# Proceedings of 4th International Conference on Recent Challenges in Engineering and Technology (ICRCET-18)

Pune, Maharashtra

2nd- 3rd April' 18

Institute For Engineering Research and Publication

4A, Girija Apartment, MMDA,

Arumbakkam, Chennai-600106, India

www.iferp.in

Publisher: IFERP Explore

**Editorial:**

We cordially invite you to attend the ***4th International Conference on Recent Challenges in Engineering and Technology (ICRCET-18)*** which will be held at ***The Central Park Hotel, Pune, Maharashtra*** on ***April 2nd-3rd, 2018***. The main objective of ***ICRCET*** is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in relevant fields of Science, Engineering and Technology. This conference will provide opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relationship and to find global partners for future collaboration.

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

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

Since February 2018, the Organizing Committees have received more than 40 manuscript papers, and the papers cover all the aspects in Electronics, Computer Science, Information Technology, Science Engineering and Technology. Finally, after review, about 22 papers were included to the proceedings of ***ICRCET - 2018***.

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of ***ICRCET 2018*** We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions made this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

**Editor-In-Chief**
**Dr. Nalini Chidambaram**
**Professor**
**Bharth University**

## Acknowledgement

IFERP is hosting the ***4th International Conference on Recent Challenges in Engineering and Technology*** this year in month of April. The main objective of ICRCET is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points, and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions. The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader.

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

**Er. R. B. Satpathy**
**Secretary**
**Institute for Engineering Research and Publication (IFERP)**

# ICRCET-18

# 4th International Conference on Recent Challenges in Engineering and Technology

*Pune, Maharashtra, March 02nd - 3rd, 2018*

## Organizing Committee

**Dr. T. Kameswara Rao**
Professor
Vasireddy Venkatadri Institute of Technology, Guntur, Andhra Pradesh

**Prof. Megha Vishant Ainapurkar**
Assistant Professor
Padre Conceicao College of Engineering Verna Goa, Goa

**Dr. Chandrashekara S. Adiga**
Professor
Manipal Institute of Technology, karnataka

**Dr. D. V. Kamath**
Professor
Manipal Institute of Technology, karnataka

**Dr. H N Suresh**
Professor
Bangalore Institute of Technology, karnataka

**Dr. Jagdish W. Dadge**
Head of Department
College of Engineering, Pune, Maharashtra

**Dr. Jaya V**
Professor & Head
Government Engineering College Bartonhill, Thiruvananthapuram, Kerala

**Dr. K. Prabhakar Nayak**
Professor
Manipal Institute of Technology, karnataka

**Dr. M. S. Deshpande**
Professor
Vishwakarma Institute of Technology, Pune, Maharashtra

**Dr. M.V.Shankar**
Professor
Yogi Vemana University, Kadapa , Andhra Pradesh

**Dr. Maya V. karki**
Professor
Ramaiah Institute of Technology, Bangalore, karnataka

**Dr. N V Subba Reddy**
Professor
Manipal University, Karnataka, karnataka

**Dr. S. Jayaraj**
Professor
National Institute of Technology Calicut, Kerala

**Dr. Shreesha Chokkadi**
Professor
Manipal Institute of Technology, karnataka

**Dr. Sobhana N V**
Professor
Rajiv Gandhi Institute of Technology, Kottayam, Kerala

**Dr.R.Nedunchelian**
Professor, Sri Venkateswara College of Engineering, Chennai, Tamil Nadu

**G Srinivasulu**
Professor & Head
Narayana Engg. College, Nellore, Andhra Pradesh

**Dr. Shrinivas A. Patil**
Professor
DKTE'S Textile and Engineering Institute, Rajwada, Maharashtra

**Dr. B.S. Kothavale**
Professor
MIT College of Engineering, Pune, Maharashtra

**Prof. Sathya Shankara Sharma**
Professor
Manipal Institute of Technology, karnataka

**Santhosh George**
Professor
National Institute of Technology Karnataka, karnataka

**Dr Rajendra Beedu**
Professor
Manipal Institute of Technology, karnataka

**Dr. G.Kameswar**
Associate Professor
NBKR Institute of Science and Technology, Nellor, Andhra Pradesh

**Dr. Ishwar P. Sonar**
Associate Professor
College of Engineering Pune, Maharashtra

**Dr. Kumkum Banerjee**
Associate Professor
National Institute of Technology Karnataka, Surathkal, Mangalore , karnataka

**Dr. Likith Kumar M V,**
Assistant Professor
Ramaiah Institute of Technology, Bengaluru, karnataka

**Dr NiranjanamurthyM**
Assistant Professor
Ramaiah Institute of Technology, Bangalore, karnataka

**Dr. R. Ramesh Kumar**
Professor
Government Engineering College Barton Hill,Thiruvananthapuram , Kerala

**Dr. R. shivarudraswamy**
Associate Professor
Manipal Institute of Technology, Manipal Academy of Higher Education Manipal, Udupi, karnataka

**Dr.R. R Dube**
Professor & Head
W.I.T Solapur, Maharashtra, Maharashtra

**Mrs Hema Kishor Munot**
Assistant Professor
College of Engineering, Pune, Maharashtra

**Dr.Santosh B. Rane**
Lecturer
Sardar Patel College Of Engineering, Mumbai, Maharashtra

**Dr. Amol C. Adamuthe**
Associate Professor & Head
Rajarambapu Institute of Technology, Rajaramnagar, Maharashtra

**Dr. shrikaant kulkarni**
Assistant Professor
Vishwakarma Institute of Technology, pune, Maharashtra

**Dr. U. Achutha Kini**
Professor
Manipal University, Karnataka, karnataka

**Dr.P.Venkateswara Rao**
Associate Professor
Sri Venkateswara College of Engineering, Tamil Nadu

**Mrs. Shailaja S. Patil**
Assistant Professor
Rajarambapu Institute of Technology, Sakharale, Sangli, Maharashtra

**S.Prakash**
Assistant Professor, Gokula Krishna College Of Engineering, Sullurupeta, Andhra Pradesh

**Dr. Sharath. R**
Assistant Professor
M.S. Ramaiah Institute of Technology, Bangalore, karnataka

**Dr.Shobha K R**
Associate Professor
Ramaiah Institue of Technology, Bengaluru, karnataka

**Ms.Prachiti S.Pimple**
Assistant Professor
K.K.Wagh Institute of Engineering Education & Research, Nashik, Maharashtra

**Anupama Hiremath**
Assistant Professor
Manipal Institute of Technology, Manipal,Udupi, karnataka

**Dr. Basavaraju Manu**
Assistant Professor
National Institute of Technology Karnataka, Surathkal, karnataka

**Dr. Shubhangi Neware**
Assistant Professor
Shri. Ramdeobaba College of Engg. & Management, Nagpur, Maharashtra

**Dr. V. Jayashree**
Professor
DKTE'S Textile and Engineering Institute, Rajwada, Maharashtra

**Dr.Perepi Rajarajeswari**
Assistant Professor
Aditya college of Engineering, Andhra Pradesh

**Ponkshe Vasudeo Shrikant**
Assistant Professor
AISSMS College of Engineering, pune, Maharashtra

**Sudheer.A.P**
Assistant Professor
National Institute of Technology Calicut, Kerala

**Dr. Vasudeo B. Virulkar,**
Associate Professor
Govt. College of Engineering, Chandrapur, Maharashtra

**Mr. Gaikwad Lokpriya Mohanrao**
Assistant Professor, SIES Graduate School of Technology, NaviMumbai, Maharashtra

**Narendra V G**
Associate Professor
Manipal Institute of Technology, karnataka

**Dr Surekha Kamath**
Assistant Professor
Manipal Institute of Technology, karnataka

**Dr. Bhaskar K**
Assistant Professor
Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Chennai, Tamil Nadu

**Dr. Sravanti Vaidya**
Assistant Professor
Ramaiah Institute of Technology, Bangalore., karnataka

**Dr.Gowri shankar**
Assistant Professor
Manipal Institute of Technology, Manipal , karnataka

**K.Krishna Prakash,**
Assistant Professor
Manipal University, Karnataka, karnataka

**Prof. Sandeep U. Mane**
Assistant Professor
Rajarambapu Institute Of Technology Rajaramnagar, Islampur, Maharashtra

**Swati R. Keshari,**
Assistant Professor
M.E.S College Of Engineering ,PUNE , Maharashtra

**Dr. Vinodu George**
Professor
LBS College of Engineering, Kerala

**Mr. Pradeep Dhanawade**
Assistant Professor
DKTE'S Textile and Engineering Institute, Rajwada, Maharashtra

**Rajendra Prasad Bellupu**
Assistant Professor
Manipal Institute of Technology, karnataka

**Dr Shabnam Farook Sayyad**
Assistant Professor
AISSMS College of Engineering, Pune, Maharashtra

**Dr. Deepa G. Nair**
Associate Professor
Cochin University of Science & Technology, Kerala

**Dr. Subha V**
Associate Professor
School of Engineering, Cochin University of Science and Technology, Cochin , Kerala

**Dr.Netra.M.Lokhande**
Associate Professor
MIT College of Engineering, Pune, Maharashtra

**Mrs. Bhavana Tiple**
Associate Professor
Maharashtra Institute of Technology, Pune, Maharashtra

**Prof.Vaibhav M. Davande**
Assistant Professor
DKTE'S Textile and Engineering Institute, Rajwada, Maharashtra

**V.V.N Bhaskar**
Assistant Professor & Head
Aditya College of Engineering, Madanapalle,Chittoor , Andhra Pradesh

**Dr. B. M. Kunar**
Assistant Professor
Institute of Technology
KARNATAKA Surathkal,
karnataka

**Govardhan Hegde K**
Assistant Professor
Manipal University, Karnataka,
karnataka

**Nikhil Damle**
Assistant Professor
Shri. Ramdeobaba College of
Engg. & Management, Nagpur,
Maharashtra

**Yedukondala Rao V**
Assistant Professor
Manipal Institute of Technology,
karnataka

**Dr Manjula Shenoy**
Professor
Manipal Institute of Technology,
karnataka

**Dr. Sunita A. Patil**
Associate Professor
K. K. Wagh Institute of
Engineering Education and
Research, Nashik., Maharashtra

**Mr.M.Rajvikram**
Assistant Professor
Sri Venkateswara College of
Engineering (Autonomous) ,
Tamil Nadu

**Prof. Mahesh P. Joshi**
Assistant Professor
MIT College of
Engineering,Pune, Maharashtra

**Dr. Muralidhar Killi**
Assistant Professor
Manipal Institute of Technology,
karnataka

**Miss.Sahu Sonali Dayanand**
Assistant Professor
Bharati Vidyapeeth College of
Engineering, Kharghar,Navi Mumbai,
Maharashtra

**Prof. Sushila Aghav**
Assistant Professor
MIT College of Engineering,Pune,
Maharashtra

**Ashwath Rao B**
Assistant Professor
Manipal Institute of Technology,
karnataka

**Dr. Abhay M Khalatkar**
Assistant Professor
Shri. Ramdeobaba College of Engg. &
Management, Nagpur, Maharashtra

**Dr. Swati Hira**
Assistant Professor
Shri. Ramdeobaba College of Engg. &
Management, Nagpur, Maharashtra

**Mrs. Minal Patil**
Assistant Professor
MAEER's MIT College of Engineering,
Pune, Maharashtra

**Sachin Subhash Patil**
Assistant Professor
Rajarambapu Institute of Technology,
Maharashtra

**Dr. S. Jagannatha**
Assistant Professor
M.S. Ramaiah Institute of
Technology, karnataka

**Mr. Rahul Vilasrao Kajave**
Assistant Professor, Tatyasaheb
Kore Institute of Engineering &
Technology,Warananagar,
Maharashtra

**Rupali M. Bora**
Assistant Professor
K. K. Wagh College of Engg.
Nashik, Maharashtra

**Bane Raman Raghunath**
Assistant Professor
SSPM College of Engineering,
Kankavali, Maharashtra

**Dr. Mark Monis**
Assistant Professor
Tatyasaheb Kore Institute of
Engineering and Technology,
Kolhapur, Maharashtra

**Dr. Atul Bansilal Patil**
Assistant Professor
College of Engineering Pune,
Maharashtra

**N.Balajiganesh**
Assistant Professor
Aditya College of Engineering,
Madanapalle, Andhra Pradesh

**Dr. Shailendra S. Aote**
Assistant Professor
Shri. Ramdeobaba College of
Engg. & Management, Nagpur,
Maharashtra

**Ms. Anuradha Shriram Deokar**
Assistant Professor, All India
Shivaji Memorable Society's
College of Engineering , Pune,
Maharashtra

**Suresh S. Balpande**
Assistant Professor
Shri. Ramdeobaba College of
Engg. & Management, Nagpur,
Maharashtra

**Deepali Yogendra Dube**
Assistant Professor
K. K. Wagh College of Engg.
Nashik, Maharashtra

**Dr. Sudhakar S. Umale**
Assistant Professor
Sardar Patel College of Engg,
Andheri Mumbai, Maharashtra

**Dr.I.Thirunavukkarasu**
Associate Professor
Manipal Institute of Technology,
karnataka

**Priyanka Prakash Shinde**
Assistant Professor
Government College Of
Engineering, Karad, Maharashtra

# CONTENTS

# CONTENTS

# CONTENTS

# A Review on Educational Data Mining

[1] Aboli Kohale, [2] Prarthana Deshkar
[2] Assistant Professor, [1] [2] Department of Computer Technology, Yeshwantrao Chavan College of Engineering Nagpur, India
[1] abolikohale@gmail.com, [2] prarthana.deshkar@gmail.com

***Abstract*:-- Data in educational institutions are growing progressively along these lines there is a need of progress this tremendous data into helpful data and information utilizing data mining. Educational data mining is the zone of science where diverse techniques are being produced for looking and investigating data and this will be valuable for better comprehension of understudies and the settings they learned. Classification of data objects in view of a predefined learning of the articles is a data mining and information administration procedure utilized as a part of collection comparable data questions together. Decision Tree is a valuable and well known classification method that inductively takes in a model from a given arrangement of data. One explanation behind its prominence comes from the accessibility of existing calculations that can be utilized to assemble decision trees. In this paper we will survey the different ordinarily utilized decision tree calculations which are utilized for classification. We will likewise contemplating how these decision tree calculations are appropriate and valuable for educational data mining and which one is ideal.**

**Index Terms: Educational data mining (EDM), Classification, Dropout Prediction, Selection Failure**

## I. INTRODUCTION

As of late the scientist concentrates on the new region of research, which is EDM (Educational Data mining). EDM is the information disclosure in database strategy or the data mining in instruction. The specialist concentrates on the improvement of technique to better comprehend understudies and the settings in which they learn. There are great cases of how to apply EDM systems to make models that foresee dropping out and understudy disappointment. These works have indicated promising outcomes regarding those sociological, monetary, or educational qualities that might be more pertinent in the forecast of low scholarly execution.

The data in any given educational association is growing rapidly. There is a need to change this data into helpful data and learning; henceforth we make utilization of data mining Distinguish and find valuable data covered up in substantial databases is a troublesome errand. An exceptionally making an assurance to answer for accomplish this goal is the utilization of learning revelation in databases techniques or data mining in training, called Educational Data Mining, EDM [15].

Educational data mining techniques drawn from an assortment of writings, including data mining and machine learning, psychometrics and different ranges of measurements, data perception, and computational displaying.

As we examined over the new territory of center for the specialists is EDM. In introduce the vast majority of the procedures was produced for the educational data mining, which foresee the disappointment and dropout understudies. Be that as it may, a large portion of the examination on the use of EDM to determine the issues of understudy disappointment and drop-outs has been connected principally to the particular instance of advanced education and all the more particularly to on the web or separation instruction. Less almost no data about particular research on basic and optional instruction has been found, and what has been discovered uses just measurable strategies, not DM methods. Along these lines, there is a need to proposed Educational data mining system that is attainable for rudimentary and optional instruction.
Classification can be depicted as a regulated learning calculation in the machine learning process. It relegates class marks to data objects in light of earlier information of class which the data records have a place. In classification a given arrangement of data records is partitioned into preparing and tests data sets. The preparation data set is utilized as a part of building the classification display, while the test data record is utilized as a part of approving the model. The model is then used to order and foresee new arrangement of data records that is not the same as both the preparation and test data sets. Decision tree calculation is a data mining enlistment methods that recursively segments a data set of records utilizing profundity first voracious approach or expansiveness initially approach until the point when every one of the data things have a place with a specific class. The tree structure is utilized as a part of arranging obscure data records. Decision tree classification system is performed in two stages: tree building and tree pruning. Tree building is done in top-down way. It is amid this stage the tree is recursively parcelled till every one of the data things have

a place with a similar class name. Tree pruning is done is a base up. It is utilized to enhance the forecast and classification exactness of the calculation by limiting over-fitting. Over-fitting in decision tree calculation brings about misclassification mistake. Tree pruning is less entrusting contrasted with the tree development stage as the preparation data set is filtered just once. In this examination we will audit Decision tree calculations executed, recognize the ordinarily utilized calculations.

## II. RELATED WORK

Decision tree is a vital strategy for both acceptance research and data mining, which is basically utilized for display classification and expectation. ID3 calculation is the most broadly utilized calculation in the decision tree up until this point. Through outlining on the fundamental thoughts of decision tree in data mining. ID3 calculation is a forerunner of C4.5 calculation and it was produced by a data mining software engineering scientist Ross Quinlan in 1983.It is utilized to build a decision tree by testing every hub's trait of tree in top-down way. ID calculation performs property choice component utilizing Entropy and Information Gain idea. A decision tree is an essential method for data mining and inductive realizing, which is generally used to frame classifiers and expectation models [2].

C4.5 is a standout amongst the most exemplary classification calculations on data mining. Decision Trees a Decision Tree is a helpful and prevalent classification procedure that inductively takes in a model from a given arrangement of data. One explanation behind its fame originates from the accessibility of existing calculations that can be utilized to manufacture decision trees [3].

CART is Classification and relapse trees. It was presented by Breiman in 1984. It fabricates the two classifications and regressions trees. The classification tree development via CART. It depends on paired part of the characteristics. It is additionally in view of Hunt's model of decision tree development. It additionally can be executed serially by Breiman et al. It utilizes gini record part measure for choosing the part quality. Pruning is finished by utilizing a segment of the preparation data set in truck. This approach utilizes both numeric and clear cut properties for building the decision tree and has in-constructed highlights that arrangement with missing qualities [11].

The fundamental distinction between CART, ID3 and C4.5 is the manner by which the parceling of data is performed. Truck utilizes the Gini list to choose the part quality, though ID3 and C4.5 utilize an estimation of data pick up and the data pick up proportion.

SLIQ is the Supervised Learning in Ques approach. It was presented by Mehta et al in 1996. It is a quick, adaptable decision tree calculation that can be executed in serial and parallel example. It does not depend on Hunt's calculation for decision tree classification. It segments a preparation data set recursively. It utilizes expansiveness first ravenous procedure that is coordinated with pre-sorting method amid the tree building stage [17].

Dash is Scalable Parallelizable Induction of decision Tree calculation. It was presented by Shafer et al. It is a quick and adaptable decision tree classifier. Like SLIQ it utilizes one time kind of the data things. It has no limitation on the info data estimate [18].

CHAID is a kind of decision tree method. It depends on balanced hugeness testing. This procedure was produced in South Africa. It is a comparable form to relapse examination. This adaptation of CHAID being initially known as XAID. It is valuable for classification and for recognition of connection between factors [16].

The present decision tree calculations likewise contrast in their capacity to deal with various sorts of data, and by a wide margin the most exceptional calculation of the gathering is C4.5. C4.5 depends on Quinlan's prior work with ID3 and is equipped for taking care of ceaseless data, data with missing esteems, and even has worked in ventures for rearranging the resultant decision tree. Another purpose for the ubiquity of decision trees is that they are regularly interpretable by human analyzers. The structure of a decision tree gives thinking to each statement of class esteem, and it is trusted that this thinking is anything but difficult to understand.

The classifier is tried first to group inconspicuous data and for this reason coming about decision tree is utilized. C4.5 calculation takes after the standards of ID3 calculation. Also C5.0 calculation takes after the tenets of calculation that is the vast decision tree can see as an arrangement of guidelines which is straightforward. C5.0 calculation gives the recognize on clamor and missing data. Issue of over fitting and mistake pruning is tackled by the C5 calculation. In classification procedure the C5 classifier can envision which properties are important and which are not applicable in classification [5]

## III. CONCLUSIONS

This paper is a review of the best in class regarding EDM and reviews the most applicable work around there to date. It would be exceptionally hard to physically experience the tremendous arrangement of scholarly records to distinguish the understudy patterns and conduct and the example in which they learn. Rather, if client makes utilization of data mining strategies on the expansive measure of scholastic

 ISBN: 978-81-932966-5-3

record, he/she can without much of a stretch gathering the understudies, distinguish shrouded designs about their learning styles, discover unfortunate understudy conduct and perform understudy profiling. In this way, data mining can unquestionably be a vital apparatus and part of mechanically progressed educational systems.

**REFERENCES**

[1] Carlos Márquez-Vera, Cristóbal Romero Morales, and Sebastián Ventura Soto, "Predicting School Failure and Dropout by Using Data Mining Techniques", Ieee Journal Of Latin-American Learning Technologies, Vol. 8, No. 1, February 2013 IEEE.

[2] IU Qin, "Data Mining Method Based on Computer Forensics-based ID3 Algorithm", 978-1-4244-5265-1/10/$26.00©2010IEEE

[3] Rong Cao, Lizhen Xu, "Improved C4.5 Algorithm for the Analysis of Sales", Sixth Web Information Systems and Applications Conference, 978-0-7695-3874-7/09 $25.00 DOI 10.1109/WISA36, © 2009 IEEE

[4] Gaganjot Kaur , Amit Chhabra , "Improved J48 Classification Algorithm for the Prediction of Diabetes" , International Journal of Computer Applications (0975 – 8887) Volume 98 – No.22, July 2014.

[5] Tomasz Bujlow, Tahir Riaz, Jens Myrup Pedersen, "A method for classification of network traffic based on C5.0 Machine Learning Algorithm", Workshop on Computing, Networking and Communications, 2012 IEEE.

[6] Raisul Islam Rashu, Naheena Haq, Rashedur M Rahman, "Data Mining Approaches to Predict Final Grade by Overcoming Class Imbalance Problem", 17th International Conference on Computer and Information Technology (ICCIT) 2014.

[7] Hina Gulati, "Predictive Analytics Using Data Mining Technique", 978-9-3805-4416-8/15/$31.00c 2015 IEEE.

[8] Rutvija Pandya , Jayati Pandya , "C5.0 Algorithm to Improved Decision Tree with Feature Selection and Reduced Error Pruning ", International Journal of Computer Applications (0975 – 8887) Volume 117 – No. 16, May 2015.

[9] Alana M. de, Morais and Joseana M. F. R. Araújo, Evandro B. Costa, "Monitoring Student Performance Using Data Clustering and Predictive Modelling", 978-1-4799-3922-0/14/$31.00 ©2014 IEEE.

[10] Kin Fun Li, David Rusk and Fred Song, "Predicting Student Academic Performance", 2013 Seventh International Conference on Complex, Intelligent, and Software Intensive Systems.

[11] Mishra, T., Kumar, D. Gupta, S.," Mining Students' Data for Prediction Performance", Advanced Computing & Communication Technologies (ACCT), 2014 Fourth International Conference on 8-9 Feb. 2014.

[12] B.K.Bhardwaj and S.Paul, "Mining Educational Data to Analyze Students Performance", International Journal Advanced Computer Science and application Vol. 2 No. 6, 2011.

[13] Yohannes Kurniawan, Erwin Halim, "Use Data Warehouse and Data Mining to Predict Student Academic performance in Schools: A Case Study (Perspective Application and Benefits)".

[14] B.K.Bhardwaj and S.Paul, "Mining Educational Data to Analyze Students Performance", International Journal Advanced Computer Science and application Vol. 2 No. 6, 2011.

[15] Lewis, R.J. (200). An Introduction to Classification and Regression Tree (CART) Analysis. 2000 Annual Meeting of the Society for Academic Emergency Medicine, Francisco, California.

[16] Mehta, M., Agrawal, R., and Rissanen, J. (1996). SLIQ: A fast scalable classifier for data mining. In EDBT 96, Avignon, France

[17] Shafer, J., Agrawal, R., and Mehta, M. (1996). Sprint: A scalable parallel classifier for data mining. Proceedings of the 22nd international conference on very large data base. Mumbai (Bombay), India.

# Review on Detection of Anomalous Cluster in Discrete database by using Similarity Measure for Text Processing

[1] Bhawana Gawande, [2] Nilima Jichkar
[2] Assistant Professor, [1] [2] Department of Computer Technology, Yeshwantrao Chavan College of Engineering Nagpur, India
[1] bhawanagawande16@gmail.com, [2] nilimajichkar@gmail.com

***Abstract*:-- Generally, finding of an unusual information i.e. anomalies from discrete information leads towards the better comprehension of atypical conduct of patterns and to recognize the base of anomalies. Anomalies can be characterized as the patterns that don't have ordinary conduct. It is likewise called as anomaly detection. Anomaly detection procedures are for the most part utilized for misrepresentation detection in charge cards, bank extortion; organize interruption and so on. It can be eluded as, oddities, deviation, special cases or exception. Such sort of patterns can't be seen to the diagnostic meaning of an exception, as uncommon question till it has been incorporated legitimately. A bunch investigation strategy is utilized to recognize small scale clusters shaped by these anomalies. In this paper, we show different techniques existed for recognizing anomalies from datasets which just distinguishes the individual anomalies. Issue with singular anomaly detection strategy that identifies anomalies utilizing the whole highlights commonly neglect to identify such anomalies. A strategy to recognize bunch of anomalous information join show atypical area of a little subset of highlights. This technique utilizes an invalid model to for commonplace topic and after that different test to identify all clusters of strange patterns.**

**Index Terms: Anomaly Detection, Pattern Detection, Topic Models, Topic Discovery**

## I. INTRODUCTION

Particularly, in information investigation anomalies like, exception, deviation, special cases and so on are critical ideas. Information articles to be considered as anomaly in the event that it has some variance from the customary information conduct in particular area. It implies that the information protest from the given dataset has "divergent" conduct. To recognize such kind of articles from the given dataset is a critical and essential errand as they have to treat uniquely in contrast to the next information. Anomaly detection is broadly utilized as a part of charge card extortion detection [6], bank misrepresentation detection [21], Whole-genome DNA coordinating, sifting of ECG signals. Promotion is the issue

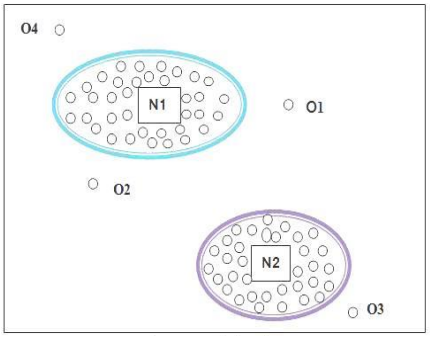



***Figure 1: Anomaly Detection***

Figure 1 indicates anomalies in a 2-dimension.It is two dimensional plane of informational collections. N1 and N2 are two typical areas. As indicated by the perceptions the greater part of informational collections lies in these areas. On the off chance that we watch deliberately then we came to realize that point's o1 and o2, o3, o4 are the focuses which not lies in ordinary areas. They are far from the ordinary districts. So we can state that they are anomalies. Figure 1 speaks to the exceptionally straightforward case of anomalies in 2-D plane. Anomalies might be presented in the information for such a significant number of reasons and they are not commotion which must be disposed of. Anomalies may be evoked in the information for such huge numbers of reasons, for example, pernicious action, e.g., Visa misrepresentation, psychological oppressor movement, interruption or breakdown of a system [6]. Yet, the shared segment of all is that they are captivating to the master. The intriguing quality of it or its genuine pertinence of exceptions is a component film of anomaly detection [23]. The primary point of AD is to discover patterns in informational collections that show startling conduct. It possesses all-encompassing use in a gigantic assortment of uses. This explored issue has monstrous use in a wide assortment of utilization spaces, for example, credit card [6], protection, charge misrepresentation detection, interruption detection for digital security, blame detection in wellbeing basic frameworks, military

observation for adversary exercises and numerous different territories. In PC information sporadic activity pattern might be demonstrates that a PC is hacked. It is conveying very delicate information. An anomalous MRI picture may demonstrate nearness of malignant tumours. Anomalies in exchanges identified with charge card information could data fraud et cetera. Predominantly, Anomaly detection is identified with yet particular from clamor evacuation. Oddity detection is identified with the anomaly detection which distinguishes the already imperceptibly patterns in the information. Recognizing anomalies is the system for distinguishing singular specimen anomalies. In information mining, extortion detection is only the grouping of information. Beforehand, Mixture of Gaussian Mixture Models is used for amass anomaly detection [12]. This procedure expect every datum point has a place with one gathering and the all focuses in the gathering are demonstrated by MM. Furthermore, thought of MGMM is reached out to FGM i.e. Adaptable Genre Model. it regards the blending extents as irregular factors considered as would be expected types. There are some restrictions for MGMM and FGM is that lone taking a shot at high dimensional include space. Therefore, it might be erroneous when an anomalous pattern lies on low dimensional highlight subspaces. Another strategy presented in [13], executed to beat the impediments of past procedures. This is organizing investigation method [26] to recognize comparable hubs for figuring anomaly scores for concealed groups [25]. Previous strategies for anomaly detection do not have an algorithmic method for finding "hard" anomaly clusters individually [14]. This strategy just recognizes the individual anomalies. In [1], there exists a technique for distinguishing bunch or a gathering of an anomaly. This technique can recognize irregular conduct of patterns and also to distinguish the root or wellsprings of anomalies. This proposes strategy considered adequately portrayed typical information. It utilizes an invalid model in preparing stage to recognize conceivable clusters of anomalous patterns in various test bunches. This framework has critical applications in different space for instance in, logical or business related applications. Distinguishing proof of anomaly clusters have numerous applications to identify comparative patterns in malware and spyware to diagnose the wellsprings of attacks, studying patterns of an anomalies to find the client conduct.

## II. LITERATURE REVIEW

In this paper[4] There is no single generally pertinent or nonexclusive exception detection approach. From the past depictions, authors have connected a wide assortment of procedures covering the full array of factual, neural and machine learning strategies. Author have endeavoured to give a wide example of current strategies however clearly, we can't portray all methodologies in a solitary paper.

In this paper [6], author has proposed a use of Hidden Markov Model (HMM) in charge card misrepresentation detection. The diverse strides in charge card exchange preparing are spoken to as the hidden stochastic procedure of a HMM. They have utilized the scopes of exchange sum as the perception images, while the sorts of thing have been thought to be conditions of the HMM. We have proposed a technique for finding the spending profile of cardholders, and also utilization of this information in choosing the estimation of perception images and starting assessment of the model parameters. It has additionally been clarified how the HMM can recognize whether an approaching exchange is fake or not.

EFD [7] is a specialist framework playing out an assignment for which there is no master, and to which measurable methods are inapplicable. Nobody has ever explored substantial populaces of cases for potential misrepresentation, and insufficient positive cases are (yet) accessible for factual or neural system learning strategies. Plan objectives of this exploration were to start with, to join accessible information in a strong way to play out the errand; second, to convey recognized potential cases in a domain that would enable the Investigative Consultants to look at points of interest effectively; and third, to maintain a strategic distance from specially appointed methodologies and bolster expansion as comprehension of the undertaking moved forward.

Author display a payload-based anomaly identifier [8], we call PAYL, for interruption detection. PAYL models the typical application payload of system movement in a completely programmed, unsupervised and exceptionally efficient form. They initially figure amid a preparation stage a profile byte recurrence circulation and their standard deviation of the application payload streaming to a solitary host and port. At that point utilize Mahalanobis separate amid the detection stage to ascertain the similitude of new information against the pre-processed profile. The finder thinks about this measure against an edge and produces a ready when the separation of the new info surpasses this edge.

Here author proposes [9] an approach that intends to locate the most exception clusters of tests by surveying a rough joint p-esteem (joint importance) for every applicant bunch. Our strategy adequately chooses and utilizes the most discriminative highlights (by picking a subset of the pairwise include tests) to decide the clusters of anomalous examples in a given clump. We contrasted our approach and techniques that utilization the p-estimations of individual examples however without grouping, and with the one-class SVM, which utilizes the element vector straightforwardly. We watched that, in recognizing Zeus among Web, our p-esteem bunching calculation, when

utilized with low greatest test orders, outflanks the tried option techniques, which all settle on discrete detection choices for each example, and which all utilization every one of the highlights (tests).

## III. RELATED WORK

In this section we present the different existing techniques for anomaly detection.

### *A. Outliers or Anomaly Detection*

Anomaly or exception pattern are those which delineates the anomalous errand than alternate patterns of same dataset. the above figure portrays dataset which having two i.e. N1 and N2 districts. From the perception on the two locales it appears that O1, O2, O3 and O4 are the focuses far from the areas. Subsequently, those focuses are called as anomalies in dataset. Anomalies find in the information for assortment of reasons. It can be a vindictive action, for example, charge card cheats, digital interruption, some psychological militant action and so forth. Advertisement is unmistakable from the clamor evacuation and in addition commotion accommodation as both is managing pointless loud information. Curiosity detection is method for recognizing developing and novel patterns in the information. The contrast amongst anomalies and the novel pattern detection is that novel pattern is portrayed into ordinary model when it is identified. There specific constraints in detection of anomalies, for example, it is confounded to characterize ordinary conduct of patterns or to characterize normal locale. Authoritative of each conceivable ordinary conduct is inconceivable. Additionally varieties of malevolent assailants to mention anomaly objective facts like a typical when they result from noxious activities. Commotion in the information has a tendency to be like the first anomaly in this way it is hard to recognize and expel.

### *B. Group Anomaly Detection*

MGMM is Mixture of Gaussian Mixture Model utilized for assemble anomaly detection in [12]. In this strategy accept every datum direct related toward one gathering and every one of the focuses in that gatherings are displayed by gathering's Gaussian blend demonstrates. MGMM demonstrate is viable for uni-modular gathering practices. It is reached out as GLDA i.e. Gaussian LDA to deal with multi-modular gathering conduct. The two procedures distinguishes point-level and gathering level anomalous conduct. Another system is Flexible Genre Model. FGM regards blending extent as arbitrary factors. Irregular factors are altered on conceivable ordinary sorts. This strategy expects the enrolment of every datum point which is known as, apriori [13]. For all intents and purposes it is difficult to bunching information into gatherings of proceeding to applying FGM and in addition MGMM component.

### *C. GLAD: Group Anomaly Detection in social Media Analysis*

Author R.Yu, X.He, Y. Liu proposed the issue of gathering anomaly detection in online networking investigation. To characterize amass anomaly they were recognized the gathering enrolment and the part of person. Happy model is additionally called as Bayes show utilized for distinguishing bunch anomaly. It uses both combine shrewd and guide insightful information toward naturally figure the participation of gathering and in addition part of people. Augmentation for GLAD model is d-GLAD model utilised to deal with examining time arrangement. For the sampling of time arrangement variational Bayesian and Monto Carlo inspecting model is utilized. Manufactured datasets and additionally genuine online networking datasets are utilized to assess the execution of GLAD and d-GLAD model. Happy model effectively recognizes the anomalous papers from logical production dataset with included anomalies though, d-GLAD concentrates the official connections changes in the counselling identified with the political events [20].

In [14], OCSMM i.e. one-class bolster measure machine calculation used to identify anomalies in gathering. It handles the total conduct of information focuses. Appropriations of gatherings are spoken to utilizing RKHS through part mean embedding's. Author K. Muandet and B. Scholkopf broadened the connection amongst OCSVM and the KDE to the OCSMM in the connection of variable portion thickness estimation, beating the hole between huge edge approach and bit thickness estimation.

### *D. Ruled Based Anomalous Pattern Discovery*

An rule based anomaly pattern discovery is examined in [25], to identify anomalous patterns as opposed to the pre-characterized anomalies. In this anomalous pattern discovery each pattern is summarised by a run the show. In execution stage it comprises of maybe a couple parts. In this system of ruled based anomalous pattern discovery, lead is essentially set of conceivable esteems which subset of absolute features [19]. This approach required to watchful certain dangers of lead based anomaly pattern detection. Thus there need to discover anomalous patterns instead of detached anomalies. To screen social insurance information to check anomalies ailment episode detection framework is talked about in [15]. In [15] look into paper, gauge technique is supplanted with Bayesian network [25]. Baysian arrange creates gauge circulation by taking the joint dispersion of information. The WSARE calculation can identifies the outbreaks in re-enacted information with before conceivable detection. Recognizing anomaly pattern in Categorical Datasets is spoken to in [16].

### *E. Clustering with MapReduce Strategy*

N.Gosavi,et al. [27], proposed a convention to settle protection of database privacy which is influenced while changing database starting with one then onto the next. Proposed convention is summed up k-mysterious and secret databases. A few procedures have been talked about by them, for example, randomization, and k-secrecy and so on. In randomisation a method for shielding the client from learning delicate information is given. It is straightforward system since it doesn't require to learning of different records. They characterized uses of their proposed work in military application or human services framework. However, there are a few impediments related to this approach is not adequate convention as though a tuple neglects to check, it doesn't embed to the database and hold up until k-1.because of this a lot of long process holding up time likewise gets increment. Some important issues are arranged in their future work, invalid passages database implementation, to enhance effectiveness of convention as far as number of messages traded and so on. Y.Patil, M. B. Vaidya [28], talked about K-Means Clustering Algorithm over an appropriated organizes. They have used guide diminish method for proposed framework execution. Proposed calculation vigorous and effective framework for gathering of information with same qualities yet in addition lessens the usage expenses of preparing such gigantic volumes of information. They anticipated that, for content or web records K-implies grouping utilizing MapReduce is can be more appropriate. Their primary centered is over an appropriated situation utilizing Apache Hadoop. In future work grouping with Hadoop stage is recommended by them.

## IV. PROPOSED SYSTEM

Our anomalous group detection approach comprises of two essential advances more than once connected to the test bunch:

a. Deciding the best current applicant anomalous group;
b. Deciding if this competitor bunch is anomalous.

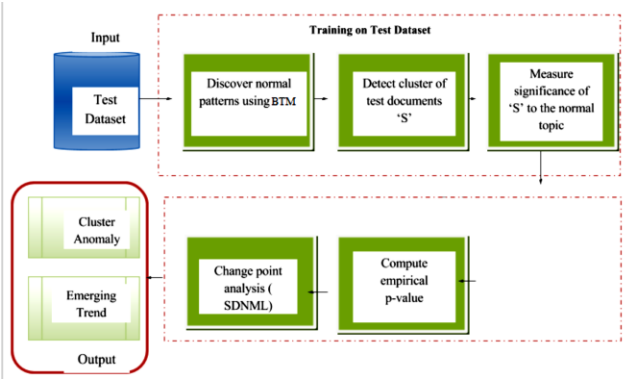



***Figure 2: System Architecture***

We propose factual tests to achieve both these means; i.e., to figure out which tests essentially have a place with the best current group applicant and to test whether the competitor displays a measurably noteworthy level of an ordinariness in respect to the invalid model. We pick BTM over PTM and LDA as the topic show for our ATD calculation in light of the fact that BTM commonly accomplishes preferable speculation precision over LDA and it consequently appraises the quantity of typical topics, dissimilar to LDA, which requires this number to be set by the utilization. In particular, the importance of any anomalous topic will be measured as for the invalid model (typical topics), either under or over fitting the invalid model. This can prompt bogus discovery of anomalous clusters due, separately, to constrained demonstrating power or to poor speculation. The detection stage in which we used report bootstrapping calculation for grouping of hopeful records in the test set. For trial result investigation we will utilized Newsgroup dataset.

## V. CONCLUSIONS

In this audit paper we have talked about some current system utilized for exception detection [23], oddity detection and anomaly detection and so forth. In this study we found that anomalies are the patterns which have anomalous conduct than the standard patterns. Past techniques utilized as a part of anomaly detection have certain confinement as, just individual anomaly can be recognized, some methodologies like, MGMM and FGM can proficiently chips away at high thickness dataset. There are a few methods, for example, GLAD, d-GLAD, OCSMM which finds the conduct of anomalies in gathering. WSARE calculation utilized as a part of run based anomaly pattern discovery. It recognizes the anomaly in clear cut dataset. As indicated by our examination from this writing survey we intend to outline a framework that can productively chips away at genuine datasets which can be fit for distinguishing gathering/bunch of anomalies with low thickness.

## REFERENCES

[1] Hossein Soleimani, and David J. Miller, "ATD: Anomalous Topic Discovery in High Dimensional Discrete Data," IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING 2016.

[2] V. J. Hodge and J. Austin, "A survey of outlier detection methodologies," Artificial Intelligence Review, vol. 22, no. 2, pp. 85–126, 2004.

[3] V. Chandola, A. Banerjee, and V. Kumar, "Anomaly detection: A survey," ACM Computing Surveys (CSUR), vol. 41, no. September, pp.1–58, 2009.

[4] A. Srivastava and A. Kundu, "Credit card fraud detection using hidden Markov model," IEEE Transactions on Dependable and Secure Computing, vol. 5, no. 1, pp. 37–48, 2008.

[5] J. Major and D. Riedinger, "EFD: A Hybrid Knowledge/Statistical-Based System for the Detection of Fraud," Journal of Risk and Insurance, vol. 69, no. 3, pp. 309–324, 2002.

[6] K. Wang and S. Stolfo, "Anomalous payload-based network intrusion detection," in Recent Advances in Intrusion Detection, pp. 203– 222, 2004.

[7] F. Kocak, D. Miller, and G. Kesidis, "Detecting anomalous latent classes in a batch of network traffic flows," in Information Sciences and Systems (CISS), 2014 48th Annual Conference on, pp. 1–6, 2014.

[8] D. M. Blei, A. Y. Ng, and M. I. Jordan, "Latent Dirichlet Allocation," Journal of Machine Learning Research, vol. 3, pp. 993–1022, 2003.

[9] H. Soleimani and D. J. Miller, "Parsimonious Topic Models with Salient Word Discovery," Knowledge and Data Engineering, IEEE Transaction on, vol. 27, pp. 824–837, 2015.

[10] L. Xiong, s. P. Barnaba, J. G. Schneider, A. Connolly, and V. Jake, ´ "Hierarchical probabilistic models for group anomaly detection," in International Conference on Artificial Intelligence and Statistics, pp. 789–797, 2011.

[11] L. Xiong, B. Poczos, and J. Schneider, "Group anomaly detection ´ using flexible genre models," in Advances in neural information processing systems, pp. 1071–1079, 2011.

[12] R. Yu, X. He, and Y. Liu, "GLAD : Group Anomaly Detection in Social Media Analysis," in Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining, pp. 372– 381, 2014.

[13] K. Muandet and B. Scholkopf, "One-class support measure ma- ¨ chines for group anomaly detection," in 29th Conference on Uncertainty in Artificial Intelligence, 2013.

[14] W. Wong, A. Moore, G. Cooper, and M. Wagner, "Rule-based anomaly pattern detection for detecting disease outbreaks," 2002.

[15] W. Wong, A. Moore, G. Cooper, and M. Wagner, "Bayesian network anomaly pattern detection for disease outbreaks," 2003.

[16] K. Das, J. Schneider, and D. B. Neill, "Anomaly pattern detection in categorical datasets," 2008

[17] E. McFowland, S. Speakman, and D. Neill, "Fast generalized subset scan for anomalous pattern detection," Journal of Machine Learning Research, vol. 14, no. 1, pp. 1533–1561, 2013.

[18] J. Allan, R. Papka, and V. Lavrenko, "On-line new event detection and tracking," 1998.

[19] X. Dai, Q. Chen, X. Wang, and J. Xu, "Online topic detection and tracking of financial news based on hierarchical clustering," in Machine Learning and Cybernetics (ICMLC), 2010 International Conference on, pp. 3341–3346, 2010.

[20] Q. He, K. Chang, E.-P. Lim, and A. Banerjee, "Keep it simple with time: A reexamination of probabilistic topic detection models," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 32, no. 10, pp. 1795–1808, 2010.

[21] V. J. Hodge and J. Austin, "A survey of outlier detection methodologies," Artificial Intelligence Review, vol. 22, no. 2, pp. 85– 126, 2004.

[22] B. Efron, "Bootstrap methods: another look at the jackknife," The annals of Statistics, pp. 1–26, 1979.

[23] K. Wang and S. Stolfo, "Anomalous payload-based network intrusion detection," in Recent Advances in Intrusion Detection, pp. 203– 222, 2004.

[24] F. Kocak, D. Miller, and G. Kesidis, "Detecting anomalous latent classes in a batch of network traffic flows," in Information Sciences and Systems (CISS), 2014 48th Annual Conference on, pp. 1–6, 2014.

[25] N.Gosavi, S.H.Patil, "Generalization Based Approach to Confidential Database Updates," in International Journal of Engineering Research and Applications (IJERA), vol.2, Issue 3, pp.1596-1602,May-June 2012.

[26] Y.S.Patil, M.B.Vaidya, "K-means Clustering with MapReduce Technique," in International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), vol.4, Issue 11, November 2015.

# Estimating the Difference of Agriculture Productivity in Asian Regions

[1] Swati Hira, [2] Anita Bai
[1] Department of Computer Science & Engineering, RCOEM, Nagpur, India
[2] Department of Computer Science & Engineering, Visvesvaraya National Institute of Technology, Nagpur, India
[1] hiras@rknec.edu, [2] anita.bai@students.vnit.ac.in

***Abstract*:-- Agriculture is the major sector in the economy of Asia. The aim of this paper is to identify the importance of agriculture in Asia continent. In this paper, we evaluate differences between and within regions of Asia (Eastern-Asia, South-Central Asia, South-East Asia, and Western Asia and Middle Asia) and their countries. We used five agriculture parameters (Agriculture Land, Cereal production, Machinery, Tractors, Cereal yield, Land under cereal production) which widely represent agriculture productivity of Asia. The means of all Asian regions and its countries are identically similar is considered as a hypothesis for agriculture parameters. We use One-way ANOVA (analysis of variance) technique for analysis. Further, Asian regions and countries are estimated to test the differences of the means between and within regions and countries of each Asian region. The results show that each Asian region and their countries are having different agriculture productivity for agriculture parameters.**

**Index Terms: Asia, Agriculture productivity, Economic growth**

## I. INTRODUCTION

ASIA is the Earth's largest continent, located primarily in the eastern and northern hemispheres. Asia covers an area of 44,579,000 square kilometres, about 30% of Earth's total land area and 8.7% of the Earth's total surface area. It is geopolitically and strategically important because of its geographic position1 shown in Fig. 1. Agriculture is one of the most important sources of earning for majority of main-workers living in countries of Asian continent and also contributes in the economy growth in terms of GDP and exports. The agriculture productivity is basically depends on fertile regions. Agriculture growth depends on various parameters such as Agriculture Land [1], Cereal production [2], Machinery-Tractors [3], Cereal yield, and Land under cereal production [4]. Agriculture land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. It includes 48% in Eastern-Asia, 67.6% in South-Central Asia, 56.8% in South-East Asia, and 22.8% in Western and Middle Asia. Machinery-Tractors help to increase food production in agricultural sector which leads to growth in consumption of pesticides, global inorganic fertilizer and animal feedstuffs etc. It also helps to increase cereal yield and its production. Cereal yield measured as kg per hectare of harvested land including wheat, rice, maize, barley, oats, rye, millet etc. Land under cereal production refers to harvested area in region. The temperature variations though periodic nature may vary from region to region and such variations are mainly dependent on location and altitude of the region and also on other factors like the nearness of sea and vegetation. Sometimes the agriculture productivity of different regions are different because of its temperature, air pressure, humidity etc variations. Anita et. al. analyzed such periodic variations using recurrence plot (RP), cross recurrence plot (CRP), recurrence rate (RR), and correlation of probability of recurrence (CPR) methods to find similarities between and within united states climatic regions and to identify their connectivity trend [5]. Information and Communication technology (ICT) is the efficient way to increase the productivity of agriculture. They extract the useful knowledge based content and identifying the patterns in dataset for identifying the important features in agricultural domain. Pallavi et. al. build an information system for improving interaction between farmer and customer to analyze and use of data mining technique specially regression analysis to predict the crop production to have decision making process easier [6]. The other parameters like fertilizer, modern seeds and water are playing a key role in boosting yields. Jonh et. al. presented and test for respective empirical links between agricultural yields and economic growth, labor share in agriculture and non-agricultural value added per worker [7].

The primary goal of this work is to estimate the agriculture productivity in terms of cereal production in Asian regions. From literature [8], [9], [10] we identify parameters which effect the production of agriculture. Since the economy of all region in Asia is different. So we try to find the countries or regions where difference exists between them in terms of agriculture production. We are doing this by identifying gap between and within regions and countries of each Asian region.

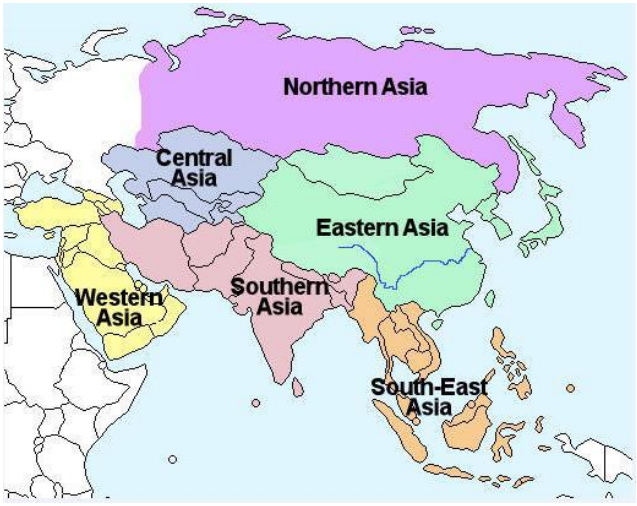



***Fig 1. Asia Regions***

The rest of the paper is organized as follows. Section II introduces details of the used dataset and adopted methods. Section III describes the experiments and results for asian regions. The conclusion and a brief discussion of opportunities for future work are presented in Section IV.

