5-27-2012

Proceedings of International Conference on Recent Development in Engineering and Technology

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Proceedings of

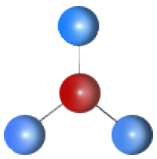
International Conference
on

RECENT DEVELOPMENT IN ENGINEERING AND TECHNOLOGY

Sec-I : Computer Science and Information Technology
Sec-II : Electronics and Communication Engineering
Sec-III : Mechanical & Industrial Engineering

27th May, 2012
Darjeeling, India

Organized by:



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Welcome to the International Conference on Recent development in Engineering and Technology aims to bring together researchers, scientists, engineers, and scholar students to exchange and share their experiences, new ideas, and research results about all aspects of Mechanical & Industrial Engineering, Computer Science and Information Technology, Electronics and Communication Engineering, and discuss the practical challenges encountered and the solutions adopted. The conference will be held every year to make it an ideal platform for people to share views and experiences in the field of Engineering and Technology.

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Editorial

Technology is a term used very broadly to mean any product or process developed by humans to solve a problem or meet a need. Technology affects the ability of humans to control and adapt to their environment, and it impacts human society in a variety of ways. In addition to complex machines and "high-tech" tools like the automobile and the latest smart phone "app", the simplest tools and devices, like a lever to move something or a kitchen gadget, are also considered technologies. Technology is closely associated with invention and innovation, the transformation of ideas for solving problems or meeting needs into useful new products or processes. Inventions can come from a moment of ingeniousness, as a solution to a specific problem, or as a development from years of research. Inventing requires creative thinking, investigation, and experimentation as part of the design process, a series of steps that help people to think creatively about a problem and produce a successful result. Inventors and engineers use a similar design process, although the field of engineering favors a collaborative team approach to problem-solving and design, while inventors often work alone. Many of the world's technology inventions were designed by engineers.

Engineering & Technology is continuously being applied for improving the quality of life of people in the society, particularly during the last 200 years. For example, the revolution in increasing the life expectancy, creating a disease free world in the midst of diseases, agricultural revolution, and electronic revolution in making the world borderless and many more applications.

Let me highlight some of the recent innovations in the field of engineering and technology. Automobile researchers are continuously working on increasing the specific power output and reducing the fuel consumption and emissions. Today, electronic multipoint fuel injection systems has become common on all the vehicles, whereas for getting better control and precision over combustion and emission, we have to work on direct injection of gasoline for better exhaust characteristics. Gasoline direct injection permits combustion of ultra-lean fuel air mixtures under diverse operating conditions and hence can deliver higher performance with lower fuel consumption and lower emission. This technology will be applicable to four-wheelers, three-wheelers and two stroke engines. One of the important aspects of diesel engine is that the oxides of nitrogen (NOx) and particulate matter in the emission are high. This has to be overcome by the use of advanced combustion technologies which will reduce both. Indian Automotive Engineers have to work on this area and offer the system for use in all types of diesel vehicles.

The most challenging area for the automobile researchers will be to design the engines and fuel injection system for making them compatible for the use with emulsified fuels (40% water + 60% diesel or Petrol) The information technology and communication technology have already converged leading to Information and Communication Technology (ICT). Information Technology combined with bio-technology has led to bio-informatics. Similarly, Photonics is grown out from the labs to converge with classical Electronics and Microelectronics to bring in new high speed options in consumer products. Flexible and unbreakable displays using thin layer of film on transparent polymers have emerged as new symbols of entertainment and media tools.

Now, Nano-technology has come in. It is the field of the future that will replace microelectronics and many fields with tremendous application potential in the areas of medicine, electronics and material science. I am sure about the use of nano-robot for drug delivery.

Nano robots when they are injected into a patient, my expert friends say, it will diagnose and deliver the treatment exclusively in the affected area and then the nano-robot gets digested as it is a DNA based product. I saw the product sample in one of the labs in South Korea where best of minds with multiple technology work with a target of finding out of the box solution.

The conference designed to stimulate the young minds including Research Scholars, Academicians, and Practitioners to contribute their ideas, thoughts and nobility in these disciplines of engineering. It's my pleasure to welcome all the participants, delegates and organizer to this international conference on behalf of IOAJ family members. I sincerely thank all the authors for their invaluable contribution to this conference. I am indebted towards the reviewers and Board of Editors for their generous gifts of time, energy and effort.

Finally let me focus a great saying of an Indian Sage Maharshi Pathanjali nearly 3000 years ago in Yoga Sutra:

"When you are inspired by some great purpose, some extraordinary project, all your thoughts break their bounds, your mind transcends limitations, your consciousness expands in every direction, you will find yourself in a new great and wonderful world. Dormant forces, faculties and talents become alive and you discover yourself to be a greater person by far than you ever dreamed yourself to be."

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SECTION-I

Computer Science and Information Technology

Testing Process Overview Exploration for a Software Product in a Large Software Development Project

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Abstract - Software testing is a process where you have the stated requirements, pre-requisite software that is to be installed and the configuration of the machine that need to be done as per the test data for the test case and for a specific platform which when verified works perfectly. This paper describes about Manual test case process overview in the testing life cycle for a large software development project and how you track the effort for the same. A Tester need to know about the fundamentals of testing concepts. Documentation of the testing concepts and the process overview of the testing life cycle for a software product need to be done initially so that a new tester when recruited can understand the basic flow as to how it is carried out in real time in an organization practically. Initially a tester need to execute the manual test case for few platforms and some tougher manual test cases need to be learnt from the tester who is having some experience. The tougher manual test cases need to be identified initially from the experienced tester who will be giving a session for the execution of such test cases. So when the foundation for a new tester is powerful the plan assigned for the execution of test cases is met. The effort tracking for the testing can be captured for a tester and should be matched with planned effort for the execution of test cases. Measurement of the testing effort plays a very important role as to how comfortable a new tester is and further root cause analysis is done if required when the new tester does not meet the planned effort.

Keywords - *software testing, system acceptance testing, confidence testing, problem list entry, exploratory testing*

I. INTRODUCTION

Software testing is part of system development life cycle wherein quality is determined by estimating the software product. Miller's goal for Testing is described as follows [12] :

"The general aim of testing is to affirm the quality of software system by systematically exercising the software in carefully controlled circumstances".

Edsger Dijkstra, a Dutch computer scientist and a major contributor in the development of software engineering community stated "Testing can only show the presence of errors, not their absence".

Miller's and Dijkstra quotations on testing suggest that a tester should always be looking for errors. The objective of testing done at every stage of software life cycle will be different in nature. However understanding of the requirements and thorough knowledge of the domain is very important and without that the functionality of the program as designed cannot be captured. Software testing process in general need to be addressed with a plan. This plan indicates the various testing techniques that is to be carried out for the product under different platforms. Therefore different testing techniques under theoretical knowledge need to be well-defined and the practical testing which is carried out need to be demonstrated. Testing is a process of verifying that a system works as specified in its stated requirements [1].In the book "The Art of Software Testing " written by Myers in 1979 transferred information about the design of the testing techniques. So the manual test case when written was given important when there is presence of error in the release of the software product. In another book Software Testing Techniques [13] which consist of different testing techniques briefs about the definition and theoretical plan which is to be carried out and addressed so that in Industrial Software Development the practicality in implementing those theoretical techniques can be carried out easily. Test case management system is based on the guidelines provided by the IEEE 829standard. Enhancements can be easily done to Test case management system because of its object-oriented design [2, 3]. Test case management system encourages a framework for the administration of tests by providing uniformity in Test Case Formats as well as Test Results Formats which are based on the IEEE 829 standard [4].

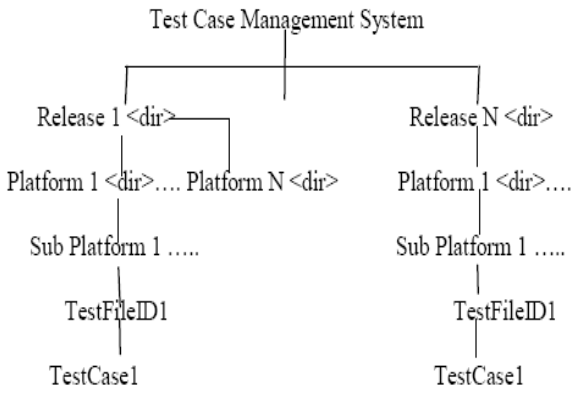

Fig. 1[9] - Hierarchy Of Test Storage

A. Hierarchy of Test Storage [9]

In this Hierarchy of Test Storage Test Case Management System stores test cases. This Hierarchy gives a three level structure for Test Case Management System to store. The structure consists of Product Release Version, Platform and Sub Platform. Product Release Version refers to the release version in which the tester is working. Platform refers to the functional area that is under test for the given system and Sub Platform refers to the grouping of tests within a Platform. Figure 1 below demonstrates separate sections based on Product Release Version, Platform and Sub Platform [9].Test Set represents a directory where all the Product Release Version of the test cases are stored. A test case in Test Set is defined as a test case description file that follows the test case format rules based on the IEEE 829 standard and other related files that are referred to from within the test case [9]. Thus a test case consists of many files. A test suite or test set can be formed by a logical grouping of tests [9].This enables the tests to be referred to as a group [9].

