not the best method to be applied instead the solution has to be considered by combining all the optimized methods to obtain the best possible solution. In addition to these energy conservation goals the industrial vendor should also keep in mind the low cost investment as there incurs costs in installation of heater and its wiring, termination circuits and the electrical and mechanical systems.

References

1. Thorat, Sudhir, Greg McQueen, and Pablo T. Luzunaris. "The Role of Optimal Design and Application of Heat Tracing Systems to Improve the Energy Conservation in Petrochemical Facilities." *IEEE Transactions on Industry Applications* 50, no. 1 (2014): 163-173.
2. Kaleeswari M, Madheswaran M., Binshad T and Vijayakumar K., "A modified power electronic converter topology for stand-alone photovoltaic power generation system," 2016 6th International Electric Drives Production Conference (EDPC), Nuremberg, 2016, pp. 158-163
3. T. Binshad, K. Vijayakumar, M. Kaleeswari, "PV based water pumping system for agricultural irrigation", Front. Energy, vol. 10, pp. 319-328, 2016.
4. K. Vijayakumar, R. Karthigaivel, N. Kumaresan and A. Arjun, "A Simple Feed Forward Controller for Stand-Alone Wind-Driven Permanent Magnet Synchronous Generator," 2009 Annual IEEE India Conference, Gujarat, 2009, pp. 1-4.
5. Lonsdale, Joseph T. "HEAT-TRACING OF PIPING SYSTEMS." *PIPING HANDBOOK* (2004): 242.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technol
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

A Novel Approach in Defining Interoperability Standards for Microgrids

Javeed Ahmed Khan
Ph.d, P.Eng, SMIEEE , School of Applied Technology, Humber College, Ontario, Canada

Abstract

Future Microgrids are developed for integration with upcoming Smart Cities. The microgrids developed are decentralized and are expected to operate in islanding mode than grid-connected mode. The increased reliability and power quality requirement of an islanded microgrid requires advanced planning. In the process of planning, the interoperability of devices and components of a microgrid play a crucial role. The devices and components of different companies are presently developed and manufactured in a non-standardized environment. This paper presents a novel approach in defining interoperability standards for microgrids through experimentation at Humber College, School of Applied Technology. Experimentation is carried out using the embedded controller architecture classification into three groups (Von-neumann, Harvard and Super-Harvard Architectures) and further sub classified into CISC and RISC architecture. Presently, the experimentation was completed on simulation and emulation level on a generic computer architecture. The same experimentation will be validated in the lab in-future.

Index Terms : Industrial Internet of Things (IIoT), Internet of Everything (IoE), Internet of Things (IoT), Interoperability, Virtual Private Network (VPN).

I. INTRODUCTION

Microgrids are mostly operated in grid-connected mode. The developments and projected developments in the smart cities underlines the necessity for island operating microgrids [1] [2] [3]. The operation and control of a microgrid can be shared in a grid-connected mode with the single-machine infinite bus system. However, in an islanding mode of operation, the microgrid controls are solely responsible for the reliable power supply with acceptable power quality. The operation of control of a microgrid in islanding mode is carried out mostly by single Original Equipment Manufacturer (OEM) company's components and devices. However, if the microgrid is to be setup by an Engineering Procurement and Commissioning (EPC) company in the future with different OEMs components and devices as the projected growth of microgrids is around 21 billion dollars US by 2020 [4], the microgrid may not be functional and if functional the liability is not defined in case of a microgrid failure as the interoperability standards for different OEMs devices and components when interconnected in a microgrid is not yet defined [5] [6] [7] [8].

The novel approach in defining interoperability standards for microgrids is to analyze the timing signal of different OEMs communication between different components and devices of a microgrid. The communication

is mostly proprietorial and hence limits the avenue for interoperability. In case, of defining the standard for timing signal of a processor (Von-neumann, Harvard and Super-Harvard Architectures) either in normal or encoded mode of operation will provide the basis for further defining different standards for interoperability. The other alternative is to use a standard encoder for the timing signal other than the proprietorial encoding of the communication signal by individual OEM.

The lab at Humber College has simulation and emulation results for defining interoperability standards for microgrids and the hardware testing and prototyping will be carried out in-future. The functional architecture for an operating microgrid in islanding mode is shown in Figure 1.

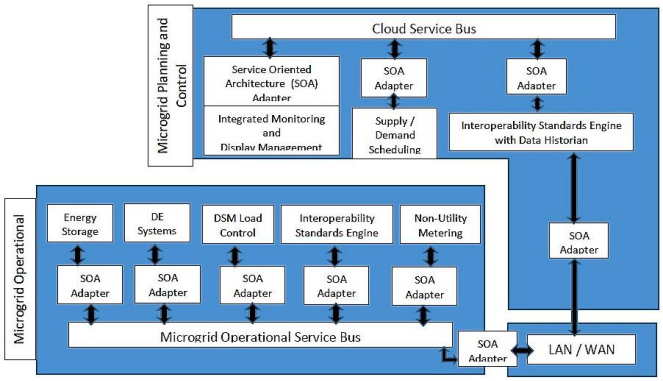


Figure 1. Functional Architecture of Islanding Microgrid at Humber College

II. LITERATURE SURVEY

This section describes about the literature reviewed and used for this research work by the author for experimentation and analysis on interoperability. The section is sub-divided into three parts – past developments, present and future developments in microgrids.

A. Past developments in Microgrids

Navigant Research has continuously tracked the developments in microgrids and the past research on microgrids shows a slow development in the early 2000 to a rapid increase in the development from 2010. Reasons for the slow developments in the early 2000 are economical and technical. The economical reason is the proposed shift from centralized power generation, transmission and distribution to decentralized power generation and utilization. The capital costs and funding required for the shift was a concern for the slow growth of microgrids in early 2000. The technical reason for the slow growth of microgrids in early 2000 are the non-availability of control and communication devices and circuits for the decentralized microgrids. With the advancements in technology and the willingness to shift from centralized power economy to decentralized, the developments in microgrids are rapid from 2010 onwards.

B. Present developments in Microgrids and IoT

With the developments in IoT, one of the greatest beneficiary is microgrid, the usage of microgrid in grid-connected mode is wide spread and encouraged for newer installations (buildings, airports, commercial complexes etc.,). However, the islanding mode of operation of microgrid is still under prototyping for wide spread usage.

C. Future developments in Microgrids, IoT and IIoT

Projected growth of microgrids for 2020 is around 21 billion USD by Navigant Research. The advancements and projected advancements in IIoT and IoE makes it possible to further grow the microgrid market in terms of technical developments. The economic perspective of ROI (Return of Investment) on microgrid capital makes it a viable solution for future installations. Microgrids in islanding mode will be the widely installed microgrids keeping in view of the proposed net-zero regulations by different municipalities.

III. LAB SETUP AND INTEROPERABILITY EXPERIMENTATION

The laboratory setup at Humber College is divided into two sections. First section is simulation with analysis (stage 1) and second section is prototyping and hardware analysis (stage 2). As described in the abstract and explained in the introduction of this paper, the purpose of this research is to define interoperability for microgrid components. The research is to ease the transition from microgrids owned and operated by OEMs to regulated installation, operation and maintenance of microgrids by OEMs and EPCs

A. Simulation and Analysis

This section describes the simulation and analysis with emulation of microgrid communication protocols in a laboratory setting (standard condition) and extending it to working conditions. In the laboratory setting the experimentation was carried out on generic computers with von-neumann architectures and the interconnectivity was carried out using market available free cloud services. The reason behind the usage of cloud services is to further extend the decentralized unified control from different places to a single location. Data centers will play an important role in unifying the decentralized interoperability locations to a single location.

B. Prototyping and Hardware Analysis

This section describes about the prototyping of microgrid in an islanding mode of operation. The hardware analysis will be carried out using different OEM devices and components for microgrids. The emulation was carried out only for the cloud control of interoperability devices and components using performance analysis of traffic for load balancing and multicasting in a networked data center on a von-neumann architecture computing devices.

The three basic digital modulation techniques emulated for performance analysis of interoperability devices and components are:

- Amplitude-shift keying
- Frequency-shift keying
- Phase-shift keying

The reason for using the basic digital modulation techniques was to analyze the performance in a digital transmission environment as opposed to an analog transmission environment, because most of the present and future microgrid devices and components are designed for digital compatibility, preferably for proprietorial usage.

The emulation testing of network management was carried out to find out the behavior of the microgrid interoperability network in different network sizes.

C. Self-defining Networks – Software and Hardware

Self-defining Networks (SDNs) are the most radical and the latest developments in IIoT [9] [10] [11]. In practice, only software defined networks are in use. This research work has ventured into hardware defined networks with interoperability of microgrid devices and components as a means. The hardware defined networks will be able to self-define the network for optimal operation of microgrid in an interoperability environment.

IV. DATA CENTER AND INTEROPERABILITY

This research also explores the possibility of established data centers performing tasks related to standards matching in an online environment as the present day updating of software is carried out. However, the standards matching and interoperability is a liability involving work environment and hence dedicated data centers with subject matter experts can monitor the decentralized islanding microgrids at a unified location.

Server loading variation experimentation using Johnson Algorithm for Load Balancing in Software defined SDNs [12] further validate the role of load balancing in both software and hardware defined SDNs.

V. RESULTS AND CONCLUSIONS

The preliminary results of the research work on interoperability are presented in this section of the paper. Table 1 shows the preliminary results through analysis and data collected analysis.

TABLE 1. RESULTS

Ease of Communication between different OEM devices and components in test mode	Projected increase in cost of Microgirds		Communication Errors and Correction	Projected increase in usage of Electricity generated by Microgrids per sq. kms
	Installation	Operation and Maintenance		
25%	72%	85%	3%	35%
75%	45%	55%	1.4%	49%
90%	13%	10%	0.3%	85%

In concluding the preliminary results and expected in-future results on interoperability, the preliminary results are promising and in-future results will hold a major role for the regulators like Professional Engineers Ontario (PEO) in implementation of the standards and technical bodies like IEEE in making the public across the globe aware of the advantages of the standards and their positive impact on the planet against climate change. The developed standards will complement the carbon taxation implemented by different countries.

In Canada, the decentralized electric power generation and utilization with unified controls will help in the economic growth of Canada as the present population is very miniscule against its habitable land mass. The capital investment for centralized power generation, transmission and distribution will be huge for further expansion as against decentralized power generation and utilization.

The detailed experimentation results without actual testing setup validate the growth of IIoT and the market share of different OEMs in market and open avenues for IoE. Data center roles for achieving the goal of error-free and intrusion-free VPNs for unified control of standardized microgrid is a reality. The experimental setup (stage-2) of the lab at Humber College will validate the results obtained through simulation and emulation.

ACKNOWLEDGMENT

The author gratefully acknowledges the support of Aleksandr Melkumyan, Savdullah Kazazi and Hussin Hassan, Professors at the School of Applied Technology, Humber College in realizing the dream of interoperability standards lab at Humber College.

REFERENCES

[1] Bob Currie et. al., "Flexibility is key in New York," IEEE magazine. power and energy, vol. 15, No. 3, pp. 20-29, May/June 2017.

[2] Jesús Varela et. al., "The IGreen Grid Project," IEEE magazine. power and energy, vol. 15, No. 3, pp. 30-40, May/June 2017.

[3] Robert Sherick and Robert Yinger, "Modernizing the California Grid," IEEE magazine. power and energy, vol. 15, No. 2, pp. 20-28, March/April 2017. Technical Reports:

[4] Navigant Research, "Emerging IoT Business Models," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Jan. 2017.

[5] Navigant Research, "Energy Efficient Buildings Global Outlook," Navigant Consulting Inc., Boulder, CO, Tech. Rep., May. 2017.

[6] Navigant Research, "Energy Storage Software Aggregation, Assest Management and Grid Services," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Dec. 2016.

[7] Navigant Research, "FutureGrid India," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Mar. 2017.

[8] Navigant Research, "Microgrid Deployment Tracker 4Q16," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Dec. 2016.

[9] Navigant Research, "Net Zero Energy Buildings," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Dec. 2016.

[10] Navigant Research, "Smart City Services Market," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Apr. 2017.

[11] Navigant Research, "Smart Grid as a Service," Navigant Consulting Inc., Boulder, CO, Tech. Rep., Jan. 2017.

[12] M. Bindhu, "Performance analysis of traffic with optical broker for load balanced and multicasting in software defined data center networking," Ph.D. dissertation, Dept. Electronics and Communication. Eng., St. Peter's Institute of Higher Education and Research, Chennai, 2017.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018IJSRCSEIT | Volume 4 | Issue 2 | ISSN :2456-3307

Wind Turbine Concepts for Energy Efficiency in Buildings

Kaleeswari M[1], Madheswaran M[2], Vijaykumar K[3]
[1,2]Department of Electrical and Electronics Engineering, Mahendra Engineering College, Namakkal, India
[3]Department of Electrical Engineering, NIT, Jaipur, India

Abstract

This paper presents the various wind turbine technologies for energy management in buildings. Zero energy buildings are the buildings in which the total energy consumed by the whole building will be equal to the total energy that is produced or generated by those buildings using renewable sources of energy. The structure of building includes the wind turbines in its structure only so that the wind that is passing in the environment of the building can be used for energy generation purpose also for the building. This paper is emphasis on the zero energy buildings for development of the nation. Further, Building augmented wind turbines installed between two buildings are also discussed briefly in the manuscript.

Introduction

Conventional or non-renewable sources of energy are used since very long time as the sources of electricity. These Sources are not clean in nature. This means the sources emit carbon monoxide and create pollution to the environment. Along with this the non-renewable sources are limited. Due to these limitations of non-renewable energy sources, the focus of people is shifting from non-renewable or conventional energy sources to renewable or non-conventional sources of energy. People are moving towards renewable sources to save the conventional one for future use and save the environment from the impacts of non-renewable sources. Techniques and designs regarding the renewable sources are being developed. Renewable sources are those sources which are not conventional and are not being used before the time. Renewable sources include sun, wind, water, geothermal energy etc [1].

Using these sources as major sources of energy has become the need of time. To establish these sources are major sources for overall energy supply, various researches and developments are required. By using renewable sources, we are saving the environment from the pollution and also we can save the energy. So, energy conservation can also be one motivation for using renewable sources to produce energy.

Wind as a source of energy has become very popular and is continuously growing since last decade. The technologies and research work regarding wind turbines and wind energy generation are getting developed in fast rate. Many programs are started which promote the use of wind energy for energy generation. Incentives are provided for that. By this the energy market of wind has also increased levels. Apart from other sources the utility side generates electrical energy using wind energy and supply this electrical energy to other utilities or consumers. But the level and popularity of wind energy has risen so much that the wind energy is used by consumer side also for power generation. Small scale wind turbine technologies[2]-[8] are used for electricity generation at small level. Consumers can install wind turbine based plants on the rooftop of their buildings, homes or in front of the homes, buildings in open area etc. Simply, this can be said that the contribution of wind energy to the overall energy supply is very significant.

A lot of energy can be saved if the users install wind turbine based power plant on or in their buildings, homes etc. Energy conservation plans also promote the use of small wind turbines technologies. This initiative can take us towards zero energy building. Zero energy buildings are the buildings in which the total energy consumed by the whole building will be equal to the total energy that is produced or generated by those buildings using renewable sources of energy. So, putting up solar panels on the rooftops of the building, solar water heaters or putting small wind turbines on or in the buildings, can lead us to the creation of zero energy buildings.

In coming days, if we continue to use renewable sources of energy for energy production and we stop relying on conventional sources, we will be saving a huge amount of conventional sources as well as energy for future use.

Development in the wind turbines based technologies includes the development of small wind turbines. Using small wind turbines, one can trap or utilise the power generated for domestic purpose or the power which is generated on-site very effectively and very efficiently. Small wind turbines are very useful for the people and authorities who wish to install the wind energy based power plants in or on their homes and buildings to make them energy efficient[3]-[5].

Small wind turbines are very popular all over the world because of their many more advantages over other turbines. These turbines being of small sizes, require less space. So, they can be installed at the rooftops of the home or the buildings or they can also be installed at the open area in front of the homes and buildings. Small turbines can be used at small level for domestic as well as commercial purpose. Second advantage of using small small wind turbines for energy generation using wind's kinetic energy is that the small wind turbines have comparatively less visual impact than the other turbines. Birds and other animals don't find any difficulty by these small turbines. They are installed

closer to the ground because they have comparatively lesser height than the other larger wind turbines. So, the birds don't face any kind of difficulty due to these small size wind turbines in their path.

Having small sizes these wind turbines are put closer to the ground. They don't need higher wind speed to start producing energy. Modest level of wind speed that is found closer to the ground, is sufficient to start these type of generators to produce electrical energy. Large size wind turbines require a good and huge infrastructure and proper transmission and distribution system [6]-[7]. Whereas small wind turbines don't require any huge infrastructure for distribution and transmission lines because small wind turbines provide the on-site generation. Here there is no utility which is transmitting the electricity from generating end to the consumer end. Here the electricity is being generated very closer to the user end. So, there is no such concept of distribution also in the case of small wind turbines.

Wind energy based system having turbines of small sizes can be used as stand alone systems or they can also be connected to the grid. There has been a huge popularity of small wind turbines all over the world because of the advantages they are having. Technologies related to these small wind turbines are getting developed.

2 Vertical axis wind turbines

Vertical axis wind turbines (VAWT) are the wind turbines which have their shaft rotating vertically. The main difference between horizontal axis wind turbines and vertical axis wind turbines is of the axis of their shaft. Vertical axis wind turbines have their rotor axis vertically and also it rotates vertically. Two to three blades are mounted on that axis which rotates parallel to the ground. In vertical axis wind turbines, it is not necessary for the turbines to be pointed or faced to the wind because of the design of the blades the turbine is having. It can catch wind from any direction and use it for the power generation purpose. This is a benefit of using vertical axis wind turbines because we need not to put additional equipment for identifying the wind's direction, its speed etc. and for orientation purpose also. It can easily be used at the places where unpredictable wind direction and wind speed is the major issue.

The vertical axis wind turbines moves on the concept of drag whereas the horizontal axis wind turbines works on lift concept. Small wind turbines can be of both types - horizontal axis wind turbines and vertical axis wind turbines. Between both of these two, the horizontal axis wind turbines are most effective and efficient. Due to this reason these turbines are used mostly but having some disadvantages these turbines can not be used for residential purpose. so , here vertical axis wind

turbines come into picture. These turbines are the most popular turbines for residential purpose. Hence they can be installed at residential as well as commercial buildings.

This type of wind turbines are usually installed near the ground. They have some advantages over horizontal axis type of turbines. The major advantage out of all is that these vertical axis wind turbines don't need any kind of yaw mechanism in their design. Since, the axis of rotor mounted on the turbine rotates vertically and these turbines can sense the wind's direction and speed, there is no need to move the complete structure according to the wind. That is why no equipment related to yaw mechanism is added to these kind of turbine system. Another advantage is that they can be start with low value of wind speed in comparison with the horizontal axis wind turbines. They require small wind speed for startup purpose. Third advantage includes that the fact that the vertical axis wind turbines are generally small in size in comparison with the horizontal axis wind turbines. So, they can easily be located at the areas where the establishment of large sized wind turbines can not be installed such as on the rooftops of the buildings. If the height of the wind turbine is half the height of the building, then the efficiency of the wind turbine is maximum. The vertical axis wind turbines require less maintenance during the operation of the plant because of it's comparatively lesser sensitivity towards the wind speed any direction.

Apart from having these advantages the turbines of vertical axis type also have some disadvantages. These turbines need small wind speed to start and to generate electrical output. Due to this reason the turbines can not take advantage of high wind speed. Also they are installed closer to the ground so they utilise only small amount of wind speed. At the time when there is high wind speed, this turbine can generate high electrical output and increase the system performance. But being located closer to the ground, these turbines can not utilise that amount of wind speed and stay restricted to their small energy output. Another drawback of such type of turbines is that they use drag mechanism to generate electrical energy output. In the drag mechanism, the problem of turbulence occur which leads to the decrement in the energy output of the turbine. Because of the problem of turbulence, the actual energy output of the plant becomes lesser than the energy that is expected to be the output of the plant. Hence, the overall efficiency gets decreased. In the case of horizontal axis wind turbines, when the wind is there and it strikes to the blades, each and every blade moves and contributes in the production of energy. But in the case of vertical axis wind turbines, not every blade contributes to the power generation. Only few blades are able to generate the torque required for energy generation. This is the reason why the vertical axis wind turbines have lesser efficiency in comparison with horizontal axis wind turbines. When it comes to reliability, the vertical axis wind turbines have lesser reliability than the horizontal axis wind turbines.

Vertical axis wind turbines are getting developed nowadays. Vertical axis wind turbines of different size, different shapes, and different technologies have been developed. Mainly the vertical axis wind turbines can be divided into two parts - savonius wind turbines and darrieus wind turbines.

2.1 Savonius wind turbines

These are the turbines having the simplest design and easiest operation. This turbine runs on the drag principle. Since it uses drag principle to rotate and generate the electricity output, there will the case of turbulence in the turbine. Theis turbulence does nothing but reduces the efficiency of the turbine. So the fact that savonius type vertical axis wind turbines works on drag principle, makes them less efficient than the other vertical axis wind turbines or horizontal axis wind turbines. These turbines have blades of shape - 'S'. Due to this type of design and structure only the blades get sufficient drag to rotate even at the small speeds of the wind. As normal vertical axis turbines, these turbines are mounted or established near to the ground. So the can easily be started at small value of wind speed. Savonius wind turbines are installed at lower heights from the ground, so they can not take benefit of the wind having higher speeds. Even at higher wind speeds, the output generation of energy of these turbines will be limited.

2.3 Darrieus wind turbines

The darrieus type of wind turbines uses lift mechanism of the rotation of the blades. So they are lift type vertical axis wind turbines. The main thing about these types of wind turbines is that they have tip speed ratio greater than one. Tip speed ratio is the ratio from the blade speed to the wind speed. Thus the tip speed ratio is the measure that by what value of wind speeds how much the blade can rotate. Having tip speed ratio greater than one implies that for very small wind speed the blades start rotating with good speed. Darrieus turbine blades have the shape of eggbeater. The main drawback to these types of turbines is that they do not have the capability of getting self start. The savonius wind turbines have quicker starting then the darrieus one. To start the rotation of the blades, a very small sized motor having small ratings is used in darrieus wind turbines. So due to this motor the turbine blades gets sufficient speed and then according to the wind speed, it rotates. It has lower efficiency than the savonius wind turbines.

Many further developments have been made on darrieus wind turbines. H-shaped wind turbines, garlove wind turbines are some of the advanced version of the darrieus wind turbines, which have small differentiation in the design but the basic mechanism of lifting remains same in the advanced version also. Garlov darrieus wind turbines are the most advanced turbines in all and they have maximum efficiency amongst all the darrieus wind turbines.

3 Building Augmented Wind Turbines (BAWT)

Wind is used to generate electricity and meet the loads accordingly. To save energy in a particular building or to make that building an energy efficient building, one need to use energy efficient devices for the buildings. Other solution can be to use renewable sources for on-site energy generation and fulfilling the loads of that building using that energy generated by the renewable source. Out of the all, wind can easily be used for energy generation purpose for a building. Generating the energy on-site equal to the total energy consumption of the building, leads to the concept of zero energy building. To make a building zero energy building or an energy efficient building, small wind turbines can be installed on or around the buildings.

The technology has been grown so much that now the wind turbines are installed around or on the buildings but apart from this the design and structure of some buildings are made in such a way that the wind turbines are located within the building. These type of technologies and these turbines are called building augmented turbines. Here, the turbines are not installed separately but they are a part of the building itself. Building are designed and constructed accordingly.

These building augmented wind turbines can be of both types- the building augmented wind turbines having vertical axis and horizontal axis. The wind flowing around the building will strike to the turbine blades but also it will strike to the building and will create turbulence. Due to this turbulence we can not get the maximum efficiency from the turbine. So, the energy output that we will get from the wind turbine will now somewhat be lesser than the expected value of the energy output.

So, to overcome this problem and to get maximum efficiency from the turbine new concept came into picture. This concept says that the wind and the surrounding of the building interacts while the flow of wind. By this interaction between both of them, some air currents are generated at that place. These air currents are useful and can make the blades rotate. So, we should put or design our building in such a way that the wind turbines come in the area of this air current. This leads to the decrement in the effect of turbulence and hence the efficiency of the wind turbines gets increased by some percentage. Thus this thing must also be taken into consideration while designing the building structure and putting the wind turbines inside it.

The building structure includes the wind turbines in itself. So including these wind turbines, can be done in various ways. The wind turbines can be installed at the top of the building structure or it can be mounted in between two building or it can be installed at the edge of the building. According to these possible cases, the building augmented wind turbines are divided into basically three configurations. These configurations are as below:

1. Building augmented wind turbines that are installed close to the building
2. Building augmented wind turbines that are installed between two buildings.
3. Building augmented wind turbines that are installed within the air conducts inside the building.

All these three type of configurations are described below. Among all the three the third one is having maximum efficiency.

4 Building augmented wind turbines installed close to the building

In this type of category of building augmented wind turbines, the wind turbines are installed at the rooftops or at the edges of the buildings. The designs of the buildings are made such that wind turbines can be located at their rooftops or at the edges of the buildings. In this case the turbines are situated close to the building but in this case because they are close to the building, the air flow at the top of the building or at the corners of the building creates turbulence. This turbulence is the main reason for decrement in the efficiency of these types of wind turbines.

This problem of turbulence is very common in small sized wind turbine. To cope up this problem there is a solution regarding the design of the building. One can design the roof surface of the building curved. When the curved rooftops are designed for the buildings, the air flow will cause comparatively lesser turbulence and hence the efficiency gets increased. Another thing that can be done to remove the turbulence is that the wind turbines should be put in the areas where the air currents are generated. This air current leads to the turbulence free airflow and efficiency is increased.

This type of building augmented wind turbines have been installed in a building in london. The height of that turbine is around 150 meters from the ground. In present it is capable of generating 50 MWh energy per year. So, using such turbines and such advanced technologies the whole load of the building can be supplied using these building augmented turbines and a lot of energy can be saved by this. This increases the energy efficiency of the building also. Below is the Fig.1 by which one can easily understand how the airflow is there in these type of wind turbines. This shows how the turbulence is created and how curved surface can decrease the problem of turbulence.

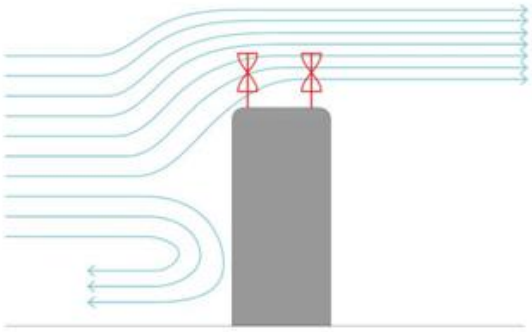


Fig. 1. Building augmented wind turbines closer to the buildings

5 Building augmented wind turbines installed between two buildings

In this configuration what happens is that the wind turbines are established between two buildings. The architecture of the building, their sizes, distance between them, angle between them all these constraints are taken into consideration and according to that the designing of the building and the wind turbines is done. The construction and angle between both the buildings is taken in a way so that the maximum wind flow can face the wind turbine and it creates minimum turbulence. The designing of the building and wind turbines according to that is a very tedious job itself.

Here, the shape of the gap between both the buildings is kept funnel shaped generally and the wind turbine is located at the second or small end of the funnel. Because of this shape the wind turbine gets maximum speed that can be possible in that area. Due to the small area the wind speed will be maximum at the turbine's side.

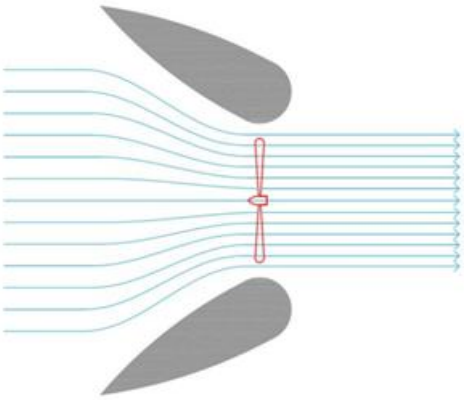


Fig. 2. Building augmented wind turbines between buildings

Here, in the Fig.2, the basic configurational design of buildings having wind turbines between them is shown. The place where the wind turbine is located has high pressure. So as a result the speed of the wind will also be high over that place.

6 Building augmented wind turbines installed within the air conducts inside the building

The last configuration that can be possible in the case of building augmented wind turbines is that the wind turbines can be located inside the building. When wind comes in the building for the ventilation purpose, at that time the wind interacts with the building environment. This interaction between both creates air conducts and the air flow increases due to this. This air flow created by this interaction is also helpful in removing the turbulence which is decreasing the turbine's efficiency.
Inside the building, the air flows from high pressure place to low pressure place. This difference in pressure causes wind to flow within the building. To utilise this complete air flow and the difference in pressure, the wind turbines should be placed in between these two different pressure places. So that the air strike the turbine and turbine starts rotating.

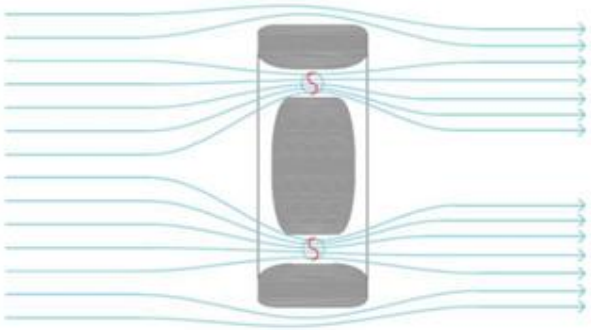


Fig. 3. Building augmented wind turbines inside air conducts throughout buildings

In the Fig.3, it can be seen that the turbines are placed in low pressure area. So according to bernoulli's theorem this place will have higher wind speed. This can be concluded by studying all the three configurations that the configuration having building augmented wind turbines inside the buildings will provide maximum efficiency in comparison with other two configurations.

7 Some other technical solutions for buildings

In present time, many new and advanced technologies for wind turbines have been introduced. Small wind turbines technology is developed. Wind turbines having various power ratings and various sizes are available in market.

Wind turbines that are used for building augmented techniques are also well established. But apart from all these technologies the wind turbines have some more other designs, having greater efficiency and more advantages than other one. Some out of these turbines are discussed below in this section. These types of turbines can also be used in buildings according to any of the three configurations mentioned above.

7.1 Darrieus and Gorlov wind turbine

Gorlov wind turbine is the advanced version of darrieus wind turbine. Being of advanced and developed design and technology, the Gorlov wind turbine has maximum efficiency among all type of darrieus wind turbines. Since they are the most efficient one, they are the only wind turbines that are able to generate the power output of 10 kW. This is the main advantage of Gorlov wind turbines. The basic principle at which Gorlov wind turbines work, is exactly the same as its main wind turbine from which it is developed i.e. darrieus vertical axis wind turbine.

Among turbines having same ratings and same sizes, the Gorlov wind turbine will provide the maximum energy output. Apart from these advantages, this kind of wind turbines has some disadvantages also. The major one amongst them is that they are inherently more breakable and having less strength than the savonius type wind turbine. Due to their structure they are not much capable of facing more wind speed and have less strength. This leads to a major limitation of these types of turbines.

Derrius turbines are generally made up of carbon steel, vetronite and steel, aluminum or aluminum with steel. Whereas, to construct the gorlov wind turbines mainly glass fiber is used. It focuses on glass fiber only but sometimes mixed with steel. Some of the companies that produce these types of wind turbines are UGE, venger wind, free tree etc.

7.2 Savonius wind turbines

The savonius type wind turbines are based on the mechanism of lifting for the rotation of the the turbine blades. These turbines don't follow the drag operation. This is why they have comparatively less turbulence and greater efficiency than any other drag operation based wind turbine. The savonius turbines are self start type turbines and can be start quickly in comparison to other darrieus and Gorlov turbines.

Savonius wind turbines are limited for wind speed. They can not exceed the wind speed higher than a fixed value. As a result their output is also limited. To start savonius wind turbines, high value of wind speed is required unlike the derrius or gorlov wind turbines.

Some producers that produce and install savonius wind turbines are Helix wind turbine, Venger wind, Turbina energy etc. Aluminum is the mainly used material that is used for the development of these type of wind turbines. Apart from that aluminum is also mixed with steel sometimes. Expanded

polyurethane, other polymers are usually taken for the construction of wind turbines which are of savonius type.

7.3 3D printing

Development in the technologies of the design and constructions of the wind turbines includes this main technology named 3D printing. It is very latest technology which helped in removing the constructional as well as some technical issues of the turbines blades. 3D printing is a manufacturing process. In this process a three dimension solid turbines blades are manufactured. By this process the design of the turbines blades are improved as well as the energy consumption by those blades decreases i.e. the losses decreases, which results in increased efficiency and power output generated. 3D printed wind turbines are generally of small sizes and small capacity. Recently a 3D based wind turbine is constructed which is able to generate electrical energy output of 600 watts. So these kinds of wind turbines can be useful for small purposes like charging the phone, laptops etc.

7.4 Invelox

Nowadays new invelox system based wind turbines are also into picture. This kind of technology consists of the single tower that can efficiently provide power to more than one turbine. Invelox is the only one technology that includes such structured turbines.

The main principle of invelox based wind turbines, at which they work is venturi effect. A invelox wind turbine has a different funnel shaped structure. First the wind enters the structure having omnidirectional input area. After that it enters the funnel shaped structure, which is having low pressure area. So, because of low pressure the wind speed gets increased as per the venturi effect. This enhanced wind speed is then provided to multiple turbine generators to convert that kinetic energy of wind into electrical energy. After the turbine generators, some diffusers are placed to again decrease the speed of wind according to the environment. This is how invelox wind turbines work. After discussing the working of these turbines it can easily be noted that these turbines require only small wind speed to get started because the wind speed will itself get increased due to the structure of the turbine itself.

7.5 Solar envy

Solar envy is a technology which is based on traditional schemes in which people used to decorate the walls of their homes using some different papers, materials etc. in this technology as the name suggests, the walls and corners of the building are covered with the solar cells which have conductive ink printed on them. These solar cells are designed in such a way that it collects the solar radiation

from the sun and provide electrical energy. These kinds of designs are preferable for buildings because they provide us a way for generating power but apart from that they also give pleasing look to the buildings. The first company which provided this concept of solar envy type wind turbines was SMIT. These solar envy based wind turbines take the energy from sunlight as well as wind and generates the electrical output.

7.6 Ewicon

Ewicon is another advanced technology for enhancing the efficiency of the wind turbines. In this technology wind turbines are taken that have no blades and no moving parts in it. Blades are always the main component for producing electricity. They produce electricity by rotating and transferring this rotational energy of wind to the turbine generator. Without blades these ewicon wind turbines generates electricity by using the droplets of charged water. So, we can say that in new emerging technologies like ewicon bladeless turbines are also invented.

Structure of ewicon consists of a frame made of steel. This frame consists of many insulate tubes which are placed in series with each other and horizontally. These tubes have many electrodes in them. These electrodes have job to emit water particles into the environment. The water particles are positively charged. In this type of wind turbines, the dependency of generated output power by the turbine is not only limited to the wind speed. Here the power output is dependent on the number of positively charged water droplets that are emitted by the electrodes.

8 Conclusions

Since non-renewable energy sources are moving towards depletion and are polluting the environment, the world is moving to renewable sources for energy production purpose. This movement has developed many technologies and many researches regarding using the renewable energy sources to increase energy efficiency and conserve the energy at domestic and commercial level. One of the ideas includes the installation of wind turbines in or on the building as well as installing them within the buildings. The structure of building includes the wind turbines in its structure only so that the wind that is passing in the environment of the building can be used for energy generation purpose also for the building itself. This will lead the complete world towards the concept of zero energy buildings in practicality. Each building can generate the energy required by the loads of that building by its own. In these type of building augmented wind turbines many things are need to be taken into consideration such as the size and distance between the buildings, the materials used for the buildings, the direction and intensity of the wind speed etc. According to that only a basic design of construction for buildings is developed and then the idea is implemented. Using these latest technologies the efficiency of the wind turbines gets increased. Along with the increase in energy efficiency of the wind turbines the new technologies include turbines blades having new and

innovative designs. Using these innovative and new designs the turbines blades give energy as the output at comparatively smaller wind speed. Apart from the building augmented wind turbines some other new technologies have also been developed till the date. These technologies include the 3D printed wind turbine, invelox based wind turbines, solar envy, ewicon etc.

References

1. Müller, Gerald, Mark F. Jentsch, and Euan Stoddart. "Vertical axis resistance type wind turbines for use in buildings." Renewable Energy 34, no. 5 (2009): 1407-1412.
2. Kaleeswari M, Madheswaran M., Binshad T and Vijayakumar K., "A modified power electronic converter topology for stand-alone photovoltaic power generation system," 2016 6th International Electric Drives Production Conference (EDPC), Nuremberg, 2016, pp. 158-163
3. T. Binshad, K. Vijayakumar, M. Kaleeswari, "PV based water pumping system for agricultural irrigation", Front. Energy, vol. 10, pp. 319-328, 2016.
4. K. Vijayakumar, R. Karthigaivel, N. Kumaresan and A. Arjun, "A Simple Feed Forward Controller for Stand-Alone Wind-Driven Permanent Magnet Synchronous Generator," 2009 Annual IEEE India Conference, Gujarat, 2009, pp. 1-4.
5. K. Vijayakumar, N. Kumaresan and N. Ammasai Gounden, "Speed Sensor-Less Maximum Power Point Tracking and Constant Output Power Operation of Wind-Driven Wound Rotor Induction Generators", *IET Power Electron.,* 8, (1), pp.33- 46, 2015.
6. Vijayakumar, K., Kumaresan, N., Ammasai Gounden, N.: 'Operation of Inverter Assisted Wind-driven Slip Ring Induction Generator for Stand-alone Power Supplies', *IET Electr. Power Appl.,* 7, (4), pp.256-269, 2013.
7. Vijayakumar, K., Kumaresan, N., Ammasai Gounden, N., Tennakoon, S.B.: 'Real and reactive power control of hybrid excited wind-driven grid-connected doubly fed induction generators', *IET Power Electron.,* 6, (6), pp.1197-1208, 2013.
8. Vijayakumar K, Kumaresan N, Bhagavan KA, Gounden NA. 'A DSP Based Closed Loop Controller for Power Smoothing Operation of Wind-Driven WRIG Systems', International Review on Modelling and Simulations. 2012;5(1):185-92.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Design and Implementation of Integrated Impedance Based Relay For Series Compensated Transmission Line

Mini P K, Dr. P Raja ,S. Venkata Hareesh K, Sujita Kumar Achary

Abstract

Distance Relays are unique devices used to protect the transmission line from various faults but, series compensation exerts influence on distance relays. Distance Relays are very sensitive to the apparent impedance seen by the relay and its zone. This paper presents a study about the installation of series compensation in the midpoint of the transmission line, and its effects on the operation of a conventional three-stepped distance relaying schemes that are used for the protection of the same transmission line. It also proposes and validates a new algorithm based on integrated impedance methodology to detect, locate and classify different types of faults in a series compensated EHV/UHV transmission line. Integrated impedance is defined as the ratio of the sum of voltage phasors across two ends of the transmission line to the sum of current phasors through two ends of the same transmission line. It is used in the identification of faults inside the protected line section.

Keywords: Series Capacitor(SC), Distance Relay, PSCAD, Integrated impedance

I. INTRODUCTION

Owing to the constraints of land availability, infrastructure and several environmental problems, it has become imperative to increase the existing power transmission capability of the contemporary power systems networks which is facing the scarcity of the power generation as compared to power demand. Flexible alternating current transmission systems (FACTS) technology opens up a new opportunity for controlling power and enhancing the usable capacity of existing lines. On the other-hand, implementation of FACT devices in existing power system produces dynamic instability into the power system. These dynamics can be; i) sudden variation in the line parameters such as impedance of the line, line current and power angle, ii) injection of harmonics and iii) Effect of transient behavior of control action into the power lines. These dynamic changes due to FACTS devices severely affect the setting of the existing protection scheme of the transmission line.

Transmission lines are used to transmit electric power to large distant load centers. These lines are exposed to faults as a result of lightning, short circuits, faulty equipments, mal-operation, human errors, overload, and aging. Many electrical faults manifest in mechanical damages, which must be repaired before returning the line to service. So the protection of the transmission line becomes essential one. The philosophy of protection is that a faulty section alone should be isolated and adjacent healthy section should not be disturbed. The protection system is expected to readily operate during faults and abnormal conditions and isolate the faulty equipment from the service, immediately. Fast detecting, isolating, locating and repairing of these faults are critical in maintaining a reliable power system operation.

There are various protection schemes employed in protection of transmission lines. Among this widely used scheme of protection is distance protection. Distance protection of a transmission line is reliable and selective form of protection for the lines where the line terminals are relatively far apart. Operation of distance relay depends on the predetermined value of voltage to current ratio and it is nothing but impedance.

The relay will operate only when the measured impedance of the line becomes less than the set impedance. Since the impedance of a transmission line is proportional to its length, for distance measurement it is appropriate to use a relay capable of measuring the impedance of a line up to a predetermined point called as reach point of the relay.

It was always recognized that ac power transmission over long lines was primarily limited by the series reactive impedance of the line. Series capacitive compensation was introduced decades ago to reduce a portion of the reactive line impedance and thereby increase the power transmittable capacity of the line. Subsequently, within the FACTS initiative, it has been demonstrated that variable series compensation is highly effective in both controlling power flow in the line and in improving stability. Series Compensation (SC) in transmission line introduces several problems like voltage and current inversion, sub-synchronous resonance (with mechanical system), ferro-resonance (with line inductance) and reaching problems (distance measurements). SC badly affects accuracy, selectivity and reliability of mho relay which leads to an unsecure power system. It is responsible for mal-operation of mho relays, particularly the reaching characteristic of the relay. In this project a new algorithm based on integrated impedance methodology is proposed to detect, locate and classify different types of faults in a series compensated EHV/UHV transmission line.

II. IMPACT OF SC ON DISTANCE PROTECTION RELAY

When a fault occurs in series compensated transmission line, it presents very complicated impedance characteristic and exerts influence on distance relay. Distance Relays are very sensitive to the apparent impedance seen by the relay and its zones. When a FACTS device say as TCSC is incorporated into the existing transmission line in order to improve the voltage profile, power flow, stability etc. it introduce problems in distance protection scheme in the measurement of the apparent impedance seen by the relay. Due to this significant change in the apparent impedance seen by the relay, it will lead to the mal operation of distance relay.

The major problems on relaying schemes on transmission line protection with series capacitors are those related to the voltage reversals, current reversals and over-reach. A voltage reversal will occur, for a fault near a series capacitor when the impedance from the potential location to the fault is capacitive rather than the inductive value. As a result, the voltage measured at relay location will be shifted approximately 180 degrees from the normal position.

A. *Current and Voltage Inversion:*

A current reversal is occurring when the current appears to be entering at one end of the line and leaving at the other, just as would occur during an external fault for an internal fault. That is possible only when the source impedance is less than the capacitive reactance.

This will cause difficulty for the distance protection to clearly identify the correct direction of the fault. This may be an impractical condition for a bolted fault due to the large fault current which rapidly bypasses the capacitors. However, in the case of faults with large fault resistance, the fault impedance can reduce the fault current below the bypass level.

B. Non-linearity of the line impedance:

In order to protect the series capacitor bank against transient over-voltages, the MOV is typically used. During the normal condition of the power system the MOV is not conducting. When a fault occurs the current in the series capacitor will increase, and so the voltage as well. When this voltage increases, the MOV starts conducting in order to protect the series capacitor. However, it should be noted that the MOV presents a non-linear behaviour, and the distance protection will see the measured impedance as a combination of RLC parameters. It must be mentioned that this behaviour depends very much on the level of fault current.

