SURVEY ON CONTENT BASED IMAGE RETRIEVAL USING COLOR AND TEXTURE FEATURES

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ABSTRACT

Content based image retrieval is a research topic since last decade and it is used to solve different problems such as construction of feature vectors, multidimensional indexing, and design of user interface and data visualization. The main problem of content based image retrieval system is with retrieval accuracy and the computational complexity (or retrieval time).This paper provides information about color features such as color space, color moment and also texture features such as Gabor filters, Wavelets. The CBIR system is useful in many applications such as medical imaging, data mining, weather forecasting, crime prevention, education etc. This paper mainly concentrated on the color and texture feature of content based image retrieval techniques.

I. INTRODUCTION

Traditional image retrieval technique uses text index, which was introduced in 1970's[6].compared to text based approach, CBIR is fast and automated retrieval technique where instead of keywords the image is indexed by its visual content[4][5].The CBIR is active research oriented topic which was introduced in early 1980's[6].

This technique is used for extraction of image from large collection of database using the low level features such as color, texture and shape. The extraction of image will be automated or computer assisted image analysis. The main advantage of CBIR system is the system uses image features instead of image itself. So it is cheap and fast compared to image search methods. Since individual features such as color and texture are not sufficient to describe the image, so combination of color and texture features are better.

1.1 Existing System

Currently, we have many content based image retrieval systems. Some of them are created in research laboratories and some are commercial available systems. The information about existing systems are found in [1].And more detailed description about existing systems are found in [6] which are shown below.

Some existing CBIR systems are:

- *QBIC or Query by image content*: It is first commercial content based retrieval system. Here, the users are allowed to graphically pose and refine queries based on features such as color, texture and shape.
- *Visual SEEK and Web SEEK*: Web SEEK is a text/image search engine where as Visual SEEK is a visual feature search engine both are developed at Columbia University.
- *Virage*: It is also a content based image search engine which supports color and texture matching.
- *NeTra*: It supports color, shape and texture matching.
- *MARS*: Multimedia Analysis and Retrieval System supports color, texture, Spatial layout, shape matching.

· *Viper*: Visual Information Processing for Enhanced Retrieval makes use of color and texture matching for image retrieval.

1.2 Color Feature Extraction

Color is one of the most widely used low level visual features and it will not vary with respect to image size and its orientation [1].Quality of color feature depends on color space selection.

1.2.1 Color Space

Color space is also called as color system or color model. It is specification of a co-ordinate system where each color represents a single point. And each color in a color space has its color co-ordinates [1]. Most widely used color space are: RGB (Red, Green, Blue), CMY (Cyan, Magenta, Black), CMYK (Cyan, Magenta, Yellow, Black), HSV (Hue, Saturation, Value).

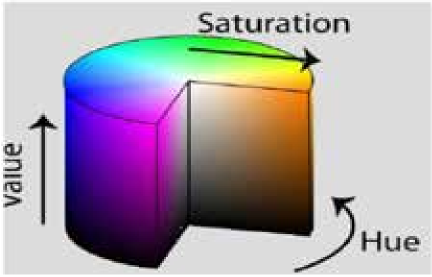

Fig 1. The HSV space color [6].

Hue is nothing but color type range from 0 to 360. Saturation is the "Vibrancy" of the color range from 0 to 100% and occasionally called as the "purity". Value means brightness of color range from 0 to 100% [7]. The HSV color space is used to reduce computation and improve efficiency.HSV color space closer to human conceptual understanding of colors and has ability to separate achromatic and chromatic components [5].

1.2.2 Color Moments

The methods which describes color feature are: color histogram, color correlation, color moments etc. The color moment has lower computational complexity and lowest feature vector dimension[3].From R,G,B color space the mean μ,standard deviation σ and skew g are extracted to form 9 dimensional feature vector. This color space is seen in the cube where x-axis represents red values increases to the left, Blue increasing to the lower right at y-axis and vertical z-axis as green increased towards top[6].

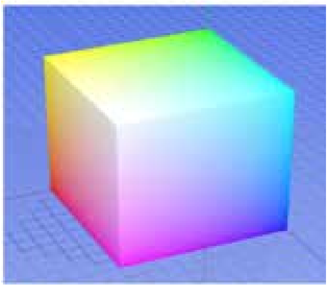

Fig 2. The RGB Color Model Mapped To The Cube. The Origin, Black, Is Hidden Behind the Cube [6].

1.3 Texture Feature Extraction

Texture is one of the important features used for image retrieval. It can be represented by grey level co-occurrences [8].It also gives information about structural arrangement of surface and objects on the image [1]. The measures for capturing the image based on texture are Gabor filters and wavelets. These texture measures retrieve images based on the changes in certain directions and the scale of the images. This is most useful in case of homogeneous texture [6].

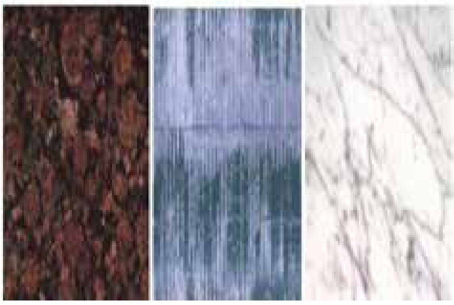

Fig 3. Examples of Textures [6]

1.3.1 Gabor Filters

These are set of wavelets and each wavelets capture image at a particular frequency and at specific orientation. These two features make texture analysis useful NeTra is an example of CBIR system where Gabor filter are used to describe and compare texture.

1.3.2 Wavelets

Wavelet is a method which is used for solving texture classification and analyses of the problems [1].The wavelet transform represents a family of basis function called wavelets. It provides good energy compaction and multi-resolution capability and it is computed linearly with time. The wavelet transform is a multi-resolution approach which uses sub-sampling and recursive filtering [2].

Wavelet transform is the improved version of Fourier transform. This method is used to solve problem in many fields like physics, pattern recognition, image processing, signal processing, medical image technology etc [6].

1.4 Applications of CBIR

There are many applications of CBIR technology some of them are listed below:

- Automated Face recognition system.
- Medical diagnosis: Tumors detection, MRI, CT, Ultrasound [9].
- Remote sensing: Weather forecast, satellite images.
- Cartography: Synthesis of weather maps, map making from photographs [9].
- Digital Forensics: Finger prints matching for crime detection [9].
- Trademark Image Registration.
- Art Collections: Fine Arts Museum of San Francisco.

II. RELATED WORK

Ahmed J Afifi, Wesam M Ashour(2012)[3]: mainly concentrated on two low level features such as color and texture. It consists of new CBIR methods that use the combination of both Ranklet texture moment feature and HSV color moment feature for retrieval of image. For this method he took the experimental results of ten class images and made use of WANG image database for system evaluation. This system provides higher accuracy then those of color and texture feature respectively.

Ching-Hong su, et.al(2012)[7]:have proposed a combination of two features such as HSV color space and edge histogram descriptor in mpeg-7 for transfers of each pixel of image to a quantized color code. Experimental database contain 1200 images which include flowers, plants, animals, sceneries from internet and 1000 test images from wang's image database. Based on experiments results he concluded that proposed system is better than then X-RGB color space schema.

P.Gangadhara Reddy(2010)[5]: Proposed a combined method of color feature and grey level co-occurrence matrix as well as color feature and CCM(Color Co-occurrence Matrix) using Euclidean distance classifier, which improves the performance of image retrieval. The retrieval of image using these methods are superior then using individual methods. By experiment results color+CCM (precision-42%) is better then color+GLCM (39.8%) and color (37.8%).

Lienina Birgale, et.al (2006)[11]: paper consists of experimental results of performance of image retrieval. He calculated results based on color and texture and also by combining both color and texture. In CBIR color gives only 62.5% average retrieval efficiency and for texture 68.75%. This shows that only texture and only color feature is not sufficient to describe image, so by combining of both color and texture average retrieval efficiency has increased to 75%.

Pengyu Liu, et.al [12]: paper provides experimental results of image database that holds 1550 color pictures which consists of car, animals, landscape and construction etc. The output will be of 10 images which are of similar distance. It provides advantage for combining of color and texture features, different features can complement each other and can enhance system retrieval precision, and make CBIR system more agile.

S.Vidivelli, S.Sathiyadevi(2011)[14]: Proposed Wavelet method for searching of image using color and texture. Wavelet coorelogram will acquire less computational time when compared with other methods. The computational time and memory buffer increases when combined with other features. Experimental results show that in database there are 160 images which consist of images of Bus, Sunflower, Lion, Elephant and Penguin. Compared to color histogram and color correlogram, the Wavelet corrlogram has improved the search efficiency.

Mond.Danish, et.al (2013) [6]: concluded that most system uses color and texture features and few systems uses only shape features. It gives overview of content based image retrieval system along with applications and challenges.

Ashwani Kr.Yadav, et.al (2014) [9]: mainly concentrated on texture analysis problems. Problems are divided into four broad categories such as texture segmentation, texture classification, texture synthesis and shape from texture and it also consist of some applications of CBIR system.

Mehwish Rehman, et.al (2012) [10]: paper consists of drawbacks of already existing technique whether they are statistical or hybrid with respect to texture is computational cost. Human visual perception seems to work perfectly in this case. Relevance feedback algorithm is used to reduce the gap between two levels of features i.e. high and low.

Hanife Kebapci, et.al (2009) [13]: This paper gives information about extraction of plant regions from image by the max-flow min-cut segmentation technique. Further combining of color and texture feature gives the accuracy of the system.

Dong Wenfei, et.al (2014) [15]: Proposed new methods such as color histogram, color correlogram, co occurrence matrix, Tamura, Hu moments which are used for extraction of images. Image retrieval experiment uses Window7 Os and core l test image database. This database consist of 100 images they are indigenous, beaches, building, buses, dinosaurs, elephants, flowers, horses, snow-capped mountains and food. The multi feature fusion improves precision rate and enhanced retrieval capability.

III. CONCLUSION

The content based image retrieval is an interesting and complex problem studied by many researchers all over the world. The complexity is due to retrieval accuracy and retrieval time. From literature survey it is concluded that a wide variety of CBIR method have been proposed in different papers. The selection feature is one of the important aspects of image retrieval system to better capture user's intentions. The purpose of this survey is to provide an overview of content based image retrieval systems. Finally it is concluded that combination of color and texture feature for extraction of image is better than the individual color and texture features.

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SURVEY ON HIGH DIMENSIONAL DATA CLUSTERING USING FAST CLUSTER BASED FEATURE SELECTION

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ABSTRACT

High-dimensional data often contain irrelevant or redundant features which slow down the mining process and cause difficulties in storage and retrieval. Feature selection is the process of selecting most relevant features from an entire set of features. The FAST (fast clustering –based feature selection algorithm) algorithm works in two steps. In the first step, features are divided into clusters by using graph theoretic clustering methods. In the second step, the most representative feature that is strongly related to target classes is selected from each cluster to form subset from each cluster to form a subset of features. To ensure the efficiency of FAST, we adopt the efficient minimum-spanning tree (MST using the kruskal's algorithm) clustering method.

I. INTRODUCTION

With the rapid growth of computational biology and e-commerce application, high-dimensional data becomes very common. The major challenge of high dimensional data is its curse of dimensionality. The complexity of many existing data mining algorithm is exponential with respect to the number of dimensions.

In the literature many approaches have been proposed for dimensionality reduction. The existing dimensionality reduction methods can roughly be categorized into two classes: feature extraction and feature selection. In feature extraction problems, the original features in the measurement space are initially transformed into a new dimension-reduced space. Although the significant variables are related to the original variables, the physical interpretation in terms of the original variables may be lost.

Feature selection aims to seek optimal or suboptimal subsets of the original features, by preserving the main information carried by the collected complete data, to facilitate future analysis for high dimensional problems.

Feature selection involves searching through various feature subsets, followed by the evaluation of each of them using some evaluation criteria. The mostly used search strategies are greedy sequential searches through the feature space, either forwards or backwards. Different types of heuristics, such as sequential forward or backward search, floating search, beam search, bidirectional search, and genetic search, have been suggested to navigate the possible feature subsets .In supervised learning ,classification accuracy is widely used as evaluation criterion. However, in unsupervised learning feature selecting is more challenging since the class labels are unavailable to guide the search.

Feature selection algorithms can be broadly classified into the filter model and the wrapper model. The filter model and the wrapper model .The filter model rely on general characteristics of the training data to select some features without involving any learning algorithm. The wrapper model requires one predetermined learning algorithm in feature selection and uses its performance to evaluate and determine which features are selected.

The ability to quickly and effectively process large amounts of data is necessary in order to effectively scale learning algorithm to match the growth of data available. Clustering algorithms are an unsupervised machine learning technique that facilitates the creation of clusters, which allow us to group similar items together so that these. Clusters are similar in some sense. Clustering has broad applications in areas such as data mining, recommendation systems pattern recognition, identification of abnormal cell clusters for cancer detection, and bioinformatics.

1.1 System Architecture

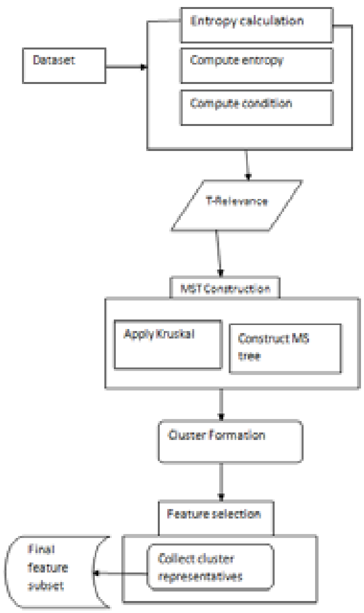

Fig 1. FAST Frameworks [1]

To remove irrelevant feature and redundant feature, the FAST algorithm has two connected components. Irrelevant feature removal and redundant feature elimination. The irrelevant feature removal is straight forward once the right relevance measure is defined or selection while the redundant feature elimination is a bit of sophisticated. In this FAST algorithm, it involves

- The construction of the minimum spanning tree from a weighted complete graph
- The partitioning of the MST into a forest with each representing a cluster and
- The selection of representative features from the clusters
- Load Data

The data has to be pre-processed for removing missing values, noise and outliers. Then the given dataset must be converted into the arff format. From the arff format, only the attributer and the values are extracted and stored into the database.

- Entropy and Conditional Entropy Calculation

Relevant feature have strong correlation with target concept so are always necessary for a best subset, while redundant features are not because their values are completely correlated with each other. Thus, notions of feature redundancy and feature relevance are normally in terms of feature correlation and feature-target concept correlation. To find the relevance of each attribute with class label, Information gain is computed. This is also said to be mutual information (MI) measure.

MI measure how much the distribution of the feature values and target classes differ from statistical independence. The symmetric uncertainty (SU) is derived from the mutual information by normalizing it to the entropies of feature values and target classes, and has been used to evaluate the goodness of feature for classification. The SU is defined as follows:

$$SU(X,Y)=2*Gain(X|Y)H(X)+H(Y)$$

Where, H(X) is the entropy of a random variable X. Gain (X|Y) is the amount by which the entropy of Y decreases.

· T-Relevance and F-Correlation computation

The relevance between the feature Fi and the target concept C is referenced to as the T-Relevance of Fi and C, and denoted by SU (Fi, C). If SU (Fi, C) is greater than a predetermined threshold, then Fi is a strong.

· Minimum spanning tree(MST) Construction

With the F-correlation value computed above, the MST is constructed. A MST is a sub-graph of a weighted, connected and undirected graph. It is acyclic, connect all the nodes in the graph, and the sum of all of the weight of all of its edges is minimum. That is, there is no other spanning tree, or sub-graph which connects all the nodes and has a smaller sum. If the weights of all the edges are unique, then the MST is unique. The nodes represent the samples, and the axis of the n-dimensional graph represents the n features. The complete graph G reflects the correlations among all the target-relevant features. MST is constructed using well-known Kruskal's algorithm.

II. RELATED WORK

Kathleen Ericson(2012) [1]:This paper provides experimental setup for clustering based on hadoop (version 1.0.0) and Granules implementation and the data initially read from HDFS cluster. All tests are run on quad-core machines which is of 2.4GHz Granules support computations that will be executed successive rounds and while retaining state it is well suited for clustering algorithm that are iterative. Mahout Naive and complementary bayes are implemented with distributed classification of algorithms which helps to determine the effect of moving a file based to a streaming based framework and these algorithms operates quickly and provide accurate recommendation in timely manner.

Anil K.Jain(2009) [6]: To have information about data clustering machine learning and pattern recognition communication are very important. For finding NP-hard problem we use the K-means algorithm which provides computationally efficient solution.

Yun zheng and Chee keong kwoh(2011) [5]: The paper mainly concentrated on the problem that helps in induction algorithms that are suffering from curse of dimensionality the redundancy and noisy attributes also results in lower performance and increased computation. To overcome curse of dimensionality feature selection algorithm is used.

S.Senthamarai Kannan (2007) [7]: Based on memetic framework a novel hybrid feature selection algorithm is proposed. Here filter ranking method is used as a local search heuristics. According to this paper the filter ranking method is a better approach then the Genetic algorithm (GA) and Memetic algorithm (MA).

Karthikeyan.P,saravanan.P,Vanitha.E(2014) [8]: In proposed FAST clustering based feature subset selection algorithm a cluster consist of features and each cluster is treated as single feature and hence dimensionality is drastically reduced. According to the experimental results feature subset selection algorithm not only reduces the number of features but also improves classification accuracy.

Yanhong Li,Ming Dong,Jing Hua (2007) [3]: Proposed feature selection algorithm which is relevant to all clusters but sometimes it is not applicable for many high dimensional datasets. This algorithm also provides better understanding of processes that generates the data. In this paper we made use of cross-projection method to have better quality of a individual clusters. According to the experimental results we cannot conclude that the clustering quality of LFS (localized feature selection) is worse than that of GFS (global feature selection) on this dataset as the error rate of LFS and GFS nearly similar.

GuangtaoWang,Baowen,BaowenXu,Yumi-ng Zhouu (2012) [9]: Proposed FOIL rule based feature subset selection algorithm which is applicable to high dimensional data. This algorithm is used not only for removing irrelevant and redundant feature but also with interactive features. The experimental results of the real world datasets show that our proposed algorithm has moderate reduction capability and it is much faster than that of other feature selection algorithm mainly on high dimensional data.

Hua-Liang Wei and Stephen A.Billings(2007) [10]: In this proposed new unsupervised learning algorithm for feature selection and dimensionality reduction. The main advantage of this algorithm is that implementation only involves the calculation of the designed correlation matrix and the forward orthogonalization procedure. It combines good effectiveness with high efficiency, often produces efficient feature subsets and thus, provides an effective solution to the dimensionality reduction.

III. CONCLUSION

The feature selection is a complex problem studied by many researchers all over the world. Complexity is due to finding a voluminous amounts of High Dimensional data, contains irrelevant or redundant features which causes difficulties in storage and retrieval. The feature subset selection algorithm for high dimensional data works based on the clusters that contains features where each cluster treated as single feature and hence dimensionality of data is drastically reduces.

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E-GOVERNANCE: TRENDING IN MODERN TIMES

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ABSTRACT

Post independence India adopted best practices in Governance from different countries of the world. It helped to serve vast cultural and geographical diversity of Indian people for a long time. Socialist ideology till the 1980's paved way for market forces in a world where boundaries cease to exist. Technology is shaping the future of Governance in India. Utility bills, medical services, pubic distribution system, land records are accessible at the click of a button. Many states are thinking of innovative methods of being responsive to their electorate. E-governance has made the systems faster, responsive, and people friendly.

Dissemination of welfare schemes, public policy initiatives, legal assistance for the needy, social sector reforms and many initiatives use technology for public good. There seems to be a reduction in corruption and dependence on people. Processes take time to get streamlined and there is a need to allocate financial resources as well. The redeployment of human resources has to be thought in advance. In a country where people go to great lengths to avoid discomfort, change management requires more than a simple will. During the period of post-liberalization in mid 1990's, user friendly technologies revolutionized Indian banking. More than two decades later, the Central government flagship program on financial inclusion added 11 million account holders in a short span of six months. Banking industry passed its litmus test once again. E-governance has made giant strides in more than fifty such sectors.