II. DESCRIPTION

This paper describes about the process overview of the software product for the testing team in industrial software development. Detailed process overview ensures the team to follow the steps and acknowledge to the team leads after every sub-process is successfully completed. Documentation of the processes and procedures must be done and it should be updated as and when required. The flow of process overview of a product for the testing team is as follows:

A. System Acceptance Testing

System Acceptance Testing is a testing method where the team is ready with the machine setup for which the build team provides the release of the software product to be tested on during which the testers execute the tests and report bugs for which a report is sent to the stakeholders and developers on a daily basis with the percentage of tests executed, issues etc.

System Acceptance Testing deals with both functional and non functional requirements wherein requirements for each test case in the test set need to be traced and well-documented. These test cases most probably deal with User interface screen by making an data entry with proper messages of successful entry or error messages in the status bar as the expected behaviour.

There are three types of log files created during System Acceptance Testing.

1) Regression Log file : This Log file is maintained and is created when some functionality that the tester has been using till yesterday has disappeared recently. The log file consists of the information under which platform, which step is not working, who is the tester and the behaviour of the test case with screen shot attached if any.

2) Non-Regression Log file : This Log file is maintained and is created when some functionality that the tester has been using previously and recently has disappeared.

3) Showstopper Log file : This log file is created when the manual test case is created and added to test set of the software product and is failed when executed for the first time.

The log file consists of the information under which platform, which step is not working, who is the tester and the behaviour of the test case with screen shot attached if any.

These Log files are reported to the developer. A screen shot of the behaviour which is not the expected behaviour must also be attached to the log file so the specific development team will analyse the issue and resolve it as early as possible.

As mentioned in System Acceptance Testing there are three log files. These log files must be reported to the developer with proper priority. Regression log file must be given High priority compared to other log files.

The Testing Life Cycle for execution of manual test cases under System Acceptance Testing is shown in the Figure 2 and Figure 3.

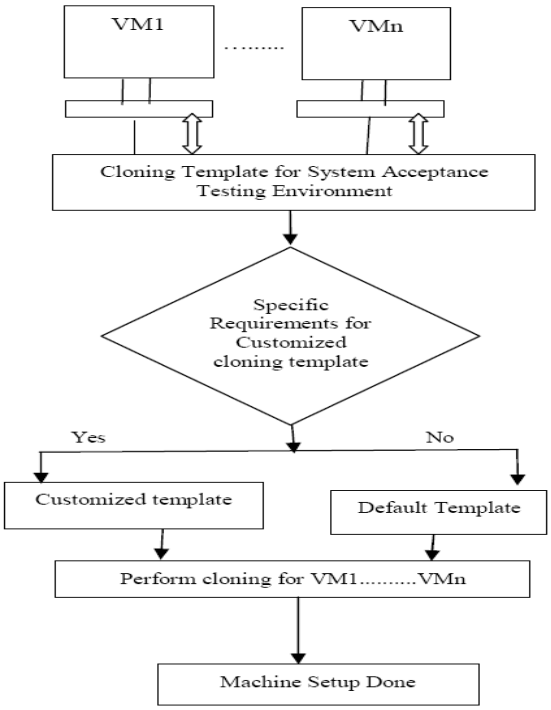

Fig. 2 : Machine Setup for System Acceptance Testing

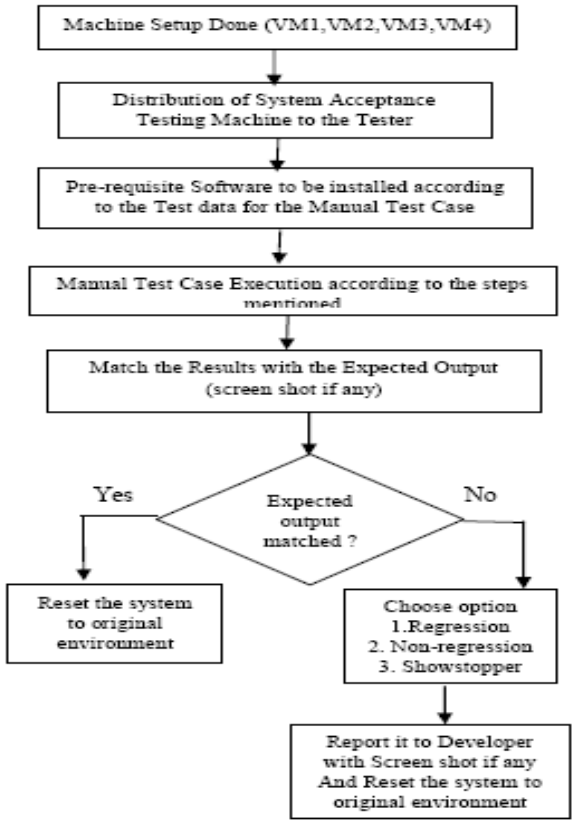

Fig. 3 : Manual Test Case Execution

The effort tracking for the system acceptance testing is done on a daily basis by making an entry in the excel sheet created for System Acceptance Testing. This sheet gives tester a plan to execute within the scheduled time for every test set under different platforms.

B. Confidence Testing

Confidence testing is another form of System Acceptance Testing wherein the bugs reported to the developer during acceptance testing are verified and need to be checked in the log file whether the status is open or fixed. If the status of the issue is open in the log file confidence testing is not carried out because the issue logged is not fixed yet. If the status of the issue is fixed confidence testing is mandatory and those test cases which have to be executed under confidence testing are grouped.

In confidence testing team may include some tests that might have impact or are critical are verified once again and any bug if found is documented in the log file and report is sent to the developer.

C. Exploratory Testing

Exploratory testing is defined as simultaneous learning, test design and test execution; that is the tests are not defined in advance in an established test plan but are dynamically designed executed and modified. The effectiveness of exploratory testing relies on the software engineer's knowledge which can be derived from various sources [6]. James Bach defines Exploratory Testing as simultaneous learning, test design and test execution [5].Tinkham and Kaner's definition of exploratory testing as “Any testing to the extent that the tester actively controls the design of the tests as those tests are performed and uses information gained while testing to design new and better tests” [10]. But according to Kaner, Bach and Pettichord exploring means “.....purposeful wandering: navigating through a space with a general mission but without a pre-scripted route. Exploration involves continuous learning and experimenting”[7].Exploratory Testing is also useful when test scripts become “tired”, that is they are not detecting many defects anymore [8].Vaga and Amland propose that exploratory testing should be planned as part of the testing approach in most of the software development projects[11].There are some pre-requisite documents of the software product for which a tester need to go through and understand the requirements and platform in order to undergo exploratory testing. A tester might focus on for example User interface screen and message display after making a data entry or the priority of logic for the radio buttons over the default check might be done in exploratory testing. Initially in exploratory testing the tester might have low priority to work towards the logic and identify the defects than

high priority towards the user interface screen. The tester always has the benefit of identifying the defects in the user interface screen and when tester makes data entry with a Number, String, and Decimal etc. The developer has the advantage of both logic and the user interface in exploratory testing.

Effort tracking for Exploratory Testing is captured in an excel sheet.

The attributes included are as follows:

1) Employee ID or Serial Number
2) Resource
3) Issue reported or Missing Test case
4) Log files creation Identifier
5) Defect created (Yes/No)
6) Defect Number
7) Test case Added
8) Number of tests
9) Comments
10) Brain storming sessions

This sheet gives a tester a clear framework as to who is doing Exploratory Testing and under which platform a tester carried out exploration of the software product.

Exploratory Testing gives a tester an in depth knowledge of the software product and a tester will be experimenting with existing functionality in the software product. The expected behaviour must be discussed with the specific development team. So to identify the development teams for analysing the expected behaviour in exploration is an important task. The communication between the developer and tester plays an important role in Exploratory Testing. Exploratory Testing should planned accordingly by the team leads but there must be a plan of carrying Exploratory Testing after system acceptance testing for every release of the software product. The plan for a tester is to discover atleast 3 defects or discuss issues regarding the existing test case or add another scenario for the existing test case during Exploratory Testing. The tester will get resolve from the developer or any experienced tester within the team and get it verified with the developer so that tester can add a test case for the test set for it after the log file is created and sent to the developer. The development team will have to fix the issue and give confirmation that it has been resolved in the release of the product version. The tester when the release of the product version mentioned will try to reproduce the steps as the fix has been done and a new test case is written for it by the tester. However this type of testing will give the tester to enhance further and get more knowledge and doing more exploration on the software product for every release. Exploratory Testing is embedded into the System Acceptance Testing where you start the initial stage of which functionality can be explored. A Strategy need to be carried out at this stage. This kind of activity for individual testers will have some competition among testers and testing team will come to know about the defects and flexibility to analyse the expected behaviour of the software product.