III. PROPOSED PROTECTION SCHEME

A. Integrated Impedance

Integrated impedance is the ratio of the sum of the voltage phasors at the two ends of the transmission line to the sum of the current phasors through the two ends of the same transmission line. The integrated impedance of the transmission line is used to determine the existence of the fault inside the protected line.

Fig.1 shows the system model with an internal fault at point F. Fig.2 shows equivalent circuit for fault with TCSC is in middle, where E_m and E_n are voltages of power sources at ends m and n, respectively. U_m, U_n I_m and I_n are the voltage and current phasors measured at ends m and n, respectively. I_{mc} and I_{nc} are currents through the equivalent capacitance at ends m and n, respectively. I_f is the current through the fault branch, and R_F is fault resistance. Z_m is the equivalent impedance of power source m, Z_n is the equivalent impedance of power source n. The transmission line is modeled as π equivalent circuit, and Z_{mc} and Z_{nc} are the equivalent capacitive impedances of the line. Z_{lm} is the line impedance from line end m to point F, and. Z_{ln} is the line impedance from end n to point F, and $Z_l = Z_{lm} + Z_{ln}$ is the entire line impedance.

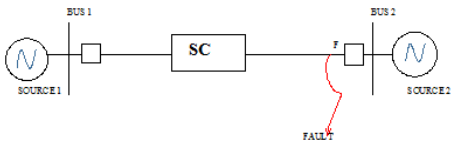


Fig. 1. One-line diagram of the system model

Voltage at both ends and current at both ends of the transmission line are used to find integrated impedance.Z_{cd} is defined as integrated impedance, which is

$$Z_{cd} = \frac{U_{cd}}{I_{cd}} \quad (1)$$

Where $U_{cd} = U_m + U_n$; $I_{cd} = I_m + I_n$ and I_{cd} is called differential current.

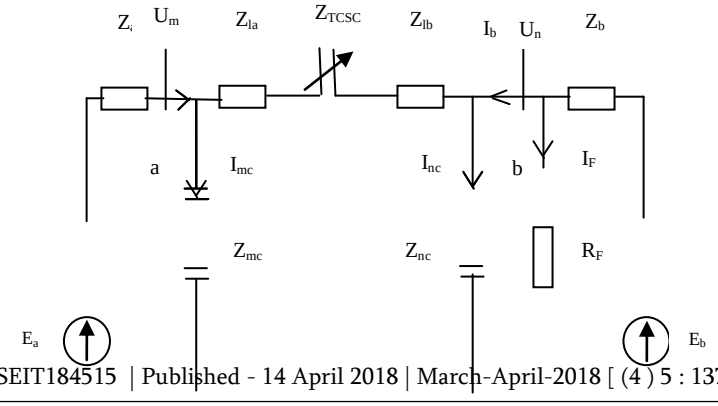


Fig. 2. Equivalent circuit for an external fault when TCSC is in the middle

Integrated impedance characteristics are depending upon series capacitor position. Integrated impedance is used to detect internal fault, so its characteristics are different for internal and external fault.

B. *Characteristics Of Integrated Impedance*

Variations in characteristics of integrated impedance in case of an external fault and internal fault for different TCSC placements are described as follows:

1) External fault:

a. TCSC installed in the middle of the line:

The differential current consists of only capacitive current when an external fault occurs. Fig.2 shows the system equivalent circuit with an external fault.

The differential currents of the line is

$$I_{cd} = I_m + I_n = I_{mc} + I_{nc}$$

$$= \frac{U_m}{Z_{mc}} + \frac{U_n}{Z_{nc}}$$

Where $Z_{mc} = Z_{nc} = \frac{2}{Y} = Z_Y$

The integrated impedance can be obtained

$$Z_{cd} = \frac{(U_m + U_n)}{I_{cd}} = \frac{2}{Y} = Z_Y \quad (2)$$

It can be concluded that when external fault occurs, the integrated impedance is equal to Z_Y, the sign of its imaginary part is negative, and its absolute value is large compared to the impedance of the power source and the line, and is independent of the Z_{TCSC}. The same conclusion can be drawn when the line is operating normally.

b. TCSC installed at one end of the line:

Assuming that TCSC is installed at end of the line, the equivalent circuit of the system is shown in Fig.3 when an external fault occurs.

As shown in Fig.3, the differential current can be obtained

$$I_{cd} = I_m + I_n = I_{mc} + I_{nc}$$

$$= \frac{U_m - (-Z_{TCSC} \times I_m)}{Z_{mc}} + \frac{U_n}{Z_{nc}} \qquad I_{cd} = \frac{U_m + U_{TCSC} + U_n}{Z_Y}$$

Where U_{TCSC} is the voltage drop while I_m flows through the TCSC.

$$U_{TCSC} = Z_{TCSC} \times I_m$$

Assuming the compensation level of TCSC is 50%, then

$$Z_{TCSC} = -0.5Z_l$$

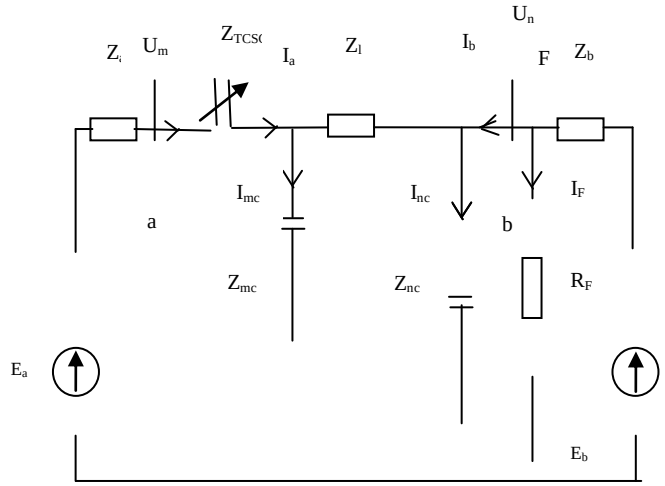


Fig. 3. Equivalent circuit for an external fault when TCSC is at the end

The integrated impedance can be obtained.

$$Z_{cd} = \frac{U_m + U_n}{(U_m + U_n + U_{TCSC})/Z_Y} = \frac{U_m + U_n}{U_m + U_n + U_{TCSC}} \times Z_Y \qquad Z_{cd} < Z_Y$$

In this case, the integrated impedance is smaller than the line capacitive impedance, but U_{TCSC} is relatively small. The absolute value of Z_{cd} is still large compared to the impedance of the power source and the line.

It can be concluded that irrespective of position of the series capacitor, absolute value of integrated impedance is larger for external fault.

2) Internal fault:

Variations in characteristics of integrated impedance in case of an internal fault for different TCSC placements are described as follows

a. TCSC installed in the middle of the line:

Assuming that TCSC is installed at middle of the line, the equivalent circuit of the system is shown in Fig.4 when an external fault occurs.

Assuming that the ratio of distance from the fault point to the end m to that of the entire line is p, then $Z_{lm} = pZ_l$, $Z_{ln} = (1\text{-}p)Z_l$.

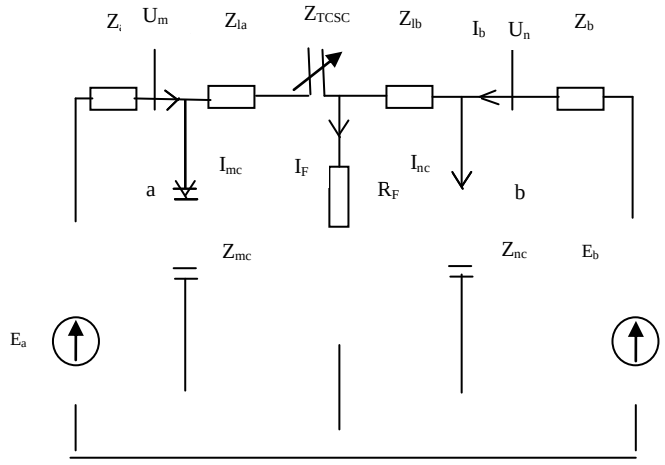


Fig. 4. Equivalent circuit for an internal fault when TCSC is in the middle

If the compensation level is 50%, $Z_{TCSC} = -0.5Z_l$

The impedances and are as follows:

1) $0 \le p \le 0.5$

$$Z_1 = Z_m + Z_{lm}$$

$$Z_2 = Z_n + Z_{ln} + Z_{TCSC}$$

2) $0.5 \le p \le 1$

$$Z_1 = Z_m + Z_{lm} + Z_{TCSC}$$

$$Z_2 = Z_n + Z_{ln}$$

Since $0 \le p \le 1$, $Z_m \le Z_1$ and $Z_n \le Z_2$ are always correct, Z_1 and Z_2 reflect the impedances of power sources and the lines of two ends m and n, respectively. When the capacitance of the line is ignored, the current through the fault branch is

$$I_f = U_{f0} / (R_F + Z_1 // Z_2)$$

Where, U_{f0} is the voltage at the fault point before the fault has occurred.

Let $U_{f0} = ke^{j\delta}(U_m + U_n)$ so

$$I_{cd} = I_m + I_n = I_{mc} + I_{nc} + I_f$$

$$= \frac{U_m}{Z_{mc}} + \frac{U_n}{Z_{nc}} + \frac{ke^{j\delta}(U_m + U_n)}{(R_F + Z_1 // Z_2)}$$

$$I_{cd} = \frac{U_m + U_n}{Z_Y} + \frac{ke^{j\delta}(U_m + U_n)}{(R_F + Z_1 // Z_2)} \quad (4)$$

Substituting (4) into (1), we can obtain

$$Z_{cd} \approx 1 \Big/ \left(\frac{1}{Z_Y} + \frac{ke^{j\delta}}{R_F + Z_1 // Z_2} \right)$$

$$Z_{cd} = Z_Y // \frac{R_F + Z_1 // Z_2}{ke^{j\delta}} \quad (5)$$

Generally, the coefficient k is about 0.5, and when the power system is under normal condition, the angle between the two equivalent power sources of the two ends of the line is less than 30^0, so $-15^0 < \delta < 15^0$. When bolted fault occurs inside the line, the current flowing into the line capacitance can be ignored because it is much less than the current flowing into the fault branch, so

$$Z_{cd} \approx \frac{R_F + Z_1 // Z_2}{ke^{j\delta}} \quad (6)$$

It can be derived from (6) that the integrated impedance Z_{cd} is related to the fault location and resistance, the power angle δ, the power-source impedances, and the line impedance. Fig. 5 shows the in the R-X coordinate diagram. It is easy to know from Fig. 5 (a) that the Z_{cd} stays in the first or second quadrant when fault without resistance or with small resistance occurs. The sign of the imaginary part of Z_{cd} is positive, and the value of the imagine part of Z_{cd} is small. Under the condition that R_F or δ is large, Z_{cd} may go into the fourth quadrant as seen in Fig. 5(b). The sign of the imaginary part of is negative, but the absolute value of its imaginary part is much less than $|Z_Y|$.

When a fault with large resistance occurs in the line, the influence of the line capacitance cannot be ignored. Because $Z_1 // Z_2 << R_F$ by ignoring $Z_1 // Z_2$ from (4.6) the following equation can be obtained:

$$Z_{cd} \approx \frac{1}{\left(\frac{1}{Z_Y} + \frac{k e^{j\delta}}{R_F}\right)} = Z_Y // \left(\frac{R_F}{k e^{j\delta}}\right)$$

So when a fault with large resistance occurs, Z_{cd} is equal to the impedance of the parallel connection of Z_Y with $\frac{R_F}{k e^{j\delta}}$. Obviously, the absolute value of the imaging part of the integrated impedance is much less than $|Z_Y|$.

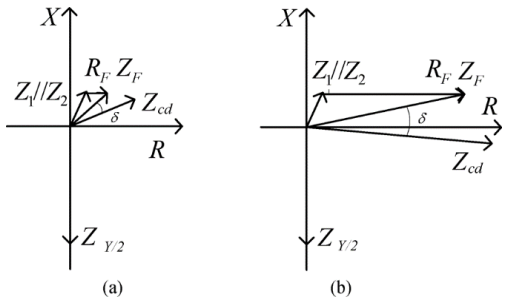


Fig. 5. Integrated impedance with an internal fault. (a) The sign of the imaginary part of is positive. (b) The sign of the imaginary part of is negative

b. TCSC Installed at one end of the line

Fig.6 shows the diagram of the equivalent circuit of the system model with an internal fault.

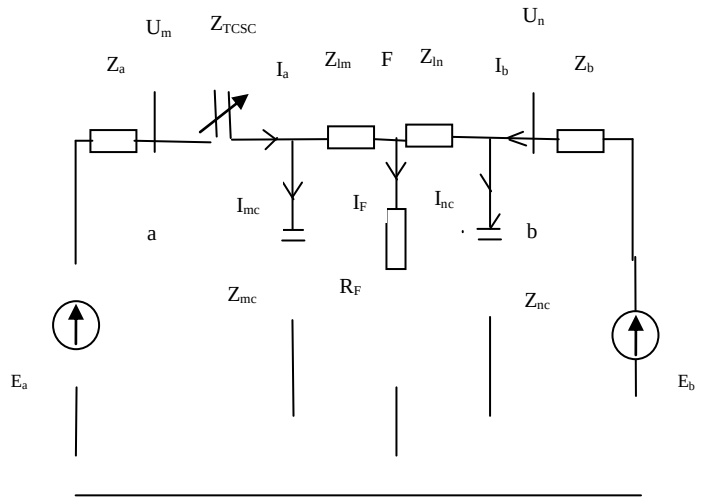


Fig.6. Equivalent circuit for an internal fault when TCSC is at the end

Assuming that the ratio of distance from the fault point to the end m to that of the entire line is p, then

$$Z_{lm} = pZ_l,\ Z_{ln} = (1\text{-}p)Z_l$$

If the compensation level is 50%, $Z_{TCSC} = -0.5Z_l$. The Impedances Z_1 and Z_2 are as follows:

$$Z_1 = Z_m + Z_{lm} + Z_{TCSC} = Z_m + (p-0.5)Z_l$$

$$Z_2 = Z_n + Z_{ln} = Z_n + (1-p)Z_l$$

From the analysis above, we can obtain

$$Z_{cd} \approx \frac{R_F + Z_1 // Z_2}{k e^{j\delta}}$$

Where Z_1 and Z_2 change with the different fault location as follows

1) When $0.5 \le p \le 1$, $Z_m \le Z_1$ and $Z_n \le Z_2$ are correct. Z_1 and Z_2 reflect the impedances of the power sources and the line of two ends m and n, respectively. Z_{cd} stays generally in the first or second quadrant. The sign of the imaginary part of Z_{cd} is positive. Under the condition that R_F or δ is large, Z_{cd} may move into the fourth quadrant, but the absolute value of its imaginary part is much less than $|Z_Y|$.

2) When $0 \le p \le 0.5, (Z_m - 0.5Z_l) \le Z_1$ and $Z_n \le Z_2$ are correct. When $Z_m > 0.5Z_l$, Z_1 reflects the impedance of the power source m and Z_2 reflects the impedance of the power source and the line of the end n. Z_{cd} with a positive imaginary part stays generally in the first or second quadrant, and the value of its imaginary part is much less than $|Z_Y|$.

3) When $Z_m < 0.5 Z_l$ and the fault occurs near the end m, the imaginary part of Z_1 will be negative, but Z_2 is still inductive and reflects the impedance of the power source and the line of the end n. In this case, Z_{cd} stays in the fourth quadrant, but the value of its imaginary part is much less than $|Z_Y|$.

From the above analysis it is clear that integrated impedance can be used to detect internal fault in a transmission line. For an external fault integrated impedance is a large value with a negative sign. But for an internal fault, integrated impedance depends on fault location, fault resistance, the power angle, the power source impedances and the line impedance.

IV. SIMULATION AND RESULTS

The proposed integrated impedance based algorithm for identifying the internal fault in an EHV/UHV transmission line has been modelled and tested using Power System Computer Aided Design (PSCAD) software. PSCAD is a Graphical User Interface (GUI) based professional's simulation tool for analyzing power systems transients. It is also known as PSCAD/EMTDC. Electromagnetic Transients Including DC (EMTDC) is the simulation engine, which is now the integral part of PSCAD.

A test system has been modelled in PSCAD/EMTDC and issues related to the series compensated transmission line has been analysed. An algorithm based on integrated impedance has been implemented and tested.

A. *Test System*

The overall simulation setup of the considered test system in PSCAD software is shown in fig.7. It is a doubly fed system of transmission line which is represented as a distributed nominal π-model.

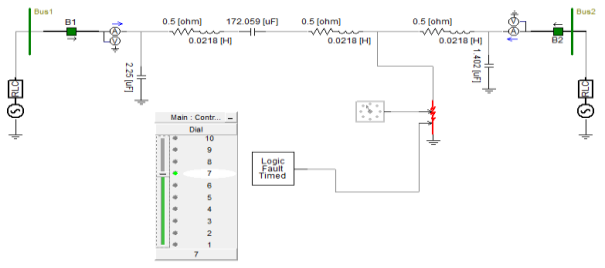


Fig. 7. Simulation diagram of test system in PSCAD

The parameters of the system shown in fig.7 is given in Table 1

Table.1. system parameters

Sl No.	Parameter/Devices	Rating/Range
1	System voltage	100 V, 50Hz
2	Source 1	100 V, 50Hz, $\delta=0^0$
3	Source 2	100 V, 50Hz, $\delta=0^0$
4	Transmission Line Parameter	R=0.01Ω/km, L=0.436mH/km, C=2.25μF/km Length: 100 km
5	Series Capacitor	50% Compensation

For the modeled system operating at 400 kV, an integrated impedance based relay is designed and tested under various constions.

B. Implementation Of The Integrated Impedance Based Relay

As discussed in chapter 4 the integrated impedance based relay algorithm is implemented as shown in fig.8. The overall system is divded into three subsystems for easy design and undestanding.

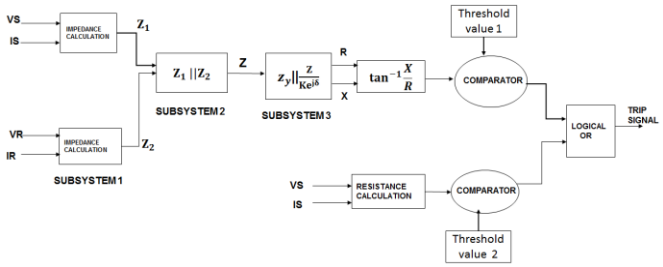


Fig. 8. Block diagram of proposed algorithm

1) Subsystem **1:**

Subsystem 1 calculates the impedance seen from both sides of the transmission line using voltage and current data measured at that location as shown in Fig.9. The magnitude and phase angle of positive, negative and zero sequence components of voltage and current have been extracted through FFT block in PSCAD.

Phase angle of positive sequence voltage and current is used to find the impedance angle. The subsystem1 estimates the impedances (Z_1 and Z_2) seen at both the ends of the transmission line. These impedances are given as inputs to the subsystem 2 shown in Fig. 10.

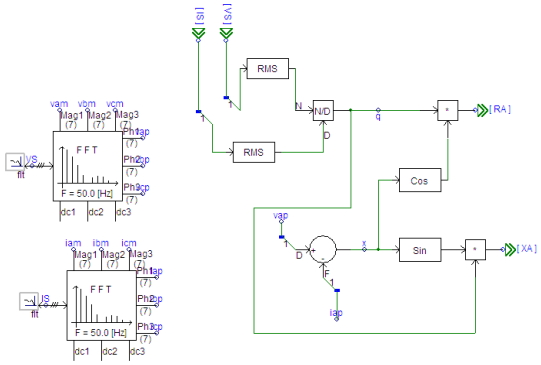


Fig. 9. Subsystem 1

2) Subsystem 2

Subsystem-2, shown in Fig. 10 calculates the parallel combination of impedances seen from both sides of the transmission line.

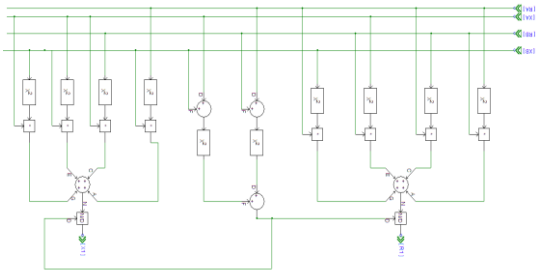


Fig. 10. Subsystem 2

The estimated impedances in subsystem1 are used for this computation in the subsystem2.

3) Subsystem 3

This subsystem is used to find the integrated impedance of the transmission line. The equation (7) is implemented in subsystem 3.

$$Z_Y \parallel \frac{Z}{k e^{j\delta}} \quad (7)$$

Where k=0.5, δ is the power angle, Z is the impedance obtained from subsystem2 and Z_Y is the capacitive impedance of the transmission line.

Then angle of impedance obtained from subsystem 3 is compared with a predetermined value and then relay is activated for internal fault. Fig.11 shows the simulation diagram for subsystem 3.

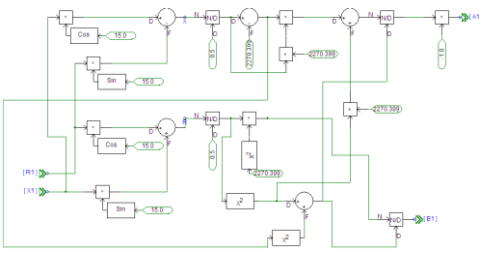


Fig. 11. Subsystem 3

For some cases according to the compensation level the fault has been wrongly detected. To rectify this problem an additional algorithm based on resistance is used.

C. Fault Location Algorithm

Fig.12 shows the block diagram of the fault location algorithm where VS, IS, VR and IR represents the voltage and current signals from both ends of the transmission line.

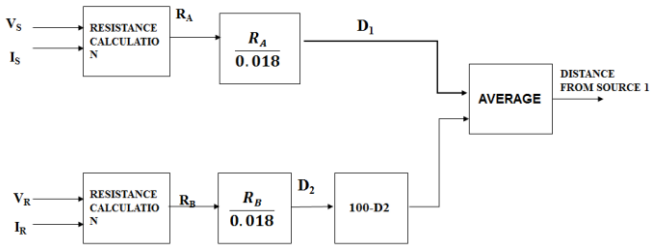


Fig. 12. Block diagram of fault location algorithm

Using voltage and current signal, resistance is calculated then it is dividing by per km resistance value of the transmission line. Average of the distance calculated from both sides is taken as location of fault.

D. Results

Relay based on integrated impedance methodology has implemented and effectively for different locations of fault in a series compensated transmission line. This algorithm is implemented to protect 80% of the transmission line.

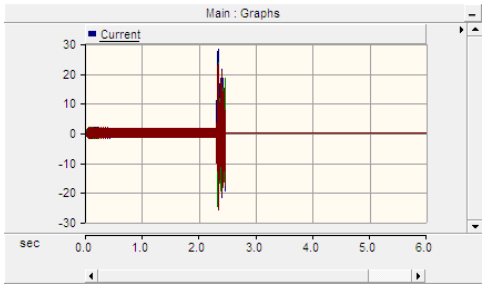


Fig. 13. Current waveform of the relay

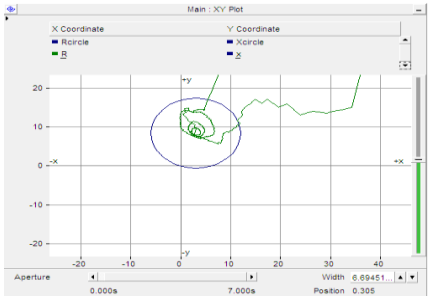


Fig. 14. Impedance trajectory of the relay for fault at 120 km

Trip signal and impedance trajectory of the relay for fault at 120 km of the transmission line is shown in fig.15 and fig. 14 respectively. Here also fault has given at 0.3 sec and trip signal is activated at 0.6 sec and

from fig. 14 it is evident that impedance trajectory is coming inside mho circle and the after clearing fault it is again going outside the circle.

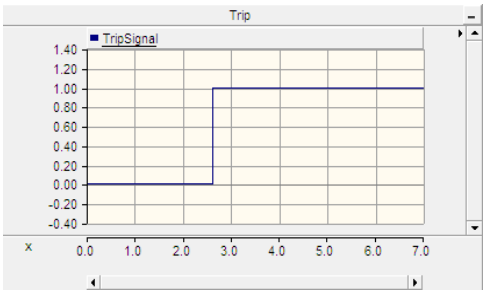


Fig. 15 Trip signal of the relay for fault at 135 km

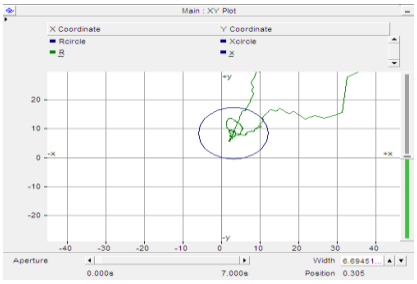


Fig. 16. Impedance trajectory of the relay for fault at 135 km

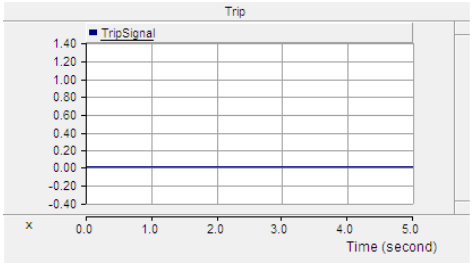


Fig. 17 Trip signal of the relay for fault at 135 km

Fig.17 and 16 shows the trip signal and impedance trajectory for fault at 135 km. Even though the mho characteristics shows that there is a fault in the transmission line, the relay is not detecting it because 80% of the transmission line is protected using angle criterion of the integrated impedance based algorithm.

Problems faced by the distance relay in a series compensated transmission line is analysed and Simulation of a typical power system with fault at different locations is carried out. Integrated impedance based relay is used to distinguish between internal and external fault. Angle of integrated impedance is used as a criterion for detecting fault and which is implemented in PSCAD.

V. CONCLUSION

Due to the presence of a complicated impedance characteristics in a series compensated transmission line, during the fault detection the conventional distance relay faces serious problem. In order to modify this drawback a different algorithm based on integrated impedance is presented in this thesis. The mathematical modeling of the relay has been extensively studied and presented in this thesis.

The designed integrated impedance based algorithm has been verified by the analytical simulation tool of PSCAD. The algorithm has been tested for a 400 kV doubly fed transmission system with 50% midpoint series compensation. The location of the fault is continuously varied from the relay location to the other end of the transmission line to validate the reach of the designed relay.

It has been identified that, simply magnitude estimation of integrated impedance will not help in detecting the fault after some fault location. Especially a fault at 90 km from the relay location is over-reached by the conventional integrated impedance method. The over-reach of the relay has been rectified by adding the angle of integrated impedance also a decision making quantity. This algorithm can have further future applications in the detection of unsymmetrical faults and zonal protection.

VI. REFERENCES

[1] Shien He, Jiale Suonan, and Z. Q. Bo, Senior Member, IEEE, "Integrated Impedance-Based Pilot Protection Scheme for the TCSC-Compensated EHV/UHV Transmission Lines", IEEE Transactions On Power Delivery, VOL. 28, NO. 2, pp. 835-844 ,APRIL 2013.

[2] Dash P. K., Ganapati Panda and S. R. Samantaray, "Fault Classification and Section Identification of an Advanced Series-Compensated Transmission Line Using Support Vector Machine", IEEE Transactions on power delivery, 22, pp. 67-73, 2007.

[3] Mohammad R. Dadash Zadeh and Tirath Pal S. Bains, "Supplementary Impedance-Based Fault-Location Algorithm for Series-Compensated Lines", IEEE transactions on power delivery, 31, pp. 334-342, 2016.

[4] Manoj Tripathy and Om Hari Gupta,"An Integrated Impedance Based Pilot Protection Scheme for SVC Compensated Transmission Line",2014.

[5] Pallavi M. Tonape, A. R. Thorat and M. M. Tonape, "Modified Design of Distance Relay for Series Compensated Transmission Line", International Conference on Circuit, Power and Computing Technologies, 2016.

[6] Chen D. S, X. Z. Duan, X. G. Yin, J. Yu and W. G. Wang, "The impact of TCSC on distance protection relay", in Proc. Int. Conf. Power System Technol.,. 1, pp. 382–388, 1998.

[7] Biswarup Das , Rudra Prakash Maheshwari and Urmil B. Parikh, "Combined Wavelet-SVM Technique for Fault Zone Detection in a Series Compensated Transmission Line", 23, pp. 1789- 1794,2008.

[8] Sanjay Dambhare, S. A. Soman and M. C. Chandorkar, "Adaptive Current Differential Protection Schemes for Transmission-Line protection", IEEE transactions on power delivery 24, pp. 1832-1841,2009.

[9] Hingorani, N.G., L.Gyugyi. Understanding FACTS concepts and technology of flexible AC transmission systems. New York: IEEE Press, 2000.

[10] Paithankar, Y.G. and S.R. Bhide. Fundamentals of Power System Protection. New Delhi: PHI Learning Private Limited, 2008

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018IJSRCSEIT | Volume 4 | Issue 2 | ISSN :2456-3307

Numerical Investigation on Electronic Cabinet with interrupted Fin heat sink using CFD

Lakshminarasimha N[1], Dr M S Rajagopal[2], Megaha Shukla[3]
[1,3]Assistant Professor, Mechanical Engineering Department, New Horizon College of Engineering, Bengaluru, Karnataka, India
[2]Professor and Chairman, Mechanical Engineering Department, Dayananda Sagar University, Bengaluru, Karnataka, India

ABSTRACT
Heat dissipation is one of the most challenging tasks in any product design more so in thermal design of Electronic Cabinets, as heat generated by these components may exceed its operating temperature limits leading to failure of components. Research shows that, for every 10^0C temperature rise above ambient temperature of the Cabinet, the life of the electronic components is reduced by half. Hence limiting the temperature of components below its operating temperature range becomes a major criterion in designing any electronic system. In this present work, CFD analysis has been carried out using ANSYS Fluent on Electronic Cabinet of size *358mm x 78mm x 252mm* consisting five heat sources with total heat dissipation of 150W. Cabinet is designed for two exhaust fans each of 48 CFM. The analysis is carried out by providing interrupted fin heat sink. The results of interrupted fin heat sink are compared with the results of continuous fin heat sink. It is found that nearly there is 2% reduction in the pumping power cost using interrupted fin heat sink due to lower pressure drop and also installing interrupted fin heat sink reduces the weight of the Electronic system. The result obtained for temperature rise in a Cabinetfound to be 3^0C which is below the threshold limit. Analysis results of temperature rise and inlet velocity was validated with analytical results and hence satisfies.
Keywords : Temperature rise, fin heat sink, CFD, ANSYS Fluent, Electronic Cabinet

I. INTRODUCTION

Electronic Cabinet provided with fan provides better cooling up to 10% than the Cabinet without fans, [1]. Also provision to fin heat sink increases the surface area in contact with cooling medium surrounding it. Heat sink is manufactured using most common materials such as Copper and Aluminium, since these materials have good thermal conductivity allowing heat to pass through it.

In present work,Cabinet is provided with exhaust fans andheat sourcepanel is provided with interrupted Aluminium fin heat sink to study the effect of cooling in maintaining the Cabinet temperature rise. The analysis is carried out using ANSYS Fluent as CFD tool provides optimum solution for an Electronic Cabinet thermal design.

II. LITERATURE SURVEY

Literature survey is carried out to understand state of art of work carried on Thermal Management of Electronic Cabinet and also to understand Selection of fans, Boundary conditions and Turbulent Models. The summary of the journals are as discussed below:

Hoffman Pentair Company, [1], [2003], this technical data sheet highlights the design parameters required in thermal design of an Electronic Cabinet. It provides the required basic parameters in selection of Fan and Calculating Temperature rise for a Cabinet.

MahendraWankede, et.al, [2], [2010], in this work the PCBS generating 100W is enclosed in an Aluminium enclosure. The experimental results are validated with analytical results. The results show that enclosure with fans provides 20% reduction in temperature than without fans.

Lakshminarasimha N, [3], [2015], this journal deals with the study on 150W generating heat source enclosed in an enclosure. The CFD analysis results are validated with analytical results. Journal highlights the analytical formulas required to calculate the temperature rise, Inlet velocity and Total heat transfer rate in an enclosure.

Bud Industries Inc, [4], [2007], this industrial data sheet provides overall thermal design aspects required for an Electronic Cabinet.

Though the present state of work is not similar to the literatures found as discussed above, the effort has been made to carry out the present work with available literatures.

III. METHODOLOGY

The step in analysis consists of Geometry, Meshing and Analysis; these are carried out using ANSYS Products and as discussed in the following sections.

A. Geometry

Fig. 1 shows the Geometry model of Electronic cabinet with interrupted fin heat sink. It consists of the following:

1. Five heat sources
2. Interrupted fins in 10 rows
3. Back plate
4. left side Cabinet opening as inlet
5. Two exhaust fans at right side of the Cabinet

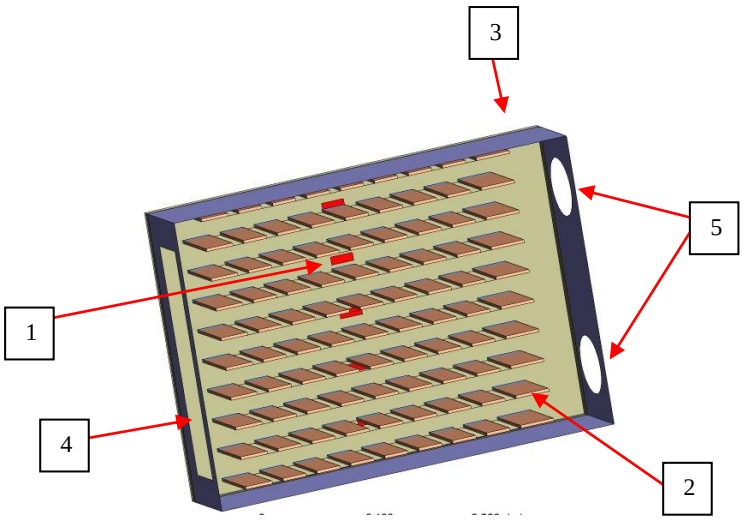


Fig.1: Electronic cabinet with interrupted fin heat sink

B. Meshing

The model is meshed with Hexagonal elements. It consists of 133690 elements. Fig. 2 shows the cut plane of the Hexagonal meshed model.

Fig.2: Cut plane of Hexagonal meshed model

Fig. 3 shows the mesh convergence plot. The Residual monitors for continuity, momentum, k and epsilon are maintained to be 1e-3 and for energy maintained to be 1e-7. The results are converged at 87 iterations (see Fig. 3).

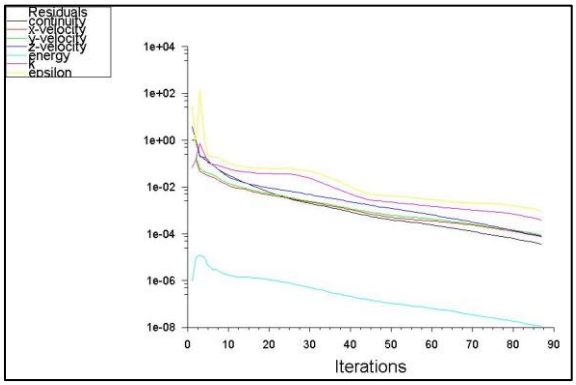


Fig. 3: Mesh convergence plot

C. Solution Methodology

The Electronic enclosure is with uninterrupted fin heat sink and with two exhaust fans of 48 CFM *(see eqn. 1)*. The heat sources are with heat flux boundary condition generating total heat of 150W. The walls are with no slip condition andthe flow is considered to be incompressible and turbulent. Since flow is turbulent, k-epsilon turbulent model is solved for obtaining results and SIMPLE discretization scheme is used to solve for turbulent parameters and momentum equations.

The total air flow requirement for the Electronic Cabinet in CFM, [4] is calculated using eqn.1 and temperature rise in a cabinet is calculated using eqn. 2.

Total CFM = $(1.76 \times Q)/\Delta T$ …….. eqn. 1

$$\Delta T = \frac{Q}{\dot{m}\, C_p} \quad \text{…….. eqn. 2}$$

$\dot{m} = \rho \times A \times V$ ……... eqn. 3

Where,

Q= Total heat dissipated in a cabinet in Watts

$\dot{m}$= mass flow rate in kg/s

ρ= Density of air= 1.2 kg/m^3

A= Area of inlet/outlet in m^2

V= Velocity at inlet or outlet in m/s

C_p= Specific heat of air = 1005 J/kg. K

ΔT = Temperature rise in ℃

IV. MATHEMATICAL MODEL

In Fluent, each and every elements of the meshed domain are converged for continuity, momentum and energy equations. Since the flow is considered to be turbulent, two more equations are converged i.e. k- epsilon turbulent equation model, where k is the turbulent kinetic energy and epsilon is the turbulent dissipation rate, [5].

The advantages of k- epsilon model, [6] are:

- simplest turbulent model as it requires only initial/boundary condition for solution
- Most widely validated and well established
- Wide application in industrial relevant flows with excellent performance

The limitations of k- epsilon model, [6] are:

- More expensive
- Poor performance for rotating, swirling and curved boundary flows

V. RESULTS DISCUSSION AND VALIDATION

The analysis and analytical results obtained for velocity, temperature, Temperature rise and pressure for Electronic Cabinet are discussed in this section and as follows:

A. Velocity contour, vector and stream line plots

Fig. 4 shows the velocity contour plot for an Electronic cabinet with interrupted fin heat sink. The maximum velocity of 13.37m/s was found at outlet. The velocity contour plot for an Electronic cabinet with continuous fin heat sink (not shown) shows maximum velocity at the outlet similar to Electronic cabinet with interrupted fin heat sink and its velocity found to be 13.01 m/s.Also for both the cases the inlet velocity was approximately found to be 6 m/s.

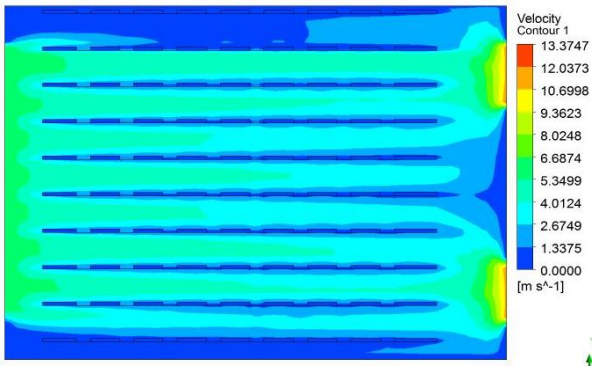


Fig. 4: Velocity contour plot for an Electronic cabinet with interrupted fin heat sink

Fig. 5 and Fig. 6 shows the vector and stream line plot for an Electronic cabinet with interrupted fin heat sink; it signifies the direction of flow of the fluid and captures the circulation zones in the domain.

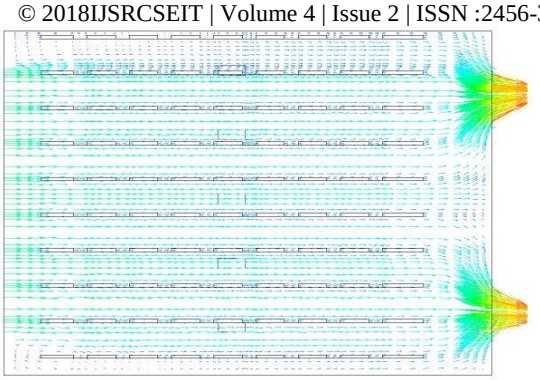


Fig. 5: Vector plot for an Electronic cabinet with interrupted fin heat sink

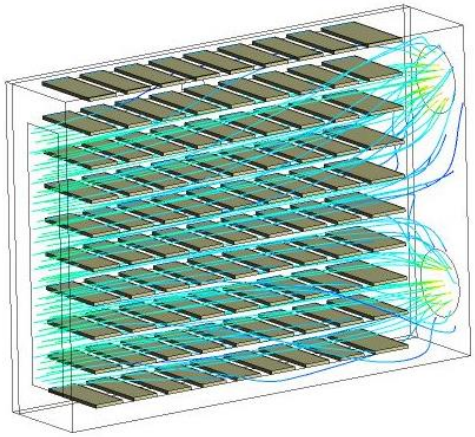


Fig. 6: Stream line plot for an Electronic cabinet with interrupted fin heat sink

Also analytically the result is validated for inlet velocity of the cabinet using eqn. 4. Analytical result shows inlet velocity of 5.64m/s and hence satisfies the analysis result.

Considering flow to be incompressible Applying continuity equation for inlet and outlet of the cabinet,

$A_iV_i = A_oV_o$ …….. eqn. 4

Where,

A_i and A_o are the areas of inlet and outlet in m^2

V_i and V_o are the velocity at inlet and outlet in m/s

B. Temperature contour plots

Fig. 7 shows the temperature contour plot for an Electronic cabinet with interrupted fin heat sink. The maximum temperature of 51.12^0C was found at heat source. The temperature contour plot for an Electronic cabinet with continuous fin heat sink (not shown) shows maximum temperature at the heat source similar to Electronic cabinet with interrupted fin heat sink and its temperature found to be 45^0C.Comparing both the cases, there is an increase in the temperature of heat source about 6^0C for an Electronic cabinet with interrupted fin heat sink.

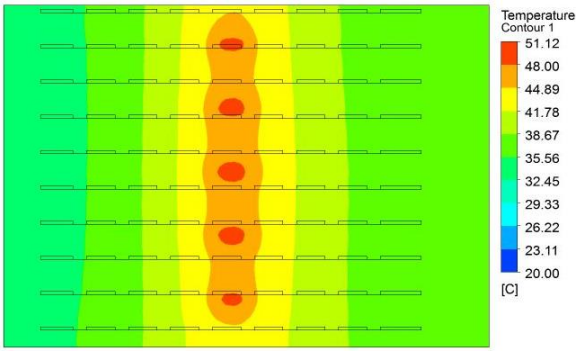


Fig. 7: Temperature contour plot for an Electronic cabinet with interrupted fin heat sink

C. Temperature rise

Fig. 8 shows the Temperature contour plot highlighting temperatures at inlet and outlet of the cabinet with interrupted fin heat sink. The inlet temperature was found to be 20^{0}C andoutlet temperature approximately found to be 23^{0}C. Therefore temperature rise in a cabinet is about 3^{0}C. Also, temperature rise in a cabinet is calculated analytically using eqn. 2 and result shows the temperature rise of about 2.8^{0}C and hence satisfies the analysis result. The result obtained for temperature rise for the cabinet with continuous fin heat sink is same as the result of cabinet with interrupted fin heat sink.

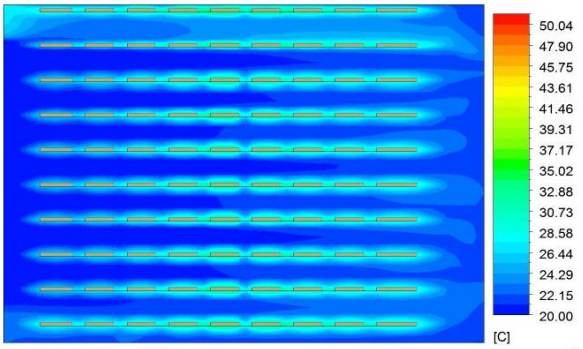


Fig. 8: Temperature contour plot highlighting temperatures at inlet and outlet of the cabinet with interrupted fin heat sink

D. Pressure results

The pressure contour plots were plotted for both Electronic cabinets with interrupted and continuous fin heat sink, the result obtained are tabulated as shown in Table 1.