The efforts of the Central and State governments in a federal structure are symbiotic. E-governance goes beyond mindset issues. It requires a carefully carved and executed strategy to make the desired impact.

This paper attempts to understand e-governance and its impact on efficiency and cutting costs. A structured questionnaire was administered on 125 respondents. Opinion of 8 experts was also taken to arrive at conclusions.

Keywords: E-Governance, Optimal Utilization of Resources

I. INTRODUCTION

The spectrum of e-governance initiatives across various states in the country is the reflection of the political to embrace change.The examples are many and varied. The Chief Minister of Andhra Pradesh takes the technology route to govern. It makes his administration more responsive and efficient. The government of Madhya Pradesh uses a geometrics application, i-GeoApproach to monitor construction and maintenance of 100000 kilometers of road.Maharashtra police uses its Facebook page where citizens report traffic congestion. Rajasthan uses a management information system to track child birth. Bihar Police has a web portal to see the status of complaints.

The national e-governance plan initially had 14 of 27 projects like e-passport and national citizen database. Various state governments provide services such as telemedicine, high-quality and cost-effective video and data connectivity. Governancerequires addressing issues of public-private partnership, water supply, waste disposal, power distribution, telecommunications network and industrial development. Logistic hubs, special economic zones for IT and ITES, amusement parks, sports complex are integral to holistic governance.E-governance requires process simplification and the greater co-ordination among multiple departments. It is common knowledge that projects with longer gestation period and uncertain demand are not easy to get financers. Ease of governance eliminates fly–by-night operators.

In modern times, it is easier to know about title of land, environmental issues, infrastructure available socio-political back check and development and planning regulations.Poorland record maintenance led to sale of land to multiple buyers resulting in mental anguish and financial loss to the affected people. It hampered the development of the area, forced industries to reconsider alternative locations. However, a lot needs to be done on computerization and regular update of land title data to make it transparent and efficient.

Road, rail and air connectivity has a bearing on development of any region. E-governance bring technology savvy international citizens closer to fruitful business lines. The Government of Gujarat converted vast areas of barren land useful for cultivation by monitoring the flow of water to parched regions. Smart cites have come up in areas where governance takes the drivers seat. International organizations and developed nations show interest after getting fully convinced on good governance and strong public policy initiatives.

India witnessed a change in Central government in May 2014. Many states elected governments which promised e-governance and sensible utilization of scarce resources.

A flagship scheme on financial inclusion became the Prime Minister’s pet project “Jan Dhan Yojana”. It added 11million account holders throughout the country. Fertilizer subsidy, educational scholarship, social service initiatives are linked to the scheme. It reduces pilferage and embezzlement of funds. It also ensures that the beneficiaries get maximum advantage with optimal utilization of resources.E-governance takes centre stage in areas where development issues tackled poorly in the past. E-governance augurs well for underdeveloped regions, societies that remained outside the benefits of development, the less privileged and also special interest groups.

Oil companies believe in e-auction, housing development boards use technology to become transparent. The bidders, based anywhere in the world, come together as technology cuts across geographical boundaries. The applications of e-governance permeate many sectors & change the history and geography of the region. Global financial, commercial and entertainment hubs are the transforming element in governance. Special economic zones with single window clearances, expressways and information highways are part of big development agenda followed by each government.

E-district pilot projects have been implemented in Karnataka, Andhra Pradesh, UP to improve efficiency through complete automated system. Online pension distribution and scholarships, procurement and distribution are facilitated by use of technology in governance.

Banks and financial institutions have taken a cue to implement e-governance. ICICI dedicated a digital village recently to the cause. RBI and NABARD extensively use technology to govern better. Multinational and private banks have focused on better implementation of user friendly technologies.

II. LITERATURE REVIEW

It is well established that big decisions of foreign collaborations, partnering growth and investments are based on technology of the country, wisdom, experiences and human resources. E-governance takes centre stage in such a situation, ripe with brilliant possibilities.

In the view of World Bank, e-governance is the use of information technology to transform relations with citizens, business and other arms of government. The use of these technologies results in better delivery of government services to citizens.

The National e-Governance Plan (NeGP) comprised of 27 Mission Mode Projects(MMPs) and 10 components came into force on May 18, 2006. It aimed at the providing access to services, focusing on service delivery while ensuring efficiency, transparency and reliability at affordable cost. The strategy included common support infrastructure, decentralized implementation, public-private partnership and ownership of Central ministries. Bharat Nirman, Rural Employment Guarantee Schemes used e-governance techniques since inception of these initiatives.

The Bhoomi enture in Karnataka, a G2B module, aims at computerized land record, which in turn makes the middleman irrelevant.The Ministry of Civil Aviation followed a G2B module in the selection of financial advisors in its Mumbai and New Delhi privatization project. The Ministry of Railways follows G2G module for postings to make e-governance work. Its G2B module helps bidders to check their status online.

The Ministry of Finance adopted G2G e-governance model to make transfers/ posting more transparent in Department of Income Tax. Many departments have followed suit. (The Times of India, December 27, 2014)

The state of Uttar Pradesh uses 17500 Common Service Centres to provide services like birth /death certificates, domicile, caste, income among many utilities. Digitization of ration cards, e-villages, e-suvidha for G2C and G2B usher in better efficiency. Global IT giants like HP help 13 rural incubation centres to encourage entrepreneurship and generate employability among rural youth in UP (The Times of India Advertorial, March 4, 2015)

III. PROBLEM STATEMENT

The focus on Governance is priority for welfare of the people. Technology is the lever which provides efficiency and speed in mass outreach initiatives. It helps to set the following objectives.

IV. OBJECTIVES

1. To study e-governance as a catalyst in providing socio economic development of people.
2. To evaluate the impact of recent initiatives on governance.

V. HYPOTHESIS

E-governance is one of the potent contributing factor for the development of India.

VI. METHODOLOGY

Tools: Qualitative as well as quantitative method of data collection was used. Analysis was done by Questionnaire method and the opinion of 8 experts was also used to conclude the paper.

Sample size 125 Respondents

Sampling Method: Simple Random sampling

Sampling Place: Mumbai

VII. FINDINGS

1. The respondents feel that India is ready for e-governance. The areas where e-governance is most helpful are utility services, municipal documents, general administration, land and revenue matters and pension/medical services to senior citizens and the poor.

2. E-governance makes life simpler for the ordinary Indian. Greater transparency in administration helps to build trust and stronger bond between people and government.

3. Increased efficiency was highest rated among the factors in e-governance. Respondents kept cost cutting, time saving and curb on corruption as the other reasons for implementing e-governance.

4. The four key areas of e- governance were agricultural and land revenue records, public-private partnership (PPP), transport /communication and public utility services.

5. Technology is a big enabler in governance. It helps to serve people better through greater access to information. Respondents felt that simplified dissemination of important information is critical to governance. Thus, the hypothesis e-governance is one of the potent contributing factor for the development of India holds true.

6. The respondents felt that Gujarat is ahead of all other states in e-governance. Maharashtra followed by Karnataka. were rated higher than other states which have accepted e-governance as the way forward.

VIII. CONCLUSIONS

The view of experts on e-governance too is that it provides better services. Empowering people is a bye product of providing greater access to information at the click of a button. It helps people participation in government and opens new avenues for citizen dialogue. In turn, it strengthens the social fabric.A strong view emerged that e-governance impacts quality of life, Simplicity of operation helps in enhancing efficiency. The expanded reach in governance helps in more responsive and clinical execution of policies.

Governance is challenging in the vast diversity of cultures, languages and ethnicity of India. The results indicate that greater co-ordination and integration of policy initiatives, happens in e-governance. There is roleclarity and evolution of one's responsibility. Fixing the problem in such situations becomes relatively easier.Greater citizen access to public information, create efficiency in the long run. The multiplier effect on efficiency makes the initial cost of installing system, procedures and process insignificant. Developed countries and ASEAN nations have long practiced this model and reaped sizable benefits. Another expert view was that managing voluminous data in governance becomes mandatory as all elements of the population need to be covered. The role of the administrator expands. The pursuit of excellence in governance takes an exponential upswing with accountability in the fore of every action.

IX. SUGGESTIONS

Governments and organization should walk the talk with commitment toward simplified systems and procedures, transparency and efficiency. It is a constant dialogue with people beneficiaries which cements partnerships. In a large Indian population with a myriad of procedures and laws, e-governance infrastructure and architecture has to be on solid foundation. Funding should precede proper planning. Course correction, if required, requires seamless processes and without administrative delays. The different PESTEL environments should not be treated as mutually exclusive; rather they could enhance performance by complementing each other.

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A NOVEL ZERO VOLTAGE TRANSITION DC-DC BOOST CONVERTER FOR PHOTOVOLTAIC (PV) ENERGY SYSTEM

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ABSTRACT

In this work, a boost converter operating all the switching devices under Zero Voltage Transition is designed and a model converter which can supply a load of 250W is designed to be used in a PV energy system. In this converter topology, a part of the circuit resonates for a small portion of the switching cycle of the converter, known as the auxiliary circuit that enhances the soft transition from ON state to OFF state and vice versa, there by improving the converter efficiency by reducing the dominating portion of in losses i.e. the losses that occur due to hard transition of the switches. Due to reduced losses during switching transitions heating effect of MOSFETs is reduced and they have a longer life. The comparative study between the new topology and conventional hard switching converter is analyzed in terms of reduction of switching losses and improvement of efficiency.

Keywords: Boost Converter, PV Energy System, Resonant Circuit, Soft Switching, ZVT.

I. INTRODUCTION

Usually, the converters operating under Zero Voltage Transition (ZVT) help solving the problem of prohibitive Electromagnetic Interference (EMI) either by using a diode whose recovery characteristics are not fast, to increase the turn OFF time of switch present in the boost circuit, which increases the switching losses [3], or by using passive snubber circuits which increase the conduction losses [4] [5], thus reducing the converter efficiency and limiting the switching frequency. So the problem of EMI is solved only at the cost of reduced efficiency. So there is a need for highly efficient converters with reduced EMI.

The most important thing in the converter design is the positioning of the auxiliary switch. If the source terminal of the switching MOSFET is not connected to the common point of grounding in the circuit, we will need a floating gate drive, which demands an effective gate voltage greater than the input voltage. A reduced stress of voltage and current peaks on the switching devices is always recommended for safety of devices.

The principle of ZVT is that the auxiliary circuit carries a current higher than the input current flowing through the boost inductor just for a fractional part of switching time, in order to attain soft turn ON and OFF transitions of the main and auxiliary switches. So, these converters have higher losses than the simple or conventional converters that do not operate under soft transition of switching. But the efficiency of soft switching converters is high as the losses due to hard switching in the soft switching converters are very low as compared to the conventional hard switching converters. Also, as the auxiliary circuit it-self is soft switching and due to the creative placing of the snubber capacitor which controls the ON to OFF transition of the switch in the boost circuit, this converter reduces the EMI and increases the efficiency.

II. HIGH SWITCHING FREQUENCY OPERATION

A power electronic converter has energy storage elements such as inductors, capacitors and transformers that account for much of its overall size. These components are used to store and transfer energy as part of the power conversion process. As a converter's switching frequency is increased, the component values of its energy storage elements Decrease, as do their physical size and weight, due to the shorter time they are required to store voltage or current. As a result, the higher the switching frequency a converter operates with, the smaller its energy storage elements (and thus its overall size) will be.

There are, however, drawbacks to operating a switch-mode power electronic converter with high switching frequency, the key one being that doing so increases the converter's switching losses. Unlike an ideal switch that would be able to turn on and off Instantaneously without any overlap between the voltage across it and the current flowing through it, a real switch does have these overlaps in voltage and current whenever a switching transition from on to off or vice versa is made.

Since power is dependent on the product of voltage and current, the fact that there is voltage/current overlap during switching transitions means that there are power losses during these times. These losses are referred to as switching losses in the power Electronics literature and the higher the switching frequency that a power converter operates with, the more switching losses it will have.

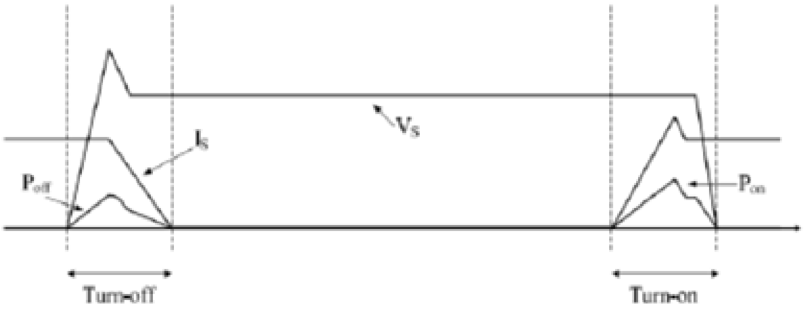


Fig 1: Typical switch voltage and current waveforms

III. POWER LOSSES IN HARD SWITCHING CONVERTER

In the switching converters, when the switching device is in ON state, as the voltage blocked by the switch is zero, the power losses are zero. When the switch remains in the off state, as the current allowed by the switch is zero, the power losses are zero. But during the transition of the switch from both ON state to OFF state and OFF state to ON state, if there is no mechanism to make either voltage or current zero, power losses occur. This is in the case of hard-switching converters.

In the hard switching converters, power losses will occur when there will be a simultaneous non-zero voltage applied across and non-zero current flowing through the switch. When the switching device turns ON or OFF, the device voltage and current are high in simultaneous cases resulting in high losses. This is shown as waveforms in figure 2, (i) showing control pulse given to the switching device, (ii) the device voltage and current and (iii) power losses per switching cycle.

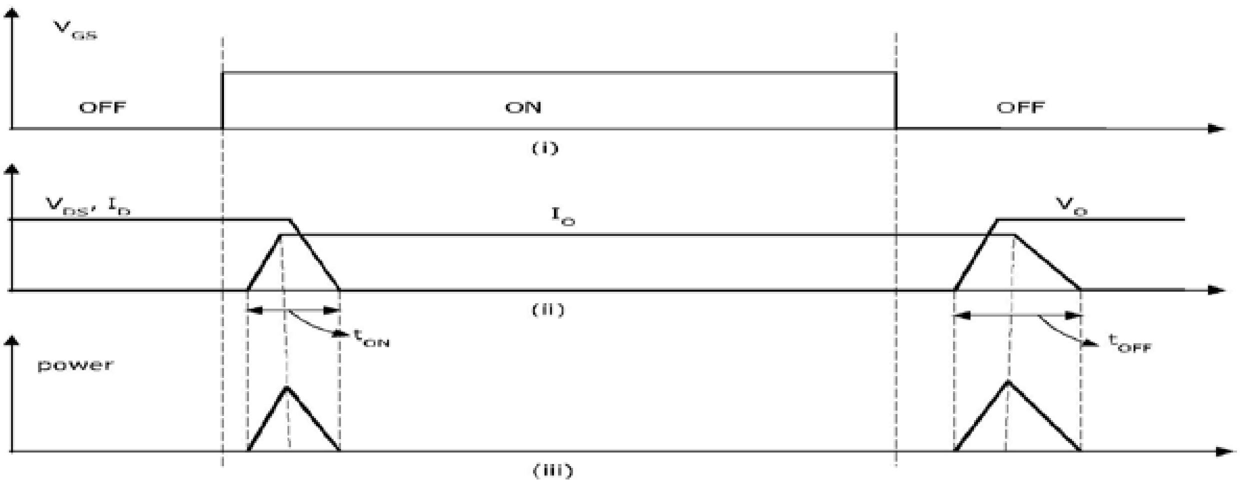


Fig 2: Switching losses in hard switching converters

The power losses corresponding to a single switching transition are the product of the voltage that appears across the terminals of the switch and the current flowing through the switch. The entire switching losses are the product of energy or power lost per switching transition and the switching frequency. The power losses that occur due to these switching transitions are referred to as switching losses.

The switching losses in one switching cycle can be denoted in equation (1)

$$P_{sw} = V_s I_s f_s \left(\frac{T_{on} + T_{off}}{2} \right) \quad (1)$$

From the above equation, the switching losses in any semiconductor device vary linearly with switching frequency and delay times. Therefore such hard switching converters cannot be used for high frequency switching applications. Though use of passive snubbers across the switch reduces voltage stresses, the efficiency cannot be improved due to high switching losses. From the equation of switching losses, it can be observed that the switching losses can be reduced in two ways

i. By reducing the delay times during turn ON and turn OFF, by using faster and more efficient switches in converter.
ii. By making the voltage across or current through the switch zero before turning it ON/OFF, the concept of soft switching converters.

IV. SOFT SWITCHING

A power converter can be operated with high switching frequencies only if the problems of switching losses can be overcome; this can be done using "soft-switching" techniques. This term "softswitching" refers to various techniques that make the switching transitions more gradual than just simply turning a switch on or off (which is referred to as "hard-switching" in the power electronics literature) and that force either the voltage or current to be zero while the switching transition is being made. Switching losses are reduced as there is no overlap of switch voltage and switch current during a switching transition as one of the two is zero during this time.

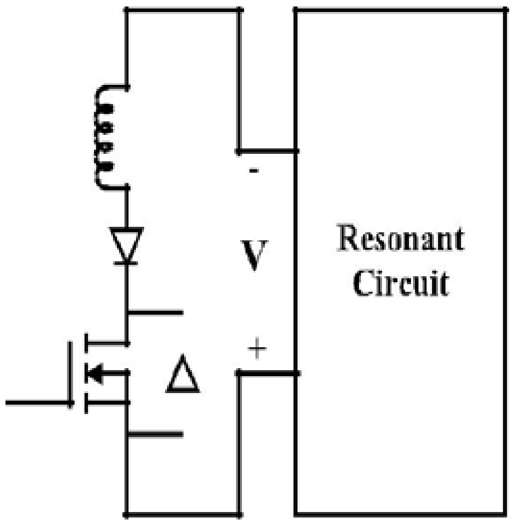
V SOFT SWITCHING TECHNIQUES

There are two basic methods to attain soft switching, zero current switching (ZCS) and zero voltage switching (ZVS), based on the parameter that is made zero, either the voltage or current through the device.

5.1 Zero Current Switching

A switch operating with ZCS has an inductor and a blocking diode in series with it. The switch turns ON under ZCS as the rate of rise of current after the voltage becomes zero is controlled by the inductor. As the inductor does not allow sudden change in current, it rises linearly from zero.

When a negative voltage is made to appear across the combination of inductor and switch using a resonant circuit, the current flowing through the switch is naturally reduced to zero which results in the turn OFF of the switch under zero current switching.



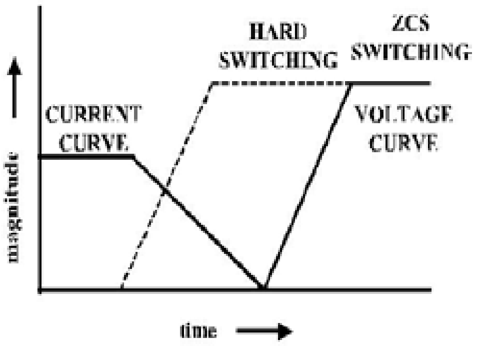


Fig 3: (a) ZCS turn OFF using negative voltage (b) Switching waveforms of hard switching and ZCS during turn OFF

5.2 Zero Voltage Switchiing

A switch operating with ZVS has an anti-parallel diode and a capacitor across it. During turn OFF as the current reduces to zero, the rate of voltage rise that takes place across the switch is controlled by the capacitor. As the capacitor does not allow sudden change in voltage, it rises linearly from zero.

The turn OFF characteristics of the switch are controlled by a capacitor connected across it. This capacitor reduces the voltage rise rate as current flow reduces to zero.