D. Root Cause Analysis

Root cause analysis is defined as the purpose of determining the root cause is to fix the problem at its most basic source so that it does not occur again even in other software products. The Root cause is the most basic causal factor or factors that if corrected or removed will present the recurrence of the situation.

Root cause analysis is done after completing the system acceptance testing. Root cause analysis template is prepared and is filled by the tester. The tester does not meeting the test set plan for system acceptance testing will have to be answered in Root cause analysis excel sheet. The template in general includes what, how and why.

The purpose of conducting a session on Root cause analysis is to avoid the delay and just to get prepared with the solution under such circumstances when it happens again in the future. The Root cause analysis factors included in the sheet are as follows:

1) The version or release of the product
2) Component on which the tester is working
3) Log file generated if any
4) Description of the Problem faced during system acceptance testing
5) Status of the log file.
6) Maintenance of the test case
7) Defect ID updating
8) Reasons behind the problem
9) Solution to the problem

E. Problem List Entry

The Problem List Entry are made by the development team of the Software product and it is sent to the tester in order to reproduce the steps mentioned in the file.

These entries are stored in a separate file with Problem List Entry ID, Platform for the execution,

Status (reproducible or not), developer's name or customer's name, customer's model if any and Headline of the Problem List Entry.

Under the Headline of the Problem list entry developer will create the detailed description of the problem which is to be analysed and communicated with specific Development team about the problem's perception. The tester initially needs to describe in brief about the reproducible steps when problem statement is analysed.

The steps to be reproduced will help the developer whether the tester has understood the requirements, objectives of the problem. The tester will have reproducible steps and will make it to write a manual test case for it and then the test case is sent for review to developer or to an experienced tester within the testing team who has worked under that platform for the software product. When the manual steps are approved by the developer the tester will include it for the System Acceptance Testing or confidence testing or further can be explored in exploratory testing. If the problem list entry made is matching with any one of existing manual test case or is an continuation of the test scenario then another test case is added or if it is completely same then it is rejected. The test case when approved is added to test set of the software product with test data, test objectives, requirements, Assumptions, test cases, platform, history of changes, step number, step name, expected behaviour and a screen shot of the expected behaviour if any. Whenever a test case is written for the problem list entry a new defect is created with the defect number and when reviewed the defect is closed. The effort is also tracked for the problem list analysed and test case written for it. This effort helps in future estimations and collating accurate metrics. It also helps to analyse the strengths of different resources.

III. RESULT ANALYSIS

The effort information for the system acceptance testing in executing the manual test cases is calculated for analysing the tester whether he is capable to meet the plan with the specification of working hours for each test set. The total number of tests in each test set assigned to tester with complexity level (low, medium and high) and initially planned working hours for the execution of test cases in every test set under different platforms must be matched when you make an entry in effort information excel sheet. The entry made in the effort information for the planned hours in execution of test cases in every test set might have increased due to some reasons is discussed in the Root Cause Analysis(RCA). Effort is calculated by the formula as follows:

Total Effort = Number of days worked in a week * 7 . (1)

Assumption: In a day 7 hours for the execution of test cases.

Variance = (Actual Planned Effort – Total Planned Effort)*100/ Actual Planned Effort . (2)

The Effort information and root cause analysis for system acceptance testing will be documented for future references.

IV. CONCLUSIONS AND FUTURE WORK

Software testing an evergreen domain in Software engineering addresses the presence of errors and provides satisfaction to the client after the release of the software product and is ready for operational use for the clients as per requirements.

However there are many upgrades in the testing techniques and the plan of choice for conducting a testing must be well-defined and documented. Software testing in industrial software development is carried out through a test plan wherein every tester will go through it and any concerns will be addressed through meetings so that when System acceptance testing starts the tester is good enough to understand the platform, requirements and effort to be met for execution of manual test cases. Tester should also know about different Development teams for that software product being tested so that when the behaviour of the functionality is not as expected it must be addressed to the specific development team and get it resolved. So Communication between tester and developer plays a vital role in the software testing process. Further some selected manual test cases can be automated in the future inorder to reduce the time. The measurement of effort tracked for testing is done wherein the initial plan of testing activity when done is matched with the effort. Effort plan for the execution of test cases for the product plays a vital role in the release of the software product.

The process overview of the testing activity done will help in building high quality software plays an important procedure for Researchers and enhancement can be done so that tester will do the testing activity more tester friendly in the future. Researchers should demonstrate the process overview of the Testing activity, plan, measurement for the software product and the execution of test cases given for tester under different platforms should be planned in such a way that tester is comfortable in all the platforms with initial understanding of the requirements and execution. Tester should not always be testing on specific platform. However the goal and plan to the tester for the execution of test cases should have been undergoing testing activity on all platforms for specific time periods and

well-documentation of the procedures and Configuration should have been done. There should be proper knowledge transfer done initially for the execution of test cases with proper configuration from the experienced tester whenever tester is assigned for the execution under different environments. Whenever the tester starts execution of the test cases under different platforms after proper knowledge transfer being done will find challenging in executing test cases. Problem list entry for a developer and Tester acts as a exploratory testing activity. Researchers should focus on the foundation being given for testers and making it more challenging with the well-documentation activity being carried for process overview of the testing activity and any updating should be done for future references.

V. ACKNOWLEDGMENT

I am happy to present this paper to my Lecturer, Naresh E (Software Engineering, Department of Information Science and Engineering). I am grateful that Naresh E gave us such an interesting idea to do, and I have tried my best to succeed at it. I would also like to thank my family members for their support. A special thanks to the authors mentioned in the references page.

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Boolean Xor based (k,n) Threshold Visual Cryptography for Grayscale images

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Abstract **-** Secure digital images is very important for today's scenario which combining methods and techniques coming from cryptography and image processing. Visual Cryptography Scheme (VCS) is a new kind of cryptography technique which allows visual information (e.g. printed text, picture etc.) to be encrypted in such a way that decryption can be performed by the human visual system without any complex computation on computers. Here we proposed a Visual Cryptography Scheme based on image division of grey level images for the generation of Secret Shares. In this paper we represent the (k, n) Threshold Visual Cryptography Scheme in which the size of generated Shares as well as Recovered Image have same as the Secret Image rather than other VCS where k is the threshold value. Also we proposed the new technique to generate the Shadow Assignment Matrix with the help of Genetic Algorithm (GA). This Shadow Assignment Matrix helped us to distribute the Temporary shadow to the users according to their occurrence of 1's in a row.

Keywords **-** *Shares; Visual Cryptography; Visual Cryptography Scheme; Temporary shadow; Shadow Assignment Matrix; Threshold;Genetic Algorithm.*

I. INTRODUCTION

With the rapid development and advancement of Network technology, Digital information is transmitted over the Internet easily. There are various type of confidential digital images are transmitted over the Internet. While using confidential digital images, security issues should be taken into consideration because Intruder may utilize weak link over communication network to steal information that they went. To deal with the security problem of confidential digital images, various image Secret Sharing Schemes [1] have been developed. Visual Cryptography is first Introduced by Moni Naor and Adi Shamir in 1994 [2]. Visual Cryptography is a cryptographic technique which allows Visual information (picture, text etc.) to be encrypted in such a way that the decryption can be done by human visual system without any calculation on computers.

Visual Cryptography scheme eliminates complex computational problem in decryption process and stacking the Secret shares is to be used to getting the Original image. Visual cryptography scheme is a secret sharing technique used for encrypting binary images. It splits a binary image into *n* shares, and gathering more than *k* shares can recover the secret. Visual cryptography is a popular solution for image encryption. Using secret sharing concepts, the encryption procedure encrypts a secret image into the so-called shares which are noise-like secure images which can be transmitted or distributed over an untrusted communication channel. The GA is a stochastic global search method that mimics the metaphor of natural Biological evolution. GAs operate on a population of potential solutions applying the principle of survival of the fittest to produce (hopefully) better and better approximations to a solution. At each generation, a new set of approximations is created by the process of selecting individuals according to their level of fitness in the problem domain and breeding them together using operators borrowed from natural genetics. This process leads to the evolution of populations of individuals that are better suited to their environment than the individuals that they were created from just as in natural adaptation. The main data structures in the Genetic Algorithm toolbox are:

1. Chromosomes
2. Phenotypes
3. Objective function values
4. Fitness values

Phenotypes

The decision variables or phenotypes in the genetic algorithm are obtained by applying some mapping from

the chromosome representation into the decision variable space.

II. BASIC MODEL

To encrypt a Secret applying a (2, 2) VC Scheme [2], the original image is divided into two Shares such that each pixel in the original image is replaced with non-overlapping block of two sub-pixels. A white pixel is shared into two identical blocks of sub-pixels. A black pixel shared into two complementary blocks of sub-pixels. To decode the image, stacking both the transparencies will permit the visual recovery of the secret. While creating the shares, if the given pixel p in the original image is white, then the encoder randomly chooses one of the first two columns of Table 1.