TABLE 1
PRESSURE RESULTS AND PUMPING POWER REQUIREMENT

Cabinet type	**Inlet pressure (p_i) in N/m^2**	**Outlet pressure (p_o) in N/m^2**	**Pressure drop (Δp) in N/m^2**	**Pumping Power requirement (W)*(see eqn. 5)***
Cabinet with interrupted fin heat sink	-24.39	-97. 59	73.19	3.29
Cabinet with continuous fin heat sink	-18.63	-93.34	74. 701	3.36

In order to pump fluid in a steady state, the power requirement, [7] is given and calculated by:

Power= $\int v\, dp = \frac{\dot{m}}{\rho} \Delta p$ …….. eqn.5

Where, Δp is pressure drop= $p_i - p_o$ in N/m^2,

$\dot{m}$ is mass flow rate in kg/s, ρ is density of fluid in kg/m^3

From Table 1, it can be observed that there is 2% reduction in pumping power cost for the cabinet with interrupted fin heat sink as because there is reduction in pressure drop for the cabinet with interrupted fin heat sink compared to Cabinet with continuous fin heat sink. The pressure contour plot forthe cabinet with interrupted fin heat sink is as shown in Fig. 9.

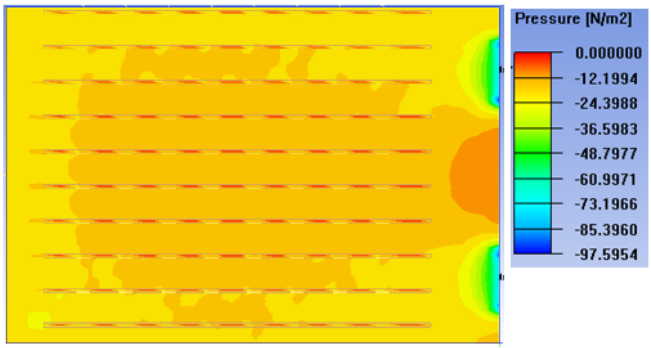


Fig. 9: Pressure contour plot for the cabinet with interrupted fin heat sink

VI. CONCLUSION

CFD Analysis was carried out for the Electronic cabinet with interrupted and continuous fin heat sink and results obtained for the velocity, temperature, temperature rise and pressure were plotted and compared between both. Also the analysis results of temperature rise and inlet velocity is validated analytically and hence satisfies. Comparing results of velocity shows negligible difference among both the cases, where as temperature results shows that there is increase in temperature of heat source by 6^0C for an Electronic cabinet with interrupted fin heat sink. Though there is increase in temperature, the temperature rise of both the cabinets was found to be same and it is about 3^0C which is below 10^0C. Also pressure results were plotted, it was found that there is a reduced pressure drop for the Electronic cabinet with interrupted fin heat sink and therefore there is reduction in pumping power cost compared to Electronic cabinet with continuous fin heat sink. Also installation of interrupted reduces the overall weight of the Electronic system.

Interrupted fin heat sink can be recommended for requirement of lower pumping power cost but not recommended for lower operating temperature application, as there is increase in heat source temperature and continuous fin heat sink can be recommended for applications where there is requirement of both lower pumping power cost and lower operating temperature.

CFD tool is very effective in determining the velocity, temperature and pressures for Electronic cabinet problems and these results obtained become a ready reckoner for beginner engineers in decision making in provision to fins. Present work is not exhaustive; it can be extended further for different cases of analysis by varying fin numbers, fin shapes, fin size, and changing fan locations. Also analysis results can be experimentally validated.

REFERENCES

[1] Hoffman- A Pentair Company, "Heat dissipation in Electrical enclosure", "Technical information on Thermal Management of Electrical enclosures", ©2003 Hoffman Enclosures Inc.

[2] MahendraWankhede, VivekKhaire, Dr. AvijitGoswami and Prof. S. D. Mahajan, "Evaluation of cooling solutions for outdoor electronics", *Journal on electronics cooling from electronics-cooling.com*, Volume 16, No. 3, Fall 2010

[3] Lakshminarasimha N, "Numerical Investigation of forced convection cooling of Electrical enclosure using CFD", *Journal of Engineering Research and Applications*, ISSN: 2248-9622, Vol. 5, Issue 11, (Part - 5) November 2015, pp.62-66

[4] Bud Industries, Inc., "Enclosure Design Tips Handbook", July 2007, © Bud Industries Inc.

[5] ANSYS Fluent User Guide, Release 15.0, Nov. 2013 and ANSYS Fluent 12.0, Theory guide, April 2009

[6] H K Versteeg and W Malalasekara, *"Computational Fluid Dynamics- Finite Volume Method"*, Text book of CFD, edition 1995

[7] R. K. Rajput, "*Heat and Mass Transfer*", Text book edition 2009-2010

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Cloud Drops

Sanjuna P Honnikoppa, Rajeshwari Banni, Pavana Baligar, Arunkumar Joshi
Department of Information science SKSVMACET, Laxmeshwar, Karnataka, India

ABSTRACT
Cloud Drops is a pervasive awareness platform that integrates virtual information from the web more closely with the contextually rich physical spaces in which we live and work .Cloud drops consists of many interactive stamp sized displays, each showing a tiny bit of digital information .The large number of displays and their small size allows the user to flexibly instrument, orchestrate and reconfigure the personal information environment. They show different form factors for stamp sized displays, provide a device concept and a fast implementation.

I. INTRODUCTION

People intensively use physical space for accessing and remembering paper bound information. Transforming large parts of the formally physical information environment into the digital realm has its obvious advantages that cannot be underestimated, but this also comes at a cost: we are giving up the notion of having an information item at a meaningful place and of using our entire surroundings for managing information. Recent advances in pervasive display technologies enable high resolution yet tiny, stamp sized touch displays that include processing power and networking capabilities. These self contained devices are capable of displaying tiny information bits while being tangible and highly mobile, such that they can be situated at virtually any location. This opens up a physical design flexibility for awareness systems, which largely overcomes the possibilities of using a handled device or a static installation. The end user can flexibly arrange the set of stamp sized displays, locate them at meaningful places and thereby easily instrument, orchestrate and reconfigure his or her personal information environment, to stay aware of digital information. However, making use of such tiny displays for awareness applications poses various challenges.

This includes questions of how the content should be mapped to displays, how it should be visualized on the tiny displays, and how the user can interact with the content .It is also unclear how several displays can be used in concert and how displays can be combined with the physical aircrafts to support situated awareness .We address these challenges and contribute cloud drops , an interactive awareness platform that consists of many stamp sized displays, which provide awareness of websites, contacts and places. The end user can scatter throughout the architectural space, to ensure each piece of information is available at a meaningful physical location.

Each display represents one user defined digital entity: a web page, contact or place. In addition they provide lightweight interactions.

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

II. PROPOSED SYSTEM

The proposed system provides different form factors based on six dimensional holistic view on the platform:
*Stamp sized pervasive displays , provide a device concept and a first implementation.
* Provide visualizations and interactions for web pages and web applications that are tailored to the tiny display size. It also shows how cloud drops can support synchronous and asynchronous communication with remote persons.
* Show concepts for associating digital contents.
*Demonstrate rich possibilities the platform is enabling by showing a set of activities and applications.

III. DESIGN CONSIDERATIONS

- ✓ The design of an awareness platform consisting of stamp sized displays that are situated in architectural space offers degrees of freedom in various dimensions. In this section it provides an overview of the main design dimensions, which are used as the foundation for the cloud drops platform.
- ✓ Cloud drops come in variety of shapes and sizes. The size of the display results as a trade-off between mobility and the amount of content that needs to be displayed.
- ✓ Custom shapes for cloud drops allow for novel affordances but also can provide a symbolic meaning.
- ✓ Cloud drops represents dynamic digital content such as websites, documents or contacts. Thereby each individual content is represented as a separate cloud drop.
- ✓ This allows the user to flexible attach each item on a physical place. In other direction it makes a physical place accessible remotely to provide situated messaging and communication.

The three ways in which cloud drops can be associated with content is as follows:

1. Content from a nearby device with a larger screen is associated with a cloud drop by using a simple gesture.
2. The cloud drop recognizes the object or surface it is attached to and displays dynamic situated information related to this object or surface.
3. Content is defined by one or more cloud drop in the proximity, which together form a group.

The concept of cloud drops can work in two prototype versions. Each emphasizes different aspects of the concept of a cloud drop. In order to visualize and interact with the information from the cloud, a cloud drop contains a small touch sensitive display. The display is big enough to show a small piece of information, which can be consumed at a glance

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

IV. IMPLEMENTATION

In prototypical implementation, each cloud drop has a full color touch sensitive screen with a diagonal of 1.5 inches and a resolution of 160x160px. It features a 600Mhz processor, a built in accelerometer and WIFI connectivity and an RFID tag attached. All cloud drops are connected to a central server. Other computing devices recognize a nearby cloud drop using an RFID reader. This implementation is compatible with standard web protocols and major application platforms and cloud drops can display and interact back with the content from web pages, gmail , skype etc.

V. CONCLUSION

It provides a platform for situated awareness of and interacting with web based information. This shows that by scattering cloud drops throughout the architectural space, people design a highly personalized and highly localized physical/digital information environment that supports awareness of persons, websites and applications as well as interpersonal communication. Future work should be examined in more detail that how people use tiny displays in architectural space over extended periods of time.

VI. REFERENCES

[1]. Back, M., Matsumoto, T. and Dunningan, A.: Prototyping a tangible tool for design: Multimedia epaper sticky notes. Journal of Artificial Intelligence for Engineering Design, Analysis and Manufacturing. 2009.

[2]. Bi, X., Grossman, T., Matejka, J., & Fitzmaurice, G.: Magic desk: bringing multi-touch surfaces into desktop work. Proc. CHI ’11.

[3]. Dey, A. K. and Guzman, E.: From awareness to connectedness: the design and deployment of presence displays. Proc. CHI '06.

[4]. Dourish, P., and Bly, S.: Portholes: supporting awareness in a distributed work group. Proc. CHI’92.

[5]. Elliot, K., Neustaedter, C., and Greenberg, S.: StickySpots: using location to embed technology in the social practices of the home. Proc. TEI’07.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Real Time Notice Board Using Raspberry Pi 3

Prof. Nirosha H, Lata S G[1] Soumya I[1], Vinayak Bandagar[1], Y Rashmi Y J[1] , Prof.Nirosha H*[2]

[1]Smt.kamala and Sri.Venkappa M.Agadi College of Engineering & Technology, Department of Electrical And Electronics Engineering, Karnataka , India

[2]Asst Professor, Department of EEE, SKSVMACET, Karnataka , India

ABSTRACT

The era of mobile technology opens the windows to the android app. Traditionally notice board is all about sticking information, but sticking various notices day to day is a difficult process. This project is designed to develop a PC controlled scrolling message display for notice board. This system can be implemented in many important places where latest information can be displayed. The websites are disappearing and the mobile phones are prominent. It's the time to change from conventional websites and other things to apps, which has become the part of our daily routine. We are introducing "VoiceTotext.apk" the android application software which would convert the voice to text. It works on all android platforms, but also it can work with a working internet. Our multipurpose program is considering the user as an Albertan or non Albertan, student or parent, faculties or office staffs individually. Project gives a total solution to everyone. It gives us more comfort and a better user interface later on Students can interact with Google directly. Latest news and updates is got through the application.

Keywords: Raspberry Pi 3, Micro controller

I. INTRODUCTION

We come across situations where we need to urgently need to display notices on a screen. For areas like railway stations and other such busy facilities the station master/announcer need not have to type in every announcement message manually on the screen. So here we offer an innovative Android based notice display system which allows the user to display the notice without typing manually. Here the announcer/administrator may speak out the message through his/her android phone, the message is then transferred wirelessly and displayed on the screen. To demonstrate this concept we here use an LCD TV screen to display messages.

II. THE MAIN OBJECTIVES

- For displaying day to day information continuously or at regular intervals during the working hours.
- It offers a flexibility to display flash news or announcement faster than the programmable system.
- To allow only authorized user to access various function and processed available in the system.
- Provide greater speed and reduced time consumption.

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

III. METHODOLOGY

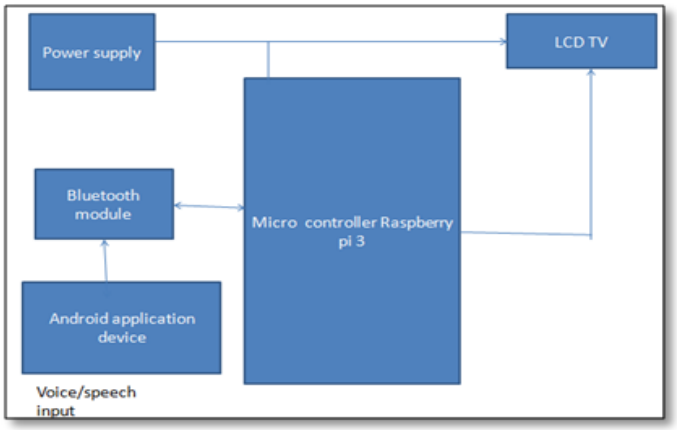


Figure 1. Block diagram of digital Notice Board

The LCD TV is interfaced with an 8051 family micro controller. Bluetooth receiver is used to receive Android-transmitted messages, sent them to the Microcontroller for decode and further into the process. The microcontroller then displays the message on the LCD TV screen. Use of this notice board system can be used in various places including railway stations, schools, colleges, offices to Display emergency announcements on screen instantly, instead of typing the message at all times. So that voice based notice board project is very useful in different organizations. Bluetooth is inbuilt in raspberry pi 3. Program is written in raspberry pi 3 using python language.SD card is installed in the Bluetooth module. "VoiceToText.apk" app is used to convert voice to text. The message to be displayedon notice board can be text or voice. That app is installed in the mobile. Only authorized person can operate this app.

IV. COMPONENTS

Figure 2. Raspberry Pi-3

i) HARDWARE REQUIREMENTS

- Raspberry pi 3
- Bluetooth module
- Android application device
- LCD TV

A.RASPBERRY PI 3

It is a series of small single-board computers. It has on-board Wi-Fi, Bluetooth, and USB boot capabilities. Processor speed ranges from 700MHz to 1.4 GHz, on-board memory ranges from 256MB to 1 GB RAM. SD cards are used to store the operating system and program memory.

B.BLUETOOTH MODULE

It has a class-2 Bluetooth module with serial port profile, which can configure as either Master or slave. A drop-in replacement for wired serial connections, transparent usage. It can be simply used for a serial port replacement to establish connection between MCU, PC to embedded projects and etc.

Specifications:

Frequency: 2.4 GHz ISM band
Speed: Asynchronous: 2.1 Mbps (max)/160 kbps, synchronous: 1Mbps/1Mbps
Power supply: +3.3 VDC 50 Ma
Working temperature: -20~+75 Centigrade
Dimension: 26.9mm*13mm*2.2mm
Profiles: Bluetooth serial port

C. ANDROID APPLICATION DEVICE

Here android phones are used and application is installed. It allows the user to display the notice without typing manually. Here the announcer or administrator may speak out the message through his/her android phone, then message is transferred wirelessly and displayed on the screen.

D.LCD TV

LCD TV is used to display the messages which are sent by the authorized person. It is interfaced with an 8051 family microcontroller through HDMI port.

ii) SOFTWARE REQUIREMENTS

- **Python:** Python is widely used high-level, general- purpose and dynamic programming language. Its design emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. Python is a widely used high level programming language. Python is preferred to code in Raspberry pi 3.

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

- **Android app:** "VoiceToText.apk" is used to display the messages on the screen.

V. ADVANTAGES

- It is easy to design and manufacture as all the components are easily available.
- The use Android mobile increases its scope of application and modification.
- It has low cost of manufacturing and no need of lengthy wires.
- The messages displayed can be saved.

VI. APPLICATIONS

- **Schools and colleges:** The way of communicating to students is convenient compared to traditional method.
- **Hospitals:** Avalibility of doctors on the particular day can be displayed & the facilities available in the hospitals can be conveyed clearly.
- **Hotels:** Menu can be displayed, special dishes on the particular day can be displayed, vacancy of rooms can be displayed.
- **Railway stations:** The passenger would learn the arrival and departure of the train. Arrival of train with platform number can be displayed

VII. CONCLUSION

Using this project papers can be avoided, reduces human effort usage in definite purpose areas.This Project is calibration of software and hardware through which most of the complicity reduces.Only Authorized user can display information.Digital notice board system created can be used for many practical purposes in various companies like in construction companies and research areas, hospitals, railways, colleges.

VIII. REFERENCES

[1] Ramachandra k. Gurav et.al [1], "Real time digital notice board using GSM technology" volume-2, issue-09, December-2015
[2] Prof. Liladhar P.Bhamre.et.al [3], "Real time digital notice board using Zigbee" volume-3, issue-1, 2017.
[3] Jadav vinod. et.al [3], "Real time digital notice board using Raspberry Pi-3", volume-3, issue-2, Feb-2016.
[4] Shraddha.J.Tupe, A.R.Salunke, "Multi-functional smart display using raspberry pi", Volume-2, Special issue (NCRTIT 2015), January 2015.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Smart Energy Metering and Power Theft Control using 8051 & GSM

Prof.Nirosha[1]*, Shambhuling S N[2] , Kirankumar N M[2], Varsha S R[2], Laxmi B R[2]
[1]Assistant Professor, Department of EEE, SKSVMACET Laxmeshwar, Karnataka, India
[2] Smt Kamala and Sri Venkappa M Agadi college of Engineering and Technology laxmeshwar, Dept of EEE, Karnataka, India

ABSTRACT
Project aims in meter reading consumed by each home through SMS without visiting the customers home every month for billing. Digital energy meter is replaced by smart energy meter. Leakage of electricity due to tapping can be detected through energy meter. If energy meter is tapped by the customer then a SMS is sent to the electricity board. Based on the electricity consumed in each home bills are prepared as per the latest tariff and bill to be paid is sent through SMS, If customer fails to pay the bill within the scheduled time then warning message will be sent. Even after warning message if customer fails to pay the bill power supply will be detached for the particular customer home and same message is sent to the customer. Sensors are used in between the spindle of the energy meter with the help of opto-coupler. For every rotation the pulse is generated and the same signal is sent to the microcontroller. The microcontroller keeps the track of the meter reading. The microcontroller is interfaced to the GSM modem for communication purposes like reading the meter, information about tapping and to detach the power.

Keywords: GSM, Power theft, Smart meter, Power monitoring, Tapping, Billing.

I. INTRODUCTION

A Smart Energy Meter system based on GSM is presented in this paper. Microcontroller can be used to monitor and record the meter readings. In case of customer defaulter, no need to send a person of utility to cut off the customer connection. Utility can cut off and reconnect the customer connection by short message service (SMS). Furthermore, the customer can check the status of electricity (load) from anywhere. In this system energy meter readings are being transferred with the help of GSM.

This system enables the electricity department to collect the meter reading every month without the meter reader visiting customer house. This can be done with the help of microcontroller unit which continuously monitors and records the energy meter reading from its permanent memory location.

II. EXISTING SYSEM

Existing energy meters are of electromechanical induction type and electronic meter type. In electromechanical induction meter, the total number of rotation of the aluminium disc is directly proportional to the power consumed.

Electronic meter shows the consumption of power, power factor, the reactive power used and it is digitally displayed on LCD or LED display. It is a single way of communication.

In existing system, there are no possibilities to stop or minimise the power theft.

III. PROPOSED SYSTEM

A smart energy meter works with communicating directly with wireless data protocol, so there will be precise reading & there is no necessary for a meter reader to take energy meter reading in consumer premises. Smart energy meters can operate in divergent ways with GSM Module. The merits of smart energy meter are as follows:

- ✓ New smart energy meters send precise reading on a regular interval in sequence about customer's energy usage to utility (Electricity provider). So the bills will be proper and labour cost is reduced for taking a reading in consumer residents.
- ✓ If the consumer did not pay the energy bill within time, the utility can remotely disconnect the service (line) of a particular consumer and after bill payment, the service will be provided to the consumer. So sending an employee to cut off energy from the network and reconnecting can be avoided.
- ✓ Lever switch is connected for detection of tampering. When anyone tries to open the meter cover the switch will be released and same information is sent to service provider.
- ✓ When the power quality is not maintained from the distribution station, then the customer equipment can be protected.

The proposed system consists of digital energy meter, a(microcontroller), GSM modem and SSR. After switching power on the microcontroller and the GSM modem, turn on the SSR and connects the energy meter. Then read the EEPROM and display the current data. Microcontroller checks the readings from voltage and current sensor i.e. PT and CT respectively.

If there is any difference in value between CT's connected in phase and neutral line then microcontroller turns OFF the relay and sends SMS to the service provider. Also, this Arduino helps the utility for power disconnection when the bill is not cleared by the customer. From customer point, this is a benefit for monitoring their daily/monthly consumption, voltage fluctuation .

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

IV. SYSTEM ARCHITECTURE

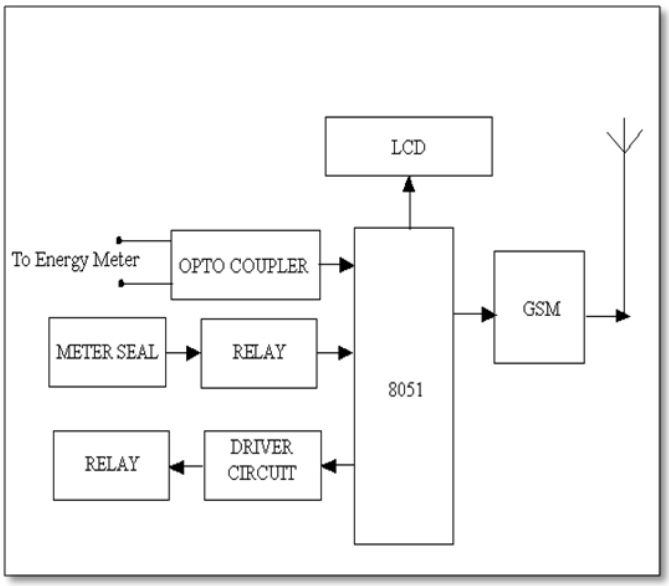


Figure 1. System Architecture

a. DIGITAL ENERGY METER

The output of digital energy meter is fed to the opto-coupler to pin number 1 and 2. For each rotation a pulse is generated in the digital energy meter. This pulse makes the LED to glow in the opto-coupler. When the LED glows the light falls on the phototransistor. Phototransistor conducts and low pulse is generated, which is then applied to microcontroller (89s52). Now the microcontroller reads the pulses coming from the Digital Energy Meter and displays the unit readings on the LCD interfaced to the microcontroller.

b. OPTO-COUPLER

MCT2E is an optocoupler integrated circuit in which light emitting diode drives a phototransistor. They are also known as optoisolators since they separate two circuits optically. These are used to couple two circuits without any ohmic contact. They allow one of the circuits to switch another one while they are completely separate. The first circuit is connected to LED while the other circuit with the phototransistor. The isolation ensures that no damage occurs in either of the circuits while the other one has a fault. An opto coupler is analogous to a relay which isolates two circuits magnetically. They differ with relays in the sense that they are smaller in size and allow fast operation. MCT2E's are commonly used in interfacing an electronic circuit to produce pulse to the microcontroller.

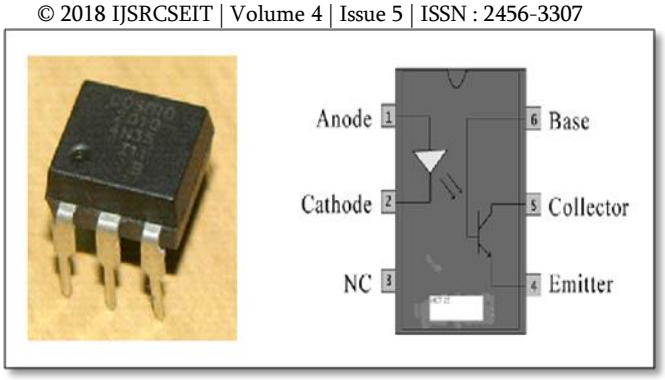


Figure 2. Opto-Coupler

c. MICROCONTROLLER

Microcontroller is the central component which controls all the activities like reading data from the card and displaying information on LCD(Liquid Crystal Display), controlling the door. In order to do all the activities a program (sequence of instruction) must be written for the microcontroller. This program is called firmware. In order to execute the program, Microcontroller requires basic configuration like 5V regulated power supply, clock, and reset circuit.

16*2 (2 line of 16 character) LCD is used for displaying status. It provides easy user interface. It needs to initialize before displaying data. This initialization is done by Microcontroller.

ATMEL AT89S51 is used in the project. This particular microcontroller is chosen because following features.

1. 4K Bytes of In-System programmable flash memory.
2. Compatible with MCS®-51 Products
3. 4.0V to 5.5V Operating Range
4. Fully Static Operation: 0 Hz to 33 MHz
5. 128 x 8-bit Internal RAM
6. 32 Programmable I/O Lines
7. Low cost.

d. DRIVER CIRCUIT

ULN2003 is a high voltage and high current Darlington array IC. It contains seven open collector Darlington pairs with common emitters. A Darlington pair is an arrangement of two bipolar transistors.

ULN2003 belongs to the family of ULN200X series of ICs. Different versions of this family interface to different logic families. ULN2003 is for 5V TTL, CMOS logic devices. These ICs are used when driving a wide range of

loads and are used as relay drivers, display drivers, line drivers etc. ULN2003 is also commonly used while driving Stepper Motors. Stepper Motor interfacing is done using ULN2003.

Each channel or Darlington pair in ULN2003 is rated at 500mA and can withstand peak current of 600mA. The inputs and outputs are provided opposite to each other in the pin layout. Each driver circuit also contains a suppression diode to dissipate voltage spikes while driving inductive loads.

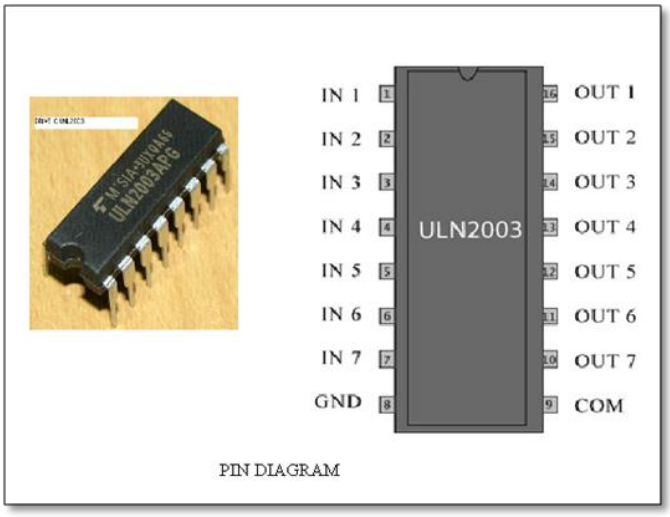


Figure 3

Here in this project relay is driven with the help of driver IC.

e. GSM MODEL

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a microcontroller or computer, this allows the microcontroller or computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS as well as for control applications using GSM.

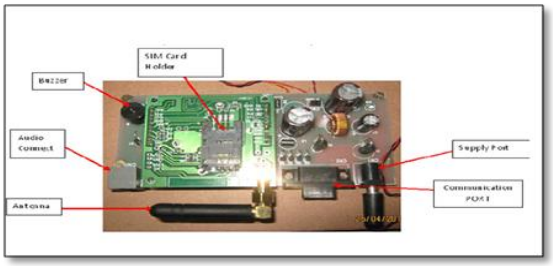


Figure 4. GSM modem

f. HARDWERE USED

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

- Power Supply 9V&5V DC: 7809 and7805
- Micro controller: AT89S52-Atmel
- LCD : (Liquid crystal display) 2 x16
- GSM Modem
- Energy meter
- Driver circuits
- Meter seal sensing circuit
- Relays

g. SOFTWARE USED

- Keil compiler
- ISP flash programmer

V. APPLICATIONS

1) To centralize and monitoring the electrical energy meter reading.
2) Tapping of electricity can be prevented.
3) Economy of electric supply board can be increased.
4)Cut the power to home from EB itself, if the bill is not paid

VI. ADVANTAGES

- We can save manpower.
- Taping of electricity can be detected and message is transmitted to substation
- If seal of the meter is opened, it transmits message to the substation
- Time can be saved.
- Economy of electric supply board can be increased.
- In the manual system if the door is locked the bill cannot be calculated.

VII. CONCLUSION

This paper has the hardware advantages for both utility and customer. Microcontroller, SSR, and GSM combined energy meter used for smart metering, power theft detection. Capable of managing and controlling of supply to that meter through SSR. In the case of power theft, defaulter meter line cutting/joining labor system is reduced. Power consumption, power quality, and its accuracy can be monitored by the consumer on their mobile. This process will reduce the labor work and human error in the distribution system and also protect the consumer equipment.

VIII. REFERENCES

[1] Visalatchi S,Kamal Sandeep K "smart energy metering and power theft control" 2017 2nd (12CT).

[2] Md.Masudur Rahman; Noor-E-Jannat; Mohd.Ohidul Islam;Md.Serazus Salakin, "Arduino and GSM based Smart Energy Meter for Advanced Metering and Billling System" 2nd Int'1 Conf.on Electical Engineering and Information and Communication Technology (ICEEICT) 2015Jahangimagar University, Dhaka-I 342,Bangladesh,21-23 May 2015

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Conversion of Single Phase AC to Three Phase AC Supply

Gaurav Sharma*[1], Naimish Kumar Bareek[2]
*[1]Electrical and Electronics Engineering, New Horizon College of Engineering, Bengaluru, Karnataka, India
[2]Electrical and Electronics Engineering, New Horizon College of Engineering, Bengaluru, Karnataka, India

ABSTRACT

This paper presents a simple converter topology for driving a load with a single-phase AC supply. Using only six active switch IGBT's(FGH40N60SFD). The converter supplies balanced output voltages at rated frequency, the proposed control approaches are supported by test results. The convertor takes single phase supply and converts it into three phase supply with the help of thyristors. The single phase supply is first converted into dc supply by using rectifier again dc supply of rectifier is given to inverter where IGBT's are used and converts the dc supply again into three phase ac supply. In the proposed scheme, Arduino Uno/Mega ADK microcontroller interfaced with Scilab(5.5.2) is used to produce PWM signals. The PWM signals generated is given to IC FAN7392(driver IC) which drives the thyristors. Three phase machines can be run on this by converting single phase to three phase AC supply wherever three phase AC supply is absent. Three phase induction motor can be used as load for testing of the hardware. For example, electric vehicles. The experimental result showed that PWM pulses produced remained approximately constant and the hardware have satisfactorily converted the single phase power to three phase power supply.

Keywords : Single Phase AC to Three Phase AC supply, IGBTs, drive system.

I. INTRODUCTION

In the past, single-phase to three-phase conversion systems were made possible by the connection of passive elements capacitors and reactors with autotransformer converters. Such kind of system presents well know disadvantages and limitations. So to overcome from this disadvantages the newly adopted thyristors and power electronics devices were used mainly thyristors like SCRs, MOSFETs, IGBTs etc.

Both have the advantages of simple structure and reasonably low cost. The project is about 'single phase to three phase conversion system using **IGBTs.** Since the beginning of the solid state power electronics, the semiconductor devices were the major technology used to drive the power processors. Looking at the semiconductor devices used in the former controlled rectifiers and comparing them with the new technologies it makes possible to figure out the astonishing Development. Beyond the improvement related to power switches, it was also identified a great activity in terms of the circuit topology innovations in the field of three-phase to three-phase, single phase to single phase and three-phase to single phase conversion systems. The single-phase induction motor drives by the three-phase induction motor drives in some low-power industrial applications. When the three phase induction motor is driven by a single phase induction motor by rotary phase converters and autotransformer capacitor phase converters, this causes more loss as compared to the new this method. Motor drives constitute a predominant load for the agricultural sector. As most rural communities in the India are supplied with single-phase ac power, these drives have to be realized with single-phase motors, or with three phase motors (Induction Motors) driven by phase converters. Autotransformer capacitor phase converters, however, cannot easily obtain balanced output voltage with reasonable cost, and rotary converters are heavy and have significant no-load losses, also both topologies have high inrush current during motor start up.

The three-phase induction motors have some advantages in the machine efficiency, power factor, and torque ripples compared to their single-phase counterparts. Though the precise control of single phase induction motor is less complex in comparison to the three phase induction motor, but when the torque requirement is considered then three phase induction motor is the best choice. The applications for these motors cover almost

every stage of manufacturing and processing. It is not surprising to find that among all type of electric motors, Induction motor is so popular, when one considers its simplicity, reliability, and low cost.

Therefore, it is desirable to replace the single-phase induction motor drives by the three-phase induction motor drives in some low-power industrial applications in some rural areas where only a single-phase utility is available, we should convert a single-phase to a three-phase supply. This paper proposes an alternative solution for phase conversion with very low overall cost, moderate motor performance during start up and high steady-state performance at line frequency.

Here we are using 16-bit Arduino microcontroller which yields enhanced operations, fewer system components, lower system cost and increased efficiency. The system is designed for driving medium power (1.5hp), 3-phase AC induction motors. Our work consist of a full bridge rectifier, a split capacitor dc bus, six active devices (IGBTs), Driver circuit (FAN 7392 IC) which drives the six thyristors, Arduino module interfaced with *scilab* to give the three phase controlled PWM output to the driver circuit. The developed hardware can be tested on a 3-phase, 415V, 50Hz Induction motor or the inverted output and graph/waveforms are analyzed and studied on Digital Storage Oscilloscope.

Scilab is an interpreted language. This generally allows to get faster development processes, because the user directly accesses a high-level language, with a rich set of features provided by the library. By this way, external libraries can be used as if they were a part of Scilab built-in features. Scilab also interfaces Arduino.

II. BLOCK DIAGRAM AND ITS EXPLANATION

A. System Overview

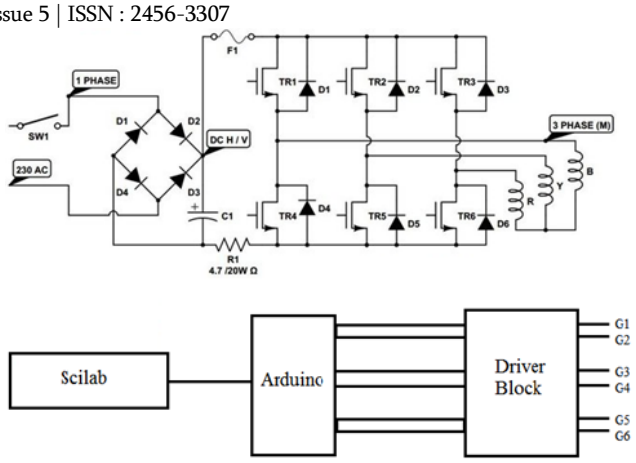


Figure 1- Block diagram of the system

All the electronics or electrical components need power supply of AC supply. So, we are converting power from single phase into three phase AC supply. Using these three phase power supply, we can drive any motor. Block diagram of converting single phase to three phase power supply consist of input, rectifier, filter, inverter, load, driving stage, microcontroller, scilab and power supply as shown in figure 1. As we seen from the block diagram the first stage is input, input is given in two circuits, first one is given to rectifier and further towards the other and the second input is given to controller stage Since the input is first works in rectifier which converts the ac supply into pulsating dc but after rectification also having some ac contain. So to remove that filters are used consisting of inductors and capacitors which helps to eliminate the ac contain and gives nearly pure dc. Further the supply is given to inverter where IGBT's are connected. In addition with main power supply again energising stage is there which use to energise IGBT's i.e. DRIVING STAGE comprises of micro controller interfaced with scilab where simulations are made accordingly and supply is given to inverter stage as per the programmer's and circuit requirement. Afterwards the dc supply which is fed to inverter is converted into ac supply in the form of three wire i.e. three phase supply. After the conversion the three phase supply is given to load which is motor. In the sense of load the load may be a motor or any three phase load.

B. Power circuit design

The power circuit designed contains full bridge rectifier with split capacitors assembly, full bridge inverter assembly. Single phase 230V, 50Hz AC supply is applied to the full bridge rectifier and IGBT. IGBT switches are protected against surge voltages using snubber circuit. This full bridge rectifier converts single phase AC input into DC which is filtered by capacitor. The pure DC supply is applied to the full bridge inverter which is made up of six IGBT switches. The output of the 3-phase inverter is given to induction motor. The energy that a switching power converter delivers to a motor is controlled by Pulse Width Modulated (PWM) signals applied to the gates of the switches. PWM signals are pulse trains with fixed frequency and magnitude and variable pulse width. The power circuit design is shown in figure 2.

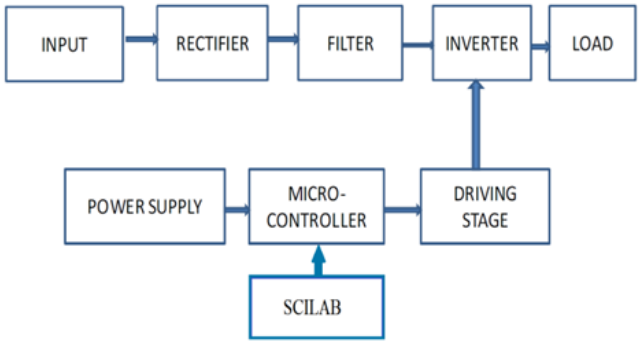


Figure 2- Power circuit diagram

C. Driver Circuit Block

The FAN 7392 is a monolithic high and low side gate driver IC, that can drive high speed MOSFET and IGBTs that operate up to +600V it has a buffered output stage with all NMOS transistors designed for high pulse current driving capability and minimum cross conduction. This processes high voltage and common mode noise cancelling techniques provide stable operation of the high side driver under high dv/dt noise circumstances. An advanced level shift circuit offers high side gate driver operation up to V_S=9.8V (typical) for V_{BS}=15V. Logic inputs are compatible with standard CMOS or LSTTL output, down to 3.3V logic. The high current and low output voltage drop feature makes this device suitable for half and full bridge inverters, like switching mode power supply and high power DC-DC converter applications. Figure 3 shows the pin diagram for 14 pin and 16 pin IC. This IC can controls two thyristor gates.

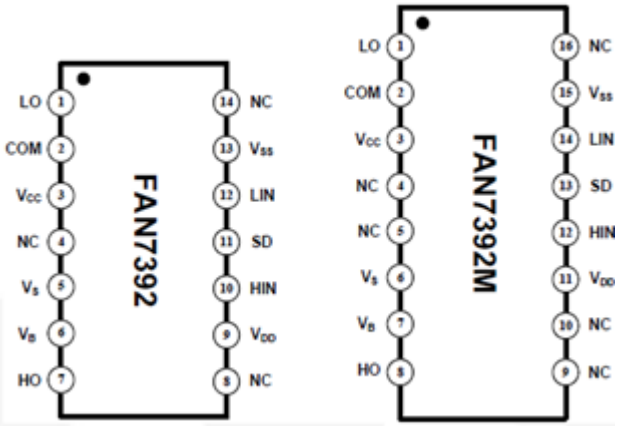


Figure 3- Pin diagram of FAN 7392/7392M

Figure 4 and figure 5 shows the internal block diagram of FAN 7392 and FAN 7392M.

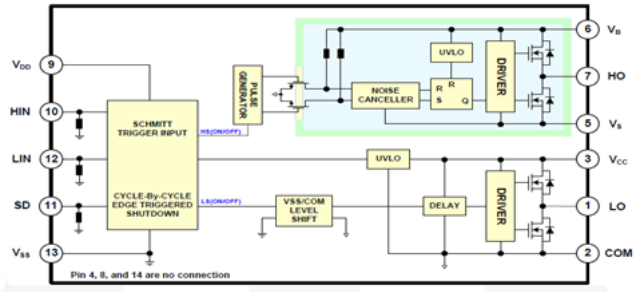


Figure 4- Internal block diagram of FAN 7392

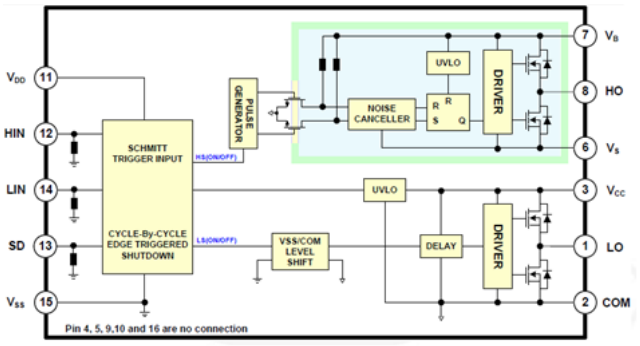


Figure 5- Internal block diagram of FAN 7392M

D. Scilab Simulation

Download the following files from: HTTPS://ATOMS.SCILAB.ORG/

1. serial_0.4.1_5.5-1.bin.

2. arduino_1.1-1.bin.x64.windows (suitable for your system).
3. toolbox_arduino_v3 (from: https://github.com/fizcris/Scilab_Xcos_arduino_toolbox_david_MPU6050/blob/master/toolbox_arduino_v3/toolbox_arduino_v3.ino)

Load toolbox_arduino_v3 to Arduino software. Also load serial_0.4.1_5.5-1.bin and arduino_1.1-1.bin.x64.windows in scilab console window and run the program.

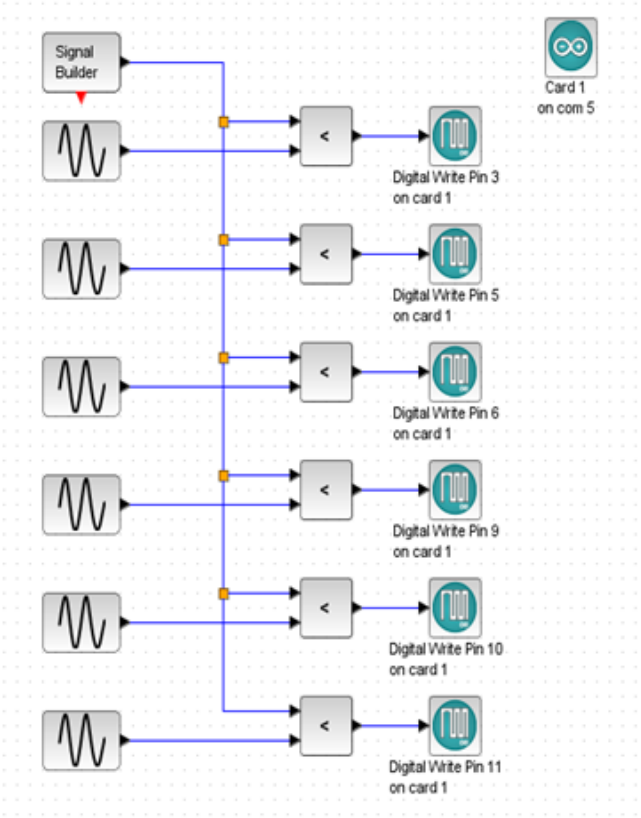


Figure 6- Circuit for generation of PWM

Used tools:

All the tool are taken from the xcos palette.

1. Signal Builder: This is used to generate triangular waveform of preferred frequency and amplitude. The specification can be changed according to the requirement.
2. Sine wave generator: This generates a sine wave of preferred frequency and amplitude. The specification can be changed according to the requirement. Here we are giving comparing six sine wave generator at 60° phase angle.
3. Relationalop: This tool compares the triangular wave form and the sine wave which results in PWM.
4. Arduino Setup: Arduino card is choosed and the port number is setup.
5. Arduino Digital Write Pin: The PWM is given to the respective Arduino pins.

Figure 6 shows the simulation circuit that generates PWM needed Trigger the IGBT's gate.

III. RESULTS AND DISCUSSION

The output of the simulation is shown in figure 7 and 8 that is given to driving circuit which drives the IGBTs at phase difference of 120° for three phase.