## II. METHODOLOGY: ANOVA AND Z-STATISTICS

### *A. Dataset*

Yearly data on agriculture parameters for 54 years (1960–2014) were collected from the World Bank data2 for Asian regions: Eastern-Asia, South-Central Asia, South-East Asia, and Western Asia and Middle Asia and their countries. The data has been transformed to normalized form. Table I, describes the World Bank data sample dataset use for further processing.

***TABLE I. USED DATASET***

| Agriculture Parameters / Years | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|
| Agriculture Land | 2025 | 2085 | 2116 | 2112 | 1926 |
| Cereal production (metric tons) | 193101196 | 201468404 | 208626900 | 211941400 | 210012500 |
| Machinary -Tractors | 65.5 | 70.1 | 73.7 | 77.6 | 83.8 |
| Cereal yield (kg per hectare) | 1926 | 2025 | 2085 | 2116 | 2112 |
| Land under cereal production | 100243408 | 99499504 | 100066500 | 100184200 | 99450800 |

The variables are: Agriculture Land, Cereal production (metric tons), Machinary, Tractors, Cereal yield (kg per hectare), and Land under cereal production for four Asian regions: Eastern-Asia (5 countries), South-Central Asia (10 countries), South-East Asia (8 countries), and Western Asia and Middle Asia (12 countries) as follows:

***Eastern-Asia:*** China, Japan, Korea, Rep., Korea, Dem. Rep. and Mongolia

***South-Central Asia:*** Afghanistan, Bangladesh, Bhutan, India, Iran, Islamic Rep., Maldives, Nepal, Pakistan, Srilanka.

***South-East Asia:*** Brunei-Darussalam, Combodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Vietnam.

***Western Asia and Middle Asia:*** Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, Yemen.

We selected the One way ANOVA technique to examine the difference between region and countries of each Asian region. For results calculation, we evaluate the mean and variance for agriculture parameter as follows:

Here we are showing the formula for a country with respect to one Asian region.

$p_{mn}$, parameter p in year m for country n; n=1, 2.., N.

$R_i$, $i^{th}$ Asian region.

$S_n$, size of $n^{th}$ country in region $R_i$,

$\bar{p}_n$, sample mean of $n^{th}$ country in region $R_i$,

$\bar{\bar{p}}$, grand mean of parameter for $n^{th}$ country,

N, number of countries in region $R_i$. For example South-Central Asia region N=10.

$S_T = \sum S_n$, Total country size,

$s_n^2$, sample arithmetic variance for country n in region $R_i$,

$\sigma_b^2$, variance between countries in region $R_i$ (e.g. between India and Srilanka countries in South-Central Asia region),

$\sigma_w^2$, variance within country of region $R_i$ (e.g. within India)

Arithmetic mean of parameter p for country n in region $R_i$ is:

$$\bar{p}_n = \sum_m \frac{p_{mn}}{S_n}, \text{ where } \mathbf{m} = 1, , \dots, S_n \quad (1)$$

Arithmetic variance for country n in region $R_i$ is:

$$s_n^2 = \frac{\sum_m (p_{mn} - \bar{p}_n)^2}{(S_n - 1)}, \quad \mathbf{where\ m} = 1, 2, \dots, S_n \quad (2)$$

Grand mean $\bar{\bar{p}}$ is:

$$\bar{\bar{\mathbf{p}}} = \sum_{\mathbf{m}} \sum_{\mathbf{n}} \mathbf{p_{mn}} / \mathbf{S_T} \quad (3)$$

### *B. Calculation of Analysis of variance (ANOVA) [11],[12] :*

Sum of squares (TS) of a parameter p calculated as sum of variation between countries (SB) and within countries (SW).

$$TS = SB + SW \quad (4)$$

Where

 ISBN: 978-81-932966-5-3

$$SB = \sum S_n (\overline{p}_n - \overline{\overline{p}})^2 \quad (5)$$

and

$$SW = \sum_m (S_n - 1) s_n^2 \quad (6)$$

***Evaluation of variance between countries (MSB):***

$$\sigma_b^2 = \frac{\sum S_n (\overline{p}_j - \overline{\overline{p}})^2}{N-1} \quad (7)$$

$$\textbf{or} \qquad MSB = \frac{SB}{N-1} \quad (8)1$$

***Evaluation of variance within country (MSW):***

$$\sigma_w^2 = \sum_n \left(\frac{S_n - 1}{S_T - N}\right) s_n^2 \quad (9)$$

$$\textbf{or} \quad MSW = \frac{SW}{S_T - N} \quad (10)$$

***C. F-test statistics***

To test the similarity in all countries of Region $R_i$ for a parameter p is:

$$F = MSB/MSW \quad (11)$$

MSB and MSW is calculated using Eq. (8) and (10). For significance testing (α=0.05), we compared calculated F value with its $Fcrit$ (α, k-1, ST -k) value.

If the hypothesis of similarity of means is rejected, a question comes that which means are unequal. Various paired comparison is performed to solve this question. This comparison is evaluated using z-test (two tailed significance level) [11] with hypothesis at α=0.05 significance level. Hypothesis indicates that there is no difference between agriculture related parameters of countries of each Asian region Vs. each country of same region.

Hypothesis, $H0$:μ1=μ2, Null Hypothesis, there is no differences exists,

$H1$:μ1≠μ2, Alternative Hypothesis, differences exists.

Z-test Statistics are

$$z = \frac{(\overline{p_a} - \overline{p_n}) - (\mu_1 - \mu_2)_{H_0}}{\sigma_{p_a - p_n}} \quad (12)$$

Where, n=1, 2, …, 10 indicates all countries in South-Central Asia region,

$p_a$, means of all countries in South-Central Asia region,

$\sigma_{p_a - p_n}$, Standard error of the difference between two means, and $\sigma_{p_a - p_n}$ is calculated as,

$$\sigma_{p_a - p_n} = \sqrt{\frac{\sigma_1^2}{S_1} + \frac{\sigma_2^2}{S_2}} \quad (13)$$

Where $\sigma_1$ and $\sigma_2$ are calculated from Eq. (2) and

$\sigma_1^2$ , indicates variance of all countries in South-Central Asia region

$\sigma_2^2$, indicates variance of one country in South-Central Asia region

Fig. 2, describes Two-tailed hypothesis test of the difference between two means at the 0.05 significance level and represents hypothesis test graphically. Region outside the both vertical lines contains 0.025 of the area. The acceptance region range (-1.64 ≤ z ≤+1.64) within vertical lines contains two equal areas of 0.475 each. We determine the critical value of z using standard table [11]. For e.g. we can see that the calculated z value 3.86 lies outside the range i.e. hypothesis is not accepted.

Eq. (5), (6) and (11) are used to evaluate Table II shows the ANOVA results represents SB, SW and TS which indicates their percentage of contribution for each agriculture parameter. The differences between Asian regions and the countries of each Asian region are much smaller than the differences within them.

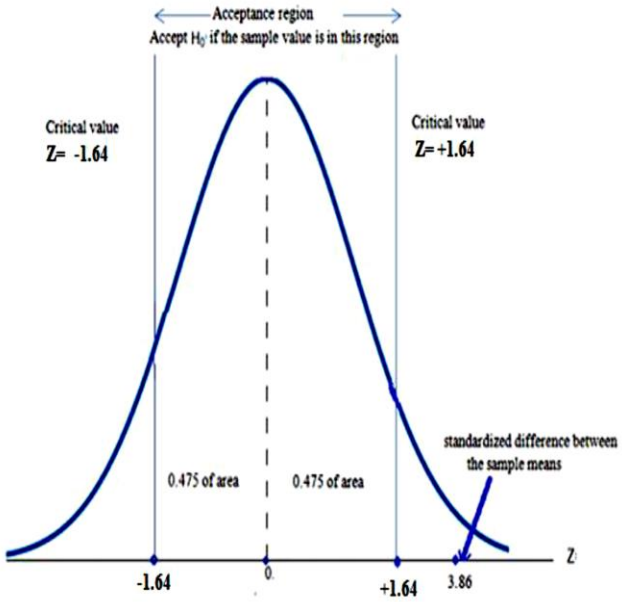



***Fig. 1 Two-tailed hypothesis test***

## III. EXPERIMENTAL EVALUATION

A number of significant experiments were performed to verify the effectiveness and efficiency of the proposed approach. All our experiments were conducted on a Intel(R) Core(TM) i3 CPU@2.10GHz processor with 3 GB of RAM and running on a Windows 7 OS. The algorithm in the experiments were implemented in Java.

***A. Results***

***TABLE II ANOVA RESULTS***

| All Asian regions | | | | | | |
|---|---|---|---|---|---|---|
| Agriculture Parameters | SB | %TS | SW | %TS | F-Statistics | F-critical |

 ISBN: 978-81-932966-5-3

| | | | | | | |
|---|---|---|---|---|---|---|
| Agriculture Land | 931.70 | 78.4 | 256.15 | 21.5 | 250.97 | 1.958 |
| Cereal production | 109.35 | 17.0 | 532.51 | 82.9 | 14.23 | 1.958 |
| Machinary, Tractors | 264.47 | 19.5 | 1090.8 | 80.4 | 16.80 | 1.958 |
| Cereal yield | 131.32 | 14.4 | 779.06 | 85.5 | 11.68 | 1.958 |
| Land under cereal production | 187.10 | 41.7 | 261.19 | 58.2 | 49.66 | 1.958 |
| Eastern-Asia | | | | | | |
| Agriculture Land | 0.472 | 7.37 | 5.924 | 92.5 | 5.178 | 1.958 |
| Cereal production | 0.731 | 4.29 | 16.288 | 95.6 | 2.919 | 1.958 |
| Machinary, Tractors | 5.143 | 15.0 | 28.953 | 84.9 | 11.54 | 1.958 |
| Cereal yield | 1.421 | 7.70 | 17.029 | 92.2 | 5.426 | 1.958 |
| Land under cereal production | 4.494 | 18.2 | 20.102 | 81.7 | 14.532 | 1.958 |
| South-East Asia | | | | | | |
| Agriculture Land | 2.731 | 16.5 | 13.789 | 83.4 | 11.77 | 1.958 |
| Cereal production | 2.052 | 5.91 | 32.639 | 94.0 | 3.737 | 1.958 |
| Machinary, Tractors | 5.637 | 13.9 | 34.741 | 86.0 | 9.644 | 1.958 |
| Cereal yield | 0.775 | 2.18 | 34.664 | 97.8 | 1.328 | 1.958 |
| Land under cereal production | 3.766 | 10.2 | 33.056 | 89.7 | 6.771 | 1.958 |
| South Central Asia | | | | | | |
| Agriculture Land | 6.0711 | 38.4 | 9.7202 | 61.6 | 36.53 | 1.958 |
| Cereal production | 6.1854 | 15.5 | 33.699 | 84.4 | 10.73 | 1.958 |
| Machinary, Tractors | 7.2879 | 14.2 | 43.709 | 85.7 | 9.753 | 1.958 |
| Cereal yield | 1.1886 | 3.29 | 34.827 | 96.7 | 1.896 | 1.958 |
| Land under cereal production | 11.594 | 28.0 | 29.801 | 71.9 | 22.76 | 1.958 |
| Western Asia and Middle Asia | | | | | | |
| Agriculture Land | 9.905 | 37.6 | 16.379 | 62.3 | 34.304 | 1.958 |
| Cereal production | 11.552 | 20.9 | 43.557 | 79.0 | 15.044 | 1.958 |
| Machinary, Tractors | 4.704 | 6.30 | 69.884 | 93.6 | 3.818 | 1.958 |
| Cereal yield | 11.576 | 21.9 | 41.207 | 78.0 | 15.936 | 1.958 |
| Land under cereal production | 9.282 | 17.5 | 43.612 | 82.4 | 12.074 | 1.958 |

Table II showing the ANOVA results. We observed from results that when examining Cereal yield in Asian regions, where only 14.42 % of the difference is described by group of Asian region and 85.57 % of the differences present within them. Agriculture Land shows maximum 78% (approx.) difference between Asian regions. Similarly for South Central Asia region we observed that Cereal yield, where only 3.29 % of the difference is described by group of South Central Asia region countries and 96.7 % of the differences present within the country. Agriculture Land shows maximum 38% (approx.) difference between countries. The indication is that large differences exist between regions and countries for various parameters which can explain region and country's level agriculture productivity.

F-statistic is evaluated using Eq. (11), we notice that the F-test statistic value exceeds the significance level of $Fcrit$ (0.05) except Cereal yield parameter.

The results describes in Table III and Table IV calculated using Eq. (12), represent the results of testing for differences between Asian regions Vs each Asia region and countries of South Central Asia region Vs a country in a region for the five agriculture parameters. Each region and country is significantly different from the group of all regions and countries.

***TABLE III***
***ASIAN REGIONS: VARIOUS PAIRED COMPARISONS***

| Paired Comparison | Z- test Stastics | Decision |
|---|---|---|
| Agriculture Land | | |
| All Asian Region vs Western Asia and Middle Asia | 29.21947 | Hypothesis rejected |
| All Asian Region vs South-East Asia | 37.09627 | Hypothesis rejected |
| All Asian Region vs South Central Asia | 33.72663 | Hypothesis rejected |
| All Asian Region vs Eastern-Asia | 40.79021 | Hypothesis rejected |
| Cereal production (metric tons) | | |
| All Asian Region vs Western Asia and Middle Asia | 11.13432 | Hypothesis rejected |
| All Asian Region vs South-East Asia | 12.60577 | Hypothesis rejected |

 ISBN: 978-81-932966-5-3

| | | |
|---|---|---|
| All Asian Region vs South Central Asia | 11.91972 | Hypothesis rejected |
| All Asian Region vs Eastern-Asia | 14.44158899 | Hypothesis rejected |
| Machinary, Tractors | | |
| All Asian Region vs Western Asia and Middle Asia | 4.824517 | Hypothesis rejected |
| All Asian Region vs South-East Asia | 7.312798 | Hypothesis rejected |
| All Asian Region vs South Central Asia | 7.170274 | Hypothesis rejected |
| All Asian Region vs Eastern-Asia | 7.776551 | Hypothesis rejected |
| Cereal yield (kg per hectare) | | |
| All Asian Region vs Western Asia and Middle Asia | 8.734273 | Hypothesis rejected |
| All Asian Region vs South-East Asia | 10.0721 | Hypothesis rejected |
| All Asian Region vs South Central Asia | 9.931016 | Hypothesis rejected |
| All Asian Region vs Eastern-Asia | 11.31569249 | Hypothesis rejected |
| Land under cereal production | | |
| All Asian Region vs Western Asia and Middle Asia | 39.27122 | Hypothesis rejected |
| All Asian Region vs South-East Asia | 38.08465 | Hypothesis rejected |
| All Asian Region vs South Central Asia | 37.85059 | Hypothesis rejected |
| All Asian Region vs Eastern-Asia | 45.21334 | Hypothesis rejected |

***TABLE IV***
***SOUTH CENTRAL ASIA (SCA) REGION: VARIOUS PAIRED COMPARISONS***

| Paired Comparison | Z- test Stastics | Decision |
|---|---|---|
| Agriculture Land | | |
| All SCA Countries vs Afganistan | 4.243096 | Hypothesis rejected |
| All SCA Countries vs bangladesh | 1.610639 | Hypothesis accepted |
| All SCA Countries vs Bhutan | -0.97731 | Hypothesis accepted |
| All SCA Countries vs India | 3.98043 | Hypothesis rejected |
| All SCA Countries vs Iran Islam | 1.061054 | Hypothesis accepted |
| All SCA Countries vs Maldives | -9.5113 | Hypothesis rejected |
| All SCA Countries vs Nepal | 2.266788 | Hypothesis rejected |
| All SCA Countries vs Pakistan | 1.955308 | Hypothesis rejected |
| All SCA Countries vs Shrilanka | -0.69711 | Hypothesis accepted |
| Cereal production (metric tons) | | |
| All SCA Countries vs Afganistan | 1.138667 | Hypothesis accepted |
| All SCA Countries vs bangladesh | -0.51677 | Hypothesis accepted |
| All SCA Countries vs Bhutan | 2.388541 | Hypothesis rejected |
| All SCA Countries vs India | 1.478581 | Hypothesis accepted |
| All SCA Countries vs Iran Islam | 0.991198 | Hypothesis accepted |
| All SCA Countries vs Maldives | -8.21656 | Hypothesis rejected |
| All SCA Countries vs Nepal | -0.86693 | Hypothesis accepted |
| All SCA Countries vs Pakistan | 1.161414 | Hypothesis accepted |
| All SCA Countries vs Shrilanka | 0.369551 | Hypothesis accepted |
| Machinary, Tractors | | |
| All SCA Countries vs Afganistan | 2.227697 | Hypothesis rejected |
| All SCA Countries vs bangladesh | 3.813452 | Hypothesis rejected |
| All SCA Countries vs Bhutan | -1.23192 | Hypothesis accepted |
| All SCA Countries vs India | -0.59357 | Hypothesis accepted |
| All SCA Countries vs Iran Islam | 0.844348 | Hypothesis accepted |
| All SCA Countries vs Maldives | -10.0161 | Hypothesis rejected |
| All SCA Countries | -2.30007 | Hypothesis rejected |
| vs Nepal | | |
| All SCA Countries vs Pakistan | 0.817903 | Hypothesis accepted |
| All SCA Countries vs Shrilanka | 0.499199 | Hypothesis accepted |
| Cereal yield (kg per hectare) | | |
| All SCA Countries vs Afganistan | 1.026758 | Hypothesis accepted |
| All SCA Countries vs bangladesh | -0.30483 | Hypothesis accepted |
| All SCA Countries vs Bhutan | -1.4291 | Hypothesis accepted |

 ISBN: 978-81-932966-5-3

| | | |
|---|---|---|
| All SCA Countries vs India | 0.797611 | Hypothesis accepted |
| All SCA Countries vs Iran Islam | 0.184585 | Hypothesis accepted |
| All SCA Countries vs Maldives | -1.63341 | Hypothesis accepted |
| All SCA Countries vs Nepal | 0.479595 | Hypothesis accepted |
| All SCA Countries vs Pakistan | 1.363809 | Hypothesis accepted |
| All SCA Countries vs Shrilanka | -0.47498 | Hypothesis accepted |
| Land under cereal production | | |
| All SCA Countries vs Afganistan | -1.06203 | Hypothesis accepted |
| All SCA Countries vs bangladesh | 1.460219 | Hypothesis accepted |
| All SCA Countries vs Bhutan | 1.139559 | Hypothesis accepted |
| All SCA Countries vs India | 1.419649 | Hypothesis accepted |
| All SCA Countries vs Iran Islam | 3.948601 | Hypothesis rejected |
| All SCA Countries vs Maldives | -15.1088 | Hypothesis rejected |
| All SCA Countries vs Nepal | 1.050159 | Hypothesis accepted |
| All SCA Countries vs Pakistan | 1.841721 | Hypothesis rejected |
| All SCA Countries vs Shrilanka | 0.420295 | Hypothesis accepted |

From Table IV, we observed that Cereal yield is the only parameter where we did not get any exception. For Cereal production parameter we got exception in two countries as Bhutan and Maldives. Similarly we got the exceptions for other agriculture parameters in countries. This provides strong conclusion for each region and country uniqueness in five agriculture parameters. Table V describes the various paired comparison for Eastern Asia and similarly determine the Z-test for South East Asia and Western Asia and Middle East regions.

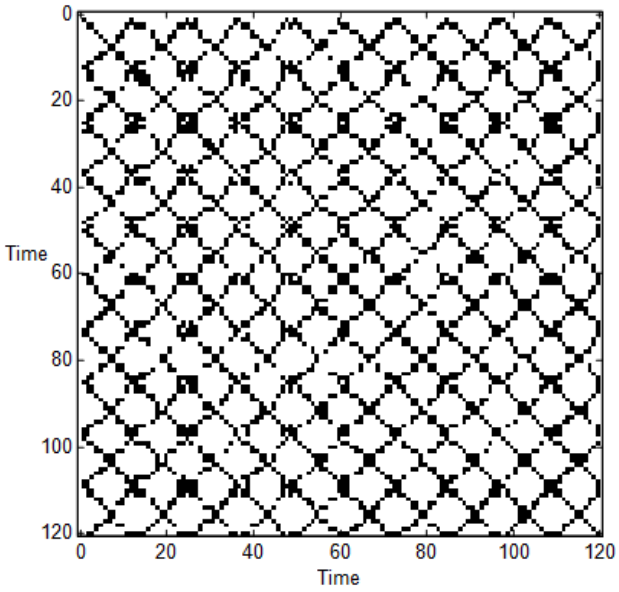
***TABLE V***
***EASTERN ASIA (EA) REGION: VARIOUS PAIRED COMPARISONS***

| Paired Comparison | Z- test Stastics | Decision |
|---|---|---|
| Agriculture Land | | |
| All Eastern Asian Countries vs Mangolia | 1.887144 | Hypothesis rejected |
| All Eastern Asian Countries vs Korea Dm | 10.11009 | Hypothesis rejected |
| All Eastern Asian Countries vs Korea Rep | 1.421297 | Hypothesis accepted |
| All Eastern Asian Countries vs Japan | -4.5138 | Hypothesis rejected |
| All Eastern Asian Countries vs China | -1.0378 | Hypothesis accepted |
| Cereal production (metric tons) | | |
| All Eastern Asian Countries vs Mangolia | -0.43037 | Hypothesis accepted |
| All Eastern Asian Countries vs Korea Dm | -1.40041 | Hypothesis accepted |
| All Eastern Asian Countries vs Korea Rep | -0.23692 | Hypothesis accepted |
| All Eastern Asian Countries vs Japan | 0.270288 | Hypothesis accepted |
| All Eastern Asian Countries vs China | 2.325762 | Hypothesis rejected |
| Machinary, Tractors | | |
| All Eastern Asian Countries vs Mangolia | 2.707213 | Hypothesis rejected |
| All Eastern Asian Countries vs Korea Dm | -2.75683 | Hypothesis rejected |
| All Eastern Asian Countries vs Korea Rep | -3.86944 | Hypothesis rejected |
| All Eastern Asian Countries vs Japan | 1.39006 | Hypothesis accepted |
| All Eastern Asian Countries vs China | 1.296821 | Hypothesis accepted |
| Cereal yield (kg per hectare) | | |
| All Eastern Asian Countries vs Mangolia | -0.0765 | Hypothesis accepted |
| All Eastern Asian Countries vs Korea Dm | -3.05113 | Hypothesis rejected |
| All Eastern Asian Countries vs Korea Rep | 1.909156 | Hypothesis rejected |
| All Eastern Asian Countries vs Japan | -0.72685 | Hypothesis accepted |
| All Eastern Asian Countries vs China | 1.222868 | Hypothesis accepted |
| Land under cereal production | | |
| All Eastern Asian Countries vs Mangolia | 0.279463 | Hypothesis accepted |
| All Eastern Asian Countries vs Korea Dm | 2.20095 | Hypothesis rejected |
| All Eastern Asian Countries vs Korea Rep | -0.40873 | Hypothesis accepted |
| All Eastern Asian Countries vs Japan | -4.43796 | Hypothesis rejected |
| All Eastern Asian Countries vs China | 3.522413 | Hypothesis rejected |

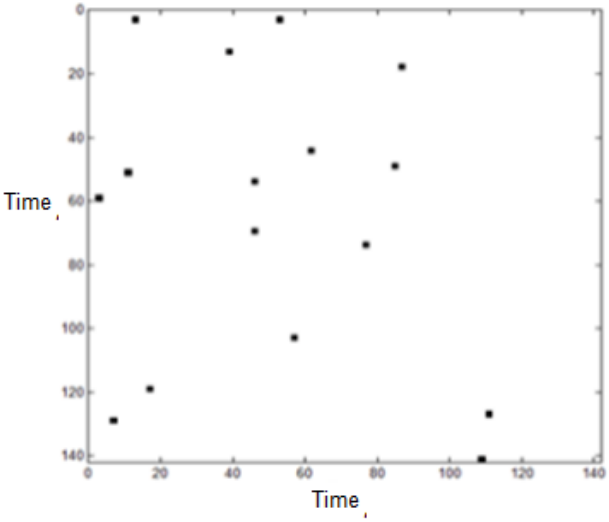
***B. Correctness of proposed method***

To validate the effectiveness and reliability of our approach we are using recurrence quantification analysis (recurrence plot, cross recurrence plots) [5] and association rules methods [13]. The recurrence plot and cross recurrence plots are shown in Fig. 3. From Fig. 3(a) we can see that RP of South-East Asia region have similar periodic variations which indicate that the occurrence of recurrent points along the main diagonal for each region is same. It means the temperature of one region follows some periodic variation which is different from another region. From Fig. 1 we can see that Central asian and South-East Asia regions are situated diagonally, so very less similarity will appear in their temperature. In other words, in the case of

Central asian and South-East Asia regions sun rays have the direct impact on Central asian and less on South-East Asia regions, so there temperature differs which is shown by less correlated number of points in CRP, Fig. 3(b).
It indicates the weak similarity between Central Asian and South-East Asia regions. We know that the agriculture productivity is directly depends on the temperature of regions. So if climate temperature is differ in regions, agriculture productivity also found to be dissimilar in different regions as shown in Fig. 3.




*(a) Recurrence Plots for South-East Asia*




*(b) Cross Recurrence Plots for Central and South-East Asia*

***Fig. 3 Recurrence plots and Cross recurrence plots***

***TABLE VI***
***ASSOCIATION RULES ON CORRELATED PARAMETERS***

| Asian Regions | Rules | Support | Strength |
|---|---|---|---|
| Eastern-Asia | (AGL, D, 4%, 3) ⇒ (CP, 1%) | 73 | 126.29 |
| | (LUCP, D, 1.2%, 1) ⇒(CP, 3%) | 71 | 122.83 |
| | (CY, D, 1%, 2) ⇒(CP, 3%) | 68 | 117.64 |
| | (MT, D, 3%, 2) ⇒(CP, 1%) | 70 | 121.01 |
| South-Central Asia | (AGL, D, 4.5%, 3) ⇒(CP, 2.5%) | 72 | 128.02 |
| | (LUCP, D, 0.8%, 1) ⇒ (CP, 2%) | 73 | 129.75 |
| | (CY, D, 5%, 2) ⇒(CP, 2.5%) | 72 | 124.5 |
| | (MT, D, 3%, 2) ⇒(CP, 2%) | 76 | 131.48 |
| South-East Asia | (AGL, D, 4.5%, 3) ⇒ (CP, 2%) | 73 | 126.29 |
| | (LUCP, D, 1%, 1) ⇒(CP, 2.8%) | 74 | 128.02 |
| | (CY, D, 1.2%, 2) ⇒(CP, 2.4%) | 70 | 121.1 |
| | (MT, D, 2%, 2) ⇒(CP, 0.8%) | 69 | 119.31 |
| Western Asia and Middle Asia | (AGL, D, 4%, 3) ⇒ (CP, 0.8%) | 70 | 121.1 |
| | (LUCP, D, 1.5%, 1)⇒(CP, 3.5%) | 68 | 117.64 |
| | (CY, D, 1.5%, 2) ⇒ (CP, 2.8%) | 67 | 115.91 |
| | (MT, D, 3%, 2) ⇒(CP, 5%) | 71 | 122.83 |

Where, AGL: Agriculture Land, LUCP: Land under cereal production, CP: Cereal production, MT: Machinary-Tractors, CY: Cereal yield, D: Direct relationship.
In Table VI causal relationship between parameters is described with its support, strength and rate of change for generated rules. For example, a rule (AGL, D, 4%, 3) ⇒ (CP, 1%), indicates direct relationship, i.e. increase in agriculture land by 4%, will increase the crop production index by 1 % after 3 years. From Table VI we can observe that the different regions having different support, strength and rate of change for similar rules because of various economic conditions which affects the agriculture productivity of asian regions.

## IV. CONCLUSION

The result of our analysis indicates that significant gap exists between and within Asian regions as well as their countries. Regardless of serving as an active body (Asian-continent) in world, there exist economic differences between regions and its countries. We used ANOVA and z test to perform necessary evaluations on 54 years time series data. Our main contribution is to test the differences among Asian regions (Eastern-Asia (5 countries), South-Central Asia (10 countries), South-East Asia (8 countries), and Western Asia and Middle Asia (12 countries)) and their counties using five parameters (Agriculture Land, Cereal production, Machinery, Tractors, Cereal yield, Land under cereal production). From our analysis we notice that only cereal yield followed the hypothesis, i.e. there exists similarity between countries of south central Asian region for cereal yield and also identified that other agriculture parameters were not having the similar characteristic. We show that each region and its countries follows unique

characteristic for agriculture parameters. Our finding helps to analyse differences exist between region and countries for various parameters which can explain region and country's level agriculture productivity. It also helps to reduce poverty, increase foreign exchange and balance economic growth between Agriculture and Industry.

## REFERENCES

[1] A. Hamidov, K. Helming, and D. Balla, "Impact of agricultural land use in Central Asia: a review". Agronomy for Sustainable Development, vol. 36, no.1, 2016, 1-23.

[2] U. Sultangazin, N. Muratova, A. Terekliov and P. Doraiswamy, "Monitoring of crop rotation and weed infestation estimation using MODIS". IEEE International Proceedings Geoscience and Remote Sensing Symposium, ,vol. 6, 2004, pp. 4066-4069.

[3] A. Rehman, L. Jingdong, R. Khatoon, and I. Hussain. "Modern Agricultural Technology Adoption its Importance, Role and Usage for the Improvement of Agriculture", American-Eurasian J. Agric. & Enviroment. Sci, vol. 16, no. 2, pp. 284-288. 2016.

[4] A. Bai, S. Hira and P. S. Deshpande, Economic evaluation of world cities based on factor analysis, International Journal Of Advanced And Applied Sciences, vol. 3, no. 4, pp.1-6, 2016.

[5] A. Bai, S. Hira, and P. S. Deshpande, "Recurrence Based Similarity Identification of Climate Data." Discrete Dynamics in Nature and Society 2017, 2017.

[6] P. V. Jirapure1 , P. Deshkar, "Regression method and cloud computing technology in the field of agriculture", International journal of innovative research in computer and communication engineering, vol. 4, no. 4, 2016.

[7] J. W. McArthur, and G.C. McCord, "Fertilizing growth: Agricultural inputs and their effects in economic development", Journal of Development Economics, 127, pp.133-152, 2017.

[8] A. D. Jones and G. Ejeta, "A new global agenda for nutrition and health: the importance of agriculture and food systems", Bulletin of the World Health Organization, vol. 94, no. 3,pp. 228, 2016.

[9] E. Nkonya, A. Mirzabaev and J. Braun, "Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development", Springer Open, 2016.

[10] D. C. Godoy and J. Dewbre, "Economic importance of agriculture for sustainable development and poverty reduction: the case study of vietnam", global forum on agriculture, policies for agriculture development, poverty reduction and food security, 2010.

[11] R. I. Levin and D. S. Rubin, Statistics for Management. Pearson Prentice Hall, University of North Carolona, 2006.

[12] G. Rupert and J. R. Miller, "Beyond ANOVA: Basics of Applied Statistics", Chapman & Hall/CRC Texts in Statistical Science, 1997.

[13] S. Hira and P. S. Deshpande, Mining precise cause and effect rules in large time series data of socio-economic indicators. SpringerPlus, vol. 5, no. 1, pp.1625, 2016.

# Satellite Constellation Design through Exhaustive Search

[1] Parthiban P, [2] Deva Arul Daniel
[1][2] Scientist/Engineer, ISRO Satellite Centre, Bangalore
[1] parthi@isac.gov.in, [2] dadaniel@isac.gov.in

*Abstract*:-- **A new Satellite Constellation has been designed for advanced remote sensing applications keeping frequent revisit periods and higher resolution images as primary requirements. The designed satellite constellation is obtained through a structured exhaustive search method to minimize the number of satellites and the revisit time gap. After the exhaustive search, a 563.6 km altitude sun-synchronous dawn-dusk orbit has been identified as an optimum orbit for the satellite constellation. The satellite constellation consists of 5 planes with 6 satellites in each plane. There are totally 30 satellites in the constellation with Synthetic Aperture Radar (SAR) as the primary payload. The satellite constellation can give meter to sub-meter resolution images of any spot on earth for every 192 minutes with +/- 230 to 530 roll tilt. Also, the obtained satellite constellation can cover the entire globe systematically within 4 days with 10% image overlap.**

**Index Terms: Satellite Constellation, Exhaustive search, Systematic global coverage, spot coverage, microwave satellite Constellation**

## 1. INTRODUCTION

The paper illustrates satellite constellation design by an exhaustive search approach for advanced remote sensing applications. Though the advancements in the field of remote sensing are exponential, the cost spent to capture images using satellites are still higher. This is due to the launch and making costs of the satellites; therefore, optimizing the satellite constellation to minimize the number of satellites is important. Efficient operation of satellites not only relies on the satellite payload characteristics and also depends on the satellite's orbital parameters. Hence, finding an optimum orbit for particular space systems/satellites is an important aspect for any space mission. Even for a single remote sensing satellite the cost spent for quality images is enormous; therefore, an extensive study must be carried out for a satellite constellation (series of satellites). An optimum satellite constellation should have the minimum number of satellites and lesser revisit time gap (frequent revisits) without compromising the performance of the satellite.

The objective of this study is to design an optimum satellite constellation. This satellite constellation should capture meter to sub-meter resolution images of the entire globe with minimum number of satellites with and without the usage of roll tilt. The problem has been approached with certain assumptions and constraints. Those constraints and assumptions are explained in Section 2. The design procedures are detailed in Section 3. Section 4 explains the results in detail with necessary data and images. Finally, Section 5 concludes the importance of such constellation design studies along with the future prospects.

## 2. REQUIREMENTS, ASSUMPTIONS, AND CONSTRAINTS

### *2.1 Requirements*

• Global coverage with roll tilt for every 3 to 6 hours (spot coverage)
• Systematic Global coverage with minimum time period
• Image resolution: meter to sub-meter
• Day & night imaging
• Any weather imaging

### *2.2 Assumptions and Constraints*

• From the requirements, it is observed that the payload should capture images in both day & night and in all weather conditions. Based on these requirements Synthetic Aperture Radar (SAR) payload (Misra et al. 2013) has been fixed as the primary payload for all the satellites. The Swath of the satellite payload is fixed to 25 km (Misra et al. 2013). SAR payloads do not require a light source to capture images and it operates on the principle of RADAR. Because of that, SAR payloads can capture images during both ascending and descending passes.

• The existing SAR payload satellites in ISRO are RISAT-1 and RISAT-2. It is found that RISAT-1 and RISAT-2 (Misra et al. 2013 & http:// www. nrsc. gov. in/Earth_Observation_Missions?q=RISAT-2) are having the SAR payload with 1m resolution at an altitude of 536 km. Therefore, the maximum altitude of the constellation search has been limited to 600 km. The maximum altitude is limited by the currently available payload range.

• Active usage of SAR payloads demands higher power generation. To meet the power requirements the design search has been limited to circular sun-synchronous dawn-dusk (local time either 6 A.M or 6 P.M) orbits (Misra et al. 2006)

• Effective operation of SAR payloads requires non-nadir or non-zero roll tilt positions to enable Doppler measurements (Misra et al. 2006). From the SAR payload capacities of Indian Remote Sensing Satellites, the payload roll tilt angles are fixed to +/- 230 to 530

## 3. DESIGN PROCEDURE

The satellite constellation design problem has been modified as an optimization problem to meet the requirements. The optimization problem as follows:

| | |
|---|---|
| Minimize: | Number of satellites (n) |
| Minimize: | Revisit time gap (t) |
| Variable bounds: | 230 < Roll tilt (r) < 530 (or) |
| | -530 < r < -230, |
| | 100 km < Altitude (h) < 600 km |
| Constraints: | Circular Sun-Synchronous Orbits |
| | (Dawn-dusk) |
| | Systematic global coverage |
| | Any spot coverage |

The above problem has been solved using a structured exhaustive search. The following steps are involved in the design of the required satellite constellation.

1. Select an Altitude: For a circular orbit, the semi-major axis (a) is the sum of altitude and Earth's radius (R = 6378.138 km); therefore, for a given altitude the semi-major axis is known
2. For this semi-major axis, satisfy the sun-synchronous condition (Larson and James Richard Wertz 1992, p.144, 180-184, Chobotov 2002, p.218, 250-254) and obtain the inclination. For a particular semi-major axis, there will be a unique inclination that gives the orbit the sun-synchronous property. Thus, for the given semi-major axis the inclination is obtained (i)
3. Assuming circular orbit, the eccentricity is known (e = 0 for circular orbits). Actually, e=0 is practically not feasible; hence, eccentricity is considered as 0.001 for more realistic results. The Right ascension of ascending node (RAAN) and the mean anomaly has been initialized as zero for the first satellites in each plane. The phasing between the satellites in each orbital planes (in-plane phasing through mean anomaly) and the phasing between each orbital planes in the constellation (out of plane phasing through RAAN) are calculated after the computation of the number of satellites required (step 7)
4. Argument of perigee has been fixed to 900 for all the satellites to tackle the altitude variation during imaging. Circular orbits are not possible (step 3); consequently, the designed orbit will be an elliptical one. Hence, fixing the argument of perigee to 900 will help to ignore the altitude variations during image processing
5. The number of satellites in a plane is calculated based on the area covered by the satellites with its maximum roll tilt capacity. The considered SAR payload has the tilt capacity of +/- 230 to 530. This indicates that the payload can cover from +230 to +530 and from -230 to -530. Fig. 2 explains the roll tilt viewing points from the satellite frame of reference during a descending pass. In Fig. 2 it is observed that for a sun-synchronous dawn-dusk orbit the nadir or zero-roll tilt viewing trace is nothing but the satellite ground trace (positive X axis towards the Earth's center in the satellite reference frame, ref Fig. 1). In the Fig. 2 the positive and negative roll tilt coverage is also illustrated. In this paper, the constellation design procedures are carried out by considering the roll tilt from -230 to -530.
6. The path pattern of the orbit is computed using Earth's rotation and the orbital period of the chosen orbit. For example, let us assume a 96-minute orbital time period orbit. If the orbit's first path intersects the equator at 00 longitude, then the next orbital path will intersect the equator approximately at 240W longitude. This is due to the Earth's rotation. Similarly, the entire path pattern of the corresponding orbit is analytically calculated
7. From steps 5 and 6, single satellite coverage with roll tilt is computed. Based on the coverage information, the number of satellites required in a single plane is calculated. The optimum number of satellites per plane is actually restricted by the roll tilt capacity of the satellite's payload. For example, for a 600 km orbit, 300 roll tilt coverage (-230 to -530) will be around 346 km, i.e. the satellite will have the capacity to cover 346 km by changing its viewing direction (roll tilt). The Earth's greater circle is the equator, each orbit will cross the equator twice (SAR payloads can image during both ascending and descending) in a single orbit, therefore the satellite can cover up to 692 km (346 km × 2). From step 6 it is understood that the gap between first and second orbit is 240 longitude or roughly 2681 km. Having 6 satellites in a plane will divide this gap equally. The gap between the first and the next satellite in a single plane will be 382 km. This 382 km difference can be covered using the 300 roll tilt along with the payload swath of the two satellites. If a 600 km altitude orbit is chosen, then more than 6 satellites per plane will not increase the coverage; rather it will decrease the roll tilt from 300 to lesser angles. Decreasing the roll tilt angles in a macro-scale is not beneficial for a SAR payload (it might be useful in case of optical payloads as the increase in roll tilt angles decreases the resolution). From the above information, total number satellites in a plane and total number of planes required in the constellation are computed. Computation of total number of planes is derived from the revisit time period. In this design procedure, the revisit time is taken between 3-6 hours

(approximately 2 to 4 orbit period for less than 600 km altitude orbits)

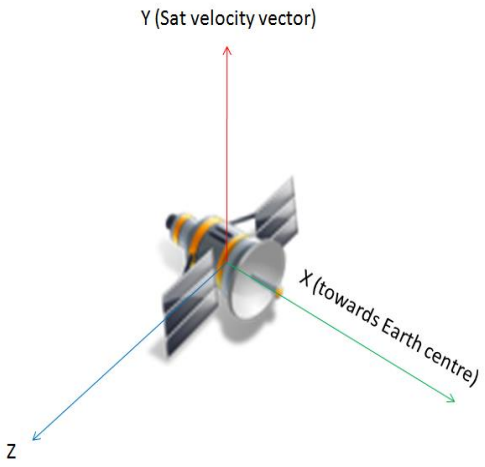



*Fig. 1.Satellite Reference frame*

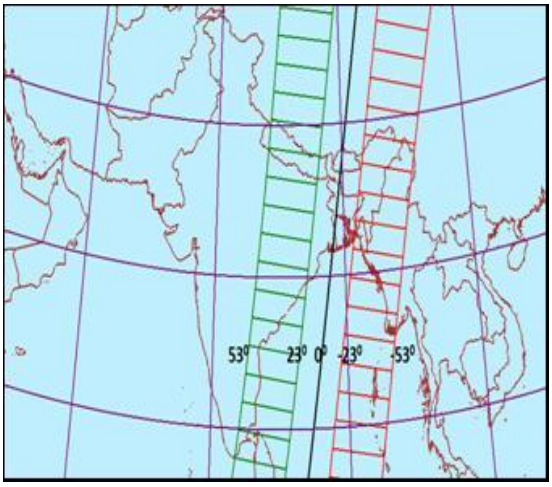



***Fig. 2.Satellite ground trace and maximum roll tilt area coverage during a descending pass***

8. The above steps are continued till the search reaches the maximum altitude. Another important aspect of this satellite constellation design is the systematic global coverage. The roll tilt capacities are useful during spot coverage. For normal satellite operations, the satellite should cover the globe without providing any roll tilt with path to path overlap. Usually, 10% overlap between paths is expected for image processing. Hence, the systematic coverage along with the overlap percentage is calculated from the path pattern (step 6). The results are analyzed based on the revisit time and number of satellites to find the optimum satellite constellation.

Fig. 3 illustrates the above design procedures through a flowchart. The flowchart systematically describes the search algorithm followed in this paper to obtain the required satellite constellation.

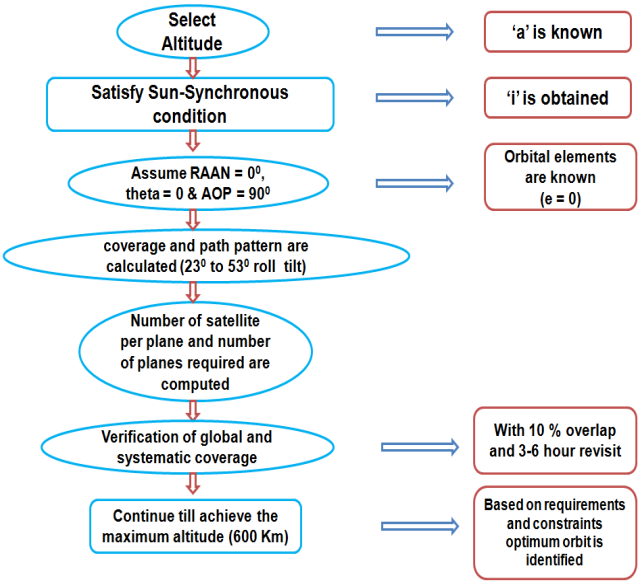



***Fig. 3. Structured satellite constellation design procedure***

## 4. RESULTS AND DISCUSSION

From the exhaustive search, the following sun-synchronous dawn-dusk orbit has been found to be optimum. The orbital parameters of the obtained orbit are given below:

| | |
|---|---|
| Altitude: | 563.597 km |
| Inclination: | 97.659 deg |
| Number of Orbits: | 1784 |
| Number of days: | 119 |
| Period: | 96.054 minutes |
| Overlap: | 10.15 % |
| Path to Path distance: | 22.464 km |
| Inner cycle: | 1 day |
| Q factor: | 14 (118/119) |

A satellite placed in the above orbit can cover the entire globe in 1784 orbits in 119 days (14 (118/119) orbits per day). The path to path difference for the obtained orbit is 22.464 km (this has been identified from step 6 in Section 3); therefore, this particular orbit will have 10% overlap during the systematic coverage (swath = 25 km).

The inner cycle defines when the next adjacent path lies in the orbital cycle. Here, 1784 orbits in 119 days is the orbital cycle. After 119 days the path pattern starts from the beginning, i.e. the 1785th orbit will fall on the 1st orbit's path; the 1786th orbit will fall on the 2nd orbit's path and so on. In the obtained orbit, the inner cycle is 1 day which indicates the next adjacent path will fall on the next day itself. Inner cycles are fixed for the given orbital parameters and cannot be altered.

From the orbital parameters, the satellite constellation requires 30 satellites with -230 to -530 (or +230 to +530) roll tilt to cover the entire Earth within 192 minutes. This satellite constellation can give any location in the globe with meter to sub-meter resolution images for every 192 minutes (two orbital periods). The constellation has 5 orbital planes with 450 RAAN difference between the planes and each plane will have 6 satellites with 600 mean anomaly phasing (equal phasing). The results are tabulated below.

In addition to that, the designed satellite constellation can cover the entire globe systematically with 10% overlap in just 4 days, i.e. without providing any roll tilt; this satellite constellation can capture the entire Earth's surface with meter to sub-meter resolution for every four days. The satellites position, phasing of each satellite in a single orbital plane, phasing of each orbital plane in the constellation are explained in Tables-1 & 2. The obtained orbit is found to be optimum for both spot coverage and for systematic global coverage.

Fig. 4 graphically describes the phasing between the satellites in a single orbital plane. Fig. 5 is a graphical illustration of the designed satellite constellation's orbital planes. This image depicts the inertial view of the orbital planes in outer space. Fig. 6 gives the coverage capacity of the satellite constellation with the maximum roll tilt (-230 to -530 roll tilt) for a period of 192 minutes.

***Table-1: Satellites phasing (in-plane) in each plane***

| Satellite No. | Mean anomaly Phasing (deg) |
|---|---|
| SARSAT-1 | 360.0 |
| SARSAT-2 | 60.0 |
| SARSAT-3 | 120.0 |
| SARSAT-4 | 180.0 |
| SARSAT-5 | 240.0 |
| SARSAT-6 | 300.0 |

***Table-2: Satellites plane phasing (out of plane) in the constellation***

| Plane No. | RAAN (deg) |
|---|---|
| Plane-1 | 360.0 |
| Plane-2 | 315.0 |
| Plane-3 | 270.0 |
| Plane-4 | 225.0 |
| Plane-5 | 180.0 |

## 5. CONCLUSION

From the exhaustive search, an optimum satellite constellation is designed using minimum number of satellites and frequent revisit time period. The satellite constellation requires just 30 SAR payload satellites (SARSAT) to capture entire Earth's surface with meter to sub-meter resolution. The satellite constellation systematically covers the Earth in just four days and can capture any place on Earth's surface for

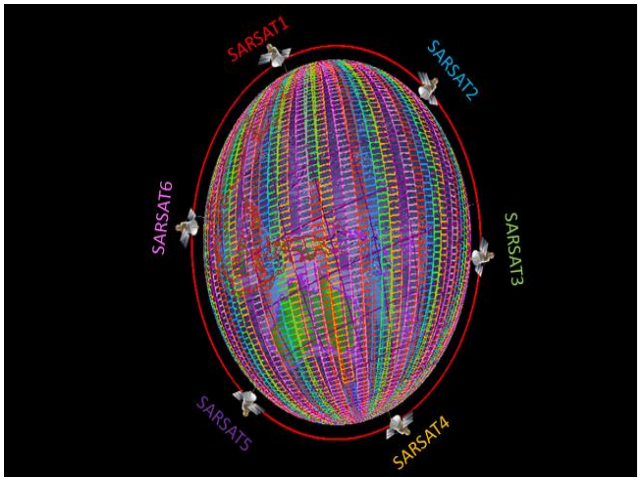



***Fig. 4.Graphical illustration of the in-plane phasing in a single plane***

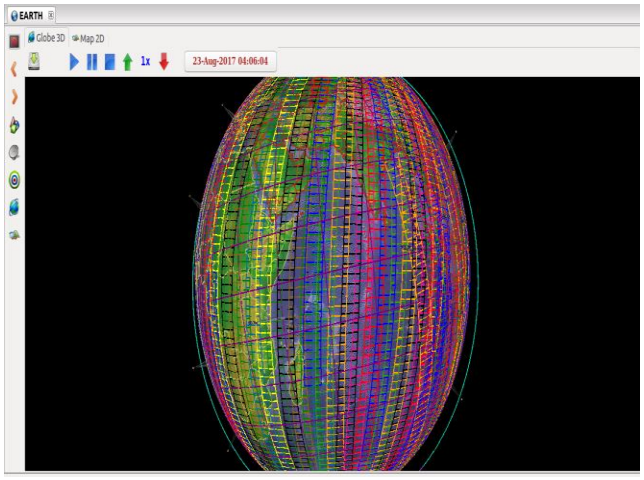



***Fig. 6.Global coverage of the obtained satellite constellation with -230 to -530 roll tilt for a period of 192 minutes***

about every three hours using the payload's roll tilt capacity. This study will be helpful especially during the natural hazards and for the selected region coverage

applications. Also, this constellation can be further used to study volcanoes, landslides, ecosystems, dynamics of ice, coastal process, etc. The roll tilt capacity of the satellites and the payload swath also plays a vital role in reducing the number of satellites in the constellation. Due to the advancements in the field of Aerospace, the payload and other constraints are expected to be eliminated in the near future. Removing those constraints will further reduce the number of satellites required in the constellation. Also, it will expand the search to a greater extent which will require an efficient

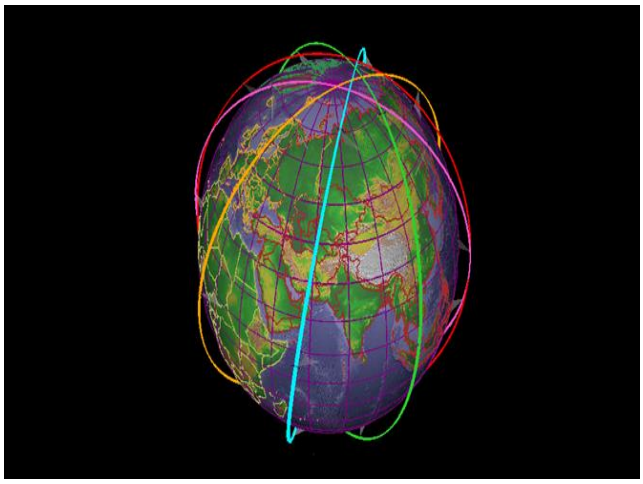


***Fig. 5.Graphical illustration of the out of plane phasing of the designed satellite constellation***

algorithm to converge the results. The future scope of this study can be extended to design a satellite constellation to monitor any given location at any point of time.