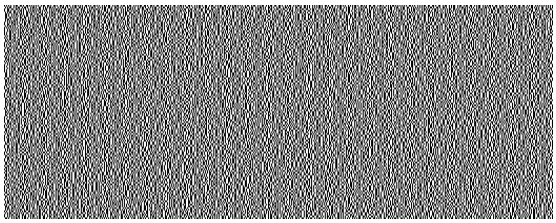
If the given pixel p is black, then the encoder randomly chooses one of the second columns of the Table 1 because both the columns have the equal probability to be chosen. The Key property used to construct Visual Cryptography Schemes for black and white images is the following: - if we stack Shares with black and white pixels, the resulting pixel that our eyes see is black. If at least one of the stacked pixels is black and is white if all stacked pixel are white. This key property does not easily extend to colored pixels. With colored pixels the state of each pixel cannot be represented any more with single bit and the reconstruction operation performed by our eyes is much more complicated than a simple OR.

Table 1. (2, 2) Visual Cryptography Scheme

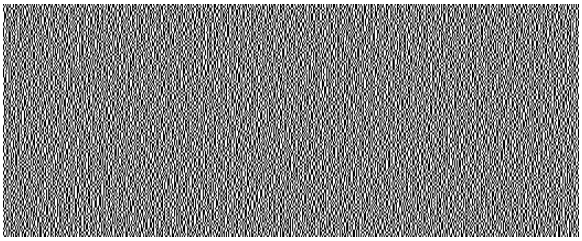
Pixel				
Probability	50%	50%	50%	50%
Share 1				
Share 2				
Stack 1 & 2				

Figure 1 shows the result of basic (2, 2) VC scheme. When the two shares are stacked together, as in Figure 1(d), the black pixels in the Original image remain black and the white pixels become grey. Although some contrast loss occurs, the decoded image can be clearly identified. Since each pixel in the original image is replaced by two sub-pixels in each share, the width of the shares as well as decoded image is twice that of the original image.

(a) Binary Image



(b) Share 1



(b) Share 2

(c) Decoded Image

Fig. 1 : Example of (2, 2) Visual Cryptography Scheme

III. PROPOSED SCHEME

Our proposed algorithm is based on Chao and Lin [3] Algorithm. Chao and Lin proposed the algorithm for (k, n) Threshold Visual Cryptography Scheme [4] for greyscale images [5].Our proposed Scheme Emphasis on generation of Shadow Assignment Matrix. We use the Heuristic approach [6] for generating the Shadow Assignment Matrix by which we assign the temporary shadow to users. For the Heuristic approach we need to define the fitness function is this way:

1. Every row must have only 3 one's and rest will be zero
2. Every column must have only 2 one's and rest will be zero

Our program is implemented using MATLAB, so the Fitness function defined in terms of MATLAB.

Initially, Taking a matrix 'A'$_{4 \text{ X } 6}$ having the entire element '0'.

A = Zeros (4, 6)

Desire = 2*ones (1, 6)

Sumofcols = sum (A)

Result = abs (sumofcols - desireAns)

Ycols = sum (Result)

Similarly we do for Rows and finally we got the expression for Fitness function.

Fitness function = ∑ (Ycols + Yrows)

And size of chromosome is 24, Generation limit is 10000, take Selection function as roulette, Mutation function as uniform, Crossover function as double point. The chromosome data structure stores an entire population in a single matrix of size 4 X 6. Initially we are taking the chromosomes like

1 0 1 1 0 1 1 0 1 1 0 1 0 1 1 0 1 1 0 1 1 0
1 1

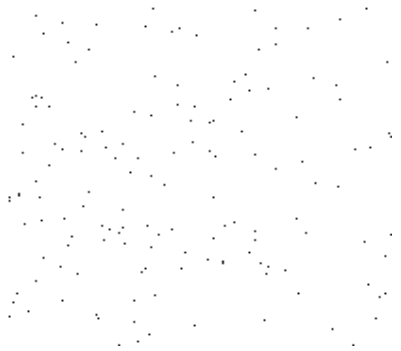
IV. RESULT

Our result is based on (3, 4) VCS where 3-out-of-4 is the threshold value and any three shares can be used for the revealing the secret image. In our scheme the original image may have any size and after resizing the original image we got the secret image.

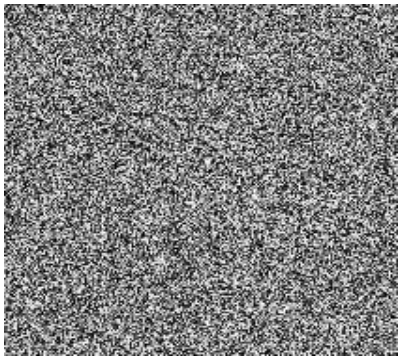
Shadow assignment matrix

$$H = \begin{matrix} 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{matrix}$$

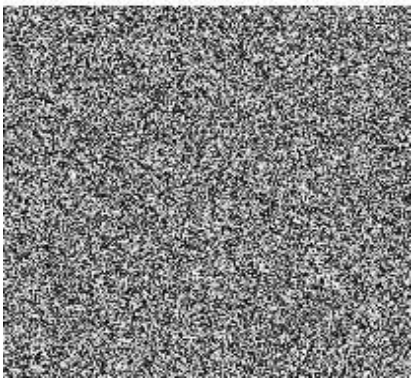
Fig. 2 (a) Secret Image



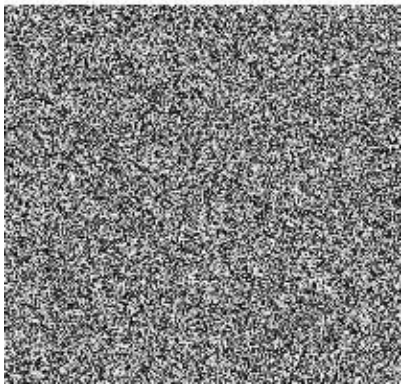
(b) Random Image



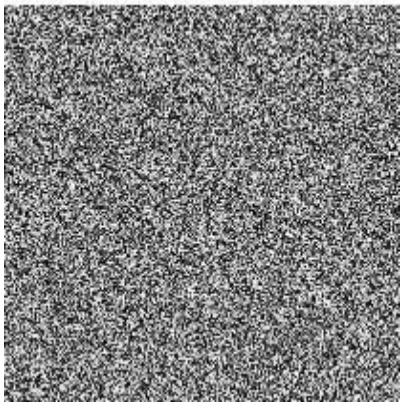
(c) XORed Image



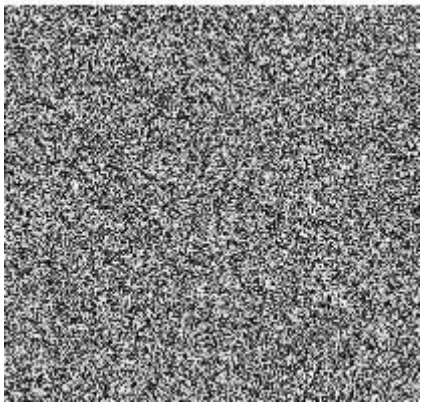
(d) Share 1



(d) Share 2



(f) Share3



(g) Share 4

(i) Recovered Image

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Determining the Positioning Algorithm for Fingerprinting Using WLAN

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Abstract - The effectiveness of Location Based Systems depends on the correct location of users and mobile devices ,the outdoor location can be easily calculated, while using technologies such as GPS (Global Positioning System), it is more difficult to obtain when the location scenario is an indoor environment. Several technologies and location techniques can be used in this field. One of these techniques is FINGERPRINTING which consists in two different phases:

The first phase is the: CALIBRATION PHASE: when data is collected and the Fingerprint Map is generated.

The second phase is the : ON-LINE PHASE: where data collected by the mobile device and the data collected in the calibration phase are used to estimate the location of the mobile node.

From the several wireless communications technologies IEEE802.11 is probably the most used in Wireless Local Area Networks.

I. INTRODUCTION

All the Location Based Services (LBS) depends on the correct estimation of the users' location. While in outdoor environments technologies such as GPS (Global Positioning System) can be successfully used, the same is not true when the operating scenario is indoor environments. In such scenarios alternative location technologies and methodologies must therefore be used, making this a very challenging research area where in the last years several different types of solutions have been developed.

Some of the most used technologies used for indoor location include the use of infra-red, ultrasonic waves

Pressure sensors, RFI (Radiofrequency Identification) and wireless communications networks.

In what concerns to the methodologies used to obtain the location, they can be divided into three main areas:

Triangulation, Proximity, Scene Analysis : Here, we focused on a particular location technique, which uses wireless communications networks as location technology, methodology based on scene analysis.

Location using fingerprinting:

Location Estimation Algorithms (LEA) will be used, and their performance was analyzed. The following LEA were considered to do this analysis:

- Nearest Neighbor – which considers the coordinates of the nearest reference as coordinates of the actual location
- k-Nearest Neighbor – which uses the average of the coordinates of the k nearest neighbors.
- Weighted k-Nearest Neighbor – which uses a weighted average of the coordinates of the k nearest neighbors.