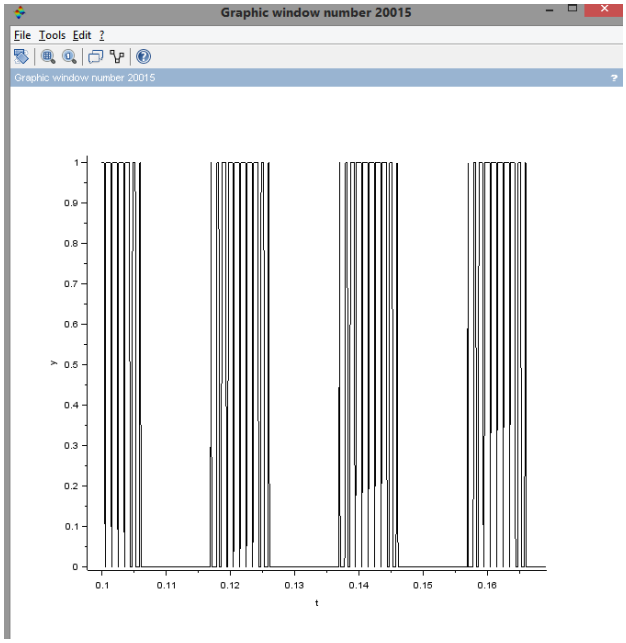


Figure 7- Generated PWM for positive cycle

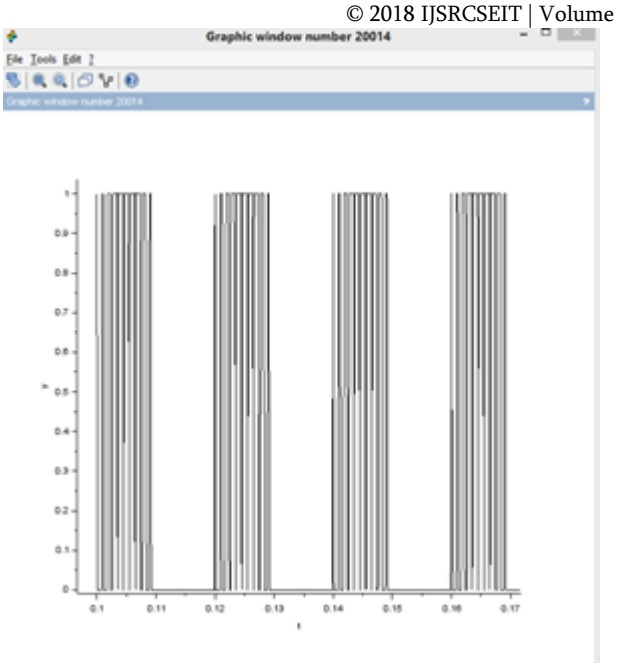


Figure 8- Generated PWM for negative cycle

We can see a 30° phase shift between positive and negative cycle. The output is shown for single phase. Similarly, three phase PWM can be generated.

IV. CONCLUSION

Three phase asynchronous induction motors are widely used in industrial applications due to their features of low cost, high reliability and less maintenance. Due to the need for three-phase electricity in today's remote areas for agriculture work where three phase power is not available easily, in those areas these single phase to three phase converters are use full. Operating a three phase induction motor using single phase supply has been presented.

The developed system is useful in remote areas where three phase supply is not available easily.

Applications of single phase to three phase converter are:

- Electric Vehicle.
- In Irrigation Pumps for Agriculture purpose.
- Rural Area Water Supply.

V. REFERENCES

[1]. Chingchi Chen, "A Hybrid Inverter/cylcoconverter-Based Variable-Speed Three-phase Induction Motor Drive for Single-phase Inputs" IEEE Tran. on Industry application,Vol.31.no.3,may/june 1995 .

[2]. P. N. Enjeti and A. Rahman, "A new single-phase to three-phase converter with active input current shaping for low cost ac motor drives,"IEEE Trans. Ind. Applicar., vol. 29, no. 4, pp. 80C813 July/Aug. 1993.

[3]. Shivanagouda.B.Patil, M. S. Aspalli, "Operating Three Phase Induction Motor Connected to Single Phase Supply", 2012, International Journal of Emerging Technology and Advanced Engineering,(Nov 2012), ISSN 2250-2459.

[4]. M. Khan, I. Husain, and Y. Sozer, "Integrated electric motor drive and power electronics for bidirectional power flow between the electric vehicle and dc or ac grid," Power Electronics, IEEE Transactions on,vol. 28, no. 12, pp. 5774–5783, Dec 2013.

[5]. Dong-Choon Lee, Member, IEEE, and Young-Sin Kim," Control of Single-Phase-to-Three-Phase AC/DC/AC PWM Converters for Induction Motor Drives," IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 54, NO. 2, APRIL 2007.

[6]. Shivanagouda.B.Patil, M. S. Aspalli," Operating Three Phase Induction Motor Connected to Single Phase Supply ," International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 11, November 2012.

[7]. Arvind K.Yadav, Nayan Wadgure, Pavan kamdi, "CONVERSION OF SINGLE PHASE TO THREE PHASE SUPPLY" International Journal of Research in Advent Technology (E-ISSN: 2321-9637), "ICATEST 2015", 08 March 2015.

[8]. M. A. Kumar and S. Lakshminarayanan, "Cost effective gate drive circuit for MLI with constant number of conducting switches," 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), Bangalore, 2016, pp. 617-622. doi: 10.1109/RTEICT.2016.7807896.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Introduction to the Industrial Automation Using Schneider Electric M340 PLC work Bench

Deepa V Bolanavar[1]
Assistant Professor, EEE Department, NHCE, Bangalore, Karnataka, India

ABSTRACT

Industrial automation is the use of control systems, such as computers or robots, and information technologies for handling different processes and machineries in an industry to replace a human being. It is the second step beyond mechanization in the scope of industrialization.This paper describes aboutSchneider Electric M340 PLC which is one of the most famous PLC in the world.Launched as one of the most innovative Programmable Logic Controllers developed to date, Modicon M340 continues to be perceived as a model basis of a modern-day automation platform, garnering recognition for its robust quality and high-end capabilities, including improved performance, compliance with the latest networking standards, and operational cost-efficiency. Designed for a widely range of process and machine management, it finds perfectly his place in numerous segments such as the Food & Beverage etc.

I. INTRODUCTION

PLC Background:

present automation system comes in to existence through its various stages. In the past, automation is done through relays and contactor logics. Since the human intervention is more, the scope of errors was also more. But with the advent of microprocessors & microcontrollers several new tools as PLCs (Programmable Logic controllers) come in to use. These have reduced human intervention. Which in turn has increased accuracy, precision and efficiency.The PLC can be described as a control ladder comprising a sequence program. PLC sequence program consists of normally open and normally closed contacts connected in parallel or in series. It also has relay coils, which turns ON and OFF as the state of these contacts change. In this paper, about all aspects of these powerful and versatile tools and its applications to process automation has been discussed.

PLC: A digitally operating electronic apparatus which uses a programming memory for the internal storage of instructions for implementing specific functions such as logic, sequencing, timing, counting and arithmetic to control through digital or analog modules, various types of machines or process.

With the upcoming technologies and availability of motion control of electric drives, the application of Programmable Logic Controllers with power electronics in electrical machines has been introduced in the development of automation systems.

The use of PLC in automation processes increases reliability, flexibility and reduction in production cost. Use of PLC interfaced with power converters, personal computers and other electric equipment makes industrial electric drive systems more accurate and efficient. PLCs have been gaining popularity on the factory floor and will probably remain preponderant in coming years. Most of this is because of the advantages they offer, like

- ✓ Cost effective for controlling complex systems.
- ✓ Flexible and can be reapplied to control other systems quickly and easily.
- ✓ Computational abilities allow more sophisticated control.
- ✓ Trouble shooting makes programming easier and reduce downtime.
- ✓ Reliable components make these likely to operate for years before failure.

The PLC was contrive in response to the needs of the American automotive manufacturing industry. Automotive industries were the first to adopt programmable logic controllers, where software alteration replaced the rewiring of hard-wired control panels when production models changed. In manufacturing automobiles, earlier, the control, sequencing and the safety interlock logic was accomplished using hundreds or thousands of relays.

Programming:

The programming technique for the first PLCs were based on relay logic wiring schematics. This eliminated the need to teach the technicians, electricians and engineers how to program a computer but this method has stuck and it is the most common technique for programming PLCs today. According to IEC 61131-3 five programming languages is defined for programmable control systems: LD (Ladder diagram), ST (Structured text), SFC (Sequential function chart), FBD (Function block diagram), and IL (Instruction list, similar to assembly language).

Industrial automation systems

Industrial automation is the use of computer and machinery aided systems to operate the various industrial operations in well controlled manner. Based on the operations involved, the industrial automation systems are majorly divided into two types; (a) Manufacturing automation and (b) Process plant automation systems.

a)**Manufacturing Automation System:** The manufacturing industries make the product out of raw materials using robotics/machines. Some of these manufacturing industries include paper making, glass and ceramic, textile and clothing, food and beverages, etc. New trends in manufacturing systems

have been using automation systems at every stage such as material handling, machining, assembling, inspection and packaging. With the computer aided control and industrial robotic systems, the manufacturing automation becomes very flexible and efficient.

b)**Process Plant Automation:** In process industries, the product results from many chemical processes based on some raw materials, some of the industries are cement industry, pharmaceutical, paper industry, petrochemical, etc. Thus the overall process plant is automated to produce the high quality, more productive, high reliable control of the physical process variables.

Salient features of PLC:

The various functionalities of programmable logic controller has evolved over the years to include sequential relay control, distributed control systems, process control, motion control and networking. PLC control system is that it regards PLC as control key component, utilize special I/O module to form hardware of control system with a small amount of measurement and peripheral circuit, to realize control to the whole system through programming.

A. High Reliability: In order to make PLC work stably and efficiently in strong interferential conditions, very high reliability and strong anti-interference quality are the most important features of PLC. Software control instead of relay control can decrease faults which are brought about by original electric contact spot outdoor working badly. Industrial grade components made by advance processing technology can sustain interferences, and self-diagnosis measures of watchdog circuit for protecting memory can improve performance of PLC greatly.

B. Good Flexibility: There are various programming languages for PLC including ladder diagram, SFC, STL, ST and soon. If operator can master any one of the programming languages, he can operate PLC well. The person who want to use PLC has a good choice. Based on engineering practice, function and capacity can be expanded by expanding number of module, so PLC has a good flexibility. 5.3 Quality of Strong Easy-Operating It is very easy to change or modify and edit program for PLC by computer offline or online. It is very easy to find out where the fault occurred by showing the information of fault location and function of self-diagnosing and all these makes repair and maintenance for PLC easier. Configuring PLC is very easy due to modularization, standardization and serialization of PLC.

C. Scan Time: A PLC program is generally executed continuously as long as the controlled system is running. The status of physical input signals is copied to an area of memory accessible to the processor, sometimes called the "I/O Image Table". The program is then executed from its first instruction down to the last one as shown in figure 4. It takes some time for the processor of the PLC to evaluate all the instructions and update the I/O image table with the status of outputs. This time of scan may be a few milliseconds for a small program or on a fast processor, but older PLCs executing

very large programs could take much longer i.e. up to 100 ms to execute the program [2]. If the scan time were too long, the response of the PLC to process conditions would be sluggish to be useful.

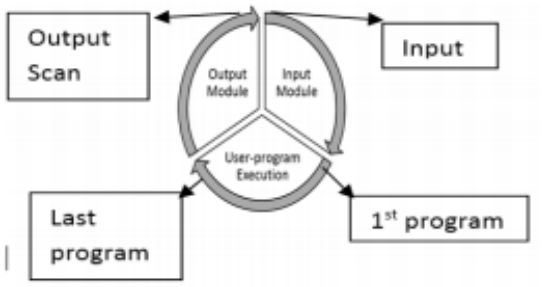


Figure 1. PLC Scan Cycle

D. Input scan: During the input scan, the current status of every signal from input module is stored in the input image (memory) table, making it up-to-date. Thus all the status of the input devices (which in turn is connected to the input module) are updated in the input memory table of PLC.

E. Program scan: Following the input scan, the CPU enters into its user program execution, or program scan. The execution involves starting from the first program
instruction, then moving on to the second instruction and carrying out its execution sequence. This continues up to the last instruction of the program. Throughout the user-program execution, the CPU continually keeps its output image (memory) table up-to-date.

F. Output scan: During program scan, the output modules are not updated continually. Instead, the entire output image table is transferred to the output modules during the output scan which comes after the program execution. Thus the output devices are activated accordingly during the output scan.

Modicon M340 automation platform:

The Modicon M340 automation platform comprises:

1. BMXP34 dedicated processors
2. A Modicon X80 I/O platform, in a single-rack or multi-rack configuration
3. Additional modules for various applications (application-specific,Ethernet communication, etc.)

M340 Processor:

Seven processor models comprising 1 Standard model (BMXP341000) and 6 Performance models (BMXP3420*** or BMXP3420***CL) with different memory capacities, processing speeds, number of I/O and number and type of communication ports.

Depending on the model, they offer a maximum (non-cumulative) of:

a) 512 to 1024 discrete I/O

b)128 to 256 analog I/O

c) 20 to 36 application-specific channels (1) (process counter, motion control and serial link, or RTU)

d) 0 to 3 Ethernet Modbus/TCP or Ethernet/IP networks (with or without integrated port and 2 network modules maximum)

e) 4 "Full Extended master" AS-Interface V3 actuator/sensor buses, profile M4.0

Depending on the model, Modicon M340 processors include:

1.A 10BASE-T/100BASE-TX Ethernet Modbus/TCP port

2. A CANopen machine and installation bus port

3. A Modbus or Character mode serial link port.

Each processor has a USB TER port (for connecting a programming terminal or a Magelis GTO, GTW, STU/STO, etc. HMI terminal).

It is supplied with a memory card (3) that enables:

1. Backing up the application (program, symbols and constants)
2. Activating a standard Web server for the Transparent Ready class B10 integrated Ethernet port (depending on the model) Depending on the model, this memory card can be replaced by another type of memory card (to be ordered separately) that supports:
3. Backing up the application and activation of the standard Web server (same as other card).
4. An 8 MB or 128 MB storage area, depending on the option card, for storing additional data organized in a file system (directories and sub-directories).

Modicon X80 I/O platform and additional modules:

The "Modicon X80 I/O" platform, which can be used "In Rack" and/or in a remote I/O (RIO) drop depending on the type of automation platform (Modicon M340, Quantum, etc.), comprises the following elements:

a) Racks with 4, 6, 8 or 12 slots (2a)

b) Power supply modules, c or a (2b) b Discrete and analog I/O modules (2c)

c) RTU (Remote Terminal Unit), serial link, AS-Interface, etc. communication modules (2d) Additional dedicated modules for the Modicon M340 automation platform that can be used on "Modicon X80 I/O" are also available:

d) Application-specific b Ethernet (Modbus/TCP, Ethernet/IP) communication module External modules, such as Modbus Plus, Profibus DP/PA communication as well as modules offered as part of CAPP (Collaboration Automation Partner Program), are also available.

Design and setup of Modicon M340 applications:

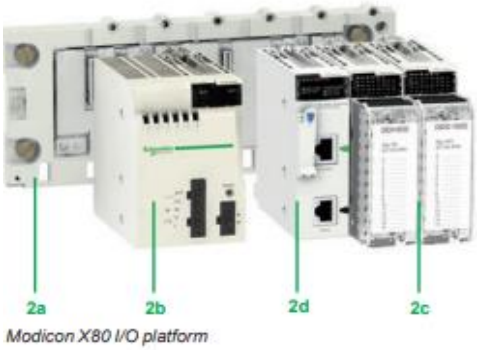


Figure 1. M340 PLC

Setting up of the Modicon M340 automation platform processors requires the use one of the following software packages:

a) Unity Pro Small programming software
b) Unity Pro Medium, Large or Extra Large programming software or identical to that used to set up Modicon Premium and Modicon Quantum automation platforms
c) Optionally, depending on requirements, Unity EFB toolkit software for developing EF and EFB function block libraries in C language

The function block software libraries provide Modicon M340 processors with the processing capability required to meet the specialized requirements within themotion control with multiple independent axis functions domain (MFB "Motion Function Blocks" library). The axes are controlled by Altivar 312/71 variable speed drives or Lexium 32 servo drives connected on the CANopen machine bus.

Unity Pro Programming Software:

Unity Prois the commonprogramming, debugging and operating software for the Premium, M580, M340, and Momentum PLC ranges. Withits five IEC61131-3 languages (ladder, FBD, SFC, IL and ST), all debugtools and diagnostics. **Unity Pro**is made for increasingyourdevelopmentproductivity and ease of maintenance.

An application developmentunder**Unity Pro**requiresseveralsteps:

1. Configure a PLC's hardware for yourproject,

2.Assign and declare all the I/O and variables that are used,

3. Program your application with Ladder Diagram Language,

4. Transfer an application in the PLC memory and test it

Create a project and configure the PLC

The first step of the PLC programmingusingUnity Pro Software consists in the configuration of the PLC's hardware regarding the real PLC configuration used in process.

Programming PLC with LD languageunderUnity Pro :

Create a ladder diagram section

In this, usingUnity Pro, wewilldiscover how to create a section (aworksheet) in whichwe can enter the ladder diagramwhichis the application designed.

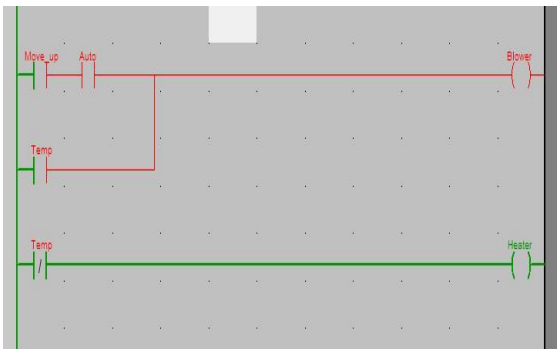


Figure 2. Ladder Editor Menu

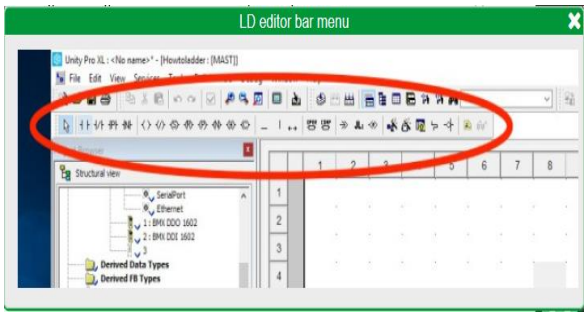


Figure 3. Input Program Example

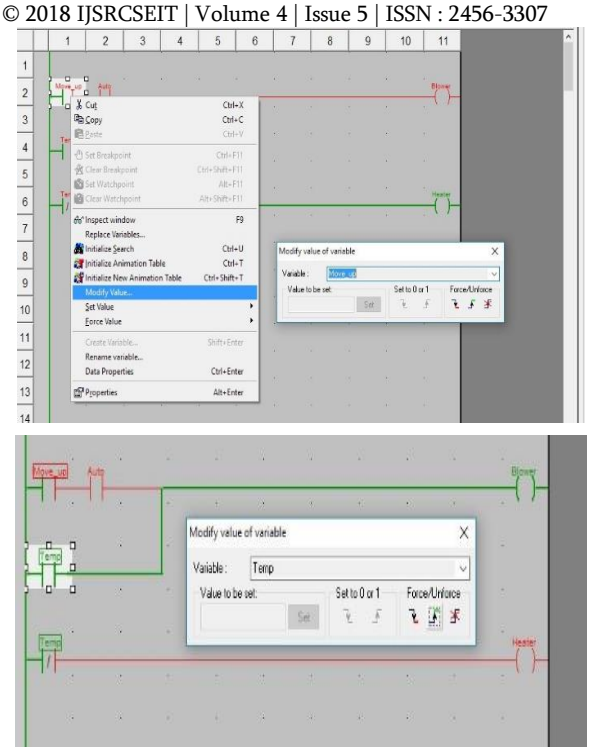


Figure 4. Output Program Example

Areas of application of PLC :

Every system or machine has a controller. Depending on the type of technologyused, controllers can bedividedintopneumatic, hydraulic, electrical and electroniccontrollers. Frequently, a combination of different technologies isused. Furthermore, differentiationis made betweenhardwired programmable (e.g. wiring of electromechanical or electronic components) and programmable logiccontrollers. The first isusedprimarily in cases, whereanyreprogramming by the user is out of the question and the job size warrants the development of a specialcontroller. Typical applications for suchcontrollers can befound in automaticwashing machines, video cameras, and cars. However, if the job size does not warrant the development of a specialcontroller or if the user is to have the facility of making simple or independent program changes, or of setting timers and counters, then the use of a universalcontroller, where the program iswritten to an electronic memory, is the preferred option. The PLC representssuch a universalcontroller. It can beused for different applications and, via the program installed in its memory, provides the user with a simple means of changing, extending and optimizing controlprocesses. The original task of a PLC involved the interconnection of input signalsaccording to a specified program and, if "true", to switch the corresponding output. Boolean algebraforms the mathematical basis for thisoperation, whichrecognizespreciselytwodefinedstatuses of one variable: "0" and "1" [2]. Proper application of a PLC beginswith an economical justification analysis. The batch process in chemical, cement, food and paper industries are sequential in nature, requiring time or eventbaseddecisions. PLCs are beingused more and more as total solutions to a

batch problem in these industries ratherthanjust a tool. In batch process savings are developedprincipally fromreduced cycle time and scheduling. Cycle automation providesrigid control enforcement to eliminatehumanerrors and to minimizemanual interventions. Increasedefficiency in schedulingis to beexpected with maximum utilization of equipment and reduction of fluctuatingdemands on criticalequipment. In large process plants PLCs are beingincreasinglyused for automatic start up and shutdown of criticalequipment. A PLC ensuresthat an equipmentcannotbestartedunless all the permissive conditions for safe start have been established. It also monitors the conditions necessary for safe running of the equipment and trip the equipmentwheneveranyabnormality in the system isdetected.

Advantages of programmable controller

- Less operating time.
- High flexibility
- Absence of moving parts increasesreliability
- Low power consumption
- Easy maintenance due to modular fabrication.
- Easyfaultfinding and diagnostic.
- Capable of handling of complicatedlogicoperations.
- Good documentation and data collectingfacilities
- Easy to interface with the process computers.
- Analog signal handling and close loop control programming.
- Timer, counter and comparator can beprogrammed.

II. CONCLUSION

The automation of the design of industrial control processes has a history of strong innovations. In this paper the concept of Programmable logic controllers and its applications are discussed. PLC applications are typically highly customized systems so the cost of a packaged PLC is less compared to the cost of a specific custom-built controller design. Development of small modular structure incomparison with earlier structures have increased the flexibility of PLC configurations, PLC computing, scan time, data processing, network communication, graphics display, and other functions. The PLC programming tools are constantly developing, so it can be used more widely in the applications of numerical control technology, control of machining center which will be more flexible and reliable.

III. REFERENCES

[1]. Rinchen G. Dorjee, "PLC and Fuzzy Logic Control of a Variable Frequency Drive," International journal of engineering trends and technology, Vol. 16, No. 4, Oct 2014, 2231-5381.

[2]. Sadeghvosough, Amir vosough, "PLC and its Applications," International journal of Multidisciplinary sciences and engineering, Vol. 2, No. 8, Nov. 2011, 2045-7057.

[3]. S. Das, S. Dutta, A. Sarkar, S. Kar, "Recognition and Disposal of Faulty Bottles in a Bottle Filling Industry Using PLC and Producing Human Machine Interface by SCADA", International Refereed Journal of Engineering and Science (IRJES), pp. 18-23, ISSN 2319-183X, Volume 3, Issue 5, May 2014.

[4]. K. Ali, R. Ghoni, A. N. Abdalla, "Advanced Control of Hybrid-PLC System", International conference on modelling optimization and computing, pp. 218-225, ISSN 1877-7058, June 2012.

[5]. Ma Shuying, C. Lidong, Shi Lei, Liu Shengtao, Z. Liang, L. Shiguang, "Design of the temperature control system of solar cell lamination machine", IEEE, pp. 506-509, Vol. 3, 2010.

[6]. Maria G. Ioannides, "Design and Implementation of PLC-Based Monitoring Control System for Induction Motor", IEEE transactions on energy conversion, pp. 469- 476, ISSN 0885-8969, Vol. 19, No. 3, Sept. 2004.

[7]. V. Vikash and H.J. Amarendra, PLC Based Sensor Operated Obstacle Detection Carriage Vehicle, International Journal of Applied Engineering Research ISSN 0973-4562 Volume 9, Issue 7 (2014) pp. 847-851.

[8]. Jing Dai, "The Design of Automatic Temperature Control System for the Dyeing Machine", Modern applied science, pp. 72-79, Vol. 2, No. 5, Sept. 2008.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Detection of urea adulteration in milk using Gas sensor

Valarmathy R[1] S, J. Haritha[2], Gowthaman S[3], Jawaharrajan B[3]
[1]Senior Professor, Department of Electronics and Communication Engineering Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India
[2] Assistant Professor, Department of Electronics & Instrumentation Engineering Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India
[3]UG Scholar, Department of Electronics and Instrumentation Engineering Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India

ABSTRACT

Milk adulteration is a global concern. Developing countries are at higher risk associated with it due to lack of monitoring and policies. However, this is one of the most common phenomena that have been overlooked in many countries. Unfortunately, in contrast to common belief, milk adulterants can pose serious health hazards leading to fatal diseases. Apart from regular techniques, recent developments in the detection techniques have also been reported. Nowadays milk is being adulterated in more sophisticated ways that demands for cutting edge research for the detection of the adulterants. The proposed work intends to contribute towards detection of the presence of urea in milk using a gas sensor. The sensor output is connected to a controller and the value is calibrated in terms of concentration (ppm). The concentration of urea is displayed using a LCD. It is observed that the proposed method can detect a minimum of 2mg/lt of urea adulterated in milk at 70°C.

Keywords: gas Sensor, mq-135, Arduino board, LCD.

I. INTRODUCTION

Adulteration is the act of addition ofsubstances to a product that makes it unfit for consumption. These impurities are added to substitute the contents of a product at a cheaper rate to increase the quantity. Milk adulteration is one of the most common and old form of adulteration. This is because India is the largest country in milk production and consumption according to the WSPA and the National Dairy Development Board, India. As the population increases, the demand will increase because there will be more mouths to feed, contamination during the process of preparation, storage and transportation. Adulterated food has adverse effects on heath because of the toxic nature of the substituting compounds or lack of compounds of nutritional value. The most common adulterants added to milk are water, urea, starch, oils etc. Consumption of urea will lead to kidney failure, damages the heart and liver. A study in Varanasi showed that the majority of milk consumers are children and these children experienced headache, eyesight problems and diarrhoea due to large scale use of urea. A national survey shows that almost 70% of our nation's milk is adulterated with detergent, neutralizers but impure water was the major contaminant. Water is the most common

adulterant; dilution of milk with impure water not only reduces nutritional value to a great extent but also causes water borne diseases.

EXISTING METHOD

The existing methodology consists of a chemical methods, spectroscopy methods and electrical methods .The chemical method will only detect the presence of adulterants only it will not measure the accurate value. And also the electrical methods will be complicated one. The two different commercial milk samples chosen (named UHT 1 and UHT 2) have never been penalized by ANVISA[4]. Initially, the milk was adulterated with a single contaminant. Subsequently, binary adulterations were obtained by combining deionised water with hydrogen peroxide, sodium hydroxide or formaldehyde. All the mixtures were performed in a beaker containing 50 ml of the total mixture presents the preparation conditions of the milk samples in order to verify the measured impedance dependenceBy increasing temperature, the mobility and the number of ions increase in solution, causing the value of the electrical impedance to decrease.

PROPOSED METHOD

In the method, the presence of urea in milk is detected using a gas sensor. The sensor output is connected to a controller and the value is calibrated in terms of concentration (ppm). The concentration of urea is displayed using a LCD.

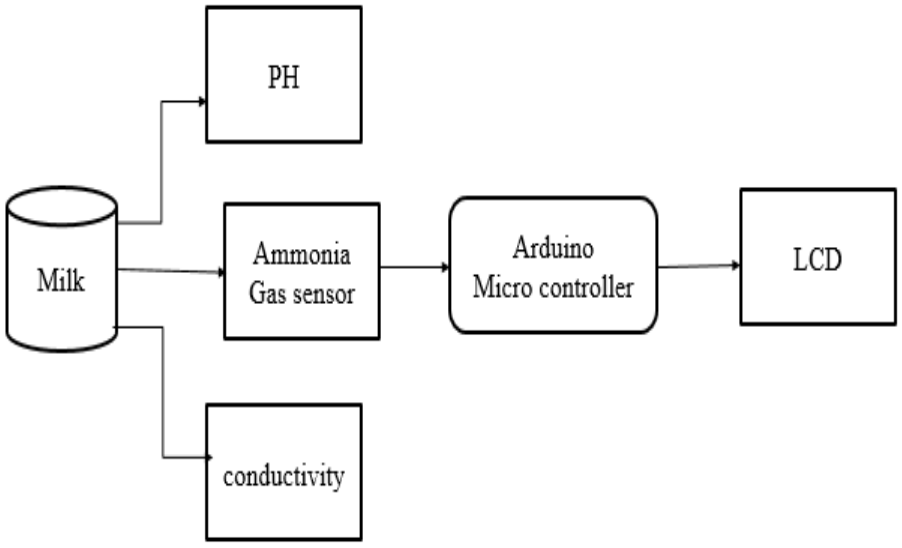


Figure 1. Block Diagram

ARDUINO MICROCONTROLLER

Arduino is an open source computer hardware and software company, project, and user community

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU GeneralPublic License (GPL), permit the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kitsThe boards are equipped with sets of digital and analoginput/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits .The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++.In addition to using traditional compiler tool chains, the Arduino project provides an integrateddevelopment environment (IDE) based on the Processing language project. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible.

PH METER

The pH300 meter measures pH, mV, and temperature parameters. The built-in microprocessor provides automatic calibration, automatic temperature compensation, data storage, and self diagnostics. The meter can recognize up to 13 types of pH standard buffer solutions. The meter's digital filter improves measurement speed and accuracy.

CONDUCTIVITY METER

An electrical conductivity meter measures the electrical conductivity in a solution. It is commonly used in hydroponics, aquaculture and freshwater systems to monitor the amount of nutrients, salts or impurities in the water. Accuracy is given in percent FULL SCALE; Use the lowest range to yield the best accuracy.The meter's display will indicate E02 or E03 if the measured value is below (E02) or above (E03) specified limits of the meter. If this occurs, please select another range as described in the Manual Range discussion in previous paragraph. Set the temperature coefficient. The factory default setting is 2.1% per °C (this nominal value is correct for most applications). Refer to the Setup section of this User Guide for details on changing this setting. Also refer to Appendix C (Temperature effects) for more information. Set the normalization (reference) temperature. The factory default setting is 25°C (this nominal value is correct for most applications). Refer to the Setup section and the User Guide for more information and instructions on changing this setting. Rinse the probe with deionized or distilled water before use to remove impurities that may add here to the electrode. When the

meter has been idle for a long period, soak the electrode for at least 30 minutes before use. When dipping the probe into a sample solution, be sure to eliminate air bubbles trapped in the probe's slot. To remove air bubbles, give the probe a gentle stir while submerged in the solution. When taking a measurement, stir the probe gently in the sample to create a homogenous sample. Allow a few seconds to elapse for the probe and the sample to reach temperature equilibrium. Ideally, wait 15 minutes to achieve maximum accuracy and best temperature compensation.

AMMONIA GAS SENSOR

MQ-135 gas sensor applies SnO2 which has a lower conductivity in the clear air as a gas-sensing material. In an atmosphere where there may be polluting gas, the conductivity of the gas sensor raises along with the concentration of the polluting gas increases. MQ-135 performs a good detection to smoke and other harmful gas, especially sensitive to ammonia, sulphide and benzene steam. Its ability to detect various harmful gas and lower cost make MQ-135 an ideal choice of different applications of gas detection.Structure of MQ-135 gas sensor is composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive. Component. The enveloped MQ-135 has 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current. Resistance value of MQ-135 is difference to various kinds and various concentration gases. So, when using this component, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 100ppm NH3 or 50ppm Alcohol concentration in air and use value of Load resistance that(RL) about 20 KΩ(10KΩ to 47 KΩ). When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel displayor other opticalthat uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as pre-set words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have largerelements.LCDs are used in a wide range of applications including computermonitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digitalcameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen televisionsets. Since LCD screens do not use phosphors, they do not suffer image burn-in when a static image is displayed on a screen for a long time (e.g., the table frame for an aircraft schedule on an indoor sign).LCDs is, however, susceptible to image persistence. The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than CRTs can be. By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes. The 16x2 LCD the advantages of LCD are Very compact, thin and light, especially in comparison with bulky, heavy CRTdisplays.Low power consumption. Depending on the set display brightness and content being displayed, the older CCFT backlit models typically use less than half of the power a CRT monitor of the same size viewing area would use, and the modern LED backlit models typically use 10–25% of the power a CRT monitor woulduse.Little heat emitted during operation, due to low powerconsumption.No geometricdistortion the possible ability to have little or no flicker depending on backlighttechnology.Usually no refresh-rate flicker, because the LCD pixels hold their state between refreshes (which are usually done at 200 Hz or faster, regardless of the input refreshrate.Can be made in large sizes of over60-inch (150 cm)diagonal.Masking effect: the LCD grid can mask the effects of spatial and grayscale quantization, creating the illusion of higher imagequality.Unaffected by magnetic fields, including theEarth's.As an inherently digital device, theLCD can natively display digital data from aDVIorHDMIconnection without requiring conversion to analog. Some LCD panels have native fibre opticinputs in addition to DVI andHDMI.Many LCD monitors are powered by a 12 V power supply, and if built into a computer can be powered by its 12 V powersupply.Can be made with very narrow frame borders, allowing multiple LCD screens to be arrayed side-by-side to make up what looks like one bigscreen.

RESULTS AND DISCUSSION

The circuit consists of the ammonia gas sensor that is mounted on the top of the beaker which contains milk. The sensor is interfaced with the Arduino. The LCD is connected to the digital pin. The sensor detects and gives the information to Arduino and it displaysthe values in LCD. To heat and stir the milk the beaker is placed on the magnetic stirrer. And the computer is connected to the Arduino to upload the program. The primary sensing will be done by using the ammonia gas sensor (MQ135). This ammonia sensor detects the ammonia gas that was escaping from the gas while heating about 70 degree Celsius. The sensor will read the value and it give to the Arduino. The analog signal that was getting from the sensor will be converted to the digital values by using the Arduino board. The voltage value of the Arduino can be converted to any units by means of programming. The values can be converted to ppm by programming the Arduino. The converted signal will be displayed as a required value by using the LCD.

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

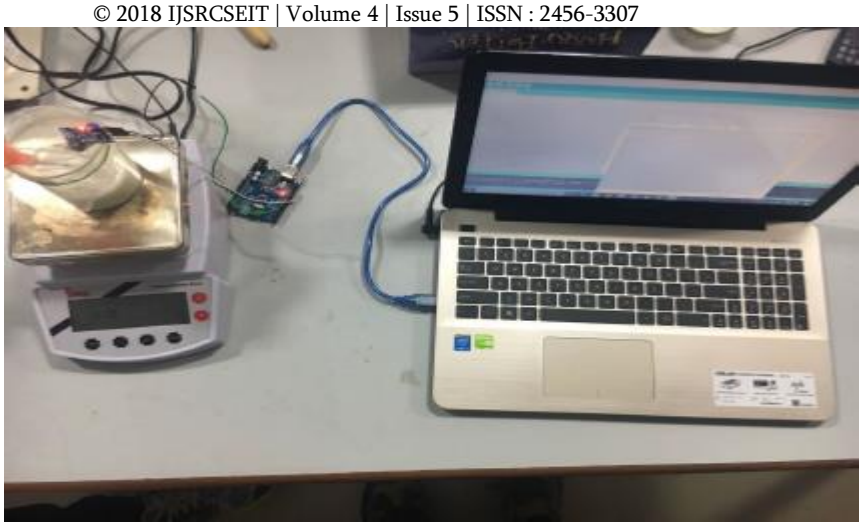


Figure 2. Experiment Setup of Urea Detection in Milk Using Ammonia Gas Sensor

Table 1. Readings for urea adulterated in water

Urea(g)	water(ml)	Temperature(˚c)	ADC value	voltage
0	50	29.3	31	0
0	50	70	104	0
0.5	50	70	130	1
1	50	70	210	2
1.5	50	70	238	2
2	50	70	251	3
2.5	50	70	263	3

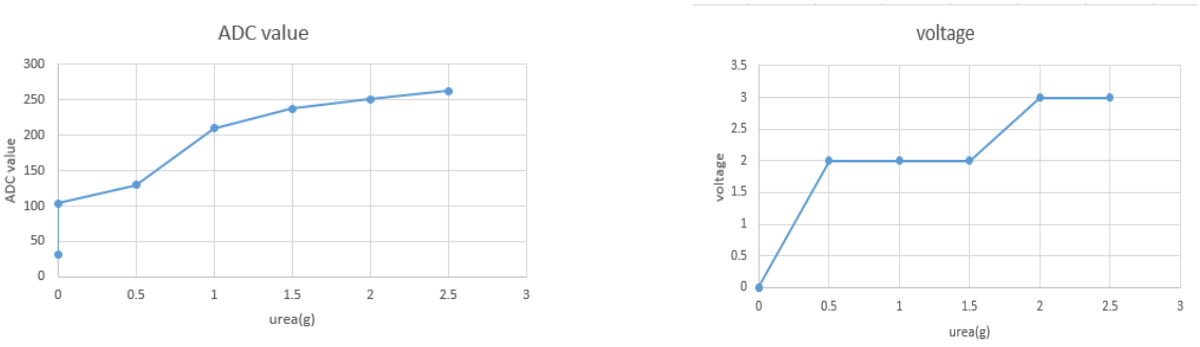
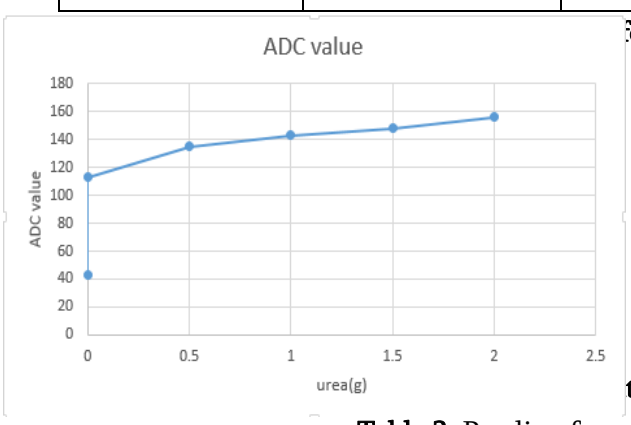


Figure. 3. Output graph showing the results of urea adulterated in water

Urea(g)	Milk(ml)	Temperature(˚c)	ADC value	voltage
0	50	29.3	43	0
0	50	70	113	0
0.5	50	70	135	1
1	50	70	143	2
1.5	50	70	148	2
2	50	70	156	2



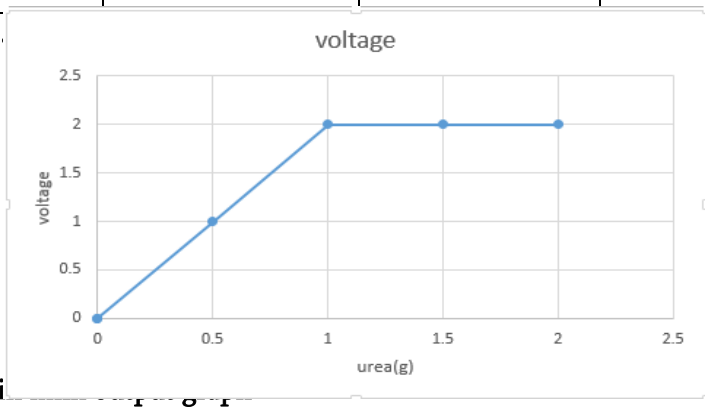
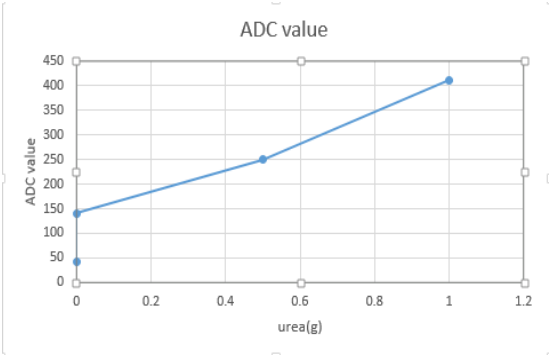


Table 3. Reading for ammonia solution added to milk

Urea(g)	Milk(ml)	Temperature(˚c)	ADC value	voltage
0	50	29.3	43	0
0	50	70	113	0
0.5	50	70	135	1
1	50	70	143	2



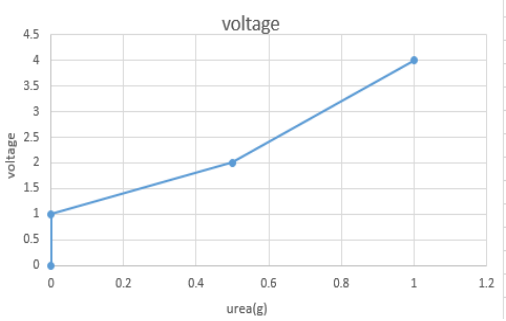


Figure. 5:. Ammonia solution adulterated in milk output graph

II. CONCLUSION

The proposed method uses a simple gas sensor to detect the adulteration of milk for urea adulteration. In this work, literature study is made and a gas sensor is identified to detect the urea adulteration in milk. Based on the study, it is evident that only spectroscopic and chemical methods are available to

detect the urea adulteration in milk. The proposed method can detect a minimum of 2mg/lt of urea adulteration in milk at 70°C. Also, the method can be developed into a hand held device such that it can be used by domestic people for identification of the urea adulteration in milk.

III. REFERENCES

[1] M. Simic, "Realization of complex impedance measurement systembased on the integrated circuit AD5933," in *Proc. 21st Telecommun.Forum (TELFOR)*, Nov. 2013, pp. 573–576.

[2] Food and Agriculture Organization of the UnitedNations, "Milk Processing," *FAO*, 2015.

[3] J.-R. Riba Ruiz, T. Canals Parelló, and R. Cantero Gómez, "Comparativestudy of multivariate methods to identify paper finishes using infrared spectroscopy," *IEEE Trans. Instrum. Meas.*, vol. 61, no. 4,pp. 1029–1036, Apr. 2012.

[4] Santos, P. M., E. R. Pereira-Filho, and L. E. Rodriguez-Saona. "Rapiddetection and quantification of milk adulteration using infra red microspectroscopy and chemometrics analysis."*Food chemistry* 138, no.1(2013): 19-24

[5]. S Das, M Sivaramakrishna, K Biswas, B Goswami (2011), Performance Study Of A ' Constant Phase angle Based ' Impedance Sensor To Detect Milk Adulteration, *Sensors and ActuatorsA:Physical*, 167(2), 273–27.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

MEMS

Amit Neelawani
Nagamani Patil, Ramakrishna Pathak, Rashmi Meti, Sudeep Kashetti
Department of Electrical and Electronics Engineering Smt. Kamala and Shri Venkappa, M. Agadi College of Engineeiring and Technology Laxmeshwar, Karnataka, India

I. INTRODUCTION

WHAT IS SMART DUST?