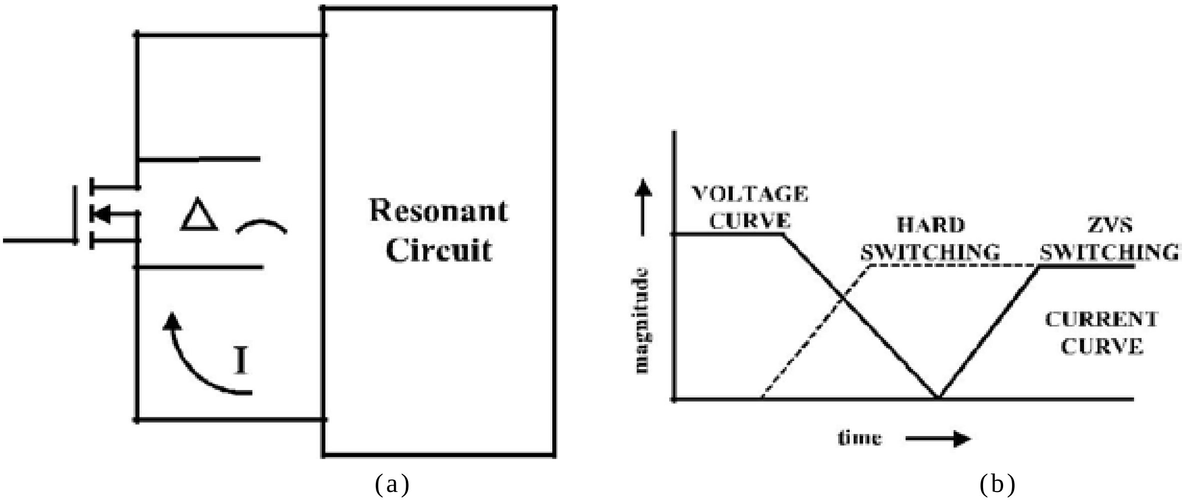


Fig 4: (a) ZVS turn ON using negative current (b) Switching waveforms of hard switching and soft switching

VI. ZERO VOLTAGE TRANSITION CONVERTERS

The ZVT converters accomplish zero voltage switching during both turn-ON and turn-OFF transitions of the primary or boost switch. The zero voltage transition in zero voltage switching converters is accomplished by turning OFF the switch which has capacitor and a diode connected in parallel with it. As the flow of current through the switch falls to zero, the capacitor maintains zero voltage across the switch. Where as in zero voltage transition, as the switch turns OFF, the current in the switch is transferred to the capacitor connected in parallel to it. The turn ON transition in zero voltage switching is accomplished by discharging the capacitor connected in parallel by making use of the energy stored in a magnetic circuit element like a transformer winding or an inductor coil. The switch is turned ON after the parallel diode enters into the state of conduction. This ensures a zero voltage across the switch during transition.There are various zero voltage switching techniques. Each one differs from other in the techniques used to control and modulate to attain regulation and also in the mechanism of storing energy to attain zero voltage turn ON.

VII. PROPOSED ZVT BOOST CONVERTER

The circuit schematic of the zero voltage transition DC-DC boost converter is shown in Figure 5. It is just a simple boost converter with a diode D_1, input boost inductor L_{in}, main switch S_1 and an output capacitor C_0 across a load $R_{load.}$ In addition to the boost circuit, it also constitutes of an additional circuit that resonates, consisting of an inductor L_r, a capacitor C_r, diodes D_2-D_5 and a capacitor C_b to feed the resonant energy to the load. The capacitance C_s shown across the main switch S_1 is its parasitic capacitance and not an external capacitance.

The basic principle of Zero Voltage Transitions is that the auxiliary circuit carries a current higher than that of the input supply current, for a small portion of the entire switching cycle in order to attain soft switching of the switching elements present in the converter. Therefore Zero Voltage Transition converters have higher ohmic losses than that of those converters that operate under hard-switching. But the efficiency of the converters that operate under soft switching is inflated unlike the hard switching converters on account of diminished switching losses.

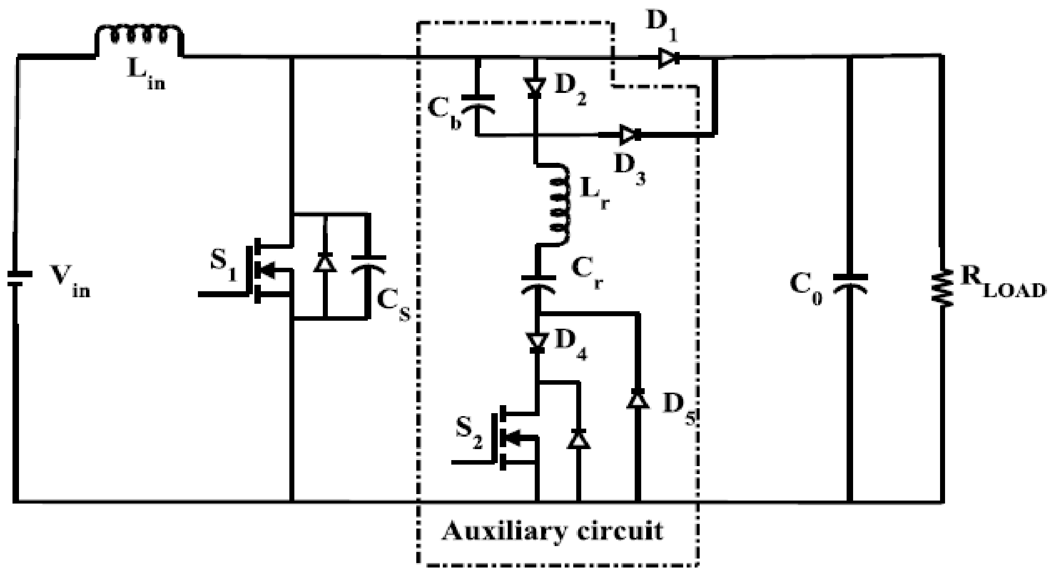


Fig 5: Schematic Diagram of ZVT DC-DC Boost Converter

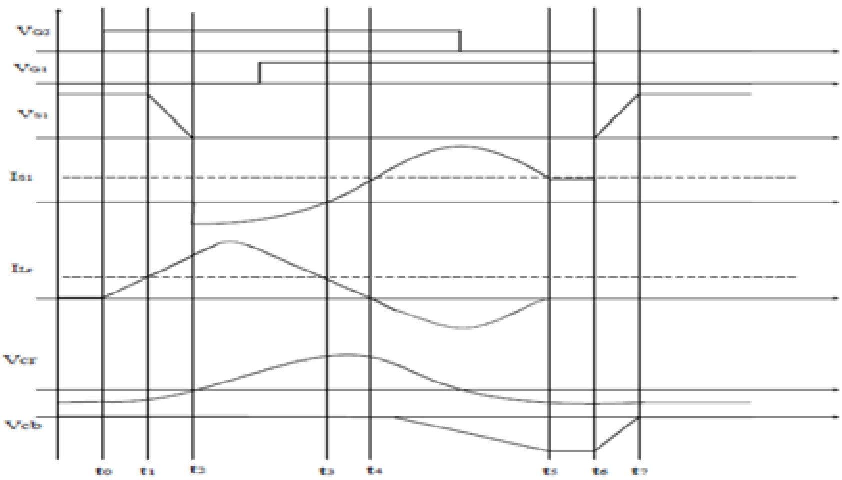


Fig 6 : Hypothetical waveforms of the converter

VIII. BOOST CONVERTER FOR PV ENERGY SYSTEM

The efficiency of a photovoltaic system is very low since the output of the PV array depends on various environmental conditions most likely to be temperature and solar irradiation. Therefore, there is a need for a system to condition the power output of the PV array before supplying it to the domestic loads. Figure 7 represents a block diagram showing the use of a converter for PV energy system. The PV array's output is supplied to the load after being conditioned by the ZVT DC-DC boost converter. The switching of the MOSFETs constituting the circuit is controlled by a maximum power point tracking (MPPT) algorithm which tracks that operating point of the PV array that meets the DC load line (including the effect of converter).

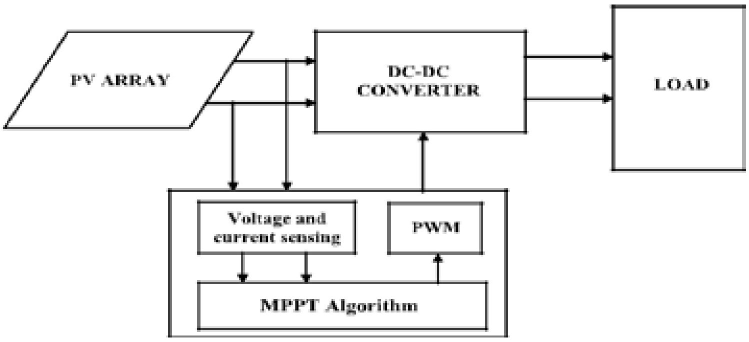


Fig 7: Block diagram of DC-DC converter with PV energy system

IX. SIMULATION AND RESULTS

The operation of the converter is verified and the waveforms of the auxiliary circuit elements for a resonant cycle and the main switch current and voltage waveforms for one switching cycle are shown below.

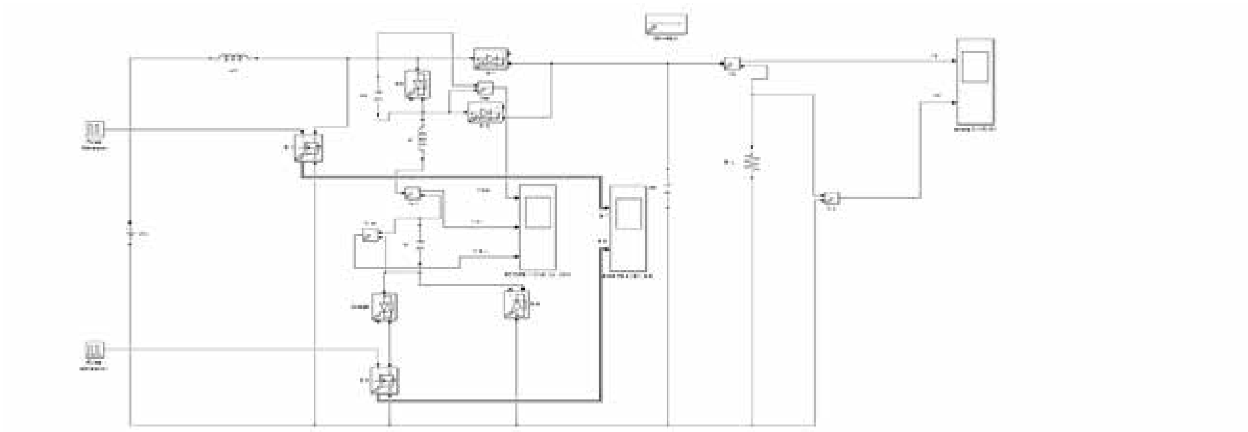


Fig 8: Simulink Model of Proposed ZVT Boost Converter

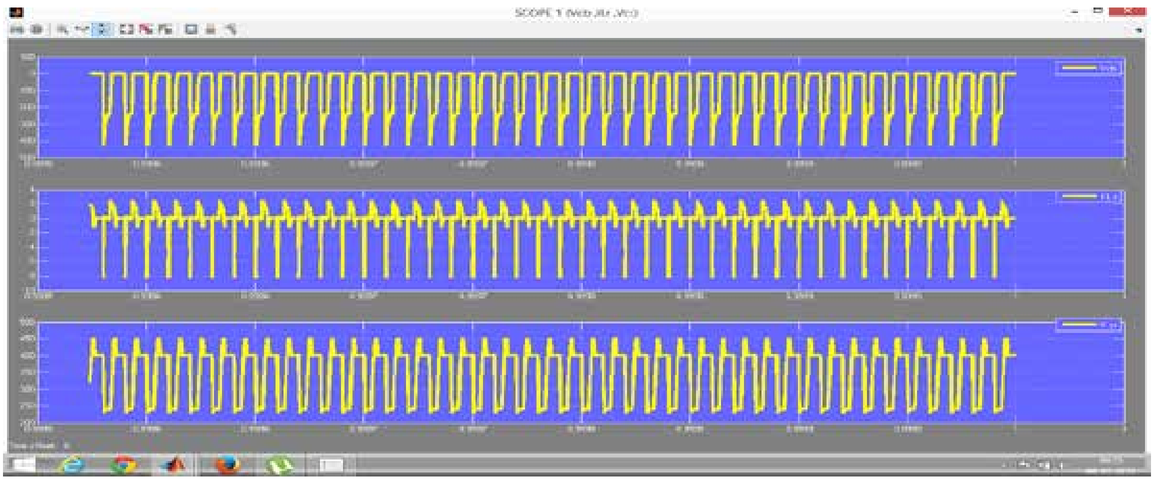


Fig 9: Feed-Forward capacitor Voltage , Auxiliary inductor current and Auxiliary capacitor voltage

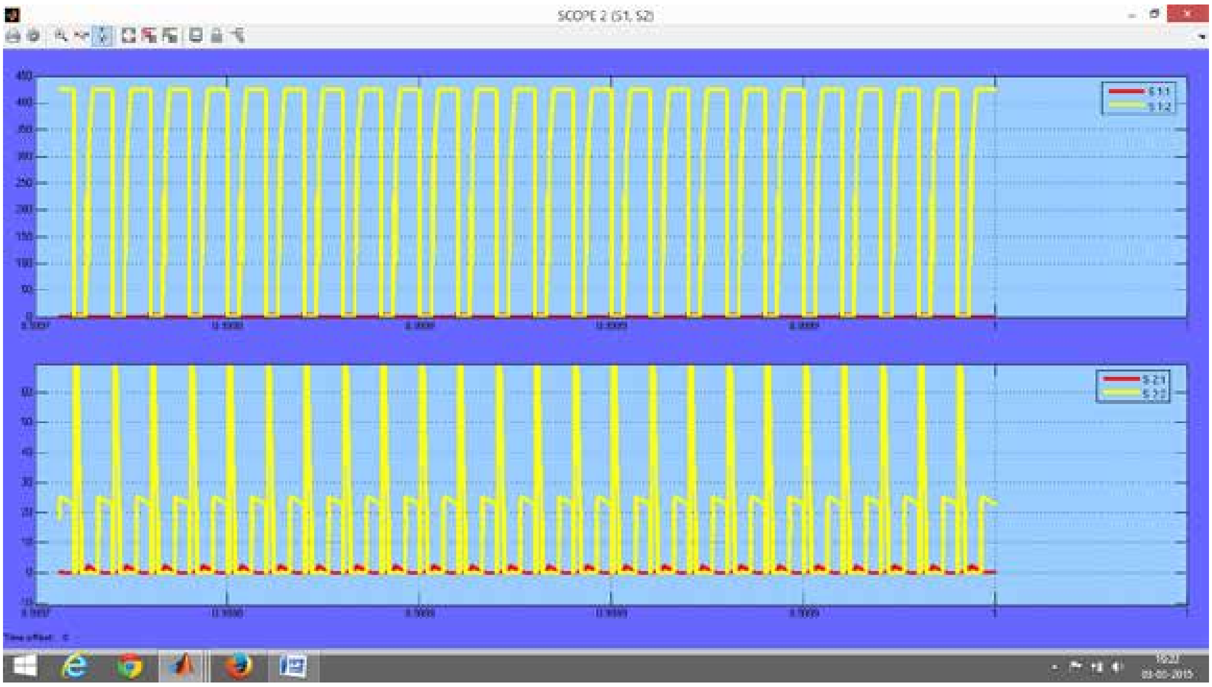


Fig 10: Mainswitch current & voltage and Auxiliary switch current & voltage

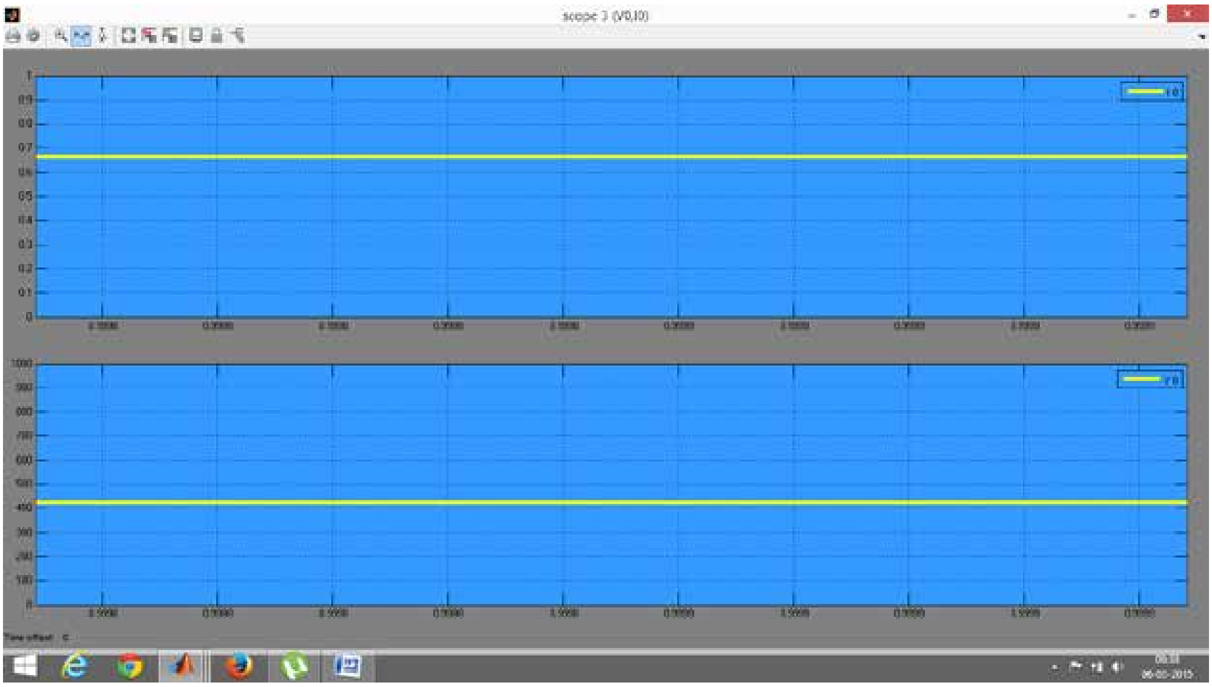


Fig 11: Current and voltage across load

The circuit is run under different input conditions with input voltage ranging from 90-265V and the circuit is found to give an output voltage of 400V for different values of duty cycles ranging from 35-80%.

X. CONCLUSION

A conventional hard switching converter is designed for the same specifications and simulated and the losses of both the converters are compared. In this paper soft switching boost converters with auxiliary resonant circuit for photovoltaic applications have been reviewed. Through this auxiliary resonant circuit, all of the switching devices perform soft-switching under zero-voltage and zero-current conditions. These boost converters have high efficiency, low cost, and ease of control. The efficiency of these boost converters is more than 98% and are useful for photovoltaic application.

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INVESTIGATION OF LASER DRILLING OF MILD STEEL AND ANICKEL-BASED SUPERALLOY CM186

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ABSTRACT

Laser drilling is a non-contact thermal process which facilitates machining by heating the material and melting or vaporising the material. Hence, it is used for all kinds of material that are very hard to be machined by conventional drilling methods, by heating the material to its melting or boiling point. The molten material is ejected with the help of assist gas to generate a hole. Laser drilling is suitable for any kind of material due to its high productivity, improved quality, etc. Its influence in the aerospace industry is on the rise due to its swift and precise drilling of a large number of holes on the turbine blades for effusion cooling. But, laser drilling leaves behind some undesirable side effects like spatter formation on the surface, resolidified layer on the walls of the hole and a layer of heat affected zone. These effects can be prevented by using the optimum sets of parameters for each material according to its properties.

This work is aimed at investigating the relationship between the common defects like spatter formation, taper, oxidation marks and the repeatability of laser drilled holes on three different specimens(1mm mild steel, 2mm mild steel and a nickel-based superalloy CM186) for lower values of power, assist gas pressure and pulse width. The assist gas employed is Nitrogen. The microstructure of recast layer and heat-affected zones is seen with the help of SEM micrographs.

1. INTRODUCTION

The current increase in demand for the materials that are difficult to process by conventional methods has led to the interest in research and development of laser machining techniques [1]. Laser drilling is the process of drilling holes onto any metal by exposing the point on the metal to continuous or pulsed high energy laser beams that focus on the particular point to be drilled. The material is heated up and melted or vaporised in the process.