**REFERENCES**

[1] Chobotov, Vladimir A., ed. "Orbital mechanics", Aiaa, 2002.

[2] http://www.nrsc.gov.in/Earth_Observation_Missions?q=RISAT-2

[3] http://www.nrsc.gov.in/IRS_DATA_PRODUCTS Larson, Wiley J., and James Richard Wertz."Space Mission Analysis and Design" No.DOE/NE/32145-T1. Microcosm, Inc., Torrance, CA (US), 1992.

[4] Lo, Martin W. "satellite-Constellation Design." Computing in Science & engineering 1.1 (1999): 58-67Misra, Tapan, et al. "Synthetic Aperture Radar on-board RISAT-1: configuration, technology and performance." Current Science (2013): 446-461

[5] Luders, R. David. "Satellite networks for continuous zonal coverage." ARS Journal 31.2 (1961): 179-184

[6] Misra, Tapan, S. S. Rana, and K. N. Shankara."Synthetic aperture radar payload of radar imaging satellite (RISAT) of ISRO." URSI-GA, Session F-08, VigyanBhavan, New Delhi 26 (2005)

[7] Misra, Tapan, et al. "RISAT: first planned SAR mission of ISRO." Asia-Pacific Remote Sensing Symposium. International Society for optics and Photonics, 2006.

[8] Misra, Tapan, et al. "Synthetic Aperture Radar on-board RISAT-1: configuration, technology and performance." Current Science (2013): 446-461

# IPV4 and IPV6 Based Hybrid Approach for Spam and Virus Detection

[1] Swati Hira, [2] Samir Ajani, [3] Pratibha Kokardikar
[1][2] Departmenent of Computer Science & Engineering, [3] Information Technology
[1][2][3] Ramdeobaba College of Engineering and Management, Nagpur, India
[1] hiras@rknec.edu, [2] ajanisn@rknec.edu, [3] kokardekarpv@rknec.edu

***Abstract*:-- The proposed email setup consist of multiple mail servers distributed at two levels to achieve desirable email access performance. It is a well-established fact that 99% of the emails received over internet are either spam or contained viruses and such emails can be dropped at the first entry point of the Network. Thus the first level in the proposed architecture has been taken as an email gateway which is equipped with antivirus and anti spam software. Spam assassion is an open source freeware software for filtering of the spam emails. Perl based spamassassion id to CPU and Memory hungry for heavily loaded server thus this new arrangement would then overcome the Problem of slow Email access for users by detaching spamassassion from email repository servers. The second level of the servers with email repositories for users all the email servers used in this implementation would be Linux X86 servers. Virtualization technique presents a software interface to virtual machines that is similar but not identical to that of the underlying hardware. First level is implemented in Virtual machine. So as to provide scalability, portability, migration and vendor independent.**

**Index Terms: spam, virus, internet protocol, multilayer filtering.**

## I. INTRODUCTION

As computing becomes pervasive, people increasingly rely over the Internet. Now, the Internet is a preferred source to access online services such as E-mail services, e-banking, e-government, etc. User mails require a strong security mechanism from viruses and spam detection [1, 2]. Security is a major issue in internet based E-mail access service system. There are various internet threats which affect the security system of internet and increase risk for receiving bulk mail resources over highly secured network. Most of the spam and virus detection system relies on single layer filtering. Single-layer filtering is the traditional security process that requires antivirus and anti spam software installation on server. Single layer filtering is vulnerable to detect spam because it requires lot of time to process mails on single server. For applications that require greater security, it may be advisable to implement more complex systems, such as multi-level anti spam, antivirus email setup [3]. In a two-level filtering system, incoming mails are processed at first level for filtering and scanning and processed mails are then forwarded to the second level mail server. The management of antivirus, anti spam and its supporting software complexities are handled by the centralized server configurations. Keeping the email-setup secure and containing clean mails in user's inbox, while receiving mails from different domains, over Internet is a challenging task. The challenges start from filtering useful mails from all received mails which are received at first level (server level) to reduce the processing time of the second server, across the Internet is the most simplified ay and without posing any potential threat to the networked resources. This paper has addressed the security issues involved in the email-setup of the organization accessible from the Internet. It allows users to access their mails present in their respective inboxes which are guarantees to contain monthly urgent emails. The above discussion underlines the need for Multilevel Email-setup for highly trusted network. To do so in the present work an Email-setup that is both secure and highly usable has been designed using multiple levels. An email setup has been designed using multilevel scheme using Virtual Machines for better resource utilization and LDAP Server for managing information's [4]. Fig. 1 shows the spam detection process of proposed architecture.

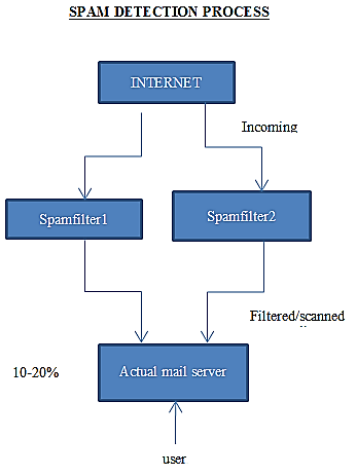



***Fig. 1 Spam detection process of proposed system***

## II. EXISTING SYSTEM ARCHITECTURE

It would not be a secure way for most of the email setup to simply use antivirus and anti spam software for spam and virus detection [5]. The existing system works only on single level. Current system has Load Distribution on single level which makes accessing of useful mail difficult from bulk mails All the processing on mails as scanning ,filtering and mail accessing done on same level .The system addressed the problem of Load balancing and low throughput. Hence we need to provide different access levels for secure accessing of mail services. Current system architecture is shown Fig 2.

## III. PROPOSED SYSTEM ARCHITECTURE

Fig. 3 shows the proposed system architecture. On first level Virtual Machines has been created with following components: Mail gateway (Qmail 1.03), antivirus (Clam AV) and anti spam (Spam Assassin) installed on first Virtual Machine. On the second level Actual Mail Server setup has been created.

Both levels have been implemented using Centos 5.5 as Operating System. The developed setup will be used to access the spam and virus free emails over the Internet. The first level of email setup detects and filters out 80% spam and virus effected mails. The second level of mail server which acts as user end email server receives clean mails from the first level. All implementations have been done using open source tools. This proposed system provides following solutions:

### *A. Trusted Email setup*

Strong security relies by filtering and scanning mails on multilevel. Clamav, Spam Assassin, Qmail 1.03 and supporting packages are uses as the level of filtering and scanning, which provides multilevel trusted Email setup for highly secured network.

### *B. Managing Anti Spam*

Spam Assassin uses as the first level of filtering/scanning, which supports pyzor , razor , DCC , Bayesian filtering and provides security against spam mails for managing the identity of the users of a secure mails.

### *C. Managing anti Virus*

The Use of Clam AV mechanism to enhance the security of mails from virus

### *D. Secure E-Mail service*

The RRCAT web mail services will be accessible over internet in simplified and secure manner.

### *E. Security Against Spam and Virus*

70-80% spam and virus effected mails are detected, so the user receives almost clean mails.

### *F. Secure Data Storage*

A LDAP directory acts as the authoritative data store for all identity information as well as the configuration information for the identity management system itself.

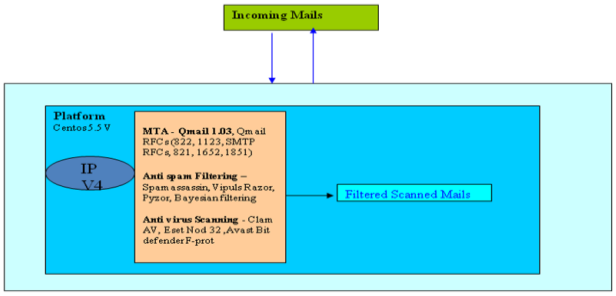



***Fig. 2. Spam and virus detection using single level architecture***

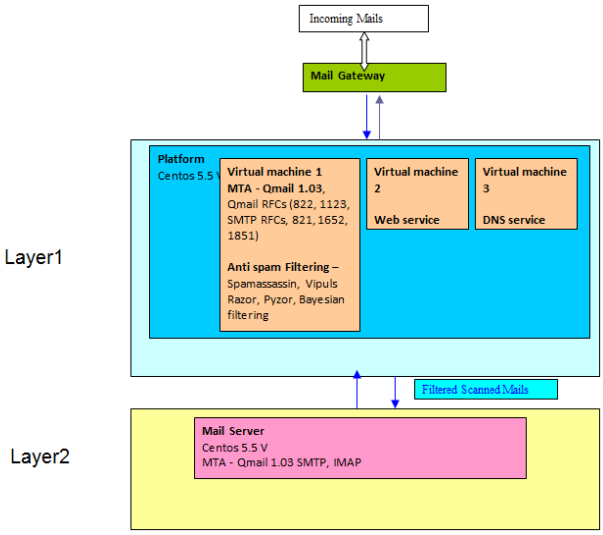



***Fig 3. Spam and virus detection using multi layer architecture***

## IV. EXPECTED OUTCOMES

The result of this paper is a Multilevel, Anti spam, Anti Virus and Email setup with IPV4 and IPV6 support. This system also provides necessary scripts and interfaces for successful creation of Virtual Machine with support for IPV4 and IPV6 protocols using Para virtualization tools [6]. This setup uses well proven and tested open source technologies for achieving multilevel filtering/scanning of emails thus providing necessary control of allowing only clean emails to reach the users. Results are shown in below figures on daily and monthly basis. Fig. 4(a) and 4 (b) shows result on single layer system. Fig. 5-7 shows result

on multiple layer system for daily and monthly received data. Fig 5(a)-5(b) and Fig 6(a)-6(b) shows the result on layer1 using different spam filter as spamfilter1 and spamfilter2. Fig.7(a)-(b), shows the result at layer2 or the finally received data by user. From results we can observed that we are getting more number of spam mails in single layer system while in multiple layer system less spam mails are received because the mails are already filtered at layer1. In other terms in previous system all types of mail (Spam/Virus/Clean) are received by user in their inbox while in proposed system user received almost clean mail received.

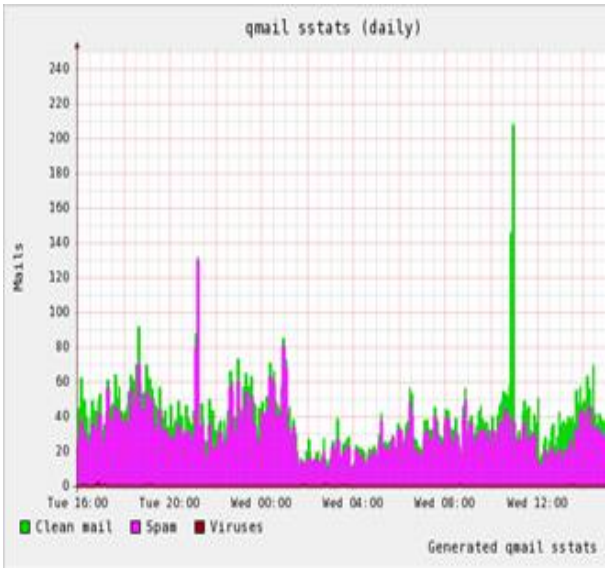



***Fig.4(a) spam and virus detection graph for previous system(daily)***

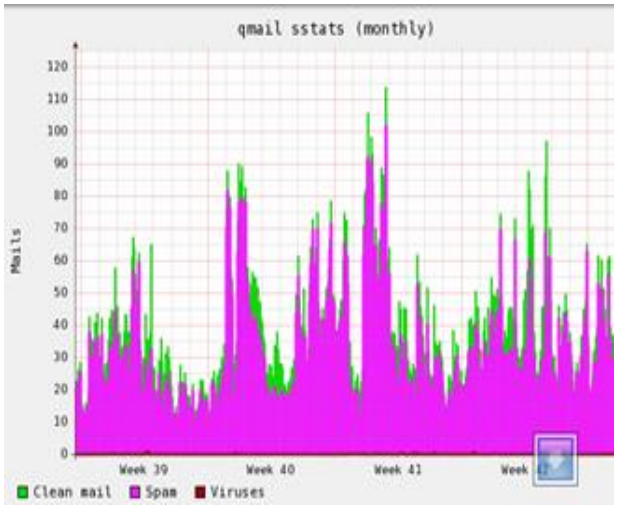



***Fig.4 (b) spam and virus detection graph for previous system(monthly)***

***Proposed System Results***

Spamfilter 1

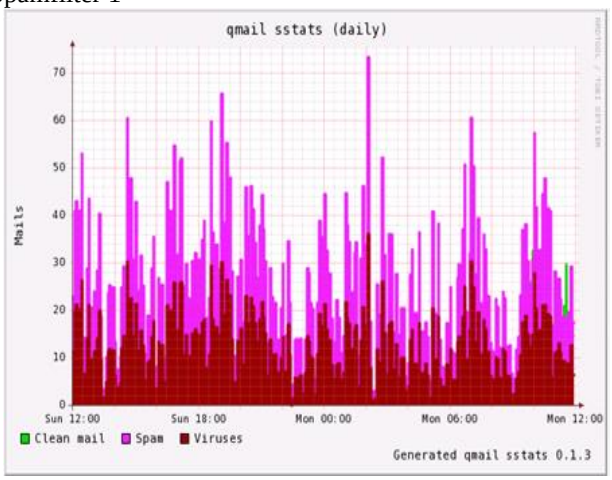



***Fig 5(a) Spam and virus detection on spamfilter1(daily)***

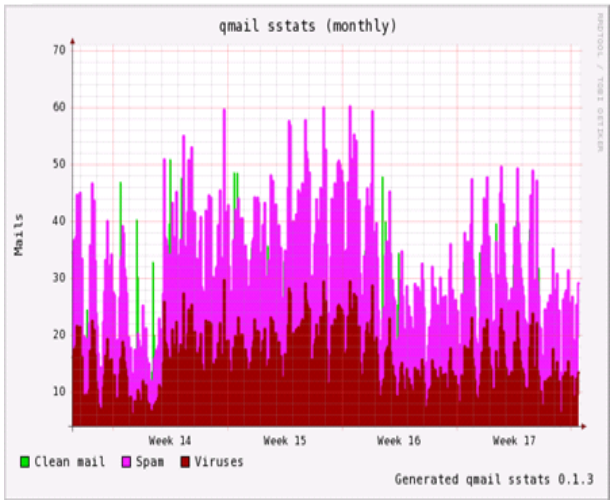



***Fig. 5(b) Spam and virus detection on spamfilter1 (monthly)***

***Spamfilter 2***

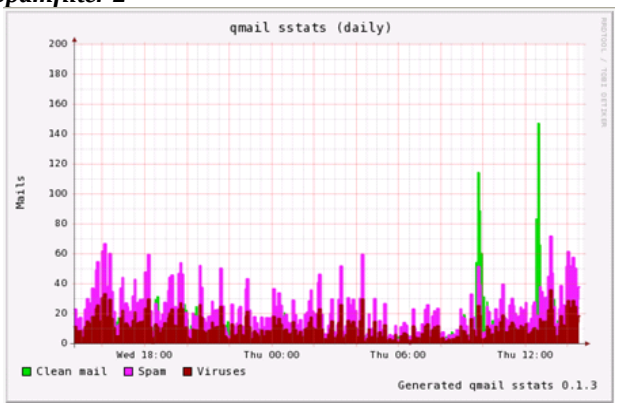



***Fig. 6(a) Spam and virus detection on spamfilter2(daily)***

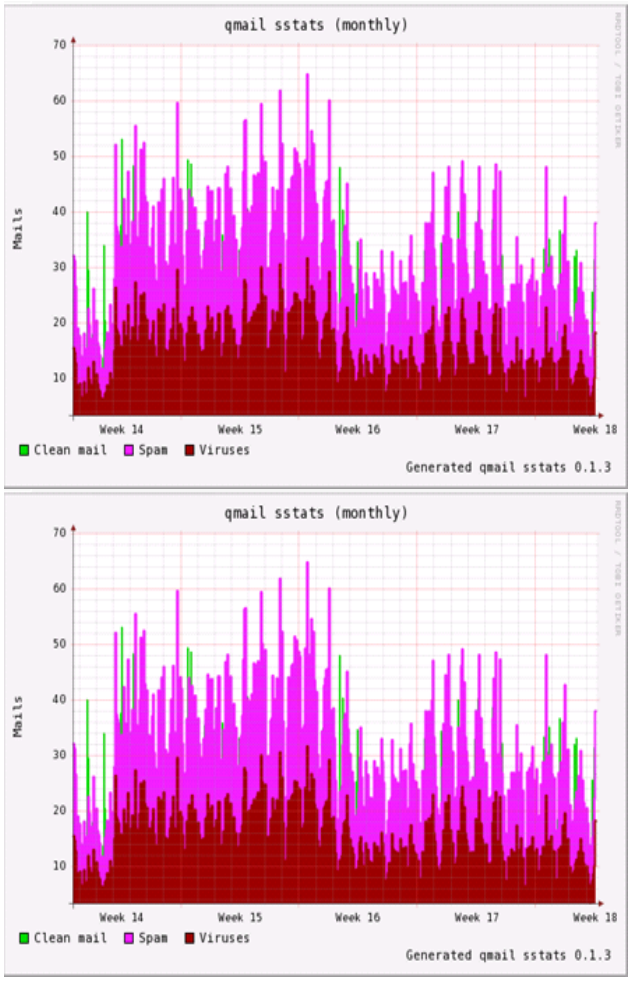



***Fig. 6(b) Spam and virus detection on spamfilter2 (monthly)***

***Actual Server***

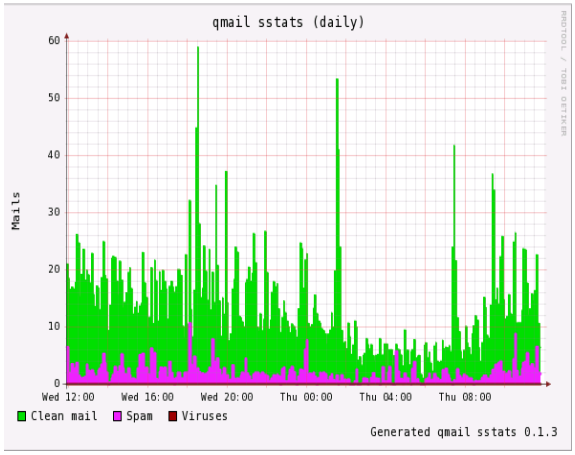



***Fig. 7(a) Spam and virus detection on actual server (daily)***

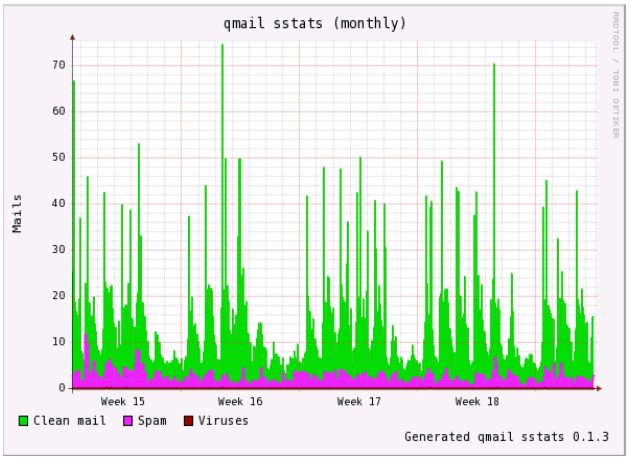



***Fig. 7(b) Spam and virus detection on actual server (monthly)***

## V .CONCLUSION

In this paper, High throughput multilevel Anti spam and Antivirus email setup with IPV4 and IPV6 support has been designed and developed. Server virtualization has been used for the development of first layer of Anti spam filtering and Antivirus scanning, to achieve optimum usage of hardware resources. The Analysis of incoming mails, spam mails and virus infected mails shows that more than 72% spam and virus mails are processed at the first layer. Hence actual user end mail server receives only clean mails at second layer which improves the performance of the mail server. It resulted in improved server response time to the user of mail servers. IPV6 implementation has also been incorporated in the setup to adhere the future generation protocol. The setup is developed using the open source software which are readily available on internet.

## REFERENCES

[1] Hassan Najadat, Ismail Hmeidi, ”Web Spam Detection Using Machine Learning in Specific Domain Features”, Department of Computer Information Systems Jordan University of Science and Technology , Referenced in 2008.

[2] Minoru Sasaki,”Spam Detection Using Text Clustering” Department of Computer and Information Sciences, Ibaraki University, Hitachi, Ibaraki, Japan, Referenced in 2005.

[3] Ye Wang, Hussein Abdel-Wahab,” A Multilayser approach of anomaly Detection for Email Systems”. Dept of Computer Science, Old Dominion University 2006.

[4] Debora jean byrne,Austin TX (US),Chetan Ram Murthy,New York,”Light Weight Directory Access Protocol(LDAP) Directory server cache mechanism and method”, Referenced on Feb 2002.

[5] Bryson P.Gordan, Campbell CA(US),"Comprehensive anti-spam system, method, and computer program product for filtering unwanted email messages.", Referenced on May 2004.

[6] Peter Kosik, Patrik Ostrihon and Reza Rajabiun, "IPV6 and Spam", MIT Spam Conference, Referenced in 2009.

# Digital Image Forgery and Detection

[1] Tulsi Thakura, [2] Kavita Singhb, [3]Arun Yadavc, [4] M. M. Raghuwanshi
[1][2][3] Department of Computer Technology, Yeshwantrao Chavan College of Engineering,Hingna, Nagpur-441110, Maharashtra, India, [4] Tata Consultancy Services, Mihan, Nagpur, Maharashtra, India

*Abstract:--* **In the era of information, where digital image acts as the foremost source of information and easily convey the mes-sage rather than the description. According to an English idiom "A Picture is worth a thousand words". However, the digital image can easily be tampered and it can raise the trouble regarding authenticity and integrity of the digital image, due to the proliferation in the field of digital image editing tools which are powerful as well as sophisticated with many advanced fea-tures. Nowadays, editing tools are easily available in the market and are able to perform manipulation with artifacts of the digi-tal image very easily and does not leave behind any footprint of such changes, which generates uncertainty on the authenticity of the digital images as these might be manipulated. So, there is a need to develop the digital image forgery detection tool to prove and verify the authenticity of the digital image. Verification of legitimacy of digital image can accomplish using two approaches. Namely, first is the active approach, which requires some embedded information with the image. The second ap-proach is a passive one that works in the unavailability of any additional data append on the source image and discover the authenticity of the digital image by analyzing the transformation in the visual information of the digital image. This paper pre-sents the detail study of passive techniques used for verification of the genuineness of digital image.**

**Index Terms: Digital image forgery, Tampering detection technique, Copy-move forgery, Splicing forgery, Image retouching**

## I. INTRODUCTION

Nowadays, everyone is living in the era, which is called as digital age, where the digital image is widespread and powerful channel of communication, which provides a possibility to process, access and share information in a very easy way. In the era of information, the image has acquired the reputation as unarguable evidence. Although, due to forgery with the digital images; these images do not remain the authentic and genuine and raise the question on the authenticity of the digital image. Forgery with the digital image means alteration perform on the visual artifacts of an image by deploying several image manipulation techniques such as copy-paste, blurring, noise addition, color enhancement, etc. Usually digital image forgery employed either for fun or to provide security to valuable documents and can be used for misguiding people as forgery accomplished with the digital image changes the visual imagery that changes information of the digital image [1]. The agile growth in the field of image editing software such as Adobe Photoshop, Picasa, etc., which are powerful and sophisticated that allows even relatively naïve user to easily process digital images and make changes in a digital image, which can challenge the credibility and legitimacy of the digital image. As the digital image genuineness made considerable imprint in day-to-day life of people, which acknowledge the necessity to develop a mechanism to validate the trustfulness of the digital image.

However, certification of genuineness of the digital image is a great deal that required in various applications. For an example the trustworthiness of the digital image has a vital role in courtrooms, where they play a role of an evidence, even daily newspapers and magazines dependent on the digital images as well as the medical field also rely on the digital image for reports, where physicians make critical judgment on the basis of digital image. So, there is an importunate need to certify the reliability and credibility of digital images. To achieve the authenticity and integrity of the digital image forgery detection become the need of the time. From the above mentioned applications, it is evident that the role of a digital image has emerged as necessity with the time in every field of life. This makes certification of genuineness of digital images an essential task.

Few of the main objectives that have been highlighted in this paper are as mentioned below:

•to introduce the phenomenon of the digital image forgery and their types

•to give an outline of distinct digital image forgery de-tection techniques that is used to detect forged area in the digital image

•to convey a comparative analysis of different tech-niques with their distinct parameters, merits and de-merits

The remaining paper is organized as follows. Section 1 has introduced about the digital image forgery phenomenon and the Section 2 presents a discussion regarding the types of digital image forgery and the next Section 3 is dedicated to study on various types of digital image forgery detection

mechanisms. Furthermore, in Section 4 and 5 presented review on several proposed techniques for the detection of digital image forgery with respect to the three mentioned forgeries, along with the comparison. At the end, Section 6 provides concluding remarks.

## 2. CLASSIFICATION OF DIGITAL IMAGE FORGERY

In this section, the paper presents the classification of the digital image forgery. Forgery with the artifacts or feature of digital images is termed as digital image forgery. The digital image forgery can be categorized in three different classes such as Copy-Move (Cloning), Image Splicing (Compositing) and Image Retouching. Each of the categories has been further discussed in forthcoming section.

### *2.1. Copy-Move (Cloning)*

Copy-move is an image forgery type that comes under the region duplication. In the copy-move forgery, the manipula-tion with the digital image can be performed by simply copy-ing a fragment or a part of the digital image to paste it into the same image frame. The motive behind the copy-move forgery is to duplicate any object or to camouflage it in that image [1].

Copy-move forgery is also known as cloning forgery as it clones one object multiple times in the same digital imagery, as shown in the figure 1. The figure 1(a) depicts the original image and figure 1(b) is a tampered image. From the figure 1(a), it can be observed that original image contained a small boat and a large boat. On the other hand, the figure 1(b) has been cloned which depicts the tampered image showing a large boat along with two small boats, where a small boat has been cloned in the image, which leads to the loss of the origi-nality of digital image and visual message changed.

***(a)***

***(b)***

***Fig. 1 Example of Copy-Move Forgery (a) Original Image (b) Tampered Image [7].***

### *2.2. Image Splicing (Compositing)*

In the image splicing forgery, fragments of two different images are united in a single frame to produce a spliced image. The image splicing forgery may change the visual message of digital images more impactful than other forgeries in the image [1].

***(a)***

***(b)***

 ISBN: 978-81-932966-5-3

*(c)*

***Fig. 2 Example of Image Splicing Forgery (a) Original image of woman standing in a garden (b) Original image of pillars and (c) Tampered image with woman and pillar combined (Source image is from CASIA TIDE v1.0 Dataset)***

Image splicing is also known as Image Compositing forgery as it composites two different image fragments and generate single image as shown in the figure (2). To understand this let's observe figure 2(a) and figure 2(b) which are depicting the original image and the figure 2(c) is depicting the tampered image (i.e., spliced image).

In the figure 2(c), two distinct image's fragments are combined to generate single composite image which leads to changes occurred in the whole meaning of the original image's visual message or content. While two different images captured in different lighting conditions and with different camera, it makes crucial task of matching lighting condition of two distinct images, to make a composite image. These lighting differences in the spliced image can be used as an evidence to detect spiced region in an image as well as the noise level of each image is different and can also be used as a clue to detect the splicing in the image.

2.3. Image Retouching

The image retouching forgery is performed by enhancing the digital image characteristic with slight changes in the digital image or reducing certain features in the image like color, brightness, contrast etc. It is an art which enhance photography. Image Retouching intensify the content of the digital image and frames it to attractive and put efforts to give a realistic approach to digital images [3].

(a) (b)

***Fig. 3 Example of Image Retouching (a) Original Image (b) Tampered Image [2].***

As shown in the figure 3, the figure 3(a) is an original image and figure 3(b) is an enhanced version of an original image showing in figure 3(a). To make it more attractive beautification filter has been employed on the digital image. Editors of the magazine are exercising with the digital image retouching to embellish certain characteristics of the digital image so that it seems to be more attractive and beautiful.

Among all the three digital image forgery categories, digital image splicing is the more impactful image forgery method as it changes the visual message more drastically than other two methods viz; cloning and retouching. It may put two digital images together to make the composite image and may show the object which is not actually present in an authentic image. Moreover, copy-move forgery implemented on the digital image only can hide the object present in the authentic image or may increase the count by employing clone multiple times of a specific object, which does not impact as by the splicing forgery. On the contrary, image retouching does not make more powerful changes as can be done by image splicing and copy-move forgery. It only employs to make digital image more beautiful and glamorous and generally used in modelling world.

As discussed earlier in introduction section, it has been observed that nowadays digital image plays a prime role in all the aspects of life. In this context, if forgery or tampering done to any digital image with any objective will be paid a heavy amercement in terms of loss of information, ambiguous information or fake information. This causes a digital image forgery a challenging issue for the researchers. Since, the act of tampering the digital image or digital image forgery cannot be stoppable, the only solution is to have the mechanism of detection of forgery occurred in the digital image. Therefore, in the last few years many researchers have proposed distinct type of image forgery detection techniques.

## 3. TYPES OF IMAGE FORGERY DETECTION TECHNIQUES

In this following section, the paper presents a brief idea about the categorization of digital image forgery detection techniques. Image forgery detection technique is nothing but a mechanism to detect the forgery in the digital image. Techniques of digital image forgery detection are mainly subdivided into two distinct approaches, namely, the first is active approach and the second is passive approach.

In active approaches, the digital image depends on addition-al appended digital data like watermark insertion or attaching digital signature on the source digital image while image obtainment procedure, which would create a boundary against the active approach in practice. Moreover, many cameras are not equipped with these

features which results failure of active approach. On the contrary, passive methods work in the absence of pre-embedded information like digital watermark or digital signature and blind method is another term for passive approach and as it does not look for additional digital data with source image to validate the authenticity of digital image. Rather the passive techniques are able to detect the image forgery by analyzing the changes in the content of the image.

The passive approach is further classified into various categories namely in pixel-based technique, format based technique, camera-based technique, physical environment based technique and geometry-based technique. A tree representation of image forgery detection techniques has been shown in figure 4.

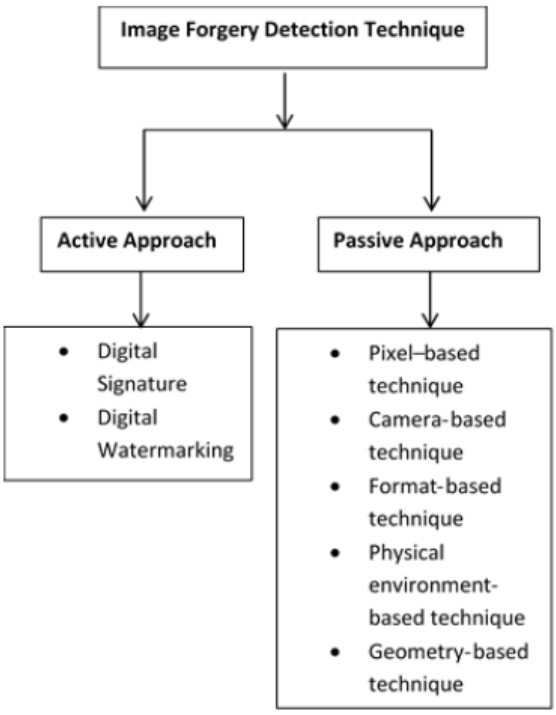



***Fig. 4 Categorization of Image Forgery Detection Techniques***

- Pixel-based techniques: Pixel-based technique often preforms detection of statistical fraudulent activity introduced at the pixel level in a digital image. The most often applied forgery detection technique is the copy-move detection technique. Detection of image resampling and image splicing are also the techniques have a place in this category.
- Camera-based techniques: Management of distinct artifacts of the image proposed by the various factors, such that camera lens, fixed pattern noise etc. The techniques works on camera-based forgery detection techniques based upon the different parameter introduced by the factors that are response of camera, sensor noise level, array of color filter and chromatic aberration.
- Format-based techniques: Format-based mechanism work on the image format. Formats are usually considered as a tag for every file system and expressed using extension. The Joint Photographic Experts Group (JPEG) is the frequently used image format with the extension of .jpg or .jpeg by many digital cameras and hence the format based forgery detection methods remarkably bring to focus on the JPEG format images.
- Physical environment-based techniques: Detection of the eccentricity in the three-distinct dimensional interaction among the camera, light and the physical objects is obtained in the physical environment-based techniques. During creation of spliced image is often challenging to exactly match the lighting effect of two different fragments of the distinct images. In this, the lighting distinctness can use as clue of forgery with an image.
- Geometry based techniques: The geometry-based technique measures the objects in their world positions with respect to the camera. The geometry based techniques includes two main aspects viz; principal point and the metric measurement. In this technique, estimated difference in the principal points of the digital image can be used as the left traces of tampering perform over the digital image.

## 4. RELATED WORK

In this section, the paper discusses the proposed passive methods by many researchers for the identification of forgery in the digital image, while first we will go for the generalize steps for the identification of the forgery in the digital image and then for the proposed passive methods. There are numerous techniques proposed by many researchers based on passive approach to overcome the problem of authenticity of the digital image and also for verification of the same issue. Before approaching the discussion on various passive approached techniques for forgery detection, this paper is initiating towards the generalize flow of the digital image forgery detection mechanism. The structure of the forgery detection systems depicts in the figure 5, where each step performing certain pre-defined task and transform the

input data into another form in the direction of detecting the forgery in the digital image. Figure 5 depicts the flow of the process which gives detail of the passive approach based forgery detection in the digital image.

The general flow structure will include steps such as taking input image, pre-processing followed by decomposition step which is basically a segmentation of an image and the next step will be feature extraction and comparison step which means performing classification, locate the forged region step will localize the tampered region in the image and at the last, it will give an output as result of forgery detection in the digital image.

- First, the system takes the digital image selected by the user as an input to process and then it performs reading.
- In the pre-processing step, it performs conversion from one color space to another color space, which is suitable to process according to the method applied on the digital image and image enhancements to remove the additive noise from input digital images with the help of various filters available for noise removal such as median filter, averaging filter, etc.
- After performing pre-processing, the preprocessed image is forwarded to next step i.e., decomposition. This step performs decomposition on the digital image that sub-divides the digital image into blocks to process each block individually. In this step, the segmentation technique is used to simply divide the image into small sub-image like block. For segmentation widely used techniques are like Discrete Wavelet Transform (DWT) [7-9, 12, 14], Discrete Cosine Transform (DCT) [3, 4, 16, 19], Multi-size Block Discrete Cosine Transform (MBDCT) [10] etc.
- Subsequently, decomposition step, feature extraction step accomplishes. This step contains the extraction of the feature from each block of an image to use them during comparison step to compare the feature of the digital image. This step performed by applying feature extraction methods like Speed-Up Robust Features (SURF) [4], Scale-invariant Feature Trans-form (SIFT) [6, 14, 15], Local Phase Quantization (LPQ) [13], Canny Edge Detector [16] etc.
- After extraction of appropriate features from the de-composed digital image and are feed to classifier, which will perform classification by comparing the train dataset features with the test image features. Classifiers are used for performing classification and widely used classifiers such as Support Vector Machine (SVM) [3, 9-11, 13, 17], K-means clustering [16], etc.
- On the basis of classification performed by classifier, it will find the forged regions and locate them in the second last step i.e., locate forged region step.

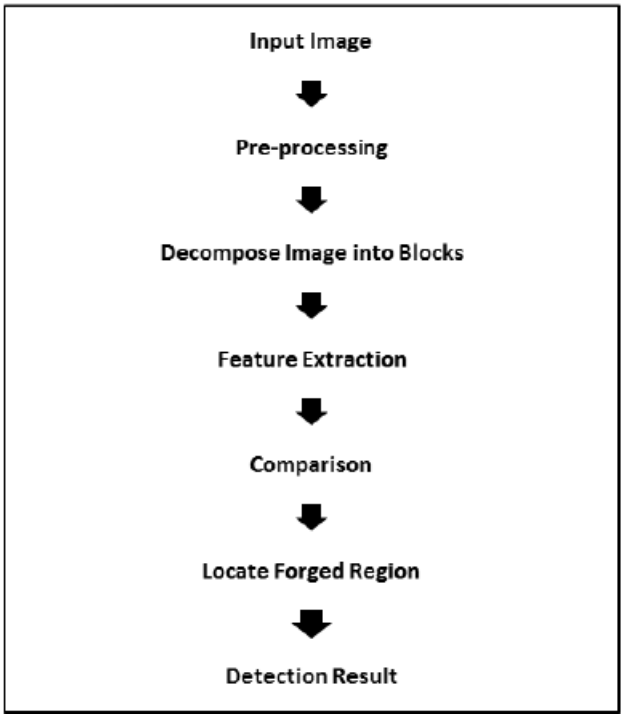



***Fig. 5 General Flow of Image Forgery Detection***

And at the end, it will provide the result of final forgery detection in the digital image.

Recently, various techniques have been proposed by many researchers for the digital image authenticity and integrity verification. This paper discussing on the passive approached mechanisms and "Blind Method" is an another term refer for passive approach technique, which does not consider any pre-inserted digital data in advanced or pre-embedded information with the digital image for the forgery detection in the digital image. To conquer with the problem of authenticity and genu-ineness, recent studies have been proposed several methods involving the use of block-based, camera-based and pixel-based forgery detection mechanisms to detect the tampering performed with the digital image.

Overview of the various detection techniques of digital image forgery based on the different methods by V. P. Nam-

poothiri et.al., [1] and Charmil Nitin Bharti et. al., [2] gives details on the classification of digital image forgery techniques. It also reveals the necessity of the digital image tampering or forgery detection in the modern era. This paper covers the passive approach based image forgery detection techniques. It classifies the several image forgery detection mechanisms in the format-based techniques, pixel-based techniques, camera-based techniques, physical environment-based techniques and geometry-based techniques. In paper [2], comparative analysis has been performed with different approaches for image forgery detection as well as it also discussed about the various operations that arises during the image forgery are noise, crop-ping, blurring, rotation, scaling, retouching, resizing etc.

In several passive approach based image forgery detection, DCT has been applied to reduce the dimensionality representation and to extract the DCT coefficients from each block as DCT divides an image into overlapping blocks in any color space. In [3] Amani A. Alahmadi et. al., presented a passive approach based splicing image forgery detection method, which is based on DCT and Local Binary Pattern (LBP), where DCT coefficients have been obtained from the chroma compo-nent (Cb or Cr) that was divided into 16×16 overlapping blocks and LBP codes calculated for those blocks and standard deviation were calculated of respective coefficients which were used as features. It has successfully detected splicing with accuracies 97%, 97.5% and 96.6% over datasets CASIA TIDE v1.0 [20], CASIA TIDE v2.0 [20] and Columbia dataset [21] respectively.

Whereas, in paper [4] Shinfeng D. Lin et. al., proposed the format-based technique that mainly focuses on JPEG format-based image and identifies two image forgeries namely, copy-move and image splicing forgery. This paper analyzed the con-sequences of double compression effect in spatial and DCT domain on the digital image, where DCT coefficients' analysis performed on double JPEG compressed digital image. However, Zhen Zhang et. al., [10] tossed an idea of a mechanism that relied on extraction of moment features by employing the MBDCT. The MBDCT can reflect the changes occur during splicing in the local frequency and MBDCT coefficients can show the change of frequency distribution in various ways. Although, Abhishek Kashyap et. al., in [8], also performed an outline analysis by employing DCT. The Object's outline was analyzed in terms of smoothness and sharpness of edged in mentioned method. In the paper [16] Reza Moradi Rad et. al., performed DCT on edge block, where edge blocks were obtained by applying canny method on the digital image. Canny method is an edge detection technique that looks for the edges of the object. The main motive behind this step was to find objects with abnormal boundaries, which were either smooth or sharp edges. Whereas, in the paper [19] Varsha Sharma et. al., conferred an approach which employ DCT to represent the overlapping blocks features. DCT extracted Coefficients that were acceptable to illustrate the major intensity distribution over the block. The mentioned technique recognized the copy-move forgery in the digital image. Additionally, it has shown invariance with added gaussian noise, JPEG compression along with small amount of scaling and rotation.

The DWT is often used method in the copy-move forgery detection. DWT generally employed for dimension reduction as the size of the digital image reduced at each level and it segments the image into four distinct sub-images that are LL, LH, HL and HH. Mohammad Farukh Hashmi et. al., in [14], proposed a method which was based on the DWT transform to decompose the digital image and obtained the LL sub-image which contains the most of the information of an image. In paper [10], the DWT has been used to catch transient or local-ized changes in spatial and frequency domains to measure the statistical differences of the digital image. Although, Preeti Yadav in [7], presented an improved algorithm based on DWT, which has been worked to detect cloning forgery. In [7], DWT has been applied on digital image to divide the image into overlapping blocks and Lexicographic sorting was per-formed on the blocks so that duplicated blocks were identified. As a result of DWT usage, detection was firstly performed on lowest level image representation i.e., LL part. This proposed method given good accuracy rate of detection process along with reduced the time requirement for the detection of forgery in an image. In the paper [8], Abhishek Kashyap et. al., also worked with the DWT for decomposition of an image. Pradyumna Deshpande et. al., presented a technique that detected copy-move forgery based on DWT in the paper [12] which did not consider rotation and scaling of tampered region.

Additionally, many researchers mainly had undertaken a keypoint based feature extractor and descriptors such as

SIFT, SURF and MIFT that are robust against the rotation and scaling. SIFT is also invariant to illumination and noise. Mohammad Farukh Hashmi et. al., in [14] and Rajeev Rajkumar et. al., in [15] employed SIFT feature extractor. Mohammad Fa-rukh Hashmi et. al., applied SIFT method only on LL coefficient to extract the useful artifact and also generated the descriptor vector of these useful artifact and then find similarities among various descriptor vectors to detect the forgery in the digital image and classify that given image as forged. Whereas, Rajeev Rajkumar et. al., in [15] used SIFT for feature extraction and implemented a method which dealt with the copy-move forgery in the digital image and also per-formed clustering and matching of keypoint feature which were extracted to detect the forgery in the digital image. Nevertheless, Kalyani Khuspe et. al., presented in [17] a method-ology on Copy-Move digital image forgery detection using key point based MIFT features. Which not only acquired the attributes of SIFT features, but also it was invariable to mirror reflection transformations and clustering was performed on the group of images after extracting the MIFT features and code-book generated using centroid of each cluster and codebook has been used for intercommunication between the transmitter and the recipient. Moreover, in paper [4] Shinfeng D. Lin et. al., the feature has been extracted by using keypoint-based SURF descriptors to resist the variation of rotation as well as scaling.

Digital image forgery detection technique that relies on the analysis of edge information has been proposed by many re-searchers which help effectively in both the forgery types i.e., cloning and compositing in the digital image. Abhishek Kashyap et. al., in [8] and in paper [16] Reza Moradi Rad et. al., illustrated a method on the basis of edge analysis. In this proposed method single framework has been implemented to examine splicing and copy-move type of forgery in the digital images. However, in [8] the Object's outline has been analyzed in terms of smoothness and sharpness of edged. The proposed method detected forged region and localized it. On the contrary, in paper [16] presented by Reza Moradi Rad et. al., proposed a method which allowed the input digital image to be singly compressed or uncompressed. Canny method has been used to perform edge analysis and detect the edge block of the digital image and then DCT applied on each detected edge block to extract the DCT coefficients. This step employed to determine objects with abnormal edge boundaries that were either smooth or sharp.

However, Yu Fan et. al., proposed a method in [5], which was dependent on the inconsistency of the illuminant color in the object regions of lightning effect in the composite image that can be employed for identification of the digital image forgery. It divided a given image into some horizontal and vertical bands, and then the illuminant of each band has been estimated with the generalized grey-world algorithms [5]. The limitation of the proposed method in [5] was that it required human intervention as an annotation for suspicious object to make final decision of tampering. Furthermore, S. Devi Mahalakshmi et. al., in the paper [6], presented a method that made use of the codebook. The set of image features has been used for generation of codebook to analyze the geometric manipulations that were occurred in image. This technique arisen with an image hash based on bag of visual words implanted as a signature on the digital image before transmission. At the destination end, the forensic hash has been inspecting to detect the geometric manipulations that employed on the received image. To deal with textured as well as contrasted manipulation pat-terns in an image encoding has been performed on the spatial distribution of image features. It required necessity for a source image to detect splicing forgery in the digital image, but it given good accuracy rate over copy-move forgery in the digital image.

Although, Tae Hee Park et. al., presented an image splicing detection mechanism, which dependent on the characteristic function moments for the inter-scale co-occurrence matrix in the wavelet domain by using only luminance components of an image in [9]. Whereas, in [11] Wei Wang et. al., presented a passive color image splicing detection approach based on the analysis of image chroma component that analyzed gray level co-occurrence matrix (GLCM) of threshold edge images of image chroma. In [9], it constituted the co-occurrence matrices by employing wavelet difference values in a pair across inter-scale wavelet sub-bands. It extracted the two-dimensional joint density function of high-order characteristic moments of generated by the inter-scale co-concurrence matrices in order to localized image splicing forgery in the digital image. It had shown precision 96.2 % for the Columbia image splicing detection evaluation dataset [22]. In the paper [11], edge images has been generated by performing

subtraction of horizontal, vertical, main and minor diagonal pixel values, respectively from current pixel values and then employed threshold with a predefined threshold value T. Moreover, the estimated GLCMs of edge images along the four directions used as key features for image splicing detection. It has been seen that features of chroma component viz; Cb and Cr were more effective over the Y component of image in [11] similar-ly in the paper [3] the chroma component Cb and Cr were performed more efficiently over the Y component. Although, Meera Mary Isaaca et. al., presented the detection mechanism for copy-move forgery along with splicing forgery in the digital image. In the paper [13], Gabor Wavelet Transform (GWT) has been employed on the chroma component of the digital input image at different scales and orientation. Local Phase Quantization (LPQ) values were determined for each of the Gabor images using the LPQ operator. The feature descriptor generated using LPQ values which are extracted from various Gabor sub-bands of an image.

## 5. COMPARATIVE ANALYSIS

All image forgery detection techniques that have been briefly discussed in section 4 were able to perform analysis and detection of different types of forgeries in the digital image. Forgery in digital image can be analyzed and compared based on different properties and features of the digital image. Table 1 depicted comparative analysis of various techniques of the digital image forgery detection. Table 1 performed summarization of various mechanisms used for image forgery with their detection domain, advantages along with their limitation.