IEEE 802.11b:

IEEE802.11b supports data rates up to 11Mbps, much higher than what IEEE 802.11 supports, increasing the variety of application that were feasible as compared to the previous IEEE 802.11 protocol. A number of different rates were defined; these can be used in different situations. These rates are: 11 Mbps, 5.5Mbps, 2Mbps, and 1Mbps. The actual user data throughput which users experience is usually around 5Mbps, similar to the actual throughput of an IEEE 802.3 10Base-T wired local network. IEEE802.11b uses the 2.4GHz Industrial, Scientific, and Medical (ISM) frequency band, which does not require a license for the user – but does require that the manufacturers meet the requirements for wireless local area network devices for their products. IEEE 802.11b WLANs can be used as a supplement to LANs or as an independent network. Today most laptop computers have a built-in IEEE 802.11b WLAN interface in addition to a IEEE 802.3

1000 base T interface. This WLAN interface helps users to avoid having to carry and connect cables. Today, most corporate and academic sites provide (legitimate) users with WLAN connectivity.

While IEEE 802.3 (Ethernet) utilizes a carrier sense multiple access (CMSA) mechanism to control when packets are sent. Specifically, IEEE 802.3 employs Carrier Sense Multiple Access with Collision Detect (CSMA/CD). With this media access protocol all stations that wish to send messages listen for when the channel is idle. As only one station can be allowed to send at a time, the others need to wait until the channel is free. If two or more stations send messages at the same time, then a collision occurs, in this case all of the messages which were being set are lost and all of the stations attempting to transmit will stop trying to send and will wait for a random amount of time

Before listening to see if the channel is idle – at which time they will attempt to transmit their message again. Because in a wired network it is possible to determine if someone else is attempting to transmit at the same time as you are, this method works quite well. Unfortunately, this is not easy to do in the case of a WLAN interface, thus IEEE802.11b uses another technique CSMA with collision avoid (CSMA-CA). Collision avoidance is necessary because the radio transmitter cannot detect a collision (unlike the wired LAN case). To avoid collisions each interface that wishes to transmit waits for a random time after detecting that the channel is idle before attempting to transmit. This period of time can be divided into different ranges of time in order to enable a mix of higher priority traffic and lower priority traffic.

Application:

WLANs provide additional features. For example, in many historic sites, it is quite hard and expensive to run new wires or cables; additionally it is better to avoid cables in order to protect the historic building's appearance, construction, and so on. The most important feature of a wireless network is their flexibility. In many indoor scenarios, the network configuration must be changed frequently, which for a wired network would require an expensive (re-)deployment; where as in a wireless network there is little wiring (as only the access points are attached to the LAN) significantly reducing the installation cost. Furthermore, WLANs also support other desirable features, such as roaming. Roaming enables users to move between APs; while retaining the ability to communicate, despite attaching to a new subnet via a new AP.

II. LOCATION DETERMINATION TECHNIQUE

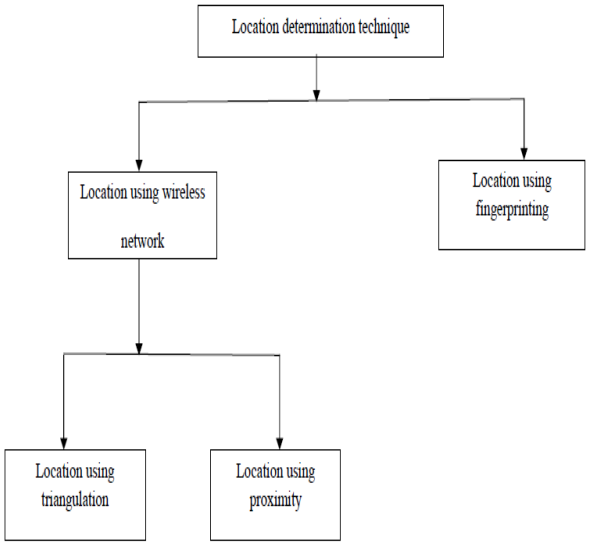

Fig1: Location determination technique

2.1 LOCATION USING WIRELESS NETWORKS

Location using wireless networks is based on the properties of wireless signals. Any property of a wireless signal can be used in location systems, as long as there is a relation between it and the current location of the mobile terminal. The signal properties that usually are used in location systems are:-

Time-of-Flight – the time needed by the information to travel from the transmitter to the receiver.

Received Signal Strength (RSS) – which indicates the power received by the wireless networks.

Technique comes under location using wireless network

2.1.1. Location using Triangulation

Triangulation uses the geometric properties of triangles to determine the location of the mobile node.

It can be divided into Lateration and Angulation.

1. Lateration uses the distances to determine the location. It takes into account the distances between the mobile node to be located and the references.
2. Angulation the angle of incidence of a signal must be known. By analyzing the Angle of Arrival of a wireless signal relatively to a given reference, it is possible to determine the location of the mobile node.

2.1.2 Localization using Proximity

Location using this methodology consists in discovering the nearest reference to the mobile terminal; therefore its spatial resolution is dependent on the number of used references.

2.2. LOCATION USING FINGERPRINTING

Fingerprinting is a scene analysis technique. In scene analysis a scene is observed and its patterns and variations along the time are observed. The information about a scene in the case of fingerprinting is obtained from one or more properties of electromagnetic signals from the references.

III. EXISTING WLAN LOCATION METHOD

3.1. Cell-ID

In this method the serving cell identifier (cell-ID) is used to locate the user. The accuracy in this method depends upon the radius of the cell. For urban areas, e.g. in a large city, this may be a few hundred meters; in rural areas it could be up to 30km.

3.2. Cell-ID and RxPowerLevels

This information is used to locate the mobile subscriber with good accuracy and high speed. The mobile terminal gathers information concerning the serving cell and the power level received from it. Along with the same information about other cells in the locality, this data is passed back to a server within the network operator's network. The network server then calculates the position of the user based on the positions of the cell base stations and the power at which they are transmitting.

3.3. Global Positioning System (GPS)

The GPS positioning method measures the distance from the satellites to the receiver by determining the pseudo ranges (code phases). The system extracts the time of arrival of the signal from the contents of the satellite transmitted message. It then computes the position of the satellites by evaluating the ephemeris data at the indicated time of arrival. Finally it is possible to calculate the position of the receiving antenna and the clock bias of the receiver by using this information.

3.4. Angle of Arrival (AOA)

This requires a minimum of two base stations with directional antenna. It measure the angle of arrival of signals, coming from a particular mobile subscriber, at the two base stations, and from this can calculate the users position.

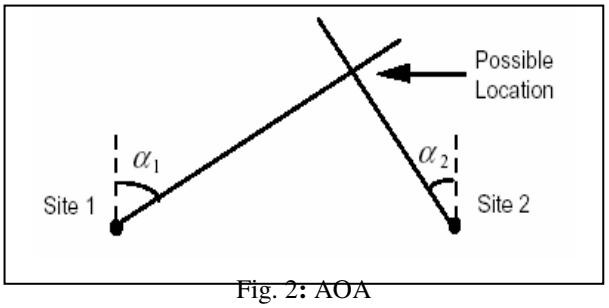

Fig. 2**:** AOA

3.5. Time of Arrival (TOA)

The Time of Arrival method locates the mobile terminal by triangulation from a minimum of three base stations. Because the speed of electromagnetic waves is known, it is possible to calculate the distance from each base station by observing the time taken to arrive. This method assumes that all transmitters and receivers are perfectly synchronized and ignores reflections or interference that will affect the position accuracy.

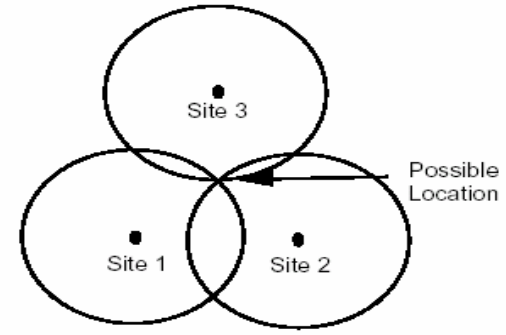

Fig. 3: TOA

3.6. Time difference of arrival (TDOA)

Time difference of arrival (TDOA) is an algorithm based on TOA, which determines the position by measuring the time difference of signal arrival. This significantly decreases the requirement for time synchronization. This technique is used in a wide range of applications ranging from wireless communication to electronic warfare. Receivers are located at known fixed positions; the transmitter's position can then be determined by a hyperbolic function.

3.7. Received signal strength (RSS)

The power density of an electromagnetic wave is proportional to transmitted power and inversely proportional to the square of the distance to the source. This physical law as well as the vectorial combination of waves that reach a receiver over different paths is the basis for estimating distance and location from signal strength measurements.