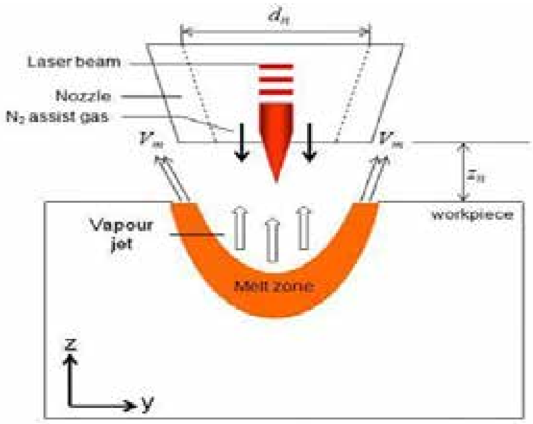


Figure 1 Process of Laser Drilling

where,

Vm - melt ejection velocity(m/s)

Zn - distance between the work piece and laser nozzle(1mm) dn - diameter of the laser nozzle(200µm)

An assist gas under pressure may be used to blow off the molten material to form a hole. The assist gas also helps in protecting the lens from the ejected material [2]. In most of the manufacturing industries, especially aerospace industry, laser drilling has been used to drill holes in various parts like turbine blades, combustion rings, nozzle vanes etc [3] [4] [5]. They require a large number of holes to be drilled on them(turbine engine needs about 1,00,000 holes for effusion cooling). It makes the laser drilling more convincing over the currently used traditional drilling processes like Electrical Discharge Machining since it requires a very short time for drilling [6]. Laser micromachining of solid metal materials is basically a thermal process in which the material is removed by melting with the assistance of the assist gas pressure [7].

The drilling processes are accompanied by removal of the molten material by vaporisation or melt ejection with the help of the assist gas. Vaporisation is the material removal used for holes of the size of nanometres and melt ejection is the process involved in the drilling of holes of the size of micrometres. The experiments involve drilling of micrometre sized holes and hence they are based on melt ejection technique.

II. PROCESS OF MELT EJECTION

The point of incidence of the laser initially is at the top surface of the material. Hence the top layer heats up rapidly and is melted and a little may be vaporised. During the initial duration of the drilling process, as the material is penetrated by the heating effect due to the power delivered by the laser, the molten material is ejected upward by the effect of assist gas pressure and recoil pressure. The recoil pressure plays an important role in the upward movement of molten material. This leads to deposition of the blown out molten material on the surface of the material in the form of spatter [7]. As the heat propagates, more material is melted and blown out until the full penetration depth is achieved. When the full penetration depth has been achieved, the melt ejection of the material occurs both upwards and downwards. The material ejected downwards is deposited on the platform provided below. The average melting through velocity of the laser decreases with thickness of the material. This is because the laser beam loses its intensity due to the absorptivity of the material[8].

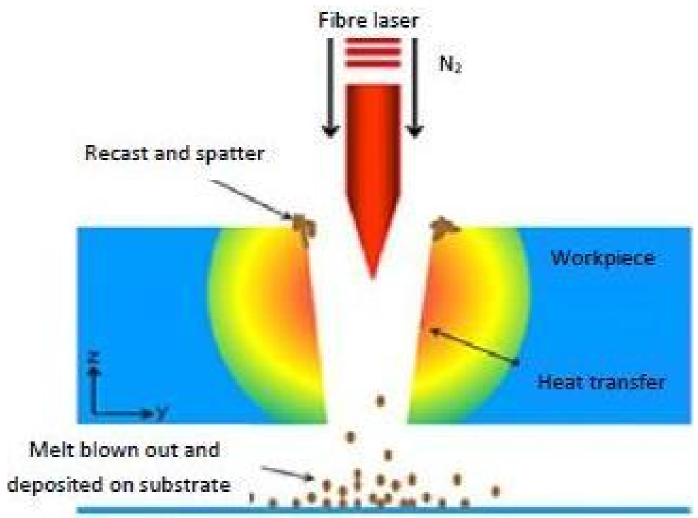


Figure 2 Melt ejection

III. METHODOLOGY

3.1. Experiment

The entire experiment consists of two stages. In the first stage a wide range of parameter combinations of laser power, assist gas pressure and pulse width were used to find which parameters play a significant role in controlling the hole dimensions. In the second session, the parameters were refined to focus on only the power and assist gas pressure variations.

3.2. Observation and Data Collection

Once the drilling is complete, the samples were cut down in the guillotine in sets of the parameters and marked clearly inorder to avoid confusion. The diameters of the drilled holes were measured using a digital microscope. Since most of the holes are not exactly circular, diameters were measured at four points for each hole at the entrance and exit and the average is taken as the actual diameter. Simultaneously, the spread of spatter on the surface as well as the extent upto which the oxidation marks have travelled on the surface of the specimen were also measured.

Figure 3 A laser drilled hole

3.3. Cross Sectioning and SEM micrograph

To view the cross section of the hole, the holes should be cut in the middle. The cut pieces of the specimen are mounted for viewing in the microscope. The mounted smaples will not be smooth and hence they need to be grinded and polished to obtain a smooth surface. The polished specimens are left out with a smooth surface finish. But, without etching, the different layers like the recast layer, heat-affected zone can’t be easily distinguished from one another.

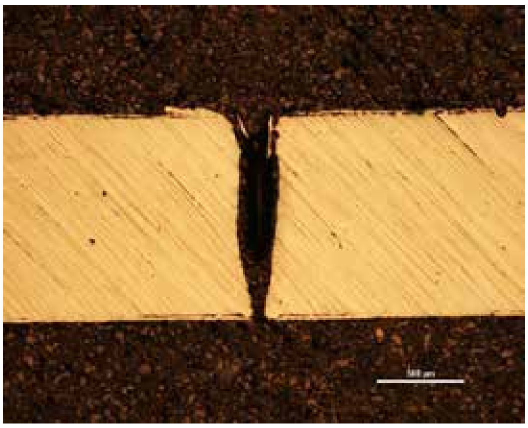


Fig. 4 An unetched specimen viewed under optical microscope

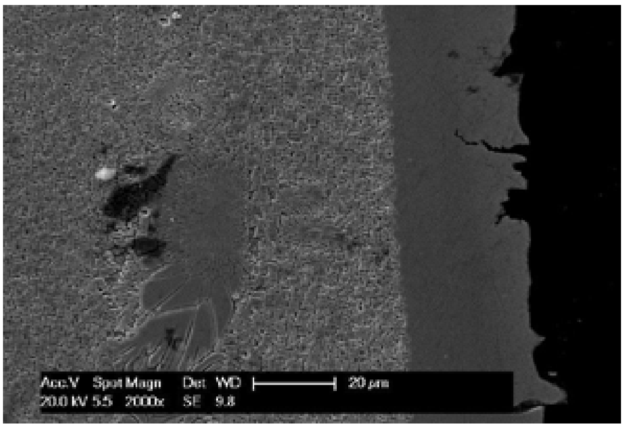
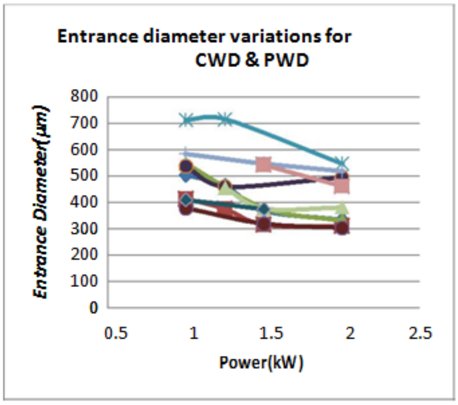
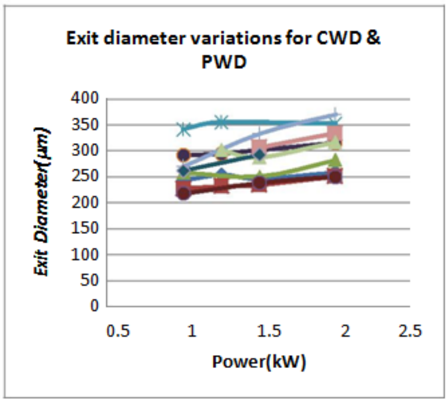
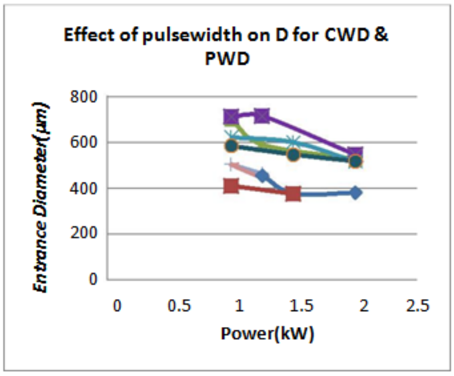


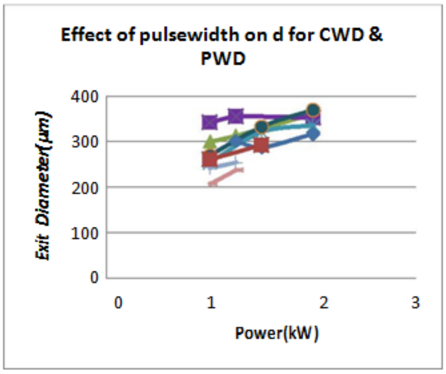
Fig. 5 Etched specimen viewed under SEM

IV. .RESULTS









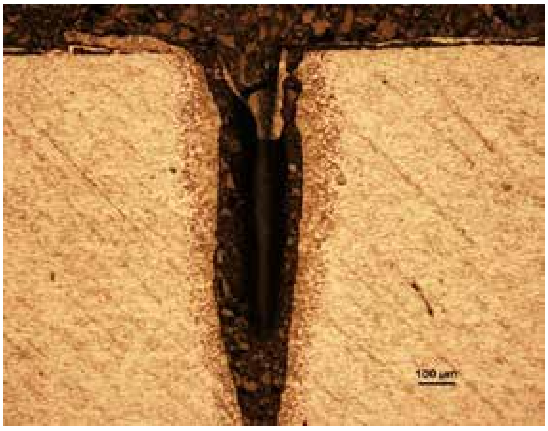


Fig. 6 Separated Layer Found Hanging Inside The Laser Drilled Hole

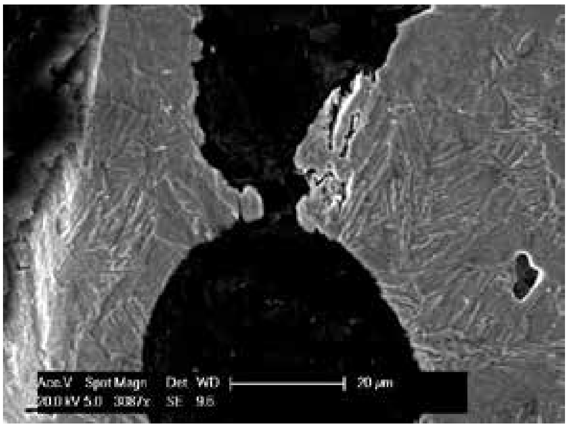


Fig.7 SEM Micrograph Shows SimilarMicrostructure of The Separated Layer And Recast Layer

V. CONCLUSION

The entrance diameter of the holes is primarily governed by the laser power. The increase in pulse width has very little effect on increasing the entrance diameter. The exit diameters increase with increase in laser power and decrease with increase in assist gas pressure. The extent of heat affected zones is affected by the amount of energy delivered, higher the energy, larger the heat-affected zone. The heat affected zones for a fixed power can be reduced with a combination of high pressure and low pulse width. The separated layer may be the result of insufficient gas pressure to blow the molten material out or the melt flowing back into the hole after the assist gas supply is stopped.

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A STUDY ON AIRFOIL CHRACTERISTICS OF A ROTOR BLADE FOR WIND MILL

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ABSTRACT

All over the world there is a substantial effort in design, development and installation of wind turbines for renewable energy production. Aerodynamic design processes involved in the design of wind rotor for power generation from wind. The design of airfoil shape of rotor blade is a most complex process for wind mill design. This article aims to study on characteristics of an airfoil of a low power wind turbine blade for rural application in domestic situation. As per the Betz's theory, forces over a turbine segment has obtained and the airfoil characteristics of a blade and it has analyzed using CFD software.

Keywords : Airfoil, CFD, Rotor Blade, Wind Mill

I. INTRODUCTION

The power from the wind is a natural source of renewable energy. In the present scenario, there is a perceived doom arising from the complete utilization of non-renewable fossil fuels, the possibility of unlimited power hidden in the natural wind provides a hope for the future. There are many efforts in design, development and erection of wind turbine for generation of electrical power and connecting it to the local electric grid system. Design of large power wind turbines for specific location assured of steady winds of high velocities, but the design of wind mills from the range of 3 to 10 kilowatt (kW) for domestic and farms involves difficult processes. The effort in this study is for the design of wind rotor of about 5 kW capacity of functioning in a wind of about 8 m/s. The emphasis here is in trying to understand the main design issues and to design a rotor for the small-power turbine following the classical method due to Betz.

II. GLOBAL THEORY OF WIND TURBINE DUE TO BETZ

The estimation of the wind power production capacity can complete using kinetics wind energy equation. Ali Musyafa [1] explains a method to estimate the production capacity of wind turbines. The Rotor is used to extract the power from wind. In practice the wind mill rotor will have certain number of blades placed equally around a hub. Typically a high speed wind rotor will have three blades. Ali Musyafa and Ronny Dwi Noriyati [2] has indicated the implementation methods for pitch angle in wind turbine position for maximum power production. The maximum power obtained from wind can calculate from Betz's law. Magdi Ragheb and Adam M. Ragheb [3] explain the global theory of wind turbine due to Betz. According to Betz's simplified analysis, there is a limit to the maximum value of power from a rotor and from oncoming wind. Fig 2 shows the wind turbine blade designed as per Betz's criterion.

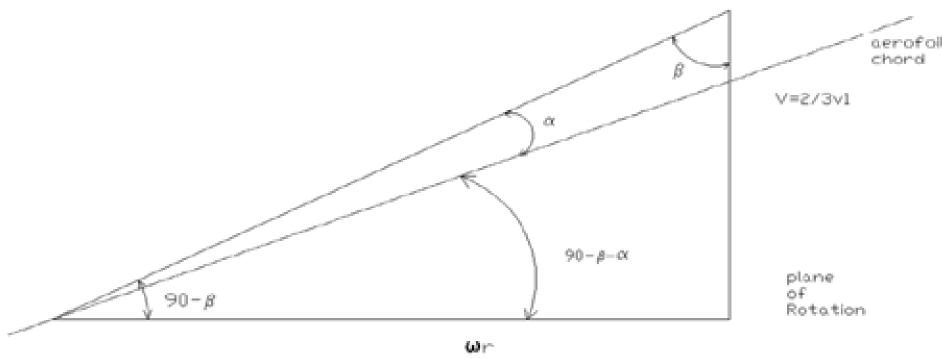

Fig 1: Velocity triangle at radius 'R' in relation to local airfoil

2.1 Design of a wind rotor: The design targets

In this study, a fast wind rotor for generating power of 5 KW has selected. For this high speed rotor we have three blades. For such a wind turbine, based on Betz hypothesis that:

(1) Wind rotor is ideal, in the sense it has no hub and has an infinite number of blades which offer no resistance or drag to the passage of air through it.

(2) The speed of air in front of it, at it and far behind is uniform across the cross sections.

(3) The velocity everywhere is purely axial, that is the component of swirl induced by the blades is ignored.

(4) The individual blades, made of aerofoil sections, have no tip losses and no tip vertices are shed.

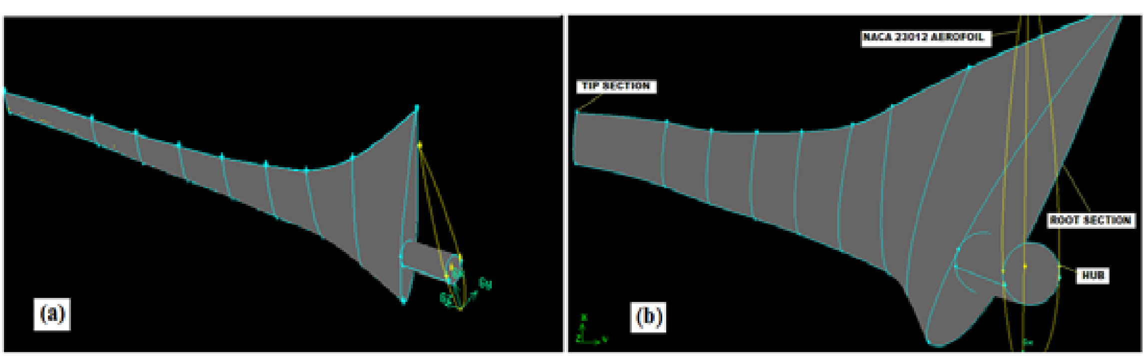

Fig 2: Wind turbine blade designed as per Betz's criterion; (a) Airfoil is NACA 23012, Design power = 5 kW, Tip speed ratio = 8, Wind speed= 7m/s, Blade diameter = 8.54 m; (b) 3 blade propeller with NACA 23012 airfoil, Tip speed ratio = 8, Wind speed = 7 m/s, Design power = 5 kW

Under these assumptions, we can obtain the distribution of local chord of the blade aerofoil as a function of the local radius r, the number of blades n, and the rotor tip-speed-ratio λ_D

$$t\ (r)=2\pi R\ 1/n\ .8/9_{CL}\frac{1}{\lambda D2\left(\frac{r}{R}\right)2+4/9}$$

Where C_L is the lift coefficient corresponding to the max L/D for the aerofoil used.

2.2 Choice of The Aerofoil

There are many kinds of airfoils used for the design of wind-turbine rotor blades. Few examples are Gottingen 623, NACA 4412, 4415, 4418, 23012, 23015 and 23018. Sandip. A. Kale and Ravindra N. Varma [4] has studied aerodynamics design of a horizontal axis micro wind turbine blade using NACA 4412 profile.

Fig 3: NACA 23012 Airfoil

In this study we choose NACA 23012 airfoil for the rotor blade. In this case,

$$\lambda_D=\pi/108.R/C_L/\sqrt{}(r/R)^2+1/154$$

$$\lambda_D=0.0291.\ R/C_L/\sqrt{}(r/R)^2+0.00649$$

For the NACA 23012 aero foil our CFD analysis shows a maximum L/D of about 53 corresponding to an incidence of 8 degrees for which the lift coefficient is 0.96 using a value of C_L=0.96, then the above equation becomes :

$$t\ (r)=0.0303./\sqrt{}(r/R)^2+0.00649$$

Table 1: Distribution of t (r), β(r) and I as a function r/R

r/R	t (r) meter	β(r) degree	(I) degree
0.0	1.54	0	82
0.1	0.9677	50.19	31.81
0.2	0.5763	67.38	14.62
0.3	0.4000	74.56	7.44
0.4	0.3046	78.23	3.77
0.5	0.2456	80.54	1.46
0.6	0.2057	82.09	-0.09
0.7	0.1762	83.21	-1.21
0.8	0.1545	84.05	-2.05
0.9	0.1375	84.71	-2.71
1.0	0.1239	85.24	-3.24

2.3 Diameter 'D' of the rotor

This being the high speed rotor we use the thumb-rule $P=0.20\times D^2\times V^3$ to determine the diameter D for a given wind speed V.

For our case P=5000 W,V=7m/s

$$\text{i,e } 5000=0.20\times D^2\times 7^3 \quad \text{or } D=8.54\text{m}$$

For thin wind rotor t (r) is given by (for R=4.27m)

$$=0.1294/\sqrt{(r/R)^2+0.00649} \qquad (m)$$

From this we can compute t (r) as shown in the table 1.