Autonomous sensing and communication in a cubic millimeter Berkeley's Smart Dust project, led by Professors Pister and Kahn, explores the limits on size and power consumption in autonomous sensor nodes. Size reduction is paramount, to make the nodes as inexpensive and easy-to-deploy as possible. The research team is confident that they can incorporate the requisite sensing, communication, and computing hardware, along with a power supply, in a volume no more than a few cubic millimeters, while still achieving impressive performance in terms of sensor functionality and communications capability. These millimeter-scale nodes are called "Smart Dust." It is certainly within the realm of possibility that future prototypes of Smart Dust could be small enough to remain suspended in air, buoyed by air currents, sensing and communicating for hours or days on end.

'Smart dust' – sensor laden networked computer nodes that are just cubic millimeters in volume. The smart dust project envisions a complete sensor network node, including power supply, processor, and sensor and communications mechanisms, in a single cubic millimeter. Smart dust motes could run for years, given that a cubic millimeter battery can store 1J and could be backed up with a solar cell or vibrational energy source. The goal of the Smart Dust project is to build a millimeter-scale sensing and communication platform for a massively distributed sensor network. This device will be around the size of a grain of sand and will contain sensors, computational ability, bi-directional wireless communications, and a power supply. Smart dust consists of series of circuit and Micro-Electro-Mechanical systems (MEMS) designs to cast those functions into custom silicon. Micro-Electro-Mechanical systems (MEMS) consist of extremely tiny mechanical elements, often integrated together with electronic circuitry.

THE MEMS TECHNOLOGY IN SMART DUST

Smart dust requires mainly revolutionary advances in miniaturization, integration & energy management. Hence designers have used MEMS technology to build small sensors, optical communication components, and power supplies. Micro electro mechanical systems consist of extremely tiny mechanical elements, often integrated together with electronic circuitry. They are measured in micrometers, which are millions of a meter. They are made in a similar fashion as computer chips. The

advantage of this manufacturing process is not simply that small structures can be achieved but also that thousands or even millions of system elements can be fabricated simultaneously. This allows systems to be both highly complex and extremely low-cost.

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. MEMS realize a complete System On chip technology.

Microelectronic integrated circuits can be thought of as the "brains" of a system and allow Microsystems to sense and control the environment. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and Smart Dust through some decision making capability directs the actuators to respond by moving, positioning, regulating, and filtering, thereby controlling the environment for some desired purpose. Because MEMS devices are manufactured using batch fabrication techniques similar to those used for integrated circuits, unprecedented levels of functionality, reliability, and sophistication can be placed on a small silicon chip at a relatively low cost. The deep insight of MEMS is as a new manufacturing technology, a way of making complex electromechanical systems using batch fabrication techniques similar to those used for integrated circuits, and uniting these electromechanical elements together with electronics. Historically, sensors and actuators are the most costly and unreliable part of a sensor-actuator electronics system. MEMS technology allows these complex electromechanical systems to be manufactured using batch fabrication techniques, increasing the reliability of the sensors and actuators to equal that of integrated circuits. The performance of MEMS devices and systems is expected to be superior to macro scale components and systems, the price is predicted to be much lower.

SMART DUST TECHNOLOGY

Integrated into a single package are:-

1. MEMS sensors.
2. MEMS beam steering mirror for active optical transmission.
3. MEMS corner cube retro reflector for passive optical transmission.
4. An optical receiver.
5. Signal processing and control circuitry.
6. A power source based on thick film batteries and solar cells.

This remarkable package has the ability to sense and communicate and is self powered. A major challenge is to incorporate all these functions while maintaining very low power consumption. Sensors collect information from the environment such as light, sound, temperature, chemical composition etc.

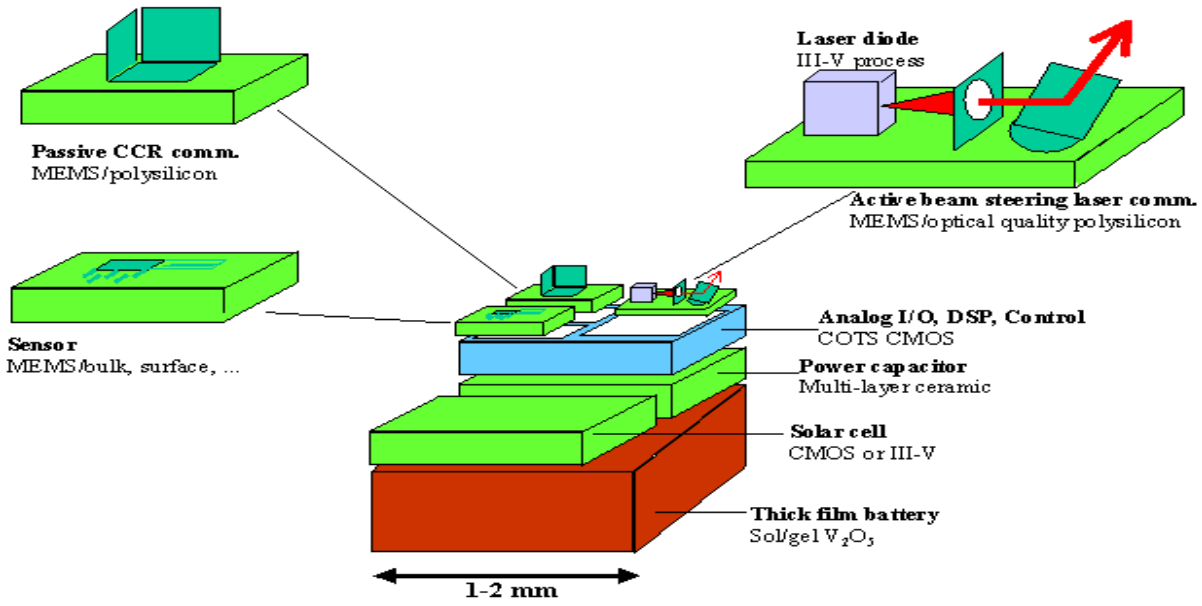


Figure 1. Conceptual diagram of the smart dust mote.

Smart dust employs 2 types of transmission schemes:-

Passive transmission using corner cube retro reflector to transmit to base stations and active transmission using a laser diode & steerable mirrors for mote to mote communication. The photo diode allows optical data reception. Signal processing & control circuitry consists of analog I/O, DSPs to control &process the incoming data. The power system consists of a thick film battery, a solar cell with a charge integrating capacitor for a period of darkness.

OPERATION OF THE MOTE

The Smart Dust mote is run by a microcontroller that not only determines the tasks performed by the mote, but controls power to the various components of the system to conserve energy. Periodically the microcontroller gets a reading from one of the sensors, which measure one of a number of physical or chemical stimuli such as temperature, ambient light, vibration, acceleration, or air pressure, processes the data, and stores it in memory. It also occasionally turns on the optical receiver to see if anyone is trying to communicate with it. This communication may include new programs or messages from other motes. In response to a message or upon its own initiative the microcontroller will use the corner cube retro reflector or laser to transmit sensor data or a message to a base station or another mote.

The primary constraint in the design of the Smart Dust motes is volume, which in turn puts a severe constraint on energy since we do not have much room for batteries or large solar cells. Thus, the motes must operate efficiently and conserve energy whenever possible. Most of the time, the majority of the mote is powered off with only a clock and a few timers running. When a timer expires, it powers up a part of the mote to carry out a job, then powers off. A few of the timers control the sensors that measure one of a number of physical or chemical stimuli such as temperature, ambient light, vibration, acceleration, or air pressure. When one of these timers expires, it powers up the corresponding sensor, takes a sample, and converts it to a digital word. If the data is interesting, it may either be stored directly in the SRAM or the microcontroller is powered up to perform more complex operations with it. When this task is complete, everything is again powered down and the timer begins counting again.

Another timer controls the receiver. When that timer expires, the receiver powers up and looks for an incoming packet. If it doesn't see one after a certain length of time, it is powered down again. The mote can receive several types of packets, including ones that are new program code that is stored in the program memory. This allows the user to change the behavior of the mote remotely. Packets may also include messages from the base station or other motes. When one of these is received, the microcontroller is powered up and used to interpret the contents of the message. The message may tell the mote to do something in particular, or it may be a message that is just being passed from one mote to another on its way to a particular destination. In response to a message or to another timer expiring, the microcontroller will assemble a packet containing sensor data or a message and transmit it using either the corner cube retro reflector or the laser diode, depending on which it has. The laser diode contains the onboard laser which sends signals to the base station by blinking on and off. The corner cube retro reflector transmits information just by moving a mirror and thus changing the reflection of a laser beam from the base station. This technique is substantially more energy efficient than actually generating some radiation. With the laser diode and a set of beam scanning mirrors, we can transmit data in any direction desired, allowing the mote to communicate with other Smart Dust motes.

COMMUNICATING WITH SMART DUST

Smart Dust's full potential can only be attained when the sensor nodes communicate with one another or with a central base station. Wireless communication facilitates simultaneous data collection from thousands of sensors. There are several options for communicating to and from a cubic millimeter computer.

Radio-frequency and optical communications each have their strengths and weaknesses. Radio-frequency communication is well understood, but currently requires minimum power levels in the multiple milliwatt range due to analog mixers, filters, and oscillators. If whisker-thin antennas of centimeter length can be accepted as a part of a dust mote, then reasonably efficient antennas can be made for radio-

frequency communication. While the smallest complete radios are still on the order of a few hundred cubic millimeters, there is active work in the industry to produce cubic-millimeter radios.

Moreover RF techniques cannot be used because of the following disadvantages:-

1. Dust motes offer very limited space for antennas, thereby demanding extremely short wavelength (high frequency transmission). Communication in this regime is not currently compatible with low power operation of the smart dust.
2. Furthermore radio transceivers are relatively complex circuits making it difficult to reduce their power consumption to required microwatt levels.
3. They require modulation, band pass filtering and demodulation circuitry.

So an attractive alternative is to employ free space optical transmission. Studies have shown that when a line of sight path is available, well defined free space optical links require significantly lower energy per bit than their RF counterparts.

There are several reasons for power advantage of optical links.

1. Optical transceivers require only simple baseband analog and digital circuitry.
2. No modulators, active band pass filters or demodulators are needed.
3. The short wavelength of visible or near infra red light (of the order of 1 micron) makes it possible for a millimeter scale device to emit a narrow beam (i.e. high antenna gain can be achieved).

OPTICAL COMMUNICATIONS

We have explored two approaches to optical communications:
Passive reflective systems and active-steered laser systems.
In a passive communication system, the dust mote does not require an onboard light source. Instead, a special configuration of mirrors can either reflect or not reflect light to a remote source.

Passive reflective systems

The passive reflective communication is obtained by a special device called CCR (Corner cube retro reflector) consists of three mutually orthogonal mirrors. Light enters the CCR, bounces off each of the three mirrors, and is reflected back parallel to the direction it entered. In the MEMS version, the device has one mirror mounted on a spring at an angle slightly askew from perpendicularity to the other mirrors. In this position, because the light entering the CCR does not return along the same entry path, little light returns to the source—a digital 0.

Applying voltage between this mirror and an electrode beneath it causes the mirror to shift to a position perpendicular to other mirrors, thus causing the light entering the CCR to return to its source—a digital 1. The mirror's low mass allows the CCR to switch between these two states up to a thousand times per second, using less than a nanojoule per 0 to 1 transition. A 1 to 0 transition, on the other hand, is practically free because dumping the charge stored on the electrode to the ground requires almost no energy. Our latest Smart Dust device is a 63-mm3 autonomous bidirectional communication mote that receives an optical signal, generates a pseudorandom sequence based on this signal to emulate sensor data, and then optically transmits the result. The system contains a micro machined corner-cube reflector, a 0.078- mm3 CMOS chip that draws 17 microwatts, and a hearing aid battery. In addition to a battery based operation, we have also powered the device using a 2-mm2 solar cell. This mote demonstrates Smart Dust's essential concepts, such as optical data transmission, data processing, energy management, miniaturization and system integration.

A passive communication system suffers several limitations: Unable to communicate with each other, motes rely on a central station equipped with a light source to send and receive data from other motes. If a given mote does have a clear line of sight to the central station, that mote will be isolated from the network. Also, because the CCR reflects only a small fraction of the light emitted from the base station, this system's range cannot easily extend beyond 1 kilometer. To circumvent these limitations, dust motes must be active and have their own onboard light source.

Active-steered laser systems

For mote-to-mote communication, an active-steered laser communication system uses an onboard light source to send a tightly collimated light beam toward an intended receiver. Steered laser communication has the advantage of high power density; for example, a 1-milliwatt laser radiating into 1 milliradian (3.4 arc seconds) has a density of approximately 318 kilowatts per steradian (there are 4 steradians in a sphere), as opposed to a 100-watt light bulb that radiates 8 watts per steradian isotropically. A Smart Dust mote's emitted beam would have a divergence of approximately 1 milliradian, permitting communication over enormous distances using milliwatts of power. Each mote must carefully weigh the needs to sense, compute, communicate, and evaluate its energy reserve status before allocating precious nanojoules of energy to turn on its transmitter or receiver. Because these motes spend most of their time sleeping, with their receivers turned off, scheduling a common awake time across the network is difficult. If motes don't wake up in a synchronized manner, a highly dynamic network topology and large packet latency result. Using burst mode communication, in which the laser operates at up to several tens of megabits per second for a few milliseconds, provides the most energy-efficient way to schedule this network. This procedure minimizes the mote's duty cycle and better utilizes its energy reserves. The steered agile laser transmitter consists of a semiconductor diode laser coupled with a collimating lens and MEMS beam-steering optics based on a two degree-of-freedom silicon micro mirror. This system integrates all optical components into an active 8-mm3 volume as the figure shows.

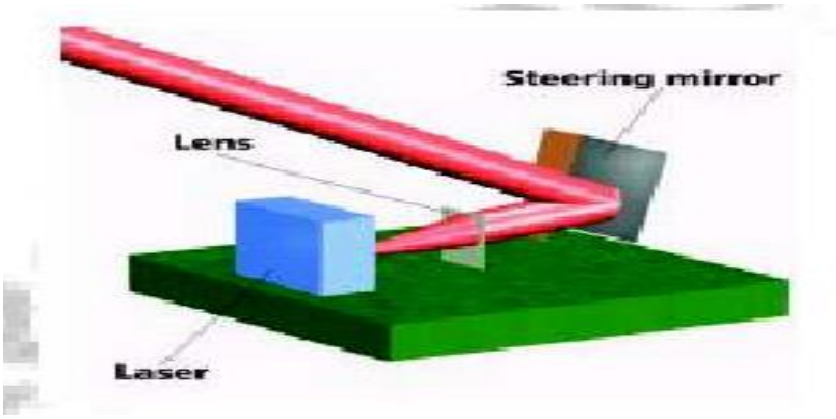


Figure 2. Active steered laser communication system.

Corner cube retro reflector

These MEMS structure makes it possible for dust motes to use passive optical transmission techniques i.e., to transmit modulated optical signals without supplying any optical power. It comprises of three mutually perpendicular mirrors of gold-coated polysilicon. The CCR has the property that any incident ray of light is reflected back to the source (provided that it is incident within a certain range of angles centered about the cube's body diagonal).If one of the mirrors is misaligned, this retro reflection property is spoiled. The micro fabricated CCR contains an electrostatic actuator that can deflect one of the mirrors at kilohertz rate. It has been demonstrated that a CCR illuminated by an external light source can transmit back a modulated signal at kilobits per second. Since the dust mote itself does not emit light, passive transmitter consumes little power. Using a micro fabricated CCR, data transmission at a bit rate up to 1 kilobit per second and up to a range of 150 meters, using a 5 milliwatt illuminating laser is possible. It should be emphasized that CCR based passive optical links require an uninterrupted line of sight. The CCR based transmitter is highly directional. A CCR can transmit to the BTS only when the CCR body diagonal happens to point directly towards the BTS, within a few tens of degrees. A passive transmitter can be made more omnidirectional by employing several CCRs, oriented in different directions, at the expense of increased dust mote size.

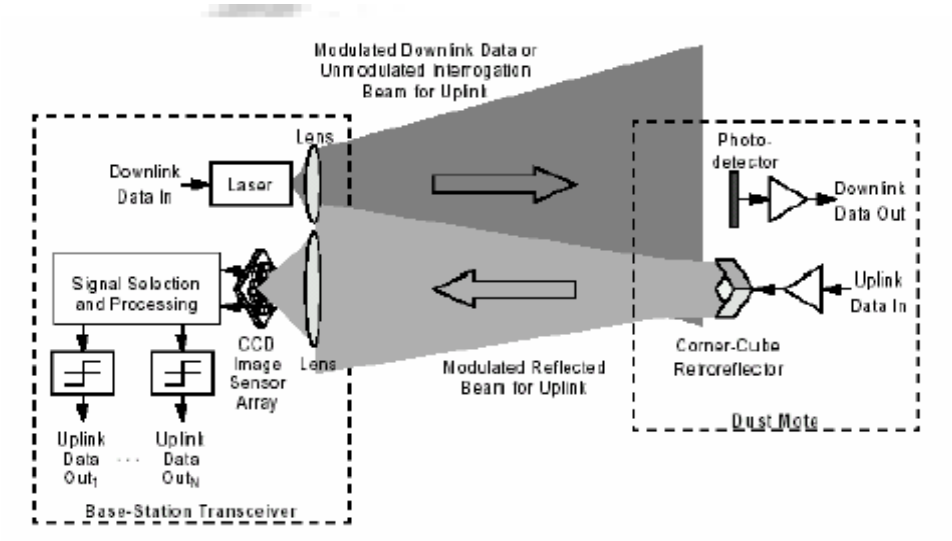


Figure 3. Free space optical network utilizing the CCR based passive uplink

The figure illustrates free space optical network utilizing the CCR based passive uplink. The BTS contains a laser whose beam illuminates an area containing dust motes. This beam can be modulated with downlink data including commands to wake up and query the dust motes. When the illuminating beam is not modulated, the dust motes can use their CCRs to transmit uplink data back to the base station. A high frame rate CCD video camera at the BTS sees the CCR signals as lights blinking on and off. It decodes these blinking images to yield the uplink data. Analysis shows that this uplink scheme achieves several kilobits per second over hundreds of meters in full sunlight. At night, in clear, still air, the range should extend to several kilometers. Because the camera uses an imaging process to separate the simultaneous transmissions from dust motes at different locations, we say it uses 'space division multiplexing'. The ability for a video camera to resolve these transmissions is the consequence of the short wavelength of visible or near infra red light. This does not require any coordination among the dust motes.

Active optical transmitters

When the application requires dust motes to use active optical transmitters, MEMS technology can be used to assemble a semiconductor laser, a collimating lens, and a beam steering micro mirror. Active transmitters make possible peer to peer communication between dust motes, provided there exists a line of path of sight between them. Power consumption imposes a trade off between bandwidth and range. The dust motes can communicate over long distances at low data rates or higher bit rates over shorter distances. The relatively higher power consumption of semiconductor lasers dictates that these active transmitters be used for short duration burst mode communication only. Sensor network using active dust mote transmitters will require some protocol for dust motes to aim their beams towards the receiving parties.

MAJOR CHALLENGES

1. To incorporate all these functions while maintaining low power consumption.
2. Maximizing operating life given the limited volume of energy storage.
3. The functionality can be achieved only if the total power consumption is limited to microwatt levels.
4. An unbroken line of sight of path should be available for free space optical links.

APPLICATIONS

1. Civil and military applications where chemical & biological agents in a battle field are detected.
2. Virtual keyboard Glue a dust mote on each of your fingernails. Accelerometers will sense the orientation and motion of each of your fingertips, and talk to the computer in your watch. Combined with a MEMS augmented-reality heads-up display, your entire computer I/O would be invisible to the people around you.
3. Inventory Control Smart office spaces The Center for the Built Environment has fabulous plans for the office of the future in which environmental conditions are tailored to the desires of every individual. Maybe soon we'll all be wearing temperature, humidity, and environmental comfort sensors sewn into our clothes, continuously talking to our workspaces which will deliver conditions tailored to our needs.
4. Individual dust motes can be attached to the objects one wishes to monitor or a large no: of dust motes may be dispersed in the environment randomly.
5. Dust motes may be used in places where wired sensors are unusable or may lead to errors. E.g.:- Instrumentation of semiconductor processing chambers, wind tunnels, rotating machinery etc.
6. May be used in biological research e.g.:- to monitor movements & internal processes of insects.

HOW FAR THEY HAVE BEEN IMPLEMENTED

1. The optical receiver for the smart dust project is being developed. The receiver senses incoming laser transmissions at up to 1Mbit/s, for a power consumption of 12NW. Although this is too high for continuous use in smart dust, it is a reasonable figure for the download of small amounts of data such as a 1Kbit program.
2. For data transmission, the team is using corner cube retro-reflectors (CCRs) built using MEMS techniques. CCRs are produced by placing three mirrors at right angles to each other to form the corner of a box that has been silvered inside. The key property of a CCR is that light entering it is reflected back along the path it entered on. For the smart dust system, the CCR is being built on a MEMS process with the two vertical sides being assembled by hand. When a light is shone into

the CCR, it reflects back to the sending position. By modulating the position of one of the mirrors, the reflected beam can be modulated, producing a low-energy passive transmission.

3. The analog-digital convertor (ADC) the 8bit ADC has so far demonstrated with an input range of 1V, equal to the power supply, and a 70kHz sampling rate. The converter draws 1.8NW when sampling at that rate, or 27pJ for an 8bit sample.
4. The latest smart dust mote, with a volume of just 16cu mm, has been tested. It takes samples from a photo-detector, transmits their values with the CCR and runs off solar cells. So smart dust is on the way.

II. SUMMARY

Smart dust is made up of thousands of sand-grain-sized sensors that can measure ambient light and temperature. The sensors -- each one is called a "mote" -- have wireless communications devices attached to them, and if you put a bunch of them near each other, they'll network themselves automatically.

These sensors, which would cost pennies each if mass-produced, could be plastered all over office buildings and homes. Each room in an office building might have a hundred or even a thousand light- and temperature-sensing motes, all of which would tie into a central computer that regulates energy usage in the building.

Taken together, the motes would constitute a huge sensor network of smart dust, a network that would give engineers insight into how energy is used and how it can be conserved. In a dust-enabled building, computers would turn off lights and climate control in empty rooms. During peak energy usage times, air conditioners that cool servers -- which drain a lot of the tech world's power -- would be automatically shut off, and then turned on again if the servers get too hot. Thus it can very lead to world’s energy conservation solutions.

III. REFERENCES

1) http://robotics.eecs.berkeley.edu/~pister/SmartDust/
2) http://www.thestandard.com/article/0,1902,27573,00.html
3) http://www.wired.com/news/technology/0,1282,44101,00.html
4) http://www-bsac.eecs.berkeley.edu/~warneke/SmartDust/
5) http://www.ce.berkeley.edu/~glaser/Current%20Civil%20Applications.ppt
6) http://madmax.me.berkeley.edu/%7Eshadr/overview.html

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Survey on Diseases of Citrus Plant Leaves and Detection Methods

Rajeshwari Banni, Pavana Baligar, Arunkumar Joshi, Nirosha H
Department of Information Science and Engineering SKSVMACET Laxmeshwar Karnataka, India

ABSTRACT
The citrus industry is an important part of Florida's agricultural economy. Citrus fruits, including oranges, grapefruit, tangelos, tangerines, limes, and other specialty fruits, are the state's largest agricultural commodities. The economic impact of citrus industry on the overall economy of the state of is substantial. The citrus industry is also one of the leading producers of jobs for people in or state and thus has huge potential for the overall economic balance of the state. These facts prove beyond doubt the importance of the citrus industry in the state's economy. As such, several important decisions regarding safe practices for the production and processing of citrus fruits have been made in the recent past. One of the main concerns is proper disease control.
Keywords: Citrus Fruit, Greasy Spot, Melanose

I. INTRODUCTION

Identification of the plant diseases is the key to prevent the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise to diagnose the plant diseases.

Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. Here we are mainly focusing on the methods used for the detection of plant diseases using their leaves images. Image analysis generally deals with the classification of diseases. Plant leaves can be classified based on their morphological features with the help of various classification techniques such as PCA, SVM, and Neural Network.

Figure 1. Bacterial Affected Citrus Leaf

Plant pathology (also phytopathology) is the scientific study of diseases in plants caused by pathogens (infectious organisms) and environmental conditions (physiological factors). Organisms that cause infectious disease include fungi, oomycetes, bacteria, viruses, viroids, virus like organisms, phytoplasmas, protozoa, nematodes and parasitic plants. Not included are ectoparasites like insects, mites, vertebrate, or other pests that affect plant health by consumption of plant tissues.

II. LITERATURE SURVEY

J.Senthil Murugan, R.Dhanaprabhu, R.Jayabalaji, C.Shinia Hephizibha has published a paper entitled "Lemon Tree Disease Detection by Analyzing Lemon Leaf"- The lemon leaf disease is detected by using the threshold based image segmentation and analyze the

features by using the gradient boost algorithm and apply the feature classification through SVM base.

ii. Peyman Moghadam, Daniel Ward, Ethan Goan has published a paper entitled "Plant Disease Detection Using Hyperspectral Imaging"- This paper proposes the use of hyper-spectral imaging (VNIR and SWIR) and machine learning techniques for the detection of the Tomato Spotted Wilt Virus (TSWV) in capsicum plants. Discriminatory features are extracted using the full spectrum, a variety of vegetation indices, and probabilistic topic models. The results show increasing classification performance as the dimensionality of the features increase.

iii. Sachin D Khirade and A B. Patil have published a paper named "Plant Disease Detection Using Image Processing" - Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases.

iv. Vijai Singh,A.K.Misra has published a paper entitled "Detection of plant leaf diseases using image segmentation and soft computing techniques" - This paper presents an algorithm for image segmentation technique which is used for automatic detection and classification of plant leaf diseases. It also covers survey on different diseases classification techniques that can be used for plant leaf disease detection.

v. Vidhya .K "Image Processing System for Plant Disease Identification by Using FCM-Clustering Technique"- Here research completely focused on providing information about plant diseases and prevention methods. Plants have become an important source of energy, and are a fundamental piece of the puzzle to solve the problem of global warming.

III. DIFFERENT TYPES OF CITRUS PLANT LEAF DISEASES

Citrus trees can exhibit a host of symptoms reflecting various disorders that can adversely influence their health, vigor and productivity to varying degrees. Identifying disease symptoms is essential as inappropriate actions may sometimes prove to be costly and detrimental to the yield.

1. **Greasy spot (Mycosphaerella citri).** Greasy spot is caused by Mycosphaerella citri. Management of this disease must be considered in groves intended for processing or for fresh fruit market. Greasy spot is usually more severe on leaves of grapefruit, pineapple, hamlins and tangelos than on valencias, temples, murcotts, and most tangerines and their hybrids. Infection by greasy spot produces a swelling on the lower leaf surface. A yellow mottle appears at the corresponding point on the upper leaf surface. The swollen tissue starts to collapse and turn brown and eventually the brown or black symptoms become clearly visible. Airborne ascopores produced in decomposing leaf litter on the grove floor are the primary source of inoculum for greasy spot. These spores germinate on the underside of the leaves and the fungus grows for a time on the surface before penetrating through the stomates (natural openings of the lower leaf surface). Internal growth is slow and

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

does not appear for several months. Warm humid nights and high rainfall, typical of Florida summers, favor infections and disease development. Major ascopore release usually occurs from April to July, with favorable conditions for infection occurring from June through September. Leaves are susceptible once they are fully expanded and remain susceptible throughout their life.

2. **Melanose (Diaporthe citri).** Control of melanose, caused by Diaporthe citri, is often necessary on mature groves where fruit is intended for fresh market, particularly if recently killed twigs and wood are present as a result of freezes or other causes. Grapefruit is very susceptible to melanose, but the disease may damage all other citrus. On foliage, melanose first appears on the young leaves as minute, dark circular depressions with yellowish margins. Later they become raised, are rough, brown in color, and the yellow margins disappear. Leaves infected when very young may become distorted. Infested leaves do not serve as an inoculum source. Young green twigs can also be infected.
3. **Star Melanose**. Star melanose occurs when copper is applied late during hot, dry weather, and is due to copper damage to leaves. It has no relationship to melanose but may resemble symptoms of that disease. Copper causes the developing tissues to become more corky and darker than normal and the shape of the lesion often resembles a star.
4. **Citrus scab (Elsinoe fawsettii).** Citrus scab caused by elsinoe fawsettii affects grapefruit, temples, murcotts, tangelos, and some other tangerine hybrids. Small, pale orange, somewhat circular, elevated spots on leaves and fruit are the first evidence of the disease. As the leaves develop, the infection becomes well defined, with wart-like structures or protuberances on one side of the leaf, often with a conical depression on the opposite side. The crests of the wart-like growths usually become covered with a corky pale tissue and become somewhat flattened as the fruit matures especially on grapefruit. The pustules may run together, covering large areas of the fruit or leaves. Badly infected leaves become very crinkled, distorted, and stunted. Fruit severely attacked when very small often become misshapen. Scab can be particularly severe on temples and lemons, and is often troublesome on murcotts, minneola tangelos and grapefruit.

IV. IMAGE PROCESSING AND COMPUTER VISION TECHNIQUES

Computer vision techniques are used for agricultural applications, such as detection of weeds in a field, sorting of fruit on a conveyer belt in fruit processing industry, etc. The underlying approach for all of these techniques is the same. First, 6 digital images are acquired from environment around the sensor using a digital camera. Then image-processing techniques are applied to extract useful features that are necessary for further analysis of these images. After that, several analytical discriminant techniques, such as statistical, bayesian or neural networks will be used to classify the images according to the specific problem at hand. This constitutes the overall concept that is the framework for any vision related algorithm.

In the past decade, agricultural applications using image processing and pattern recognition techniques have been attempted by various researchers. Object shape matching functions, color-based classifiers, reflectance-based classifiers and texturebased classifiers are some of the common methods that have been tried in the past. The following sections will discuss some past work done using these methods.

1. **Object Shape Matching Methods**

Tian et al. (2000) developed a machine vision system to detect and locate tomato seedlings and weed plants in a commercial agricultural environment. Images acquired in agricultural tomato fields under natural illumination were studied extensively and an environmentally adaptive segmentation algorithm, which could adapt to changes in natural light illumination, was developed. The method used four semantic shape features to distinguish tomato cotyledons from weed leaves and a whole plant syntactic algorithm was used to predict stem location of whole plant. Using these techniques, accuracies of 65% for detection of tomato plants were reported.

2. **Color Based Techniques**

Woebbecke et al. (1995b) developed a vision system using color indices for weed identification under various soil, residue and lighting conditions. Color slide images of weeds among various soils and residues were digitized and analyzed for red, green and blue (RGB) color content. It was observed that red, green and blue chromatic coordinates of plants were very different from those of background soils and residue. For distinguishing living plant material from a non-plant background, several indices of chromatic coordinates were tried and were found to be successful in identifying weeds. A weed detection system for Kansas wheat was developed using color filters by Zhang and Chaisattapagon (1995). Gray scale ratios were used to discriminate between weed species common to wheat fields.

3. **Reflectance Based Methods**

A method to assess damage due to citrus blight disease on citrus plants, using reflectance spectra of entire tree, was developed by Edwards et al. (1986). Since the spectral quality of light reflected from affected trees is modified as the disease progresses, spectra from trees in different health states were analyzed using a least squares technique to determine if the health class could be assessed by a computer. The spectrum of a given tree was compared with a set of library spectra representing trees of different health states. The computed solutions were in close agreement with the field observations.

4. **Texture Based Methods**

In many machine vision and image processing algorithms, simplifying assumptions are made about the uniformity of intensities in local image regions. However, images of real objects often do not exhibit regions of uniform intensities. For example, the image of a wooden surface is not uniform, but contains variations of intensities which form certain repeated patterns called visual texture. The patterns can be the result of physical surface properties such as roughness or oriented strands, which often have a tactile quality, or they could be the result of reflectance differences such as the color on a surface.

V. CONCLUSION

The survey on different diseases classification techniques used for plant leaf disease detection and an algorithm for image segmentation technique that can be used for automatic detection as well as classification of plant leaf diseases are presented in this work. Banana, beans, jackfruit, lemon, mango, potato,

tomato, and sapota are some of those ten species on which proposed algorithm is tested. Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases.

VI. REFERENCES

[1] Peyman Moghadam, Daniel Ward, Ethan Goan has published a paper entitled "Plant Disease Detection Using Hyperspectral Imaging Digital Image Computing: Techniques and Applications (DICTA), 2017 International Conference on 29 Nov.-1 Dec. 2017.

[2] S. Arivazhagan, R. NewlinShebiah, S. Ananthi, S. Vishnu Varthini, "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", CIGR, vol.15(1), pp. 211-217, March 2013.

[3] Sachin D Khirade and A B. Patil "Plant Disease Detection Using Image Processing.

[4]

[5] "International Conference on Computing Communication Control and Automation (ICCUBEA), 2015.

[6] E Borgoes,A P. Matosc C Correia "Early detection and monitoring of plant diseases by Bioelectric Impedance Spectroscopy".

[7] Usama Mokhtar, Mona A. S. Alit, Aboul Ella Hassenian, Hesham Hefny has published a paper on "Tomato leaves diseases detection approach based on support vector machines" IEEE pp. 978-1-5090-0275-7/15, 2015.

[8] Vijai Singh, Varsha, A. K. Misra "Detection of unhealthy region of plant leaves using image processing and genetic algorithm.

[9] Martinelli, F., Scalenghe, R., Davino, S., Panno, S., Scuderi, G., Ruisi, P., Villa, P., Stroppiana, D., Boschetti, M., Goulart, L.R., Davis, C.E., Dandekar, A.M. (2014). Advanced methods of plant disease detection. A review. Agronomyfor Sustainable Development. 35: 1–25. doi:10.1007/s1359301402461.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

FOG SCREEN

Anjuna P Honnikoppa, Prof. Mahaling Salimath
Department of Information science SKSVMACET, Laxmeshwar, Karnataka, India

ABSTRACT

Fog Screen is breakthrough technology that allows projection of high quality images in the air. It is currently the only walk-through projection screen. It literally uses the air as the user interface by touching only the air with the bare hands. The screen is created by using a suspended fog generating device with no frame around and works with video projectors. The fog used is dry, so it doesn't get wet even if it stays under the Fog Screen device for a long time .The fog is made of ordinary water with no chemicals what so ever. With two projectors, it can be project different images on both sides of the screen. It is a display device which is the application of computer graphics.

I. INTRODUCTION

Inspired by science fiction movies such as Star Wars, two Finnish virtual reality researches created the Fog Screen to recreate some of the effects from these movies in real life.

- Fog Screen is an exciting new projection technology that allows to project images and video onto a screen of "dry" fog, creating the illusion that the images are floating in midair.
- Fog Screen is the world's first immaterial walk-through projection screen. Its qualities, in particular the walk-through capability, set Fog Screen apart from other displays and thus created a seemingly successful market for its products.
- The Fog Screen is an innovative display technology that allows for projections on a thin layer of dry fog. Imagine the traditional pull down screen that is found in many classrooms today. Instead of a screen being pulled down from the ceiling, fog is pushed down and held in place by several small fans, allowing for a consistent surface for display.
- It is one type of advanced projecting device which consumes water and electricity to form fogs on which images are projected.

II. EXISTING SYSTEM

A projection screen is an installation consisting of a surface and a support structure used for displaying a projected image for the view of an audience. Projection screens may be permanently installed as in a movie theatre, painted on the wall, semi-permanent or mobile, as in a conference room or other non dedicated viewing space such as an outdoor movie screening. Uniformly white or grey screens are used almost exclusively as to avoid any discoloration to the image, while the most desired brightness of the screen depends on number of variables, such as the ambient light level and the luminous power of the image source. Flat or curved screens may be used depending on the optics used to project the image and the desired geometrical accuracy of the image production, flat screens being the common of the two. Screens can be further designed for front or back projection , the more

common front projection systems having the image source situated on the same side of the screen as the audience. Different markets exist for screens targeted for use with digital projectors, movie projectors, overhead projectors and slide projectors, although the basic idea for each of them is very much the same: front projection screen works on diffusely reflecting the light projected onto them, whereas back projection screens work by diffusely transmitting the light through them.

III. PROPOSED SYSTEM

It is one type of advanced projecting device which consumes water and electricity to form fogs on which images are projected. Fog Screen is a patented technology, which Rakkolainen, one of the senior researchers and founders behind this technology, describes as, "an immaterial projection screen that consists of air and a little humidity, and enables high quality projected images in thin air, as well as many new applications.

- Fog Screen is an exciting new projection technology that allows to project images and video onto a screen of dry fog, creating the illusion that the images are floating in midair. Fog Screen is a just 2D projection screen, but not a common opaque screen like hundreds of others in the market, rather than an immaterial screen. A user may also interact with objects displayed in fog with the use of an input device like a data clove, a tracked wand, or simply using hands. The system starts with water that is held in a large plastic container or comes from a regular water pipe. This water is drawn through a plastic tube via a small engine. Users have the ability to control the density and flow of the fog and the strength of the sandwiching air streams. Fog Screen is a new invention which makes objects seems to appear and move in thin air. The basic components of the screen are alumina, on turbulent airflow, and a thin fog screen created this way, the fog screen is an internal part of the laminar airflow, and remains thin and turbulence.

IV. WORKING OF FOG SCREEN

- Fog Screen technology is a high-tech version of the technology in a cool air humidifier.
- Tap water is pumped into the fog tank where it is blasted with ultrasound, turning it instantly into a thick fog made of tiny water particles 2-3 microns in diameter. The tank's internal design plus 3 sets of fans work together to create a very thin wall of mist about half of an inch thick. One set of fans blows the fog downwards while the other two sandwiches the fog between air curtains so that it becomes a smooth projection screen. Fog screen works much like many screens in terms of its projection properties and requires a 2kw power supply, with on screen using fifty liters of tap water per hour. The device situated above the fog screen enables the purification of the water via a silver-ion channel and minerals within the tank are cleaned out through regular maintenance. The opacity will depend on a number of factors namely fog density, the projector, image brightness and the background. It appears to be a very versatile technology and can be combined with many methods in order to achieve the imagery required, such as pseudo 3D display and mechanisms to allow further interactivity via tracking. The founders of the fog screen were intrigued with the prospect of creating an image that could float in the air and that people could walk through. They set out to make a projected image float in the air by using different media such as dust, water, fog and then a mist of tiny water droplets. They

had to iterate their design repeatedly to ensure that people would not get wet and that the Fog Screen could operate within a broad range of environmental conditions.

V. CONCLUSION

Technology of the future literally revolutionizes the limits of projection screens and blurs the boundaries among art, science and fun .Facilitates projection of high quality images. This presents an immaterial, interactive screen which is a new kind of a user interface floating in thin air. It employs ultrasonic tracking, although many other kinds of tracking methods could also be used. The interactive screen has many applications on fields such as entertainment, visualization, art etc.

VI. REFERENCES

1. Fog Screen, 2005-2007. All pages available from: http://www.fogscreen.com/en/[Accessed 2 October 2007].
2. Fog Screen, 2005-2007. Fog Screen, Inc.Reference Cases. Available from: http://www.fogscreen.com/en/sales/Reference_cases/ [Accessed 9 December 2007].
3. IO2 Technology, 2007. All pages. Available from: http://www.io2technologgy.com/technology/overview[Accessed 15 November 2007].
4. Nony Designs, 2005. Fog Screen Fascinating to Behold. Available from: http://www.nonydesigns.com/site/780912/product/FGS-001[Accessed 4 December 2007].
5. Woods, JW., 2007. Fog Screen Solutions. Available from: http://techrepublic.com.com/5208-1035--0.html?forumID=102&threadID=243196&messageID=2356837[Accessed 2 December 2007].
6. Dimacast , 2007. DIMAcast [068] Interview with Jordan Woods. Available from: http://www.dimacast.libsyn.com/index.php?post_id=258906[Accessed 4 October 2007].
7. Reuters, 2003. Making a video screen out of thin air. Available from: http://www.io2technoloy.com/images/cnn-website.jp[Accessed 3 december 2007].
8. Rakkolainen, IK., AK., 2007. Immaterial display for interactive adverstisements. Paper presented at the proceedings of the international conference on Advances in computer Lugmayr,entertainment technology, 2007, Salzburg, Austria. Available from: http://portal.acm.or/citation.cfm?id=1255066[Accessed 4 November 2007].
9. Olwal, A., DiVerdi, S., Candussi, N., Rakklainen, I., Hollerer, T., 2006, An Immaterial, Dual –sided Display system with 3D Interaction. Paper presented at the Proceedings of the IEEE Virtual Reality Conference, 2006. Available from: http://portal.acm.or/citation.cfm?id=1130450[Accessed 4 November 2007].
10. Palovuori, K., Rakkolainen, I., 2005. Laser scanning for the interactive walk-through fog screen . Paper presented at the Proceedings of the ACM symposium on Virtual reality software and technology, 2005, Monterey,CA,USA. Available from: http://portal.acm.org/citation.cfm?id=1101661[Accessed 5 November 2007].

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Remote Monitoring and Control of Wireless Sensor Network Using Zigbee

Lipsa Dash[1] , Agnes Maria James[2], Sharat Sajjan[2], Sonal Ganesh Hegde[2]
[1]Senior Assistant Professor, Department of Electronics and Communication, New Horizon College of Engineering, Karnataka, India
[2]Student,B.E. , Department of Electronics and Communication, New Horizon College of Engineering Outer ring road, Marathahalli, Bengaluru, Karnataka, India

ABSTRACT

The idea of the project is to build a prototype for monitoring and control of complex electrical systems. The proposed system includes various system nodes that constantly monitor different parameters such as voltage, current and temperature in an electrical system. The sensed data from node is transmitted using sink node using Zigbee module. the data from sink node send to the Thingspeak cloud and mobile app. This application is a perfect example of IOT based monitoring and control system.
Keywords: Zigbee, ARM7, Thingspeak cloud, Arduino, Wifi, Blynk app

I. INTRODUCTION

The technology used in the system is wireless sensor network. Wireless sensor network refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organising the collected data at a central location. Sometimes they are called as dust networks, referring to minute sensors as small as dust. The proposed system consists of two nodes(substations) with inhouse voltage, temperature and current sensors connected to a sink node(Base station) through ZigBee module which acts as a data transfer device.The sink node in turn interacts with the thingspeak cloud for continuous updation of system parameters.An administrator uses a mobile app for monitoring the cloud and subsequently control the adverse condition existing in substation. Three sensors are connected to Arm7 microcontroller to measure voltage, temperature and current from transformer which is connected to load through relay. The temperature sensor used is LM35.Three zigbees are used here. Two zigbees are used as routers and one is used as coordinator. The data from the routers is transferred to the coordinator using serial communication. The ZigBee routers function as ZigBee transmitters and the coordinator functions as ZigBee receiver. ARM7 is used in the transmitter side in both the nodes. It is an advanced RISC machine which is 32 bit microprocessor. It is high performing, low power consuming with Von Neumann architecture. The sensed data is transferred from the ZigBee receiver to the thingspeak cloud using WiFi module. The data is stored in the thingspeak cloud which can easily be viewed by the administrator.

If any of the values exceed the threshold values, immediately the buzzer alerts, notification is sent to cloud and mobile app. Administrator turns off the relay as soon as notification is received . By doing so,the node and load are protected.

II. WORKING

Two nodes are taken in this project. Various parameters such as voltage, current and temperature are sensed. Since these parameters are analog in nature, they are converted into digital values by ARM7 Controller. The pins P0.4 used for temperature, P0.28 for voltage, P0.29 for temperature are used. The measured values are sent to zigbee transmitter via UART communication(serial communication).

The digital values are received by the zigbee receiver. The receiver values are further sent to the arduino microcontroller board. The values are sent to the thingspeak cloud from arduino via a in built wifi module.The various parameter values are displayed and stored in thingspeak cloud and mobile app.