***Table 1: Comparative analysis of distinct image forgery detection techniques***

| S.no | Paper | Technique | Detection Domain | Advantage | Limitation |
|---|---|---|---|---|---|
| 1 | Splicing Image Forgery Detection Based on DCT and Local Binary Pattern [3] | Local Binary Pattern (LBP), DCT, SVM | Image Splicing | 97% accuracy with chrominance color space | Less accuracy in gray and color channel |
| 2 | Less accuracy in gray and color channel | DCT, Speed Up Robust Feature (SURF) | Spliced Image and Copy-move Forgery | Successfully local-ized multiple forged region in the same im-age | Restricted to specific image format like JPEG |
| 3 | Image Splicing Detection with Local Illumination Estimation [5] | Local Illumina-tion Estima-tion, color inconstancy. | Spliced Image | Effective and robust over two datasets with good accuracy | required human intervention |
| 4 | A Forensic Method for Detecting Image Forgery [6] | Code-book, Hash | Spliced image and copy-move image forgery | Generated less com-plex Codebook and gives good performance | Restricted for identifi-cation of splicing at-tack, if the source image is not found |
| 5 | Detection of Copy-Move Forgery of Images Using Discrete Wavelet Trans-form [7] | DWT, shift vector | copy-move image forgery | lower computational complexity and detect small size and multiple copy-move forgery | ---------- |
| 6 | Detection of Digital Image Forgery using Wavelet Decomposition and Outline Analysis [8] | DCT, Wave-let decomposi-tion | Spliced Image and Copy-move Forgery | Good accuracy with 81.50% | ---------- |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Image splicing detection based on inter-scale 2D joint characteristic function moments in wavelet do-main [9] | DWT, PCA, SVM | Splicing forgery detection based on inter-scale 2D joint characteris-tic function | Attains accuracy 96.2 % for the Columbia image splicing detection eval-uation dataset. | Less accuracy attained with color image while it gives better accuracy with gray image. |
| 8 | An Effective Algorithm of Image Splicing Detection [10] | Multi-size Block Discrete Cosine Trans-form (MBDCT), SVM Image quali-ty metrics (IQMs) | Spliced Image | Attains highest accuracy rate 89.16% | Need of 80% training for higher accuracy |
| 9 | Effective Image Splicing Detection Based on Image Chroma [11] | Gray level co-occurrence matrix (GLCM), SVM | Gray level co-occurrence matrix used for splicing de-tection | best accuracy against the Columbia Image Dataset i.e. 96.2%. | ---------- |
| 10 | Pixel Based Digital Image Forgery Detection Tech-niques [12] | DWT, | Pixel level Copy-move For-gery detection | Consider angle rotation which shows good effi-ciency. | considers only 90, 180, 270 angle rota-tions. |
| 11 | Fast, automatic and fine-grained tampered JPEG image detection via Dis-crete Cosine Transform coefficient analysis [19] | Discrete co-sine transform coefficients | Double quantiza-tion effects hid-den among his-tograms of DCT coefficients | Insensitive to the forgery | Limitation to Image Format |

## 6. CONCLUSION

Recently many digital image forgery detection approach have been proposed. An overview performed on the image forgery detection techniques, this may benefit researchers or research scholars to discover new innovative ideas and provide new answer to the difficulties in the field of passive forgery detection approach. This paper gives a concise overview of the digital image forgery detection and it also described the cate-gorization of approaches for digital image forgery detection into active approaches and passive approaches. In this paper study of the different types of the digital image forgery has been performed as it has become the prime necessity to make trust in all images and photographs as it has originated as a challenging issue to establish authenticity of an image. This paper discussed the terse idea of the general flow of Image forgery detection in the digital image. It also discussed on the various proposed techniques for the forgery detection in the digital image that assist us to detect and analyze forgeries. This paper also accommodates with the comparative study of work done by researchers on different types of forgery in the digital image and different proposed techniques based on dif-ferent digital image features with its advantages and disad-vantages. An effort has been made to encourage various tech-niques that represent rational enhancements in the digital im-age forgery detection techniques to resolve the challenges en-countered. This also discovered that the blind approach for forgery detection method should be robust against the pre-processing issues like rotation and scaling. It should be less complex but at the same time it should not compromise with the detection accuracy.

## REFERENCE

[1] V. P. Nampoothiri and N. Sugitha, “Digital Image Forgery - A threaten to Digital Forensics”, IEEE In-

ternational Conference on Circuit, Power and Com-puting Technologies (ICCPCT), 2016, pp. 1-6.

[2] C. N. Bharti and P. Tandel, "A Survey of Image Forgery Detection Techniques", IEEE International conference on Wireless Communication, signal Pro-cessing and Networking, 2016, pp. 877-881.

[3] A. A. Alahmadi, M. Hussain, H. Aboalsamh, G. Muhammad, G. Bebis, "Splicing Image Forgery Detec-tion Based on DCT and Local Binary Pattern", IEEE Global Conference on Signal and Information Pro-cessing, Feb 2013, pp. 253-256.

[4] S. D. Lin and T. Wu, "An Integrated Technique for Splicing and Copy-move Forgery Image Detection", IEEE 4th International Congress on Image and Sig-nal Processing, 2011, pp. 1086-1090.

[5] Y. Fan, P. Carré and C. Fernandez-Maloigne, "Image Splicing Detection with Local Illumination Estima-tion", IEEE International Conference on Image Pro-cessing (ICIP), 2015, pp. 2940-2944.

[6] S. D. Mahalakshmi, K. Vijayalakshmi and E. Agnes, "A Forensic Method for Detecting Image Forgery", IEEE International Conference on Emerging Trends in Computing, Communication and Nanotechnology (ICECCN), 2013, pp. 590-594.

[7] P. Yadav, "Detection of Copy-Move Forgery of Images Using Discrete Wavelet Transform", IEEE International Journal on Computer Science and Engi-neering (IJCSE), 2012, Vol. 4, No. 04, pp. 565-570.

[8] A. Kashyap, R. S. Parmar, B. Suresh, M. Agarwal and H. Gupta, "Detection of Digital Image Forgery using Wavelet Decomposition and Outline Analysis", International Conference of Signal Processing and Communication (ICSC), 2017, pp. 187-190.

[9] T. H. Park, J. G. Han, Y. H. Moon and K. Eom, "Image splicing detection based on inter-scale 2D joint characteristic function moments in wavelet domain", SpringerOpen. EURASIP Journal on Image and Vid-eo Processing, 2016, pp. 1-10.

[10] Z. Zhang, J. Kang and Y. Ren, "An Effective Algorithm of Image Splicing Detection", IEEE Interna-tional Conference on Computer Science and Software Engineering, 2008, pp. 1035-1039.

[11] W. Wang, J. Dong and T. Tan, "Effective Image Splicing Detection Based on Image Chroma", IEEE International Conference on Image Processing (ICIP), 2009, pp. 1257-1260.

[12] P. Deshpande and P. Kanikar, "Pixel Based Digital Image Forgery Detection Techniques", International Journal of Engineering Research and Applications (IJERA), Vol. 2, No. 3, 2012, pp.539-543.

[13] M. M. Isaaca and M Wilscy, "Image forgery detection based on Gabor Wavelets and Local Phase Quantization", ELSEVIER Second International Symposi-um on Computer Vision and the Internet (Vision-Net'15), 2015, pp. 76-83.

[14] M. F. Hashmi, A. R. Hambarde and A. G. Keskar, "Copy Move Forgery Detection using DWT and SIFT Features", IEEE International Conference on Intelligent Systems Design and Applications (ISDA), 2013, pp. 189-193.

[15] R. Rajkumar and K. M. Singh, "Digital Image Forgery Detection using SIFT Features", IEEE Interna-tional Symposium on Advanced Computing and Communication (ISACC), 2015, pp. 186-191.

[16] R. M. Rad and K. Wong, "Digital Image Forgery Detection by Edge Analysis", IEEE International Con-ference on Consumer Electronics-Taiwan (ICCE-TW), 2015, pp. 19-20.

[17] K. Khuspe and V. Mane, "Robust Image Forgery Localization and Recognition in Copy-Move Using Bag of Features and SVM", IEEE International Confer-ence on Communication, Information Computing Technology (ICCICT), 2015, pp. 1-5.

[18] A. V. Mirea, S. B. Dhokb, N. J. Mistrya and P. D. Poreya, "Factor Histogram based Forgery Localiza-tion in Double Compressed JPEG Images", ELSE-VIER Eleventh International Multi-Conference on In-formation Processing (IMCIP), 2015, pp. 690-696.

[19] V. Sharma, S. Jha, R. K. Bharti, "Image Forgery and it's Detection Technique: A Review", International Research Journal of Engineering and Technology (IRJET), 2016, Vol. 3, No. 03, pp. 756-762.

[20] The dataset mentioned in the paper is freely available to reader at the address [online]. Available: http://forensics.idealtest.org/casiav1/

[21] The dataset mentioned in the paper is freely available to reader at the address [online]. Available: http://forensics.idealtest.org/casiav2/

[22] The dataset mentioned in the paper is freely available to reader at the address [online]. Available: http://www.ee.columbia.edu/ln/dvmm/downloads/AuthSplicedDataSet/AuthSplicedDataSet.htm

# Reactive Power Compensation and Harmonic Mitigation in Steel plant

[1] Nupur L. Mali, [2] Dr. V. N. Kalkhambkar, [3] Abhijeet Shete
[1][2] Department of Electrical Engineering, Rajarambapu Institute of Technology, Islampur, 415414, India
[3] Sharda Electronics & Co. J 32, MIDC kupwad, Sangli
[1] nupurlmali@gmail.com, [2] vaiju.kalkhambkar@ritindia.edu, [3] abhis@shardacapacitor.com

***Abstract*:-- Power quality problems play a vital role in power system network. One of the important loads in the network is the Electric Arc Furnace (EAF) which is used in Steel Producing plants along with electrical drives and welding machines. Non-linear characteristics of EAF are the major source of power quality issues that include reactive power consumption, harmonic production and system unbalance. This leads to voltage flickers and fluctuations. Static VAr compensator (SVC) is one of the effective FACTS devices to overcome these power quality problems. In this paper, Operating principle and control strategy of TCR-FC are described briefly. Thyristor Controlled Reactor - Fixed Capacitor (TCR-FC) type of SVC is used in proposed work for reactive power compensation and harmonic mitigation. The SVC model is simulated in MATLAB software and results are observed.**

**Index Terms: Power Quality, Harmonic, Reactive power, EAF, SVC, TCR-FC, Passive filters**

## I. INTRODUCTION

Nowadays, power quality issues are more important in power system. Power quality is defined as a steady supply of voltage within prescribed range, steady ac frequency near rated value and smooth waveform. However, with increased load demand, power electronic equipments and automation in industrial processes create disturbance in the ideal power quality issues [1, 2]. These disturbances include

a. Voltage variation: Over voltages, under voltage, sag, swell, flicker, dips, reactive power
b. Frequency: over frequency, under frequency
c. Waveform: harmonic, transient, oscillation, notching

The various dynamic loads such as electric drives, arc furnaces, rolling mills and spot welding machines absorb heavy reactive power for their operation. These loads are major source of power quality problems in terms of harmonic, large reactive power, voltage flicker and fluctuation [3, 4]. Therefore System losses and system cost increases. For improving the industrial power supply quality some useful standards are developed by IEEE [5-7]. To meet these standards and overcome power quality problems various types of devices are used such as synchronous condenser, fixed reactor or fixed capacitor, FACTS devices [8, 9], active and passive filters [10].

Proposed work is carried out in steel industry. Steel plants production is based on Electrical Arc Furnace (EAF) for smelting and refining of scrap material. EAF is a nonlinear and time varying load. It demands large fluctuating reactive power. Therefore EAF is responsible for producing power quality problems in form of harmonics, poor power factor, voltage sag and swell, and flickers and fluctuations [11, 12]. To remove these power quality problems SVC plays a vital role over other devices due to it produced required reactive power [13-15]. Fixed Capacitor-Thyristor Controlled Reactor (FC-TCR) type SVC is considered in proposed work to mitigate harmonics and reactive power compensation.

In this paper, Impact of SVC on power Quality phenomenon (harmonics, reactive power, and voltage fluctuation) which is produced by steel plant is studied. Section II introduces proposed a scheme, SVC, and nonlinear load (furnace) operation. The basic principle of operation of TCR-FC type SVC is explained briefly in section III. Control strategy for firing angle variation is described in section IV. Section V carries out simulation results to demonstrate the effectiveness of SVC.

## II. PROPOSED METHODOLOGY

The block diagram of proposed scheme for reactive power compensation and harmonic elimination is shown in Fig 1. It consists of power source, non-linear load for representing EAF, Static VAr compensation (SVC) and firing delay angle controller to control reactive power output of SVC. Combination of TCR and FC is used for rapidly controlling of reactive power and harmonic mitigation [].

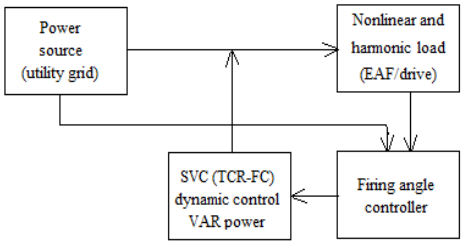



***Fig.1. Block diagram of proposed scheme***

***A. SVC (Static VAr Compensator)***

To improve power system quality and stability various types of FACTS devices are used [8]. These are series controller and shunt controller. SVC is one of the shunt controller FACTs devices which are able to provide controlled and variable reactive power leading, lagging or combination of both. SVC's are used to control dynamic and steady state system voltages, improve transient stability, correct power factor, reduce voltage flicker and fluctuation at industrial arc furnaces, damping oscillation, and reduce sub synchronous resonances[16]. SVC consists of following main parts and their combination Fig 2:

*i.* Thyristor controlled Reactor (TCR) which is generally operated with fixed capacitor (TCR-FC).
*ii.* Thyristor switched reactor (TSR)
*iii.* Thyristor switched capacitor (TSC)
*iv.* Combination of TCR and TSC (TCR-TSC)

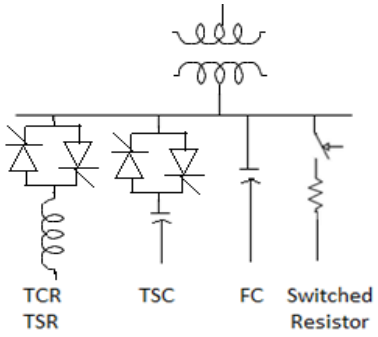



***Fig.2. Different types of SVC***

TSR and TCR both are shunt connected thyristor controlled reactors. Output of TSR is controlled in stepwise manner that is 'completely on' or 'completely off', whereas output of TCR is controlled by controlling firing angle. TSC operates similar as TSR, but capacitor is present instead of reactor. The reactance of TSC is varied by thyristor switch that is either fully connected or fully disconnected. With different combinations of these components, SVC fulfills variable reactive power requirement.

***B. Nonlinear load (EAF)***

Many power quality problems are produced because of industrial nonlinear loads. Due to varying impedance, current drawn by these loads is non sinusoidal. EAF is an unbalanced, nonlinear and time varying load [11]. Many factors are involved in the furnace operation such as electrode position, electrode arm control scheme, supply voltage, operating reactance and the materials used for smelting and refining [12]. EAF operation is divided into three distinct steps; striking (boring), melting, and refining. During the striking stage, the electrode is lowered with the help of hydraulic actuator system to maintain the stable arc. Then at melting stage a maximum no of buckets of scrap material are added into the furnace. The pieces of steel create momentary short circuits at secondary side of the furnace transformer. Therefore arc characterizes are changed and causes fluctuation in current [17, 18]. The refining period is further divided in several stages. During the refining stage, a long arc is produced. The arc currents are more uniform during the refining period hence, less impact on the power quality problems. This Arc current is also responsible to create harmonic problem. Dynamic V-I characteristics of arc furnace is illustrate in Fig 3.

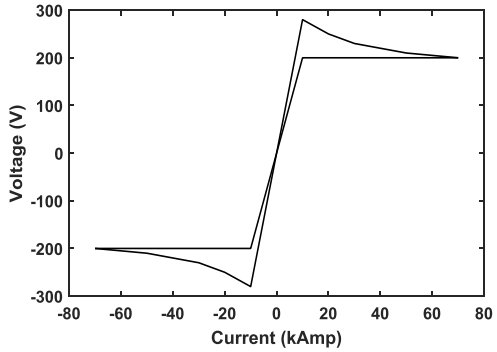



***Fig.3. Dynamic V-I characteristic of arc furnace***

Single line diagram of proposed work is represented in Fig. 4. The model consists of the variable-resistance and variable-inductance combination and representing the time variation at the fundamental frequency component and current source in parallel with the EAF to inject the harmonics and the inter harmonics of the EAF current [19-20]. Shunt connected SVC is used to improve power quality of EAF [21].

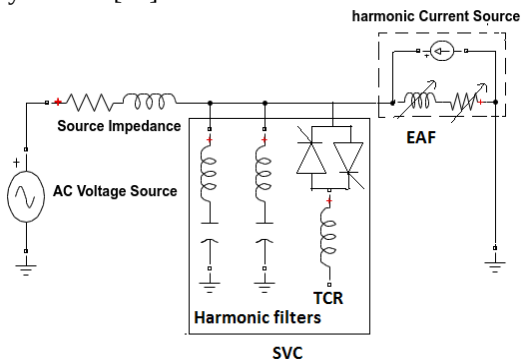



***Fig.4. Single line diagram of proposed work***

 ISBN: 978-81-932966-5-3

## III. THEROTICAL BACKGROUND OF (TCR-FC)

TCR-FC type SVC is used in proposed work for reactive power compensation and harmonic mitigation.

### *A. Principle of Operation of TCR-FC-*

The TCR-FC type var compensator generator consists of a variable reactor (controlled by delay angle α) and a fixed capacitor as shown in Fig. 5. The reactor current can be controlled from maximum value to zero by changing the firing angle delay [22]. The range of firing angle 'α' of TCR extends from 90o to 1800. When thyaristor is completely closed (α= 90o) current reaches the highest value in the reactor and when α = 1800, thyristor valve is switched off completely and the current reaches the lowest value. A basic TCR consist of an anti-parallel connected pair of thyristor valves in series with reactor. The TCR acts like a variable susceptance [23]. Variations in the firing angle, alpha changes the susceptance and consequently, the fundamental current component which is shown by equation (1),

$$i_L(t) = \frac{1}{L}\int_{\alpha}^{\omega t} v(t)dt = \frac{v}{\omega L}(\sin \omega t - \sin \alpha)) \quad (1)$$

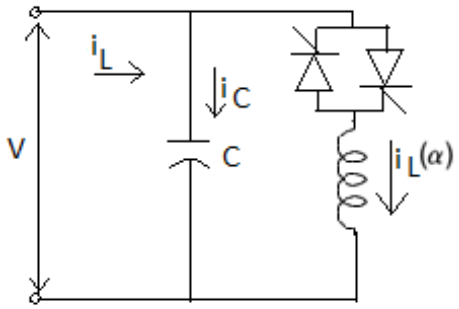



***Fig.5. TCR-FC type SVC***

Then Fundamental reactor current is carried out from above equation,

$$i_{LF}(\alpha) = \frac{v}{\omega L}\left(1 - \frac{2}{\pi}\alpha - \frac{1}{\pi}\sin 2\alpha\right) \quad (2)$$

susceptance of TCR,

$$B_L(\alpha) = \frac{1}{\omega L}\left(1 - \frac{2}{\pi}\alpha - \frac{1}{\pi}\sin 2\alpha\right) \quad (3)$$

## IV. CONTROL SCHEME

SVC can generate required reactive power by varying firing pulse of TCR [24], [25]. Therefore this control system is used to generate appropriate firing pulses as well as fast and dynamic control operation of reactive power compensation. Fig.6. shows control system for SVC. This system is divided into four parts.

i) Voltage measurement

Voltage measurement measures the positive-sequence primary voltage. This unit is driven by a Phase-locked loop (PLL) is used to continuously changing frequencies and phases according with measured input signal. Basically PLL consists of variable frequency oscillator and phase detector.

ii) Voltage regulation

Voltage Regulator uses a PI regulator to regulate primary voltage at the reference voltage. A voltage droop is incorporated in the voltage regulation to obtain a V-I characteristic with a slope. Operating point of SVC changes from fully inductive to capacitive value with system voltage.

iii) Distribution system

Distribution Unit uses the primary susceptance Bsvc computed by the voltage regulator to determine the firing angle α of TCR. The firing angle α as a function of the SVC susceptance Bsvc is implemented by a look-up table from the equation (3)

iv) Synchronous and Firing unit

Firing unit gives firing pulse to each phase of TCR. This is accomplished by the firing pulse generator circuit which produces the necessary gate pulse for the thyristors to provide the reactive current. This unit consists of PLL for synchronize gate pulse with peak value of system voltage

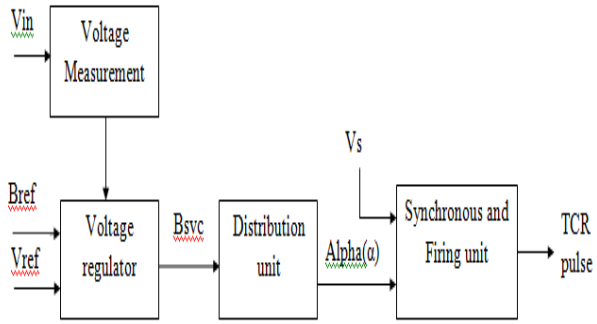



***Fig.6. Control scheme for TCR-FC***

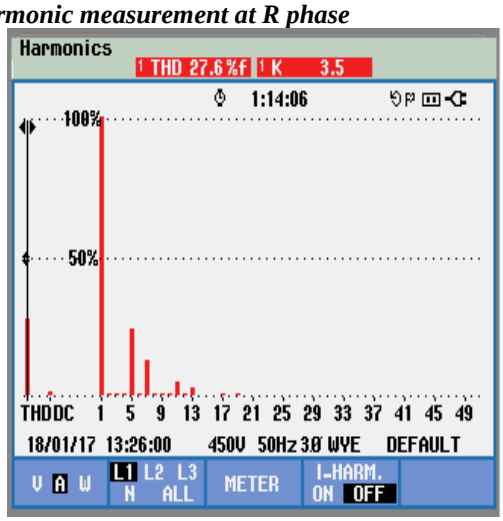
## V. RESULTS AND DISCUSSION

For designing, analysis and modeling of SVC measurement are done at EAF. According to these measurements data calculate the design parameters and analyze the effectiveness of SVC [26].

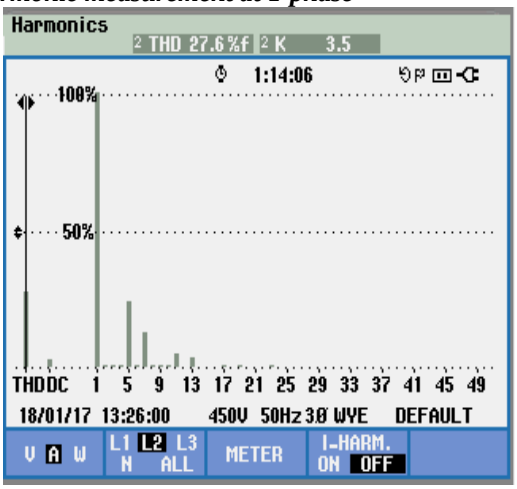
Measurement carried out at EAF

- Connected Load - 1555 KW
- Actual load – 1220 KW

***1. Harmonic measurement at R phase***




***2. Harmonic measurement at Y phase***




***3.Harmonic measurement at B phase***

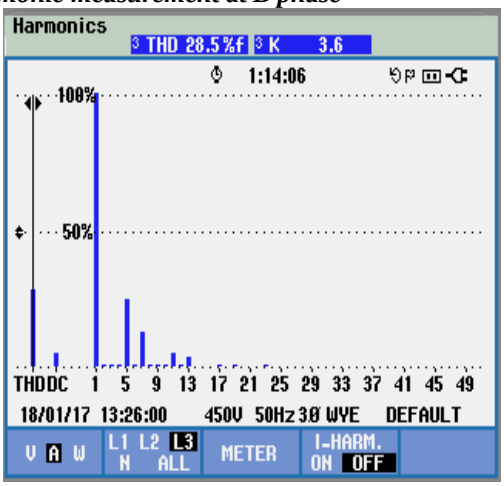



***Fig.7. Power analyzer's readings***

For power quality analysis required data is available from above power analyzer's screenshots as described in Fig.7. Table 1 represents summary of harmonics present at furnace. By analyzing all data 5th and 7th order of harmonic is dominating. This order of harmonic is reduced by connecting passive filter which is tuned at particular frequency.

***Table 1.Summary of harmonics present at furnace***

| Parameters | Current Harmonics (%) At Furnace | | |
|---|---|---|---|
| Phase | R phase | Y phase | B phase |
| I-THD | 27.6 | 27.7 | 28.5 |
| 3rd harmonic | - | - | - |
| 5th harmonic | 23.7 | 27.7 | 24.6 |
| 7th harmonic | 12.3 | 12.0 | 12.7 |
| 9th harmonic | - | - | - |
| 11th harmonic | 4.9 | 4.7 | 4.2 |
| 13th harmonic | 3.2 | 3.8 | 3.5 |

***B. Designing of FC-TCR***

***1. Fixed capacitor***

Total reactive power requirement - Q MVAR
Source voltage -V
Dominating harmonics - $5^{th}$, $7^{th}$

$$Qnet = Vs^2/X_1 \quad (4)$$

Then
At resonance frequency $X_{L2} = X_{c2}$
$X_{L1} * h = X_{C1} / h$, $X_{L1} = X_{C1} / (h)^2$
Then,
$X1 = X_{C1} - X_{L1} = X_{C1} - X_{C1} / (h)^2 = ((h)^2 - 1) X_{C1} / (h)^2$
From $X_{C1}$ and $X_{L1}$, we can find value of c and L
$X_{C1} = 1/ (2 \pi f C)$, $X_{L1} = (2 \pi f L)$

***2. TCR***

By controlling firing angle, current through TCR changes as equation (5). Therefore, reactive power of TCR changed [26]. Value of inductor is depends on reactive power and to control overvoltage in system value.

***B. Simulation result***

***1.Harmonics mitigation***

MATLAB/simulink model is developed for 5th and 7th order of harmonics mitigation. Fig. 8 shows the voltage and current waveform. This is the disturb waveform containing 5th and 7th order dominating harmonics.

 ISBN: 978-81-932966-5-3

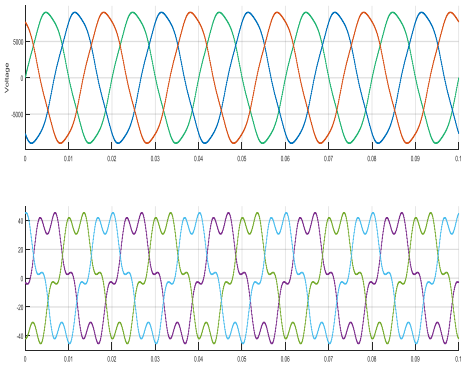


***Fig.8. Voltage and Current waveform (Without filter)***

After connecting passive filter tuned with resonant frequency pure sinusoidal waveform is achieve. It is illustrate in Fig.9.

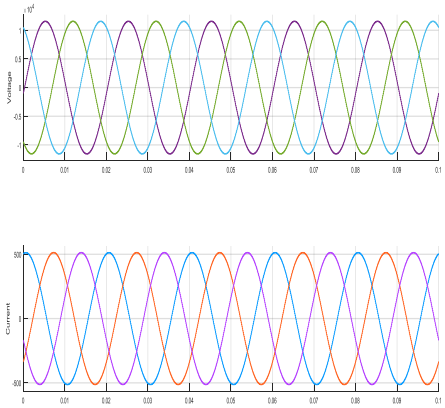
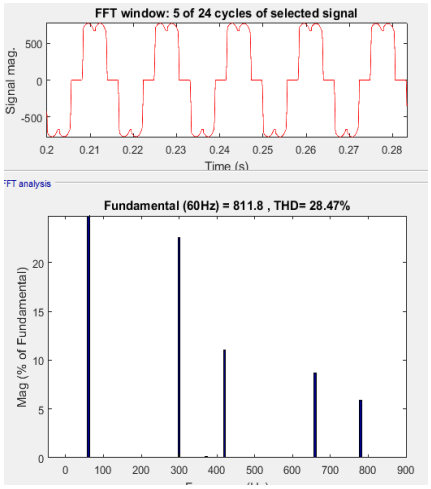
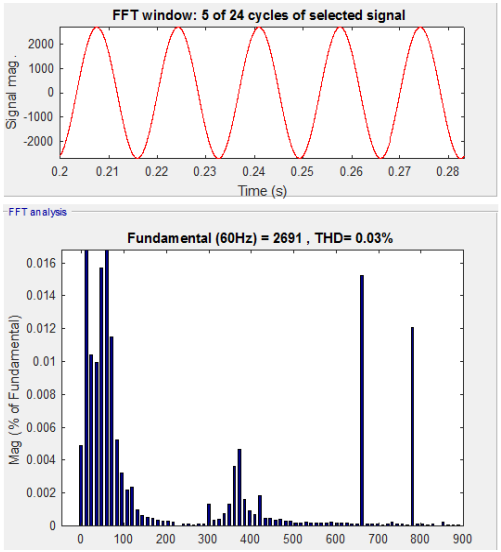


***Fig.9. Voltage and current (with filter)***

Total harmonic distortion of current are also shown Fig.10 by using FFT analysis. Before connection of passive filter THD of current waveform is 28.47% and after connecting filter THD is reduced to 0.03%.




***(a)***

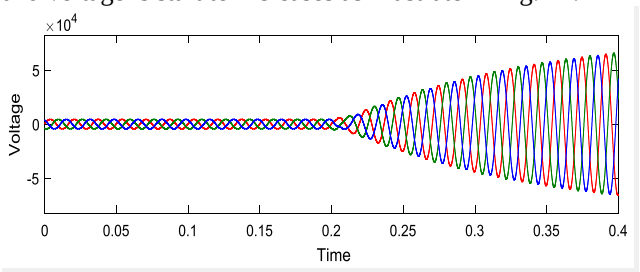



***(b)***

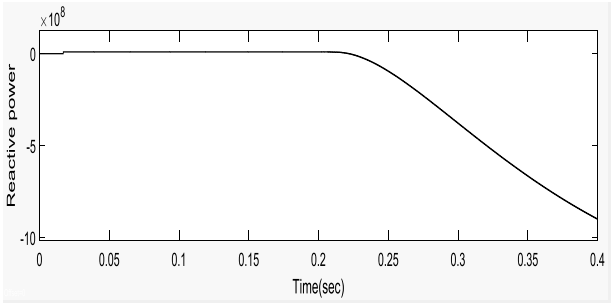
***Fig.10. FFT Analysis (a) with filter (b) without filter***

***2. Reactive power compensation with SVC***

Model of SVC is developed in MATLAB / simulink for observing dynamic response of TCR with system voltage. Fig. 8 shows variation of firing angle alpha and suseptance (Bsvc) according per unit value of system voltage. At t = 0.2 s heavy inductive load is disconnected from the system and voltage is start to increases as illustrate in Fig. 11.



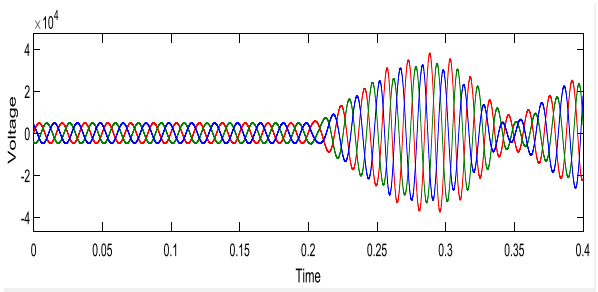

***(a)***



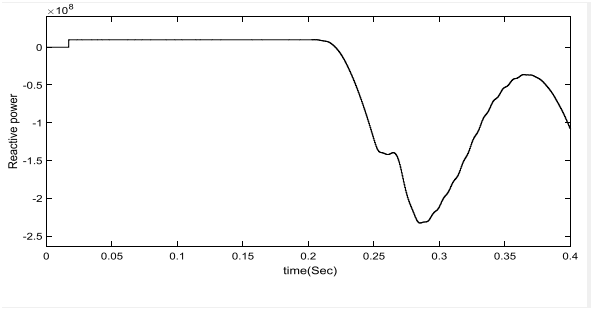

***(b)***

***Fig.11. without SVC (a) voltage (b) reactive power***

If the SVC is connected into system then it is absorbed the increasing reactive power and voltage fluctuation is reduced as shown in Fig.12.




*(a)*




*(b)*

***Fig.12. with SVC (a) voltage (b) reactive power***

When per unit voltage is start to increases TCR is fired and reactive power is absorbed. TCR pulses are shifted by changing firing angle and therefore current in TCR also changes. TCR is responsible to reduce voltage fluctuation as shown in Fig.13.

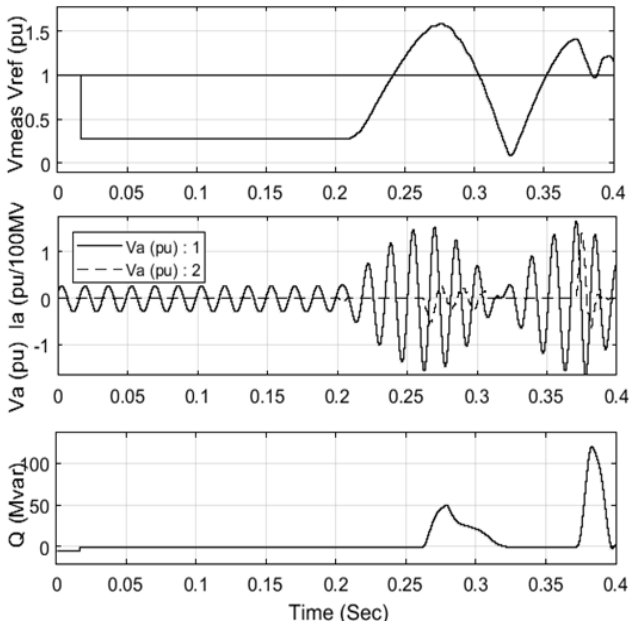



***Fig.13. TCR current and voltage***

As the simulation results showed, it is clear that the proposed SVC model and its control system able to provide required reactive power and mitigate harmonics from system.

## CONCLUSION

SVC successfully compensates the dynamical variation in reactive power. The variation of reactive power by varying firing angle is studied with the help of control scheme of SVC. The range of reactive power control can be increased by using the combination of thyristor-controlled reactor and fixed capacitor system. It is also observed that harmonics can be effectively mitigated by a specifically tuned passive filter. Therefore SVC with passive filter improves power quality of steel plant.

## REFERENCES

[1] M.H.J. Bollen, "Review-What is power quality?", Electric Power Systems Research, vol-66, PP-5-14, 2003

[2] Ibrahim M. El-Amin, Abdullah Al-Elyani and Abde lrahman Shuaib, "Power Quality Indices: A Saudi Steel Mill Case Study",International Conference On Computing, Electrical And Electronic Engineering,2013

[3] Ambra Sannino, Jan Svensson, Tomas Larsson, "Review-Power electronic solutions to power quality problems", science direct Electric Power Systems Research, Vol-66 PP:71-82, 2003

[4] Peter W. Hammond, Robicon Coy, "A new approach to enhance power quality for medium voltage drives" IEEE conference, Paper No.-PCIC-95-25, August 2002

[5] IEEE standard 519-1992, "IEEE Recommended practice and requirements for harmonic control in electrical power systems"

[6] IEEE Std 141-1993, "IEEE Recommended practice for electric power distribution for industrial plants"

[7] IEEE Std 1459-2002, "IEEE Recommended practice for measurement and limits of voltage fluctuations and associated light flickers on ac power systems.

[8] Gaurav singh J. Rajput, "Use Of Facts Device For Improving Power Quality In Industry", International Journal of Electrical Engineering & Technology, Volume 8, Issue 1, January-February 2017, pp. 38–44,

[9] Huilian Liao, Jovica V. Milanovic, "On capability of different FACTS devices to mitigate a range of

power quality phenomena", IET Generation, Transmission & Distribution

[10] Gonzalez Damian A., McCall, John C. "Design of Filters to Reduce Harmonic Distortion in Industrial Power Systems," IEEE Transactions on Industry Applications, vol. IA-23, pp.505-511, 1987

[11] Özgül Salor, Burhan Gültekin, Serkan Buhan, Burak Boyrazo˘glu, Tolga ˙Inan, Tevhid Atalık, Adnan Açık, Alper Terciyanl, "Electrical Power Quality of Iron and Steel industry in Turkey", IEEE transactions on industry applications, vol. 46, no. 1, February 2010.

[12] Y.J. Hsu, K.H. Chen, P.Y. Huang and C.N. Lu, "Electric Arc Furnace Voltage Flicker Analysis and Prediction", IEEE Transactions on Instrumentation and Measurement, Vol. 60, No. 10, October 2011.

[13] Albrecht wolf, Manoharan Thamodharan, "Reactive power reduction in three-phase electric arc furnace", IEEE Transactions on industrial electronics, vo1.47, no.4, pp 729-33, Aug.

[14] Ali Asghar Ghadimi, Narges Rezayi Ravesh, "Arc Furnace Power Quality Compensation Using SVC: A case study in IRAN", Electrical Power Distribution Conference, May 2016

[15] Isamu Hosono, Masao Yano, Shunichi Yuya, Satoru Sueda, "Suppression and Measurement of arc furnace flicker with a large Static VAr Compensator", IEEE Transactions on Power Apparatus and Systems, Vol. PAS-98, No.6 Nov./Dec. 1979

[16] Yi-Kuan Ke, Pei-Hwa Huang and Ta-Hsiu Tseng, "Performance Measurement of Static Var Compensators in Distribution System'', SICE Annual Conference, Taiwan. Vol.2, No. 6. 21 August 2010.

[17] Rafael Collantes-Bellido, Tomas Gome, "Identification and modeling of a Three Phase Arc Farnace for Voltage disturbance Simulation", IEEE Transactions on Power Delivery, Vol. 12, No. 4, October 1997.

[18] G. C. Maontanari, M. loggini, A. Carallini, L. Pitti, D. Zaninelli, "Arc furnace model for the study of flicker compensation in electrical networks.", IEEE Transactions On power delivery, vol3, No 4, 1994.

[19] Thomas J. Dionis, Sam Morell, Thomas L. Mank, "Installation, Startup and Performance of a Static VAr Compensator for an Electric Arc Furnace Upgrade", IEEE Transactions on Industry Applications, July 2017

[20] M. B. Jannat, J. S. Abdulmalek, "Reducing the Effects of Harmonics Produced by Electrical Arc Furnaces inMisurata Steel Plant", Environment and Electrical Engineering (EEEIC), 2012, 11th International Conference, May 2012.

[21] Sam Morello, Thomas J. Dionise, "Comprehensive Analysis to Specify a Static Var compensator for an Electric Arc Furnace Upgrade", Volume: 51, December 2015.

[22] Miller T.J. Reactive Power Control in Electric Systems. John Willey & Sons: New York, 1982

[23] Rolf Grünbaum, Per Ekström, Anna- Åsa Hellström, "Powerful Reactive Power compensation of a Very Large Electric Arc Furnace", 4th International Conference on Power Engineering, Energy and Electrical Drives Istan bul, Turkey, 13-17 May 2013.

[24] H. Samet and M. Parniani, "Predictive method for improving SVC speed in electric arc furnace compensation," IEEE Trans. Power Del., vol. 22, no. 1, pp. 732–734, Jan. 2007.

[25] Arash Dehestani Kolagar, Arash Kiyoumarsi, "Reactive power compensation in a steel industrial plant with several operating electric arc furnaces utilizing open-loop controlled TCR/FC compensators", Euro. Trans. Electr. Power 2011; 21:824–838.

[26] IEEE Special Stability Control Working Group, "Static Var Compensator Models for Power Flow and Dynamic Performance Simulation", IEEE Trans., on Power Systems, Vol. 9, pp. 229-240, 1994

# To Design Efficient and Reliable Smart Grid AMI for Meter Reporting Technique

[1] Nikhil M.Manekar, [2] Prof. A. N. Thakare
[1] M.Tech, [2] Assitant Professor
[1][2] Computer Science and Engineering, Bapurao Deshmukh college of Engineering,sewagram
[1] manekar.nikhil777@gmail.com, [2] amu_thak@rediffmail.com

*Abstract*:-- **Due to the lack of automated scrutinizing, poor visibility, situational alertness and mechanical switches, today's electric power grid is getting older and unsuitable for twenty-first century's increasing demand for electricity. Besides, the global climate change and the greenhouse gas emissions on the Earth caused by the electricity industries, the growing population, one-way communication, equipment failures, energy storage problems, the capacity limitations of electricity generation, decrease in fossil fuels, and resilience problems put more stress on the existing power grid. Consequently, the smart grid (SG) has emerged to address these challenges. To realize the SG, an advanced metering infrastructure (AMI) based on smart meters is the most important key. A smart grid is an intelligent electricity grid that analyzes the distribution and consumption of electricity, which can be used to optimize the generation, distribution, and consumption of electricity.**

**Index Terms: advanced metering infrastructure, communications, security, smart grid, smart meters.**

## I. INTRODUCTION

AMI (Advanced Metering Infrastructure) is the collective term to describe the whole infrastructure from Smart Meter to two way-communication network to control center equipment and all the applications that enable the gathering and transfer of energy usage information in near real-time. Two-way communication with the customers has been possible by the usage of AMI, which is the backbone of smart grid. The objectives of AMI can be remote meter reading for error free data, network problem identification, load profiling, energy audit and partial load curtailment in place of load shedding [1]. Thus, besides enabling a more accurate fine-grained power data from the consumers for grid operations, many new applications can also use this Advanced Metering Infrastructure (AMI). For instance in Outage Management System (OMS) application [5], SMs can collect and send the real-time outage information when outage occurs. SMs can also send on-demand verification after outage restoration information based on the utility company's request.

While many approaches exist for the performance improvement of IEEE 802.11s-based SG AMI communications networks, none of these approaches considered the impact of the gateway location on the performance of data collection. Different gateway locations will affect the routing paths from SMs and thus the performance of IEEE 802.11s-based SG AMI communications network under different gateway placement locations needs to be investigated before it can be deployed, particularly when the peak load traffic occurs. This may happen when all SMs send their data simultaneously or when outage occurs in large area due to the bad weather and many SMs send their outage reports to the utility company in real time. Here the gateway placement in a NAN by exploiting the combinatorial optimization for network facility location problems [1].

As compared with the conventional energy meter, Smart meter is an advanced energy meter that supports two-way communications. Hence, it can measure the energy consumption data of a consumer and then transmits added information to the utility companies and energy storage devices, and bill the customer accordingly [11]. Usually, smart meters can read the real time energy consumption information of customers, such as value of voltage and meter id then this information is securely transmitted to control centers. By using bidirectional communication of data, smart meters can collect information regarding the electricity consumption values of customer premises. The different parameters such as the unique meter identifier and the unit of electricity consumption are combined together and stored by smart meter. The usage of the energy can be monitored on the basis of the data collected by smart meters. Smart meters can be programmed such that, only power consumed from the utility grid is billed whereas the power consumed from the distributed generation sources or storage devices owned by the customers is not billed [11].

A smart meter system includes various control devices and microcontroller to identify parameters in SG and then the collected data is transmitted to the control center via GSM device in smart meter. The utility companies gets an advantage to manage electricity demand/response more efficiently from the collected electricity consumption data

from all devices of customers on a regular basis and it also helps the utility companies to provide useful information to the customers about the variations in the electricity usage in their residence. Hence, smart meters would play an extremely important role in monitoring the performance and the energy usage characteristics of the load on the electricity distribution grid in the future [9].

Typically, smart meters implement two major functions, which are communication and measurement [11]. Hence, each meter is equipped with two subsystems as communication and metrology, respectively. Smart meters should have four basic functionalities, which include the following:

***Security communication:*** The meters have ability receiving operational commands and sending stored data as well as upgrades for its firmware trustworthily.

***Power management:*** Smart meters have to help the system to properly maintain its functionality when the primary source of energy is lost.

***Display:*** Smart meters will send and display information usage of electricity energy to customers for billing in real-time. Besides, the information of real time consumption displayed on smart meters helps customers to manage their demand efficiently.

***Synchronization***: Typically, smart meters transmit data of customers to the collector systems or central hubs for billing and data analysis. Hence, timing synchronization is very important for reliable transmission of data.

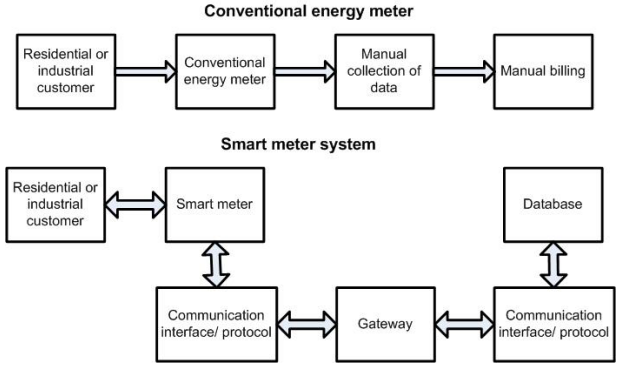



***Figure 1. Architectural model of conventional energy meter and smart meter [11].***

## II. LITERATURE REVIEW

NicoSaputro,[1] In this paper, we proposed three novel data collection mechanisms to set the periodic reporting time of each smart meter to improve TCP performance in IEEE 802.11s-based wireless mesh AMI networks. In this paper, solve the problem of data collection in IEEE 802.11s-based SG AMI networks in terms of scheduling and gateway placement also.

NicoSaputro[2], the author proposes a packet reassembly mechanism for TCP. We evaluated the effectiveness of our proposed mechanism using both PHE and FHE-based aggregation approaches in AMI in terms throughput and end-to-end delay on a 802.11s-based wireless mesh network by using the ns-3 network simulator.

K. Akkaya, [3] focus on the routing issues in the SG communications infrastructure which consists of different network components, such as Home Area Networks (HANs), Neighborhood Area Networks (NANs) and Wide Area Networks (WANs). We also identify the future research issues that are yet to be addressed with respect to the applications and network components.

V. Gungor, [4] in this paper overviews the issues related to the smart grid architecture from the perspective of potential applications and the communications requirements needed for ensuring performance, flexible operation, reliability and economics.

Hamid Gharavi, [5] In this paper, the author present a multi-gate mesh network architecture that has been developed to ensure high performance and reliability under emergency conditions when a system expects to receive power outage notifications and exchanges. In order to handle the metering traffic, under time varying outage conditions we introduce a multi-gate and single-class back-pressure based scheduling algorithm, which takes into account both the hop count, as well as the queue length of each mesh node.

Athar Ali Khan, [6] it overcome issues like rising energy demand, aging infrastructure, emerging renewable energy sources, as well as reliability and security, the Smart Grid (SG) paradigm has been introduced with a variety of state-of-the-art enabling information technologies .These technologies cover the areas of embedded sensing, broadband wireless communication, pervasive computing, adaptive control, as well as automated and intelligent S. Shao, [7] in this paper solve the large density of meter data collection problems of a traffic scheduling mechanism based on interference avoidance for meter data collection in Meter Data Collection Building Area Network (MDCBAN).the traffic scheduling algorithm is presented on the basis of interference avoidance schemes.

Nithin.S, [8] in this paper studied a smart grid test bed based on GSM technology which is capable of load management, fault detection and self-healing. Which worked efficiently in single phase. This work could be extended into the smart meter can be easily modified into a smart Energy meter. The system is designed in such way that any other wireless technology like ZigBee or Bluetooth could be interfaced for future implementation.

V. Cagri Gungor,[9] A sophisticated, reliable and fast communication infrastructure is, in fact, necessary for the connection among the huge amount of distributed elements, such as generators, substations, energy storage

systems and users, enabling a real time exchange of data and information necessary for the management of the system and for ensuring improvements in terms of efficiency, reliability, flexibility and investment return for all those involved in a smart grid producers, operators and customers.

BassamAoun. [10]In this paper, address the problem of gateways placement, consisting in placing a minimum number of gateways such that quality-of-service (QoS) requirements are satisfied.

Trong Nghia Le [11] In this paper, derived the Security standards and address the problem network based threats

## III. PROPOSED SYSTEM

### *A. AMI System*

Smart Meter for consumers/ system shall be provided based on GPRS/3G/4G communication technology or combination of these technologies as per the site requirement and to ensure the performance level given in this document[4]. The smart meter data Access point and transported to HES through WAN while the data from smart meters using GPRS/3G/4G technologies shall be transported directly to HES through WAN. The control shall be responsible for proper data exchange among Smart meter, DCU, MDM, HES(Head end System) and other operational/requisite software as part of fully functional AMI system.

AIA may design appropriate architecture for providing end-to-end metering reporting solution. AIA is free to decide upon the best solution out of all the available options. The communication provider may adopt GPRS/3G/4G communication technology or RF based canopy system or a combination of these technologies as per the site requirement adopting best available technology in the proposed area of implementation[7][6].

***The following core modules of AMI system shall be provided:***

a. Smart Meters
b. Communication infrastructure
c. Meter Data Management System (MDM)
d. Web application with updated on-line data of consumers etc.
e. Mobile app: A mobile app through which consumer shall be able to log in through android/Window based mobile app to see information related to his/her energy consumption. App shall also provide platform for implementation of peak load management functionality by providing existing tariff & incentives rates, participation options etc. This mobile app shall be part of complete system and therefore no additional cost shall be payable for upgradation / maintenance separately.

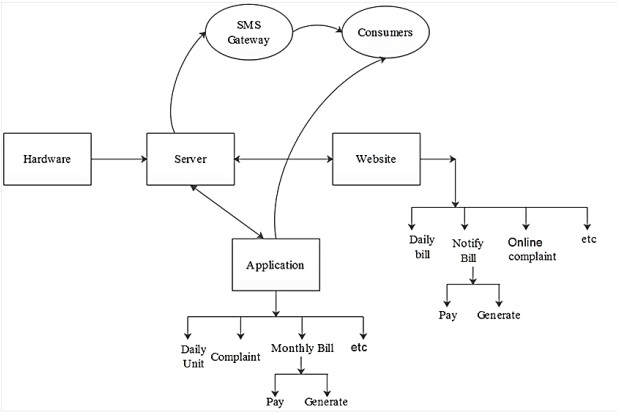



***Fig. 2. Operational Procedure of Smart Grid AMI network***

### *B. Functions of AMI*

The AMI system shall help utility to manage their resource and business process efficiently. AMI system shall support the following minimum functionalities:

a. Remote Meter data reading at configurable intervals(push/pull)
b. Time of day (TOD)/TOU metering
c. bill paid functionality
d. Net Metering/Billing
e. Notification and reporting
f. Remote firmware upgrade
g. Integration with other existing systems like Billing & collection software, consumer indexing, new connections & disconnection.
h. Security features to prevent unauthorized access to the AMI including Smart meter & meter data etc. and to ensure authentication of all AMI elements by third party.