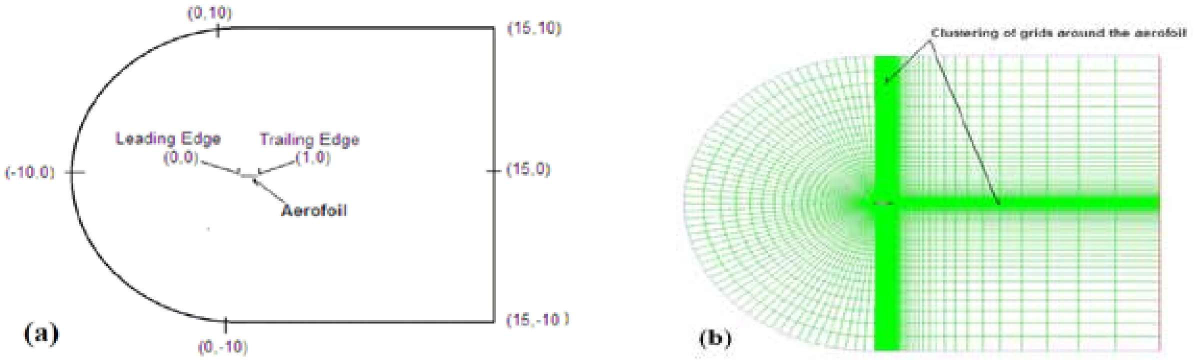

Fig 4: (a) Aerofoil is placed between (0,0) and (1,0); 4 (b) Quadrilateral grids around the airfoil with suitable clustering

2.4 Setting angle for the profiles

At any section r we have the velocity triangle shown in fig 1, under optimum or Betz's condition.

$$\tan\beta = \omega r/v = 3/2\ \omega r/v_1 = 3/2\ \omega r/v_1.\ (r/R)$$

$$=3/2\ .\lambda_D\ \ (r/R)$$

Where by definition $\lambda_D=\omega R/v_1$, v_1 being free stream velocity. For the present case λ_D=8 and we have

$\tan\beta = 12(r/R)$

We can now compute β(r) as function of r/R as shown in the table 1.

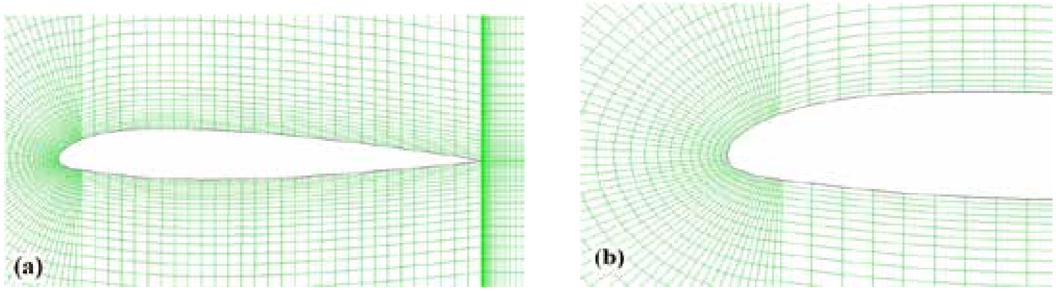

Fig 5: (A) Close View Of The Grid Around Naca 23012 Aerfoil; (B) Close View Of The Grid At The Leading Edge

As we can see from the velocity triangle β is the direction of the resultant velocity at the Plane of the rotor at a radius r. For its best performance the aero foil should take this "free stream" at an optimum incidence α, where L/D is Maximum. We have chosen NACA 23012 as the aero foil and this aero foil has a maximum L/D of about 70 around an incidence of 8°, where the lift coefficient is 0.96. We choose the keep the incidence same for all the sections although one may choose different incidence. With thin the following distribution of setting angles Z results along the radius of the rotor blades. The table 1 shows the distribution of chord t (r), local flow angle with respect to the flow direction β(r), setting angles (I) as a function r/R.

III. COMPUTATIONAL FLUID DYNAMICS

Thanks to the continuous developments in more and more powerful computers, with enormous speed and storage capabilities, the field of Computational Fluid Dynamics (CFD) has now reached a stage of maturity where it is claimed that it possible to do, routinely, computations to obtain simulation of complex flows over complex geometries and for real-life flow situations -- very reliably and in a short time. Over the years the field of grid generation has grown from simple rectangular body piercing grids to body conforming grids. There are also zonal methods for grid generation for dealing with special set of geometry in given shape, overlapping grids and unstructured grids. The field of grid generation has indeed grown into a fully mature field. We use in this study FLUENT which is the flow code and the GAMBIT which is the grid generation code.

We have studied in this report the geometric parameters such as extent of domain for computations, the role of relaxation parameters in the process of numerical convergence of numerical solution. Furat Abdal Rassul Abbas and Mohammed Abdulla Abdulsada, [5] have studied the simulation of wind-turbine speed control using MATLAB. For validation we have chosen baseline NACA 23012 aerofoil as a candidate since our study in this project concerns the same aerofoil with split flap on it. This validation study contains comparison of basic aerofoil lift, drag vs. angle of attack as a basis of validation. We have chosen standard experimental results available in literature. Based on this study we fix up range of parameters for our investigation of flow over the split flap.

3.1 Characteristics of NACA 23012 as validation Exercise

Fig 3 shows NACA 23012 aerofoil and Table 1 contains standard coordinates. These coordinates are imported to GAMBIT and quadrilateral grids are created over sub-domains into which the main domain of fluid flow hs divided. The numerical flow domain taken for this study has shown in Fig.4 (a). The aerofoil is placed between (0,0) and (1,0). The chord of the aerofoil is thus unity. Fig.4(b) shows the quadrilateral grids around the airfoil with suitable clustering. Close view of the grid around NACA 23012 aerfoil as shown in fig 5(a). Fig 5(b) shows closely spaced grid around leading edge close to the body in order to pick up rapid changes taking place in that region. In this study, spalart allmaras one equation code has choose for model.

We have retained default options for parameters in the model and we have used second order upwind finite differencing. In fluent for solving simultaneous equations, various iterative methods are available and that results from discretisation of equation of conservation of motion from finite volume grid chosen. It’s been our experience that converging results are obtained with relaxation factor continuity x and y and turbulence viscosity has set as 0.3.

We had chosen inherent choice as an available option in fluent. Fig 6 shows the lift and drag characteristics of basic NACA 23012 aerofoil compared with Experimental values.

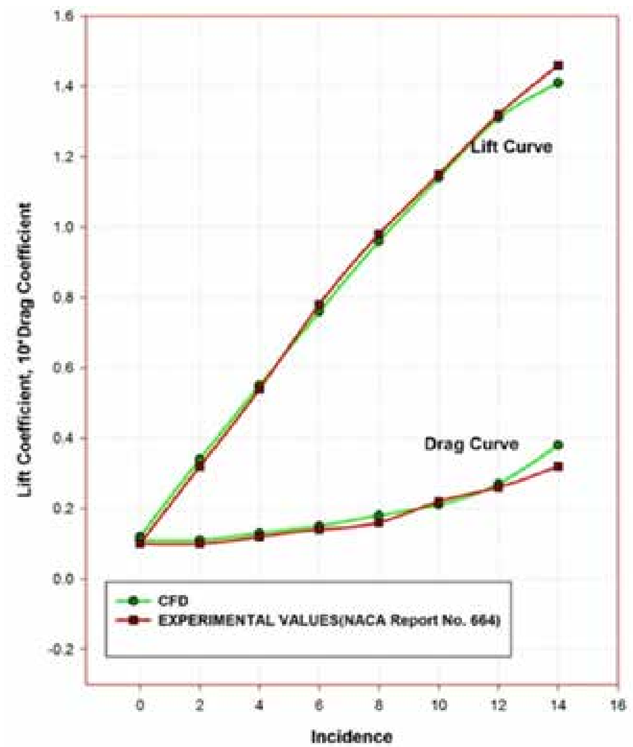

Fig 6: Lift and Drag characteristics of basic NACA 23012 aerofoil compared with experimental values

3.2 Flow Simulation Versus Prediction Capabilities of CFD

Although considerable progress has been made in the field of computational fluid dynamics by the way of excellent algorithms, of flow models for particularly turbulent flows as well as the equations of conservation laws of fluid dynamics, very many software's available in the literatures. In general fluid mechanics particularly that there is large number of extraneous parameters peculiar to algorithm or to flow model, turbulent etc. one of the essential steps in CFD namely the grid generation also would involve several parameters peculiar to geometry, some of these would include the need for special grids around specific flow regions where flow gradients are high as well as peculiarity of grids for capturing boundary layer. We would like to distinguish the simulation capabilities from predictive capabilities of the given software. We mean by simulation capability the possibility of obtaining any experimental results considered to be accurate but known as the time of computation.

In simulation, it may so turn out that on reasoning the code it's just possible to mimic the experimental results. Often this may take some time. In itself this capability also is of practical importance because after having fixed up the parameters space and after assessing that these will give the best results. One way use the code along with the parameter space for generating data for geometries quite close to the geometry use in simulation exercise to generate useful practical results. In contrast to this if software were to have predictive capability, one should be able to obtain good comparison with standard result with some default options for parameters in the code. While more and more software achieving predictive capability there still some room for improving other codes in direction of CFD.

VI. CONCLUSION

The effort in this study is for the design of a low power wind turbine in the range of 3 to 10 kW. This contains the CFD analysis of the aerofoil chosen for the blade and the procedure for the design of a wind turbine rotor. This is an attempt to design a wind rotor of about 5 kilowatt capacity capable of functioning in a wind of about8m/s. This study consists of Computerized Fluid Dynamics (CFD) analysis of the aerofoil chosen for the blade and the procedure for the design of a wind turbine rotor. The procedure outlines the main issues involved in the determination of the diameter and of the radial chord distribution for a three bladed horizontal axis wind turbine.

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WIND TURBINE PITCH AND YAW CONTROL

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ABSTRACT

This paper proposes a strategy for pitch and yaw control of wind turbine. The system is considered here is to avoid damage to wind turbine and avoid mechanical losses in wind turbine. The wind speed will be varying from time to time, so to protect wind turbine from the damage due to wind speed pitch control is designed. The direction is also variable to time, so to capture the maximum energy from the nature yaw controller is designed. Pitch control and yaw control that are designed in this paper is by considering the mechanical forces acting on the blades and nacelle.

Key Words: Blade Forces, Pitch Control, Renewable Energy, Wind Turbine and Yaw Control

I. INTRODUCTION

The challenges, noted in the DOE-issued report '20% Wind Energy by 2030' is improvement of wind turbine performance and reduction in operating and maintenance costs. After the capital costs of commissioning wind turbine generators, the biggest costs are operations, maintenance, and insurance. Reducing maintenance and operating costs can considerably reduce the payback period and provide the impetus for investment and widespread acceptance of this clean energy source.

The structure of wind turbine is as shown in figure 1. The main parts of the wind turbine are blades, nacelle, tower and the main controller. The nacelle has gear box, generator, power converter and transformer. The blades are rotated due to the wind. The gear box interconnects the turbine blades shaft and the generator shaft. The power generated from the generator is send to the grid by a transformer.

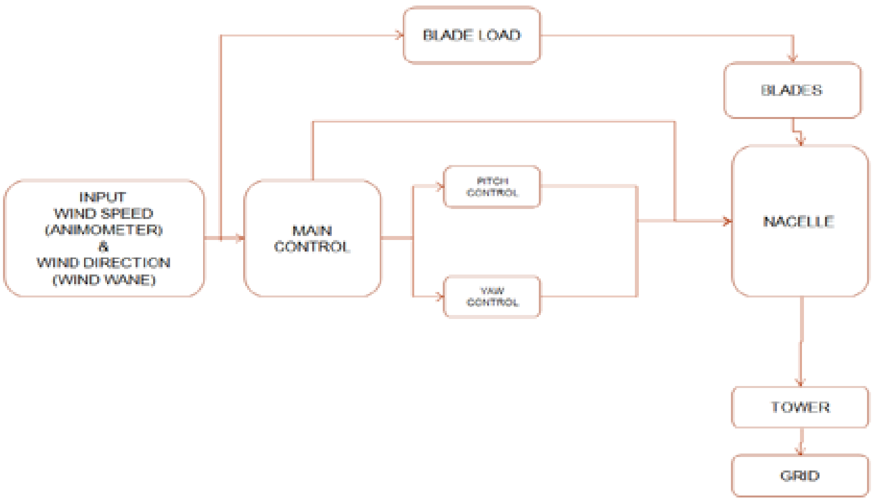

Figure 1 Structure of Wind Turbine

Non-torque loads are applied to the wind turbine as input and output at the blade side and generator side respectively. This non-torque loads influence the wind turbine drivetrain mechanical load and stress[1]. Along with these the torque load also influences the wind turbine drivetrain mechanical load and stress. Sometimes unwanted loads are caused by the wind at the input shaft side such as sudden changes in wind direction, uneven loading of blades, wind turbulence and accumulation of dust on the blades. All these factors influence the generation of power of wind turbine to overcome such disturbances we need to design the control system which includes pitch control system and yaw control system. For the sudden change in wind direction the yawing action of the wind turbine should occur for yawing we use four servo motors at 90 degrees between them. The whole nacelle has to be moved in the direction of the wind. In such a way the servo motor should act. All the four servo motors should be operated at a time with the same action by them. So we design a single control system for the four servo motors to operate. The mechanical power of the wind turbine is controlled by the pitch function. If the wind speed is greater than the rated wind speed the pitching angle should be increased. If the wind speed is lesser than the wind speed the pitching angle has to be reduced. So for this operation to occur we require a control system to control the pitching.

II. PITCH SYSTEM

The forces that are acting on the rotor blades which are excited by the wind speed during the conversion of the kinetic energy of the wind into the mechanical power then converted into electrical power is described by the aero dynamic system[2]. There are mainly two forces on the blade which causes the moment in the blades, the forces are lift force and drag force. The torque and thrust force are resolved from the tangential component and an axial component respectively from these forces. The forces acting on the blades are as shown in figure 2.

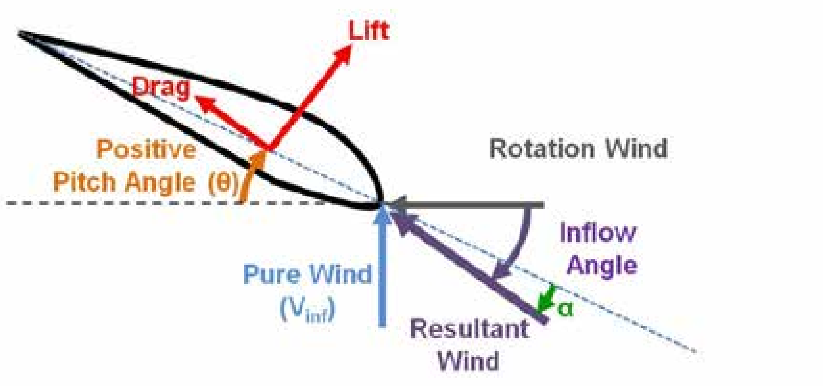

Figure 2 Forces acting on the blades

$$\mathrm{Lift} = 0.5 * \mathrm{v}^2 * \mathrm{A} * \rho * \mathrm{C_L}$$

$$Drag = 0.5 * v^2 * A * \rho * C_D$$

$$Rotation\ wind = Rotor\ Speeed(\omega) * Radius$$

$$Inflow\ Angle = tan^{-1}(\frac{pure\ wind}{rotation\ wind})$$

$$Angle\ of\ Attack(\propto) = Inflow\ angle - Pitch\ angle$$

Here C_L is the coefficient of lift and C_D is the coefficient of drag. C_L and C_D depend on angle of attack (α).

The consider wind turbine is the three blade wind turbine. To control the pitching of the blade the hydraulic motor is used for each blade. All the three hydraulic motors should act at the same instant on all the blades at a time. Single pitch control is used for all the three hydraulic motors. The mechanical power which has to be delivered to the generator must be limited when the turbine reaches the rated power. The cut out speed of wind turbine is 25 m/sec, the rated wind speed is 12.5 m/sec and the cut in wind speed is 3 m/sec. Rated power of the generator is attained at 12.5m/sec wind speed after 12.5 m/sec wind speed the rotor of the generator becomes over speed, it has to be controlled. The controlling of the over speed of generator is done through the pitching control which pitches the blade by some angle. Here the rate pitching has to be controlled.

III. YAW SYSTEM

The angle of attack will be affected by changing the yaw angle of a wind turbine. Thus the different aero dynamic behaviour of the blade can be resulted, so the performance characteristics of the wind turbine can be varied with respect to the yaw angle[3].

The yaw moment of the wind turbine should be zero for a zero degree yaw angle. The upstream and downstream momentum configuration is as shown in figure 3a and figure 3b respectively. The yaw momentum about the tower for yaw angle 0^o as for yaw angle 10^o, 20^o and 30^o when it is located in upstream. The turbine which is operating with the positive yaw angle which will be in order of 2^o to 4^o. The yaw momentum about the tower for yaw angle 0^o as for yaw angle 10^o, 20^o and 30^o when it is located in downstream. The turbine which is operating with the positive yaw angle which will be in order of -2^o to -4^o.

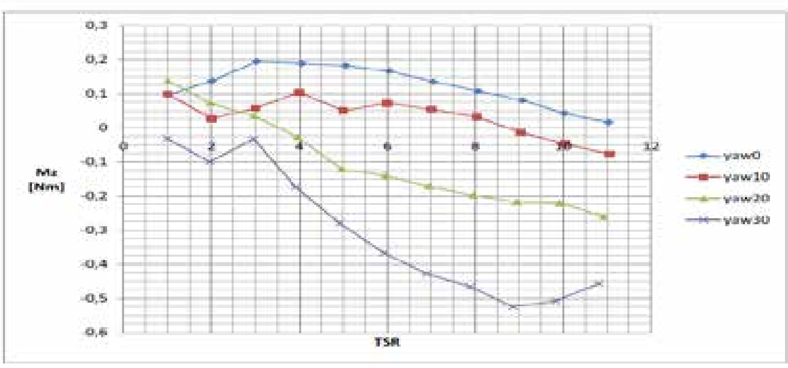

Figure 3a : Yaw Moment For Upstream

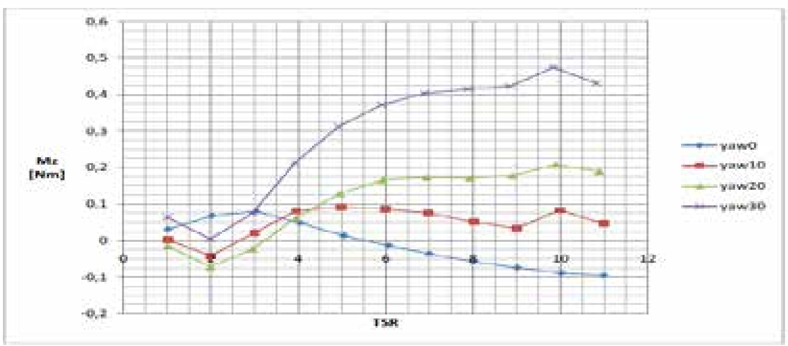

Figure 3b: Yaw Moment For Upstream

IV.SIMULATION DIAGRAMS

Simulation diagrams of pitch control and yaw control are simulated by using MATLAB. Figure 4 represents the control structure of pitching. Pitch command is the input how pitch should vary. Extension is the how much pitch has to be changed for the next instant. Extension rate is the rate at which the angle has to be extended. Force is the output how it occurs. Figure 5 represents the control structure of the yaw command. Yaw is the how much angle should it be changed. Yaw rate is that at which rate that it has to be changed. The torque is the output of the system. In yaw controller we use two controllers they are yaw rate control and another is yaw angle control. Here we are using PI controller for all the controllers. PI controller is for less overshoots and avoids sudden changes in pitching and yawing.