The values can be viewed in the mobile by the Blynk App in real time. A threshold values is set to all the parameters. If any of these parameters exceed the threshold level, the buzzer will
alert and alert notification message is sent from node to sink node from sink node to thingspeak cloud and alert notification will be displayed in blynk app. Administrator turns off the relay as soon as notification is received . Thus preventing the nodes from any electric damage.

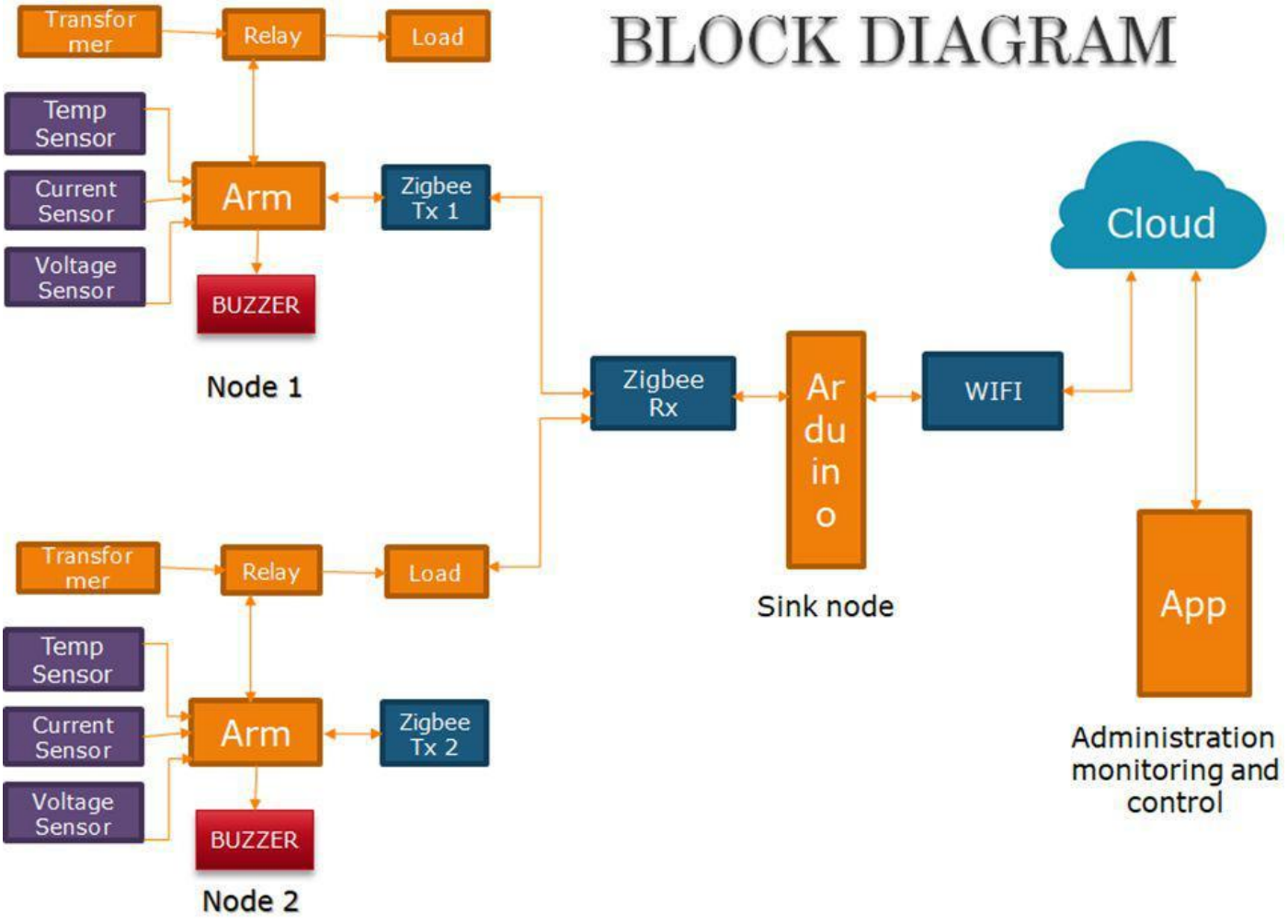


Figure 2.1

A **current sensor** is a device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

Temperature sensor:

Figure 2.1

III. PROTOTYPE CONSTITUENTS

Voltage Sensor :

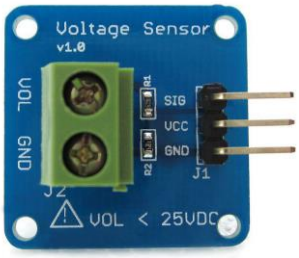


Figure 3.1

In general,a **temperature sensor** is a device which is designed specifically to measure the hotness or coldness of an object.**LM35** is a precision IC temperature sensor with its output proportional to the temperature (in °C).With LM35,the temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from **-55°C to 150°C**.The LM35's low output impedance,linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.It has find its applications on power supplies,battery management,appliances.

ARM7 board :

Figure 3.2

Voltage sensors are basically a device which can sense or identify and react to certain types of electrical or some optical signals. Implementation of **voltage sensor** and current sensor techniques has become an excellent choice to the conventional current and voltage measurement methods

Current sensor:

ARM, previously **Advanced RISC Machine**, originally **Acorn RISC Machine**, is a family of reduced instruction set computing (RISC) architectures for computer processors, configured for various environments. British company ARM
Holdings develops the architecture and licenses it to other companies, who design their own products that implement one of those architectures—including systems-on-chips (SoC) and systems-on-modules (SoM) that incorporate memory, interfaces, radios, etc. It also designs cores that implement this instruction set and licenses these designs to a number of companies that incorporate those core designs into their own products.

Processors that have a RISC architecture typically require fewer transistors than those with a complex instruction set computing (CISC) architecture (such as the x86 processors found in most personal computers), which improves cost, power consumption, and heat dissipation. These characteristics are desirable for light, portable, battery-powered devices—including smartphones,laptops and tablet computers, and other embedded systems.[3][4][5] For supercomputers,which consume large amounts of electricity, ARM could also be a power-efficient solution.[6]

ARM Holdings periodically releases updates to architectures and core designs. All of them support a 32-bit address space (only pre-ARMv3 chips, made before ARM Holdings was formed, as in original Acorn Archimedes, had smaller) and 32-bit arithmetic; instructions for ARM Holdings' cores have 32-bit fixed-length instructions, but later versions of the architecture also support a variable-length instruction set that provides both 32- and 16-bit instructions for improved code density.Some older cores can also provide hardware execution of Java bytecodes. The ARMv8-A architecture, announced in October 2011,[7] adds support for a 64-bit address space and 64-bit arithmetic with its new 32-bit fixed-length instruction set.

With over 100 billion ARM processors produced as of 2017, ARM is the most widely used instruction set architecture in terms of quantity produced.[8][9][10][11][12]Currently, the widely used Cortex cores, older

"classic" cores, and specialized SecurCore cores variants are available for each of these to include or exclude optional capabilities.

Arduino board :

Figure 3.3

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontroller and microcontroller

kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processinglanguage project.

Zigbee :

Figure 3.4

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios,such as for home automation, medical device data

collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.

The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless networking such as Wi-Fi . Applications include wireless light switches, home energy monitors, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer.

Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and

environmental characteristics.[1] Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking (Zigbee networks are secured by 128 bit symmetric encryption keys.) Zigbee has a defined rate of 250 kbit/s, best suited for intermittent data transmissions from a sensor or input device.

ThingSpeak cloud :

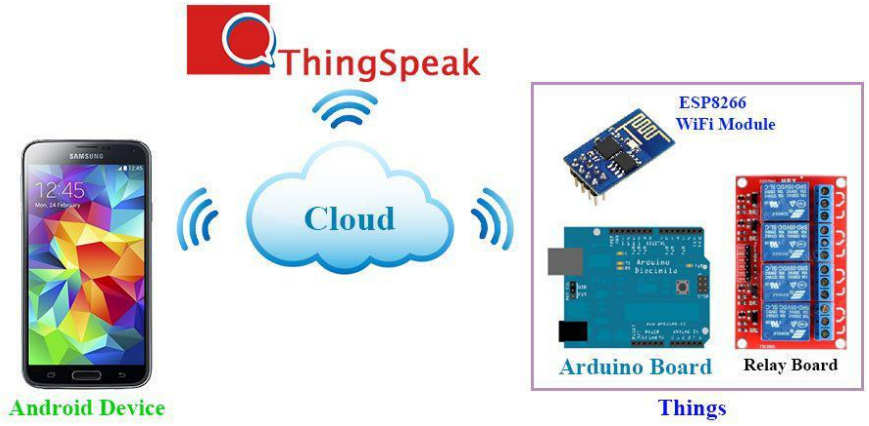


Figure 3.5

According to its developers, "**ThingSpeak** is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates".[2]

ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IoT applications.[3]

ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks,[4] allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks.

ThingSpeak has a close relationship with Mathworks,Inc. In fact, all of the ThingSpeak documentation is incorporated into the Mathworks' Matlab documentation site and even enabling registered Mathworks user accounts as valid login credentials on the ThingSpeak website.[5] The terms of service[6] and privacy policy[7]of ThingSpeak.com are between the agreeing user and Mathworks, Inc.

Blynk app :

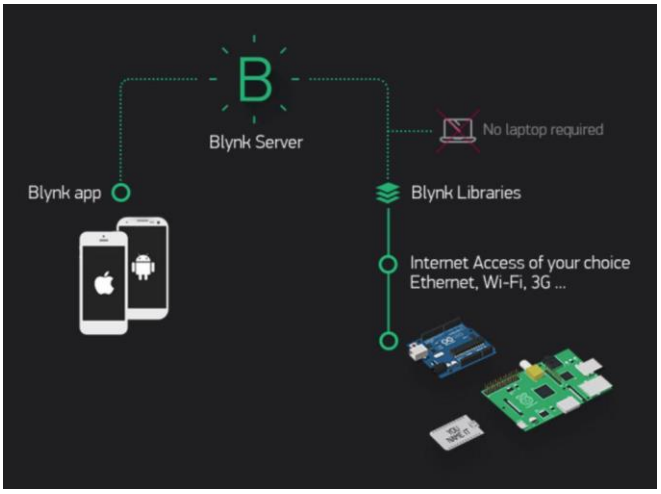


Figure 3.6

Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

It's really simple to set everything up and you'll start tinkering in less than 5 mins.

Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the **Internet Of Your Things**.

IV. PROTOTYPE BUILDING/RESULTS

Following is the prototype for the proposed system:

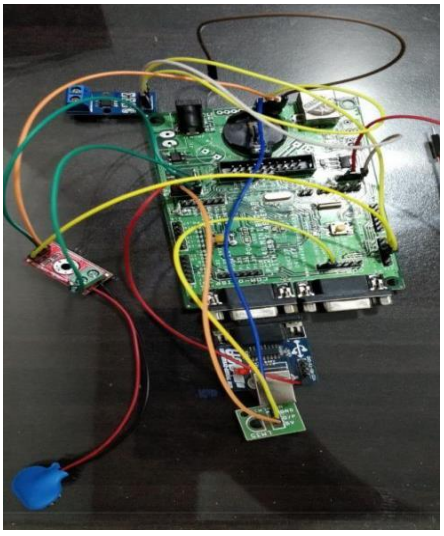


Figure 4.1

Figure 4.2

The above figure shows the values of sensed parameters at sensor nodes.

V. CONCLUSION

A prototype is built for monitoring and control of complex electrical system. The system constantly monitors different parameters such as voltage, temperature and current in an electrical system. The supervision and control of substation using Internet of Things(IOT) has been experimentally proven by connecting relay to transformer. This control system is modelled for multiple output and input arrangements for substation applications. There are different drawbacks of existing system like difficulty in wiring, high maintenance cost and limitations of control range of the system. This system overcomes the limitations of the existing system. This system is suitable for real time monitoring of substation parameters. Remote monitoring and controlling is possible. The measured parameters are displayed and stored in the Thingspeak cloud and mobile app(Blynk app). Threshold level is set for the parameters. If any of these parameters exceed the threshold level, buzzer is alerted and the relay is turned off. Hence, the load is prevented from electrical damage.

VI. FUTURE SCOPE

The future work includes increasing the distance between monitoring and control section by increasing the number of nodes i.e. creating star, mesh topology etc. The other parameters of substation such as circuit breaker can also be monitored and automatic control of the system can be included in future work.

Using this system as framework the system can be expanded for energy monitoring, or weather stations. This kind of a system can be the best alternative where human invasion is impossible or dangerous, and it can also be implemented for environmental monitoring with respective changes.

VII . REFERENCES :

[1]. Power system analysis and design by B.R. GUPTA.
[2]. The 8051 Microcontroller and embedded systems using assembly and „C‟ by Muhammad Ali Mazidi/Janice Gillispe Mazidi/Rolin D.Mc Kinlay.

[3]. M. Shravanth Vasisht, C. Vishal, J. Srinivasan and Sheela K. Ramasesha, "Solar photovoltaic assistance for LHB rail coaches": Current Science, Vol. 107, No. 2, 25 July, 2014.

[4]. Gianfranco Rizzo, Ivan Arsie, Marco Sorrentino, Solar energy for cars: perspectives, opportunities and problems, GTAA Meeting, Mulhouse, 2627 May, 2010.

[5]. [5] Available[online]: http://www4.unfccc.int/submissions/INDC/Published%20Doc uments/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf

[6]. The New Indian Express, Chennai edition, 28 September, 2015;Available[online]:http://www.newindianexpress.com/citi es/chennai/Rail-Solar-Panels-canSave-11-Crore-LitresFuel/20 15/09/28/article3050807.ece

[7]. Hong-Jun Zhu, (2010), "Global Fisheries Development Status and Future Trend Analysis", Taiwan Economic Research Monthly, 33(3)

[8]. Philips G. Lee, (1996), "A Review of Automated Control Systems for Aquaculture and Design Criteria for Their Implementation" 9] "How about the Eutrophication", (2006) YAHOO knowledge April 4, 2013, from: http://tw.knowledge.yahoo.com

[9]. Zi-En Lin, Deng-Fu Guo, Yu-Yang Er, (2000) "Fish disease topic - Hokkaido University Faculty of Veterinary Infectious Diseases Chair", Feed Journal of Nutrition , 12, (p.85~93)

[10]. "Fish World", (2003), Fish World Magazine, March, 2003

[11]. Zhi-Zhong Huang, (2007), "Recirculating Aquaculture Promotion Results", Council of Agriculture Executive Yuan-Sustainable Fisheries Energetic Fisheries,184

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Flexible compartments IoT driven smart pill-box

Lipsa Dash[1], Arun R[2], Bhavani R[2], RethnaJennifer S[2]
[1]Professor, Department of Electronics and Communication, New Horizon College of Engineering, Outer Ring Road Marthahalli, Bengaluru, Karnataka, India
[2]Student Department of Electronics and Communication, New Horizon College of Engineering, Outer Ring Road Marthahalli, Bengaluru, Karnataka, India

ABSTRACT
The scenario today in taking care of elderlypeople and other groups of people who need continuous medical attention involves assisting them with the right medication at the right moment of time. To enable these set of people to take medication on their own without the assistance of another individual is the main aim of this proposed paper. The proposed system is said to have inculcated Assistive technology which provides means of assistance by use of rehabilitative devices to people with varies disabilities. Assistive technology(AT) aims at promoting independence of the people by actually enabling them to perform varies tasks with ease which they were unable to perform otherwise. Assistive technology provides means of enhancing the lifestyle of people by providing assistance. On a reality check today not everyone is able to access AT catering to reasons like high costs, less awareness and less availability of the varies assistive devices. But it has been estimated that by 2050, a major portion of the society will be running on AT devices. In this paper we have proposed an approach advancing towards using AT devices. There has been usage of open source technologies and gives a new organised manner of taking medication dosages."Flexible compartment smart pillbox" basically allows the organization of several medication schedules that health disorders presented in elderly people and other groups of people require. The proposed system includes a buzzer along with an automatic pill dispensing system, user-friendly display interface and a notification system that uses a WIFI module. ARM-7 is taken as the principal controller. The development of this device is mainly focused on supporting elderly people and other groups of people who may have the needfor an assisted care.

Keywords: Assistive technology, IoT, ARM7, smart pill box

I. INTRODUCTION

Assistive care area has become a significant field in medical sciences. The World Health Organization (WHO) defines Assistive Technology (AT) "As systems and services related to delivery of assistive products that enables people to live healthy, productive, independent, and dignified lives, and also able to participate in education, the market labour and civic life"[1].Priority groups on medical area (which could vary according to the location) are; pregnant, personnel withintellectual and development disabilities, also people with special needs, individuals with catastrophic diseases, kids, and elderly[2]. All of them could be benefited from assistive technology in order to reduce the need for formal health services. Then, as estimated by 2050, more than 2 billion people will be in need of at least 1 assistive product with many elderly

needing 2 or more [3]. Elderly, those aged 60 or above, are said to make important contributions as family members, active economy participants, volunteers. Though some people aged well, many of others become frail and sensitive and some of them at risk of disease and a expensive dependence [4]. Especially, people suffering withdementia and cognitive disorders have become a common health problem. This is mainly because of the natural aging which is said to increase chronic diseases [5]. There are health problems which require dosages of varies medication to be given many times in a day. Brain troubles are common due to the brain tissues deteriorating and it ends among things in problems to remind the time to take the medication [6]. The practice carried for dispensing medication to a patient is to allow the patient to take the medication by himself, or vest these responsibilities to a keeper or a doctor concerned. The administration by nurses and doctors is often expensive and impractical for the administrating of medicine within home. Taking wrong dosages or forgetting to take medication is a common issue in elderly patients who are generally lonely and lose track of time [7]. Nowadays there are systems which schedule alarm clocks or even apps mainly designed to schedule and notify medication's time in mobilephones. Also there are pill organizers which are commonly used by patients to save and remind by themselves dosages. The disadvantages of those systems are; Firstly, there are not medication (pills) stored and secondly it doesn't have an alarm system. Electronic developments covering these requirements and aspects have resulted in pill boxes or dispensers, many of pill dispensers with only alert systems to notify the patients as alarms (sound alerts) or lights, and other costly ones with mechanical dispense systems but none without reports about the varies scheduled dosages. This lack of availability of patient-related information can cause many errors in healthcare. The usage of new information and communication technologies (ICTs) could increase it's essential for patient safety andthe accessibility of medical information [8]. Internet of things (loT) which is a global network infrastructure, links physical and virtual objects through the exploitation of data capture and communications capabilities. The connectivity of the varies sensors and other healthcare devices (loT) plays an significant role in care of patients, as it allows to getaccess in real-time of medical information. Therefore, the study and development of an effective Healthcare/loT gateway driven could be crucial in patient care. The creation of alternatives of AT devices looks necessary and promising due to which today only 1 in 10 people have the access to AT due to high expenses and a less awareness, and less availability, personal training. The introduction of AT devices along with loT could lead us to a future where significant information of patients would be available anytime and anywhere, in order to make a right treatment decision and to prevent calamities. In this paper, we propose an approach related to the design of AT device, to give a new choice of taking medication dosages which uses new technologies linked to free hardware and software, with a low cost which does not have limitations on functions and licenses. This programmable device has been built with consideration to quality attributes (e.g., usability, reliability), which allow the organization of several medication schedules that health disorders used to present in elderly require. This device is mainly focused on the support to elderly people due to this special and sensible group for assisted care required for them.

II. EXISTING SYSTEM

A combination between electronic and mechanical pill boxes or dispensers is presented. It's been included that certain traditional pills organizers, which represent the first step in these developments and have enabled us to obtain the ideas required for the designing of useful patterns in development of this solution.

In [9] is presented a pill dispenser which has different prescribed administration schedules. It includes a plurality of pill storage compartments, each of them capable of holding more than one pill. This device has a pill detector and generates a signal to alert patients to take the prescribed medicine. There are twelve storage compartments, arranged in a ring about a vertically rotating wheel. However, the limitation to this solution was that this pill dispenser could only hold doses for 24- hours

A current design presented in Cheyene[10], presents a device that enables the storing and dispensing of pills and various other supplements (i.e., food, drug, supplements, liquids, powders or pills). This device is said to work as an alarm clock and may work with blisterpacked pills or alternatively use an encapsulated compartment to hold and dispense loose pills. Also, it can be connected by wireless means to external environments (cellphones, computers). But, this device does not allow the basic management of several dosages and different kind of pills.

In providinganother solution was the e-pill [11]. It had in its stock various alternatives to organize and dispense pills, which can be mentioned especiallyin two ways: i) A device mainlydesigned to dispense pills composed by 2 medication trays, and 3 day-dosage discs. It hada circumference shape and it had turning compartments for each of the scheduled dosage time. The scheduled dosages are dispensed when an alarm is activated, this device does not use referential diseases, just use dosages per days, and is also not programmable for any particular schedule; ii) it is a reminder medication product mainly focused on patients, caregivers or medical health professionals. This device locks automatically and includes 2 keys. For patients trying to get medications prior it's time there is tamper resistant provided. This device considers supplying pills for one week, four times per day. Also it has alarm and text message reminders.Disadvantages perceived are to close device by interaction of keeper and is not independent. As far as we know, more than it has been described before, there are many solutions which offers advantages as dispensing or alerting system however they do not provide an automatic reminder system, different alert forms or a study in loT field, besides devices are economically difficult to access.

The nextproposes a Smart PillBox with camera. The Camera is placed inside the Box which detects the matrix code on the med bag. User interface on the surface will provide the reminder and alarm functioning.Code gets updated after the Doctor visit. The change of the matrix code and its compartments remains a problem.

The next module uses the WEDUINO module installedin Smart PillBox to achieve 2way messaging with remote relatives via IoT.The module first reads the sensing signals in the kit and uses WI-FI to transmit the signals to the WI-FI router and then sends the medication information to the remote webpage or cell phone for monitoring.It's a 4 compartment PillBox. Also the cell phone can send a remind message back to the LCD screen on Smart PillBox by means of internet.

The last one is based on Arduino Mega 2560 taken as the principal controller[12]. This prototype contains; a programmable alarm system with an automatic opening and closing system, an interactive user interface and a notification system through GSM network.In this work, it proposes a solution that solves these problems.

III. PROTOTYPE CONSTITUENTS

The components are chosen based on their functionality and precision. They are very cost efficient and easily available.

3.1 ARM-7 [LPC 2148]

It is a 32-bit controller with 64 pin configuration. It has 2 ADC,2 UART (hardware serial ports) and real time clock present in it. 45 pins are used for accessing. It also has a 20MHZ crystal oscillator,16 interrupts and 512kb RAM. It also has a USB port that helps us easily connect to the computer. Associated compatible products and capabilities in ARM 7 lets user manage different modules including dc motor, stepper motor controllers.sensors or touch screens which are part in materials chosen and which will have a specific task in the pillbox.

Figure 1. the arm-7 controller

3.2 LCD display

It is a 16x2 display used to show the values of the sensors used, the timing of the pill to be dispensed, the pill that is being dispensed and the patient details. It takes in hexadecimal commands to display data.

It has 16 pins where enable activates the LCD and other pins have their own particular functions.

Figure 2. LCD display

3.3 RFID reader and RFID tag

It works on the principle of radio frequency based electromagnetic field to transfer data from tag to reader. It is distance limited. The tag has to be close to the reader for it to read it. The tag had unique code for authentication of only that particular patient. We use passive reader were a battery is present internally. It works on UART protocol.

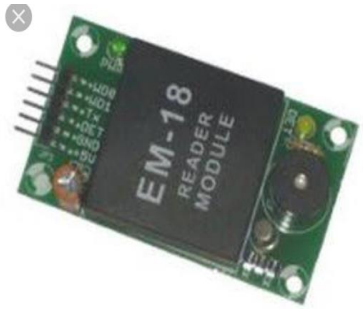


Figure 3. RFID reader module

3.4 WIFI module

In this project we use ESP8266 WIFI module to connect to the customised app on the mobile of the doctor or care taker. It uses a standard set of instructions to send and receive data from the cloud. It directly interfaces with arm-7. It works on the principle of IoT.

Figure 4. WIFI module

3.5 Sensors

in this project we use temperature sensor, blood pressure sensor and pulse sensor. The temperature sensor used is LM35. It operates at 5v. It is an analog device that shows the difference in temperature due to the presence of resistance in it. It gives values in degree Celsius. It works on ADC protocol.

The pulse sensor reads the heart rate of the patient. The LED present in it absorbs the blood flow and the IC processes the data.

The blood pressure sensor works on UART protocol. It reads the blood pressure of the patient. The blood pressure reading has to done manually

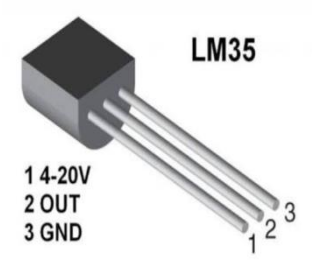


Figure 5. Temp sensor

Figure 6. pulse sensor

3.6 Stepper and DC motors

They are both used for the opening and closing mechanism of the dispenser. They have driver circuit for the interfacing with the controller.

We use Kiel-u vision software for writing the controller code in embedded C. Flashmagic is used to dump the code the controller. The app code is written in JAVA for its object oriented and platform independent qualities.

IV. WORKING

- The device aims to dispense the pills to the elderly patients and also patients with disorders such as amnesia, dementia etc at the programmed time.
- The device is designed such that only one authorised patient can use it thus avoiding any wrong medication reaching the wrong patient.
- The dispenser automatically dispenses the medicine thereby reducing the problem of opening and closing the compartments by the patient.
- The main advantage is that the patient himself/herself can use this system all by themselves reducing the task of the caretakers and the doctors.

- The doctors/caretakers who will have the customised app on their phones can monitor the patient from any place.
- The blood pressure, temperature and heart rate values are being recorded and send to the doctor each time the patient takes the medicine thus helping the doctor update the medication on his/her visit. The entire proposed system is automated except for the blood pressure measuring means

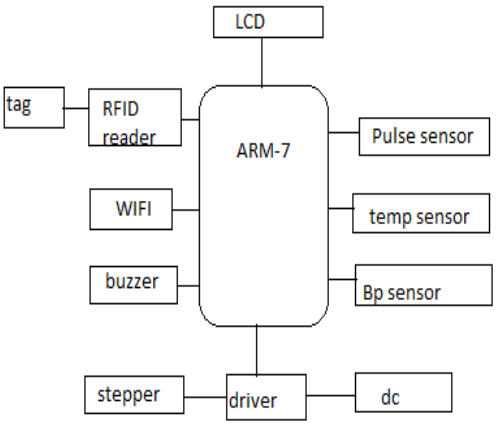


Figure 7. basic block

V. PROTOTYPE BUILDING/RESULTS

The main objective of this analysis is all about using free hardware and software in order to develop a valid and effective device to assist people in taking correct doses of prescribed medicine along with the basic temperature, blood pressure and heart rate readings. ARM-7 was taken as the principal controller. "The Flexible compartment IoT PillBox" is used as a pills storage device, which contains a programmable alarm system, an automatic opening and closing system, an interactive and friendly user interface and a notification system through WIFImodule.

5.1 RFID reader and sensor functions

The RFID tag assigned to each patient will have a unique code. This code is transmitted to the reader giving the patient access to the pill dispenser. Only one patient has access to the dispenser. Once the authorisation is done the sensors read the patient's temperature, heart rate and blood pressure. These values are sent to the doctor/ caretakers informing them the patient's health condition.

5.2 Notification system

The notification is sent through the WIFI module, to the cloud and reaches the doctor /caretaker through a customised app. The doctor confirms the readings from the sensors on the app and sends a confirmation message asking the patient to take the pills. These readings are also displayed on the LCD screen. The details of the patient are also displayed on the app and LCD screen.

5.3 Buzzer and pill dispensing

Once the confirmation message is obtained the buzzer rings indicating the patient that the particular pill is going to be dispensed. The stepper motor rotates in step angle and DC motor rotates in circular motion stopping at the particular compartment from where the specified pill is being dispensed. The pill falls into a container and the patient has to just consume it. Once this is done the, a message is again updated on the app telling that the patient has consumed the pill.
The process repeats on hourly basis based on the timings the pill is dispensed.

Figure 8. proposed pillbox

Figure 9. dc & stepper

VI. FUTURE WORK

Thermometer: A thermometer can be included in order to analyse the internal temperature of the device for the correct conservation of the pills. An alarm will be activated if the temperature exceeds the previous set limit.

Security: After the design is selected, a lock system could be added. The device will be used only by; doctors, keepers, and patients without significant disorders. They would only program the device with a personal password.

Touch Screen: Another module marked as inconclusive is the TFT LCD Touch Screen. In this process the touch function is not available, but the goal is to use this interface to configure the medication scheme.

Camera and voice recorder: These devices could be added to provide an enhanced means for monitoring the patients.

Biometric Blood pressure: This can be inculcated to combat the odds of manually taking the blood pressure readings.

VII. CONCLUSION

Elderly constitute 30% of the population and people with a need of an assistive aid are high in number. The disabled patients and people who cannot afford for a caretaker also require aid. This device aims at dispensing pills according to the patient's health requirements at the right time and dosage.The system also sends notifications regularly to the doctor/caretaker helping them keep a check on their condition. It is cost efficient and easily accessible for patients of all sectors.

As mentioned in the future works a touch screen LCD could be added and also a thermometer to conserve the pills could be implemented. Further research is being done.

VIII. REFERNCES

1. W. H. Organization, "Assistive Technology," Assistive Technology, 2016. [Online]. Available: http://www. who. intlmed iacentre/factsheets/assistivetechnology/en/.
2. Ministerio Salud Publica, "MAIS (Manual del Modelo de Atenci6n Integral de Salud)," Ministerio de Salud Publica del Ecuador. p. 210, 2012.
3. L. Garyon et al., "Medical and Assistive Health Technology: Meeting the Needs of Aging Populations," vol. 56, pp. 293-302, 2016.
4. C. Mollaret, A. A. Mekonnen, F. Lerasle, I. Ferram\ 1. Pinquier, and B. Boudet, "A multi-modal perception based assistive robotic system for the elderly," vol. 0, pp. 1-20,2016. P. Casanova-Sotolongo,
5. P. Casanova-Carrillo, and C. Casanova-Carrillo, "Deterioro cognitivo en la tercera edad," Rev. Cuba. Med. Gen. Integr., vol. 20, no. 5-6, pp. 0-0, 2004.
6. C. Canet, La Tercera Edad, 1st ed. Victoria, Canada, 2005.
7. J. H. Brown, P. E. N. Knowles, F. Booth, and H. C. Post, "United States Patent [[19]," 909628, 1980.
8. C. Elena and C. Octavian, "Internet of Things as Key Enabler for Sustainable Healthcare Delivery," Procedia - Soc. Behav. Sci., vol. 73, pp. 2S1-2S6, 2013.
9. K. E. Lewis and A. Roberts Jr, "United States Patent [19] [54]," 4,573,606, 1984.
10. Shaahin Cheyene, "(19) United States (12)," vol. 1, no. 19,2011.
11. e-pil1 medication Reminders, "E-pil1 Medication Reminders. " [Online]. Available: www.epill.com.
12. Juan Marcelo Parra 1, Wilson Valdez \ Andrea Guevara\ Priscila Cedillo2, Jose Ortiz-Segarra 3 University of Cuenca "Intelligent pillbox: Automatic and programmable assistive technology device" 2017 IEEE.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Wear Behavior of Aluminum Alloys under Low Stress Three Body Dry Sliding Abrasion Conditions

Viswanath Bellie*[1] , Vinod Kumar .S[2]
[1]Professor, Mechanical Engineering, NHCE, Bangalore, Karnataka, India
[2]Asst. Professor(2),EEE, NHCE, Bangalore, Karnataka, India

ABSTRACT

Wrought Aluminum alloy 6063-O fingers of size 8 mm dia and 50 mm length were machined from 12 mm dia rods and cast Aluminum alloy A 356.0 rods of 12 mm dia were melted and cast in permanent cast iron moulds and later machined to 8 mm dia and 50 mm length fingers. Two types of cast samples were prepared namely the as-cast and T6 tempered conditions. Dry sliding 3 body abrasive wear behavior of these materials under low stress conditions with applied load from 1N to 3 N has been investigated using a specially designed pin on disc wear tester at a fixed sliding speed of 1.3 m/s. SiC emery paper of grit 220 was pasted on the steel counter face and made to run against the fixed pin made of the Aluminum alloy. The wear mass loss was measured for various test conditions and wear factor calculated and plotted. The wear mechanisms were identified and the wear scars viewed through the optical microscope and inferences drawn. The wear rate was found to decrease when the sliding distance and the applied load was increased. The results revealed that severe wear occurred, the wear factor being in the range 10^{-3} to 10^{-5} mg/Nm, in spite of the low stress applied. The wear behavior was correlated to the test conditions and the properties of the materials used. The study pertains to IC engines, valves, brakes, material handling equipment, bearings, electromechanical and MEMS devices to name a few.

Keywords: Low stress abrasion, three body abrasion, wears mechanisms; wear scar microstructures, wear factor, MML (Mechanically mixed layer).

I. INTRODUCTION

Wear may be defined (Budinski and Budinski, 2005) as the surface damage or removal of material from one or both of two solid surfaces in a sliding, rolling or impact motion to one another as a result of mechanical action. The wear phenomenon can occur due to adhesion, abrasion, surface fatigue or tribochemical reaction. In addition, many studies reveal that the wear situation comprising of the materials under consideration, its shape, weight, applied load, test duration and environment conditions, affect the wear rate and the wear mechanisms. Wear is a serious problem in many engineering applications, especially moving parts like bearings and engine parts. There is also an increasing demand for light weight materials with good wear resistance in the automotive and aerospace sectors (Gui et al. 2000).

Aluminum alloys exhibit mild to severe wear. A transition from mild to severe wear depends on the applied load and the sliding speed during dry sliding wear (Zhang and Alpas, 1997). When the wear is severe, ductile materials such as Aluminum alloys experience substantial surface plastic deformation at the surface (Dautzenberg and Zaat, 1973, Perrin and Rainforth, 1997, Singh and Alpas, 1996).

The investigation of Horn & Zeigler (1983) showed that pure Aluminum, non-heat treatable alloys and cast Al-Si alloys have poor dry abrasive wear resistance and that cold work does not cause a significant improvement. Heat treatable wrought alloys and cast alloys aged to optimum hardness showed improved performance. The work of Rao & Sekhar (1986) concluded that the wear rate of a range of Aluminum alloys did not decrease with the increase of their Vicker's Hardness. It has also been stated that friction is inversely proportional to hardness (Drozdov and Archegov ,1981). It is still not clear despite many studies which Al alloy would offer the best wear performance and whether a precipitation hardened matrix would be optimum, or whether a work hardened characteristic would be important (Ghazali et al., 2007).This applies to Al MMC's (Metal matrix composites) also. Therefore this paper attempts to study the wear behavior of cast Al A 356.0 in the as-cast and T6 tempered condition and compared to the wear performance of wrought Al alloy 6063-O, in the annealed stage. Both the alloys are Magnesium Silicon alloys, with the 6063 alloy, being a popular aerospace material and the cast alloy A 356.0 used for applications like machine tool parts, aircraft wheels, pump parts, valve bodies, cylinder heads and engine blocks.

As already stated the wear situation plays a major role in the wear behaviour of any material and in this study the counterface of steel is pasted with SiC 220 grit emery paper with 75 micron size irregular shaped abrasives. The pin being Al alloy, the wear rate would be severe in nature and hence lower applied loads 1N to 3 N have been applied. The wear situation is expected to be more aggressive than the adhesive wear situation, studied by many authors. Wear studies have been conducted earlier at the Meso, Micro and Nano scales for MEM'S devices, with applied loads ranging from a few nN to 100 mN (Le, et al., 2008). Adhesive wear studies involved higher applied loads up to 50 N.Very little work has been conducted on low stress abrasion and sliding and fretting wear, and this pertains to coatings. Little or no work has been carried out in the load range 1N to 3 N for bulk materials or coatings, with the wear situation described.

II. EXPERIMENTAL WORK

2.1 Apparatus

The experimental test fixture is shown in Figure 1, which is a pin on disc tribometer.Here the flat pin of size 8 mm x 50 mm length is loaded precisely with weights of 1N, 2 N and 3 N. The wear loss of the test material is calculated from the mass loss during the test. The test conditions like load applied, sliding speed and distance simulate the real life situations of many practical wear applications. The set-up has been specially designed and fabricated to test with low load applications.

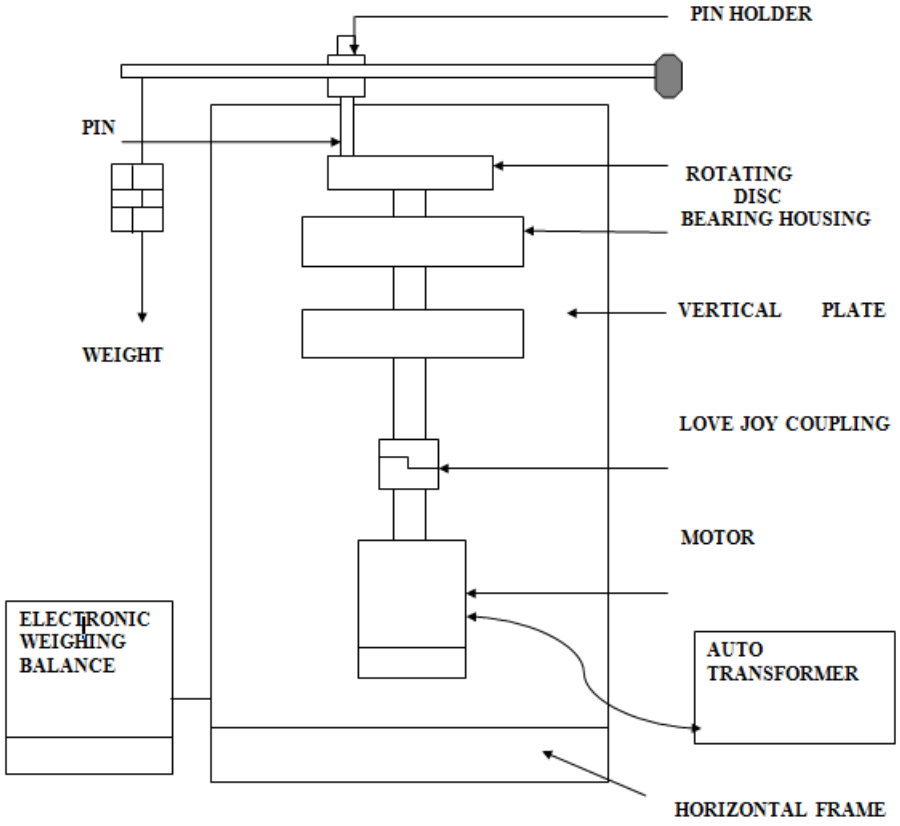


Figure 1. Pin on disc wear test apparatus

2.2 Test conditions

The test pins are made of Al 6063-O wrought alloy and cast Al A 356.0 in the as-cast and T6 treated conditions, of size machined to 8 mm dia x 50 mm length. The counter face is made of EN-8 steel with SiC 220 grit emery sheet pasted on it. The size of SiC particles is 75 microns with irregular particle shape. The emery sheets are replaced after the test duration of 7 minutes. The diameter of the disc is 60 mm and thickness 15 mm.The test conditions for testing were sliding speed of 1.3 m/s, applied loads 1N, 2N and 3N and the sliding distances of 82 m, to 574 m in steps of 82 m. Prior to testing, test samples were polished with emery paper and cleaned in acetone, dried and then weighed using an electronic balance having a resolution of 0.1 mg. After each test, the specimens were removed, cleaned in acetone and weighed in a similar fashion. At each load the mass loss from the surface of the specimens were determined as a function of the applied load and the sliding distance. Confirmation tests were also conducted to establish the values. Additional information pertaining to the wear situation is detailed below (Raymond) in Table-1.

Table 1. The wear situation

Parameter	Description
No. of bodies	3 body(the abrasive particles are constrained by a counter face and trapped between the two independent bodies)
Stress level	Low stress up to 0.019 MPa to 0.059 MPa
Presence of fluid	Dry abrasion
Relative hardness of particles to surface	Surface softer than particles
Motion	Sliding unidirectional high speed (1300 rpm)
Contact geometry	Circular area in surface contact
Test environment	25 C, 50% RH
Materials	Dissimilar

The wear factor (K) in mg/Nm is calculated as per the following formula:

$K = W \div LN$, where W is the wear mass loss in 'mg', L is the sliding distance in 'm', and N is the applied load in 'N'.

2.3 Materials

The composition and properties of Al 6063-O and Al cast A 356.0 are shown in Tables 2 to 4 and the counter face characteristics are detailed below (Elwin).

Counter face: SiC fine emery sheet of grit 220, particle size 75 microns, irregular shape. SiC has a hardness of 2800 kg/mm^2 and compressive strength of 3900 MPa.

Table 2. Composition of Al 6063 –O (annealed).

Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others	Al
.20 to .60	.35	.1	.10	.45 to .90	.1	.1	.10	.15	rest

Table 3. Composition of cast Al A 356.0

Si	Fe	Cu	Mn	Mg	Ni	Zn	Ti	Others	Al
6.5-7.5	.2	.2	.10	.25 to .45	Nil	.1	.20	.05	rest

Table 4. Properties of wrought Al 6063-O and cast Al A 356.0

Sl.no.	Property description	Al 6063-O	Al A 356.0
1	Melting point , °C	600	650
2	Density, g/cc	2.68	2.67
3	Thermal Expansion Coefficient ,10^{-6} °C	23.4	21.4
4	Thermal Conductivity at 20 °C, W/mK	200	167
5	Specific Heat KJ/kgK	0.91	0.963
6	Elastic modulus GPa	70	72.4
7	Hardness HB	25	42 (soft) 63 (T6)
8	UTS (Ultimate tensile strength) MPa @ R.T.	131	234
9	Poisson's ratio, 'υ'	0.33	0.33

2.4 Metallographic observation: Specimens for the metallographic observations were prepared by standard polishing techniques. The microstructure of the specimens were investigated by means of optical microscopy model Censico with a magnification of 200 X. Keller's reagent with composition, 194 ml distilled water, 5 ml Nitric acid, 3 ml HCl and 2 ml Hydrofluoric acid was used as the etching reagent. The wear scars of the worn surfaces were similarly prepared and observed. The specimens were run for duration of 3 minutes for the various applied loads before polishing.

III. RESULTS AND DISCUSSION

The results of the wear loss measured are plotted in the graphs shown in Figure 2.

Figure-3 shows the wear factor against sliding distance curves at the applied load range of 1 to 3 N.

Figure - 4 shows the microstructures of the materials.

Figure – 5 to 7 shows the wear scars of the material.