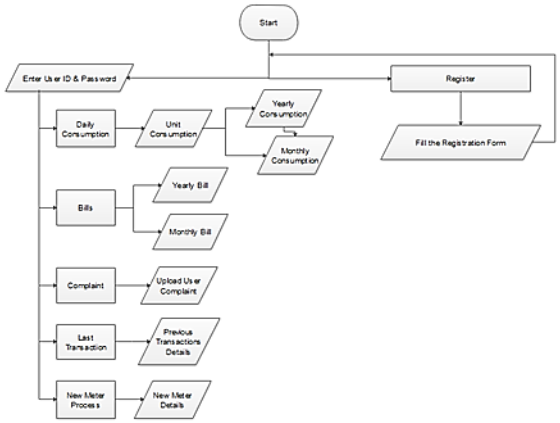



***Fig 3: Data flow diagram of mobile application module***

### *C. Smart Meters*

The Smart meter installation shall be as per the rules and regulations and practices of Utility.After meter installation,

 ISBN: 978-81-932966-5-3

customer identification no., meter ID, its hardware & software configuration, name plate details, make shall be updated in control server. The information would also be updated on the portal/app for providing information to consumers.


***Fig 4: workflow of a smart meter***

***D. Communication infrastructure***

The communication infrastructure should either be based on cellular network. The communication network shall be based on suitable standards from for NAN or WAN network. Communication network shall provide reliable medium for two-way communication between various nodes (smart meter) & HES. RF based network should use license free frequency band available in India.

## IV. NETWORK SECURITY

The Network shall have adequate cyber security measures not limited to the measures as described below. The network security would be extended to all the interfaces also.

***a. Secure Access Controls:*** The system shall include mechanisms for defining and controlling user access to the operating system environment and applications. Best practices from enterprise security including password strength, password aging, password history, reuse prevention etc. must be followed for access control.

***b. Authorization Controls:*** A least-privilege concept such that users are only allowed to use or access functions for which they have been given authorization shall be available.

***c. Logging:*** Logs must be maintained for all attempts to log on (both successful and unsuccessful), any privilege change requests (both successful and unsuccessful), user actions affecting security (such as password changes), attempts to perform actions not authorized by the authorization controls, all configuration changes etc. Additionally, the access to such logs must be controlled in accordance to the least-privilege concept mentioned above, so that entries may not be deleted, accidentally or maliciously.

d. Hardening: All unnecessary packages must be removed and/or disabled from the system. Additionally, all unused operating system services and unused networking ports must be disabled or blocked. Only secure maintenance access shall be permitted and all known insecure protocols shall be disabled.

***e. Malicious Software Prevention:*** Implementation of anti-virus software and other malicious software prevention tools shall be supported for all applications, servers, databases etc.

***f. Network Security:*** The network architecture of the HES must be secure with support for firewalls and encryption. The system shall also allow host-based firewalls to be configured, as an additional layer of security if the network firewall were to fail.

## V. CONCLUSION

AMI based on smart meters in SG has been identified, and their state-of-the-art research activities were reviewed. In addition, the issues on security of AMI in SG have also been discussed. Future SG should comprise intelligent monitoring systems to keep a track of all electricity flows and a huge amount of collected data from smart devices as well. Hence, it must be flexible and resilient to accommodate new requirements in an economical manner. To achieve these goals, communications in AMI based on GSM will certainly play an important role for infrastructures of the SG. Typically, a bad data detection system is used to ensure the integrity of state estimation and to filter faulty measurements introduced by device malfunctions or malicious attacks. Moreover, accurate state estimation methods need to propose in the future to detect blind false data injection attacks because accurate state estimation is of paramount importance to maintain normal operations of AMI.

## REFERENCES

[1] Nico Saputro, Kemal Akkaya, “Investigation of Smart Meter Data Reporting Strategies for Optimized Performance in Smart Grid AMI Networks” IEEE Internet ofThings Journal 2017.

[2] Samet Tonyali, Kemal Akkaya. “A Reliable Data Aggregation Mechanism withHomomorphic Encryption in Smart Grid AMI Networks”, 13th IEEE Annual Consumer Communications & Networking Conference 2016.

[3] N. Saputro, K. Akkaya, and S. Uludag, “A survey of routing protocolsfor smart grid communications” Comput. Netw., vol. 56, no. 11, pp.2742–2771, Jul. 2012.

[4] V. Gungor, E. Natalizio, P. Pace, and S. Avallone, “Challengesand issues in designing architectures and protocols for wirelessmesh networks,” in Wireless Mesh Networks, E. Hossain andK. Leung, Eds. Springer US, 2008, pp. 1–27.

[5] Hamid Gharavi, Chong Xu “Traffic Scheduling Technique for Smart Grid Advanced Metering Applications” IEEE Transaction on communication Vol. 60 June 2012

[6] Athar Ali Khan, Martin Reisslein, "Cognitive Radio for Smart Grids: Survey of Architectures, Spectrum Sensing Mechanisms, and Networking Protocols", IEEE Communications Surveys & Tutorials 2015.

[7] S. Shao, S. Guo, X. Qiu, L. Meng, Y. Jiao, and W. Wei, "Traffic schedulingfor wireless meter data collection in smart grid communicationnetwork," in Computing, Communication and Networking Technologies International Conference on, July 2014

[8] Nithin.S, N.Radhika "Smart Grid Test Bed Based On GSM ", International Conference on Communication Technology and System Design Elsevier 2011.

[9] V. Cagri Gungor, Taskin Kocak, "A Survey on Smart Grid Potential Applications andCommunication Requirements "IEEE Transaction on industrial informatics Vol. 9 February 2013.

[10] Bassam Aoun, Raouf Boutaba, "Gateway Placement Optimization in Wireless MeshNetworks With QoS Constraints " IEEE Journal on selected areas in communication Vol. 24 Nov 2006.

[11] Trong Nghia Le, Wen-Long Chin,, "Advanced Metering Infrastructure Based on Smart Meters in Smart Grid " Inspirations for Energy Utilities – INTECH June 29, 2016.

# DC-DC Converter for Electric Vehicular Application

[1] Diksha S. Ramteke, [2] Manisha B. Gaikwad
[1] Student, M.Tech, [2] Asst. Professor
[1][2] Department of Electrical Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
[1] ramtekeds@rknec.edu, [2] gaikwadmb@rknec.edu

***Abstract*:-- Electric vehicles are becoming increasingly important as not only do they reduce noise and pollution, but also they can be used to reduce the dependence of transport on oil-providing that the power is generated from fuels other than oil. Electric vehicles (EV) can also be used to reduce carbon emissions. Production of zero release of carbon dioxide requires that the energy for EV is produced from non-fossil-fuel sources. Therefore the alternate propulsion technologies have been increasingly pursued by the automobile industries and this has led to the increased development rate of the Hybrid Electric Vehicle (HEV) or Battery Electric Vehicles (BEV) technology in the past two decades. In this paper conventional and isolated dc-dc converter is proposed. Isolated dc-dc converter is used for an energy charging device. This dc-dc converter consists of two H-bridges which are located in primary side and secondary side of the isolation transformer. Transformer is used to isolate the input and output of dc-dc converter. At the same time transformer step-up and step-down the voltage level. Sinusoidal-Pulse-Width-Modulation (SPWM) technique is used for triggering the switches. An equivalent proposed model is simulated and verified through MATLAB/Simulink**

**Index Terms: DC-DC Converter, Electric Vehicle, SiC MOSFET, Transformer, Li-ion Battery.**

## I. INTRODUCTION

As modern culture and technology continue to develop, the growing presence of global working and irreversible climate change draws increasing amounts of concern from the world's population. Countries around the world are working to drastically reduce CO2 emissions as well as other harmful environmental pollutants. Cars and trucks are responsible for almost 25% of CO2 emission and other major transportation methods account for another 12%. DC-DC converters are used in battery charging and discharging system not only to manage the battery charging and discharging current, but also to regulate the discharger's output voltage level to a desired value while the excess energy is stored back to the battery [1]–[3].

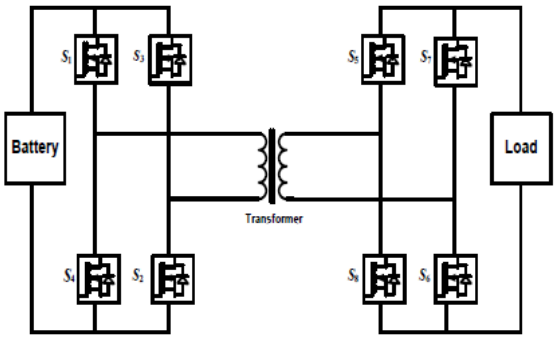



***Fig. 1. Isolated DC-DC Converter***

Fig. 1 shows the isolated dc-dc converter. Basically there are two parts of the isolated dc-dc converter. One is high power side and another is low power side. Transformer is used to transform power from low power to high power side and vice versa. Transformer also provides the isolation between the two converters. In buck operation, receiving end voltage become lower than the sending end voltage and in boost operation, receiving end voltage become higher than sending end voltage.

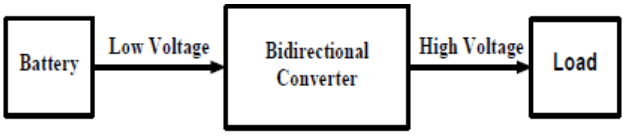



***Fig. 2(a) Battery discharging mode***

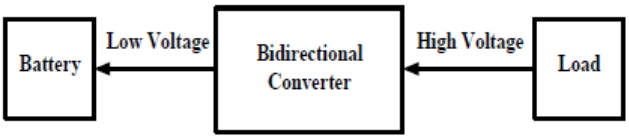



***Fig. 2(b) Battery charging mode***

Fig. 2(a) shows the block diagram of battery discharging mode and Fig. 2(b) shows the block diagram of battery charging mode [4]–[5].

This paper is organized as follows. In Section II, the introduction of Electric Vehicle is presented. Section III described the proposed model of the whole system. Section IV shows the simulation results of buck converter, boost converter, buck-boost converter and isolated dc-dc converter.

## II. ELECTRIC VEHICLE

Due to the increasingly severe environmental problems around the world, exploitation of clean and renewable energy has been a crucial topic. As indispensable transportation in modern society, vehicles are common but also one of the main sources of pollutants. Because of their increasing in demand, it is almost impossible to decrease the volume of vehicles. One of the solution is that to minimize the emissions in the electric vehicle. Overall, the electric vehicle is more energy efficient, environmentally friendly and cleaner than the vehicle that relies on fossil fuels. By popularizing the electric vehicle, both environmental and economic costs of vehicles can be significantly reduced. Therefore, the electric vehicle has attracted the attention of academia as well as industries in the recent decades [6]–[8].

## III. DESCRIPTION OF PROPOSED MODEL

Buck, boost and buck-boost converters are used in non-isolated as well as in an isolated dc-dc converter. An isolated dc-dc converter consists of converter1 (H-bridge inverter) and converter2 (full bridge rectifier).

### *A. Buck Converter*

In a buck converter, the average output voltage Va, is less than the input voltage, Vs—hence the name "buck," a very popular converter. The circuit diagram of a buck converter using a power MOSFET is shown in Fig. 3(a) and this is like a step down converter.

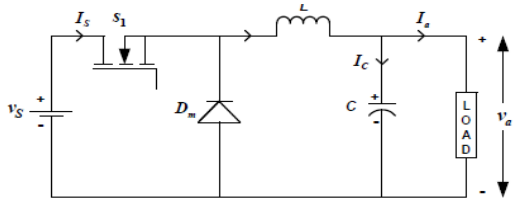



***Fig. 3(a) Circuit diagram of buck converter***

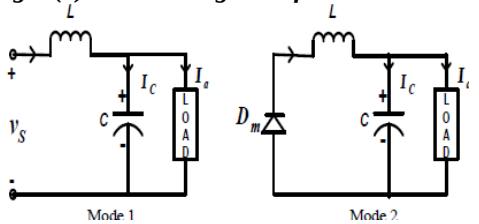



***Fig. 3(b) Equivalent circuit of modes of operation***

The circuit operation can be divided into two modes. Mode 1 begins when switch S1 is switched on at t = 0. The input current which rises flows through filter inductor L, filter capacitor C and load resistor R. Mode 2 begins when switch S1 is switched off at t =t1. The freewheeling diode Dm conducts due to energy stored in the inductor and the inductor current continues to flow through L, C, load and diode Dm. The inductor current falls until switch S1 is switched on again in the next cycle. The equivalent circuits for the modes of operation are shown in Fig. 3(b) [9].

### *B. Boost Converter*

In a boost converter, the output voltage is greater than the input voltage—hence the name "boost." A boost converter using a power MOSFET is shown in Fig. 4(a).

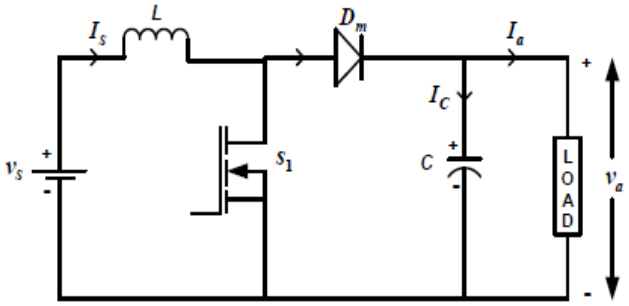



***Fig. 4(a) Circuit diagram of boost converter***

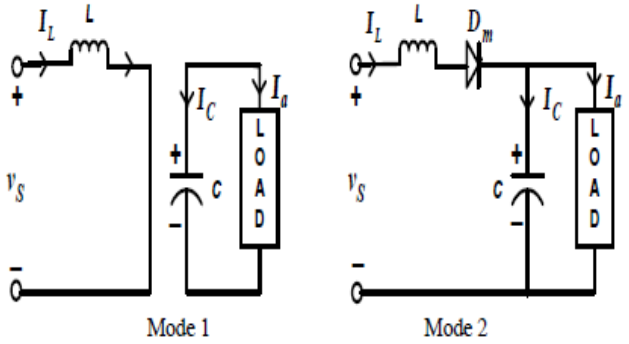



***Fig. 4(b) Equivalent circuit of modes of operation***

The circuit operation can be divided into two modes. Mode 1 begins when switch S1 is switched on at t = 0. The input current which rises flows through inductor L and switch S1. Mode 2 begins when switch S1 is switched off at t = t1. The current that was flowing through the switch would now flow through L, C, load and diode Dm. The inductor current falls until switch S1 is turned on again in the next cycle. The energy stored in inductor L is transferred to the load. The equivalent circuit for the modes of operation are shown in Fig. 4(b) [9].

### *C. Buck-Boost Converter*

A buck-boost converter provides an output voltage that may be less than or greater than the input voltage—hence

the name "buck-boost", the output voltage polarity is opposite to that of the input voltage. This converter is also known as an inverting converter. The circuit arrangement of a buck-boost converter is shown in Fig. 5(a). The circuit operation can be divided into two modes. During mode1, switch S1 is turned on and diode Dm is reversed biased. The input current which rises flows through inductor L and switch S1. During mode 2, switch S1 is switched off and the current which was flowing through inductor L would flow through L, C, Dm and the load.

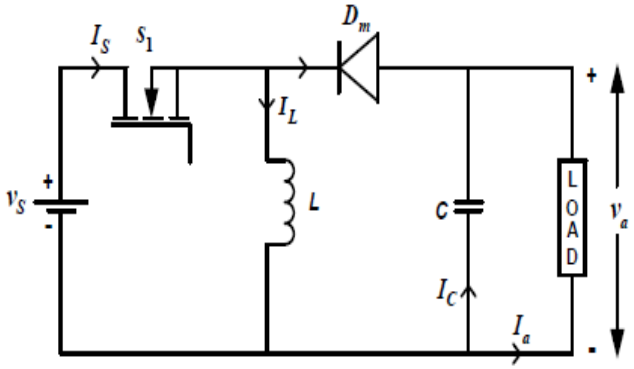



***Fig. 5(a) Circuit diagram of buck-boost converter***

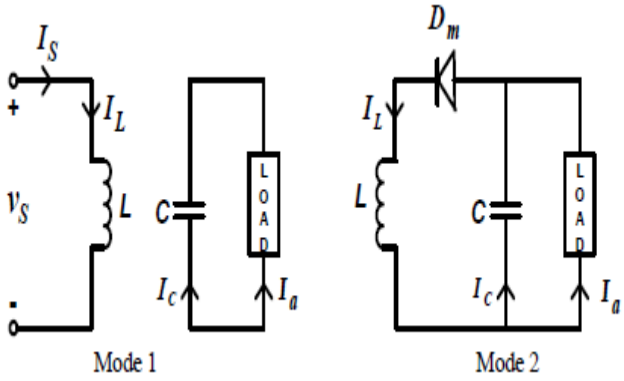



***Fig. 5(b) Equivalent circuit of modes of operation***

device or circuit that converts AC into DC is called "Rectifier". It is also referred as AC-DC Converter. The devices which allow current in one direction only can be used as rectifiers. The circuit arrangement of a single-phase full converter is shown in Fig. 7, with a highly inductive load so that the load current is continuous and ripple free. energy stored in inductor L fed to the load and the inductor current would fall until switch S1 is switched on again in the next cycle. The equivalent circuits for the modes are shown in Fig. 5(b) [9].

***D. Converter1 (H-Bridge Inverter)***

An inverter is a DC to AC converter used to convert a DC input voltage into a symmetrical AC output voltage of desired magnitude and frequency.

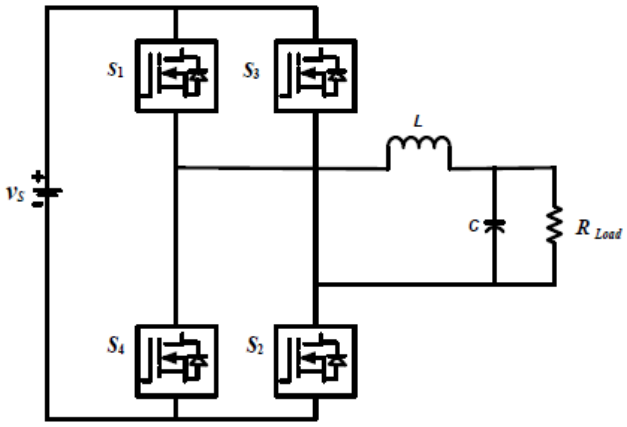



***Fig. 6. Full-bridge inverter***

The wave shape of output voltage are square, quasi-square or distorted sinusoidal. Inverters used in low and medium power applications normally give square or quasi-square wave output which is acceptable. However, in high-power applications sinusoidal waveform is required, so inverters are carefully designed to give sinusoidal output with low distortion. Inverters are widely used in industrial and household applications. Fig. 6 shows the full-bridge inverter [9].

***E. Converter2 (Full Bridge Rectifier)***

AC supply is used in most of the applications worldwide. However, in many applications, DC supply is preferred due to certain advantages. Some of these applications include Battery charging, DC motor drives in paper mills, textile mills, steel-rolling mills etc. Rectification is the process of removing alternations (in magnitude or direction). Thus AC is converted into DC, when alternations in it are removed. A

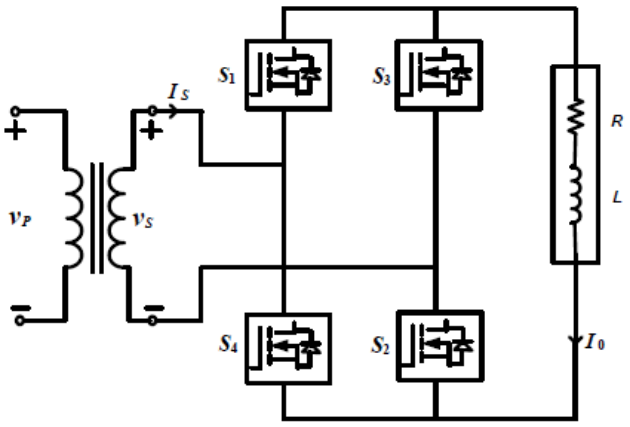



***Fig. 7. Single-phase full bridge rectifier***

From the circuit, we can observe that one switch from a top group (S1, S3) and one switch from the bottom group (S2, S4) must conduct for load current flow. However S1 and S3 or S2 and S4 cannot conduct simultaneously. During

the positive half-cycle, switch S1 and S2 are forward biased and when these two switches are fired simultaneously at wt = α, the load is connected to the input supply through S1 and S2. Due to the inductive load, switch S1 and S2 continue to conduct beyond wt = π, even though the input voltage is already negative. During the negative half-cycle of the input voltage, switches S3 and S4 are forward biased and firing of switches S3 and S4 applies the supply voltage across switches S1 and S2 as reverse blocking voltage [9]–[10].

### *F. Li-Ion Battery*

Since the commercial release of lithium-ion battery in 1991, lithium-ion battery technology has progressed significantly in safety, power and energy densities. Li-ion is a low-maintenance and rechargeable battery. Self-discharge of li-ion battery is less than half of nickel-based systems and this helps the fuel gauge applications. The nominal cell voltage of 3.60V can directly power mobile phones, tablets and digital cameras, offering simplifications and cost reductions over multi-cell designs. Lithium Cobalt Oxide (LiCoO2), Lithium Manganese Oxide (LiMn2O4), Lithium Nickel Manganese Cobalt Oxide (LiNiMnCoO2 or NMC), Lithium Iron Phosphate (LiFePO4), Lithium Nickel Cobalt Aluminum Oxide (LiNiCoAlO2) and Lithium Titanate (Li4Ti5O12) are the types of li-ion battery [11].

## IV. SIMULATION RESULTS

A. Buck Converter

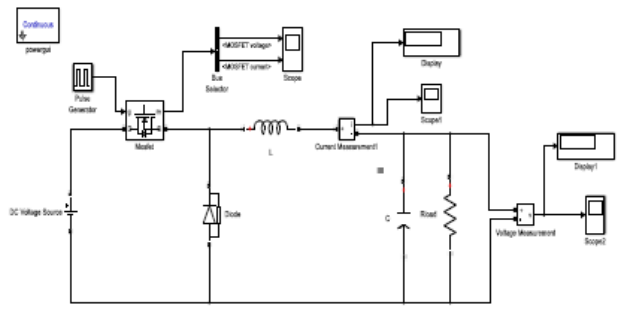


*Fig. 8(a) Simulation model of buck converter*

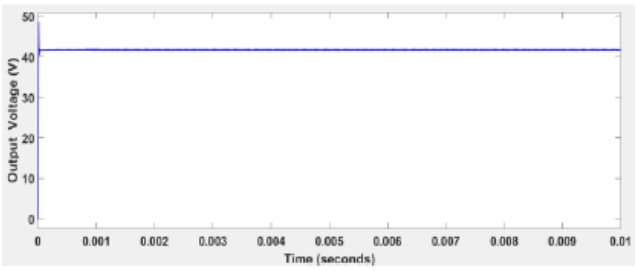



*Fig. 8(b) Simulated result of buck converter*

### *B. Boost Converter*

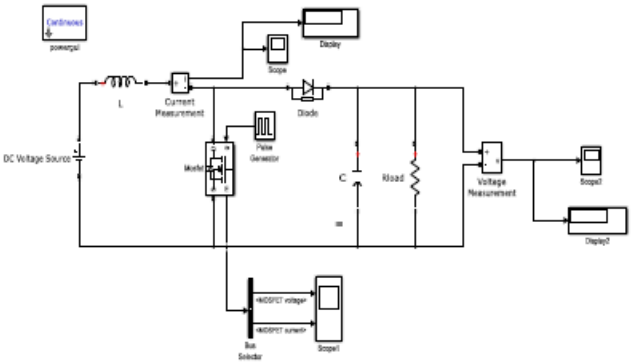


*Fig. 9(a) Simulation model of boost converter*

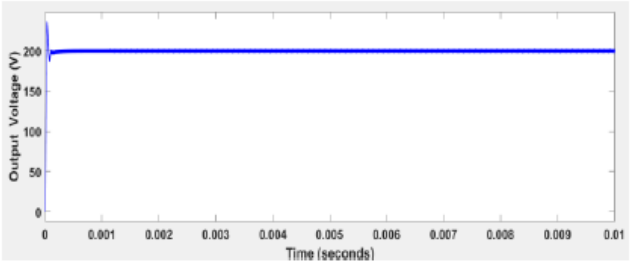



*Fig. 9(b) Simulated result of boost converter*

### *C. Buck-Boost Converter*

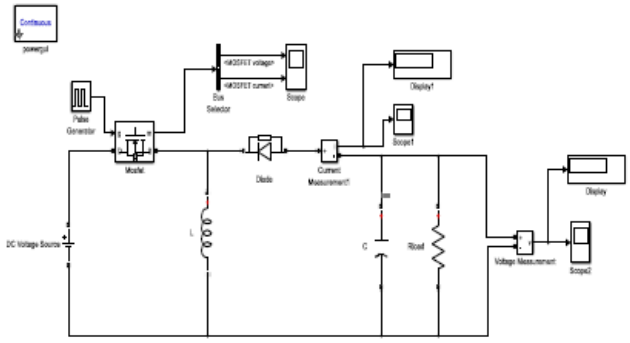


*Fig. 10(a) Simulation model of buck-boost converter*

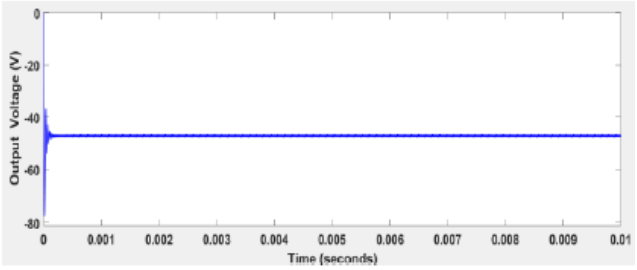



*Fig. 10 (b) Simulated result of buck converter*

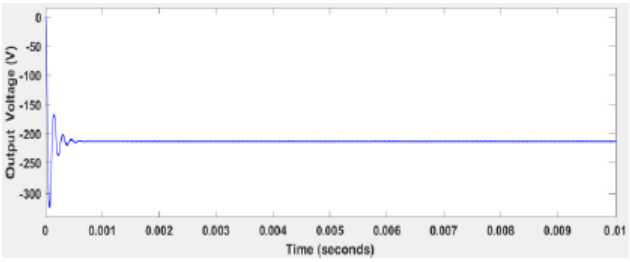



*Fig. 10 (c) Simulated result of boost converter*

In isolated DC-DC converter, two batteries has been taken. First battery is acting as a source and another as a load. In Fig. 11(a), battery is providing dc input to the inverter. It converts this dc input voltage into the ac output voltage. For triggering the switches SPWM technique is used. Transformer step-up this voltage level and also provide isolation between input and output of dc-dc converter. Rectifier converts ac voltage into dc voltage. L and C filter is designed to reduced harmonic contains and battery will be charged at desired voltage.

***D. Isolated DC-DC Converter***

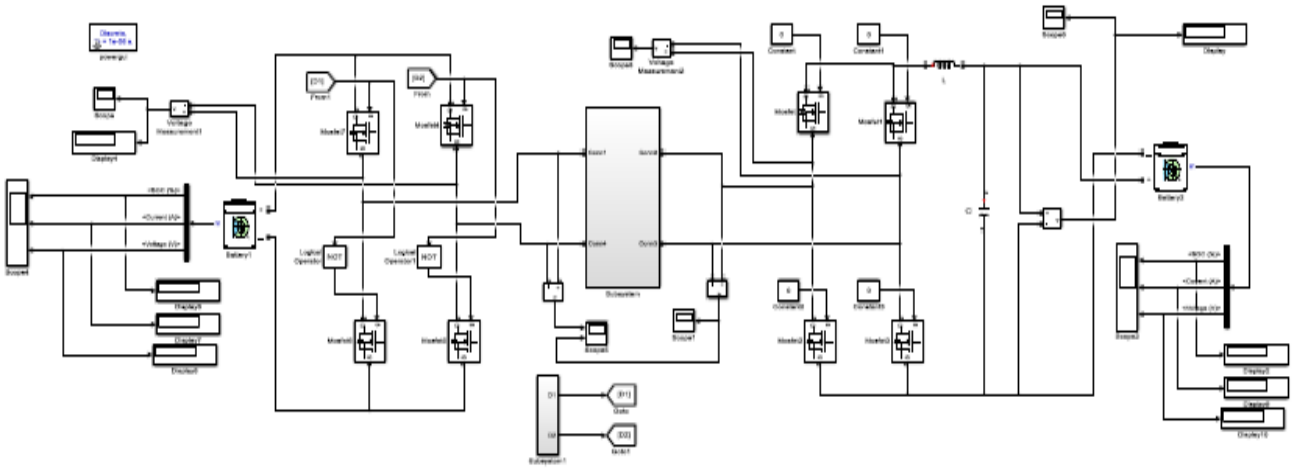


*Fig. 11(a) Simulation model of isolated dc-dc converter*

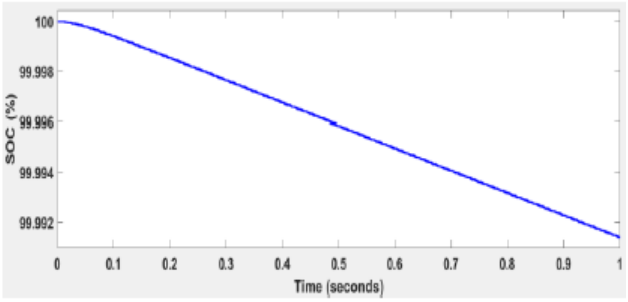



*Fig. 11(b) SOC of battery (battery 1)*

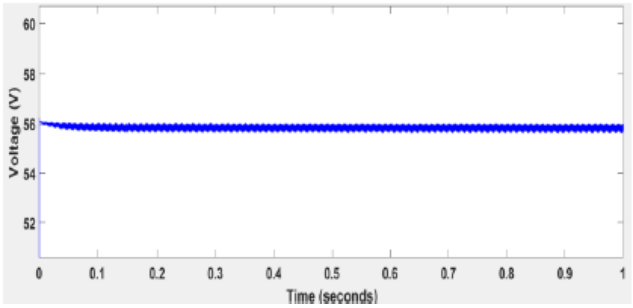



*Fig. 11(d) Simulated result of battery input voltage*

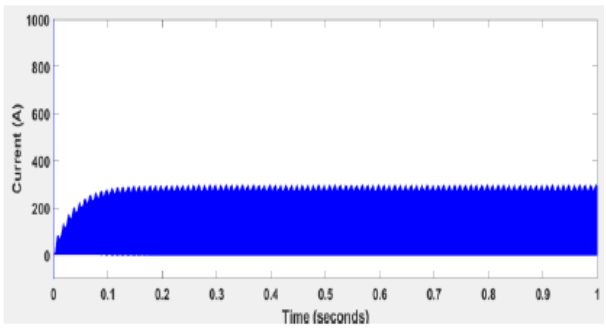



*Fig. 11(c) Simulated result of battery input current*

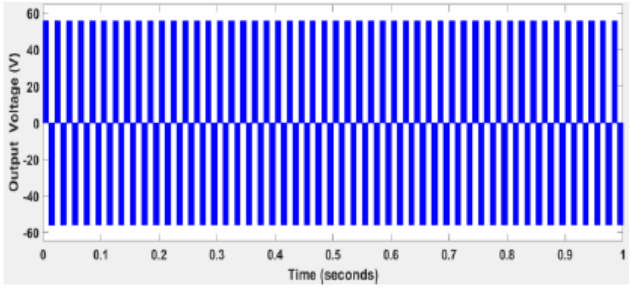



*Fig. 11(e) Simulated result of primary voltage of transformer*

 ISBN: 978-81-932966-5-3

***TABLE I***
***FORMULAE OF BUCK, BOOST AND BUCK-BOOST CONVERTER***

| | Duty cycle | Inductor (L) | Capacitor (C) |
|---|---|---|---|
| Buck Converter | $\frac{V_{out}}{V_{in} * n}$ | $\frac{D\ (V_{in} - V_{out})}{I_{ripple} * f_s}$ | $\frac{I_{ripple}}{8 * f_s * \Delta V_{out}}$ |
| Boost Converter | $1 - \left(\frac{V_{in} * n}{V_{out}}\right)$ | $\frac{V_{in}\ (V_{out} - V_{in})}{I_{ripple} * f_s * V_{out}}$ | $\frac{1 * D}{f_s * \Delta V_{out}}$ |
| Buck-Boost converter | $\frac{V_{out}}{V_{in} + V_{out}}$ | $\frac{V_{in}\ (V_{out})}{(V_{out} + V_{in}) * f_s * I_{ripple}}$ | $\frac{I_{ripple} * D}{f_s * \Delta V_{out}}$ |

Where,

$I_{ripple} = 20\%\ to\ 40\%\ of\ I_{out}$

$\Delta V_{out} = 1\%\ of\ V_{out}$

***TABLE II***
***KEY PARAMETERS***

| Parameters | Buck Converter | Boost Converter | Buck-Boost Converter | |
|---|---|---|---|---|
| Input voltage | 220V | 48V | 220V | 48V |
| Output voltage | 41.65V | 202.5V | -47.59V | -214.6V |
| Duty cycle | 24.24% | 80.363% | 17.91% | 82.089% |
| Switching frequency | 1MHz | 1MHz | 1MHz | 1MHz |
| Inductor | 9.475uH | 14.891uH | 10.261uH | 22.38uH |
| Capacitor | 1.145uF | 0.365uF | 1.79uF | 8.2uF |
| Resistive load | 10Ω | 100Ω | 100Ω | 100Ω |

***TABLE III***
***INPUT AND OUTPUT VALUES OF ISOLATED DC-DC CONVERTER***

| Parameters | Source (battery 1) | Parameters | Load (battery 2) |
|---|---|---|---|
| SOC | 99.9912% | SOC | 10.0064% |
| Input Current | 305A | Output Current | 25.35A |
| Input Voltage | 55.7V | Output Voltage | 228.035V |

## CONCLUSION

This paper presents an isolated dc-dc converter. The main treats of environment and human life is pollution and is done by the use of large number of automobile in this world. Therefore, an isolated dc-dc converter is designed for electric vehicular application and proposed system is simulated in MATLAB/Simulink. In an isolated dc-dc converter SPWM (Sinusoidal-Pulse-Width-Modulation) technique is used to control the switches. In this paper, also buck converter, boost converter, and buck-boost converter has studied and simulated using MATLAB/Simulink. As a future work, bidirectional isolated dc-dc converter can be introduced in the proposed system and performance can be analyzed in MATLAB/Simulink for BFEV.

## REFERENCES

[1] Pritam Das, S. Ahmad Mousavi, and Gerry Moschopoulos, "Analysis and Design of a Nonisolated Bidirectional ZVS-PWM DC-DC Converter With Coupled Inductors," IEEE Trans. on Power Electronics, vol. 25, no. 10, October 2010.

[2] Lung-Sheng Yang and Tsorng-Juu Liang, "Analysis and Implementation of a Novel Bidirectional DC-DC Converter," IEEE Trans. on Industrial Electronics, vol. 59, no. 1, January 2012.

[3] Junlong Lu, Yi Wang, Xin Li, and Songda Wang and Taijun Chen, "A Boost Type Control Strategy in Dual Active Bridge
Bidirectional DC-DC Converter," 2017 IEEE Transportation Electrification Conference and Expo, Asia-Pacific (ITEC Asia-Pacific).

[4] Remon Das and Md. Ashraf Uddin Chowdhury, "PI Controlled Bi-directional DC-DC Converter (BDDDC) and Highly Efficient Boost Converter for Electric Vehicles," iCEEiCT 2016.

[5] Hirofumi Akagi, Shin-ichi Kinouchi, and Yuji Miyazaki, "Bidirectional Isolated Dual – Active – Bridge (DAB) DC-DC Converters Using 1.2-KV 400A SiC MOSFET Dual Modules," CPSS Trans. on Power Electronics and Applications, vol. 1, no. 1, December 2016.

[6] Fan Zhang, Xu Zhang, Min Zhang, Abigail S. E. Edmonds, "Literature Review of Electric Vehicle Technology and its Applications," 2016 5th Inter.Conf. on Computer Science and Network Technology (ICCSNT).

[7] Mehnaz Akhter Khan, Adeeb Ahmed, Iqbal Husain, Yilmaz Sozer, and Mohamed Badawy, "Performance Analysis of Bidirectional DC-DC

Converters for Electric Vehicles," IEEE Trans. on Industry Applications, vol. 51, no. 4, July/August 2015.

[8] ZhenZhang,andKwok-TongChau, "Pulse-Width–Modulation-Based Electromagnetic Interference Mitigation of Bidirectional Grid Connected Converters for Electric Vehicles," IEEE Trans. On Smart Grid, vol. 8, no. 6, Novembor 2017.

[9] M. H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd Edition.

[10] Amir Tokic, Admir Jukan, and Jasmin Smajic, "Parameter Estimation of Single-Phase Rectifier-Based Loads: Analytical Approach," IEEE Trans. on Power Delivery, vol. 31, no. 2, April 2016.

[11] Jorge Varela Barreras, Cl´audio Pinto, Ricardo de Castro, , Erik Schaltz, Søren Juhl Andreasen, Peter Omand Rasmussen, and Rui Esteves Ara´ujo, "Evaluation of a Novel BEV Concept Based on Fixed and Swappable Li-Ion Battery Packs," IEEE Trans. on Industry Applications, vol. 52, no. 6, November/December 2016.

# Privacy Preserving Multi-keyword Ranked Search over Group Shared Encrypted Cloud Data using Ternary Tree

[1] Shruthi Damodaran, [2]Dr. Vinodu George
[1] MTech Scholar, Department of Computer Science and Engineering, LBS College of Engineering and Technology, Kasaragod, Kerala, India.[2] Professor, Department of Computer Science and Engineering, LBS College of Engineering and Technology, Kasaragod, Kerala, India
[1] shruthidamu@gmail.com, [2] vinodu.george@gmail.com

*Abstract:*-- **Increasing popularity of cloud computing has lead the data owner to outsource the data to cloud which is more efficient, and has reduced cost. Whatsoever, the keyword based document retrieval becomes different in case of sensitive data. The keyword based document retrieval applied on normal data is different from those applied on sensitive data. In order to outsource sensitive data, it requires to be encrypted for privacy requirements. Here a multi-keyword ranked search scheme is performed over encrypted cloud data. The vector space model, term frequency and inverse document frequency are utilized to perform the index construction and query generation. Here a ternary tree-based index structure is constructed and "Greedy Depth-first Search" algorithm to provide efficient multi-keyword ranked search. The accurate relevance score calculation between encrypted index and query vectors helps to rank the documents while resulting back to the data user. Instead of building an index tree for each data owner, a group has been introduced where the members of the group are authorized to access the documents of the group. This method in this proposal manages space and efficient search.**

**Index Terms: Cloud computing, Inverse document frequency, Multi-keyword ranked search, Relevance score, Term frequency.**

## I. INTRODUCTION

The various features of cloud computing has attracted individuals as well as enterprises. The features include organizing huge resources for computing, storage and applications, enabling ubiquitous computing etc. But these features become inefficient when comes the case of sensitive data such as emails, personal health records etc. Outsourcing of these sensitive data to remote users requires privacy concerns. A general approach to provide data confidentiality can be encrypting the data before it is outsourced. But the fact is, the techniques applied on keyword based document retrieval on plaintext cannot be directly applied on encrypted data. Also, this requires a huge cost and this is impractical to download such data from cloud and decrypting it.

Above problem can be solved using the concept of fully-homomorphic encryption which is a general purpose solution. But, due to high computational overhead this is an impractical solution. Practically, special purpose solutions, such as searchable encryption has made large contributions in efficiency, functionality and security. This work helps the client to store encrypted data in the cloud and also performs execution on the cipher text domain. Many works have been contributed in accordance with different threat models like single keyword search, similarity search, multi-keyword Boolean search, ranked search and multi-keyword ranked search. The data owners can upload their data to the cloud server so that the needy users can access.

This paper proposes a ternary tree based search scheme over the encrypted cloud data, which supports the multi-keyword ranked search and the grouping architecture provides a secure efficient search over large collection of documents. Since the index tree constructed is for a group of data owners instead of a single owner where the group is initiated by the group admin. This method uses vector space model and product of term frequency and inverse document frequency for index construction. High search efficiency in terms of space and time is acquired in case of ternary tree based index structure and here we use greedy depth first search (GDFS) algorithm for searching keyword. The accurate relevance score calculation between the encrypted index and query vectors suggest nearest document the user is searching for. In this paper, a basic dynamic multi-keyword ranked search (BDMRS) is constructed in the known cipher text model. [1]

The contributions in the proposal include:
1. Searchable encryption scheme supports accurate mutli-keyword ranked search on the document collection.

2. Due to the ternary tree based search scheme there is more efficiency in space and is time consuming.

The paper is organized as follows. Literature survey is discussed in section 2. Then section 3 follows the problem definition and section 4 describes the scheme in detail using the tree structure. Section 5 includes the conclusion and future work.

## II. LITERATURE SURVEY

Searchable encryption scheme helps the clients to outsource the data to cloud servers and perform keyword search over the encrypted data. Several techniques have been proposed in order to provide symmetric encryption and search capabilities. One approach of provisioning symmetric encryption with search capabilities is with a so-called secure index. [3]

One of the works which was proposed earlier was single keyword Boolean search, which gives the presence or absence of keyword with a 1 or 0. Later single keyword search was introduced, though; simple in functionality it cannot satisfy users those who prefer multiple keywords. Similarity search, multi-keyword Boolean search, ranked search and multi-keyword ranked search are later works.

Similarity search solves the problem of low functionality power of the search functions over encrypted data. The efficiency is provided through tree based structure and multi dimensional algorithm. This is better than linear search and the data users without knowing the secret keys of the data owners can issue a query. To boost search efficiency a vector space model with cosine measure is introduced. [5] Then one of the proposed schemes for multi owner where data owners have different secret key. Also, the authors proposed "additive order preserving functions" to obtain the most apt search results, but these do not work for dynamic operations. [6]

Multi-keyword Boolean search as per the request queries of the data users output suitable documents, but these give a yes or no answer as 1 or 0 and do not provide any ranking functionality.

To overcome this ranked search was introduced, which sends back top-k relevant documents. But the disadvantage is that it is for single keyword search. Also the search efficiency is linear with respect to the document collection and is not accurate enough. [7], [8], [9]

Mutli- keyword Boolean search overcomes all the limitations so far found out. This method is supported by tree based index construction using the term frequency*inverse document frequency model (TF*IDF) and vector space model [1]. The architecture supports group sharing of the encrypted cloud data making it a secure setup for outsourcing and retrieving documents in profound manner.

## III. PROBLEM DEFINITION

### *A. Preliminaries*

Vector space model: Here, each document is denoted by a vector and the vector has the normalized TF values of the documents. The query vector is denoted by the normalized IDF. The term frequency or TF is the number of times a given keyword appears in the document and inverse document frequency or IDF is obtained by dividing the cardinality of document collection by number of documents containing the keyword. The length of TF and IDF vectors become naturally equal and their dot product helps to calculate the relevance score between the query and document corresponding to it.

The notations used in relevance score calculation are: [Xia et.al]

$N_{f,wi}$- The number of keyword $w_i$ in document f.

N- The total number of documents.

$N_{wi}$- The number of documents that contain keyword $w_i$.

$TF'_{f,wi}$- The TF value of $w_i$ in document f.

$IDF'_{wi}$- The IDF value of $w_i$ in document collection.

$TF_{u,wi}$- The normalized TF value of keyword $w_i$ stored in index vector $D_u$.

$IDF_{wi}$- The normalized IDF value of keyword $w_i$ in document collection.

$$RScore(Du, Q) = Du.Q = \sum_{wi \epsilon Wq} TFu,wi \times IDFwi$$

If u is an internal node of the tree, $TF_{u,wi}$ is calculated from index vectors in the child nodes of u. If the u is a leaf node, $TF_{u,wi}$ is calculated as:

$$TFu,wi = \frac{TF'f,wi}{\sqrt{\sum_{wi \epsilon W}(TF'f,wi)^2}}$$

where $TF'_{f,wi} = 1 + \ln N_{f,wi}$ .

And in the search vector Q, $IDF_{wi}$ is calculated as:

$$IDFwi = \frac{IDF'wi}{\sqrt{\sum_{wi \epsilon Wq}(IDF'wi)^2}}$$

where $IDF'_{wi} = \ln(1 + N/N_{wi})$.

Keyword ternary tree: The tree structures are mainly used to perform search operations efficiently and in optimized manner. Each node in the ternary tree consists of ID, the identity of the node; Pl, Pm and Pr are the pointers to left and right child respectively. The FID

 ISBN: 978-81-932966-5-3

value, which is the identity of node and D denotes the TF values.

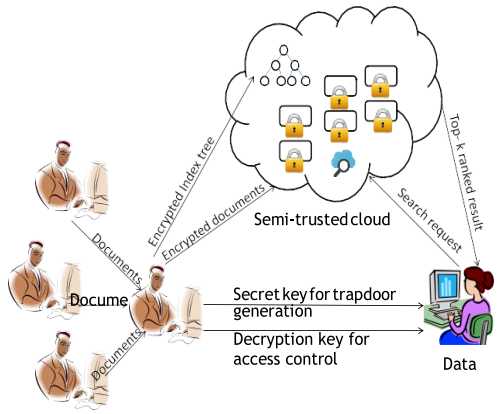



***Figure 1: The architecture search over group shared encrypted cloud data***

### *B. System Architecture*

The system consists of four different entities:

Data Owner: The data owner initializes by outsourcing the documents to trusted group admin.

Group Admin: The admin initializes the group and has the provision to add members to the group. The members of the group are data owners and data users. The group admin on receiving the documents F= {f1, f2, f3,…, fn} from the data owner, outsources it to the cloud server in the encrypted form by constructing a secure index tree.

Data User: The data user can access the documents outsourced by the group admin. According to the query given by the user, trapdoor is generated, according to which the k- top ranked results are retrieved.

Cloud server: The duty of cloud server is to store the encrypted collection of documents and also the tree based index structure for searchable encryption. And the cloud server is treated as honest but curious which is dedicated too much works.

The system model in this paper involves grouping of so called data owners and data users. The data owners forward their documents to the group admin and the admin creates the secret key upon which the encrypted index tree is built. The admin stores the encrypted documents to the cloud storage. Secret key is shared to the authorized users of the group and the users on requirement build the trapdoor which is send as search request to the cloud server. On specific relevance score calculation the relevant documents are received as response by the data user, which is decrypted for further access. For instance, Alice is the group admin of a group of particular department who receives sensitive documents from the team leads of the department, which are to be shared among the authorized users of their department. Say, if Bob is one of the authorized users of the department who wants access to the documents shared by the team leads of the department. Alice on receiving the documents secures them by encrypting and building encrypted index tree using secret key generated by her and sharing it with the semi-trusted cloud server. Alice shares the secret key with the authorized users by a secure sharing method. Bob creates trapdoor using the secret key and forwards it to the cloud server as the search request. The response to the request can be downloaded and decrypted using decryption key shared by the admin.

### *C. Threat model and Design goals*

The threat model proposed here is known ciphertext model and the cloud server can perform only ciphertext only attack as the cloud server knows only about the encrypted document collection, the index tree and trapdoor generated for the query of the authorized user.

The main design goals to enable secure efficient multikeyword ranked search over group shared encrypted cloud data are as follows:

Search efficiency: The aim is to attain sub linear search efficiency by constructing a tree based index and an efficient search algorithm.

Privacy preserving: The scheme is built such that the cloud server doesn't get any additional information about documents, index tree and query. The privacy requirements include:

Index and query confidentiality: The plaintext information, keywords in the index and query and also the TF and IDF values in the index and query keywords respectively must be protected from cloud server.

Trapdoor unlinkability: The generation of two trapdoors for same search request must not be determined by the cloud server.

Keyword privacy: From statistical information like TF, the cloud server must not be able determine the keywords.

## IV. THE PROPOSED SCHEME

This section describes about the multi-keyword ranked search scheme over encrypted data. The index construction is using the ternary tree and greedy depth first search is carried out as the search process. The proposed scheme is basic dynamic multi-keyword ranked search (BDMRS).

### *A. Index Construction*

In BDMRS scheme, the index construction is with the support of a ternary tree. Each leaf node represents the documents in the collection and the internal nodes are generated as per the leaf nodes. Algorithm 1 BuildIndexTree describes the construction of index tree, and following are the notations used:

1. CurrentNodeSet- the nodes which are currently being processed with no parent.
2. TempNodeSet- newly generated nodes.

***Algorithm 1:*** BuildIndexTree

***Input:*** document collection F= {f1, f2, f3,…, fn} with identifiers FID= {FID| FID=1,2,3,…,n}.

Output: the ternary tree.