3.8. Time of flight (TOF)

The distance between a transmitter and receiver equals the time of flight, or electromagnetic propagation time, of the transmitted signal times the speed of propagation, which is the speed of light. Distance can be determined from measurement of time of arrival (TOA) of a signal at a receiver when transmission time is known, or from differences of reception time at different locations (time difference of arrival—TDOA).Another expression of time of flight is the phase of the received signal, which may be referred to as phase of arrival (POA), since phase may be related to time and distance through the signal wavelength and speed of light.

IV. INTERACTION BETWEEN MOBILE DEVICE AND SERVER

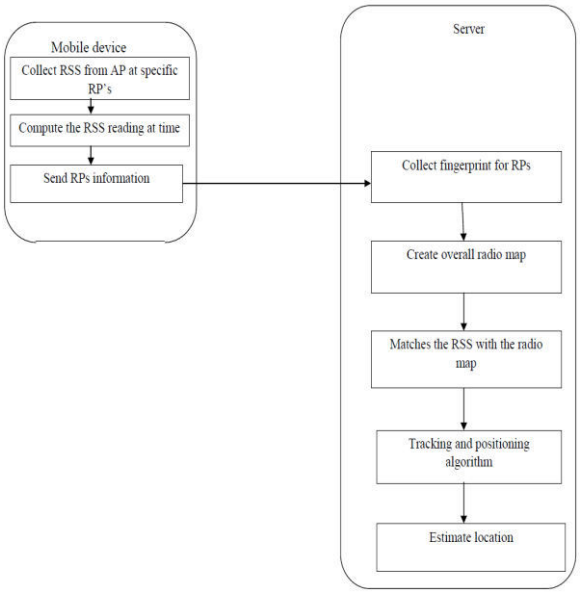

Fig 4: Interaction between mobile device and location determination server

V. PROPOSED METHODOLOGY

A dynamic KNN algorithm is proposed, which uses triangulation and a KNN (k nearest neighbor) as a mathematical model to estimate location and a positioning algorithm for location estimation is designed by merging the TRIANGULATION and KNN approach to estimate the location of mobile devices and to improve accuracy.

5.1 LOCATION ESTIMATION USING TRIANGULATION:

The transmitted signal (Tx) and the received signal (Rx) are two of the most important parameters used for location prediction of wireless node. Tx is used to calculate Available Signal Strength (ASS) and Rx is used to calculate Receive Signal Strength (RSS). These ASS and RSS are used to calculate the distance between the sending node and the receiving node. If there are three or more access point in a room or in an area then it is possible to build a triangulation positioning technique. Signal level drops when the distance between the antenna and the mobile device increases. Under ideal conditions the contours of signal level around the antenna are circles. If we know the relation between signal level and distance,

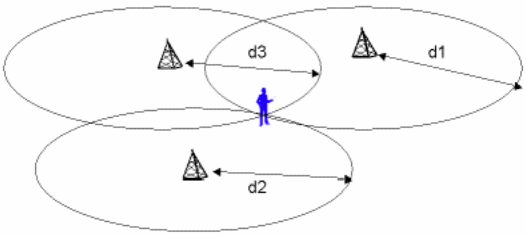

Fig 5: Location estimation using triangulation

from the signal level measured we can get the distance from the mobile device to the antenna. The mobile device is on the circle around the antenna with the distance as semi-diameter. Once the signal levels of the mobile device from three antennas are measured, using triangulation we can estimate the location of the mobile device.The distance can be calculated using Euclidean distance.

5.2 LOCATION ESTIMATION USING KNN ALGORITHM:

In the KNN algorithm the mobile device measures the signal strength of each of the access point within range, then searches through the radio map database to determine the signal strength tuple that best matches the signal strength, it has measured. The system estimates the location associated with the best matching signal strength tuple (i.e. nearest neighbor) to be the location of mobile. We use the following Euclidean distance to measure----

$$Sd = \sqrt{\Sigma (si - si')^2}$$

Using this measure, we investigate the signal space to find the position in the physical space. In this formula---

Si is signal matches in the database for APi and Si' is the measured signal strength in the real-time operation for APi.

This technique basically calculates the Euclidean distance(sd) in the signal space and pick the signal tuple that minimize this distance in signal space and declares the corresponding physical coordinates as its estimate of the mobile location.

VI. SYSTEM ARCHITECTURE

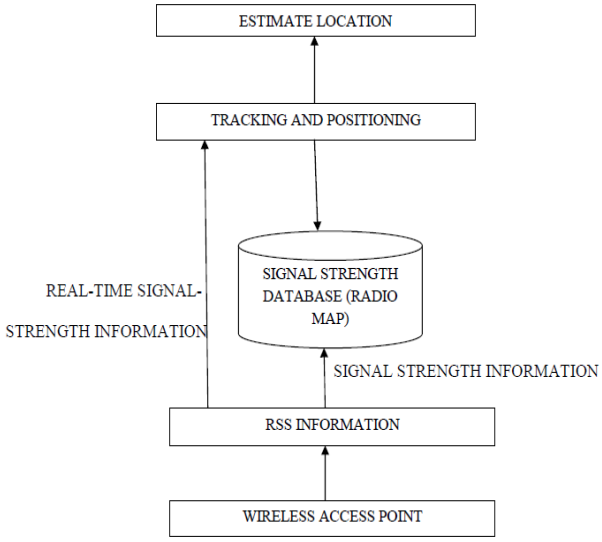

Fig 6: System Architecture

System architecture: We are using three access points in our project. We first collect multiple values of RSS (received signal strength) from the three access point and create a signal strength database and report it to the location determination server. The location determination server matches the RSS value with the stored database (radio map) using tracking and positioning algorithm i.e. here we are using Triangulation and KNN approach and estimate location of mobile device.

VII. PROPOSED ALGORITHM (POSITIONING ALGORITHM FOR LOCATION ESTIMATION)

Step 1: Begin

Step 2:Input: Real-time signal strength information.

Step 3: Open signal strength strength database

Step 4: Read a first record from signal strength database

Step 5: If direction of current record = direction of real-time signal information.

Step 6: Then calculate Euclidean distance of current record and signal strength information, otherwise Loop: next record in the signal strength database and go to step4.

Step 7: After calculating Euclidean distance compare that current Euclidean distance < minimum distance.

Step 8: If this condition holds then minimum distance = current Euclidean distance, otherwise Loop: next record in the signal strength database and go to step4.

Step 9: estimated location = location of current record.

Step 10: Close the signal strength database.

Step 11: Output: estimated location.

Step 12: End

VIII. CONCLUSION

The best candidate to determine a user location in indoor environment is by using IEEE802.11 (Wi-Fi) signals, since it is most widely available installed on most mobile devices used by users. Unfortunately, the signal strength, signal quality and noise of Wi-Fi in worst scenario, fluctuate up to 33% because of the reflection, refraction, temperature, humidity and dynamic environment etc. This makes problem in determining a user location indoor. This study present our current development on a light-weighted algorithm, which is designed to be easy, simply but robust in producing the determination of user location. We study determination of estimated location and improve accuracy. A dynamic KNN algorithm is proposed, which uses triangulation approach and KNN algorithm to estimate the location of mobile device and a positioning algorithm for location estimation is designed by merging the TRIANGULATION and KNN approach to estimate the location of mobile devices and to improve accuracy and accuracy is increased by merging the Triangulation and KNN approach.

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A Transparent Approach For Mobile Security

(Protecting AES Keys In Transparent Cryptography)

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Abstract - The aim of this paper is to analyze how digital content for mobile phones can be protected in an effective way in the context of transparent cryptography. The main goal of the implementations is to prevent the extraction of secret keys from the program. In the whitebox attack the keys in an AES implementation are completely exposed to an attacker. In this paper we will describe a technique which hides the AES keys in the implementation.Consider a basic round of AES (for details on the AES algorithm Each round is split into different components. These components will be encoded and represented by lookup tables. This prevents an attacker from finding secret keys in the implementation.

Keywords - *transparent cryptography for wjite box cryptography*

I. INTRODUCTION *(TRANSPARENT CRYPTOGRAPHY)*

Definition (Encoding)

Let X be a transformation from m to n bits. Choose an m-bit bijection F and an n-bit bijection G.Call X0 = G ◦ X ◦ F−1 an encoded version of X. F−1 is an input decoding and G is an output encoding.

Each encoding is decoded in another table, which results into a functionally equivalent AES computation.The idea is to make an implementation which consists entirely of encoded lookup tables.