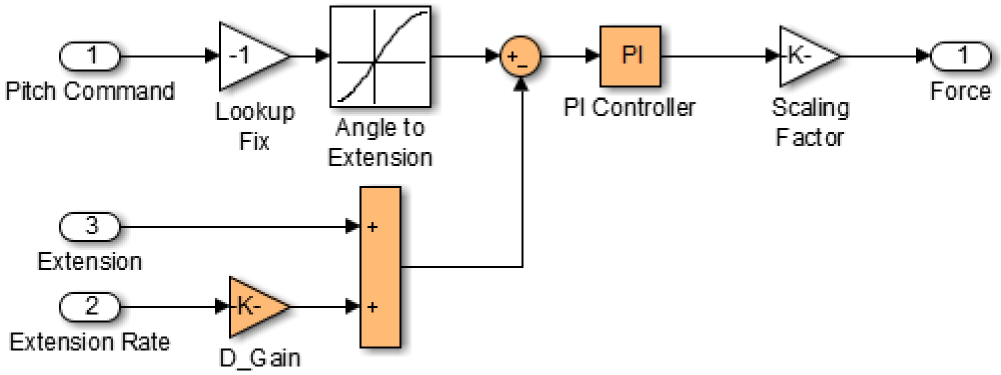

Figure 4 Control structure of pitch system

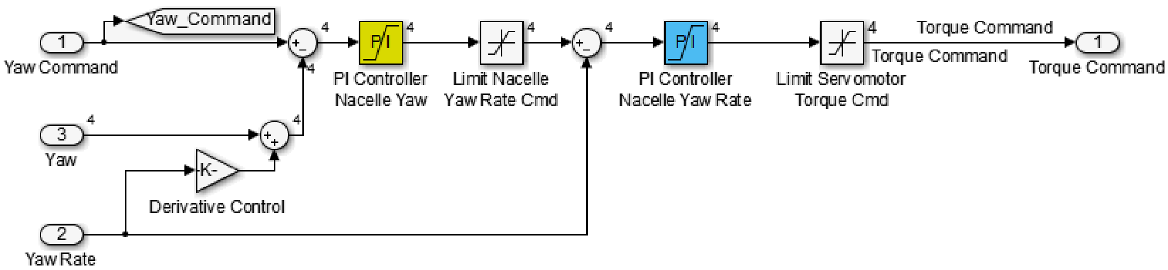

Figure 5 Control structure of yaw system

V. SIMULATION RESULTS

The simulation results of the pitching and yawing are as shown in figure6 and figure 7 respectively. Figure 6a and 6b shows the pitching wave forms of ideal and practical systems respectively. The pink colour indicates the input signal for pitch and yellow colour indicates output signal of pitching in both the waveforms. Figure 7 indicates the yawing waveforms; lower waveform shows the yaw rate and in upper wave form pink indicates the yaw command, yellow indicates the yawing.

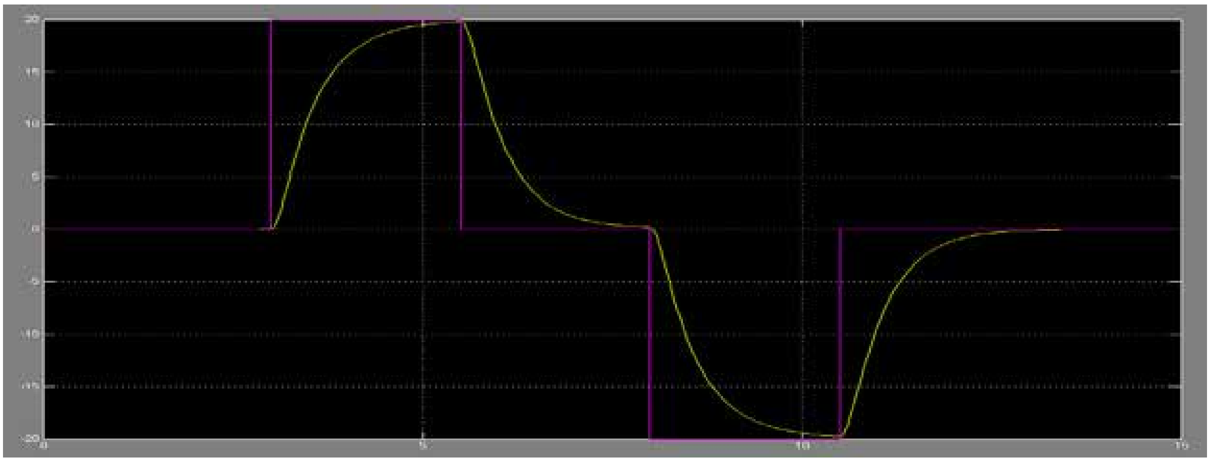

Figure 6a Pitch waveforms for ideal pitching

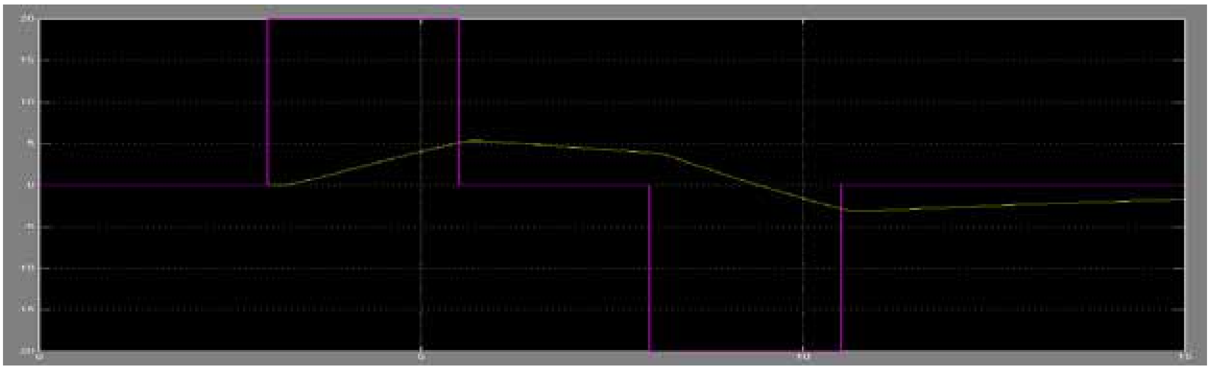

Figure 6b Pitch waveforms for practical pitching

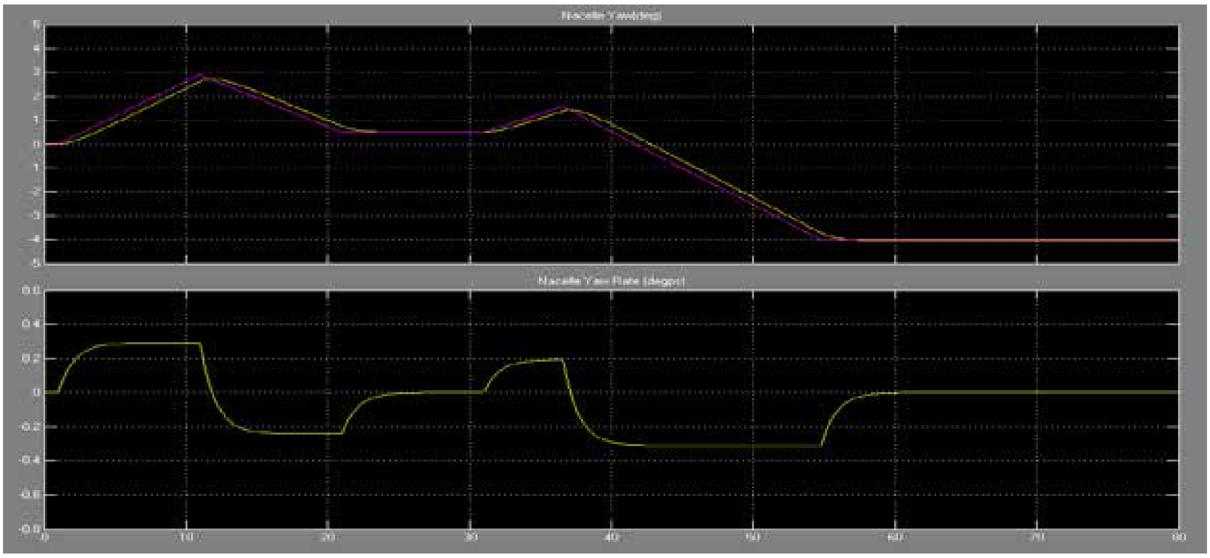

Figure 7 Yawing Waveforms

VI. CONCLUSION

The control structure of the pitching and yawing are developed by using MATLAB. The output waveforms follow the input pitch and yaw command. We can observe that the difference between ideal and practical pitch systems. The controlling is done successfully.

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MONITORING CIVIL STRUCTURES BASED ON IEEE 802.15.4 WSN

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ABSTRACT

The civil structures are often exposed to severe loadings during their lifetime, especially at extreme events like earthquake and typhoon, which causes serious concerns on the integrity of the structures that, is closely related to the public safety. Tragic disasters on the civil structures, like collapses of bridges or buildings, often accompany a large number of casualties as well as social and economic problems, thus most of the industrialized countries are on the verge of increasing their budget for structural health monitoring (SHM) of their major civil infrastructures. Ubiquitous monitoring using a network of wireless sensors is one of the most promising emerging technologies for this purpose. Structural health monitoring aim to find out the natural vibration frequencies of a structure under naturally induced or forced vibrations, and use this information to detect any structural damage or wear the system might have. The stress and strain on various beams in the structure is also useful for monitoring the health of a structure. We have designed and implement an efficient monitoring system in order to realize progressive accumulation of damages due to seismic events, unforeseen foundation settlement, material aging, design error, etc., using the combination of MEMS sensors and embedded network terminals.

Keywords: Structural Health Monitoring (SHM), Micro-electromechanical systems MEMS Sensor (ADIS16223), Accelerometer ADXL335, Wireless Sensor Network (WSN) IEEE 802.15.4

I. INTRODUCTION

The interest in sensing technology for various uses has been growing, and new kinds of sensors have been developed by micro-electro mechanical systems (MEMS) technology. Environmental information such as brightness, temperature, sound, vibration, and a picture of a certain place in a building, is evaluated by the network to which a huge number of microcomputer chips with sensors were connected.

Periodic monitoring needed to guarantee an adequate level of safety and serviceability. The installation of a permanently installed sensing system in buildings has to be economically viable.

The SHM system often offers an opportunity to reduce the cost for the maintenance, repair, and retrofit throughout the life-cycle of the structure. In the conventional SHM system, the expensive cost for purchase and installation of the SHM system components, such as sensors, data loggers, computers, and connecting cables, is a big obstruction. To guarantee that measurement data are reliably collected, SHM systems generally employ coaxial wires for communication between sensors and the repository. However, the installation of coaxial wires in structures is generally very expensive and labor intensive. For example, it was reported that a SHM system installed in a tall buildings generally cost in excess of $US5000 per sensing channel.

As SHM systems grow in size (as defined by the total number of sensors), to assess the current status of the structure accurately, the cost of the monitoring system can grow much faster than at a linear rate. For example, the cost of installing about 350 sensing channels on Tsing Ma Suspension Bridge in Hong Kong was estimated to have exceeded $8 million. If the maintenance cost of the SHM system, which will be increased as the system gets older, is also considered, the total cost may be increased exponentially.

This limitation on economical realization of SHM system may prevent installation of large number of sensors enough to assess the accurate status of a large civil structure, if the big budget for the SHM system is not secured. Recently, smart wireless sensor has been considered as an alternative tool for economical and accurate realization of structural health monitoring system. Smart wireless sensor is an emerging sensor with the following essential features: on-board micro-processor, sensing capability, wireless communication, battery powered, and low cost. When many sensors are implemented on a SHM system for a sizable civil structure, wireless communication between sensors and data repository seems to be attractive in the aspects of the cost.

Dense arrays of low-cost smart wireless sensors have the potential to improve the quality of the SHM dramatically using their onboard computational and wireless communication capabilities. These wireless sensors provide rich information which SHM algorithms can utilize to detect, locate, and assess structural damage caused by severe loading events and by progressive environmental deterioration as well as economical realization of SHM system. Information from densely instrumented structures is expected to result in the deeper insight into the physical state of the structural system. A risk monitoring of buildings for natural and man-made hazards mitigation is discussed in this paper. The following section defines about micro-electromechanical MEMS sensor and accelerometer required for SHM.

1.1 Mems Sensor

Recent advancements in micro-electromechanical sensor made it feasible to deploy low-cost, self-configuring wireless sensor networks for monitoring an area of interest with fine granularity. The ADIS16223 Sensor is a tri-axial, digital vibration sensor system that combines industry-leading MEMS sensing technology with signal processing, data capture, and a convenient serial peripheral interface (SPI). The SPI and data buffer structure provide convenient access to wide bandwidth sensor data.

The ADIS16223 also offers a digital temperature sensor, digital power supply measurements, and peak output capture. The ADIS16223 is available in a 15 mm × 15 mm × 15 mm module with a threaded hole for stud mounting with a 10-32 UNF screw.

1.2 Accelerometer

The main trigger for the recording of an acceleration measurement is the detection of the start of an earthquake. Accelerometer and strain gauges are the two sensors that are most useful for structural monitoring applications. The three-axis accelerometer (ADXL335) provided with the mote platform measures acceleration with a minimum full-scale range of ±3 g. It is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

II. PROBLEM DEFINITION

1. To design and implement an smart sensing system to realize early detection of progressive accumulation of collapse to a multistory age building
2. To guarantee an adequate level of safety and serviceability economically using a combination of the local acceleration data and strain data from multiple sensors and voice activation system (wireless sensor nodes)across the building

3. The strain sensors are mounted at the base of the building to measure the settlement and plastic hinge activation of the building.
4. The accelerometers are mounted at every floor of the building to measure the seismic response of the building.

III. WIRELESS SENSOR NETWORK

Due to its commercial potential, monitoring of large public buildings is a significant emerging application area for wireless sensor networks. Wireless sensor networks can be deployed for monitoring the response of structures to strain and ambient vibration (e.g, wind, earthquakes), monitoring and controlling of indoor environment (e.g., lighting, heating, air quality), and helping in extreme event response (e.g., detecting congested exits, finding safe routes during an evacuation).

A wireless sensor network spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. Table 1 shows various kinds of hazards, and possible applications/combination of sensors. The more modern networks are bi-directional, also enabling control of sensor activity. WSN is one of the fastest growing technologies in ubiquitous networking today. Standardization efforts, such as IEEE 802.15.4 are geared to reduce costs, provide device customizability for diverse applications and create standards for interoperability. The risk to buildings includes aging of structural performance, fatigue, damage, gas leak, invasion, fires, etc. According to the results of risk monitoring, appropriate risk control measures such as structural control, maintenance, evacuation guidance, warning, alarm, fire fighting, rescue, security measures, can be applied (Fig. 1).

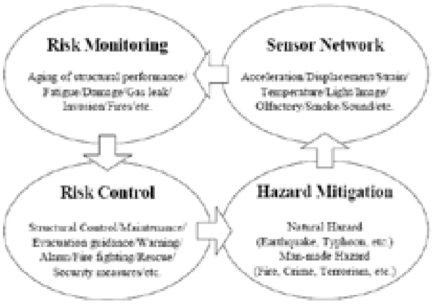


Fig.1 Building Risk Monitoring and Hazard Mitigation

Table 1. Sensor Applications.

HAZARD	APPLICATION	SENSOR
Earthquake /Wind	Observation	Acceleration
	Experiment	Acceleration, strain
	Structural control	Acceleration
	Health monitoring	Acceleration, strain
	Damage detection	Acceleration,
Fire	Fire detection	Temperature, smoke, acoustic,
	Gas leak detection	Olfactory
	Alarm, warning	Sounder
	Evacuation	Temperature, smoke, acoustic,
Crime	Surveillance	Acceleration,
	Security alert	Sounder

A wireless sensor network plays a vital role in such strategies and can be connected to the internet so that this information can be used for monitoring future risks. Wireless sensors are easy to install, remove, and replace at any location, and are expected to become increasingly smaller (i.e., “smart dust”) by using MEMS technology. They provides a ubiquitous environment in buildings. For example, acceleration and strain of each beam and column, temperature and light in each room, images and sounds in desired locations can be obtained by the “smart dust” sensors, as illustrated in Figure 2.

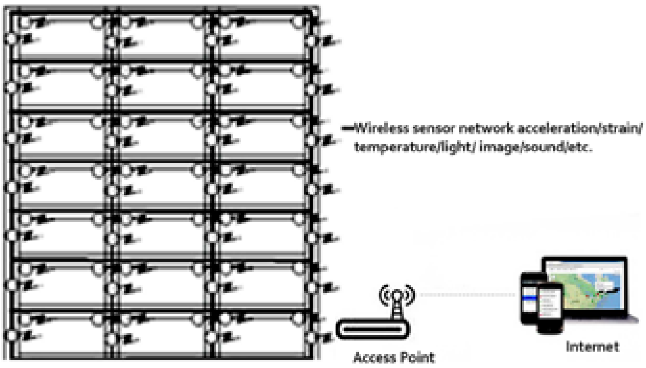


Fig. 2 Example Of Risk Monitoring System

IV. PRINCIPLE OF OPERATION

The monitoring nodes (fig.3) are selected based on their location and amount of environmental noise. Ground level node may be suitable. The monitoring node senses the data and passes it to the nearby base station via router. The base station compares the received data with the preset threshold value, if the received value exceeds the threshold value it will send a wakeup signal to both monitoring nodes as well as non –monitoring nodes.

The base station receives all the cumulative data from the building module and checks once again to conform that the response has occurred. Immediately the base station will pass the information that the building is going to collapse and people have to vacate the building.

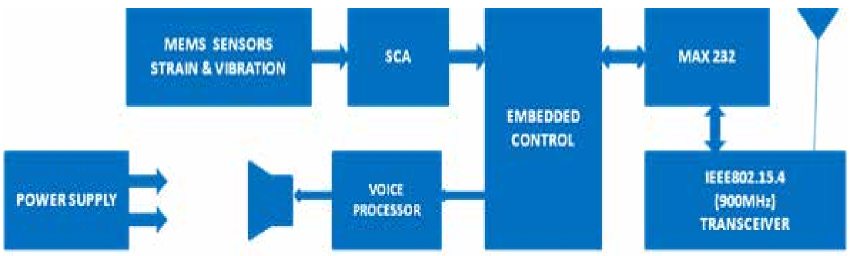
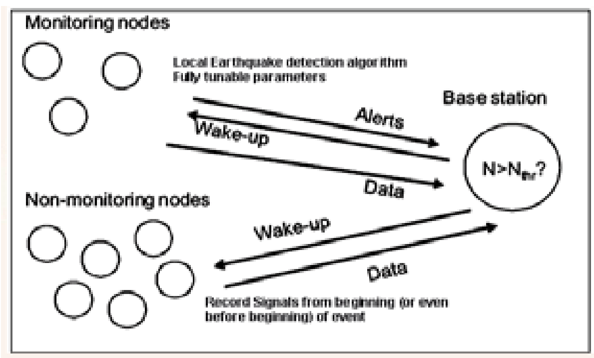


Fig.3 Block Diagram Of Monitoring Node



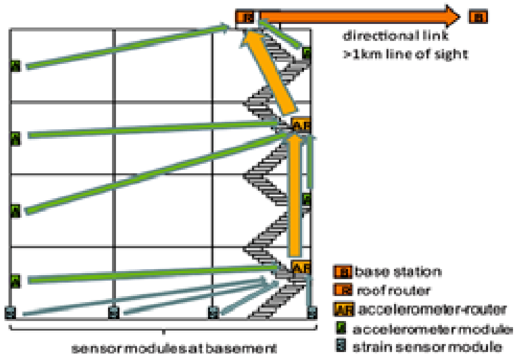


Fig.4 Working Principle of Monitoring System

Fig.5 Architecture of the Structural Monitoring System

V. PERFORMANCE TEST

To investigate the performance of the wireless acceleration sensor, free vibration tests were conducted using Visual Basic Software. An oscilloscope software application included in the Tiny OS version 0.6 is used. Fig. 6 shows building shakes alert monitoring node in normal case. Fig.7 shows Seismic event occurred indicating emergency symbol in the Monitoring Node.

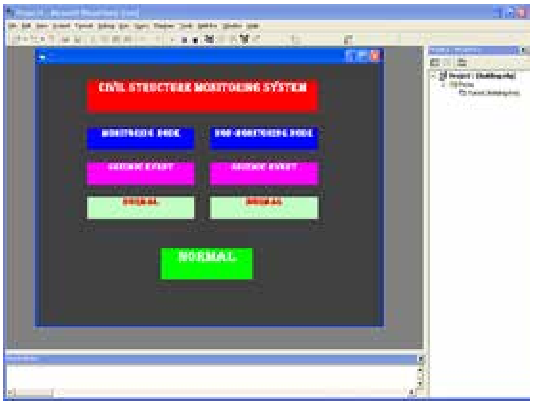


Fig. 6 Building Shakes Alert Monitoring Node In Normal Case

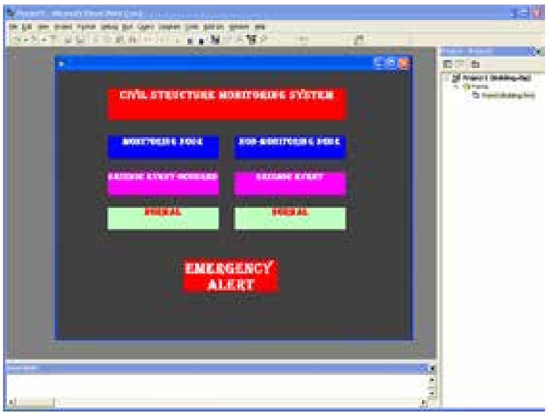


Fig.7 Seismic Event Occurred In The Monitoring Node

VI. CONCLUSION

The sensor observations are tested and found working satisfactorily. The integration of hardware using MAC protocol has to be completed. We hope our system will improve the survival rate of the human lives from natural disasters and seismic events. The presented wireless system for building monitoring takes advantages of the unique features of custom-developed MEMS sensors to realize a solution which offers long battery lifetime and potentially low cost in manufacturing, installation and maintenance, while providing high-quality sensor data at right time.