1: for each document fFID in F do
2: Construct a leaf node u for fFID, with u.ID= GenID(), u.Pl= u.Pm= u.Pr= null, u.FID= FID, and D[i]= TF(fFID,wi) ; for i= 1,. . .,m;
3: Insert u to CurrentNodeSet;
4: end for;
5: while the number nodes in the CurrentNodeSet is larger than 3 do
6: if the number nodes in the CurrentNodeSet is 3, then
7: for three nodes u',u''and u''' of the former nodes in CurrentNodeSet;
8: Generate a parent node u for u', u" and u"' with u.ID= GenID(), u.Pl= u', u.Pm= u" and u.Pr=u"', u.FID= 0 and D[i]= max{u'.D[i]; u".D[i]: u"'.D[i]} for each i= 1, . . .,m;
9: Insert u to TempNodeSet;
10: end for;
11. else
12. for nodes u', u" and u"' of the former nodes in CurrentNodeSet do
13. Generate a parent node u1 for u', u" and u"' and similarly create other parent nodes u2, u3 and so on;
14: Insert u1, u2, u3 to TempNodeSet;
15: end for;
16: Create a parent node u4 for the three internal nodes(u1, u2, u3) which is the parent of 3 leaf nodes, similarly create parent nodes for other internal nodes:
17: Insert u4 and other parent nodes to TempNodeSet;
18: end If
19: Replace CurrentNodeSet with TempNodeSet and then clear TempNodeSet;
20: end while
21: return the only node left in CurrentNodeSet, namely, the root of index tree T;

### *B. Search process*

The search process depends on the GDFS algorithm. Here, a list is created consisting of relevance score and FID called RList. The resultant list consisting of k documents depending upon the largest relevance scores to the query is ordered in descending manner. GDFS algorithm is mentioned in algorithm 2.
Notations[1] used are:

1. RScore(Du,Q)- relevance score for query vector Q and index vector Du stored in node u.
2. Kthscore- The smallest relevance score in current RList, which is initialized as 0.
3. Hchild- The child node of a tree node with higher relevance score.
4. Lchild- The child node of a tree node with lower.

### *Algorithm 2[1]*

GDFS(Index tree node u) [XIA et.al]: the Greedy-depth first search algorithm is carried out to do the search process which returns only the relevant results without traversing the whole tree.

### *C. BDMRS Scheme*

The scheme consists of following algorithms: [XIA et.al]
1. SK- it is secret key set generated by the data owner. SK includes m bit vector S where m is the cardinality of the dictionary and two m*m invertible matrices M1 and M2. Namely, SK=(S, M1, M2).
2. I- GenIndex(F, SK) using the algorithm 1 BuildIndexTree(F), an unencrypted tree is generated. Next, the duty of data owner is to generate two random vectors {Du'.Du"} for index vector Du. If S[i]=0 then Du'[i] and Du"[i] equals to Du[i], else if S[i]=1 then Du'[i] and Du"[i] will be set to random values whose sum equals Du[i]. As the last step, index tree is generated which stores two encrypted index vectors Iu={M1TDu'.M2TDu"}.
3. TD- GenTrapdoor(Wq,SK) Wq is the keyword set. If wi is keyword in Wq then Q[i] has normalized IDF value of wi; else Q[i] has value 0. The query vector Q is split into Q' and Q". If S[i]=0 then Q' and Q" is set to two random values whose sum is equal to Q, else Q' and Q" are set equal to Q. Trapdoor generated is {M1-1Q'.M2-1Q"}.
4. RelevanceScore- the cloud server calculates the dot product of the query vector with the index vector.
Security Analysis
• Index confidentiality and query confidentiality: the cloud server without the knowledge of secret key SK cannot infer Du and Q from Iu and TD. Cloud server can only perform ciphertext only attack and hence cannot calculate the matrices M1 and M2.
• Query unlinkability: the trapdoor generated by splitting the query to two. So, a single query request is made into different query trapdoors. Thus, query unlinkability is protected.
• Keyword privacy: the search process can merely introduce the inner product of the computed encrypted vectors and so leaks no information about the specific keyword in known cipher text model.

## V. CONCLUSION AND FUTURE SCOPE

A secure and dynamic privacy preserving scheme is proposed here. The proposal supports multi keyword ranked search scheme and it is supported by ternary tree based structure for index construction. The ternary tree is better than tree structures like binary trees, since, ternary tree is fast and space efficient. The greedy depth first search helps to make search process faster and in applicable manner.
There are still many challenging problems in the symmetric searchable encryption. In the proposed scheme, the updates such as insertion, deletion of the documents are not specified and upon this a work can be implemented. Moreover, the system considers the cloud server as honest but secure system. There are chances when the cloud server can attack the scheme statistically by constructing histograms based on the term frequency distribution of the documents. Hence, this is a challenging problem in known

background model, though the scheme is secure in known ciphertext model. So, considering the scheme in other different threat models like known background model is a work that can be handled in the future.

**REFERENCES**

[1] Zhihua Xia, Xinhui Wang, Xingming Sun and Qian Wang, "A Secure and Dynamic Multi- Keyword Ranked Search Scheme over Encrypted Cloud Data", IEEE Transactions on Parallel and Distributed Systems, VOL. 27, NO. 2, February 2016

[2] Y.-C. Chang and M. Mitzenmacher, "Privacy preserving keyword searches on remote encrypted data," in Proc. 3rd Int. Conf. Appl. Cryptography Netw. Secur., 2005, pp. 442–455.

[3] R. Curtmola, J. Garay, S. Kamara, and R. Ostrovsky, "Searchable symmetric encryption: Improved definitions and efficient constructions," in Proc. 13th ACM Conf. Comput. Commun. Secur., 2006, pp. 79–88.

[4] N. Cao, C. Wang, M. Li, K. Ren, and W. Lou, "Privacy-preserving multi-keyword ranked search over encrypted cloud data," in Proc. IEEE Infocom, Apr. 2011, pp. 829–837.

[5] W. Sun, B. Wang, N. Cao, M. Li, W. Lou, Y. T. Hou, and H. Li, "Privacy-preserving multi- keyword text search in the cloud supporting similarity-based ranking," in Proc. 8th ACM SIGSAC Symp. Inf., Comput. Commun. secur., 2013, pp. 71–82.

[6] Jiadi Yu, Peng Lu, Yanmin Zhu, Guangtao Xue, and Minglu Li, "Toward Secure Multikeyword Top-k Retrieval over Encrypted Cloud Data", IEEE Transactions on Dependable and Secure Computing, VOL. 10, NO. 4, July/August 2013 239

[7] A. Swaminathan, Y. Mao, G.-M. Su, H. Gou, A. L. Varna, S. He, M. Wu, and D. W. Oard, "Confidentiality-preserving rank-ordered search," in Proc. ACM Workshop Storage Security Survivability, 2007, pp. 7–12.

[8] S. Zerr, D. Olmedilla, W. Nejdl, and W. Siberski, "Zerber+ r: Top-k retrieval from a confidential index," in Proc. 12th Int. Conf. Extending Database Technol.: Adv. Database Technol., 2009, pp. 439–449.

[9] C. Wang, N. Cao, K. Ren, and W. Lou, "Enabling secure and efficient ranked keyword Search over outsourced cloud data," IEEE Trans. Parallel Distrib. Syst., vol. 23, no. 8, pp. 1467– 1479, Aug. 2012.

# A New Harmonic Mitigation Scheme using Magnetically Controlled Reactor

[1] Mohammed Usama S. A. Shaikh, [2]D Dr. H. T jadhav
[1][2] Department of Electrical Engineering, Rajarambapu Institute of Technology, Islampur, 415414, India
[1] m.usamashaikh07@gmail.com, [2] htj@ritindia.edu

*Abstract*:-- **Power electronics has revolutionized the electrical industry but it comes with certain drawbacks. Harmonic is one of the issues with the power electronic system which needs to be addressed. Currently, a passive filter is being used to eliminate these problems. N-numbers of tuned filters are required to eliminate various harmonics. Effective use of filter can be done by the use of special purpose of reactor known as Magnetically Controlled Reactor (MCR). This paper presents a new filtering scheme with the use of MCR which works on the principle of DC biasing. Proper controlled excitation is given to the DC bias to have control on the reactance value. This paper also explains more about the control algorithm, the filter performance analysis through simulation results.**

**Index Terms: Harmonics, Passive Filter, Variable Permeability, Magnetically Controlled Reactor.**

## I. INTRODUCTION

Power Quality is the ability of electrical network to maintain pure and steady power supply. In other words, Power Quality is always the availability of pure sinusoidal wave [1]. This wave is within standard limit of voltage and frequency but no real power source is ideal & generally can deviate in following ways, Voltage variation, Frequency variation, Waveform distortion. The oscillation of voltage & current follows the form of sinusoidal nature. However, it can alter due to imperfection in loads/generator. This imperfection referred to the distortion of the ideal waveform is knows as total harmonic distortion.

In order to prevent harmonic from affecting the supply system, IEEE 519 has been established as the recommended practices & requirements for harmonic control in the electrical power system [2]. So in order to meet this IEEE std 519 many power Quality improving methods have been proposed e.g. use of linear elements (in passive filters) having various contribution such as RL,LC,LLC etc Non-linear elements active filters having DC link. Passive filters are widely used as they don't require any external power supply, Can handle large current & high voltage, can handle large power supply, is very reliable & hence is more used comparative to active filters [3, 4]. But there is need of separate filter for each harmonic this disadvantage of passive filter makes harmonic filtering costly and bulky. In this proposed work the above disadvantage is eliminated by the use of Magnetically Controlled Reactor (MCR) [5, 6].

Generally industrial loads have a peculiar demand according to the operation being done. As in steel industry according to the arcing in the arc furnace the power supply changes i.e. harmonic content in various stages changes and hence there is need of all the harmonic filters at all time of operations. This need of all filter can be eliminated by selective elimination of harmonic in a particular stage of operation of the arc furnace by using MCR & switched capacitor dominant harmonic can be eliminated at any time with only one filter scheme [7]. The Controllable reactor is based on the magnetic amplifier, using a dc control circuit to change the saturation degree of the iron core [8, 9]. Magnetically controlled shunt reactors are currently being employed in various extra high voltage (EHV) and ultra-high voltage (UHV) applications as reactive power compensation, to improve systems dynamic performance and damping power system oscillation as well as fault current limiting reactor [5-10]. MCR's are yet to be utilized to their full extend for medium voltage (MV) and low voltage (LV) application. This work will contribute in improving MCR potential in MV and LV system.

## II. PROPOSED SCHEME

Current flows through the least impedance path. Passive filters provide least impedance path to harmonic currents by tuning the filters at particular frequency [3]. Value of Inductor and Capacitor is so selected that it resonates at a particular tuned frequency which in turn provide the required low impedance path to the harmonic current.

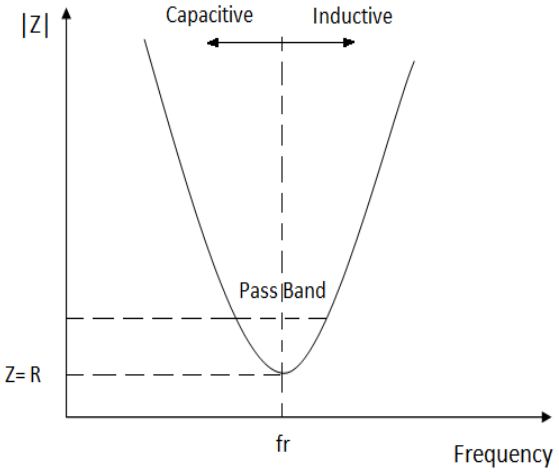



***Fig.1. Single Tuned harmonic filter |Z| vs Freq***

According to Fig.1. at resonance frequrncy (fr) the filter circuit is resistive, the impedance minimum with value Z=R and power factor unity. R << Xl (at fundamental frequency). In order to provide least impedance path shunt connected passive filters are used. Dynamic non-linear loads produced different order of harmonics at different time instant. For eliminating this, numbers of tuned filters are required [4]. MCR is a variable inductor which can be used with specific value of capacitor to tune for the present dominant harmonic and reactive power support in the system by the help of control circuit and thyristor switches for selecting appropriate capacitors at different time instant as shown in Fig.2. [11].

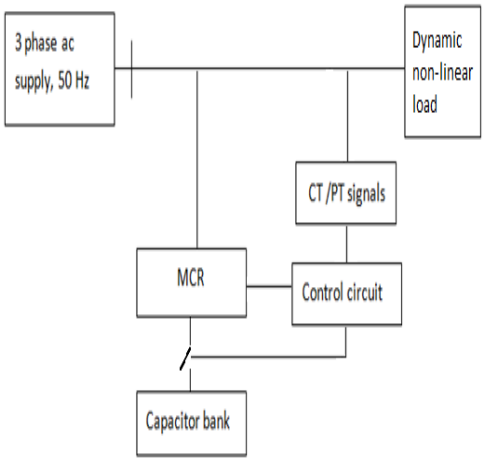
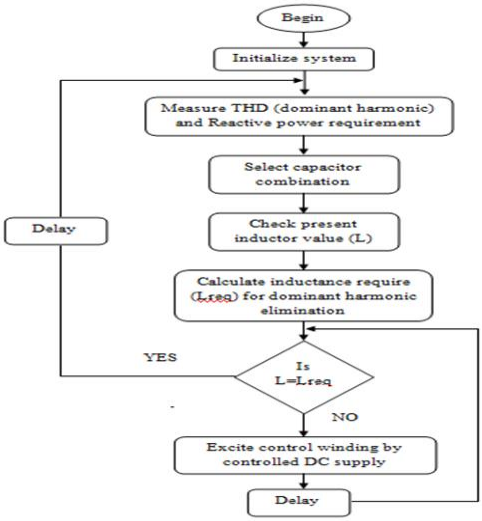



***Fig.2. Block diagram of proposed scheme***

The flowchart explains detailed overview of MCR tuned filter where THD and reactive power measurement is done, capacitor and inductor value are calculated according to dominant harmonic present. Inductor value is checked and required value is obtained by changing excitation level of control winding [12].




***Flow chart 1. Sequence of operation***

## III. OPERATING PRINCIPLE

The working principle of MCR is based on magnetic flux phenomenon. MCR circuit is divided into two parts that is working winding and control winding which is shown in FIG.3. [13, 14] MCR works according to the control of magnetic saturation phenomenon as a magnetic magnifier [11].

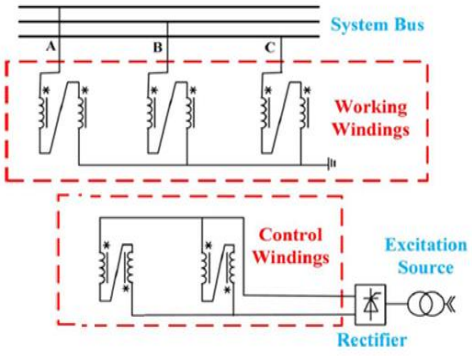



***Fig.3. structure of MCR winding***

The Sequence of operation is as follows
When control winding is excited with controlled dc current which produces magneto-motive force given by

$$F_m = I_{dc} * N \qquad (2)$$

The magneto-motive force produces magnetic field

$$H = F_m / l_e \qquad (3)$$

The field produces flux density

$$B = \mu * H \qquad (4)$$

At saturation of magnetic core even if Magnetic flux intensity (H) increases ΔB is very small hence to satisfy the equation (4) μ changes accordingly represented by Fig 4.[12].

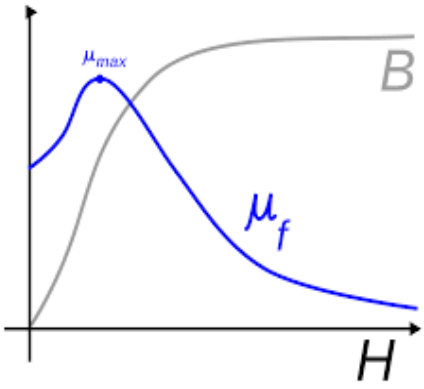



***Fig.4. B Vs H & μ Vs H curve***

Where,
B= magnetic flux density in Tesla
H= magnetic flux intensity in Ampere-Turn/Meter

$$\mu = \mu_0 \mu_m$$

$\mu_0$ is permeability of air and $\mu_m$ is permeability of magnetic material

As controlling $\mu$ will control the value of inductor because L is directly proportional to $\mu$.

The equation (5) for iron core inductor is given by

$$L = \frac{4\pi\mu AN^2}{MPL} \qquad (5)$$

Where,
L=value of inductance in Henrys

N= Number of turns

A= cross-sectional area of coil in sq-meter

MPL = magnetic path length in meters

## IV. SIMULATION RESULT

Simulation carried out by the use of variable load which produces different order of harmonics at different time instance are effectively eliminated with the use of magnetically controlled reactor in L-C combination of passive filtering [15, 16].
Because of the varying order of harmonic load 5th and 7th harmonics are present in 0.0sec to 0.5sec and 11$^{th}$ and 13$^{th}$ order of harmonic presents in 0.5sec to 0.8sec of period which is illustrated in Fig.5

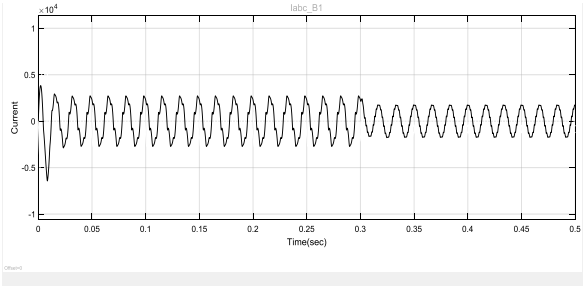
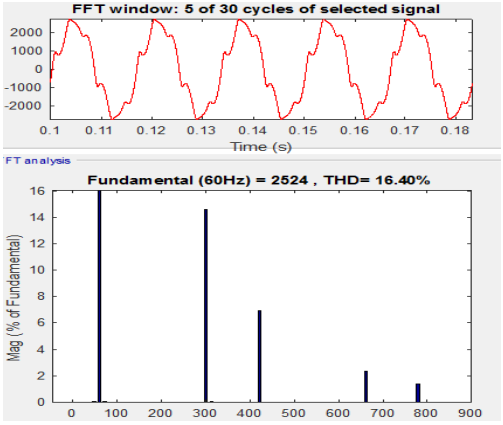
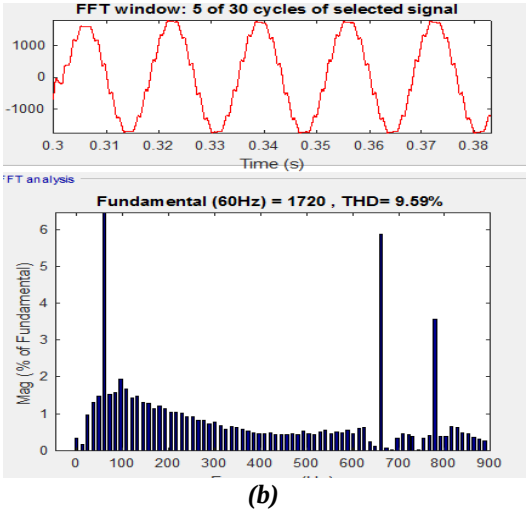



***Fig.5. waveform of phase A of load current (without MCR)***

FFT analysis is carried out on varying harmonic load current. Total harmonic distortion of particular harmonics is also shown in Fig.6. THD of 5$^{th}$ and 7$^{th}$ harmonics are 16.40% which is beyond the IEEE standard and THD of 11t$^{h}$ and 13$^{th}$ harmonics are also beyond the standard.




***(a)***




***(b)***

***Fig.6. FFT analysis (a) 5th and 7th (b) 11th and 13th***

After connecting MCR into the circuit this dominant harmonics are mitigated. MCR provide low impedance

 ISBN: 978-81-932966-5-3

path for dominant harmonics by tuning required inductor value with switching capacitor.

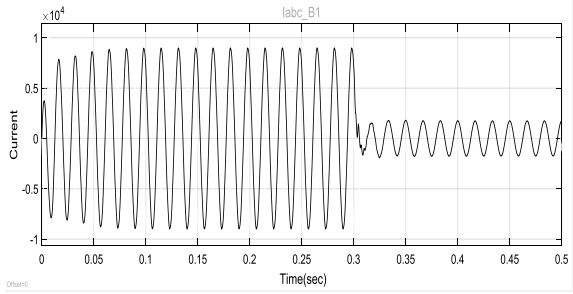
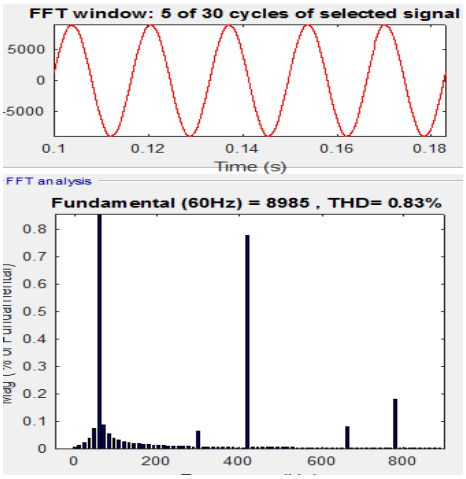
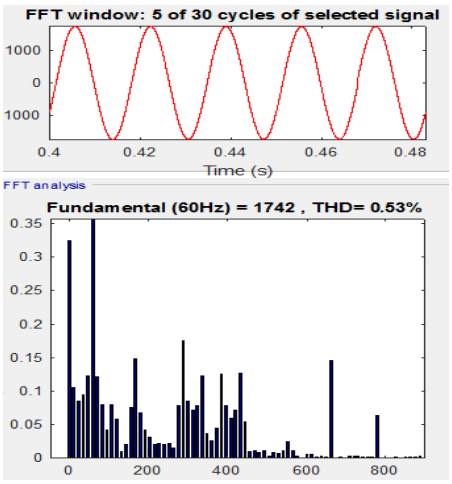



***Fig.7. Waveform of phase A of load current (with MCR)***
***FFT analysis after connecting MCR is shown in Fig.8.***




***(a)***




(b)

Fig.8. FFT with MCR

***Test Results***

Experiment being performed on single phase MCR prototype of 2.7mh. 95amp. Table1 gives detailed data regarding testing on MCR.

***Table1. Measurement result***

| Vac | Iac | Idc | mH | Hz |
|---|---|---|---|---|
| 59.05 | 70.2 | 0 | 2.641 | 49.98 |
| 50.4 | 68 | 15 | 2.36 | 49.98 |
| 42.11 | 68.2 | 31 | 1.966 | 49.97 |
| 35.63 | 69.2 | 44 | 1.639 | 49.98 |
| 20.12 | 71.2 | 57 | 1.302 | 49.98 |
| 21.011 | 72 | 72 | 0.929 | 49.96 |
| 14.115 | 77.8 | 95 | 0.578 | 49.97 |
| 13.8 | 76.8 | 103 | 0.572 | 49.98 |

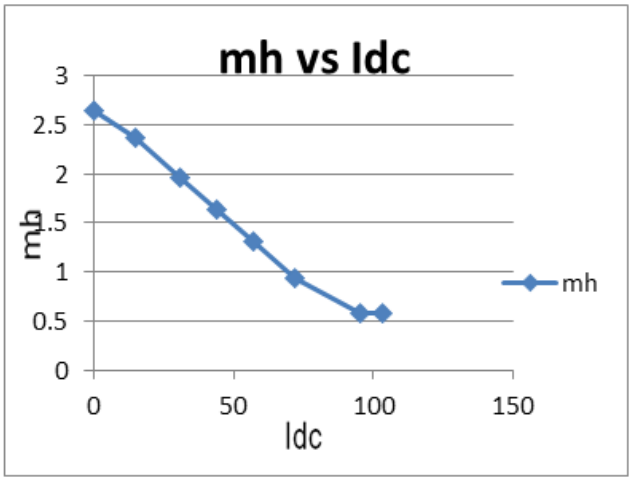



***Fig8 – variation of inductance***

The result shows the variation of L value with increase in DC current (fig 8). Hence it can be proved that value of L can be changed from 100% to 30% of the value.

## CONCLUSION

Harmonic is a very severe issue when it comes to power quality in distribution network. The use of different type of filter is incorporated in the system. The proposed filtering scheme has a advantage of low cost as compared to n-type of detuned filter. The use of magnetically controlled reactor for filtering application is properly demonstrated in this paper where inductance changes as to tune for mitigating dominant harmonics. This operation is based on magnetic saturation phenomenon in the iron core.

**REFERENCES**


[1] M.H.J. Bollen, "Review-What is power quality?", Electric Power Systems Research, vol-66, PP-5-14, 2003

[2] Ambra Sannino, Jan Svensson, Tomas Larsson, "Review-Power electronic solutions to power quality problems", science direct Electric Power Systems Research, Vol-66 PP:71-82, 2003

[3] Remus N. Beres, Xiongfei Wang, Frede Blaabjerg, "Optimal Design of High-Order Passive-Damped Filters for Grid-Connected Applications", IEEE Transactions on Power Electronics, MARCH- 2016

[4] Remus Narcis Beres, Xiongfei Wang, Marco Liserre, Frede Blaabjerg, "A Review of Passive Power Filters for Three-Phase Grid-Connected Voltage-Source Converters", IEEE journal of emerging and selected topics in power electronics, vol. 4, no. 1, MARCH-2016.

[5] Mehmet Tümaya, Tu ğçe Demirdelena, Selva Balb, Rahmi İlker Kayaalpc, Burcu Doğruc, Mahmut Aksoyd, "A review of magnetically controlled shunt reactor for power quality improvement with renewable energy applications", Elsevier Renewable and Sustainable Energy reviews vol. 77, pg. no. 215-228, 2017

[6] Ma C, Bai B, An Z, Dong Y. Study on main magnetic field of ultra-high voltage magnetically controlled saturated reactor. In: Proceedings of the 17th International Conference on Electrical Machines and Systems (ICEMS); 2014, p. 3615–3619,

[7] R.R. Karymov , M. Ebadian, "Comparison of magnetically controlled reactor (MCR) and thyristor controlled reactor (TCR) from harmonics point of view", Electrical Power and Energy Systems vol. 29, pg. no. 191–198, 2007

[8] Yusi Liu, H. Alan Mantooth, Juan Carlos Balda, Chris Farnell, "Realization of High- Current Variable AC Filter Inductors Using Silicon Iron Powder Magnetic Core", IEEE Applied Power Electronics Conference and Exposition (APEC), 2017

[9] Tian M, Li Q, Li Q. "A controllable reactor of transformer type" IEEE Trans Power Deliv 2004;19 (4):1718–26.

[10] JIA Gui-xi, SU Yuan, "Research on Soft Starter of Asynchronous Electromotor Based on Magnetically Controllable Reactor", 2nd IEEE International Symposium on Power Electronics for Distributed Generation Systems, August 2010

[11] Xuxuan Chen, Baichao Chen, Cuihua Tian, Jiaxin Yuan, Yaozhong Liu, "Modeling and Harmonic Optimization of a Two-Stage Saturable Magnetically Controlled Reactor for an Arc Suppression Coil", IEEE Transactions on Industrial Electronics, vol. 59, no. 7, July 2012

[12] Wang Y, C. Sun, G. Chen. "A novel control algorithm for magnetically controlled reactor." In: Proceedings of the IEEE 23rd International Symposium on Industrial Electronics (ISIE); 2014, p. 360–365

[13] Torbjörn Wass, Sven Hörnfeldt, and Stefan Valdemarsson, "Magnetic Circuit for a Controllable Reactor", IEEE transactions on magnetics, vol. 42, no. 9, SEPT. 2006.

[14] Ben Tong, Yang Qingxin, Yan Rongge, Zhu Lihu, "Magnetically Controlled Saturable Reactor Core Vibration under Practical Working Conditions", IEEE Transactions on Magnetics, Volume: 53, June 2017

[15] ZHAO Shi-shuo, YIN Zhong-dong, Li Peng, "Research of Magnetically Controlled Reactor Simulation Model and it's Experiments", IEEE 7th International Power Electronics and Motion Control Conference - ECCE Asia JUNE 2-5, 2012, Harbin, China.

[16] Chen X, B. Chen, C. Tian, J. Yuan. "Modeling and simulation of the multi-stage saturable magnetically controlled reactor with very low harmonics", In: Proceedings of the International Conference on Power Systems Transients; 2013.

# Work Measurement to Productivity Improvement of Bride Construction

[1] Latthe A. B, [2] Deshpande U. L
[1] Student of Construction Management Department, Government College of Engineering Karad
[2] Assistant Professor, Department of Applied Engineering Research, Government College of Engineering Karad

***Abstract*- Improvement in productivity of labors has become vital area to focus for industry last two decades. Construction industry mostly depends on labor productivity. Complete project without delay and cost overrun is challenging for construction industry and researchers to work. Many factors affecting on productivity of labors in construction industry are determined by researchers. This paper discusses literature reviews on construction productivity measurement methods. The paper gives a review on different factors affecting on construction productivity and different theories and innovations on improvement of construction productivity. On reviews it is noted that there are different techniques of improvement in construction productivity and different methods of productivity measurement. But there are different adverse conditions and factors influencing on productivity improvement.**

***Key Words*: Improvement in productivity, labor productivity, delay, cost overrun, factors affecting, productivity measurement.**

## I. INTRODUCTION

Many researches are related to poor level of productivity and performance in construction industry. Productivity of workers plays an important role in overall performance of onsite construction project. In India after agriculture construction industry has given second highest employment. All over the world, India is second in population therefore many labors are available for construction sector. The paper gives a review on different innovative methods of productivity improvement with appropriate productivity measurement technique. To Productivity improvement necessary qualified and skilled workers are required for minimizing resources as well as time overrun form different activities of the construction project. In construction industry productivity management and control on performance time of labor and actual cost measurement is very difficult. Labor performance is increased with the help of productive use of labor working hours (Tinivavi Moyo et al 2014). Not only Proper utilization of resources but also selection of labors for different job for improving productivity and successful completion of project. Crew formation in labor management plays an important role because 30% to 50% of cost of project account for labors (Florez et al 2016). Improper management of resources leads to low productivity at on site construction. Therefor contractors, consultants and project managers are to be aware of different methods to find out productivity of equipment and workers. For efficient utilization of resources and improving productivity, proper control on the productivity is necessary aspects like workers, equipment, material, cash flow etc. (Mostafa E. Shehata 2012).

This paper discusses reviews on site productivity measurement which is considerably depending upon site location and its size which is very challenging. Different productivity measurement methods and analysis for improving productivity are work measurement, setting baseline, total productivity, average labor productivity (ALP), automated technologies for site material management like Radio Frequency Identification (RFID), Global Positioning System (GPS).

**Productivity and Methods of Work Measurement:**

Definition: Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance. There was not worry about exact meaning of terms mentioned in definition like “a qualified worker” and “a defined level of performance”. That was nothing other than “Work measurement”. The term which was described different techniques, which were used for work measurement. Measuring the time required to perform job, it mean’s work measurement. Management of time required for performance of job or its activity and ineffective time was separated from effective time. Ineffective time was accepted as “natural things”. Work measurement played another role to set standard time for performing the job. If there was any unproductive time it was instantly shown the more than standard time thus management pay- attention on it. Objective of the measurement was to analyses the productivity with the help of different work measurement methods.

Different work measurement methods are as follows:-

1) Historical data
2) Time study
3) Work sampling
4) Estimating
5) Synthesis

All these methods mostly concern with time study. This study was the basic work measurement and other methods developed from it. The basic steps were necessary for effectively carrying out the work measurement.

The steps involved in work measurement are as follows:

1) Select the job for study.
2) Record appropriate data related to different conditions of job. Standard method was used for performing job and different activities in them.
3) All the details of work and working condition are necessary to record. Work break down into activities or elements.
4) Find out the standard time for the operation to do every single element including relaxation and personal need etc.
5) Issue the standard time for activities of job and specific method of operation.

If work measurement was used as investigation tool of method study or find out the effective alternate method and unproductive time. Only first four steps are used in that case.

**Productivity Measurement**

Lingguan Song et al (2008) measured the productivity to find out in terms of labor work output per unit time. Labor input was measured in working hours. Due to different construction activities, labor workout was diversified.

In historical data, productivity measurement requires three steps as mentioned below.

1) Productivity measurement number.
2) Data acquisition number.
3) Productivity model development.

Company's historical data records were used for improving company's productivity in future on the past performance and productivity details. They used theoretical model of different analysis for improve productivity.

In time study Tirivari Moyo et al (2014) studied that there were many challenges for using that technique. They found different difficulties as follows:

1) Less number of workers was studied and it required several observers for study.
2) Limited data was gathered for time study.
3) Observers study was not sufficient, for detail study with less accuracy.

Valuable information was provided by work sampling technique to construction manager for taking corrective action in the areas of low productivity. It was valuable for allocating workforce and improving productivity onsite. Work sampling was very simple and low cost method for managers to control cost and time overrun of projects. Estimating method was divided into two types analytical and comparative estimating. First was based on the skill and experience of workers. Comparative estimating depends on time interval allocated for job. Work measurement method was mostly used for measurement work around 95% comparing to order methods.

**Factors affecting on productivity**

**Management**

The poor management in the construction project leads to poor productivity. Decisions of management play key role at actual construction work. For great productivity not only proper management but also proper decisions are required. Fulford and Standing (2013) selected the companies which operate differently, one takes the government projects another takes infrastructure development and major sub projects and third organization produces supply facility for case study. They implemented collaboration in construction productivity. They developed model of collaborative network approach to study every company's strengths and weaknesses. Productivity was improved by collaboration between companies; one was very good in other company's weaknesses. But there were some limitations in decision making and controversies between companies. Oral Musatfar et al (2011) concluded that statistical method was not effective for labor productivity prediction in construction.

They found supervised learning method was advantageous in modeling ease prediction accuracy.

1) Different methods of supervised learning:
2) Free Forward Back Propagation (FFBP)
3) General Regression Neural Network (GRNN)
4) Self-Organizing Maps (SOM)

These methods were used for decision making with the help of neural network. Onsite problems were resolved by these methods with the great accuracy. Self-organizing maps (SOM) were more accurate than other two methods in prediction of crew productivity.

Rana Singhe Upal et al (2012) studied new method for improving productivity on construction site. Construction productivity improvement officer (CPIO) was appointed for decision making on project. (CPIO) took the responsibilities of work productivity planning, monitoring, coordinating and listening requirements of stakeholders. Decisions of (CPIO) were implemented for 10 weeks at case study. They found 6.72% saving of time due to implementation of (CPIO). Due to good impact of decisions, this method was implemented for other projects.

**Lack of measurement**

Cost overrun and time overrun in construction project cause due to poor productivity of workers. Records of different activities on construction site were kept and productivity of crew was measured on regular interval. These records were

compared with standard benchmarks. Focus of standardized data collection to measure work accomplished by every worker in a single shift. Ratb J. sweis et al (2009) found that daily output fall between upper and lower control limit. The accurate baseline productivity of other projects or old projects had similar scope, design, specification, conditions. That baseline records was used by them for estimating crew in new projects. They distinguished good performing projects with poor performing projects. They found that the measurement of productivity was helpful for proper management and improvement in productivity. Mostafoe et al (2012) focused on workload of workers and their output with the help of project management index. (PIM) was more accurate method for measuring the output of workers.

**Material Procurement**

Planning storage of material and material procurement leads to improvement in onsite construction productivity. Appropriate planning and execution of material procurement and storage was overcome on the shortage or excessive material at construction site. Misham Said et al (2011) used Construction Logistics Planning (CLP) model for decision optimization of material procurement and storage material. This model was useful for difficult task of planning and storage decisions and optimization of material procurement. In this online collaboration system was developed between owners, contractors, suppliers and designer. Proper utilization of onsite space and indoor space of buildings was used for storage of material inventory. David Gua et al (2009) used automated material tracking process like Radio Frequency Identification (RFI) and Global Positioning System (GPS) for improving productivity. They compared the traditional material tracking process with automated material tracking process. Time recorded by traditional tracking process was 36.8 minutes for 400 components of Steel. Automated process of tracking was faster than traditional process, which recorded 4.56 minutes. Traditional method was containing 9.52% of unidentified components while automated tracking was containing 0.54% only.

**Site Layout and Design**

Job site layout affects the working capabilities of site. Site layout contains different facilities like temporary offices, sanitation, workers rest area, storage, access points, access roads, workshops, health and safety, security features, proper locations of material and equipment improves the productivity. Edgar P. Small et al (2016) focused on improving job site productivity. They carried out response survey for importance variable of job site layout and design. Highest ranking given for crane locations, access points of vehicles and inventory storage area. The owner's or contractor's office received lowest ranking as per response survey. Survey was carried out to find, who was responsible for site planning and design of job site layout, out of owner, contractor, designer, consultant, etc. Majority of tasks were performed by contractor 39% then consultant 30%. Contractor was required to show interest in the relationship between productivity and site layout.

**Motivation and Safety**

Suitable motivation played key role for improving crew production. The lack of motivation was the effect on behavior of workers, which resulted to coming late to job, careless work, failure to achieve target, absentees. For achieving better output, management took the responsibility to motivate the labors. Khan ahsanali (2015) collected empirical data to find out, how management played the role for motivating workers. They found that management required high productivity and completion of the project within the deadline. Project was having deficiency of facilities like security, transport, canteen, safety measures in many organizations. Management was not interested to spend money on motivational factors for achieving more productivity.

Proper safety provisions were required for the workers to work safely on construction site. Shree raja Gopal T.G. et al (2016) conducted detailed analysis which concluded, if the safety measures were not provided; productivity of workers get reduced. Proper safety management were conducted with the help of safety engineer then more productivity was achieved. Proper management of safety equipment, maintenance of equipment, inadequate lights were not conducted due to that loss of labor productivity.

**Skills and Abilities of Labor**

Productivity of construction industry usually depends upon personal qualities and abilities of workers. Qualities like worker's skills, training, experience and education were helpful for improvement in workers output. Skilled workers had high physical and mental ability than the unskilled workers. Iaura Florez (2016) took case study of missionary construction for improving productivity. They found that every meson was having different personalities, method of work, qualities. Some meson's productivity was more while working together and some have less productivity. They recorded the complex missionary work for several days. They found that meson having different skills, abilities made balance between complexities off work. High rate of performance was achieved on the basis of skills and abilities of worker. Ghate Prachi R. et al (2016) studied the productivity of skilled and unskilled workers while construction of columns. Abilities and skills of workers were affecting on productivity. Skilled workers reduce time of work by 5 days as well as cast by 46,500 for column construction. They calculated that productivity of skilled labor was more than unskilled labor.

**External Issues**

Adverse climate situations, dust, radiations, noise, crowded work area, new technology, changes in specification and

design, change in agreements, complexity and size of project this were different external issues. This issue effects on productivity of workers directly or indirectly. There were high health and safety risks in construction projects as compared to other industries. M. Abrey et al (2014) used self-administrated questionnaire survey for finding adversely affecting site conditions. Unsatisfactory conditions were converted in to increase of injuries and accidents of workers. That may cause for delay and loss of productivity. Old construction technique and increase in large scale of corruption reduces the productivity.
Markus Liberda et al (2014) used Prioritized Index for identifying different factors under human, external issues, and management category. These factors were affecting on site productivity. They found that the external factors have low rating while management factors have high rating, out of top 10 high rated factors. 8 factors of external issues were considered for Prioritized Index Rating.

## II. CONCLUSION

Above literature concluded that there are many methods of work measurement for improving productivity in construction industry. Work measurement techniques are used for controlling cost and time overrun, factors affecting on productivity of works. Different methods consists martial tracking and procurement, effective management system, motivation and safety to workers, external issues and other factors to improve onsite productivity.
Some effective methods to improve onsite productivity and to control cost and time overrun are as follows:

Work measurement by estimating and work sampling technique.
1) Automation to material taking and control.
2) Collaboration in different industries.
3) For controlling activities onsite with the help of CPIF.
4) Controlling the factors affecting on productivity.

These methods are successfully used to minimize the factors affecting on the productivity onsite in construction industry. There are many companies invests in work measurement techniques to achieve different benefits.

## References

[1] Ahsan Ali Khan and SadiaAjmal “Role of Management in Motivating Labor to Improve Labor Productivity” Journal of Advanced Management Science Vol. 3, No. 3, September 2015, PP179-185

[2] Albart P.C., David Scott Ada P. L. Chan “Factors Affecting The Success Of A Construction Project” Journal of Construction Engineering and Management, ©ASCE 0733-9364 (2004)

[3] AtfalMurodif, Erizal " Measurement of Productivity Using Work Sampling Method at MenaraSentraya building Project Jakarta Indonesia" Scholars Journal of Engineering and Technology (SJET) 2016, pp-244-248

[4] Attar A .A. , Gupta A. K. ,Desai D. B. “A Study of Various Factors Affecting Labor Productivity and Methods to Improve It” IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684,2014 PP: 11-14

[5] AviWiezel and Ali Erhan Oztemir "The Influence of Design Methods on Construction Productivity" Construction Research Congress, © ASCE

[6] Cindy L. MenchesP.E.,Awad S. Hasan P.E. “Quantity Measurement of Successful Performance form the Project Manager’s Perspective ”DOI: 10.1061/(ASCE)0733-9364(2006)132:12(1284) Journal Of Construction Engineering And Management (ASCE)/DESEMBER 2006,132 (12):1284-1293.

[7] David Grau, Carlos H. Caldas " Assessing the Impact of Materials Tracking Technologies on Construction Craft Productivity " Automation in Construction 18, 2009, pp- 903–911

[8] Edgar P. Small, Marwa Baqer "Examination of Job-Site Layout Approaches and Their Impact on Construction Job-Site Productivity" Procedia Engineering 164, 2016, pp- 383 – 388

[9] F. F. Alireza Ahmadian; Ali Akbarnezhad; Taha H. Rashidi and S. Travis Waller, “Accounting for Transport Times in Planning Off-Site Shipment of Construction Materials” DOI:10.1061/(ASCE)CO.1943-7862.0001030.©2015AmericanSocietyof Civil Engineers.

[10] Hee-sung park, stephen R. Thomas and Richard L. Tucker "Benchmarking of Construction Productivity" Journal of Construction Engineering and Management, Vol. 131, No. 7, ©ASCE, ISSN 0733-9364, 2005, PP -772–778

[11] Henry Alinaitwe and Jackson Mwakali "Labor Productivity in the Building Industry"

https://www.irbnet.de/daten/iconda/CIB6202.pdf Date-11/08/2017

[12] Hisham Said, S.M.ASCE1; and Khaled El-Rayes, M.ASCE2" Optimizing Material Procurement and Storage on Construction Sites" DOI: 10.1061/(ASCE)CO.1943 7862.0000307.© 2011 American Society of Civil Engineers.

[13] Jan Brochner and Thomas Olofsson " Construction Productivity Measures for Innovation Projects" Journal of Construction Engineering and Management, Vol. 138, No. 5, ©ASCE, ISSN 0733-9364,2012, PP-670–677

[14] José Ramón San Cristóbal "Time, Cost, and Quality in a Road Building Project" DOI: 10.1061/(ASCE)CO.1943-7862.0000094.

[15] James T. O'Connor, M.ASCE,1 and Youngki Huh2 'Crew Production Rates for Contract Time Estimation: Bent Footing, Column, and Cap of Highway Bridges' DOI: 10.1061/(ASCE)0733-9364(2005)131:9(1013).

[16] Karen Manley, Ph.D.1; and Le Chen, Ph.D.2 "Collaborative Learning to Improve the Governance and Performance of Infrastructure Projects in the Construction Sector" DOI: 10.1061/(ASCE)ME.1943-5479.0000545© 2017 American Society of Civil Engineers.

[17] Jiali Liu, ArashShahi "Validation Methodologies and Their Impact in Construction Productivity Research" Journal of Construction Engineering and Management, © ASCE, ISSN 0733-9364/04014046

[18] KaWah (Calvin) Chui "On-Site Labor Productivity measurement for Sustainable Construction" ASCE 2012 ICSDC 2011 pp 335-342

[19] Kevin N. Hassanali "A Productivity Model Utilising a Work Study Approach for Performance Measurement" ISSN 1000 7924 The Journal of the Association of Professional Engineers of Trinidad and Tobago Vol.40, No.1, April/May 2011, pp.13-25

[20] Laura Florez, Jean C. Cortissoz "Defining a Mathematical Function for Labor Productivity in Masonry Construction: A Case Study" Procedia Engineering 164, 2016, pp-42 – 48

[21] Lingguang Song, Simaan M. AbouRizk " Measuring and Modelling Labor Productivity Using Historical Data" DIO:10.1061/ (ASCE) 0733-9364(2008)134:10(786) Journal of Construction Engineering and Management © ASCE / October 2008.

[22] Markus Liberda, JanakaRuwanpuraand George Jergeas. "Construction Productivity Improvement: A Study of Human, Management and External Issues" ©ASCE 2003 PP 524-531

[23] Mostafa E. Shehata and Khaled M. El-Gohary "Towards improving construction laborproductivityand project's performance" Alexandria Engineering Journal, accepted 5 February 2012,PP 321–330

[24] Mustafa Oral, EmelLaptali Oral "Supervised vs. Unsupervised Learning for Construction Crew Productivity Prediction" Automation in Construction 22, 2012, pp-271–276.

[25] Neil N. Eldin "Measurement Of Work Progress: Quantitative Technique" J. Constr. Eng. Manage., 1989, 115(3): 462-474 ASCE.

[26] Prachi R. Ghate and Pravin R. Minde "Analysis of labor Productivity in Construction Sector around Mumbai region" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue: 6June 2016 PP 555 – 557

[27] Rateb J. Sweis and Ghaleb J. Sweis "Modeling the Variability of Labor Productivity in Masonry Construction" Jordan Journal of Civil Engineering, Volume 3, No. 3, 2009, PP 197-212

[28] Richard Fulfordand Craig Standing "Construction Industry Productivity and the Potential for Collaborative Practice" International Journal of Project Management accepted 23 May 2013 PP 1-12

[29] Shree Raja T.G. Gopal,K. Murali "Secondary Data Analysis on Factors Affecting Labor Productivity in Construction" International Journal of Scientific and Research Publications, Volume 6, Issue 5, May 2016 ISSN 2250-3153 PP 401-405

[30] SerdarDurdyev, Syuhaida Ismail, and Nooh Abu Bakar "Construction Productivity in Turkmenistan: Survey of theConstraining Factors" International Journal of e-Education, e-Business, e-Management and e-Learning, Vol. 3, No. 1, February 2013 PP 18-23

[31] Sherif Mohamed, KorbSrinavin "Forecasting Labor Productivity Changes in Construction Using the PMV Index" International Journal of Industrial Ergonomics 35, 2005, pp- 345–351

[32] Sudam Chavan , Hemant Salunkhe "A Study on Labor Productivity in Construction Industry" International Journal of Engineering Research ISSN:2319-6890(online),2347-5013(print) Volume No.5, Issue Special 1 pp : 247-249 8 & 9 Jan 2016

[33] Tirivavi Moyo , Ellen Mangore and Benviolent Chigara "Work Measurement Techniques Utilized by The Building Industry in The Midlands Province Of Zimbabwe" International Journal of Sustainable Construction Engineering & Technology (ISSN: 2180-3242) Vol 5, No 1, 2014

[34] Upul Ranasinghe, Janaka Ruwanpura "Streamlining the Construction Productivity Improvement Process with the Proposed Role of a Construction Productivity Improvement Officer" Journal of Construction Engineering and Management, Vol. 138, No. 6, June 1, 2012. ©ASCE, ISSN0733-9364, 2012 PP 697–706

[35] Vaishant Gupta1, R. Kansal "Improvement of Construction Labor Productivity in Chambal Region" IJRET: International Journal of Research in Engineering and Technology ISSN: 2321-7308 Volume: 03 Issue: 10 Oct-2014, PP 34-37

[36] Book of International Labor Office "Introduction To International Labor Office Work Study" Revised Edition Geneva 1969 Printed By Impression Couloirs Weber, 2501 Bienne, Switzerland

# Activated Sludge Process

[1] Mohd Yasar F. Patel, [2] Umesh L. Deshpande
[1] Student (M.Tech- Construction Management), Government College of Engineering, Karad.
[2] Prof, Assistant Professor, Government College of Engineering, Karad.

***Abstract*- Activated sludge process is an environmental and engineered system. Wastewater is an outcome of agricultural activities, industries and municipalities. The chemical composition of waste water indicates it's origin. Organic materials from waste water needs to be disposed so that the quality standards can be meet. The methods that are used for wastewater treatment are Activated sludge process, oxidation pond, anaerobic process, drop filtration. This overview shows the available information about the removal of organic material by active sludge process. Activated sludge process is the biological aerobic wastewater purification system that uses microorganisms and air to biologically oxidize the organic pollutants. This uses naturally occurring bacteria and protozoa, so it is an environmentally friendly and also an economical process. The active sludge process proved to be an effective method with room for further research in terms of cost-effectiveness, effluent of good quality, efficient removal of BOD and COD.**

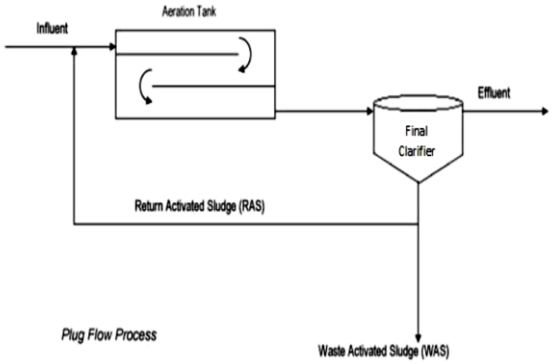
***Key Words*: Mixed Liquor Suspended Solids (MLSS), Mixed Liquor Volatile Suspended Solids (MLVSS), Food / microorganism ratio(F:M ratio), Cell Residence Time(CRT), Return Activated Sludge (RAS), Sludge Volume Index (SVI), Sludge Density Index (SDI).**

## I. INTRODUCTION

Activated sludge is a sludge particle that is reduced in the wastewater by the growth of organisms in aeration tanks. The term 'activated' comes from the fact that the particles are teaming with bacteria, fungi and protozoa and differs from primary sludge in the sense that the sludge particles contain many living organisms that can feed on the incoming waste water. Described simply, screened wastewater is mixed with varying amounts of recycled liquid containing a high percentage of organisms taken from a secondary clarification tank, and it becomes a product called mixed drink. This mixture is stirred and injected with large amounts of air, until care for oxygen and keep solids in suspension. After a while, mixed liquid flows to a settler where it can settle. Some of the bacteria are removed when it settles and the partly cleaned water continues to flow for further treatment. The result has been resolved solids, the activated sludge, are returned to the first tank to start the process again. Today a number of variations on the basis process have been developed. This issue of Pipeline contains descriptions of three of the most common variations: extensive aeration, sequencing batch reactors and oxidation locks. The activated sludge plant is the most popular biological treatment process for larger installations.