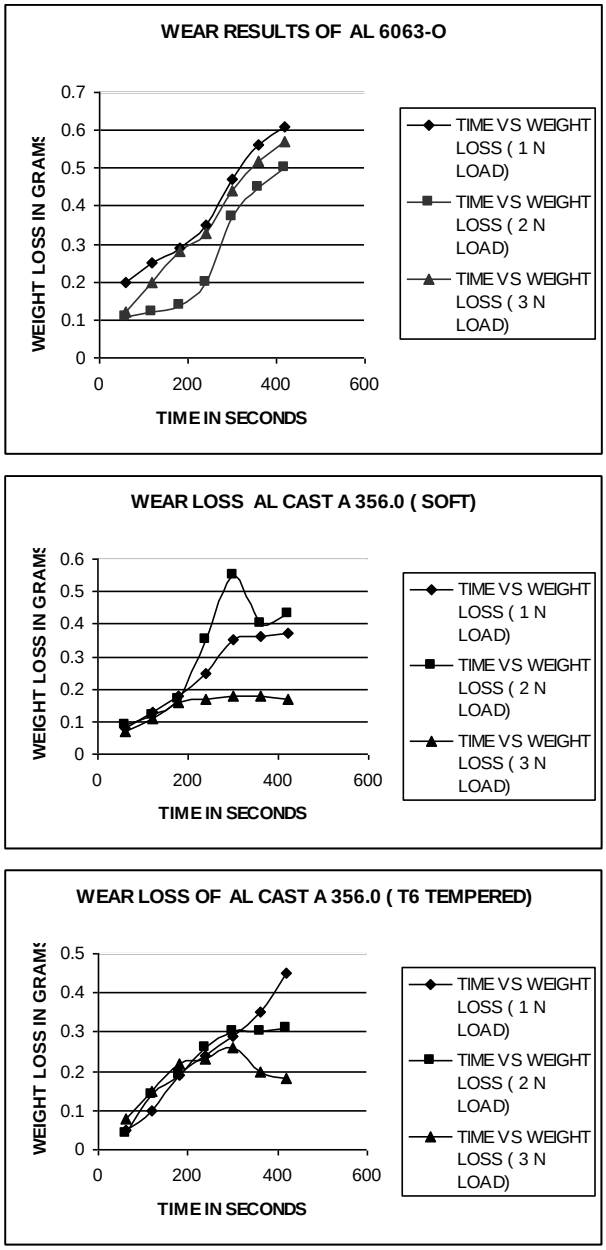


Figure 2. Wear loss in grams as a function of sliding distance and applied load

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

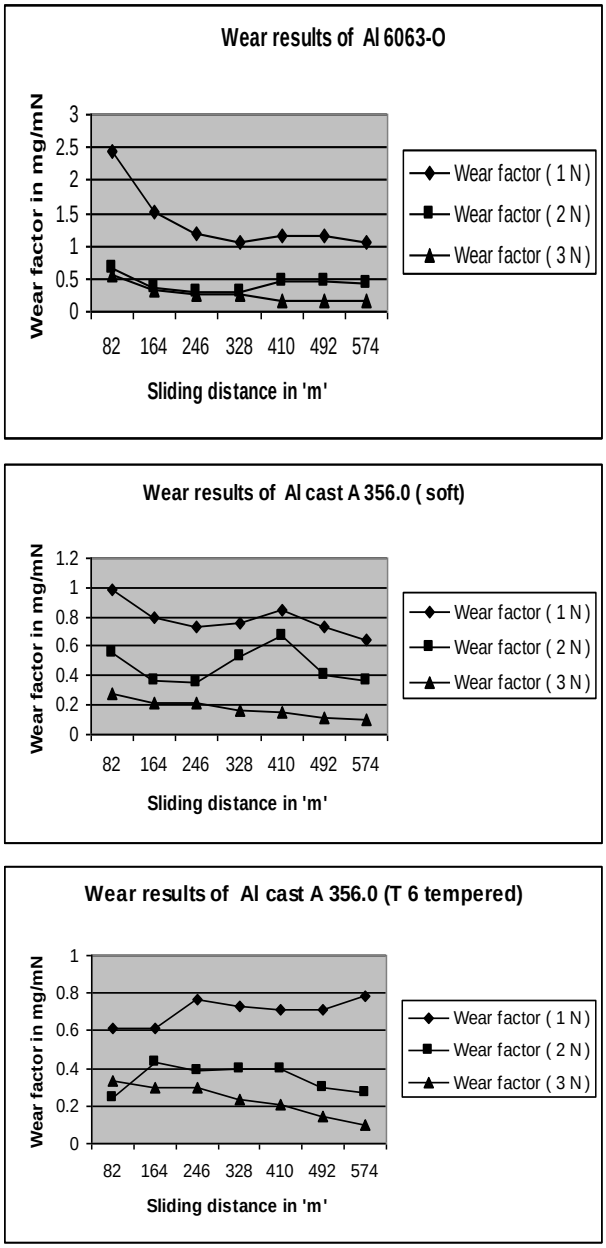
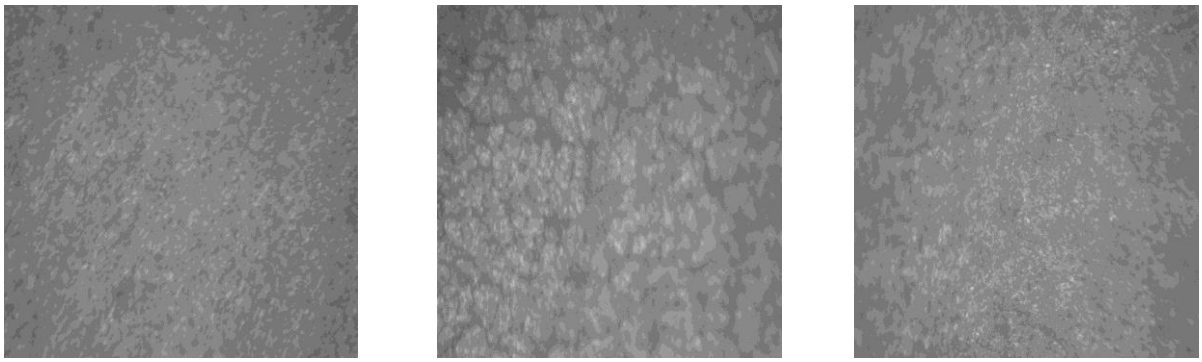


Figure 3. Wear factor in 10^{-3} mg/Nm as a function of sliding distance and applied load



a) Al 6063-O b) Al cast A 356.0 as-cast c) Al cast A 356.0 T6 treated

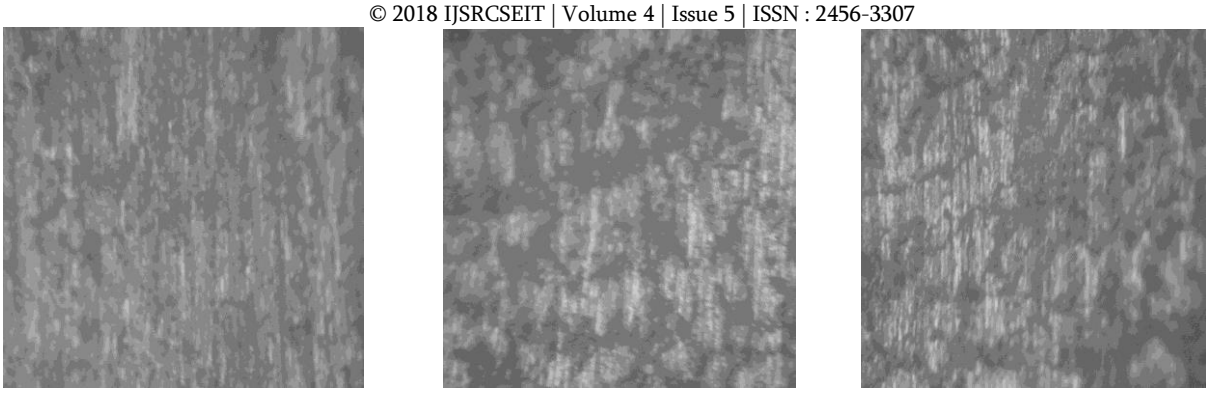
Figure 4: Microstructures of the test specimens run for 246m sliding distance and 3 N applied load

The microstructure is typical of Aluminum alloy with small particles of Silicon and Magnesium in Aluminum solid solution.

a) Al 6063 (1N load) b) Al 6063 (2N load) c) Al 6063 (3N load)

Figure 5. Wear scars of Al 6063-O for various applied loads

The wear scars show a plowing and grooving action due to low hardness and flow stress of the material. The wear rate is high though the MML is present. The dark patches are that of SiC.



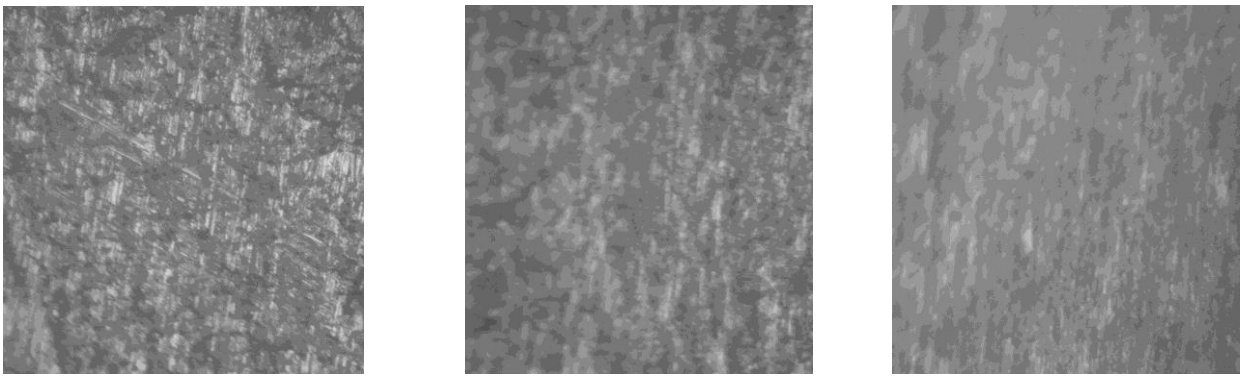
a) Al A 356/0 As-cast (1N load)

b) Al A 356/0 As-cast (2N load)

c) Al A 356/0 As-cast (3N load)

Figure 6. wear scars of cast Al A 356.0 for various applied loads

The higher hardness and higher flow stress values lead to cutting and fragmentation and lower ploughing and also due the presence of the MML the wear rate is lower. Dark patches of SiC are seen.



a) Al A 356.0 T 6 treated (1 N load)

b) Al A 356.0 T 6 treated (2 N load)

c) Al A 356.0 T 6 treated (3 N load)

Figure 7. Wear scars of cast Al A 356.0 T 6 treated, for various applied loads

The wear scars are polished and wear mechanism is mainly due to fragmentation and less ploughing due to the MML Wear rate is lower. Dark patches of SiC are seen.

3.1Properties of materials and wear conditions correlated to wear behavior (Raymond):

1. The wear rate depends on the hardness of the specimens, as the depth of indentation for a given load by the abrasive particle is a function of the hardness of the material. The results show ploughing wear mechanism in the case of Al 6063-O with deeper grooves when compared to cast Al A 356.0 in the tempered condition. Higher the hardness, lower the ductility resulting in a change in the abrasion mechanism from predominantly plowing/cutting to fragmentation.

2. Wrought Al being more ductile than cast Al, plowing takes place and the probability of wear debris formation is high which get embedded in the grooves and also the proportion of ploughing will be more than cracking or fragmentation.

3. As the Contact pressure increases, the wear rate increases.

4. The contact conditions of velocity and impingement angle of the abrasive plays a major role in the wear rate. Higher the sliding velocity, higher will be the wear rate. In this study the sliding velocity has been kept constant. The impingement angle is 0° in this study and hence a lower wear rate.

5. The abrasive particle characteristics like size and hardness ratio of wear material and the abrasive are important parameters. Higher the abrasive size, the greater will be the wear rate. Lower the H/Ha, as in the case of 6063 Al, plastic deformation takes place as in this study.

6. The microstructure plays a major role in the wear rate of the materials. In the T 6 treated condition the microstructure is more homogenous and hence the wear rates are lower.

7. For materials of equivalent hardness, the plastic flow behavior depends on the E/σ_y ratio. Higher the ratio more will be the plowing action. Flow stress σ_y for Al 6063-O is lower and E/σ_y is higher and hence a ploughing action results. E/σ_y is lower for the case of Cast Al.Cutting and microchips formed in this case.

3.2 Discussion of the wear loss and the wear factor results.

1. The wear loss increases as the sliding distance is increased for all the load conditions and materials.

2. The wear loss of Al 6063 is more than the cast alloy 356.0 for all load conditions and sliding distances.

3. In the case of Al 6063, the wear loss for the applied load of 2 N is lower for all the sliding distances, which is due to the mechanically mixed layer of SiC and Aluminum formed with a higher load bearing capacity. Refer the wear scar microstructure. The dark areas are that of SiC in white patches of Al.

4. In the case of Al cast 356.0, both in as cast and T6 tempered conditions, for the applied load of 1N the wear loss is more than for other loads. Al specimens in T 6 condition fared better than the soft specimens.

5. The experiments were not conducted for higher loads as the trend was similar.

6. The tests were discontinued after a sliding distance of 574 m as the wear loss stabilized.

7. The wear loss is lower for higher applied loads, due to the MML formation.

8. The wear factor decreases for all the applied loads and increasing sliding distances for the materials considered.

9. The wear factor for the 2N and 3 N applied loads is lower than the wear factor for 1 N load, which shows the better wear performance of the materials at higher applied loads.

10. The wear factor is the highest for the Al 6063 alloy and the lowest for the Cast Al 356.0 T6 tempered condition revealing the better performance of the cast alloy in the heat treated condition.

11. The morphology of the wear scars of 6063 –O Al and cast A 356.0 Al, for the applied loads of 1N to 3N, sliding speed of 1.3 m/s and sliding distance of 246 m are shown in the figures.

For 1 N load, 6063 Al exhibited a rough wear surface with deeper grooves, with the major wear mechanism being ploughing (plastic deformation due to higher ductility).Similarly for the cast specimens, the scars are rough due to cutting/fragmentation. The microstructure is less rough and seen as polished due

to the mechanically mixed layer formation comprising of Al and SiC phases in the case of 2N and 3 N loads for Al 6063 and Al 356.0 cast specimens. The mechanism is a combination of micro cutting and ploughing.The mechanically mixed layer has a higher load bearing capacity and hence the lower wear rates. Li and Tandon, (2000) state that the MML played a vital role in dry sliding wear in the range of loads.

12. In general, the wear loss of the materials increases linearly with increasing sliding distance and applied load, but the wear rate decreased with increasing sliding distance since wear rate is the ratio of wear mass to sliding distance in a certain wear condition.

IV. CONCLUSIONS

1. Wear rate of any material depends on the hardness of the material and its ductility. Cast Al A 356.0 T6 treated showed a better wear performance than Al A 356.0 in the as cast condition and Wrought Al alloy 6063-O in the annealed condition.
2. The wear performance of the materials selected showed a better result for higher loads applied due to the formation of a mechanically mixed layer with a higher load carrying capacity. This is applicable for the low stress range and the sliding distances selected and also for the wear situation described.
3. The wear loss increases as a function of sliding distance and applied load initially and then flattens for the materials tested.
4. In this study, the wear is found to be severe in all cases; though it is better in the case of heat treated cast alloys. The wear rate being in the range 10^{-2} to 10^{-5} mg/Nm falls in the regime of severe wear. Critical load is the applied load when the transition from mild to severe wear takes place. In this study, for the wear situation considered 1 N may be considered well above the critical load.
5. Though applied stresses are lower, the wear situation, especially the abrasive grain size of 75 microns of SiC, has contributed for the severe wear.

V. REFERENCES

1. Budinski K.G and Budinski M.K., 'Engineering Materials, Properties and Selections, 8th edition, 2005,p 78.
2. Gui M, Kang S B Lee J M 'Wear of spray deposited Al-6Cu-Mn alloy under Dry sliding conditions', Wear Vol.240,2000,p 186.
3. Alpas A T and Zhang J, 'Transition between Mild and severe wear in Aluminum alloys', Acta Mater, vol 45, 1997, p 513.
4. Dautzenberg J H and Zaat J H, Wear,Vol.23,1973,p 9.
5. Perrin C and Rainforth W M, Wear, Vol 204, 1997, p171.
6. Alpas A T and Singh J, 'Metallurgical and Materials Transactions A', Vol 274, 1996, p 3135.
7. Horn W and Ziegler W, 'The wear behaviour of Aluminum alloys,' Metullk, Vol 2, 1983, p223.
8. Sekhar J A and Narasimha Rao K, 'Comparative wear behavior of Aluminum alloys,' J.mater.Sci.L&t.,Vol 5,1986,p 1186.
9. Archegov V G and Drozdov N Yu , Wear, Vol 69, 1981, p 299.

10. Ghazali M J, Jones H and Rainforth W M, 'Tribology International', Vol 40,2007,p 160.
11. Le H.R , Luo J.K, and Williams J A., 'Characterization of tribological behaviour of Silicon and ceramic coatings under repeated sliding at micro-scale,' Int.J of science and Engineering,Vol 2, Nos.1/2, 2008.
12. Raymond G.Bayer,'Fundamentals of wear failures', ASM handbook
13. Elwin.L.Rooy, 'Introduction to Aluminum and Aluminum alloys, ASM handbook.
14. Li.Y&Tanden.K.N, 'Microstructutral characterization of mechanically mixed layer and wear debris in sliding wear of an Al alloy and an Al based composite', Wear, Vol 245, 2000, p 148.

VI. ACKNOWLEDGEMENT

The students of final year Mechanical Engineering, Karpagam College of Engineering, Coimbatore, Tamil Nadu, India, namely P.Palanikumar, R.Titus and A.Jayaramakrishnan, have carried out the various tests as per the authors instructions and their service is highly appreciated.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Wildlife-Vehicle Collision Avoidance using Spectroscopy

Swaroop Kulkarni[1],Viswajeet Gupta[2], Dr. S. Sujitha[3]
[1]Swaroop Kulkarni New Horizon College of Engineering, Marathalli, Bangalore, Karnataka, India
[2]Viswajeet Gupta New Horizon College of Engineering, Marathalli, Bangalore, Karnataka, India
[3]New Horizon College of Engineering, Marathalli, Bangalore, Karnataka, India

ABSTRACT
There have been many cases where numerous accident have been reported on vehicles colliding with wildlife and human being, especially while traveling at night or on highways. Despite this, there has been no proper solution to this problem. Developing a long range and efficient sensor which would alert the driver about the obstacle ahead would result in lesser number of such accidents. This paper is a review on the motivations to lower the rate of such accidents. The sensor uses spectrum waves to differentiate between humans, animals and other objects. The system uses real time data and try to mimic human reasoning thus prove promising accident control. We give an in depth study on the design, benefits and limitations of this technique.
Keywords: Smart Cities, Intelligent Accident Control, Spectroscopy, Human/Animal Detection.

I. INTRODUCTION

There are many highways and roads that run across protected wildlife areas. In places like that it is inevitable that the human beings or wild animals will enter the highways. This very often leads to fatal accidents resulting in loss of wildlife and also human

life. As of now there are no proper/autonomous systems to prevent accidents like these, especially at night time its gets tough to identify such obstacles. This project aims at developing a multifaceted system to prevent accidents like these. In this project humans and animals are detected near the human-animal environment overlap to avoid fatal accidents.

Man-animal conflict is seen across the world in a variety of forms, including monkey menace in the urban areas, depredation by elephants, animals walking on the roads, and cattle and human killing by tigers and leopards.

In places like national highways and roads it is inevitable that the wild animals will enter the highways and the railways.

II. EXISTING SOLUTIONS

Boundary walls and solar fences around the sensitive areas are built to prevent the wild animal attacks. Overhead or underground structures are built to divert the wild animals into a different path not interfering with vehicle traffic. But this system takes longer duration, labor and moreover not economical and they cannot totally prevent animals from entering the roads. There are no systems to avoid birds from sitting on the roads either.

Some devices of information technology, viz., radio collars with very high frequency, global positioning system and satellite uplink facilities, are being used by the research institutions to monitor the movement of lions, tigers, elephants, crocodiles and other wild animals to understand their movements and their use pattern of the habitat. But installation of the system becomes difficult and is not always possible.

III. PROPOSED SOLUTION 3.1 STRATEGY

The system is designed to prevent wildlife/human – vehicle collision within the highways as well as in city conditions. The sensor uses the principle of absorbance spectroscopy to detect and classify the obstacles. The sensor detects and classifies the type of obstacle ahead and sends a warning to the driver about the same and turns off the warning when the obstacle has been cleared.

3.2 Principle

Spectroscopy is the study of interaction between matter and electromagnetic radiation. Spectroscopy is the scientific measurement technique. It measures light that is emitted, absorbed or scattered by materials and can be used to study, identify and quantify those materials. Absorbance spectroscopy, commonly referred to as spectrophotometry, is the analytic technique based on measuring the amount of light absorbed by a sample at a given wavelength. The graph shows the absorption and reflectance pattern for each color. If orange light is emitted, blue is reflected. If red light is emitted, green light is reflected and so on.

3.3 Working

The absorption and reflectance is measured using a micro spectroscope. In order to achieve data with minimum error, we assume that the angle of incidence between the light source and the sample is 0°.

The light reflected from a skin sample is scattered in all possible directions of the viewing hemisphere. We are interested in measuring only that amount of the scattered light that is reaching a single viewpoint. The spectroscope is designed to measure the

Bidirectional Reflectance Distribution Function (BRDF) of various materials. The spectrograph uses a diffraction grating to disperse the light into its component wavelengths.

Photodiode arrays have almost an order of magnitude better signal to noise ratio than the corresponding CCD sensors.

The color of the reflected light depends on the color of incident light. Thus, the true descriptor of the spectral behavior of a material is the ratio of the light reflected from that material over the light that is incident on that material. For non-Lambertian surfaces this ratio changes as the angle

of incidence and angle of reflectance change. The ultimate goal is to produce a complete BRDF for in-vivo human skin. Our current measurements are for a 0" angle of incidence and approximately 4" angle of reflectance. Thus, what we are measuring is:

$$BRDF(4,0;0,0;\lambda) = \frac{Reflected(4,0;0,0;\lambda)}{Incident(0,0;\lambda)} \quad (1)$$

where BRDF() is the Bidirectional Reflectance Distribution Function, which is a five parameter function.

The following figures show the BRDF ratio plotted against the wavelength of the visible part of the electromagnetic spectrum.

Fig. 1Absorbance Spectrum Chart

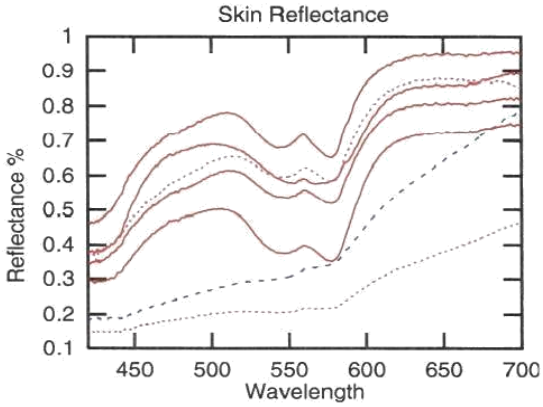


Fig2. Spectra of the back of the hand

Although the data collected, shows a diverse set of skin spectra, there is clearly a particular pattern that can be observed. A gradual increase with respect to wavelength can be immediately noticed, with a dip around 575nm.

The skin spectra of various races are interspersed and no clear classification can be done. There is one exception. One can observe that darker shaded skin, independent of race, reflects a smaller proportion of the incident light (which is how a darker surface can be described) and does not exhibit the curvature variation of the other plots. Hence, by dividing each reflectance distribution by the maximum value of that distribution we are ignoring the effect of the darkness of skin and are concentrating on the shape of the spectrum.

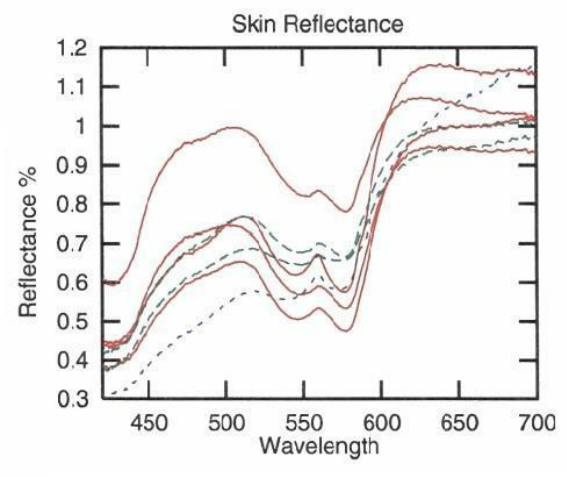


Fig. 3 Scaled spectra of the back of the hand

In order to test whether the variations of the shape of the skin spectra could be attributed to the local skin structure and to melanin, spectra of the palm is also considered. From the observed results, it is found that even palms exhibit similar properties to that of the back of the hand. Except, they exhibit a much reddish spectrum compared to the back of the hand, as expected. But in the spectrum of palm, it can be noted that all types of skin are almost identical shape and various spectra are closely clustered.

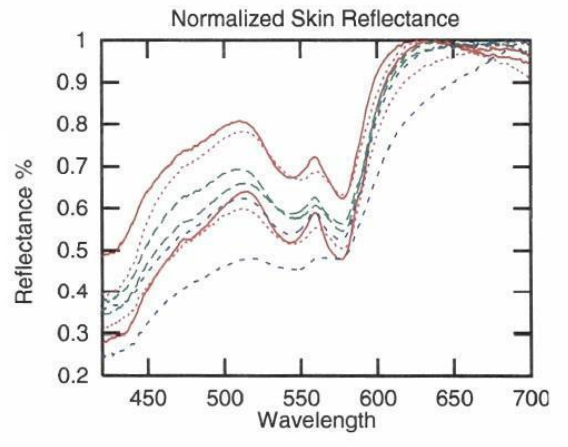


Fig. 4 Scaled spectra of the palm

It is to be noted that melanin plays a major role in reflectance and absorption. In the absence of melanin, the spectra are much closer to each other. It should also be noted that the amount of hair, pores, follicles, wrinkles, etc… also has a minor impact on the spectrum of the skin. The measured spectra demonstrate that there is a very specific pattern in the spectral distribution of the color of skin. Now, we should check whether this pattern is sufficiently unique to provide for the identification of human skin, especially when compared to a mannequin which comes the same key features with humans (lips, nose, eyes, arms, legs etc.)

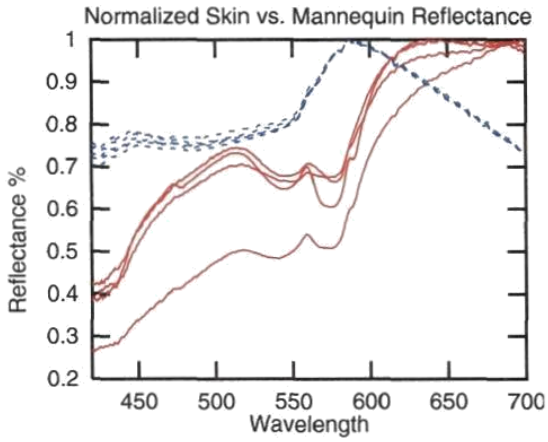


Fig. 5 Spectra of human hand versus mannequin

The graph showed the reflectance spectra of the mannequin versus that of the back of the hand, since that is more representative of the skin variations which are typically observed in humans. Notice the different shape of the spectral distributions between the two groups.

In the rescaled plots the existence of two separate spectra becomes evident.

3.4 Detection

Eye inspection of the reflectance data shows that there is a persistent pattern that seems to be unique to the human skin. All the measured reflectances, with the exception of the more tanned people, exhibit a localized " W pattern (two dips with a bump in the middle) in the middle of the visible spectrum.

The following algorithm can be used to automatically detect the pattern: "W" pattern detection algorithm:

1. Find all the local minima and maxima of the curve (places where the derivative is zero).
2. Find the two smallest local minima after 430nm.
They should be the two dips of the 'W" pattern.
3. Let h = wavelength of the leftmost dip.
4. Let % = wavelength of the rightmost dip.
6. If h3-h1<50nm,
Find the local max between hl and h3.
This should be the middle bump.
Let h2=wavelength of the middle bump.
Else,
No "W" pattern is present, because the two smallest local minima are not close to each other. While the "W" pattern identifies thehuman and animal skin effectively, we must also consider other factors such as: epidermis, dermis and hypodermis as they also play an important role in

absorbance and reflectance of the spectrum rays. In most individuals, the absorption of the epidermis is usually dominated by the absorption caused by melanin. The reflectivity (BRDF) of the skin at various wavelengths is mainly determined by the chromophores present in the various layers of the skin.

All the analysis thus far indicates that the existence of the "W" pattern implies the presence of live human skin.

IV. PRACTICAL MODEL

Block diagram for the proposed system:

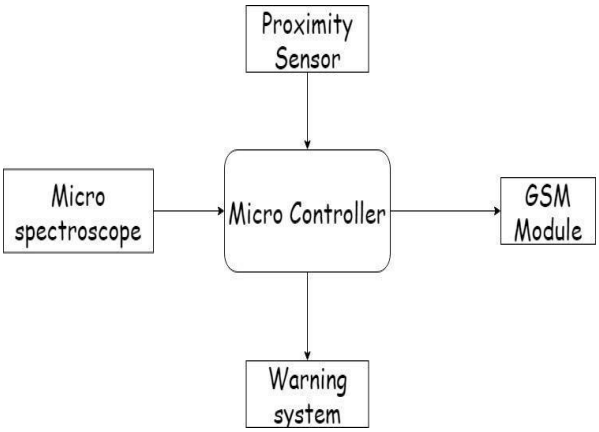


Fig. 6 Block diagram

The sensor can be retrofitted in any type of vehicle regardless of the make and size.

The data from the spectrograph is sent to the micro controller where we plot the graph and analyze the data. If there is a human or animal ahead, the warning system displays a message to the user of the obstacle ahead. Else no action will be taken.

In order to notify the respective authority in case of an accident, we embed a proximity sensor in the system. If there is an obstacle detected and if any collision takes place, the micro-controller sends a report to the nearest authority regarding the accident so that necessary actions can be taken immediately.

The system is flexible and can be embedded into any kind of vehicle easily. Since IR spectrum is being used, detection is possible even in dark.

V. CONCLUSION

We designed a spectroscopic sensor which identifies and classifies human beings/ animals and other miscellaneous obstacles. The sensor works on the principle of absorbance spectroscopy. From multiple samples, the behavior of skin on exposure to spectrum waves is observed. A

spectrograph is used to record output data. After plotting the output in a graph we look for a "W" pattern in the recorded output to give a positive result. The calculation process is based on reflectance parameters (BRDF). On obtaining positive results, the microcontroller alerts the driver of the obstacle ahead and incase of any collision the system notifies the nearest authority for suitable action without delay. The mortality rate and accident rates of wildlife-vehicle collision can be significantly reduced using this method.

VI. REFERENCES

1. Elli Angelopoulou "The Reflectance Spectrum of Human Skin", University of Pennsylvania, 2012.
2. Antonio-Javier Garcia-Sanchez, Pawel Kulakowski, Alejandro Rodríguez, "Wireless Sensor Network Deployment for Monitoring Wildlife Passages" in sensors -ISSN 1424-8220 www.mdpi.com/journal/sensors
3. Rosie Woodroffe, Simon Thirgood and Alan Rabinowitz, ed. (2005). People and wildlife: "Conflict or Co-existence?"
4. George Zonios and Aikaterini Dimou, "Light scattering spectroscopy of human skin in vivo".
5. Hall, R. A. and Greenberg, D. P. "A testbed for realistic image synthesis." IEEE Computer Graphics and Applications, Vol. 3, No. 8, 1983. pp. 10-19.
6. Van Gemert, M. J. C., Jacques, S. L., Sterenborg, H. J. C. M. and Star, W. M. "Skin Optics." IEEE Transactions on Biomedical Engineering, Vol. 36, No. 12, 1989. pp. 1146-1 154.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Study of Inlet Guide Vanes for Centrifugal Compressor in Miniature Gas-Turbines

Ronald Reagon R[1] Roshan Suhail[2], Shashank N[3], Ganesh Nag[4] Vishnu Tej[5]

[1] Asst. Professor, Department of Mechanical Engineering, New Horizon college of Engineering, Karnataka, India

[2-5] Student, Department of Mechanical Engineering, New Horizon college of Engineering, Outer Ring Road, Bengaluru, Karnataka, India

ABSTRACT

we believe miniaturization is the step forward. This paper gives a brief overview of a gas-turbine, how miniaturization of it has a plenty of applications and specifically focuses on the miniaturization of the centrifugal compressor used in it. This paper suggests that the centrifugal compressor of an automobile turbocharger can be used as the compressor for the miniature gas turbine due to its geometrical similarities and also provides an insight into the challenges that might be faced when this is incorporated. It also suggests a few modifications, when applied to the turbo-compressor; it may overcome the challenges and the modification being introduction of a pre-whirl effect. The pre-whirl effect proves to be efficient as it helps reduce surging, turbulence, chocking and shocks that might be induced into the turbo-compressor when it is used in a miniature gas turbine due to high speed. Therefore this paper is a step towards miniaturization of the gas turbine at a low cost, at the same time uses a high precision manufactured product (turbo-compressor).

Keywords: Centrifugal Compressor, Gas Turbine, Turbo Charger, Pre-whirl, Miniaturisation, Guide Vanes.

I. INTRODUCTION

Gas turbine which is also known as Jet engine is an internal combustion reaction type engine, which produces a fast moving jet, which in-turn provides the thrust. This is known as jet propulsion. A typical gas turbine is a highly technical, geometrically large and a very expensive machine which is engineered, manufactured and produced with the highest possible precision techniques. [1] The leading manufacturers of the gas turbines like GE, ROLLS ROYCE, PRATT AND WHITNEY etc. concentrate in manufacturing engines for large scale applications. Hence research towards small scale applications of gas turbine is often neglected. A miniaturized gas turbine finds its applications mainly in militaristic devices such as drones. As there is no proper research done in this field, the manufacturing of these mini gas turbines turns out to be an extremely expensive affair. The small gas turbines which are made with the required reliability end up being extremely expensive partly because they are made in such small numbers and also because their configurations change for each application. There are many acceptable configurations of the miniature gas turbines, the most commonly accepted design is the use of single stage compressor and turbine, with the compressor being centrifugal in nature.

Fig. 1 **:** Miniature Gas Turbine

This paper focuses primarily towards the compressors used in gas turbine.
There are only two types of compressors used in gas turbines [2]

a) Axial flow compressors: Used in large scale applications.
b) Radial flow compressors: Used in small scale applications

Fig. 1 : Centrifugal Compressor

These radial flow compressors are also known as centrifugal compressors. This paper is oriented towards research on the centrifugal compressor. There are a wide variety of centrifugal compressors that are currently used in the market. One such application in which centrifugal compressors are pre-eminently used is the turbocharger of automobiles. As this research is focused on miniaturization of gas turbine, it can be taken into account that the turbo-compressor is geometrically small and it can also be observed that the characteristics of the turbo-compressors were very similar to that of the required compressor at its working range, relative to the inlet and outlet requirements. Hence it was theoretically possible by the equation that governs all centrifugal compressors that the pressure ratio created by the turbo-compressor is in accordance with the required conditions at the working range of the gas turbine.[3]
The working range of the turbocharger is at a speed range of 60000-120000 rpm at a pressure ratio of approximately 3, when this working range is taken in comparison with the working range of a gas turbine, the speed range of miniature gas turbine is around 150000-200000 rpm at a pressure ratio of 9.

II. CHALLENGES

If this turbo-compressor is to be incorporated into a gas turbine, it is going to run at a speed of 150000-200000 rpm, therefore the pressure ratio of the turbo-compressor increases automatically. The following are the challenges that might be posed due to the increase in the speed and the pressure ratio:

- ✓ The relative velocity between the blades and inlet air is very high, therefore shock maybe induced.
- ✓ Due to the high speeds, turbulence is created, which in-turn creates vibrations, which might lead to failures.
- ✓ Since turbo-compressors work at an optimum rpm the output air flow might be less due to pressure build up, hence surging might occur.
- ✓ Also if the air flow is too high then chocking might occur.

A. SURGE**:** To understand surge one needs to know the working principle of the compressor, which is imparting kinetic energy to the fluid at the impeller and then sacrificing this kinetic energy at the diffuser to increase the static pressure of the fluid and decreasing the kinetic energy of the fluid.[4] If maximum head capacity is reached, then pressure in diffuser will be greater than pressure at impeller outlet. This will prevent fluid from moving further at impeller outlet and causes the fluid in diffuser to flow back, i.e. flow reversal takes place. This can be deteriorating as it has potential to damage the bearings and other rotating parts, and also cause high vibrations.

B. SHOCK: When the relative velocity between the working fluid and blades reach the speed of sound, there are characteristic waves produced causing damage to the blades.

C. CHOKE: It is operating point at minimum flow capacity condition where high velocity air flow causes severe damage on the compressor creating instability.[5]

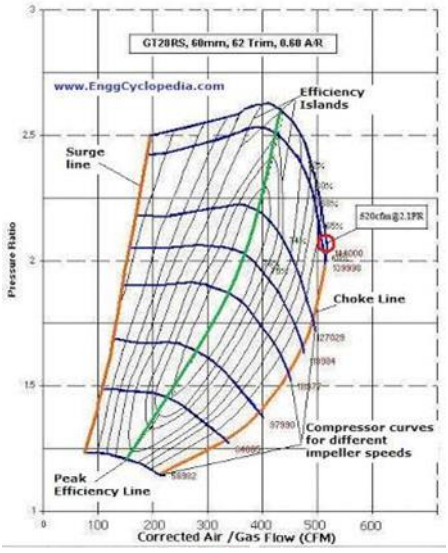


Fig. 2 **:** Surge and Choke Margin

III. OBJECTIVES

Even though the pressure ratio increases due to the rapid increase in the speed, this pressure ratio cannot be sustained due to the above mentioned phenomenon. So this paper suggests the adoption of the below mentioned methods in order to sustain the pressure ratio created.

- Inclusion of inlet guide vanes[6]
- Diffuser vanes
- Use of vortex generator

This paper exclusively deals with the changes that might occur on the account of inclusion of guide vanes at inlet of the turbo-compressor. These guide vanes induces pre-whirl. Pre-whirl is the phenomenon of adding a circular component to the inlet air. The circular component maybe towards or away from the inlet blade angle of the compressor. Pre-whirl reduces the angle of attack and increases the mass flow rate and hence the surging is prevented. [7]

By accommodating the guide vanes with a positive angle of attack, a positive pre-whirl can be generated, which in-turn increases the speed of the compressor blades. By accommodating the guide vanes with a negative angle of attack, a negative pre-whirl is generated, which in-turn decreases the speed of the compressor blades. If surge is detected, a positive angle is given to the inlet guide vanes in-turn increasing the flow rate of air. If choke is detected a negative angle of attack is established which in-turn produces a negative pre-whirl this reduces chocking.

IV. METHODOLOGY

In this paper we are considering the use of the automotive turbocharger compressor from GARRETT model GT-28. This turbocharger was used in the Nissan skyline GT-R, which was famed for its reliability and its excellent performance far beyond its official capacity. It was intended to design a virtual model of a compressor according to the geometry and dimensions of the compressor used in the above mentioned automobile turbocharger, so that the guide vanes can be designed for the same.

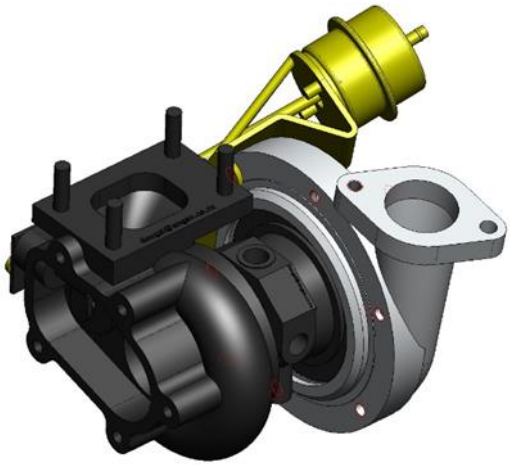


Fig 4: GARRETT Turbocharger

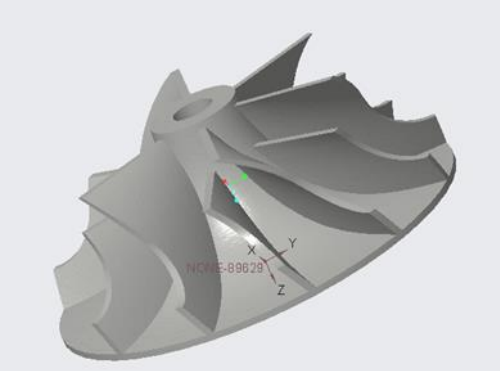


Fig 5: CAD Model of GARRETT GT-28 compressor

Design suggestions for pre-whirl:

- Inlet guide vanes can either be fixed or variable. Since this particular application deals with the working of compressor above the speed at which it was designed to work at, the characteristics may abruptly change with little or no variation in the working parameters. This has to be controlled at all speeds, hence variability is required.
- The general blade design of guide vane is of parabolic shape, this brings unwanted components into this particular application. Therefore for this application the guide vanes are initially linear and have no angle relative to the inlet air direction and later have a parabolic curve for the induction of pre-whirl.[7][8]

V. DESIGN OF INLET GUIDE VANES

As mentioned earlier, the angle of attack of the guide vanes determines the nature of the Pre-Whirl effect that is imparted to the inlet air. Keeping this in mind the following steps were taken to design the Inlet Guide Vanes.

- ✓ The diameter of the Casing for the Inlet Guide vanes was considered to be the same as that of the compressor casing.
- ✓ To begin with, Straight blades were designed. Straight Blades are blades without any curvature with respect to the flow. This designed had to be abandoned because it induced unwanted characteristics to the Inlet Air
- ✓ Then curved parabolic blades were also designed and were found to be inducing sufficient Pre-whirl into the inlet air.
- ✓ Blades which were initially straight in orientation and gradually transformed into parabolic shape with respect to the inlet air were found to be the most efficient, because these blades produced better results at high velocities compared to just the straight and parabolic ones.
- ✓ The blades were designed according to the nature of the whirl required at a particular distance from the blade. Since the radial velocity increases linearly along the radius of the blade, the same thing was

incorporated into designing the pre-whirl also the angle of the blade has been increased from root to the tip linearly.

- ✓ To give perspective into this design, A 30 degree blade will have a root angle of 15 degree at the impeller and an angle of 45 degree at the tip (casing). This design was adopted to give more whirl at the points on the blades which have higher velocity.

The following steps are to be done.

- Simulate the working of turbo-compressor at working speed of gas turbine with and without pre-whirl using Ansys Fluent.
- Give the working parameters, speed of blade, flow conditions, boundary conditions to the virtual assembly.
- Simulate the virtual assembly at all speeds and angles of attack and plot for each.
- Suggest the best guide vane angle at a given speed.

VI. CONCLUSIONS

The project team has designed a turbo-compressor similar to the geometry of the turbocharger mentioned in the paper (GARRETT GT-28). After testing the different blade profiles for this particular high velocity application. Following were the results obtained

- Straight blades: At low velocity there was low pressure area situated behind the active part of the blade. And at high velocities the blade produced whirls which had negative effect.
- Parabolic blades: At low velocity they worked as intended. But at high velocity whirls were created right behind blades at terminal end of the blade.
- Mixed Profile blades: They work efficiently at all flow velocities.

VII. REFERENCES

[1] "Components of Jet Engines " https://en.m.wikipedia.org/wiki/Components_of_jet_engines

[2] "Centrifugal Compressor" https://en.m.wikipedia.org/wiki/Centrifugal_compressor

[3] Shuai Guo, Fei Duan, Hui Tang, "Multi-objective Optimization of Centrifugal Compressor of Mini Turbo Jet Engine", Aerospace Science and Technology 2014.

[4] C. Rodgers, "Centrifugal Compressor inlet Guide Vanes for increased Surge margin", ASME 1991.

[5] "Compressor Choke or Stonewall" http://www.enggcyclopedia.com/2012/02/compressor-choke-stonewall/

[6] Michele Becciani, Alessandro Biachini, Giovanni Ferrara, "A Pre Model to estimate the effect of variable inlet Guide Vanes on performance on map of a Centrifugal Compressor for Automotive applications", SAE international 2017.

[7] A. Whitfield and A.H.Abdullah, "The Performance of a Centrifugal Compressor with high inlet Pre-whirl", journal of ASME 1997.