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A SURVEY OF TOPOLOGY CONTROL OF MULTIHOP WIRELESS NETWORKS FOR ENERGY EFFICIENCY AND ROUTING IN AD HOC NETWORKS

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ABSTRACT

An ad hoc wireless network, or simply an ad hoc network, consists of a collection of geographically distributed nodes that communicate with one other over a wireless medium. An ad hoc network differs from cellular networks in that there is no wired infrastructure and the communication capabilities of the network are limited by the battery power of the network nodes. One of the original motivations for ad hoc networks is found in military applications. We present two centralized algorithms for use in static networks, and prove their optimality. For mobile networks, we present two distributed heuristics that adaptively adjust node transmit powers in response to topological changes and attempt to maintain a connected topology using minimum power. We analyze the throughput, delay, and power consumption of our algorithms using a prototype software implementation, an emulation of a power-controllable radio, and a detailed channel model.

Keyword: Optimum Centralized Algorithm, Topology Control, Multihop Wireless Network

I INTRODUCTION

There are no wired infrastructures or cellular networks in ad hoc wireless network. In this survey, we assume that each wireless node has an omni-directional antenna and a single transmission of a node can be received by any node within its vicinity which, we assume, is a disk centered at this node. We also discuss specifically the topology control when directional antennas are used. Each mobile node has a transmission range. Node v can receive the signal from node u if node v is within the transmission range of the sender u. Otherwise, they communicate through multi-hop wireless links by using intermediate nodes to relay the message. Consequently, each node in the wireless network also acts as a router, forwarding data packets for other nodes. In addition, we assume that each node has a low-power Global Position System (GPS) receiver, which provides the position information of the node itself. If GPS is not available, the distance between neighboring nodes can be estimated on the basis of incoming signal strengths and the direction of arrival. Relative co-ordinates of neighboring nodes can be obtained by exchanging such information between neighbors. In this paper we study the problem of assigning transmission ranges to the nodes of a multihop packet radio network so as to minimize the total power consumed under the constraint that adequate power is provided to the nodes to ensure that the network is strongly connected (i.e., each node can communicate along some path in the network to every other node). Such assignment of transmission ranges is called complete. We also consider the problem of achieving strongly connected bounded diameter networks.

For points in three dimensions we show that the problem of deciding whether a complete range assignment of a given cost exists, is NP-hard. For the same problem we give an O(n2) time approximation algorithm which provides a complete range assignment with cost within a factor of two of the minimum. The complexity of this problem in two dimensions remains open, while the approximation algorithm works in this case as well.

A packet radio network is a network where the nodes consist of radio transmitter/receiver pairs distributed over a region. Communication takes place by a node broadcasting a signal over a fixed range (the size of which is proportional to the power expended by the node's transmitter). Any receiver within the range of the transmitter can receive the signal assuming no other nodes are transmitting signals that reach the receiver simultaneously. For a message to be sent to a node outside of the range of the message originator, multiple “hops" may be required, whereby intermediate nodes pass on (re-broadcast) the message until the ultimate destination node is reached.

Such networks have applications in many situations, over many different scales, where traditional networks are too expensive or even impossible to build.

Some examples include as follows

(1) setting up a LAN in a historic building where adding wiring would destroy or obscure valuable features of the building.

(2) battlefield or disaster situations where temporary WANs are required but the infrastructure for a traditional network does not exist.

(3) networks which include nodes in outer space (e.g., satellites, space stations, the moon).

Why do we need to control the topology? Simply because the wrong topology can considerably reduce the capacity,increase the end-to-end packet delay, and decrease the robustness to node failures. For instance, if the topology is too sparse, there is a danger of network partitioning and high end-to-end delays. On the other hand, if the topology is too dense, the limited spatial reuse reduces network capacity. Networks that do not employ topology control are likely to be in one of these modes for a significant fraction of their operational time, resulting in degraded performance, or even disrupted connectivity. Furthermore, transmit power control results in extending battery life of the nodes - a crucial factor for many multihop wireless networks.

A *multihop wireless network* is one in which a packet may have to traverse multiple consecutive wireless links in order to reach its destination. Over the years, this general concept has manifested itself in numerous forms under numerous names. These include *packet radio* networks, developed several decades ago for tactical military communications, and more recently, *ad* ***hoc*** networks, used to refer to a collection of hosts communicating over a wireless channel. Other terms include *mobile* networks Ricochet **[l]** network and the Army Near-Term Digital Radio (NTDR) [2] network are examples, respectively, of fully operational commercial and military multihop wireless networks.

The *topology* of a multihop wireless network is the set of communication links between node pairs used explicitly or implicitly by a routing mechanism. The topology depends on .'uncontrollable" factors such **as** node mobility, weather, interference, noise, as well as on "controllable" parameters such as transmit power and antenna direction. While considerable research has been done on *routing* **[3]** – mechanisms that efficiently react to changes in the topology due to uncontrollable factors, the area of adjusting the *controllable* parameters in order to create the desired topology has received little attention. This paper addresses the problem.

Ad hoc wireless networks consist of wireless nodes that can communicate with each other in the absence of a fixed infrastructure. Wireless nodes are battery powered and therefore have a limited operational time. Recently, the optimization of the energy utilization of wireless nodes has received significant attention. Different techniques for power management have been proposed at all layers of the network protocol stack. Power saving techniques can generally be classified into two categories: by scheduling the wireless nodes to alternate between the active and sleep mode, and by adjusting the transmission range of wireless nodes. In this paper, we deal with the second method.

II PROBLEM STATEMENT

In this section, we develop a new representation for multihop wireless networks and define terms used in this paper. Conventionally, multihop wireless networks are represented as a. graph where two vertices have an edge if and only if the corresponding nodes can communicate. We develop a new framework chiefly because the conventional representation hides the radio parameters and propagation properties that are critical to a realistic analysis. In our representation, the entities that contribute to the ability to communicate, namely the geographical locations, the propagation characteristics, and the node transmission parameters are kept separate.

Definition 2.1: A *multihop wireless network* is represented as M = (N, L), where N is a set of nodes and L : N = *(Z+,Z+)* is a set of coordinates on the plane denoting the locations of the nodes.

Definition 2.2: A *parameter vector* for a given node is represented *P = { f1,f2….fn*} where f1:N->R, is a real valued adjustable parameter.

In general, we can look at the topology control problem as one of optimizing a set of cost metrics under a given set of constraints. Examples of constraints include degree boundedness, k-connectivity for a particular value of *k*, bounded diameter, etc. Examples of cost metrics include total transmit power, maximum transmit power, maximum spreading length etc.

III MODELING AD HOC NETWORKS

One can model an ad hoc network as a collection of points in 2-dimensional (or 3-dimensional)Euclidean space, where each point represents a network node. Each node can be characterized by its computational and communication power. The computational power of a node determines thelevel of coding and encryption that the node can perform, two key issues in wireless communication. The communication characteristics of the network are governed by the propagation characteristics of the radio channel and the environment, and the battery power and power control capabilities of the individual nodes. We now elaborate on these issues.

The radio propagation and interference models can be used to derive meaningful bounds on the capacity of ad hoc networks, given node locations and transmission power constraints. Such a model based on physical layer parameters, however, is cumbersome to use for designing and analyzing higher layer protocols. A simpler model that abstracts away the physical layer details is to represent an ad hoc network as a graph G -(V, E) in Euclidean space. The set V is the set of all nodes. We refer to G as the transmission graph. Interference can be modeled to a limited extent by the following assumption: a transmission from u to v is successful only if there is no other node ~v that has an edge to v and is simultaneously transmitting. This is essentially the model that has been used to study packet radio networks (PRNs).

The PRN model, as described above, assumes that each node of an ad hoc network always transmits at the same transmission power. Modern mobile wireless units have the ability of adjusting their transmission power according to the transmission needs, subject to a maximum limit. Such power control reduces interference, conserves battery power of the mobile units, and hence allows for better use of the channel bandwidth. For example, if we represent the network using the transmission graph G as described in the preceding paragraph, we can have a node u successfully transmitting to v, even if there is a node w adjacent to v that is transmitting at the same time; this may happen because the received power at v of w's transmission may be much less than that of the received power at v of u's transmission, owing to different levels at which u and w are transmitting at that time.

IV STATIC NETWORK: OPTIMUM CENTRALISED

4.1 Algorithm

A static network affords the luxury of using a centralized or even an offline algorithm to compute the transmit power levels. The node locations, as well as the least-power function are available as input to the algorithm. We present two polynomial time algorithms, one that results in a connected network, and the other in a biconnected network.

Algorithm CONNECT is given formally in the box below. It is a simple “greedy” algorithm, similar to the minimum cost spanning tree algorithm. It works by iteratively merging connected components until there is just one. Initially, each node is its own component. Node pairs are selected in non-decreasing order of their mutual distance. If the nodes are in different components, then the transmit power of each is increased to be able to just reach the other. This is done until the network is connected. The description assumes for simplicity that network connectivity can be achieved without exceeding the maximum.possible transmission powers. However, the algorithm can be easily modified to return a failure indication if this is not true.

```
Algorithm CONNECT
Input: (1) Multihop wireless network M =
(N, L) (2) Least-power function λ
Output:  Power levels p for each node that
induces a connected graph

begin
1. sort node pairs in non-decreasing order
   of mutual distance
2. initialize |N| clusters, one per node
3. for each (u,v) in sorted order do
4.     if cluster(u) ≠ cluster(v)
5.             p(u) = p(v) = distance(u, v)
6.             merge cluster(u) with cluster(v)
7.             if number of clusters is 1
               then end
8. perNodeMinimalize(M, λ, p, 1)
end
```

The augmentation of a connected network to a Bi-connected network is done using Algorithm BICONN-AUGMENT. Once again, it is a greedy technique. We first identify the biconnected components in the graph induced by the power assignment from algorithm CONNECT. This is done using a standard method based on depth-first search. Then, node pairs are selected in non-decreasing order of their mutual distance and joined only if they are in different biconnected components. This is continued until the network is biconnected.

```
Algorithm BICONN-AUGMENT
Input: (1) Multihop wireless network M =
(N, L) (2) Least-power function λ (3) Initial
power assignment inducing connected network
Output:  Power levels p for each node that
induces a biconnected graph.

begin
1. sort node pairs in non-decreasing order
   of distance
2. G = graph induced by (A, λ, p)
3. for each (u, v) in sorted order do
4.     if biconn-comp(G,u) ≠ biconn-comp(G,v)
5.         q = λ(distance(u,v))
6.         p(u) = max(q, p(u))
7.         p(v) = max(q, p(v))
8.         add (u, v) to G
9. perNodeMinimalize(M, λ, p, 2)
end
```

A post-processing phase similar to that of Algorithm CONNECT ensures per-node minimality. In this case, the solution may not be per-node minimal even in the absence of side-effect edges. Nonetheless, the same “fix” works, whatever the cause.

```
Procedure perNodeMinimalize(M, λ, p, k)
begin
1. let S = sorted node pair list
2. for each node u do
3.     T = { (n1, n2) ∈ S : u = n1 or u = n2 }
4.     sort T in non-increasing order of distance
5.     discard from T all (x, y) such that
       λ(d(x, y)) > p(u)
6.     for (x, y) ∈ T using binary search do
7.         if graph with p(u) = λ(d(x, y))
           is not k-connected, stop
8.         else p(u) = λ(d(x, y))
end
```

We note that, in practice, the per-node-minimality postprocessing phases for both CONNECT and BICONN-AUGMENT may be ignored. The few extra edges it introduces may be seen as an advantage. Indeed, if one were to build a biconnected network from scratch (that is, execute BICONN-AUGMENT immediately after CONNECT), there is no reason to make the connected graph per-node minimal. In our implementation, we have omitted per-node minimalization.

V TOPOLOGY CONTROL IN MULTIHOP WIRELESS NETWORK

The absence of a central infrastructure implies that an ad hoc network does not have an associated fixed topology. Indeed, an important task of an ad hoc network consisting of geographically dispersed nodes is to determine an appropriate topology over which high-level routing protocols are implemented. In this section, we consider topology control, the problem of determining an appropriate topology in an ad hoc network. Let V denote the collection of nodes and let G denote the graph on V in which there is an edge from node u to node v if and only if u can directly reach v. Let T denote the topology returned by the topology control algorithm. The quality of the topology T can be evaluated according to several criteria including connectivity, energy-efficiency, throughput, and robustness to mobility. In the remainder of this section, we elaborate on these measures.

We consider a wireless ad hoc network consisting of a set V of n wireless nodes distributed in a two-dimensional plane. By a proper scaling, we assume that all nodes have the maximum transmission range equal to one unit. These wireless nodes dene a unit disk graph UDG(V) in which there is an edge between two nodes if and only if their Euclidean distance is at most one. In this survey, we concentrate on how to apply some structural properties of a point set for wireless networks as we treat wireless devices as two-dimensional points.

5.1 Connectivity and Energy-Efficiency

Perhaps, the most basic requirement of a topology is that it be connected. More precisely, we require that any two nodes that are connected in G also connected in T. Since the topology T forms the underlying network for routing protocols, it is also desirable that there exist energy-efficient paths between potential source-destination pairs. One notion of energy-efficiency is the *energy stretch factor*.We would like to provide connectivity and energy-efficiency using a "simple" topology that is "easy" to maintain. While there is no single way to formalize "simplicity" and "maintainability", some objective measures that influence these subjective goals are the size of the topology in terms of the number of edges in T and the maximum degree of any node in T.Connectivity, degree and size are network design measures common to both wired and wireless settings. Analogous to the notion of energy stretch factor is that of *distance stretch factor* (or simply the stretch factor) in fixed-connection networks, where the distance between two nodes is the length of the shortest path between the two nodes. The problem of designing topologies with low stretch factors has been extensively studied by network designers.What distinguishes the topology control problem in the mobile ad hoc setting from traditional network design is that we need to determine the topology in a completely distributed environment. A number of distributed topology control algorithms have been proposed recently.These algorithms draw upon computational geometry techniques that define connected topologies on points in Euclidean space. The techniques, and the topologies obtained, vary in the degree of simplicity, the quality of the topology, and their suitability for distributed implementation. We now review some well-studied geometric structures and their associated topology control algorithms.

5.2 Throughput

In addition to connectivity and energy-efficiency, we would like to have a topology with high capacity or throughput; that is, it must be feasible to route "about as much traffic" in the topology as any other topology, satisfying the desired constraints. Depending on the network characteristics that are being studied and the traffic patterns being considered, one can formalize the notion of throughput of an ad hoc network in different ways.

Gupta and Kumar analyze the throughput of ad hoc networks under both the physical and protocol models of interference , They define the throughput in terms of terms of a bit-distance product.

Suppose we say that the network transports one *bit-meter* when one bit has been transported a distance of one meter. Then, the throughput of a network can be measured in terms of the number of bit-meters that are transported per second. It is for n identical nodes randomly located in a disk of unit area, each node using a fixed transmission range, the throughput achievable for each source for a randomly selected destination.

The throughput-competitiveness of a topology depends on, among other factors, the level of interference inherent to the topology. Define the *interference number* of an edge e in T to be the maximum number of other edges in T that interfere with e, in the sense. Define the interference number of the topology to be the maximum interference number of an edge in T. A plausible goal then is to seek a topology with a small interference number. The particular interference number achievable, however, depends on the relative positions of the ad hoc network nodes and their transmission radii. This leads to the following open problem in network design: Given a collection of ad hoc network nodes, design a connected topology that minimizes the interference number. It seems unlikely that the preceding optimization problem can be solved effectively by a local algorithm; nevertheless, a centralized algorithm for the problem may be of theoretical interest.

5.3 Robustness to Mobility

An additional challenge in the design of distributed topology control algorithms is to ensure some degree of robustness to the mobility of nodes. One measure of robustness of the topology is given by the maximum number of nodes that need to change their topology information as a result of a movement of a node. This number, which may be referred to as the *adaptability* of the topology control algorithm, depends on the size of the transmission neighborhood of the mobile node u, and the relative location of the nodes. The topology control algorithms based on proximity graphs all have low adaptability, since a change in a node location will only require the nodes in its neighborhood (both old and new) to recompute their edges in the topology. The topology of is more complex since it relies on a hierarchical clustering of the nodes. Under certain assumptions about the distribution of points on the plane, however, they have shown that the number of nodes that need to be updated due to a change in the underlying transmission graph is proportional to the number of nodes in the immediate neighborhood of the mobile node, the update time per node being a constant. Other than maintaining the topology, mobility also entails changes in the routing paths

VI ROUTING METHOD

In the previous section, we considered the design of topologies that have certain desirable properties in terms of connectivity, energy-efficiency, and throughput. We now consider the design of routing schemes that harness these properties. We note that while the presentation in this article follows the approach of separating the network design and routing scheme design components, the two components are closely intertwined. The choice of the particular topology control algorithm may have a strong impact on the choice of the routing scheme. Since the topology is constantly changing, the routing scheme has to be robust to changes in topology.

How do we analyze the efficiency of an ad hoc network routing protocol? One framework is to analyze the cost of individual routing requests using the measures namely, stretch and power stretch. Also relevant are the measures of adaptability and the memory overhead. The memory overhead is simply the size in bits of all the data structures used by the routing protocol

6.1 Localized Routing

The geometric nature of the multi-hop ad-hoc wireless networks allows a promising idea: localized routing protocols. A routing protocol is localized if the decision to which node to forward a packet is based only on:

1 The information in the header of the packet. This information includes the source and the destination of the packet, but more data could be included, provided that its total length is bounded.

2 The local information gathered by the node from a small neighborhood. This information includes the set of 1-hop neighbors of the node, but a larger neighborhood set could be used provided it can be collected efficiently.

Randomization is also used in designing the protocols. A routing is said to be memory-less if the decision to which node to forward a packet is solely based on the destination, current node and its neighbors within some constant hops.

6.2 Localized Routing Protocols

We summarize some localized routing protocols proposed in the networking and computational geometry literature. The following routing algorithms on the graphs were proposed recently

Compass Routing: Let t be the destination node. Current node u finds the next relay node v such that the angle vut is the smallest among all neighbors of u in a given topology.

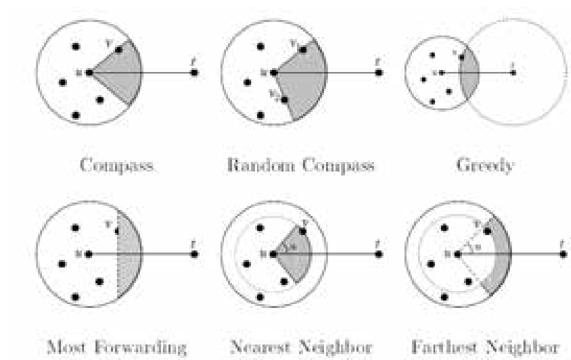
Random Compass Routing: Let u be the current node and t be the destination node. Let v1 be the node on the above of line ut such that angle v1ut is the smallest among all such neighbors of u. Similarly, we define v2 to be nodes below line ut that minimizes the angle v2ut. Then node u randomly choose v1 or v2 to forward the packet.

Greedy Routing: Let t be the destination node. Current node u finds the next relay node v such that the distance vt is the smallest among all neighbors of u in a given topology.