**PROCESS:**

A primary settler (or primary pre-cleaner) can be introduced to a part of the suspended solids present in the influent and this reduces the organic load to the activated sludge system. The biological reactor or aeration tank is filled with a mixture of activated sludge and influent, known as "mixed liquor". It is necessary to maintain certain mixed spirits suspended solids (MLSS) in the aerated tank maintain good removal efficiency. The aeration equipment transfers the oxygen required for the oxidation of organic material in the reactor, while at the same time sufficient turbulence is introduced to thesludge flakes in suspension. The continuous introduction of new influent results in a continuous discharge of mixed liquid to the secondary settler where separation of solids and liquid takes place. The liquid leaves the system as treated effluent, while part of the sludge is returned to the aeration tank called 'return sludge' and the rest of the sludge is taken anaerobic digestion.




Source: Amy Garbe (WDNR) and Operation of Municipal Wastewater Treatment Plants, Water Environment Federation (WEF) (Vol. II, 6th ed.)

**OVERVIEW OF CONTROL FACTORS:**

The proper functioning of an activated sludge installation requires knowledge of biological and physical factors that influence the efficiency of the process. These factors include:

- organic and hydraulic loads of the aeration tank
- dissolved oxygen in the aeration tank
- waste percentage of bio solids
- return the amount of activated sludge
- load occupancy rate

• solid particles sedimentation and compaction properties

**ORGANIC LOADING:**

Organic loading refers to the number of kilos per day that BOD enters the process. In most activated sludge plants this is based on the primary effluent, but in installations without primary clarification sources it would be based on the flow of the influent of the installation. Pounds per day BOD load can easily be calculated using the Pounds formula. Multiply the flow rate in million gallons per day by the weight of one gallon of water (8.34 lbs / gallon) and multiply the milligrams per liter of BOD in the flow to give the number of kilos per day of BOD in that flow.

It may be advantageous to calculate the organic load as a moving average of five days or seven days. This helps to moderate day-to-day load fluctuations, allowing more consistent control of operation. A moving average of seven days would be calculated by averaging the pound BOD for a given day with values for the six days before.

**QUANTITYOF MICRO ORGANISMS:**

The concentration of the mixed liquid (MLSS) is determined by analyzing the suspended particles of the suspension in the aeration tank. Because this suspension comprises both biological mass and inorganic material in the waste water, the amount of biological mass is estimated by determining the organic content of the MLSS. Mixed Liquor Volatile Suspended Solids (MLVSS) is determined by lighting a sample of the dried MLSS in a muffle furnace at 550 ° C. The material that burns at that temperature is considered organic and therefore estimates the biological mass. The material that remains (non-volatile or solid) estimates the inorganic fraction of the MLSS. Thus, in process control calculations where all solids are to be considered, MLSS is used in the calculation. In calculations where only the active biological population must be taken into account, MLVSS is used. Food / microorganism ratio (F: M) is one of the primary controls used in plants with activated sludge. This helps the operator to maintain a balance between the amount of food available with the amount of microorganisms in the aeration tanks. Although the best treatment may not occur at the same F: M ratio in different plants, the range for conventional activated sludge plants is often given as 0.25 to 0.45. Activated sludge plants operating in the extended aeration mode typically work with F: M in the range of 0.05 to 0.15.

**CELL RESIDENCE TIME:**

Cell Residence Time (CRT), also known as Sludge Age (SA) or Solids Retention Time (SRT), can be defined as the average duration in days that an organism remains in the secondary treatment system.

When a food supply is brought into a biological treatment plant that is in operation, there is an abundance of food but very few organisms. It is said that the organisms are in the Lag phase when they begin acclimatizing to the waste, produce the required enzymes and the population starts to rise. Once the organisms have been acclimatized, the growth rate increases rapidly in the log growth phase. At this point, the food supply is not a limiting factor because BOD is converted into biological mass, producing large quantities of sludge. In the declining growth phase, the population has grown to such an extent that the available food supplies begin to reduce the production of new cells and that organisms begin to compete for food. As the population ages (CRT 5 days or longer), larger and more complex organisms that are able to compete for the remaining food are more numerous, and predatory organisms begin to feed on smaller ones when a food chain develops. In the endogenous phase the food supply is depleted and as the age of the population increases (CRT is now up to >15 days), the growth rate of the organism continues to decline. Food that the organisms have stored is metabolized and the organisms feed on each other in endogenous breathing. Although the concentration of organisms is large, sludge production is lower. In view of the objectives and the costs of waste water treatment, there are clear advantages in operating an active sludge system in the extended aeration mode. BOD will have almost completely disappeared, producing high-quality waste water and sludge production will be the lowest.

**RETURN ACTIVATED SLUDGE:**

Return Activated Sludge (RAS) refers to the biological solids (solids of mixed liquids) that settle in the secondary settling tank and are continuously returned to the aeration tank. There are two main reasons for returning these organisms

**SLUDGE VOLUME INDEX:**

SVI is used by operators to determine and compare the settling capacity of mixed liquids. It relates mathematically to the settled sludge volume in the settleometer to the MLSS concentration. The definition for SVI is the volume in milliliters occupied by one gram of activated sludge that has been established for 30 minutes. Note that SVI relates the sludge volume in milliliters to the MLSS concentration in grams per liter

**SLUDGE DENSITY INDEX:**

SDI is another way to express sludge compaction, uses the same information as SVI, but expresses it as sludge density (weight by volume instead of volume by weight). The definition for SDI is the number of g of active sludge that takes up volume of 100 ml after 30 minutes of sedimentation.

**AERATION REQUIRMENTS:**

Aeration of the contents of the active sludge reactor accomplishes two important requirements. Mixing must take place to make contact between biomass and incoming pollutants; ensure that the entire content of the aeration tank

is kept in suspension. Dead zones in the tank may allow for deposition and mixed liquid will collect at the bottom of the tank. When this settled material begins to decompose, an area with little dissolved oxygen is created, creating conditions conducive to the growth of filamentous bacteria. These filaments bridge between floc particles, reduce the density of the mixed liquid and cause sedimentation problems in the secondary settler. In facilities where aeration equipment does not provide adequate mixing, additional mixing may be required.

Aeration should also provide oxygen to the vast population of aerobic and facultative bacteria and other organisms in the mixed fluid. Operators usually control the aeration rate to ensure a concentration of 2 - 3 mg / L dissolved oxygen (D.O.) at the discharge end of the aeration tank. Higher D.O. concentrations of waste capacity, while low D.O. (<1 mg / L) can stimulate the growth of filamentous bacteria. The amount of air that must be supplied to the aeration tank for the required D.O. concentration depends on various factors. As BOD (biochemical oxygen demand) increases, the organisms will need more oxygen to metabolise the waste and more air must be supplied to the D.O. concentration within the desired range. Likewise, since the number of pounds of biomass in the system is increasing, the air supply must be increased; each organism will use the amount of oxygen needed to sustain itself. Treatment goals such as nitrification and denitrification are also factors that determine how much air must be supplied. Although it takes 1.0 to 1.5 pounds of oxygen to degrade 1 pound of BOD, it takes 4.5 pounds of oxygen to convert 1 pound of ammonia into nitrate (nitrification). The oxygen transfer efficiency of the aeration equipment plays a major role in determining how much oxygen is supplied to the organisms at each cubic foot of air delivered into the aeration tank. Not all oxygen supplied to the aeration tank is dissolved in the water; most if it remains in gaseous form, bubbles to the surface and disappears for the atmosphere. The Standard Oxygen Transfer Efficiency (SOTE) for different aeration equipment ranges from about 10% to about 40% in clean water and up to 15 feet of immersion (diffuse aeration). Oxygen transfer can also be given as standard oxygen transfer rate (SOTR) given in units of kilogram of oxygen transferred per horsepower. The actual oxygen transfer efficiency (AOTE) or the actual transfer rate of oxygen (AOTR) in wastewater will be considerably less than the SOTE or the SOTR. The transfer of oxygen is influenced by many factors, including the type of equipment used (and how well it is maintained), the air temperature, the chemical properties of the water and the speed with which the organisms use the oxygen (oxygen uptake rate). For example, while the SOTR can reach as high as 6.5 pounds of oxygen per horsepower for a particular aeration device, the AOTR can be expected to be in the range of 2.5 pounds of oxygen per horsepower.

**AERATION EQUIPMENT - MECHANICAL AERATION:**

Air can be supplied to the aeration tank with the aid of mechanical aerators or a diffuse aeration system. Mechanical aerators splash the mixed liquid into the air, causing oxygen to dissolve in the water. There are many types of mechanical aerators, including vertical and horizontal designs. Vertical aerators can pump mixed liquid away from the bottom of the tank and place it against a deflector, or can act as large impellers, partially submerged in the mixed liquid near the surface of the aeration tank. Adjusting the depth of immersion changes the amount of aeration and mixing that occurs. Horizontal mechanical aerators, or rotors, are often seen in oxidation channel arrangements in which a long horizontal axis is suspended just above the surface of the aeration tank. Metal brushes or plastic discs mounted on the shaft rotate partially immersed in the mixed liquid, causing aeration and imparting speed to the mixed liquid that keeps the biomass in suspension. Here too, the aeration rate can be changed by adjusting the depth of the liquid in the tank, thereby increasing or decreasing the immersion of the rotor. Actual oxygen transfer rates for mechanical aerators range from about 1.8 to 2.5 pounds of oxygen per hour per hour. Aeration equipment - Diffuse aeration The most common aeration method in conventional installations with activated sludge is the diffuse aeration system. In this system a blower (compressor) is used to supply air at low pressure to a piping composition with air diffusers submerged near the bottom of the aeration tank. The diffusers break the airflow into small bubbles from which oxygen is transferred to the liquid as the bubbles rise to the surface. Increasing the amount of time that the bubble is in contact with the liquid increases the efficiency of the oxygen transfer. Aeration tanks are typically deep enough designed (often about 15 - 18 feet) to maximize the travel time from the bubble to the surface, but not so deep that so much head (pressure) against the blower arises that it is out of reach for maximum efficiency. Aeration tanks are sometimes also configured to cause a rolling movement of the liquid in the tank, again to keep the air bubbles in contact with the mixed liquid for as long as possible.

**BLOWERS**

centrifugal Blowers Centrifugal blowers are used in almost all medium to large installations with activated sludge. These work as turbines with a high speed, with air outputs of 20,000 - 150,000 CFM. The volume of the pumped air is variable within a range, adjusted by controlling an inlet guide vane (throttle valve on the suction side of the fan).

Positive displacement fans are often called rotating lobes blowers. As the rotating lobes rotate, a fixed volume of air is displaced each time the lobes come together. These blowers operate at lower revolutions than centrifugal blowers and generally produce less than 20,000 CFM of air. Unlike

centrifugal blowers, the air delivery of blowers with positive displacement can not be varied by the use of throttle valves. Air output can only be changed by changing the speed at which the blower operates, for example by changing the pulley size on the blower or the engine.

**Blower maintenance**

Whether centrifugal or positive displacement, blowers are difficult and expensive to repair, largely due to the fact that they work at high speed and are machined to a very close tolerance. The shops of wastewater treatment plants are rarely equipped to carry out major repairs on this type of equipment and usually contract this work. Heat, vibration and dust are often causes of premature wear and failure of the fan. Improperly maintained air filters that result in air restrictions on the suction side or leaks that allow dust to enter the blower are harmful to both types of blowers. Lubrication and other preventive maintenance must be carried out in accordance with the manufacturer's specifications. Pipes connecting the blower to the air diffusion system at the aeration tank may be a simple down pipe extending from the deck of the aeration tank to the bottom of the tank, or may be a sway system. The advantage of the swing system is that hinges in the pipes allow the operator to remove an aeration battery from the tank using a tap on the deck of the tank when maintenance of the diffuser is required. Naturally, this operation requires an adequate crew and careful compliance with all safety considerations.

**DIFFUSION EQUIPMENT**

Air diffusers have been designed in many shapes and sizes over the years; some are more successful than others. Air vents can generally be classified as either coarse bubbles or fine bubbles.

**Coarse bubble spreaders**

Coarse bubble spreaders have been used for many years in installations for activated sludge. Because compressed air from the blower flows from the air supply through a small opening in the diffuser, the air is inflated in small bubbles. The diffusers are usually made of plastic or stainless steel and ensure good mixing and aeration with minimal loss of the head. These diffusers are resistant to clogging and can work for a long period with minimal maintenance. Reported standard oxygen transfer efficiency in clean water for diffuse diffusers for coarse bubbles ranges from 9% to 13% at 15 foot immersion. Actual oxygen transfer rates vary from about 1 to 2 pounds of oxygen per horsepower, depending on the type of diffuser and the configuration of the aeration tank.

**Fine bubble spreaders**

Fine bubble spreaders began to gain popularity in the 1970s when energy costs increased and the limits for discharge licenses became stricter. Since energy costs for the use of the aeration system in an active sludge installation represent a very large part of the annual budget for the installation, the need to maximize the efficiency of aeration systems is obvious. Reported standard oxygen transfer Efficiency varies greatly depending on the type of diffuser, ranging from 13% to 40% in clean water at 15 feet of immersion. Again, it should be noted that actual transfer efficiency in waste water will be lower than in clean water, especially as the system ages. Actual transfer rates of oxygen range from about 1.3 to 2.5 pounds of oxygen per hour per hour.

## II. CONCLUSION

The efficiency of activated sludge process is dependent on the organic loading rate, dissolved oxygen in the tank and the external oxygen entrained by using aeration process. Compared to the other process of wastewater treatment, activated sludge process is more efficient, sustainable, economical and more wastewater can be treated

## REFERENCES

[1] Metcalf, and Eddy, “Wastewater Engineering. Treatment Disposal Reuse,” G. Tchobanoglous and F.L. Burton (Eds.), 1820 pp. New York: McGraw-Hill, 1991.

[2] Metcalf, and Eddy, “Water and wastewater treatment,” Tata McGraw hill Publication New Delhi, 5th Edition, pp. 196-1202, 2004.

[3] Mark Sustarsic, “Wastewater Treatment: Understanding the Activated Sludge Process,” aiche.org/CEP., Nov. 2009.

[4] “Activated Sludge Process,” Water and Wastewater Engineering.

[5] “Activated Sludge Treatment Process,” The World Bank Group, 2014.

[6] “Dissolved Oxygen and Biochemical Oxygen Demand,” Water: Monitoring and Assessment.

[7] Tilley, David F., “Aerobic Wastewater Treatment Processes: History and Development,” IWA, 2011.

[8] Lenore S. Clescerl, Arnold E. Greenberg, Andrew D. Eaton, “Standard Methods for Examination of Water and Wastewater,” 20th Edition, 1991.

[9] United States Environmental Protection Agency, “Primer for Municipal Wastewater Treatment System,” EPA 832-R-04-001, September 2004.

[10] Status of Sewage Treatment in India by Central Pollution Control Board, November 2005.

[11] Norton, John F., "Standard Methods for Examination of Water and Sewage," American Public Health Association, 9th Edition, p. 139, 1946.

[12] Clair N. Sawyer, Perry L., McCarty, Gene F. Parkin, "Chemistry for Environmental Engineering and Science," New York: McGraw-Hill, 5th Edition, and ISBN 0-07-248066, 2003.

[13] "Wastewater Technology Fact Sheet: Fine Bubble Aeration," EPA 832-F-99-065, September 1999.

[14] "Experiment on Determination of Turbidity," National Institute of Technical Teachers' Training and Research, Chennai.

[15] "Wastewater Technology Fact Sheet: Package Plants," EPA 832-F-00-016, September 2000.

[16] "Standard methods for the examination of wastewater," American Public Health Association, American Water Works Association, and Water Environmental Federation, Washington. D.C., 1995.

[17] Brandy L. Nussbaum, Alf Soros, Andrzej Mroz, and Bjorn Rusten, "Removal of Particulate and Organic Matter from Municipal and Industrial Wastewater Using Fine Mesh Rotating Belt Sieves," Water Environment Foundation, 2006.

[18] Timothy G. Ellis, "Chemistry of Wastewater," Chemical Sciences and Engineering and Technology Resources – Sample Chapters, 2004.

[19] "Wastewater Treatment: The Municipal Sludge Production Process," United Nation Environment Programme.

[20] Shivaraju. H.P, "Removal of Organic Pollutants in the Municipal Sewage Water by Tio2 based Heterogeneous Photo catalysis," International Journal of Environmental Sciences, Vol. 1, No 5, 2011.

[21] "Understanding Laboratory Wastewater Tests: I. Organics (BOD, COD, TOC, O& G)," The University of Georgia College of Agricultural and Environmental Sciences, April 2014.

[22] Anonymous, "Biological Oxygen Demand (BOD) – Overview."

# Constructed Wetland System

[1] Onkar R. Misal, [2] Umesh L. Deshpande
[1] Student (M.Tech- Construction Management), Government College of Engineering, Karad.
[2] Prof, Assistant Professor, Government College of Engineering, Karad.

***Abstract*- Constructed wetland treatment system (CWTS) is a engineered system, which is used as a advanced secondary treatment for wastewater. It involves physical, chemical and biological process for treatment of wastewater. Planted vegetation with its supporting media (soil and rock) plays an important role in contaminant removal. CWTS is low cost, sustainable and effective alternative in comparison with conventional wastewater treatments like Activated Sludge Treatment, Bio-tower, etc... CWTS is used to purify the wastewater and helps to improve the vegetation. There are several methods of treatment of water but due to lack of awareness most of the time such a treatment methods are fails to fulfil the practical need of reuse of water. As the various researchers carried out the study and it is found that Constructed Wetland (CW) System is more efficient and effective to solve the problem of wastewater. This system is applicable for the agricultural field as it performs the function of irrigation system for the crop.**

***Key Words*: Constructed Wetland Treatment System (CWTS), Vegetation, Reuse of wastewater.**

## I. INTRODUCTION

Wastewater is the by product which is arises from the different domestic, commercial, and industrial activities. As the water arises from these sources contained some impurities due to this reason, we can't use such a wastewater directly for any other purpose such as drinking, washing etc. So the treatment of wastewater is the today's modern need in order to convert the wastewater by using constructed wetland system so that it is beneficial to ecosystem, environment as well as human beings. The treated water by using constructed wetland system can also fulfil the need of irrigation in agricultural field so that it saves the additional quantity of water which is needed for crop. The treatment of wastewater or storm water by constructed wetlands can be a low-cost, low energy process requiring minimal operation.

## II. TYPES OF CWTS

**2.1 Surface flow wetland system :**
In this system water level is above the ground surface and vegetation is rooted and emerges above the water surface. It is the system which includes the water flow above the ground. It s also called as Free Surface Wetland. This system is advantages because of their low capital and operating cost. The construction operation and maintenance of this system is not too much complicated. But the only disadvantage of this system is that it require larger land area as compare to sub-surface flow system.

**2.2 Sub-surface flow wetland system :**
This system is reversal to that of the surface flow system in which water level is bellow the ground and flow of water is maintained through a sand or gravel bed & roots penetrate to the bottom of the bed. This system consist of sealed basin with a porous rock or gravel bed. This systems are called by the several names according to type or pattern of flow such as vegetated submerged bed, root zone method, microbial rock reed filter, and plant rock filter system.
This system is advantageous as it provides greater surface area for the treatment of water. It involves the faster treatment of water due to greater surface area as compared with surface flow wetland system. But the only disadvantage of this system is that it is more expensive to construct and operate. It also cause a problem of clogging and non-uniform surface flow which unnecessarily increase the repairing cost of the system.

**2.3 Hybrid system : which is combination of surface and subsurface flow wetland system.**

## III. GENERAL DESIGN OF CONSTRUCTED WETLAND TREATMENT SYSTEM :

Design of CWTS is quite complex from the technological point of view, as the numerous research and publication gives the actual design of constructed wetland but its applications has not yet been determined. Design criteria involves the following steps :

- Planning
- Site selection
- Land use and access
- Land availability
- Topography

Examples: Agricultural wastewater, domestic wastewater, Coal mine drainage, storm water runoff etc.

**3.1 Construction**
CWS involve following parts

**3.1.1 Liner :**
It helps in preventing the percolation of wastewater into the ground water. It is water tight component of wetland system generally made up with the most common and reliable

material such as Polyvinylchloride (PVC). PVC liner is advantageous over the clay liner as it prevents the cracking and does not allow the wastewater to seeps through it.

**3.1.2 Distribution media :**

Distribution medium is provided at the inlet and is usually made up with the coarse drained filled rock nearly about 2.5 inches in diameter. Distribution media is used to spread the wastewater evenly across the width of wetland.

**3.1.3 Inlet :**

It is a component which allows the entry of water in the storage basin of the constructed wetland. It is provided in the form of PVC pipe with the perforations at the entrance to allow the water to pass uniformly.

**3.1.4 Outlet :**

It continues with the line of inlet pipe provide with the perforations same as that of inlet pipe to allow the treated water to pass outside from the wetland system.

## IV. OPERATION, MAINTENANCE AND MONITORING:

**4.1 Operation of CW:**

Wastewater which is arises from any source whether it may be industrial or domestic is first of all settled in a settling tank so that sewage effluent is precipitated at the bottom of the settling tank and the wastewater at the top most surface is incorporated in the CW through the inlet and outlet arrangement. As the water pass through the inlet pipe through perforations is allow to flow uniformly so that continues flow of water is maintained and the microbes which are present in wastewater bring out the decomposition of organic matter which latter on after the completion of required design period gets completely vanished from the wastewater due to continuity of flow and gives treated water.

**4.2 Maintenance and Monitoring of CWTS :**

In CWTS it is important to set water depth to control structures. Schedule for cleaning and maintaining inlet and outlet structures, valving, and monitoring devices which helps to smooth running of the system. Proper Schedule for inspecting embankments and structures for damage. Maintenance and Monitoring plan of CWS should involves a sufficient depth of sediment accumulation before removal is required. Operating range of water levels, including acceptable ranges of fluctuation of water flow. The supplemental water source to be used to ensure adequate water levels during operation.

## V. CONCLUSION

CWTS is sustainable, effective and productive approach to improve the present status of vegetation. CWTS is the best solution to remove contaminant and microbes from the wastewater. This system gives maximum efficiency when it is properly constructed, maintained and operated. It is cost effective system which does not require any external water pumping system as it works by gravity. CWTS is best alternative over the conventional wastewater treatment like activated sludge process, bio-tower, etc...

## REFERENCES

[1] Y. M. Patil, G. R. Munavalli Performance evaluation of an Intigrated On-site Greywater Treatment System in a tropical region. Ecological Engineering 95 (2016) 492-500.

[2] Atasi Patra Modeling and simulation of a wetland park: An application to Keoladeo National Park, India IMACS.

[3] P. G. Sonavane Potential of Batch Constructed Wetland for Nitrogen Removal Journal of Indian Water Works Association October - Desember 2007.

[4] P. G. Sonavane Modeling nitrogen removal in a constructed wetland treatment system WST 2009.

[5] Izharul Haq Farooqi Constructed Wetland System for Wastewater Treatment The 12th World Lake Conference: 1004-1009.

[6] K. V. Jayakumar A Study on the Use of Constructed Wetlands for Treatment of Municipal Wastewater During Summer and Rainy Seasons in a Semi Arid City in India Global Solutions for Urban Drainage 2002.

[7] Michael Trepel Models for wetland planning, design and management EcoSys Bd. 8, 2000, 93-137.

[8] A. S. Juwarkar Domestic Wastewater Treatment Through Constructed Wetland In India Wat. Sci.Tech. Vol.32, No.3. pp. 291-294.1995.

[9] Abdel Razik A. Zidan Wastewater treatment in horizontal subsurface flow constructedwetlands using different media (setup stage) National Water Research Center.

[10] ElZein. Z. Constructed Wetlands as a Sustainable Wastewater Treatment Method in Communities Procedia Environmental Sciences 34 ( 2016 ) 605 – 617.

[11] Katarzyna SKRZYPIEC The use of constructed wetlands for the treatment of industrial wastewater JOURNAL OF WATER AND LAND DEVELOPMENT 2017.

[12] Jan Vymazal Constructed wetlands for treatment of industrial wastewaters: A review J. Vymazal / Ecological Engineering 73 (2014) 724–751

# Management of Construction & Demolition Waste

[1] Shraddha R.Zodpe, [2] B.A. Konnur
[1] Student (M.Tech- Construction Management), Government College of Engineering, Karad.
[2] Prof, Assistant Professor, Government College of Engineering, Karad.

***Abstract*- Technological Advancement, & improved management system, bring out the necessity of improvement as well as development in the construction phase. Construction and demolition waste is the today's major problem faced by the developing countries like India. Government is also actively participating in this field to reduce the huge impact of construction and demolition (C&D) waste on environment. The term wastage in case of a construction and demolition refers to the variation between estimated and actual consumption of an individual item and total consumption of the inputs in construction project. It is necessary to bring about a new way of working and thinking in order to reduce the wastage of materials and convert it into another alternative and usable form. So that it requires implanting modern technology to improve productivity in construction waste Management.**

***Key Words*: Construction and Demolition (C & D), Wastage of Materials, Technology, Impact, Input.**

## I. INTRODUCTION

Construction and demolition (C&D) waste is obtained from construction, renovation, repair, and demolition of houses, large building structures, roads, bridges, piers, and dams and other repairing and renovation works. C&D waste is generally consist of wood, steel, concrete, masonry, plaster & metal. The total quantum of C&D waste generated in India is estimated to 11.4 to 14.69 million tonnes per annum (TIFAC, 2000). The concrete, brick and masonry together constitutes more than 50 per cent of the total C&D waste. This shows the importance of Management of C&D waste. Excessive production, improper handling, improper storage, manufacturing defects are the main cause of wastage of materials. Many researchers suggested that the main aim of this research work is to improve existing situation of C&D waste and manage it properly, especially in the construction of new residential buildings.

**1.2 Methodology**: The methodology that is to be adopted in this work, is to carry out a detailed literature study along with the site observation.

**1.3 Construction and Demolition Wastes**

In addition to this it also includes the materials generated as a result of natural disasters such as flooding, earthquake. Construction and demolition waste can be classified into two components; major components includes cement concrete, bricks, cement plaster, steel from RCC, doors & windows roofing support systems, rubble, stones, timber etc. and minor components includes conduits, GI pipes/Iron pipes/Plastic pipes, electrical fixtures, panels, glass etc. Components of C&D debris include materials such as concrete, wood, brick, metals. Demolition wastes are much larger in volume than the construction wastes. Construction wastes are mainly leftovers from new construction materials like cut-offs, damaged materials, packaging waste, used materials during construction.

**1.4 Overview Of Construction And Demolition Waste**

The disposal of C&D wastes is becoming a major concern in the recent years. The wastes are being disposed off improperly and illegally in order to avoid transportation and tipping costs. Farm land, prime residential areas, pits and low lying areas have become disposal sites. These illegal dumping to landfills mainly threats to ground water contamination. It is estimated that the construction industry in India generates about 10-12 million tons of Construction and Demolition (C&D) waste annually. With rapid urbanization the quantum of C&D waste is ever increasing and needs urgent attention. Construction Waste Management is an aspect of Sustainable Development, which is fuelled by the growing concern for the effect of man's activities on the environment. The management of Construction processes to reduce, reuse, recycle and effectively dispose of wastes has a serious bearing on the final cost, quality, time and impact of the project on the environment. poor understanding of waste management leads to the wastage of materials and most companies did not have a policy on Material Waste Management. It also includes incidences of wastages in labour and energy used in construction works. However, material waste has been recognized as a major problem in the construction field that has important implications both for the efficiency and for the environmental impact of construction projects. In an Indian construction industry huge amount of construction and demolition waste is generated due to improper management strategy.

**A. Benefits of C&D Waste Recycling**

C&D waste recycling bring out the necessity of new way of working and thinking. It generates a new employment opportunities in recycling industries and also solve the problem of illegal dumping of such a huge amount of material directly to the landfill. Recycling of C&D waste saves energy and also reduces the environmental impact. A

lot of money can be saved by reducing the project disposal costs, transportation costs and the cost of new construction materials by recycling old materials onsite.

**B. Environmental Benefits of Recycling Construction and Demolition Waste**

The environmental benefits of recycling construction and demolition waste are considerable pollutants and contaminating agents which are responsible for ground water contamination and also hazardous to environment are removed and avoided through the process of recycling.

**1.5 C AND D WASTE MANAGEMENT INCLUDES FOLLOWING STEPS.**

1. Storage and segregation: C&D wastes should be deposited/collected at source or place of generation. If they are Separation can be carried out at source during C&D activities or it can be achieved by processing the mixed material to remove the solid wastes. Separation at source is most efficient in terms of energy utilization, cost and time.

2. Collection and transportation: The time taken for handling (loading and unloading) large volumes of wastes should be kept to minimum by using front-end loaders and trucks.

3. Recycling and reuse: The growing population and requirement of land has reduced the availability of land for C&D waste disposal. Reuse and recycling are important strategies for management of waste. Other reasons that support the adoption of these strategies are reduced extraction of raw materials, reduced transportation cost, improved profits and reduced environmental impact. To conserve the conventional natural aggregate for other important works, all fast exhausting sources of conventional natural aggregate has demanded the use of recycling/ reuse technology.

4 Disposal: These material can be used for filling or levelling of low-lying areas. In the developed countries, special landfills are created for inert waste, which are normally located in abandoned areas. Construction & Demolition (C&D) Waste Management Plan should identify the construction and demolition waste materials that will likely be generated on a building site; the procedures that will be used to collect and sort the waste materials on site; how will the waste material be transported from site; the location to which the materials will be hauled; how the materials will be reused or recycled.

1.6 C&D Management Practices Followed In India: Delhi ( India's First Construction and Demolition Waste Management Plant). ( Article : Times of India Published on Jul 7, 2015)

It is India's first large scale operational C&D recycling facility. Delhi Government take an initiative to manage the construction and demolition waste This Plant was set up in 2009 by Municipal Corporation of Delhi (MCD) through PPP in collaboration with IL&FS Environmental Infrastructure & Services Ltd. As Delhi grows, the infrastructure projects like construction of roads, flyovers, metro routes generate large quantities of Construction & Demolition (C&D) waste. This increases further due to the vertical growth in the residential. The city of Delhi itself generates 4000 to 5000 Tons Per Day (TPD) of C&D waste.

1. The plant produces fine sand, dust and other building construction materials like pavement blocks and curbs stones. The land for establishing the plant is provided by MCD in Burari, North of Delhi for a period of ten years.
2. The processing fee for C&D Waste is about INR 205 per ton. The city has been divided into three zones for collection of waste- Karol Bagh, Sadar-Paharganj and the City zone.
3. All vehicles used for the facility have been equipped with GPS. IEISL commitment to the project is about INR 23 crore inclusive of INR 8 crore capital investments. The capital expenditure incurred by the project is proposed to be covered over a period of 10 years by deriving value from the processed C&D Waste.

## II. CONCLUSION

- The Proposed site is located in the Pune City which involves a demolition of residential house & construction of new structure on the same place that is redevelopment work.
- From the site observation it is clear that, the waste prevention and minimization should be the first priority, because at present, no such a management practices followed in order to reduce the impact of such a huge amount of waste arises in the construction field.
- The amount of Demolished materials such as concrete, bricks, reinforcement that is arises on site is generally dumped or sold on the lump sum basis & no one is carried out a proper demolition plan for the wastage of such a material. Therefore it is a necessary to adopt the best practices so as to reuse and recycling of the demolition materials for example, use of recycled materials for site clearance, use of waste debris for plinth filling ,road construction works etc.
- Use of recycled materials reduces the quantities of waste which ultimately needs to be land filled. The effort should be to prevent waste generation and also to reduce the amount of waste generated during the construction.
- The contractors should plan the construction process to eliminate or reduce waste.

- They should be responsible to minimize the volume arising in the site, use the reclaimed materials in the works and influence wastage caused by poor materials handling.
- Management Practices should be followed before the actual commencement and execution of the work at site, this may leads to proper and effective completion of project with less distraction of unwanted construction waste.

***Fig 1: Demolition of Slab on Site***

***Fig 2: Demolished Material of Staircase***

**REFERENCES**


1. Shen L.Y.,et al "Mapping approach for examining waste management on construction sites" Journal of Construction Engineering and Management, Vol. 130, No. 4, August 1, 2004. ASCE / july/august 2004.

2. Dat Tien Doan et al " Modeling Construction and Demolition Waste Recycling Program in Bangkok: Benefit and Cost Analysis" Journal of Construction Engineering and Management, © ASCE, ISSN 0733-9364.

3. Hee Sung Cha,et al " Case Study on Selective Demolition Method for Refurbishing Deteriorated Residential Apartments" Journal of Construction Engineering and Management, Vol. 138, No. 2, February 1, 2012. ©ASCE, ISSN 0733-9364/2012.

4. HilaryI.Inyang"Framework for Recycling of Wastes in Construction" Journal of Environmental Engineering,Vol. 129, No. 10, October 1, 2003. ©ASCE, ISSN 0733-9372/2003/10-887–898.

5. Ming Lu, M.ASCE, et al" Simulation Approach To Evaluating Cost Efficiency Of Selective Demolition Practices: Case Of Hong Kong's Kai Tak Airport Demolition" Journal of Construction Engineering and Management, Vol. 135, No. 6, June 1, 2009. ©ASCE, ISSN 0733-9364/2009/6-448–457.

6. Jack C.P. Cheng et al,"Construction And Demolition Waste Management Using BIM Technology" Proc. 23rd Ann. Conf. of the Int'l. Group for Lean Construction, 28-31 July,(www.reaearchgate.net).

7. JongsungWon"Identifying potential opportunities of building information modeling for construction and demolition waste management and minimization" Automation in Construction • March 2017 DOI: 10.1016/j.autcon.2017.02.002

8. Madelyn Marrero et al," Demolition Waste Management in Spanish Legislation" The Open Construction and Building Technology Journal, 2011, 5, (Suppl 2-M7) 162-173

9. Paola Villoria Sáez et al," European Legislation and Implementation Measures in the Management of Construction and Demolition Waste" The Open Construction and Building Technology Journal, 2011, 5, (Suppl 2-M6) 156-161 1874-8368.

10. Mercedes del Río Merino et al,"Legal Aspects which Implement Good Practice Measures in the Management of Construction and Demolition Waste" The Open Construction and Building Technology Journal, 2011, 5, (Suppl 2-M2) 124-130

11. N. Gonzalez Pericot et al," Management Of Waste From Packaging Of Construction Materials In Building Construction Works" The Open Construction and Building Technology Journal, 2011, 5, (Suppl 2-M5) 149-155.

12. Jil T. Seth,et al " Analysis of Construction and Demolition Waste Management Policies from Sustainability Perspective" (IJSRD/Conf/Habitat/2016/006)

13. Anagal Vaishal et al," Construction And Demolition Waste Management - A Case Study Of Pune"Paper No. A-18 October 12-14, 2012.

14. Roshan S. Shetty, "Construction and Demolition waste – An Overview of Construction Industry in India"International Journal of Chemical, Environmental & Biological Sciences (IJCEBS) Volume 1, Issue 4 (2013) ISSN 2320-4079; EISSN 2320–4087.

15. Siddharth Patel et al ," Construction and Demolition Waste Recycling" IJIRST –International Journal for Innovative Research in Science & Technology Volume 1 Issue 7 December 2014 ISSN (online): 2349-6010

16. Shant A. Dajadian et al," Waste Management Models and Their Applications on Construction Sites " International Journal of Construction Engineering and Management 2014, 3(3): 91-98

17. Harish. P. Gayakwad et al," Construction and Demolition Waste Management in India"International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 03 June-2015.

18. Manal S. Abdelhamid ,"Assessment of different construction and demolition waste management approaches" Housing and Building national research center (HBRC) Journal (2014) 10, 317–326.

19. Job Thomas et al," Construction waste management in India" American Journal of Engineering Research (AJER) e-ISSN : 2320-0847 p-ISSN : 2320-0936 Volume-2 pp-06-09.

20. Bon-Gang Hwang et al," Perception on benefits of construction waste management in the Singapore construction industry" Article in Engineering Construction & Architectural Management • July 2011 (www.researchgate.net).

21. Markandeya Raju Ponnada et al,"Construction and Demolition Waste Management – A Review" International Journal of Advanced Science and Technology Vol.84 (2015).

# Common factors of Fibonacci-Like, Fibonacci and Lucas Numbers

[1] Yashwant K. Panwar , [2] G. P. S. Rathore, [3] Richa Chawla
[1] Department of Mathematics, Mandsaur Institute of Technology, Mandsaur, India
[2] Department of Mathematical Sciences, College of Horticulture, Mandsaur, India
[3] School of Studies in Mathematics, Vikram University, Ujjain, India
[1] yashwantpanwar@gmail.com

***Abstract*- The classic Fibonacci numbers have been used as in different sciences. The Fibonacci number is famous for possessing wonderful and amazing properties. In this paper, we present identities involving common factors of Fibonacci-Like, Fibonacci and Lucas numbers. Binet's formula will employ to obtain the identities.**

***Key Words*: Fibonacci numbers, Fibonacci-Like numbers, Lucas numbers, Binet's formula.**

## 1. INTRODUCTION

There are a lot of identities of Fibonacci and Lucas numbers described in [7]. Thongmoon [14], defined various identities of Fibonacci and Lucas numbers. Singh, Bhadouria and Sikhwal [11], present some generalized identities involving common factors of Fibonacci and Lucas numbers. Gupta and Panwar [2], present identities involving common factors of generalized Fibonacci, Jacobsthal and Jacobsthal-Lucas numbers. Panwar, Singh and Gupta ([9], [10]), present generalized identities involving common factors of generalized Fibonacci ($V_k$ & $U_k$), Jacobsthal and jacobsthal-Lucas numbers and related identities.

Singh, Sikhwal, and Bhatnagar [12], defined Fibonacci-Like sequence by recurrence relation $S_k = S_{k-1} + S_{k-2}$ , $k \geq 2$ (1.3)

$with\ S_0 = 2,\ S_1 = 2.$

The associated initial conditions $S_0$ and $S_1$ are the sum of the Fibonacci and Lucas sequences respectively, i.e. $S_0 = F_0 + L_0$ and $S_1 = F_1 + L_1$.

Natividad [8], Deriving a Formula in solving Fibonacci-Like sequence. He found missing terms in Fibonacci-Like sequence and solved by standard formula.

Gupta, Panwar and Sikhwal [4], defined generalized Fibonacci sequences and derived its identities connection formulae and other results. Gupta, Panwar and N. Gupta [3], stated and derived identities for Fibonacci-Like sequence. Also described and derived connection formulae and negation formula for Fibonacci-Like sequence. Singh, Gupta and Panwar [13], present many combinations of higher powers of Fibonacci-Like sequence. In this paper, we present identities involving common factors of Fibonacci-Like, Fibonacci and Lucas numbers.

## 2. PRELIMINARIES

Before presenting our main theorems, we will need to introduce some known results and notations.

The sequence of Fibonacci numbers $F_n$, [7], is defined by

$F_n = F_{n-1} + F_{n-2}$, $n \geq 2$ $with\ F_0 = 0,\ F_1 = 1$ (2.1)

The sequence of Lucas numbers $L_n$, [7], is defined by

$L_n = L_{n-1} + L_{n-2}$, $n \geq 2$ $with\ L_0 = 2,\ L_1 = 1$ (2.2)

The sequence of Fibonacci-Like numbers $S_k$, [12], is defined by

$S_k = S_{k-1} + S_{k-2}$ , $k \geq 2$ $with\ S_0 = 2,\ S_1 = 2$ (2.3)

The Binet's formula for Fibonacci-Like sequence is given by

$$S_k = 2\left(\frac{\Re_1^{k+1} - \Re_2^{k+1}}{\Re_1 - \Re_2}\right) \quad (2.4)$$

where $\Re_1$ & $\Re_2$ are the roots of the characteristic equation $x^2 = x + 1$ and

$$\Re_1 = \frac{1+\sqrt{5}}{2} \quad and \quad \Re_2 = \frac{1-\sqrt{5}}{2} \quad .$$

## 3. MAIN RESULTS

Fibonacci-Like sequence is similar to the other second order classical sequences. In this section we present identities of the Fibonacci-Like sequence (2.3) and we describe and derive the identities of common factors of Fibonacci-Like, Fibonacci and Lucas numbers. We shall use the Binet's formula for derivation.

The few terms of the Fibonacci-Like sequence are 2, 2, 4, 6, 10, 16, 26 and so on.

**Theorem1:** $S_{4k-1}+2=S_{2k-2}L_{2k+1}$, *where* $k\geq 1$ (3.1)

**Proof:**

$$S_{2k-2}L_{2k+1}=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k-1}-\Re_2^{2k-1}\right)\left(\Re_1^{2k+1}+\Re_2^{2k+1}\right)$$

$$=\frac{2}{\Re_1-\Re_2}\left\{\left(\Re_1^{4k}-\Re_2^{4k}\right)+\left(\frac{\Re_2}{\Re_1}-\frac{\Re_1}{\Re_2}\right)\right\}$$

$$=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k}-\Re_2^{4k}\right)-2\left(\frac{\Re_1^2-\Re_2^2}{\Re_1\Re_2\left(\Re_1-\Re_2\right)}\right)$$

$$=S_{4k-1}+2$$

This completes the proof.

**Corollary1.1:** *For* $k\geq 1$,

$$S_{2k-2}L_{2k+1}=2\left[F_{4k}+1\right] \quad (3.2)$$

**Theorem2:** $S_{4k-2}+2=S_{2k-2}L_{2k}$, *where* $k\geq 1$ (3.3)

**Proof:**

$$S_{2k-2}L_{2k}=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k-1}-\Re_2^{2k-1}\right)\left(\Re_1^{2k}+\Re_2^{2k}\right)$$

$$=\frac{2}{\Re_1-\Re_2}\left\{\left(\Re_1^{4k-1}-\Re_2^{4k-1}\right)+\left(\frac{1}{\Re_1}-\frac{1}{\Re_2}\right)\right\}$$

$$=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k-1}-\Re_2^{4k-1}\right)+2\left(\frac{\Re_2-\Re_1}{\Re_1\Re_2\left(\Re_1-\Re_2\right)}\right)$$

$$=S_{4k-2}+2$$

This completes the proof.

**Corollary2.1:** *For* $k\geq 1$,

$$S_{2k-2}L_{2k}=2\left[F_{4k-1}+1\right] \quad (3.4)$$

**Theorem3:** $S_{4k+3}+2=S_{2k+3}L_{2k}$, *where* $k\geq 0$ (3.5)

**Proof:**

$$S_{2k+3}L_{2k}=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k+2}-\Re_2^{2k+2}\right)\left(\Re_1^{2k}+\Re_2^{2k}\right)$$

$$=\frac{2}{\Re_1-\Re_2}\left\{\left(\Re_1^{4k+2}-\Re_2^{4k+2}\right)+\left(\Re_1^{2}-\Re_2^{2}\right)\right\}$$

$$=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k+2}-\Re_2^{4k+2}\right)+2\left(\Re_1+\Re_2\right)$$

$$=S_{4k+3}+2$$

This completes the proof.

**Corollary3.1:** *For* $k\geq 0$,

$$S_{2k+3}L_{2k}=2\left[F_{4k+2}+1\right] \quad (3.6)$$

**Theorem4:** $S_{4k+4}+2=S_{2k+2}L_{2k+2}$, *where* $k\geq 0$ (3.7)

**Proof:**

$$S_{2k+2}L_{2k+2}=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k+1}-\Re_2^{2k+1}\right)\left(\Re_1^{2k+2}+\Re_2^{2k+2}\right)$$

$$=\frac{2}{\Re_1-\Re_2}\left\{\left(\Re_1^{4k+3}-\Re_2^{4k+3}\right)+\left(\Re_1-\Re_2\right)\right\}$$

$$=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k+3}-\Re_2^{4k+3}\right)+2$$

$$=S_{4k+4}+2$$

This completes the proof.

**Corollary4.1:** *For* $k\geq 0$,

$$S_{2k+2}L_{2k+2}=2\left[F_{4k+3}+1\right] \quad (3.8)$$

**Theorem5:** $S_{4k+2}-2=S_{2k+1}L_{2k+1}$, *where* $k\geq 0$ (3.9)

**Proof:**

$$S_{2k+1}L_{2k+1}=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k}-\Re_2^{2k}\right)\left(\Re_1^{2k+1}+\Re_2^{2k+1}\right)$$

$$=\frac{2}{\Re_1-\Re_2}\left\{\left(\Re_1^{4k+1}-\Re_2^{4k+1}\right)-\left(\Re_1-\Re_2\right)\right\}$$

$$=\frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k+1}-\Re_2^{4k+1}\right)-2$$

$$=S_{4k+2}-2$$

This completes the proof.

**Corollary5.1:** *For* $k\geq 0$,

$$S_{2k+1}L_{2k+1}=2\left[F_{4k+1}-1\right] \quad (3.10)$$

**Theorem6:**

$$S_{4k+2}-2=S_{k+1}L_kL_{2k+1}, \text{where } k\geq 0 \quad (3.11)$$

 ISBN: 978-81-932966-5-3

**Proof:**

$$S_{k+1}L_kL_{2k+1} = \frac{2}{\Re_1-\Re_2}\left(\Re_1^k-\Re_2^k\right)\left(\Re_1^k+\Re_2^k\right)\left(\Re_1^{2k+1}+\Re_2^{2k+1}\right)$$

$$= \frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k}-\Re_2^{2k}\right)\left(\Re_1^{2k+1}+\Re_2^{2k+1}\right)$$

$$= \frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k+1}-\Re_2^{4k+1}\right)-2$$

$$= S_{4k+2}-2$$

This completes the proof.

**Corollary6.1:** *For* $k \geq 0$,

$$S_{k+1}L_kL_{2k+1} = 2\left[F_{4k+1}-1\right] \quad (3.12)$$

**Theorem7:**

$$4L_{4k+1}-4 = 5S_{2k+1}S_{2k+2}, \text{ where } k \geq 0 \quad (3.13)$$

**Proof:**

$$5S_{2k+1}S_{2k+2} = \frac{20}{\left(\Re_1-\Re_2\right)^2}\left(\Re_1^{2k}-\Re_2^{2k}\right)\left(\Re_1^{2k+1}-\Re_2^{2k+1}\right)$$

$$= 4\left(\Re_1^{2k+1}-\Re_2-\Re_1+\Re_2^{2k+1}\right)$$

$$= 4\left(\Re_1^{4k+1}+\Re_2^{4k+1}\right)-4\left(\Re_1+\Re_2\right)$$

$$= 4\left(L_{4k+1}-1\right)$$

This completes the proof.

**Theorem 8:**

$$S_{4k+4}-2 = S_{2k+3}L_{2k+1}, \text{ where } k \geq 0 \quad (3.14)$$

**Proof:**

$$S_{2k+3}L_{2k+1} = \frac{2}{\Re_1-\Re_2}\left(\Re_1^{2k+2}-\Re_2^{2k+2}\right)\left(\Re_1^{2k+1}+\Re_2^{2k+1}\right)$$

$$= \frac{2}{\Re_1-\Re_2}\left\{\Re_1^{4k+3}+\Re_1\left(\Re_1\Re_2\right)^{2k+1}-\Re_2\left(\Re_1\Re_2\right)^{2k+1}-\Re_2^{4k+3}\right\}$$

$$= \frac{2}{\Re_1-\Re_2}\left(\Re_1^{4k+3}-\Re_2^{4k+3}\right)-2$$

$$= S_{4k+4}-2$$

This completes the proof.

**Corollary 8.1:** *For* $k \geq 0$,

$$S_{2k+3}L_{2k+1} = 2\left[F_{4k+3}-1\right] \quad (3.15)$$

**Theorem 9:**

$$4L_{4k+3}+4 = 5S_{2k+3}S_{2k+2}, \text{ where } k \geq 0 \quad (3.16)$$

**Proof:**

$$5S_{2k+3}S_{2k+2} = \frac{20}{\left(\Re_1-\Re_2\right)^2}\left(\Re_1^{2k+2}-\Re_2^{2k+2}\right)\left(\Re_1^{2k+1}-\Re_2^{2k+1}\right)$$

$$= 4\left(\Re_1^{4k+3}-\left(\Re_1\Re_2\right)^{2k+1}\left(\Re_1+\Re_2\right)+\Re_2^{4k+3}\right)$$

$$= 4\left(\Re_1^{4k+3}+\Re_2^{4k+3}\right)+4\left(\Re_1+\Re_2\right)$$

$$= 4\left(L_{4k+3}+1\right)$$

This completes the proof.

## 4. CONCLUSION

In this paper we have derived many identities of common factors of Fibonacci-Like, Fibonacci and Lucas numbers with the help of their Binet's formula. The concept can be executed for generalized Fibonacci sequences as well as polynomials.

## REFERENCES


[1] Dresel, L. A. G., Transformations of Fibonacci-Lucas identities, Applications of Fibonacci Numbers, 5 (1993), 169-184.