Here we will explain the basic idea with a simple model. Suppose we have as components the following i mappings X which need to be hidden:

X 1 o X 2o ….Xi

The bijectionsM1, . . . ,M2i are randomly chosen and are put around the components along with their inerses:

$$M_1^{-1} \circ M_1 \circ X_1 \circ M_2 \circ M_2^{-1} \circ M_3^{-1} \circ M_3 \circ X_2 \circ M_4 \circ M_4^{-1}$$

Parts are taken together and put into separate tables. Each table is composed out of different mappings. Two mappings F−1 and G are put around it, otherwise the first and the last table are composed out of one mapping which is not secure. F and G−1 are also available to the user which he needs to decrypt the message.

$$\underbrace{F^{-1} \circ M_1^{-1}}_{table} \circ \underbrace{M_1 \circ X_1 \circ M_2}_{table} \circ \underbrace{M_2^{-1} \circ M_3^{-1}}_{table} \circ \underbrace{M_3 \circ X_2 \circ M_4}_{table} \circ \ldots \circ \underbrace{M_{2i-1} \circ X_i \circ M_{2i}}_{table} \circ \underbrace{M_{2i}^{-1} \circ G}_{table}$$

The result is that the different components are no longer visible on their own. A similar technique was proposed by Paul Gorissen et al. in Ease of Use

A. *A transparent AES Implementation*

The input to the AES encryption and decryption algorithm is a single 128-bit block. This block is represented by a 4 × 4 matrix consisting of bytes. AES consists of 10 rounds for AES-128. Each round updates a set of sixteen bytes which form the state of AES, thus each AES round processes 128 bits. AES-128 uses a key of 128 bits. This key serves as input for an algorithm which converts the key into different round keys of 128 bits. A basic round consists of four parts: SubBytes, ShiftRows, MixColumns, AddRoundKey

Before the first round an extra AddRoundKey operation occurs, and fromround ten the MixColumns operation is omitted. The only part that uses the key is AddRoundKey, the other three parts do nothing with the key.In the implementation we change the boundaries of the rounds, because we want to compose the AddRoundKey step with the SubBytes step of the next round into one step. We let a round

begin with AddRoundKey and SubBytes followed by Shiftrows and finally MixColumns.

Step 1: Hiding the Key in S-Boxes

First, we want to hide the key by composing the SubBytes step and the AddRoundkey together into one step. This makes the key no longer visible on its own. Because the key is known in advance, the operations involving the key can be pre-evaluated. This means that the standard S-Boxes which are used in the step SubBytes can be replaced with key-specific S-Boxes. To generate key-specific instances of AES-128, the key is integrated into the SubBytes transformations by creating sixteen 8 × 8 (i.e. 8-bit input, 8-bit output) lookup tables $T^r_{i,j}$ which are defined as follows:

$$T^r_{i,j}(x) = S(x \oplus k^{r-1}_{i,j}) \qquad i = 0,\ldots,3,\ j = 0,\ldots,3,\ r = 1,\ldots,9,$$

where S is the AES S-box (an invertible 8-bit mapping), and kr i,j is the AES subkey byte at position i, j of the 4×4 matrix which represents the round key for round r. These T-boxes compose the SubBytes step with the previous round's AddRoundKey step. The round 10 T- boxes absorb the post-whitening key as follows:

$$T^{10}_{i,j}(x) = S(x \oplus k^{9}_{i,j}) \oplus k^{10}_{sr(ij)} \qquad i = 0,\ldots,3,\ j = 0,\ldots,3,$$

where sr(i, j) denotes the new location of cell i, j after the ShiftRows step.

In total we have 10×16 = 160 T-boxes. However, the key can easily be recovered from T- boxes because S−1 is publicly known:

$$\begin{aligned} T^r_{i,j}(x) &= S(x \oplus k^{r-1}_{i,j}) \\ S^{-1}(T^r_{i,j}(x)) &= S^{-1}(S(x \oplus k^{r-1}_{i,j})) \\ S^{-1}(T^r_{i,j}(x)) &= x \oplus k^{r-1}_{i,j} \\ k^{r-1}_{i,j} &= x \oplus S^{-1}(T^r_{i,j}(x)) \end{aligned}$$

The key kr−1 i,j can be calculated, by choosing an arbitrary x and calculating x ⊕ S−1(Tr i,j(x)). This makes additional encodings necessary. Linear transformations are used for diffusing the inputs to the T-boxes. These linear transformations are called mixing bijections and can be represented as 8 × 8 matrices over GF(2). The mixing bijections are inverted by an earlier computation to undo their effect. In the following section we explain the use of mixing bijections in more detail.

Step 2: Inserting Mixing Bijections

An AES state is represented by a 4×4 matrix consisting of bytes. The MixColumns step operates on a column (four 8-bit cells) at a time. Consider a 32 × 32 matrix MC. If this is represented by a table, this table would cost 232 × 32 = 137438953472 bits = 16 GB. In order to avoid such large tables the matrix is blocked into four sections.MC is blocked into four 32 × 8 sections, MC0,MC1,MC2,MC3. Multiplication of a 32-bit vector x = (x0, . . . , x31) by MC is done by four separate multiplications yielding four 32-bit vectors (z0, . . . , z3) (Figure 1). This is followed by three 32-bits xors giving the final 32-bit result z:

$$MC \cdot (x_0,\ldots,x_{31})^T = (MC_0 \| MC_1 \| MC_2 \| MC_3) \cdot (x_0,\ldots,x_{31})^T = MC_0 \cdot (x_0,\ldots,x_7)^T \oplus MC_1 \cdot (x_8,\ldots,x_{15})^T \oplus MC_2 \cdot (x_{16},\ldots,x_{23})^T \oplus MC_3 \cdot (x_{24},\ldots,x_{31})^T = z_0 \oplus z_1 \oplus z_2 \oplus z_3 = z$$

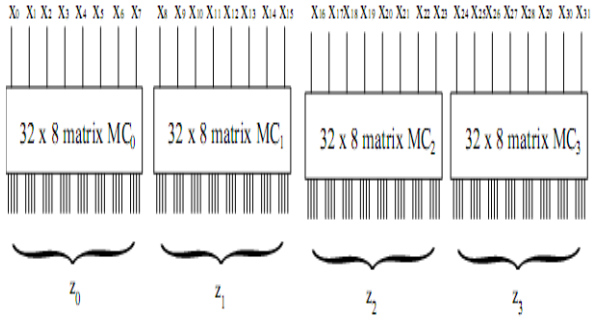

Fig. 1: MC blocking

The four tables together only cost 4 × 28 × 32 = 32768 bits = 4 KB.

The three xors will be divided into 24 4-bit xors with appropriate concatenation (e.g.((z[0, 0], z[0, 1], z[0, 2], z[0, 3])+(z[1, 0], z[1, 1], z[1, 2], z[1, 3]))k((z[0, 4], z[0, 5], z[0, 6], z[0, 7])+(z[1, 4], z[1, 5], z[1, 6], z[1, 7]))k . . .). By using these strips and subdivided xors, each step is represented by a small lookup table. In particular, for i = 0, . . . , 3 the zi are computed using 8 × 32 tables, while the 4-bit xors become 24 8 × 4 tables. Input decodings and output encodings are put around the xors. These encodings are randomly chosen non- linear 4 × 4 bijections. The tables are called type IV tables (Figure 2). Type IV tables take as input 4 bits from each of two previous computations. The output encodings of those computations are matched with the input decodings for the type IV tables to undo each other. The choice for 4 × 4 non-linear bijections depended on the size of the tables. In this situation a type IV table is only 28 × 4 = 128 bytes. We need 24 tables which cost together 3 KB. If we did not divide the xors we

would need three xor tables which computed 32-bit xors. Ons such a table would cost 224 KB. This is way large to store.

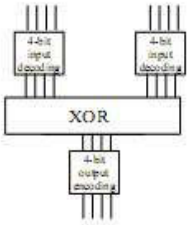

Fig. 2 : Type IV table

The T-boxes and the 8 × 32 tables could be represented as separate lookup tables. Instead, we compose them creating new 8×32 tables computing the SubBytes and AddRoundKey transformations as well as part of MixColumns. This saves both space (to store the T-boxes) and time (to perform the table lookups).

Before splitting MC into MCi as above, MC will be left-multiplied by a 32 × 32 mixing bijectionMB chosen as a non-singular matrix with 4×4 submatrices of full rank. The use of mixing bijections increases the number of possible constructions for a particular table.

$$MB \circ MC(x_0, \ldots, x_{31})^T =$$
$$MB \circ (MC_0 \| MC_1 \| MC_2 \| MC_3)(x_0, \ldots, x_{31})^T =$$
$$MB \circ MC_0(x_0, \ldots, x_7)^T \oplus \ldots \oplus MB \circ MC_3(x_{24}, \ldots, x_{31})^T$$

We put everything together in an 8 × 32 type II table surrounded by 4 × 4 input decodings and 4 × 4 output encodings (Figure 3). These output encodings and input decodings are non-linea 4 × 4 bijections which must match the input decodings and output encodings of the type IV tables.The type II tables are followed by type IV tables.