Most Forwarding Routing (MFR): Current node u finds the next relay node v such that v0t is the smallest among all neighbors of u in a given topology, where v0 is the projection of v on segment ut.

Nearest Neighbor Routing (NN): Given a parameter angle , node u finds the nearest node v as forwarding node among all neighbors of u in a given topology such that angle vut lessthan or equal to alpha.

Farthest Neighbor Routing (FN): Given a parameter angle , node u finds the farthest node v as forwarding node among all neighbors of u in a given topology such that angle vut lessthan or equal to alpha.



VII CONCLUSION

Wireless ad hoc networks has attracted considerable attentions recently due to its potential wide applications in various areas and moreover, the ubiquitous computing. In this survey, we present an overview of the recent progress of topology control and localized routing in wireless ad hoc networks. Nevertheless, there are still many excellent results that are not covered in this survey due to space limit.

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EXPERIMENTAL STUDIES ON EFFECT OF DIFFERENT FIBERS ON THE BEHAVIOUR OF STRUCTURAL COMPONENT

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ABSTRACT

Concrete plays a very important role in construction industry. In last few decades, many researchers have tried to understand the behavior of concrete under different climate condition, loading condition, freeze-thaw effect, sulphate attack, chloride attack, carbonation etc. Improvement in structural properties of concrete became main area of interest. Many scientists and researchers started experimenting concrete by adding discrete discontinuities fiber, popularly known as fiber reinforced concrete so as to study the effect on mechanical and durability properties of concrete. In present study, different fiber such as steel, polypropylene and glass having different volume fraction were considered so as to study the effect of them on RC beam. Crack pattern, initial cracking load, ultimate load carrying capacity, maximum deflection of beam were studied for different percentage of steel, polypropylene and glass fiber. Effective and efficient performance of structural elements was determined for different percentage of different fiber so that optimum percentage can be calculated for each fiber.

Keywords: Fibre Reinforced Concrete; Steel; Polypropylene; Glass: Ultimate Load Carrying Capacity

I. INTRODUCTION

Concrete is most widely used construction material in the world. Concrete is good in compression but weak in tension. Ordinary cement concrete possesses a very low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks, leading to brittle failure of concrete.. Many researches are carried out to improve the brittle fracture behavior of concrete by adding new ingredient to concrete mix. Addition of discrete discontinuities fiber to cement, water, fine and coarse aggregates to form a composite material is called fiber reinforced concrete.

Addition of fiber to concrete helps to control cracks occurring due to drying and plastic shrinkage, reduce the permeability and thus reduce bleeding of water. Depending upon the type of fibers added to concrete mix, it increases the impact and abrasion resistance in concrete. Fiber plays a very important role in improving the mechanical properties of concrete such as compressive strength, ultimate load carrying capacity of structures etc. It helps to increase corrosion resistance, increase tensile strength, increase ductility and thus helps in increasing the durability of concrete structures. Thus, it can be said that the brittle fracture behavior of concrete is converted to ductile behavior to some extent by addition of fiber.The amount of fibers added to a concrete mix is expressed as a percentage of the total volume of the composite (concrete and fibers), termed "volume fraction".

In this paper, an experimental investigation is done to understand the effect of different volume fraction of different fiber like steel, polypropylene and glass on structural behavior of RC beam.



Crimped Steel Fibres **Polypropylene Fibres** **E-Glass Fibres**

II .EXPERIMENTAL STUDY

Three point bending Tests were conducted on simply supported RC beams having different volume fraction to estimates the mechanical properties, load at initial crack, deflection of beam at various loading condition and finally ultimate load estimation.

2.1 Material Properties, Mixes, Beams

Concrete mixes were designed with the grades of compressive strength according to the Indian standards [IS 10262:2009 & IS 456:2000]. The mix were made of ordinary Portland cement 53grade, natural sand, crushed aggregate size below 12mm and potable water, (Normal strength concrete, NSC). The NSC mix proportion by weight of cement, fine aggregates, coarse aggregates and water were taken as 1:1.87:3.37:0.42. andsuperplasticizer 1% adopted in mix. The same mix proportion was adopted for different fiber. Volume fraction of steel fiber added was 0.5%, 1% and 1.5% in concrete mix. Volume fraction of polypropylene fiber was 0.2%, 0.4% and 0.6%. Volume fraction of glass fiber was 0.3%, 0.6% and 1.0 %. The specimen preparation was strictly controlled to minimize the scatter in the test results. The NSC specimens were demoulded after 1 day and cured in a water tank at ambient temperature for 28 days. RC beams of 100x200 mm in cross section and length 1 m were casted and tested to estimate initial crack load and ultimate load carrying capacity. Figure a, b and c represent the casted RC beams with different volume fraction of steel, polypropylene and glass fibre as specified above respectively.

Fig a

Fig b

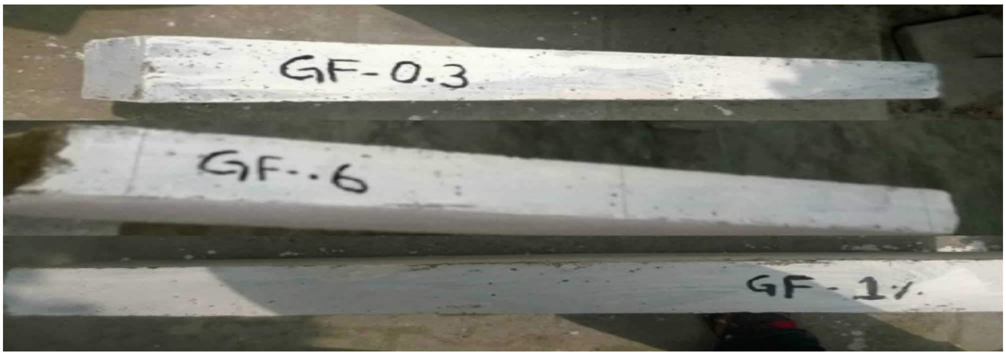

Fig c

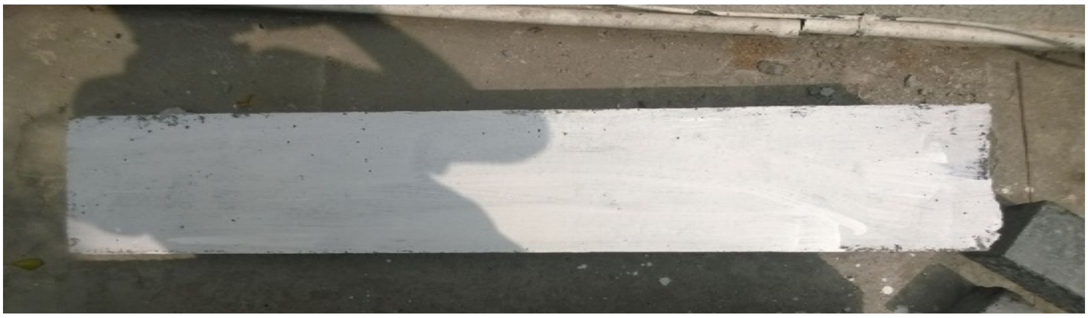

Fig d

Figure 1:RC beam casted with different volume fraction of fiber(a) steel fiber (b) polypropylene fiber(c)E Glass fibre(d)Rc Beam with no fibre.

Table 1: Fibres properties

Materials	Density (kg/m3)	Length (mm)	Diameter (mm)	Tensile Strength (Mpa)
Steel Fibre	900	12	0.038	330-414
Polypropylene Fibre	7900	50	1.0	850
E-Glass Fibre	2540-2600	12	0.007	3445

III EXPERIMENTAL SETUP AND TEST PROCEDURES

RC beams were simply supported over a clear span of 0.99m and tested under three point bending, as shown in figure 2. Figure 2 represent the experimental setup for testing of RC beam under three point bending. Figure 3 shows the Universal Testing Machine, which was used for testing all the specimen without and with fiber RC beams. Figure 4 shows the arrangement of strain gauge under the loading point which is centre, for estimating the centre deflection of the RC beam under incremental load at centre of specimen in three point bending. The load is applied in incremental order of 5kN. The corresponding deflection was noted down as well as the crack pattern was observed for understanding the characteristic behavior change in RC beam under different volume fraction. Estimation of load at initial crack for all specimen as well as ultimate load carrying capacity was determined.

Figure 2.Experimental setup for testing of RC beam under three point bending

Figure 3.Experimental setup of Strain gauge at centre of RC beam

Figure 4:UTM used for testing all specimen.

IV RESULTS AND DISCUSSION

In this study, RC beams having different volume fraction of steel, polypropylene and glass fibers were tested to understand the behavior on mechanical properties of beams with respect to controlled beam. The study was conducted to estimate increase in ultimate load carrying capacity and study of crack pattern of beam under same fiber but different percentage. The initial cracking load for controlled beam is 20kN and ultimate load carrying capacity is 50kN. Table 2 represents the initial cracking load for different volume fraction for steel, Polypropylene and glass fiber. It can be seen that there is no proper relationship with increase in fiber percentage and cracking load. Also table 2 gives us the ultimate load carrying capacity, and it can be observed that load carrying capacity increased with increased in steel fiber percentage from 0.5 % to 1.5% but opposite relationship is observed in case of polypropylene fiber , decrease in load carrying capacity. And in case of glass fiber, ultimate load increases and then decrease with increase in volume fraction.

Table 2: Initial and ultimate load for different fibers

Type of fiber	Volume fraction of fiber(%)	Initial Cracking Load(kN)	Ultimate Load(kN)
Steel	0.5	35	59.4
	1	30	61.4
	1.5	30	65.24
Polypropylene	0.2	22	64.1
	0.4	26	60
	0.6	21	59
Glass	0.3	23	54
	0.6	24	55
	1	21	51

Figure 5 represents the crack pattern in controlled RC beam. Figure 6 represents the crack pattern in RC beam consisting of different volume fraction of steel fiber. Figure 7 represents the crack pattern in RC beam consisting of different volume fraction of polypropylene fiber. Figure 8 represents the crack pattern in RC beam consisting of different volume fraction of glass fiber. It can be seen that number of crack reduced with increase in percentage of fiber content in RC beam. Crack pattern and crack propagation depends on many factor like tensile strength of RC beams, crack arresting properties (bridging action) which mainly depends on distribution and orientation of fiber present in beam, and also on bonding properties of fiber with cement matrix in concrete. The variation in initial cracking load in fiber reinforced concrete beam with respect to controlled beam for different fiber such as steel, polypropylene and glass are presented in figure 7, 8 and 9 respectively. The percentage increases in ultimate load carrying capacity in fiber reinforced concrete beam with respect to controlled RC beam for different fiber are plotted in figure 10, 11 and 12 for steel , polypropylene and glass fiber respectively

Figure 5:Cracked ControlledBeam

Figure 6: Cracked Steel Fibe

Figure 7:Cracked Polyproylene Fiber Reinforced Beam

Figure 8:Cracked Glass Fiber Reinforced Beam

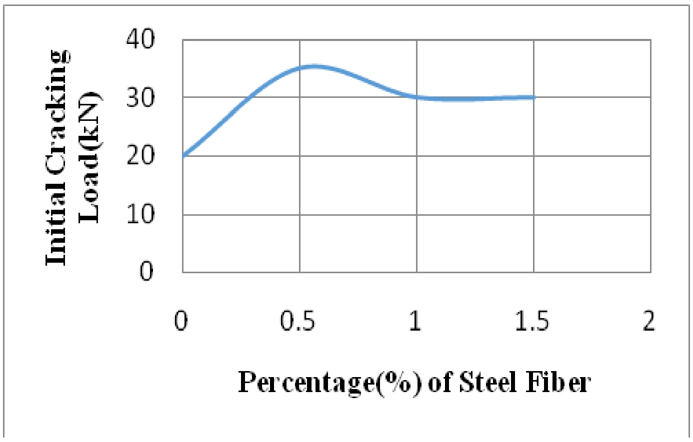

Figure 7: Variation of Initial Cracking Load in Steel Fiber Reinforced Beam.

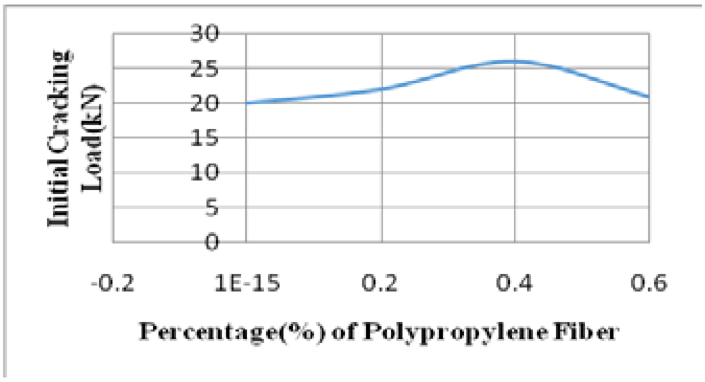

Figure 8: Variation of Initial Cracking Load in Polypropylene Fiber Reinforced Beam

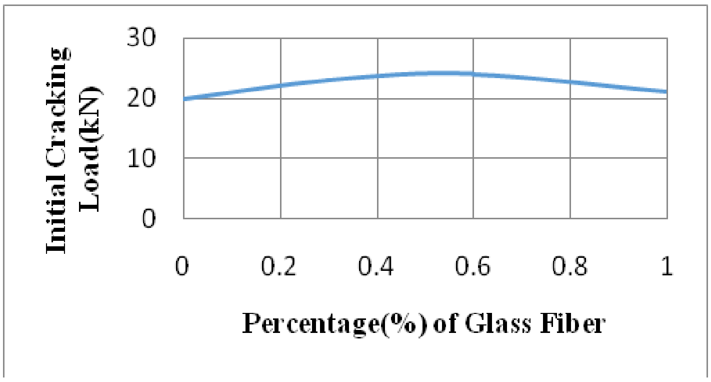

Figure 9: Variation of Initial Cracking Load in Glass Fiber Reinforced Beam

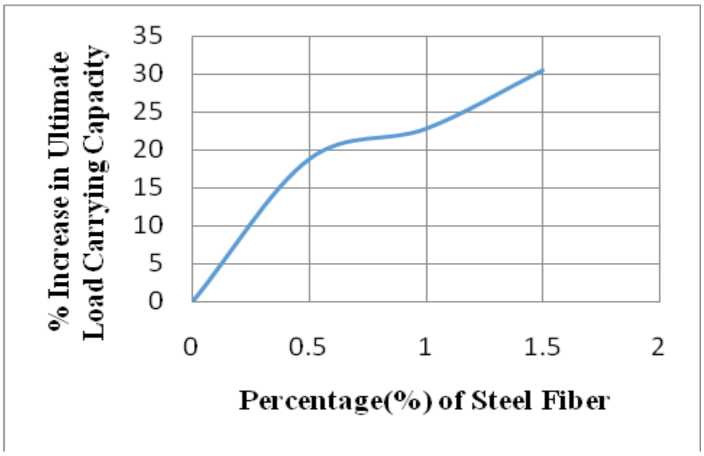

Figure 10: Percentage Variation in Ultimate Load Carrying capacity in Steel Fiber Reinforced Beam

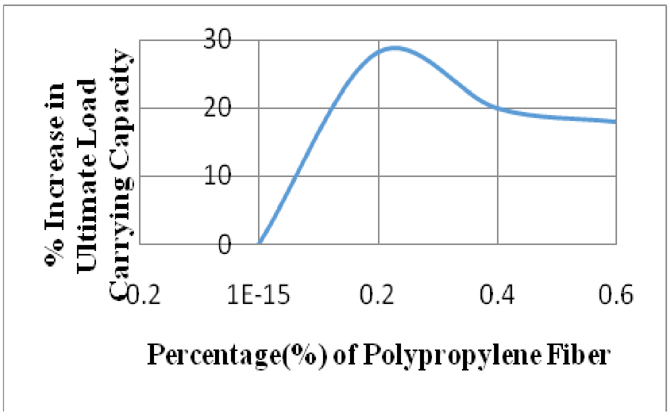

Figure 11: Percentage Variation in Ultimate Load Carrying capacity in Polypropylene Fiber Reinforced Beam

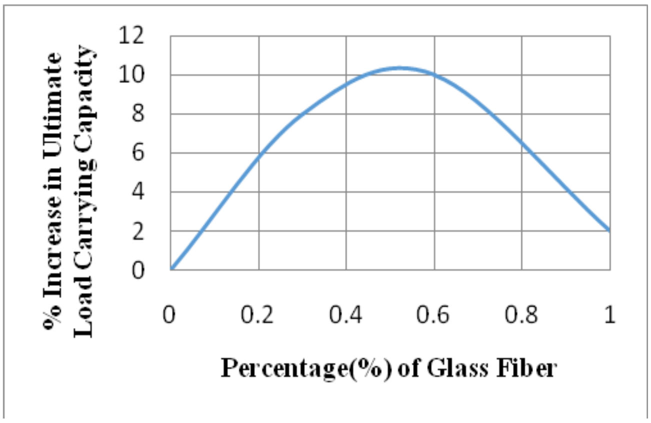

Figure 12: Percentage Variation in Ultimate Load Carrying capacity in Glass Fiber Reinforced Beam

V CONCLUSION

The experimental investigation has been undertaken to study the structural behavior of the RC beams with different fiber like steel , polypropylene and glass. Based on the results obtained, following conclusions can be drawn:

1. It can be observed that fiber reinforced concrete beam perform much better as compared to NSC beam in term of initial cracking load, ultimate load carrying capacity etc. Thus, it can be concluded that fiber reinforced beam helps to improvise the structural behavior such as tensile strength, converting brittle fracture behavior of concrete to ductile fracture behavior, ductility, flexural stiffness, toughness etc.

2. As the initial cracking load for steel fiber is much higher than controlled beam, polypropylene and glass fiber reinforced beam, it can be said that steel fiber are good in arresting the crack formation in RC beam as steel fiber are more good in improving the tensile strength and help in bonding the ingredient of concrete together for much higher load as compared to polypropylene and glass fiber. So, it can be concluded that bridging action of steel is much better than other two fibers.

3. There is variation in initial cracking load with different volume fraction of different fiber. This is because of the aspect ratio of different fiber used and the distribution and orientation of fiber throughout the RC beam. 0.5%, 0.4% and 0.6 % volume fraction of steel, Polypropylene and glass fiber give maximum initial cracking load respectively.

- It can be observed that increase in percentage of steel fibers there is increase in ultimate load carrying capacity. These is because, increase in volume fraction increase the tensile strength i.e. converting brittle behavior of concrete into ductile behavior. Steel fiber helps in arresting the crack and they are more effective in bridging the crack and thus beam perform better with increased in percentage from 0.5% to 1.5%. It can be seen that there is 30.48% increase in ultimate load carrying capacity when 1.5% volume fraction of steel fiber were present in RC beam.
- It can be observed that load carrying capacity increased and then decreased in polypropylene fiber. There is 30 % increase in initial cracking load for 0.4% volume fraction of polypropylene fiber. 0.2% of polypropylene fiber give maximum load carrying capacity 64.1kN. Thus, it can be concluded from above result that optimum percentage of polypropylene fiber which should be used is appropriately in range of 0.2% to 0.4%.
- 3.It can be observed that load carrying capacity increased and then decreased in glass fiber. There is 20 % increase in initial cracking load as well as we get maximum load carrying capacity as 55kN for 0.6% volume fraction of glass fiber. Thus, it can be concluded from above result that optimum percentage of glass fiber which should be used is appropriately 0.6%.
- With increase in percentage of fiber in RC beam, it can be observed that crack width and crack opening has reduced as well as crack propagation inside the beam has reduced, thus improving the behavior of beam such as by increasing the initial cracking load ,tensile strength . Ultimate load carrying capacity of beam and ductility.
- It can be concluded that volume fraction , aspect ratio ,distribution and orientation of fibres play a very important role in bridging effect, deflection of beam, crack width , crack propagation, initial cracking load and ultimate load carrying capacity.

Thus, we can conclude from the above study that steel fiber having volume fraction of 0.5% steel fiber give maximum initial cracking load and 1.5% of steel fiber give maximum ultimate load. So, steel fiber reinforced concrete beam give good performance as compared to other fiber. The optimum percentage of different fibers to get effective and efficient performance of structural element was determined in the above study

VI ACKNOWLEDGEMENT

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