[2] Gupta, V. K. and Panwar, Y. K., Common factors of generalized Fibonacci, Jacobsthal and Jacobsthal-Lucas numbers, International Journal of Applied Mathematical Research, 1(4), 377-382, 2012.

[3] Gupta, V. K., Panwar, Y. K. and Gupta, N., identities of Fibonacci-Like sequence, J. Math. Comput. Sci. 2(6) (2012), 1801-1807.

[4] Gupta, V. K., Panwar, Y. K. and Sikhwal, O., Generalized Fibonacci Sequences, Theoretical Mathematics & Applications, 2(2) (2012), 115-124

[5] Hoggatt, V.E. Jr., Fibonacci and Lucas numbers. Houghton – Mifflin Co., Boston, 1969.

[6] Kalman, D. and Mena, R., The Fibonacci Numbers – Exposed, The Mathematical Magazine, 2 (2002).

[7] Koshy, T., Fibonacci and Lucas Numbers with Applications, John Wiley, New York, 2001.

[8] Natividad, L. R., Deriving a Formula in Solving Fibonacci-like sequence, International Journal of Mathematics and Scientific Computing, 1(1) (2011), 19-21.

[9] Panwar, Y. K., Singh, B. and Gupta, V. K., Generalized Identities Involving Common factors of generalized Fibonacci, Jacobsthal and Jacobsthal-Lucas numbers, Journal of Analysis and Application, 3(1) (2013), 53-59.

[10] Panwar, Y. K., Singh, B. and Gupta, V. K., Identities of Common factors of generalized Fibonacci, Jacobsthal and Jacobsthal-Lucas numbers, Applied Mathematics and Physics, 1(4) (2013), 126-128.

[11] Singh, B., Bhadouria, P. and Sikhwal, O., Generalized Identities Involving Common Factors, of Fibonacci and Lucas Numbers, International Journal of Algebra, 5(13), (2011), 637-645.
[12] Singh, B., Sikhwal, O. and Bhatnagar, S., Fibonacci-Like Sequence and its Properties, Int. J. Contemp. Math. Sciences, 5(18) (2010), 859-868.
[13] Singh, B., Gupta, V. K. and Panwar,Y. K., On Combinations of Higher Powers of Fibonacci-Like sequence, Open Journal of Mathematical Modeling, 1 (2), (2013), 63-66.
[14] Thongmoon, M., New Identities for the Even and Odd Fibonacci and Lucas Numbers, Int. J. Contemp. Math. Sciences, 4(7), (2009), 303-308.
[15] Vorobyov, N. N., The Fibonacci numbers, D. C. Health and company, Boston, 1963.

# IoT based garbage monitoring System

[1] Anusha R Easwar, [2] Petchiammal Kombaiah, [3] Princy Palanisamy, [4] Priyanka Karuppasamy, [5] Prof.A.N.Kemkar
[1] Department of Electronics and Telecommunication Engineering,SIES Graduate School of Technology, Nerul,Navi Mumbai.

***Abstract-*** **In many places,the municipal garbage bins are overflowing and they are not cleaned at time.This unhygienic condition affects the lifestyle of citizens.The proposed system is about IOT based garbage Monitoring System using INTEL GALILEO GEN2. An Ultrasonic Sensor is used for detecting whether the trash can is filled with garbage or not and it is installed at the top of Trash Can and will measure the distance of garbage from the top of Trash can and we can set a threshold value according to the size of trash can.Then the status of the bin is sent to the government officials through ubidots platform). With respect to the distance sensed by the ultrasonic sensor the level of the bin will be displayed in LCD, Accordingly the backlight of LCD changes.**

## I. INTRODUCTION

We are experiencing a fast development of smart cities where cities around the world are on the run to become smarter, due to this development the waste quantity increases day by day . It has to be taken into care by the authorities and should think what method can be followed to overcome this. This project will help to eradicate or minimize the garbage disposal problem. The Internet of Things (IoT) is a recent communication paradigm that envisions near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users. The waste management has to be done instantly else it leads to irregular management which will have adverse effect on nature. The Smart waste management is compatible mainly with concept of smart cities.

## II.LITERATURE SURVEY

In International Research Journal of Engineering and Technology (IRJET) paper titled "Garbage Bin Monitoring System for Dry Waste" they have used android application from which the user will get the data but for this application ,user will need internet throughout to check the status of the bin.[1]

In paper titled Waste Bin Monitoring System Using Integrated Technologies by Kanchan Mahajan and Prof.J.S.Chitode,they have used ARM 7 microcontroller to read real time data and have used zigbee wireless technology to send data to user.Even though clock speed of ARM controller is rising, they are still low and multicore chips are also not available.Zigbee technology requires knowledge of the system for the user to operate zigbee devices.The data is also not secure like wifi based secured system.[2]

In paper titled "Internet of Things: Chal-lenges and State-of-the-art solutions", describes that the level of garbage in the dustbins is detected with the help of Sensor systems, and communicated to the authorized control room through GSM system. Micro controller is used to interface the sensor system with GSM system. A GUI is also developed to monitor the desired information related to the garbage for different selected locations.[3]

In paper titled "A new secure SIM-card based RFID reader" describes the use of RFID technology which has become convenient and its manufacturing cost is also low, but it also threatens security and privacy of individuals and organizations [4]

## III.PROPOSED ARCHITECTURE

The main aim of the project is to design a smart system which would notify the officials about the current status of various garbage bins in the city automatically, would have real-time monitoring capabilities, which would be remotely controlled using IoT techniques.The ultrasonic sensor is interfaced with Intel, suitably programmed with and attached to the lid of the dustbin. The ultrasonic sensor uses the high frequency sound pulse with the time difference between sending and receiving pulse to determine the distance to an object.The distance measured and level of garbage in the bin is determined and this data is pushed into the IOT cloud (Ubidots) in the form of data. This data can be accessed by an operator user who has rights like checking status of all bins, deploying collection vehicles and generating data analysis report. The status of the bin is notified to the public through LCD which is interfaced with intel board. The level

of the garbage is displayed on the LCD along with which the backlight of LCD will also change. The garbage level indications are as follow

| GARBAGE LEVEL | LCD BACKLIGHT COLOUR |
|---|---|
| 1.High level | Red |
| 2.Medium level | Blue |
| 3.Low level | Green |

***Fig.1.Block diagram***

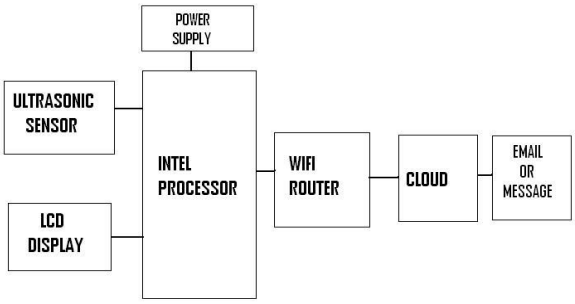
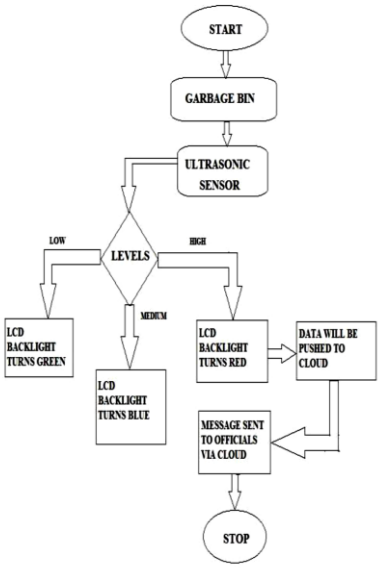



***Fig.2.System flow***




## IV.IMPLEMENTATION

A.The distance sensed by the ultrasonic sensor is displayed in ubidots platform which is indicated by gauge meter.

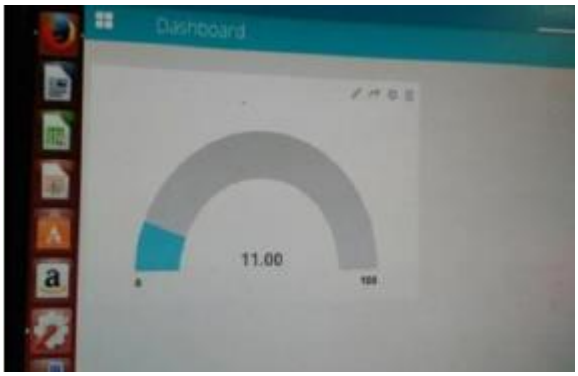



***Fig.A***

B.According to the given condition the value was sent through mail.


***Fig.B***

C.The status of the bin is displayed in the LCD.As the sensed value falls in medium level, the level displayed is medium and the backlight is blue.

***Fig.C***

## V.PROPOSED MODEL

The proposed model consists of following hardware and software requirements,

***Hardware requirement:***

***Intel Processor-*** In this project we have used "Intel Galileo gen2".It is 32-bit Intel Pentium processor operating at speed upto 400MHz .It supports shields that operate at 3.3V or 5V.It consist of 14 digital I/O pins and 6 analog input pins.

***Ultrasonic Sensor-*** In this project we have used HC-SR04 Ultrasonic sensor. It emits ultrasonic waves at 40,000Hz which travel through air and reflects back to the sensor if obstacles or objects are kept in its path. It can measure distance from 2cm to 4meters.

***LCD Display-*** In this project we have used Groove LCD RGB backlight. It is 16x2 LCD display and operates at 5V. Its main feature is RGB backlight.

***Software requirement:***

Ubidots- Ubidots offers a platform for developers that enables them to easily capture sensor data and turn it into useful information.We use the Ubidots platform to send data to the cloud from any Internet-enabled device. Eclipse-Eclipse is an integrated development environment (IDE) used in computer programming, and is the most widely used Java IDE.It contains a base workspace and an extensible plug-in system for customizing the environment.

## VI.CONCLUSION

This paper has described the development of a smart garbage monitoring system, which is based on INTEL.There is no heating effect observed in INTEL.It can be used 24X7 unlike Raspberry Pi,arduino. It is very useful in improving the efficiency of solid waste disposal management especially in the flat residential areas, where the garbage piles at the bins are one of the residents major concerns owing to its ability to continuously measure the garbage level in the bin and alerting the municipality for immediate collection.The proposed system is suitable to be implemented in all flat residential areas, due to its practicality, reliability and reasonable cost.This project supports real time data transmission and access and it supports 'Swacch Bharat Abhiyan' mission.

## VII.REFERENCES

[1]Twinkle sinha, K.mugesh Kumar, p.saisharan, SMART DUSTBIN, International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Volume-3, Issue-5, May2015.

[2]Kanchan Mahajan, Prof.J.S.Chitode, Waste Bin Monitoring System Using Integrated Technologies, International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 7, July 2014.

[3] Arkady Zaslavsky, Dimitrios Georgakopoulos ,"Internet of Things: Chal- lenges and State-of-the-art solutions in Internet-scale Sensor Information Management and Mobile Analytics",2015 16th IEEE International Conference on Mobile Data Management.

[4]Xu, Yiqun, Zijun Guo, and Jianhua Deng. "A new secure SIM-card based RFID reader." 2010 International Conference on Anti-Counterfeiting, Security and Identification. IEEE, 2010 .

# Solar Powered Smart Dustbin

[1] Rujul Chouthai, [2] Sumit Bodke, [3] Hemant Darekar
[1] Department of Electronics and Telecom SIES graduate school of technology.

***Abstract-*** **Due to the rapid growth in urbanization, metropolitan cities are facing a common problem of waste management and Managing the waste has been the top most priority for ecologically sustainable environment. The primary problem faced is the overflow of the dustbin which has degraded the standard of living. To overcome this situation a low cost low power efficient smart waste management has to be developed. It is very necessary to keep the environment clean and hygienic. So our project "Solar powered Smart dustbin" will definitely help to eradicate the disposal problem. These dustbins are interfaced with Node MCU based system having various sensors, solar panel along with central system showing current status of garbage which is mobile app by using Wi-Fi. Hence the status will be updated real time on the app. The main aim of this project is to reduce human resources and efforts along with the enhancement of a smart city vision. Our project has overcome the difficulties which were faced while managing the waste by using low cost low power robust hardware, renewable energy as well as effective dynamic routing**

**Index Terms—App, IOT, Garbage level, Sensor, Solar power, Supply.**

## I. INTRODUCTION

Our project "Solar Powered smart dustbin" is based on the IOT. Internet is one of the most important and transformative technology ever invented. The internet of things (IOT). Is evolution of mobile, home and embedded application that are being connected to the internet integrating great capabilities by analyzing and extracting the data and then acting upon it. All the components we use can be controlled and monitored by using IOT. These devices uses sensors to communicate with each other across the internet. This paper aims in structuring a state of the art review on IOT. Smart Dustbin works with a combination of ultrasonic sensor, gas sensor that indicates the waste level as well as if there is a presence of smoke or gas. These sensors will analysis and will send the data to the Node MCU with the help of Wi-Fi. The Node MCU will processes the data and then sends it to a server. The output will be displayed on the mobile app. The waste collection services are often provided by the government authorities where the worker manually checks and collects the waste. So our project will help ease the work of these authorities.

## II. LITERATURE SURVEY

This paper [1] is a survey based on Smart Garbage Management in Cities using IOT. This survey involves various smart garbage management ideas that can be easily implemented. Keywords: -Sensors, Microcontroller, GSM, GUI, IOT, Internet, Android app.

This paper [2] proposes a method to keep cleanliness in the society. Here, ultrasonic sensors are used for checking the level of garbage in the dustbins and communicated to the concerned authority via GSM System. MCU is used to interface the sensors with GSM. A GUI is also developed to monitor the required info related to the waste for different locations. This system also helps to monitor if any reports are fake and hence can reduce the corruption in the management system.

The paper [3] proposes a method where a trashcan is interfaced with MCU having IR wireless system along with central system indicating real time status of garbage on mobile, web browser. There by to reduce human resources and efforts. Considering the urbanization, the smart garbage bin can be a expensive but considering the amount of overflow of dustbin in India, it has become a necessity. Weight sensor is used for detection of amount of garbage in dustbin. The drawback is it detects only the weight of the waste and not the level of it. The message can be sent directly to the Municipality instead of contractor.
The paper [4] is on a transportation model for solid waste collection details on waste storage and management. This was proposed for the city of Asansol. The aim was to schedule the trucks on selected collection routes. The data from bins was processed in the DSS and then sent to concerned authority of the management department in a particular place and to road police. It is combined with dynamic algorithm to max the efficiency of waste management.

This paper [5] proposes a model for smart cities. Infrared sensor (IR sensor) is which can detect the level of garbage. IR sensor emits the light, which is invisible to naked eye but the electronic components can detect it. Sensor senses level of the bin. The GUI gives the output of what level of garbage is filled. Sensor senses level of the bin. It gives the output of what level of garbage is filled. When the level of garbage reaches above the threshold level in the bin, then LED placed at the certain location of the bin starts to blink. When the

blinking LED is clicked, a display pops up showing the given location of the bin, bin status, the time and date at which bin gets filled, cell phone number and the text to send to the concerned authority. The drawback is that this system does not ensure trash will be cleaned within a given date and transportation is also another issue.

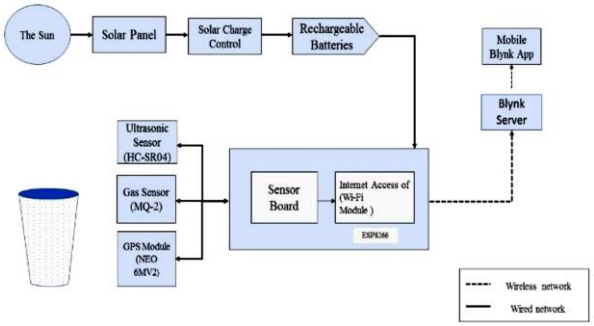
This paper [6] is a proposed model of garbage management using IOT for Smart Cities for waste management. Ultrasonic sensors are used which communicates with authority through GSM module. The main difference is that it features MATLAB based GUI. There is a requirement for slave and master units. The circuit is placed on the top of trash can. Ultrasonic sensor is interface to arduino uno board and it indicates it via GSM module. In Master unit, as soon as SMS is received it will indicate the approximate percentage of garbage in the trash can and inform the cleaner of the floor.

## III. PROPOSED SYSTEM

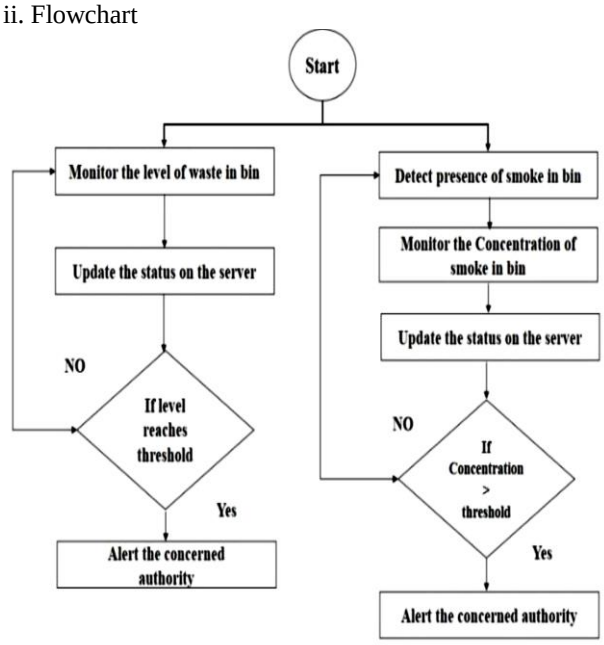
The block diagram shows different hardware and software component which are used in creating the system. The project module is divided into two parts the hardware and the software. Here, the hardware is used for monitoring and detection and whereas software that is the app is used for displaying the output. The sensor based smart dustbin will the monitor and detect the level of garbage present in the dustbin. The part of monitoring and detection is done by the ultrasonic sensor which is place on the top of the lid. Not only it will detect the level of waste but it will also simultaneously detect presence of smoke or gas. The detection is done by the gas sensor. These sensors are wirelessly integrated with the microcontroller. So the data will be sent to microcontroller via Wi-Fi. The microcontroller will process the data and then sends it to the server.

Now the server then forwards the data on our app which is accessible on mobile phone. Our app displays real time status of the dustbin. In case, the level of the dustbin filled with garbage is over 70% or if there is any presence of smoke then it will alert the person about it via the app. Not only that but it will also show the location where the dustbin is about to overflow and will guide the user with minimal route to reach there.The highlight of this project is that the whole system will be powered by the solar energy. The supply module in the system consist of 2x 2000 MAH rechargeable battery. The power circuitry for this module is created in such a way that on battery will power the module while the other be kept for charging.

i. Block diagram




ii. Flowchart




## IV. EXPERIMENTAL SETUP

### *A. HARDWARE*

#### *i. Node MCU*

Node MCU is the name of a microcontroller designed by Express it systems. Node MCU is programmed with LUA scripting. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin out. With a micro USB cable, you can connect Node MCU Dev Kit to your laptop and flash it without any trouble, just like Ardiuno.

#### *ii. Solar Panel & Ultrasonic sensor*

***Figure 1***

The ultrasonic sensor can be consider convenient for testing the level of the garbage in the dustbin. An ultrasonic sensor will be placed on the interior side of the lid, the one facing the solid waste the threshold has been pre-decided by the user to prevent the bin from overflowing. As garbage level increases, the distance between the ultrasonic and the trash reduces. The MQ2 Sensor will give the output in the form of analog voltage. A threshold has already been set in the code that if the output value of the sensor is greater than 400, then buzzer will start to beep. If the output value is less than 400 then the Buzzer will remain quiet. This will be displayed on the App as well.

***iii. Solar panel & GPS***


***Figure 2***

It is a several combination of solar panel that convert light directly into electricity. As technology is increase day to day life the output should increase further. The conversion is done by using semiconductor material from which each solar cell is made. So that output energy can store easily using rechargeable batteries. Global Positioning System will be helpful for getting the location of the place where the bin is located. So it is convenient for the concerned authority to ease the collection process.

***B. SOFTWARE***

Mobile Application: There are three major components in the platform Blynk app allows to you create amazing interfaces for your projects using various widgets we provide. Blynk Server responsible for all the communications between the smart phone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. Its open source, could easily handle thousands of devices and can even be launched on a Raspberry Pi. Blynk libraries for all the popular hardware platforms enable communication with the server and process all the incoming and out coming commands. The mobile application will show the status of our project on real time basis i.e. the output of the ultrasonic sensor and the gas sensor will be shown on this application.

## CONCLUSION

In this project the system of IOT, for efficient and economic garbage collection, ultrasonic Sensor is introduced. The developed system provides database for trash collection time and waste amount at each location. We analyzed the solutions currently available for the implementation of IOT. In order to avoid overflowing of garbage from the trashcan hence have implemented this project. The traditional way in the residential area which either loaded the trash manually or with the help of loaders in municipality trucks. It will automatically monitor the trash level and send the data to concerned person. The APP based system for waste collection in smart cities will just upsurge the development of applications for city administrations, municipal staff.

## REFERENCES

[1] P. Bellavista G. Cardone A. Corradi L. Foschini ”Convergence of MANET and WSN in IoT urban scenarios” ¡em¿IEEE Sens. J.¡/em¿ IEEE vol. 13 no. 10 pp. 3558-3567 Oct. 2013.

[2] A. Laya V. I. Bratu J. Markendahl ”Who is investing in machine-to-machine communications?” ¡em¿Proc. 24th Eur. Reg. ITS Conf.¡/em¿ pp. 20-23 Oct. 2013.

[3] D. Cuff M. Hansen J. Kang ”Urban sensing:Out of the woods” ¡em¿Commun. ACM¡/em¿ vol. 51 no. 3 pp. 24-33 Mar. 2008.

[4] M. Dohler I. Vilajosana X. Vilajosana J. Llosa ”Smart Cities: An action plan” ¡em¿Proc. Barcelona Smart Cities Congress¡/em¿ pp. 16 Dec. 2011.

[5] I. Vilajosana J. Llosa B. Martinez M. Domingo-PrietoA. Angles X. Vilajosana ”Bootstrapping smart cities through a self-sustainable model based on big data flows” ¡em¿IEEECommun. Mag.¡/em¿ IEEE vol. 51 no. 6 pp. 128-134 Jun. 2013.

[6] A. R. Al-Ali I. Zualkernan F. Aloul ”A mobile GPRSsensors array for air pollution monitoring” ¡em¿IEEE Sensors J.¡/em¿ IEEE vol. 10 no. 10 pp. 1666-1671 Oct. 2010.

# Reliability Analysis of Wake Effect in Wind Farm Layout using Modified Binary PSO

[1] U. Mallesh, [2] P. Rizwan
[1] M. Tech., Reliability Engg. [2] Lecturer in EEE
[1][2] JNTUA CEA, AP, India

*Abstract*- **Nowadays, in order to meet the increased demand of electrical energy for industries, agriculture, domestic purposes etc., installation of Wind Energy farms is increasing at a faster rate to provide clean energy. However, energy production of wind farm is greatly influenced by the wake effect and due to intermittent, stochastic nature of Wind Turbine Generators (WTGs), the problem of stability rises in wind power output. In this paper, a methodology is proposed to reduce the impact of wake effect in the wind farm by providing a optimal layout scheme by considering the number of Wind Turbine Generators along with wind speeds and their directions. A modified binary particle swarm optimization algorithm is used to solve the optimization problem to improve the reliability of generating system and reduce the power loss due to the wake effect with respect to the indicated measurement of parameters. A comparison is also made with and without wake effect in terms of reliability and losses.**

**Index Terms— Wind Turbine Generators (WTGs), Wake-Effect, Modified Binary Particle Swarm optimization, Loss of Load Probabilities (LOLPs), Reliability, Expected Energy Not Served (EENS)**

## I. INTRODUCTION

The utilization of electrical energy demand is extensively increased since the population, industries etc., are gradually increasing at a faster pace for the recent years. In order to meet the electrical demands of various industrial applications, Wind Energy has become one of the main renewable resources for the production of power. The utilization of Wind Energy also helps to reduce environmentally harmful emissions such as smoke, dust etc., [1]. As the wind power output mainly depends on wind speed and its direction, the problem of stability rises because of dynamic nature of wind power output over a short period of time. Also there is variation in wind speed for different Wind Turbine Generators because of Wake-Effect. Power loss due to wake effect ranges from 5% to 20% of the total power produced in the wind farm [2]. Therefore, it has become a great challenge to optimize the design of a wind farm to reduce the impact of the wake effect.

Many mathematical models with different techniques have been developed and implemented for optimizing the wind farm layout with Wind Turbine Generators. But, the result may not be globally optimal as the optimization can be obtained by considering several layouts [6]. In the traditional method, each wind farm layout is subdivided into square cells such that WTGs are placed exactly in the center of each cell. Other than the center, WTGs are not allowed to be placed anywhere in the cell. As a result, the optimal layout may not be globally optimal solution [3]. To obtain the globally optimal a method is developed by employing the evolutionary algorithm.

The main objective function considers maximizing the energy production of wind farms and minimizing the location of restrictions. But in the wake mode, the partially covered by the wake shade area upstream WTs over downstream WTGs and simulation technique has been used to evaluate the reliability of the wind farm with the consideration of a wake effect [4].

In literature, it is identified that wake effect is not considered by optimal layout scheme of wind farm. In this paper, a new optimization method is proposed for the wind farm layout consisting of Wind Turbine Generators in order to increase the efficiency of the system, to maximize the equivalent energy production and to improve the reliability of power system. The method considers the distribution of the combined probability of wind speed along with its direction observed in the wind farm for the optimization of the wind farm layout. Depending on the wind direction, horizontal and deviating distances are calculated. Geometric analysis is carried out to calculate the deviating distances, horizontal distances, upstream areas and downstream areas. To locate the upstream and downstream wind turbines a technique is developed. The method aims working on the objective function to optimize the maximum equivalent power of the wind farm by employing the Modified Binary Particle Swarm Optimization. Evaluation of reliability indices with wake effect consideration is calculated.

## II. BASIC MODEL AND TECHNIQUE

### *A. Wind Energy Model:*

The power output of Wind Turbine Generator depends on wind speed (V) which is given by

$$P_a(V) = \begin{cases} 0 & 0 < V < V_{ci} \\ (a + bV + cV^2)P_a & V_{ci} < V < V_r \\ P & V_r < V < V_{co} \end{cases} \quad \ldots(1)$$

where,

$P_a$ = Power output of wind turbine generator
a, b and c = Selection parameters which depends upon cut in and rated speeds
$V_{ci}$ = Cut in wind speed
$V_r$ = Rated wind speed
$V_{co}$ = Cut out wind speed

*B. Wake Effect Model:*

There is a variation in wind flow from upstream WTG to the downstream WTG because of wake effect. Wind farm energy is not only effected by wind speed but also by wind direction.

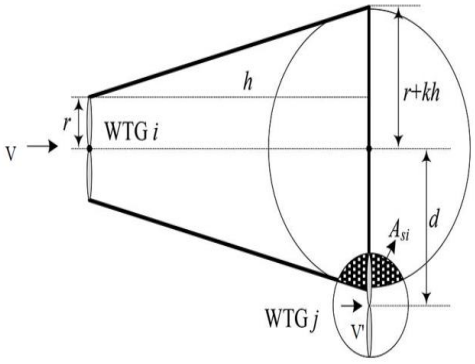



Fig.1: Wake Effect Model

A Jensen wake model [10] is used to describe the wake effect, in which wind speed that flows to the downstream turbine is given as:

$$V' = V_{in}[1-\sum_{i=1}^{Nus}(1-\sqrt{1-Ct})\left(\frac{r}{r+kh}\right)^2(A_{si}/A)] \quad \ldots(2)$$

where,

k = Wake reducing coefficient
$V_{in}$ = Input velocity
$C_t$ = Thrust coefficient
r = Rotor radius of the wind turbine
A = $\pi r^2$ = swept area
$A_{si}$ = Shaded area
$N_{us}$ = Up-Stream wind turbine generators
h = horizontal distance

*C. Modified Binary Particle Swarm optimization*:

In Particle Swarm Optimization [9], optimization can be achieved mainly by updating two functions, the function of updating the speed and the function of updating the position, the prior values of speed and position values are originally updated by the current speed and position values. Modified Binary Particle Swarm Optimization uses genotype-phenotype concept for the update of position along with mutation number [7].

The update functions of Particle Swarm optimization changes as follows:

$$V_{(i,j)}(t+1) = \mu V_{(i,j)}(t) + a_1R_1(p_{(best,i,j)} - X_p(t)) + a_2R_2(g_{(best,i,j)} - X_p(t)) \quad \ldots(3)$$

$$X_g(t+1) = X_g(t) + V_{(i,j)}(t+1) \quad \ldots(4)$$

$$X_p(t+1) = \begin{cases} 0 \; if \; rand() \geq S(Xg(t+1)) \\ 1 \; if \; rand() < S(Xg(t+1)) \end{cases} \quad \ldots(5)$$

where,

$S(Xg(t+1)) = \frac{1}{1+e^{-Xg(t+1)}}$
$V_{(i,j)}(t)$ = Velocity update function
$\mu$ = Inertia weight
$X_g$ = Genotype velocity update function
$X_p$ = Phenotype velocity update function
$g_{best}$ = Global best values
$p_{best}$ = Personal best values
S = Sigmoid function.

## III. METHODOLOGY:

Installation of wind turbines in wind farm with 3.6MW identical Wind Turbine Generators [6] with cut-in speed ($V_{ci}$), rated speed ($V_r$) and cut-out speed ($V_{co}$) of 4m/s, 12m/s and 20 m/s, respectively is planned. Rotor radius of wind turbine generator is same as length of the blade which

is equivalent to 52m. In the wake model, thrust coefficient ($C_t$) is a function of wind speed, which is always provided by manufacturer [8]. The wake decreasing coefficient ($k_{wake}$) is taken as 0.05. The mutation number ($r_{mut}$) is 0.1 and the maximum number of iterations for mutation is set as 20. The Particle Swarm Size is set is taken as 40. The size of Wind farm is considered as 500×500 $m^2$. The direction of wind is taken as $\theta$ is equal to 45°.

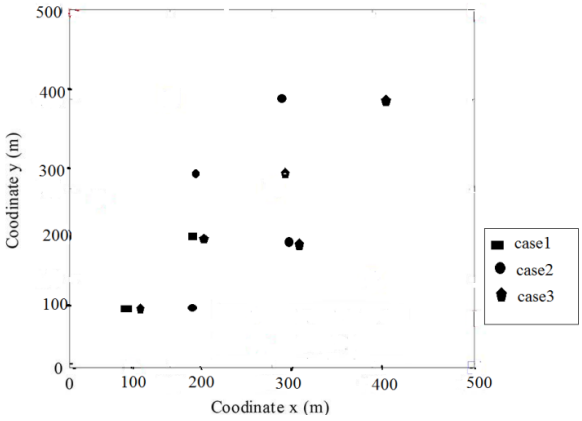



***Fig.2. Location of Wind Turbine Generators***

From Fig. 2, it is observed that there are 3 cases to be evaluated. They are as follows:

Case1: Number of Wind Turbine Generators (n) are 2 at their respective locations.

Case2: Number of Wind Turbine Generators (n) are 4 at their respective locations.

Case3: Number of Wind Turbine Generators (n) are 5 at their respective locations.

*A. Method for determining WTG location and distance*

For the given wind direction in Fig.3 WTG $_i$ is an upstream WTG of WTG $_j$ in the coordinate system. The deviating distance and horizontal distance are calculated as:

For $0°<\theta<360°$ :

$$\text{Deviating distance (d)} = \frac{|x_i - \cot\theta(x_i - y_j) - y_j|}{\sqrt{1+(\cot\theta)^2}} \quad \ldots (6)$$

$$\text{Horizontal distance (h)} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 - d^2} \quad \ldots (7)$$

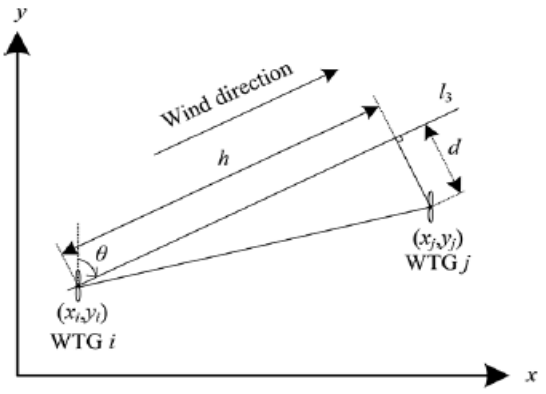



***Fig. 3. Horizontal and Deviating distances of two WTGs***

where,
$x_i$, $y_i$ is the location of $WTG_i$ and $x_j$, $y_j$ is the location of $WTG_j$ in the coordinate system.

*B. The Average Annual Energy Production (AAEP):*

The Average Annual Energy Production is defined as total amount of electrical energy that is produced during a year. It is calculated as:

$$AAEP = \frac{1}{Nr}\sum_{i=1}^{Nr}\sum_{t=1}^{8760} EP(i,t) \quad \ldots (8)$$

$$EP\ (i,t) = \sum_{i=1}^{Nd}\sum_{j=1}^{Ns} P(\theta,i,t) \quad \ldots (9)$$

where,
EP = The Equivalent Power
$N_d$ = Number of considered Wind directions
$N_s$ = Number of considered wind speeds
$N_r$ = Total Number of years analyzed

*C. The Wake Effect Index factor (WEI):*

The Wake Effect Index factor determines the accurate prediction of wind power and is given as:

$$WEI\ (\%) = \frac{AAEPnowake - AAEPwake}{AAEPnowake} \times 100 \quad \ldots (10)$$

WEI is also used to evaluate the influence of wake effect on the wind farm.

D. *Reliability Analysis*:

 ISBN: 978-81-932966-5-3

There are certain Reliability indices of power system that must be calculated as follows:

*1. Loss of Load Probabilities (LOLPs):*

During a given period, if the system demands exceeds the capacity, then LOLP gives the measure of probabilities of the exceeding demands. It is calculated as:

$$(\text{LOLPs}) = \sum_j \frac{pj \times tj}{100} \quad \ldots (11)$$

where,

$p_j$ = Capacity output probability

$t_j$ = Percentage of time when load exceeds remaining generation capacity [9].

*2. Loss of Load Expectation (LOLE):*

$$\text{LOLE} = \text{Sum of 365 daily max LOLP's (d/y)} \quad \ldots (12)$$

*3. Expected Energy Not Served (EENS):*

When the load exceeds the generation capacity of the system, then the expected energy that will not be served under these conditions is termed as Expected Energy Not Served. It is given as:

$$EENS = C_{out} \times P_{out} \times T_{out} \quad ...(13)$$

$C_{out}$ = Capacity out (MW)
$P_{out}$ = Probability of capacity out
$T_{out}$ = Time of capacity out

*Algorithm for optimal layout of wind farm:*

Step1**:** Determine the limitations of wind farm layout size and location of wind turbine generators. Set limits $[x_{min}, x_{max}]$, $[y_{min}, y_{max}]$.
Step2: Determine wind direction along with upstream and downstream WTGs.
Step3: Calculate the Deviating distance (d) and Horizontal distance (h) between the wind turbine generators.
Step4: Calculate the wind speed variation in front of each wind turbine generator considering the wake effect.
Step5: Compute the Equivalent Power function and Energy production of farm by considering the wake effect.
Step6**:** Calculate the Average Annual Energy Production [AAEP] of the wind farm.
Step7**:** Calculate the wake effect index (WEI).
Step8**:** Reliability analysis is carried out to calculate the Reliability indices.
Step9: Repeat the above steps until the optimization of wind farm is achieved.

## IV. RESULTS AND ANALYSIS

### *1. Annual Average Energy Production (AAEP) and Wake Effect Index (WEI):*

Considering the different cases with different number of turbines and placement locations, Horizontal and deviating distances are calculated first based on Eqn.(6) and Eqn. (7) and then maximum Equivalent Power is calculated from Eqn.(9).
From the Eqn. (8), the AAEP with and without wake effect is calculated.

***Table 1. AAEP and WEI***

| Number of wind turbines | Annual Average Energy Production(AAEP) (MW/yr) | | Wake effect index WEI (%) |
|---|---|---|---|
| | Without wake effect | With wake effect | |
| 2 | 31616 | 31152 | 1.46 |
| 4 | 63233 | 61441 | 2.83 |
| 5 | 79402 | 76630 | 3.52 |

A graph is plotted between the No. of Turbines in the wind farm to the Equivalent Power

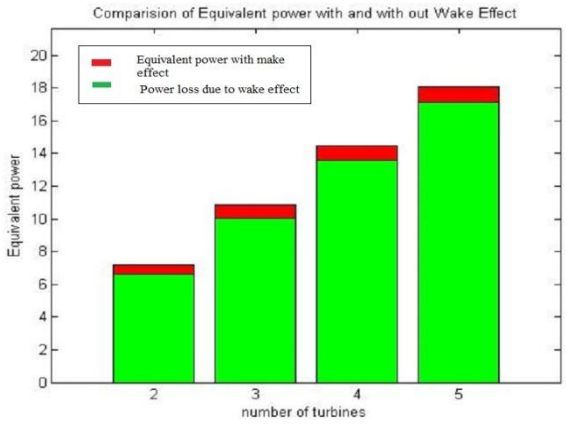



***Fig. 5. No. of turbines vs Equivalent power***

From Fig.4, the graph between No. of Wind Turbines to Equivalent power shows that there is increase in power loss due to wake effect. It is also observed that the power loss increases as the No. of Turbines increases.

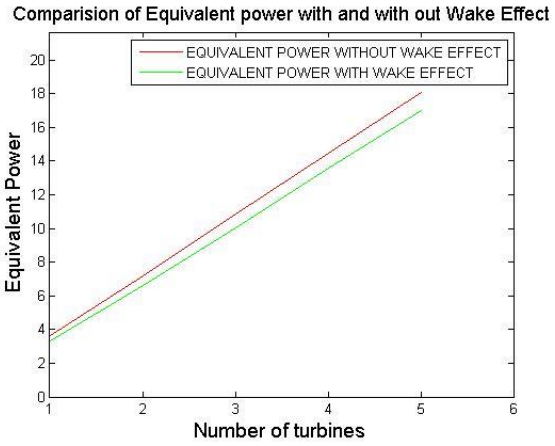



***Fig. 6. No. of wind turbine generators vs Equivalent power with and without wake effect***

The deviation in the graph Fig. 5 shows that the AAEP with wake effect compared to without wake effect decreases with the increased number of turbines In the wind farm.

1. *Loss of Load Probabilities (LOLPs) and Expected Energy Not Served (EENS) without wake effect:*

   Number of Wind Turbines = 2
   Total capacity = 7.2 MW
   Forced Capacity Out Rate (FCOR) = 0.02
   = Unavailability (U')
   Availability (A') = 1 – (U') = 0.98

Table 2. LOLPs and EENS values without Wake Effect

| Units Out | Capacity (MW) | | Binomial distribution | Individual probability | Cumulative probability |
|---|---|---|---|---|---|
| | Out | In | | | |
| 0 | 0 | 7.2 | A'*A' | 0.9602 | 1.000 |
| 1 | 3.6 | 3.6 | 2*U'*A' | 0.0391 | 0.0395 |
| 2 | 7.2 | 0 | U'*U' | 0.000412 | 0.000412 |

After calculating the individual probabilities with capacities outages, capacity in the LOLPs and EENS without wake effect are calculated by using Eqn.(11) and Eqn.(12).

Expected Energy Not Served (EENS): 7008 MW/yr

2. *Loss Of Load Probabilites (LOLPs) and Expected Energy Not Served (EENS) with wake effect*

   Number of Wind Turbines = 2
   Total capacity = 6.76 MW
   A1 = 0.98
   A2 = 0.86
   U1 = 0.02
   U2 = 0.14

Table 3. LOLP and EENS values with wake effect

| Units Out | Capacity (MW) | | Binomial distribution | Individual probability | Cumulative probability |
|---|---|---|---|---|---|
| | Out | In | | | |
| 0 | 0 | 6.76 | A1*A2 | 0.8428 | 1.0000 |
| 1 | 3.6 | 3.16 | A1U2+A2U1 | 0.1544 | 0.1592 |
| 2 | 6.76 | 0 | U1*U2 | 0.0028 | 0.0028 |

After knowing the individual probabilities with capacities outages, capacity in the LOLP and EENS with wake effect are calculated by using Eqn. (11) and Eqn. (12).

Expected Energy Not Served (EENS): 13227 MW/yr

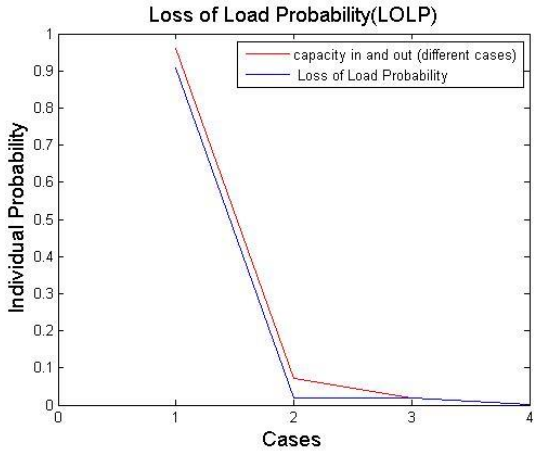



***Fig. 7. Capacity in and outage (different cases) vs Loss of Load Probabilities***

From Fig. 6 the depending on the availability and non-availability of the wind turbines in the wind farm the probability of the system varies.

***Table 4. Wake effect index (WEI) with Binary Modified PSO***

| Number of turbines | Annual Average Energy Production (MW/yr) | | Annual Average Energy production-Modified Binary PSO (MW/yr) | Wake effect index (%) | Wake effect Index WEI _ Modified Binary PSO (%) |
|---|---|---|---|---|---|
| | without wake | with wake | | | |
| 2 | 31616 | 31152 | 31211 | 1.43 | 1.28 |
| 4 | 63233 | 61441 | 61582 | 2.86 | 2.61 |
| 5 | 79402 | 76630 | 76829 | 3.522 | 3.14 |

From Table. 4, it is observed that the wake effect index with the optimization technique calculated using the Eqns. (3),(4) and (5) is decreased.

## V. CONCLUSIONS

It is observed that, wake effect has a significant role in reducing the maximum energy production of wind farm. The optimization is achieved for a wind farm by considering a wind energy conversion model and the wake effect using the Modified Binary Particle Swarm Optimization to maximize the wind energy production. In the wake model, wind shade, wind shear along with wind direction of arbitrary angels are considered. Optimization method considers all wind directions by real wind farms so that the optimization efficiency is greatly improved. Results obtained shows that the proposed technique effectively reduces the wake effect, increases the energy production of wind farm, and improves the Reliability of system.

## VI. REFERENCES


[1] Hejun Yang Et al., " Wind Farm Layout Optimization and Ita Application to Power system Reliability Analysis," IEEE TRANSACTIONS ON POWER SYSTEMS, 2015 IEEE.

[2] M. S. Kang, H. Lee, and T. Ku, "Applications of FANP and Benefit Opportunity Cost Risk in renewable energy study on the choice of the Sites for wind farms," *IEEE Transactions. Ind. Applcation*, vol. 49, no. 2, pp. 980-991, 2013.

[3] W. Husien, and Dekem, "Effect of the wake behind wind rotor on optimal energy output of wind farms," *Renew. Energy*, vol. 49, pp. 127–133, 2013.

[4] S. Pookpunt Et al., "Optimal placements of wind turbines with in wind farm using Binary Particle Swarm Optimization along with time varying acceleration co-efficients," *Renew. Energy*, vol. 55, pp. 265 to 277, 2013.

[5] X. Han, Guo, and Wang, "Adequacy study of a wind farm with consideration of terrain and wake-effect," *IET Gener. Trans. Distrib.*, vol. 6, no. 10, pp. 1000–1009, 2012.

[6] M. Ali, Et al., "Wake Effect consideration on estimated cost of wind energy curtailments," in *Proc. 8th Int. Workshop Large Scale Integration of Wind Power Into Power Systems as Well as Trans Networks. for Off-shore Wind Farms*, Germany, 2009.

[7] Sangwink lee, S. soak, Et al," Modified particle swarm optimization" IEEE Trans. Appl. vol. 18 issue no. 9 pp. 1160-1167, 2008

[8] Jhon Bird, "Wind Turbine Power calculatons RWE npower renewable Mec. and Ele. Engg.," Engineering Mathamatics, fifth edition, 2007.

[9] J. Kennedy Et al., " A Particle swarm optimization," in *Proc. IEEE Int. Conf. Neural Networks*, vol. 4, pp. 1941–1949, 1995.

[10] O.Jensen Et al, "A note of wind generator interaction," Denmark: Riso National Lab.., pp. 1–18, Nov. 1993.

# Experimental analysis of rotary friction welded joints of mild steel and evaluation of mechanical properties by varying basic parameters under normal and wet condition.

[1] Sarthak Bhokare, [2] Aishwarya Bansilal
[1][2] MIT College of Engineering

***Abstract*- Friction welding is an important solid state welding process that generates heat through mechanical friction between a rotating component and a stationary component. After heat generation phase an additional forging force is applied which completes coalescence. This paper incorporates the investigation of rotating frictional welding on mild steel example. Weld specimens were prepared on conventional lathe machine by variation of parameters like rpm of rotating specimen, friction and forging force applied. Another variation included in this study was welding under normal atmospheric conditions and welding under continuous stream of water. A special setup was designed and assembled for the force measurement on conventional lathe machine. Mechanical properties of joints were evaluated utilizing tensile test and hardness at heat affected zone.**

**Index Terms— Rotary friction welding , rpm, temperature, time, friction and forging force**

# A new approach for determination of age of structures

[1] Shrikant D. Gaikwad
[1] PhD Scholar, College of Engineering, Pune, India

***Abstract*- During last two decades, technology has evolved for more accuracy and utility and has become more user-friendly. At the same time engineering, especially civil engineering is facing challenges that cropped up recently. Major problem in modern civil engineering is how to determine the age of a structure: especially of RCC structure. After World War II, reinforced concrete replaced all traditional methods of house, building and bridge construction. Initially it was believed that concrete gains strength with passage of time and might last for centuries. But in the last four decades; it was observed that concrete ages over a period of time. Researchers all over the world identified and formulated many entities responsible for concrete ageing. Many destructive and non –destructive tests have been developed in order to assess the strength of concrete in place. But none of the tests have given perfect results. It is a question whether the properties like characteristic strength, modulus of elasticity, etc change with time or not. If yes, how can values of these changed properties be determined? Moreover reinforced concrete is composed of two different materials viz., concrete and steel. Among the two, due to precise methods of production, steel is the most reliable for its specified qualities. Whereas concrete is produced as per requirement with mixed design-which is designed every time as per local material properties. Thus it becomes very difficult to determine characteristic strength and modulus of elasticity for concrete in place and is one of the biggest challenges today. Advancement in technology will help to determine and monitor these properties for RCC structures. Use of high quality sensors, strain gauges, data acquisition systems, and data processing softwares will help in resolving these issues. An interdisciplinary attempt will give a concrete solution to the problem.**

# VSI Based DSTATCOM for compensating Nonlinear and Unbalanced loads

[1] S.R.Reddy, [2] P.V.Prasad, [3] G.N.Srinivas
[1] Asst Professor, EEE Department, [2][3]Professor, EEE Department
[1] GNITC, Ibrahimpatnam Hyderabad, India, [2] CBIT, Gandipet Hyderabad, India, [3]JNTU, Hyderabad
Hyderabad, India

***Abstract-*** **This paper presents study of distribution static compensator (D-STATCOM) for compensation of neutral current, source&PCC current harmonic distortion, PCC voltage regulation and compensation of unbalanced current waveform for the three phase four wire nonlinear and unbalanced load medium voltage distribution system. The proposed control algorithm is developed based on synchronous reference frame theory with PI controller. The obtained reference current signal from control algorithm is compared in hysteresis band current controller for better switching of D-STATCOM. The performance of system without & with D-STATCOM is also analysed and compared. The proposed control method is implemented on 11/0.4kv medium voltage distribution system and it is provided effective compensation for reactive power and harmonic distortion mitigation. The simulation results are obtained using MATLAB/SIMULINK.**

**Keywords—Distribution static compensator (D-STATCOM), Synchronous reference frame (SRF) theory, PI controller, voltage source inverter (VSI), hysteresis current controller, harmonic distortion.**

# To Design Efficient and Reliable Smart Grid AMI for Meter Reporting Technique

[1] Nikhil M.Manekar, [2] A. N. Thakare
[1] M.Tech(Computer Science and Engineering) Bapurao Deshmukh college of Engineering,sewagram
[2] Assitant Professor (Computer Science and Engineering), Bapurao Deshmukh college of Engineering,sewagram

***Abstract*- Due to the lack of automated scrutinizing, poor visibility, situational alertness and mechanical switches, today's electric power grid is getting older and unsuitable for twenty-first centu advanced metering infrastructure, communications, security, smart grid, smart meters. ry's increasing demand for electricity. Besides, the global climate change and the greenhouse gas emissions on the Earth caused by the electricity industries, the growing population, one-way communication, equipment failures, energy storage problems, the capacity limitations of electricity generation, decrease in fossil fuels, and resilience problems put more stress on the existing power grid. Consequently, the smart grid (SG) has emerged to address these challenges. To realize the SG, an advanced metering infrastructure (AMI) based on smart meters is the most important key. A smart grid is an intelligent electricity grid that analyzes the distribution and consumption of electricity, which can be used to optimize the generation, distribution, and consumption of electricity.**

**Index Terms— Advanced metering infrastructure, communications, security, smart grid, smart meters.**