[8] Xinqian Zheng, Anxiong Liu, "Loss Mechanism and Flow control for improved Efficiency of a Centrifugal Compressor at High inlet Prewhirl", ASME 2016

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Intelligent Lighting Network Applications Using Can Bus

S.Ramakrishnan[1], T. Muni Prakash[2]
[1]Asst. Prof. EEE Department New Horizon College of Engg., Banglore, Karnataka, India
[2]Sr.Asst. Prof. EEE Depaartment New Horizon College of Engg., Banglore, Karnataka, India

ABSTRACT:
In this paper describes a new embedded system based on CAN bus protocol for remote monitoring and controlling of lighting networks, where the network nodes are lighting lamps and environment sensors. The applications such as: light dimming control of a single lamp, or a group one, through one lighting network node having an environment sensor. The embedded system was implemented in a small prototype lighting network based on CAN 2.0B with three 28 Watts fluorescent T5 lamps, one 13.86 Watts HBLED lamp composed of six LEDs, and two environment sensors. The proposal can be expanded to more than 2048 nodes and other kind of lighting lamps can be used. Individual and group control for dimming and turning on/off, fault detection condition of lamp tubes and environment sensors monitoring. The main characteristic of the embedded system is its non-master capability, allowing implementation of a novel fully functional CAN bus lighting network with a reliable two wire remote control. Applications for this CAN bus lighting network include building management or studio lighting where it is desired to control lamps for saving energy consumption, performing lamp maintenance or creating precision lighting effects.

I. INTRODUCTION

The term ”intelligent lighting system” refers to a system where multiple lighting fixtures are connected to a network, The intelligent lighting system providing the necessary light dimming and on/off to desired location actually construct a fundamental experiment system based on that concept; and verify the effectiveness of the newly developed control method. . The use of electronic embedded systems for driving fluorescent lamps has been notably increased in last years, the main reason is their extensive advantages compared with electromagnetic ballasts. The design goal has been extended to provide the right light using more efficient systems with design issues like: low harmonic distortion, high power factor, light dimming and maintenance-oriented features, reducing in this way lighting energy consumption and maintenance time response. One important lighting feature is the lamp remote controllability, which requires lamp capability to send and receive useful information, using some reliable communication protocol through a network, and allowing a complete remote control of a lighting environment.

The Controller Area Network (CAN) is an asynchronous serial CSMA/CD communication protocol for microcontrollers networks, supporting distributed real-time control with a very high level of security. CAN communication protocol is based on a distributed scheme, there is no central unit, allowing a direct data transfer between any two or more nodes without a master node mediation. The Standard ISO 11898 defined CAN bus as a two wire reliable protocol for high-speed applications. A standard CAN bus

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

configuration is implemented with CAN nodes composed of: microcontroller, CAN controller and CAN transceiver, an N nodes network is shown in Figure 1.

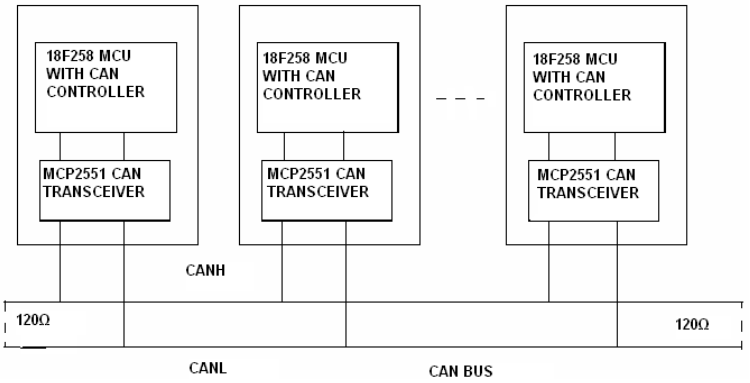


Fig1. General Can Bus Standard Configuration

The identifier field length of CAN 2.0B protocol is 29 bits. Data frames are used to transmit up to 8 bytes of information from one specific CAN node to one or several CAN nodes. An 29 bits identifier field length allows more than 2048 available identifiers or logical addresses, where each one can be assigned as one specific functional node. J1939 provides a communication protocol over a CAN network. The CAN network is comprised of two or more interconnected Electronic Control Units (ECUs).As per the SAE J1939-11 specification. The ECUs are connected using linear shielded twisted pair wiring, with a data rate of 250 Kbits/second.

II.BASIC CONCEPTS OF CAN

CAN has the following properties

- Prioritization of messages
- Guarantee of latency times
- Configuration flexibility
- Multicast reception
- Multimaster
- Error detection and signaling
- Automatic retransmission of corrupted message as soon as bus idle again

29 BIT MESSAGE IDENTIFIER

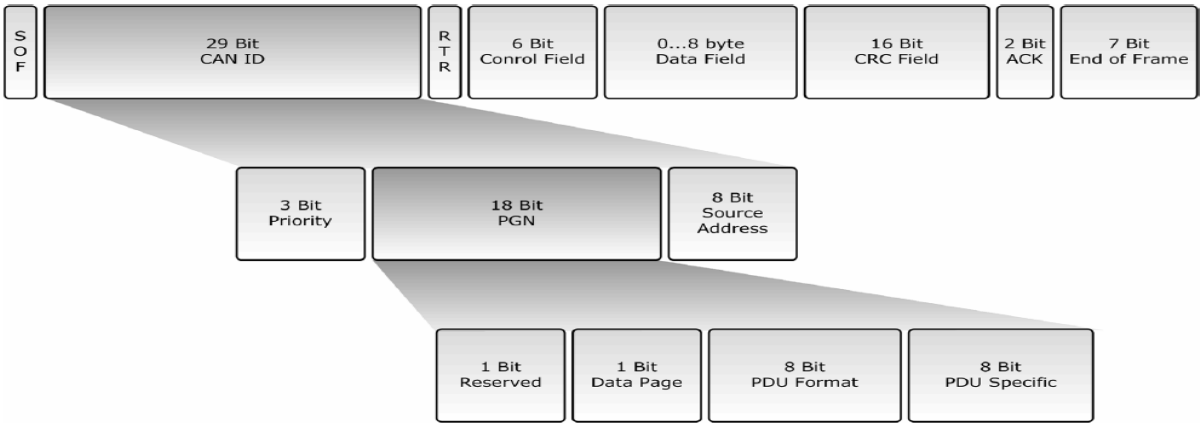
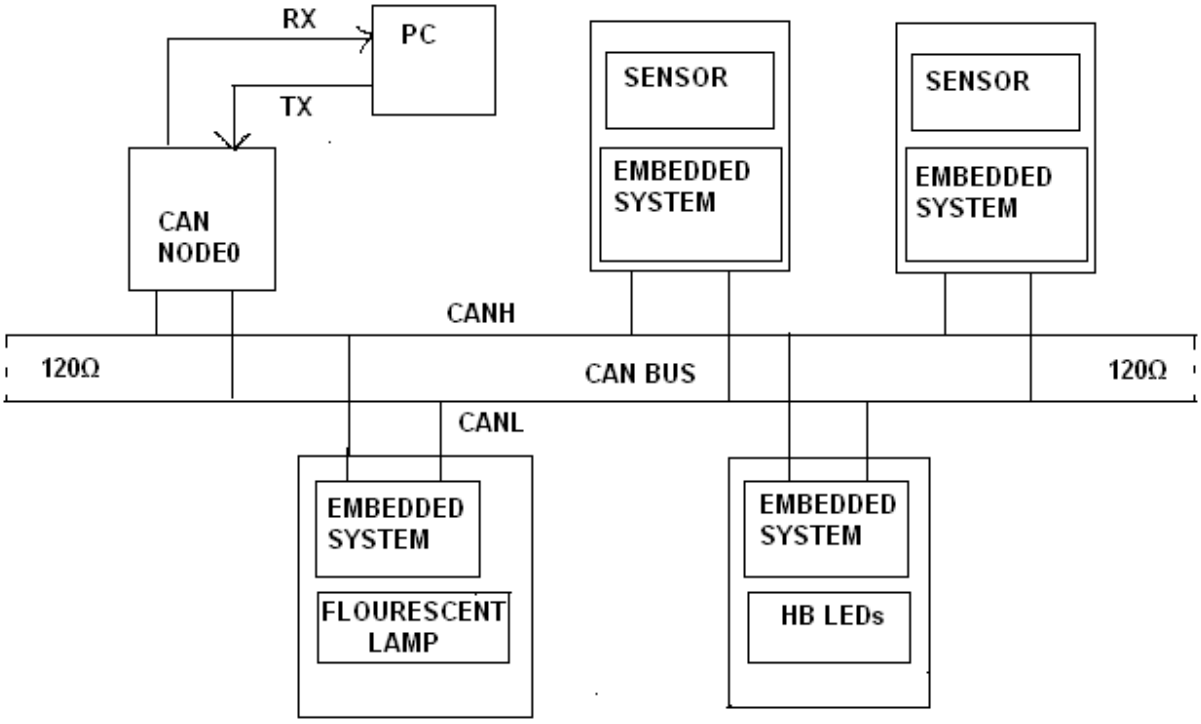


Figure 2

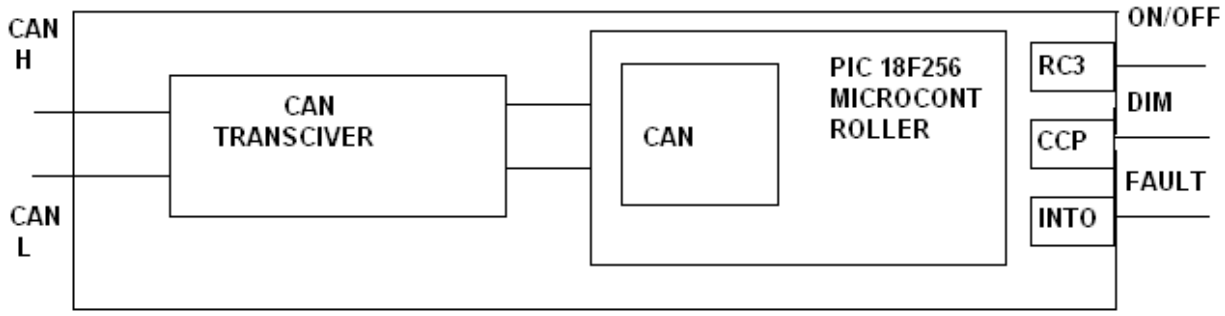
III.FUNCTION OF LIGHTING NETWORK

The defined network functions include: dimming and turning on/off for individual or group of lighting lamps, environment sensors monitoring and fault detection condition such as lamp removal, end of life or broken tube. The daylight sensor will sense the light intensity and gives analog voltage as input to the controller. Using the analog voltage the controller will generate corresponding PWM signal. The duty cycle of the PWM signal will control the dimming operation. The dimming level voltage is obtained from the average voltage of a 40 kHz PWM signal, generated within the Compare/Capture/PWM (CCP) module, through RC filtering. Occupancy sensor will sense the presence or absence of the image and send the analog value to the controller. Then the RC3 microcontroller pin controls the ON/OFF signal. The fault detection condition triggers external interrupt event and the corresponding interrupt service routine (ISR) sends a warning through the lighting network.

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307



Block diagram of lighting network using CAN bus

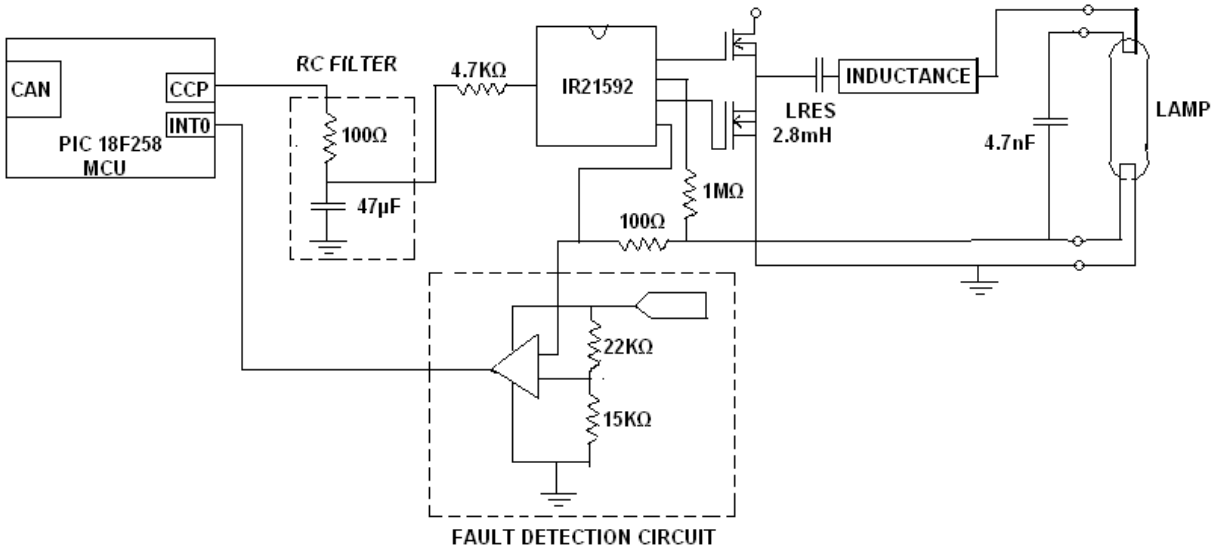


Block diagram of embedded system

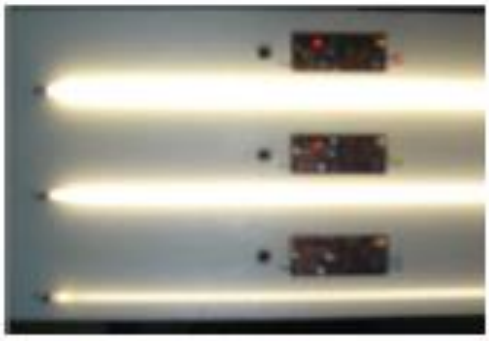
Each CAN network node has an individual and unique assigned 29 bit identifier. The addressing map is divided to achieve the lighting group control, where each lighting lamp has two identifiers: an individual and a group one. Also some identifiers are reserved for the environment sensors to send data through the lighting network. a PC-node communication one or a group of specific lighting lamps is requested to execute a network function in two phases. First the function command is sent through the PC serial port to CAN node 0 as a 4 bytes code. This code indicates both the instruction to be executed and the specific node (or group) identifier to be applied on. In second phase the CAN node 0 transmits the instruction code as a CAN data frame to the addressed node (or nodes), where identifier field includes the 11 bits identifier

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

and data field includes one byte instruction code. In the same way two phases are done in a node-PC communication where a specific node message is received by the PC, such as lamp fault condition or sensor monitoring. In first phase a CAN data frame is sent by the specific node to the CAN node 0, including its 11 bits identifier and a fault message code. In second phase CAN node 0 sends the received message code and node identifier, through the serial port, to the PC in a 5 byte format.



Circuit of microcontroller connected to fluorescent lamp & fault detection



Fluorescent lighting lamp at 100%, 50%, 10%.

In the below Figure is shown an individual lighting dimming test for the three fluorescent ballasts controlled through the CAN node 0 operating at 100%, 50% and 10%. The obtained power values were: 27.77 watts, 15.79 watts and 3.37 watts, respectively. As the results show the proposal successfully performed the lighting dimming function, in the same way all other defined functions were accomplished.

© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

IV.CONCULSION

The embedded system based on CAN bus protocol for two wire remote monitoring and controlling of lighting networks is presented. The embedded system was implemented in a small prototype lighting network with three fluorescent lamps, one HBLED lamp, and two environment sensors namely occupancy and daylight sensor were used. According to obtained results the proposed system performed established network functions successfully, allowing the implementation of a novel fully functional CAN bus lighting network with a reliable remote control. The non master-slave scheme characteristic of CAN bus protocol allows the addition of intelligent lighting network features.

V.REFERENCES

[1] T. Marchesan, G. Dernardin, R. Silveira, A. Campos, and R. Prado, "Development of a control fieldbus for HPS electronic ballasts using power lines," Proc. of 35th Annual IEEE Power Electronics Specialist Conference, Aachen, Germany, pp. 3593-2596, 2004.
[2] K. Kutluay, I. Cadirci, A. Yafavi, and Y. Cadirci, "Dual 8b microcontrollers–digital control of universal telecommunication power supplies," IEEE Ind. Appl. Magazine, vol. 12, no. 1, pp. 59-67 Jan/Feb 2006.
[3] C. Contenti and T. Ribarich, "Digitally Addressable DALI Dimming Ballast," Proc. Applied Power Electronics Conference and Exposition, Dallas Texas, USA, pp. 936-942, 2002.
[4] J. M. Alonso, J. Ribas, J. J. del Coz, A. J. Calleja, E. L. Corominas, and M. Rico-Secades, "Development of a distributive control scheme for fluorescent lighting based on LonWorks technology," IEEE Trans. On Industrial Electronics, vol. 47, no. 6, pp. 1253-1262, Dec. 2000.
[5] M. Miki, T. Hiroyasu, and K. Imazato. "Proposal for an intelligent lighting system, and verification of control method effectiveness," Proc. on IEEE Conference on Cybernetics and Intelligent Systems, pp. 520-525, ingapore, 2004.
[6] ALONSO J M, RIBAS J, DEL COZ J J, CALLEJA A J, LOPEZ E, RICO-SECADES M Intellignt Control System for Fluorescent Lighting Based on LonWorks Technology. Proc IEEE IECON, Vol.1998, No.Vol.1, Page92-97, (1998)
[7] 1. A Comprehensible Guide to Controller Area Network by Wilfried Voss
[8] J1939-based application profiles by Holger Zeltwanger – CiA.

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Low Harmonic Mitigation Through Fuzzified Inverter Control For Grid Connected Solar Energy System

Roopgandha[1], M. K. Kiran[2]
[1]PG Scholar, AMC Engineering College, Bangalore, Karnataka, India
[2]Assistant Professor, AMC Engineering College, Bangalore, Karnataka, India

ABSTRACT
With increasing renewable distributed generation(DG) units connected to utility power grids, deterioration of power quality at the point of common coupling (PCC) becomes a major concern. Power electronic devices in DG units generate harmonics; these harmonics along with harmonics from other nonlinear load in the system might cause excessive harmonic distortion at the PCC. In this paper, an extensive literature review is conducted focusing on harmonic mitigation techniques through advanced control methods for grid-interfacing inverter. The intend of the fuzzy logic approach is to meet high quality output, minimum THD,fast response and high robustness.
Keywords: Distributed-generation,harmonic-mitigation,Total harmonic distortion, power quality

I. INTRODUCTION

In this modern world ruled by science, the demand of electrical power increases for every year due to growing industries, commercial and domestic applications, etc. To meet the demand, the renewable energy systems have been designed instead of conventional systems of electric power generation. Out of the available renewable energy sources, solar PV based system design plays a vital role for the generation of electrical power as it is pollution free, noiseless and has abundant energy [1-3]. For these reasons, PV has been used as the input source for the proposed inverter topology and Perturb and Observe (P&O), Maximum Power Point Tracking (MPPT) algorithm is used to extract maximum power from the solar PV panel because it is simple, cost effective and easy to implement [4-5]. The major issue lies in converting the available dc sources into ac sources with better power quality aspects such as THD, power factor, etc.

To ensure a good quality of power supplied to the consumers, utility companies need to maintain harmonics level within an acceptable limit as indicated in different grid codes. For example, according to IEEE std. 519, the acceptable limit of the voltage total harmonic distortion (THD) at the PCC with each consumer is 5% [2]. To mitigate harmonic distortions, passive LCL or LC filters are traditionally used with the grid interfacing inverters, however, such filters have disadvantages such as the fixed compensation capability, creation of resonance problem etc.To overcome the limitations of passive filters, the DG interfacing converters can be utilized to operate as power conditioners for

power quality improvement. Although, the primary function of the interfacing converter is to supply real power to the grid, it can also provide auxiliary harmonic compensation service upon the availability of sufficient apparent power rating. With proper design and control, the DG interfacing converters can improve the system efficiency and ensure reliable harmonic compensation performance. The electric power distribution systems are unbalanced due to untransposed distribution lines and unbalanced loads. Also the loads on the power system vary from time to time. Hence there is the need to design and active power filter, which is capable of maintaining the THD limit within the IEEE norms under variable load conditions.

This chapter presents a fuzzy logic based PWM current control technique which performs well under unbalanced and variable load conditions since the controller do not need an accurate mathematical model; it can work with imprecise inputs and can handle nonlinearity.

II. PROPOSED SYSTEM

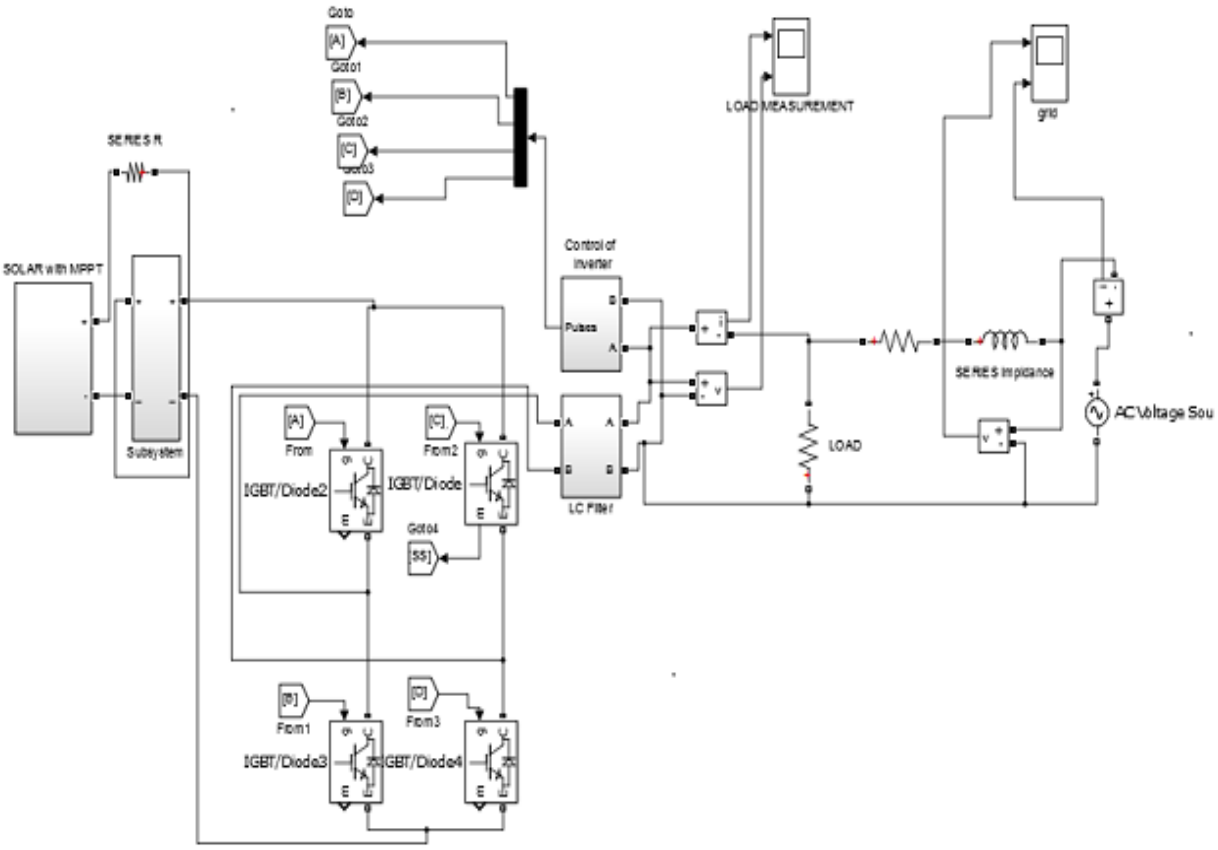


Figure1. Schematic Diagram of Proposed Low harmonic mitigation through Inverter control for grid connected renewable energy sources (using MATLAB Simulink)

2.1 Solar PV Panel

Solar PV systems are usually consists of numerous solar arrays, although the modules are from the same manufactures or from the same materials, the module performance characteristics varies and on the whole the entire system performance is based on the efficiency or the performance of the individual components.

Maximum Power Point Tracking, frequently referred to as MPPT, operates Solar PV modules in a manner that allows the modules to produce all the power they are capable of generating. MPPT is not a mechanical tracking system but it works on a particular tracking algorithm and it based on a control system. MPPT can be used in conjunction with a mechanical tracking system, but the two systems are completely different. MPPT algorithms are used to obtain the maximum power from the solar array based on the variation in the irradiation and temperature. The voltage at which PV module can produce maximum power is called 'maximum power point' (or peak power voltage). Maximum power varies with solar radiation, ambient temperature and solar cell temperature. Here Perturb and Observe algorithm is used. Rating of solar panel used here is 480W, Output 150V is given as input to fly back converter to obtain constant DC.

2.1.1 MATLAB SIMULINK Model of Solar PV

The primary component of grid-connected PV systems is power conditioning unit (PCU). The PCU converts the DC power produced by the PV array into AC power as per the voltage and power quality requirements of the utility grid.

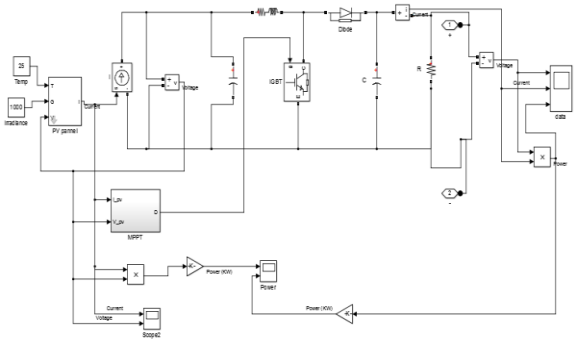


Figure 2. MATLAB SIMULINK Model of Solar PV

A bi-directional interface is made between the PV system AC output circuits and the electric utility network, typically at an on-site distribution panel or service entrance. This allows the AC power

produced by the PV system to either supply on-site electrical loads or to back-feed the grid when the PV system output is greater than the on-site load demand. This safety feature is required in all grid-connected Factors Facts Module technology Modules account for 40–50 % of total system costs. These determine the total area needed to install the system. Less area per watt is desired to maximize roof or land use O&M Grid tied PV systems do not have notable O&M costs .Most small scale grid-tied systems do not have moving parts and therefore maintenance is minimal Large-scale systems may use tracking systems and therefore may require more work Battery assisted systems may require acid refills when valve regulated batteries are not used .Some arrays will require regular cleaning. This could represent additional costs especially for large scale systems Energy use and cost System size depends mostly on energy use, solar resource and component efficiency .Reducing energy consumption greatly reduces the initial capital cost investment necessary PV systems can be cost competitive in locations with high energy prices and Net metering programs. The assumption that PV is expensive is therefore relative to the solar resource and utility energy prices in a location indirect benefits Emissions reductions provide a wide range of economic, environmental and health benefits. These are difficult to quantify, yet they cannot be ignored. Application of MATLAB/SIMULINK in Solar PV Systems PV systems, and ensures that the PV system will not continue to operate and feed back into the utility grid when the grid is down for maintenance or during grid failure state. In grid-connected systems, switching of AC power from the standby generator and the inverter to the service bus or the connected load is accomplished by internal or external automatic transfer switches.

2.2 Development of Fuzzy Based Current Controller

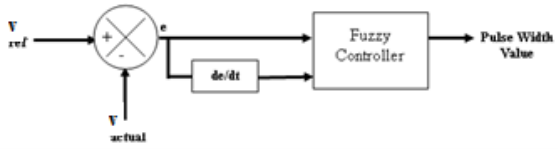


Figure 3. Schematic diagram of fuzzy controller

Fuzzy logic controller architecture is shown in fig. In this proposed approach, fuzzy logic based voltage controller has been designed. To control various nonlinear applications, fuzzy controller is the most appropriate solution. Fuzzy logic controller comprises of membership functions (input/output). The input response collected in the knowledge base is categorized into error'd' and change in error 'de'.

2.3 Space Vector Pulse Width Modulation

PWM controls the inverter output voltage and minimizes the THD considerably. Moreover, filters such as LC, LCL, etc may not eliminate the lower order harmonics and hence, PWM has been used for the reduction of such lower order harmonics. But, there are some drawbacks in PWM such as

Lower order harmonics may not be eliminated effectively, The higher PWM frequency would increase the power losses along the switches[6]. Due to the above limitations of the PWM approaches, SVPWM techniques have become an attractive research solution. In this research work, Space Vector PWM (SVPWM) has been used. SVPWM receive reference sine wave as the input from the current controller. From the grid voltage, instantaneous active voltage component (V_d) and instantaneous reactive voltage component (V_q) are separated using Transformations. The magnitude estimation of (V_d) and (V_q) is given by $|V_{ref}|$. Then, the angle is extracted from the active and the reactive voltage component. The attained angle is compared with the angles and the appropriate sector for that angle is identified. Now, each sector represents 60^0 .The adjacent vectors in each sector of SVPWM need to be averaged. Two adjacent vectors and zero vectors are combined to generate the appropriate PWM signals.

III. SIMULATION RESULTS

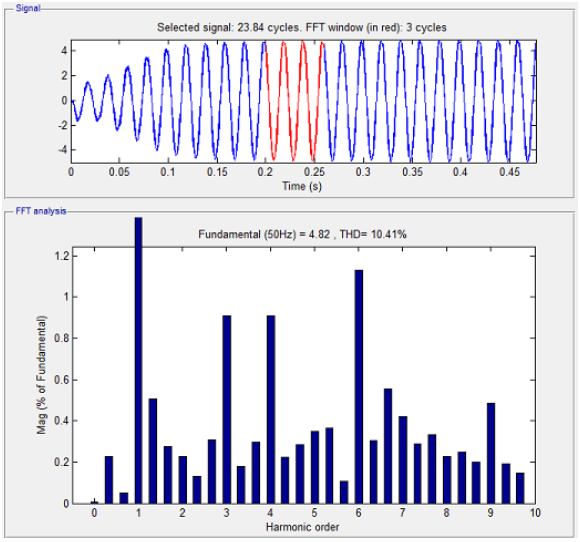


Figure 4. THD result without fuzzy-inverter controller

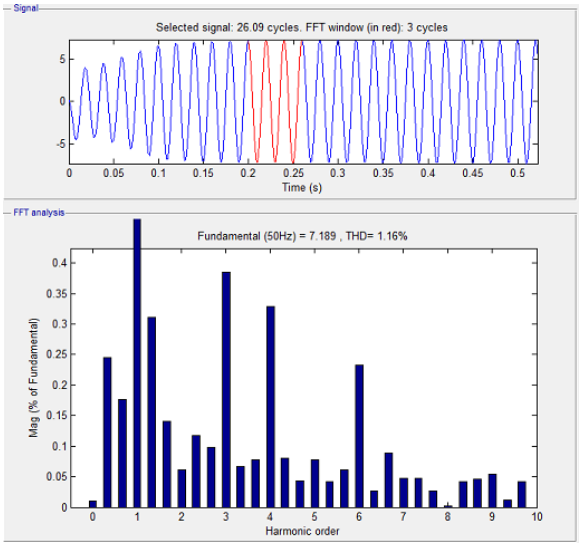


Figure 5. THD result with fuzzy–inverter controller

IV. CONCLUSION

In this paper, harmonics generated by a solar PV system reviewed.LC type filter is used to reduce harmonics.Futher to reduce low harmonics fuzzy controller method which acts as error block is used. Error Output of fuzzy controller is given to inverter which always ensures to get constant reference voltage (say 230V).Using FFT analysis simulation is carried out and where, there is considerable percentage reduction in THD is achieved.

V. REFERENCE

[1] Xiaodong Liang Chowdhury Andalib-Bin-Karim , "Harmonic Mitigation through Advanced Control Methods for Grid- Connected Renewable Energy Sources" in Proc.IEEE 2017-PSEC-0801

[2] A. Chidurala, T. K. Saha, N. Mithulananthan, and R. C. Bansal, "Harmonic emissions in grid connected PV systems: A case study on a large scale rooftop PV site," in Proc. IEEE PES General Meeting, Conference & Exposition, 2014, pp. 1-5.

[3] X. Liang, "Emerging power quality challenges due to integration of renewable energy sources", IEEE Trans. Industry Applications, vol. 53,no. 2, pp. 855-866, 2017.

[4] M. A. Awadallah, B. Venkatesh, and B. N. Singh, "Impact of solar panels on power quality of distribution networks and transformers", CanadianJournal of Electrical and Computer Engineering, vol. 38, no. 1, pp. 45-51, 2015.

[5] R. K. Varma, S. A. Rahman, T. Vanderheide, and M. D. N. DANG, "Harmonic impact of a 20-MW PV solar farm on a utility distribution network", IEEE Power and Energy Technology Systems Journal, vol. 3, no. 3, pp. 89-98, 2016.

[6]Chinnathambi Govindaraju, Kaliaperumal Baskaran,"Power Loss Minimizing control of cascaded multilevel inverter with efficient hybrid carrier based space vector modulation", International Journal of Electrical and Computer Engineering Systems, Vol. 1, No. 1, pp 43-53, June 2010.

[7]Dr.N.Amuthan and Srikanth H.P ,"Review of IGBT Based Ultrasonic Circuits",International Journal of Power Electronics,Vol.6,Issue 1

[8] Gounden NA, Peter SA, Nallandula H, Krithiga S (2009) Fuzzy logic controller with MPPT using line-communicated inverter for three-phase grid-connected photovoltaic systems. Renewable Energy 34:909–915

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 5 | ISSN : 2456-3307

Heat Recovery System in Automobile

Anurodh Mohapatra*[1], Karan Kumar Aneja R[2], Sagar Kadam[3], Aaqib Rafiq[4], Alekh Anil[5]
[1-5]Mechanical, New Horizon College of Engineering, Bangalore, Karnataka, India

ABSTRACT

Nowadays the performance of the vehicles has been the trend of improvement, but the efficiency of the vehicles has not seen good improvement as engines efficiency is limited to 30-40% and other 60-70% of the fuel energy is being wasted to the environment through various factors such as heat, friction & engine coolant. Waste heat is the heat, which is generated in a process by a fuel combustion and released into the environment, though it can be used for economical, and some useful purpose. Some power of IC engine is used to run alternator, which reduces the mileage. We have used Thermoelectric Generator (TEG's) for utilizing the waste heat energy from the exhaust line through seebeck effect, which generates E.M.F with temperature difference; our motto is to supply this energy to the external accessories such as a portable mobile charger or auxiliary lights for various locations on the bike. The weight of the TEG setup is not as heavy as a reason it can be introduced to vehicles, the cost of the TEG is significantly affordable but the design, and construction of TEG is the challenging factor for us.

Keywords: Waste heat recovery, TEG, Thermo electric generator, Seebeck effect.

I. INTRODUCTION

In vehicle engines, enormous amount of heat is released to the environment. As a lot as 60-70% of the heat generated from combustion in an automotive fuel engine is dissipated to the environment through exhaust fuel and other losses which is recoverable at least partly.

In the case of high-performance engines the exhaust heat is used both for turbo-charging or supercharging. A turbocharger makes use of a turbine attached to the exhaust machine whereas a supercharger is connected immediately to the engine to run a compressor. A range of other heat recuperation techniques, generally conceptual, has been proposed to recover the waste heat of a vehicle engine.

Current ICEs are 20% to 45% environment friendly under typical using stipulations depending on the engine type and working conditions. The closing 55%–80% will be wasted as heat in each the coolant and the exhaust gases. A waste heat recovery system has the manageable to convert some of this waste heat into electrical energy and can be utilized to provide electricity to greater add-ons .TEGs may want to be used in conjunction for use in a waste heat restoration system. Their compact measurement and strong country layout make them perfect for automotive applications.

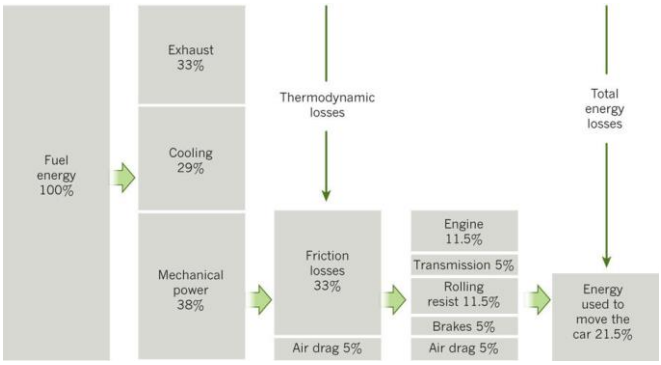


Fig.1. Heat lost chart

TEGs makes use of what is acknowledged as the Seebeck impact, which is explained in Fig. 2. A TEG is made up of many elements of N type and P type semiconductor materials, which are connected electrically in sequence however thermally in parallel. When one side of the TEG is heated and the different aspect cooled, a voltage is generated. The voltage generation capacity there is purposes for these TEGs to generate electricity the place temperature variations are present. Their efficiency is generally 5% [1] and they can generate energy from any temperature difference. Their efficiency is restrained by means of the Carnot efficiency. So greater the temperature difference, the more efficient they will be. A TEG operates at about 20% of the Carnot efficiency over an extensive temperature vary.

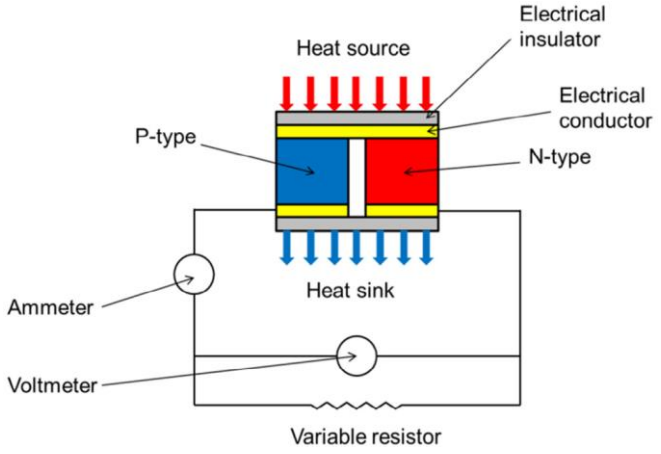


Fig. 2. Seebeck Effect

II. METHODS AND MATERIAL

Seebeck Effect

Seebeck effect is a phenomenon which uses Peltier device as a mode of energy conversion wherein the temperature difference created by the slab placed on silencer and the fins exposed to atmosphere generates a sufficient amount of E.M.F. which can drive a small capacity battery or any auxiliary devices such a portable charger etc. hence we have designed a model for the bike Access 125 from Suzuki where we have created single layered slab of single material with fins within which the TEG is embedded.

Materials

Table 1

Material	Mild Steel	Aluminum Alloy
Thermal Conductivity	32W/m2K	295 W/m2K
Usage Position	Before TEG	After TEG

Design

The design for heat recovery system is shown in fig. 3 with dimensions.

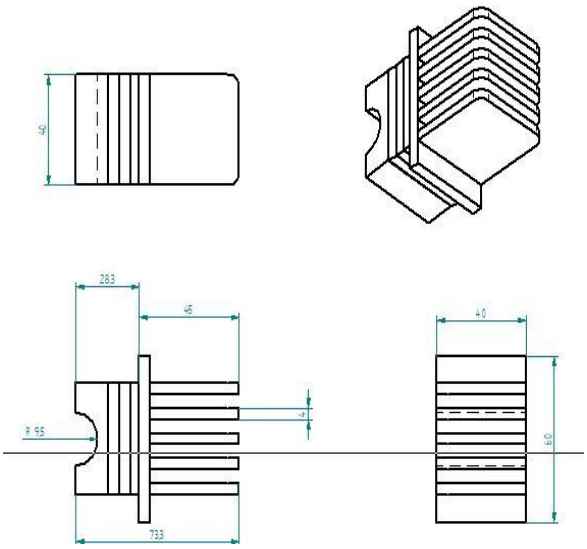


Fig.3. Dimensions of Heat Recovery system

III. RESULTS AND DISCUSSION

Analysis

The main issue with TEGs is that they have very low working temperature. For our experiment, we have selected TEC1-12706 whose working temperature is 150˚C. For that purpose, we have to design a slab such that temperature from 200˚C can be reduced to 150˚C. Analysis has been done in Ansys workbench V16 and result is shown in fig.4.

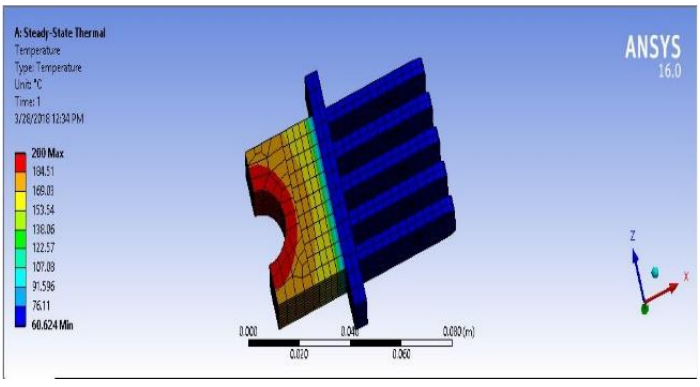


Fig.4. Analysis in Ansys V16

IV. CONCLUSION

As we have described our work on the vehicle using TEG we could find that a lot of improvement can take place if this field is dug properly with incorporation of electrical knowledge as the electrical circuits are much more effective than the mechanical circuits because they are more reliable and less prone to fail but the challenging factor we faced is the design and the construction of these modern bikes isn't simple and not same because of the emission norms restricted by the government for the less pollution emission from the vehicles which may help in degradation of global warming at significant level because number of vehicles on road keeps increasing day by day because of the advancement of the technology and innovation which has a significant attraction of our nation which increase the sales of automobiles.

V. REFERENCES

[1]M.A. Karri, E.F. Thacher, B.T. Helenbrook, Exhaust energy conversion bythermoelectric generator: two case studies, Energy Convers. Manag. 52 (2011)1596–1611.

[2] H. L. Talom and A. Beyene, "Heat recovery from automotive engine, "Applied Thermal Engineering, 29 (2009) 439–444.

[3]S. Kim, S. Park, S. Kim, S.H. Rhi, A thermoelectric generator using engine coolantfor light-duty internal combustion Engine-Powered Vehicles, J. Electron. Mater.
40 (2011) 812–816.

[4] H. Goldsmid, Bismuth telluride and its alloys as materials for thermoelectricgeneration, Materials 7 (2014) 2577–2592.

[5] R. Stobart, D. Milner, The potential for thermo-electric regeneration of energyin vehicles, SAE Technical Papers (2009) doi:10.4271/2009-01-1333.

[6] X. Yang, Y.Y. Yan, D. Mullen, Recent developments of lightweight, highperformance heat pipes, Appl. Therm. Eng. 33–34 (2012) 1–14.

[7] C.T. Kniess, M.B.H. Mantelli, A. Cunha, G.J.M. Martins, G.V. Nuernberg,W. Angelo,et al., Experimental study of mercury and naphthalene thermosyphons,presented at the 14th International Heat pipe Conference, Florianopolis, razil,
2007.

[8] Q.E. Hussain, D.R. Brigham, C.W. Maranville, Thermoelectric exhaust heatrecovery for hybrid vehicles, SAE Int. J. Engines 2 (2009) 1132–1142.

www.ijsrcseit.com

International Journal of Scientific Research in
Computer Science, Engineering and Information Technology
(International Journal Bimonthly Publication)
www.ijsrcseit.com

Published by :
TechnoScience Academy
www.technoscienceacademy.com

NEW HORIZON
COLLEGE OF ENGINEERING

International Conference on New Horizons in Science Engineering Technology (NHSET-2018)

Organised by
Department of Electrical and Electronics Engineering
New Horizon College of Engineering, Ring Road,
Bellandur Post, Bengaluru, Karnataka, India

Email: editor@ijsrcseit.com, ijsrcseit@gmail.com