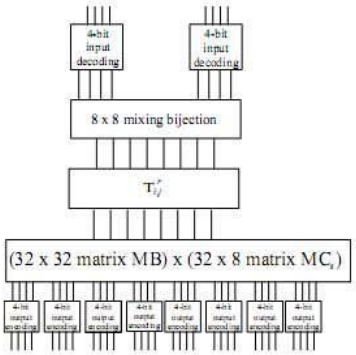

Fig. 3: Type II table

In order to invertMB, an extra set of tables is used for calculatingMB−1. Let (x00, . . . , x031) be the input to MixColumns, and let (z0, . . . , z31) be the output after MixColumns. Let (z0 0, . . . , z031)T be the result after multiplication with MB. (z00, . . . , z031)T serves as input to the type III tables.

$$MB^{-1} \circ MB \circ MC(x_0, \ldots, x_{31})^T =$$
$$MB^{-1} \circ MB(z_0, \ldots, z_{31})^T = MB^{-1}(z'_0, \ldots, z'_{31})^T =$$
$$(MB_0^{-1} \| MB_1^{-1} \| MB_2^{-1} \| MB_3^{-1})(z'_0, \ldots, z'_{31})^T =$$
$$MB_0^{-1}(z'_0, \ldots, z'_7)^T \oplus MB_1^{-1}(z'_8, \ldots, z'_{15})^T \oplus MB_2^{-1}(z'_{16}, \ldots, z'_{23})^T \oplus MB_3^{-1}(z'_{24}, \ldots, z'_{31})^T$$

Note that we ignored the input encodings and the output decodings here. This is done because the input decodings of the type III tables undo the output encodings of the type II tables.In type III tables, MB−1 will be left-multiplied by the inverses of the four input mixing bijections of the next round's type II tables, and split into four 32 × 8 blocks:

$$mb^{-1} \circ (MB_0^{-1}(z'_0, \ldots, z'_7)^T \oplus \ldots \oplus MB_3^{-1}(z'_{24}, \ldots, z'_{31})^T) =$$
$$mb^{-1} \circ MB_0^{-1}(z'_0, \ldots, z'_7)^T \oplus \ldots \oplus mb^{-1} \circ MB_3^{-1}(z'_{24}, \ldots, z'_{31})^T$$

where the mb−1i's are the inverses of the 8 × 8 mixing bijection for the next round's type II tables.We put everything together in an 8 × 32 type III table surrounded by 4 × 4 non-linear input decodings and 4 × 4 non-linear output encodings (Figure 4). These tables are followed by corresponding type IV tables.

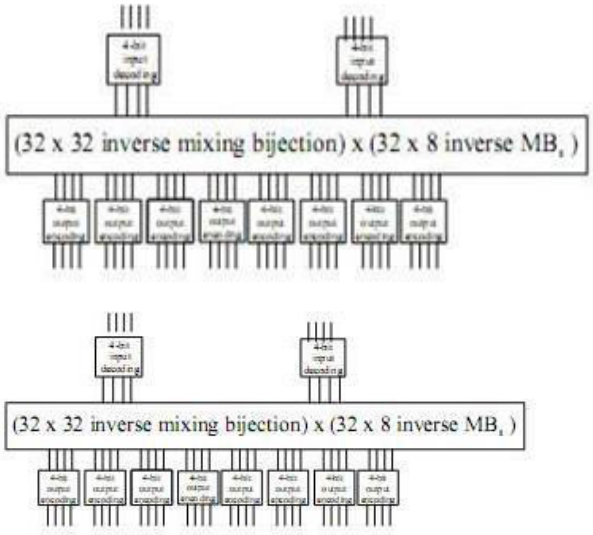

Fig. 4 : Type III Table

In Figure 5. we show what happens in one round of white-box AES for one strip of 32 bits.One

round consists of type II tables plus supporting type IV tables, followed by type III tables plus supporting type IV tables. The type II tables have an input of 8 bits and and output of 32 bits: p[i, 0], . . . , p[i, 31]) for i ∈ 0, . . . , 3. The type III tables have an input of 8 bits and an output of 32 bits: (q[i, 0], . . . , q[i, 31]) for i ∈ 0, . . . , 3. The bits (q[8i], . . . , q[8i + 7]) serve as input bits for the next round's type II tables for i ∈ 0, . . . , 3.

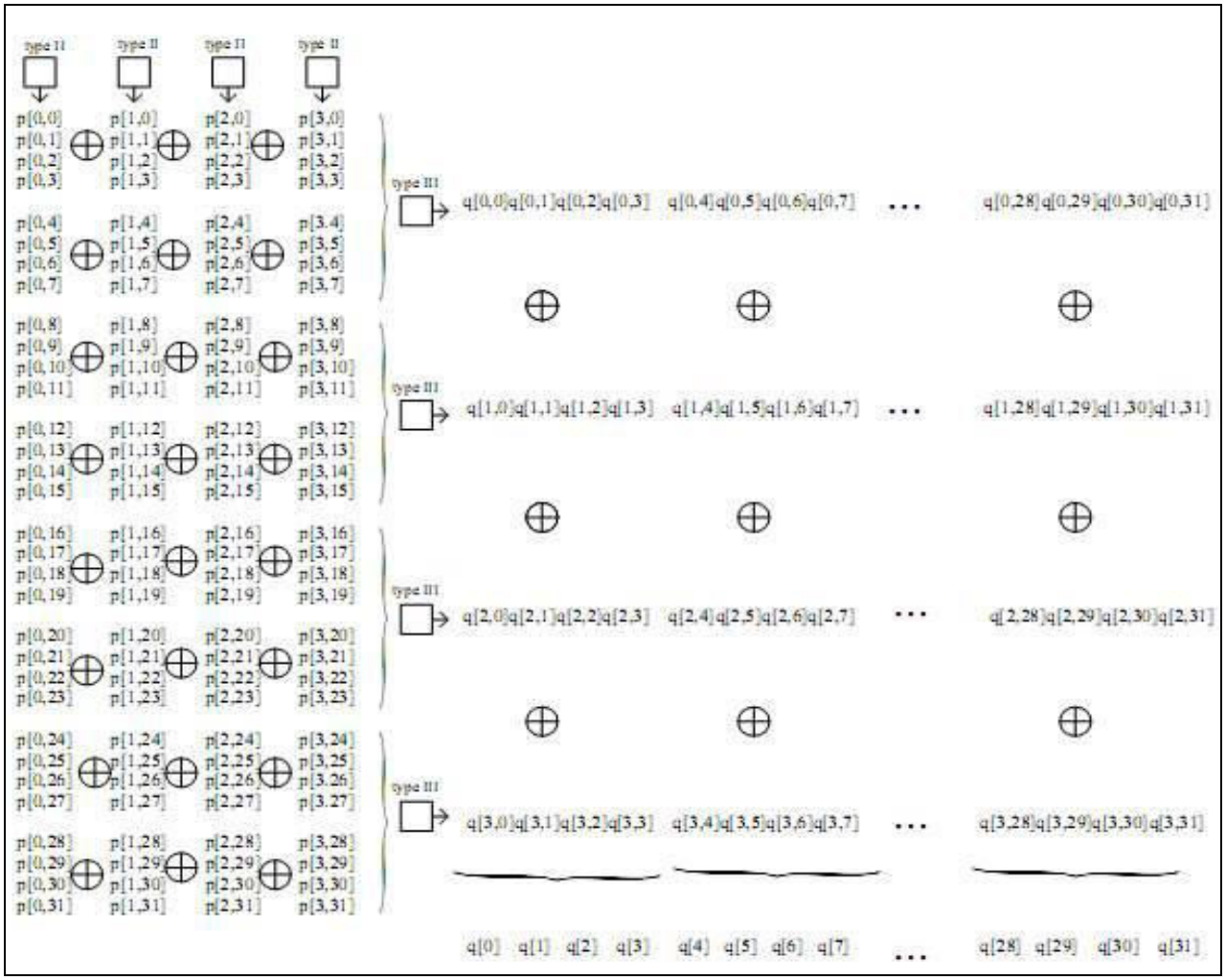

Fig. 5 : Part of the tables for one round

Step 3: Inserting External Encodings

Two encodings F−1 and G are put around the white-box implementation. These encodings are called the external encodings. F−1 is composed of non-linear input decodings and a linear bijection U−1. G is composed of a linear bijection V and non-linear output encodings.

The mixing bijections U−1 and V are randomly chosen as 128 × 128 linear bijections which consist of 1024 4×4 submatrices of full rank. U−1 is inserted prior to the first AES AddRoundKey operation. To undo the 8 × 8 mixing bijections for T1, U−1 will be left multiplied by the inverted input mixing bijections for T1. The result is split into 128 × 8 strips, and is followed by 4-bit to 4-bit non-linear input decodings and output encodings (Figure 6). These output encodings have to be decoded, xored together and reencoded to complete the implementation. The output encodings of the last stage of type IV tables supporting U−1invert the input decodings of the type II tables for round 1.

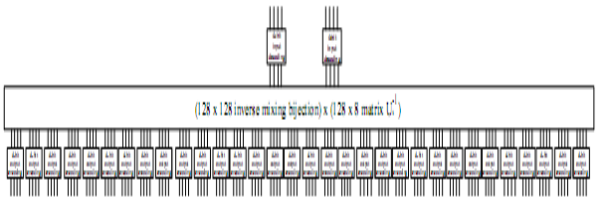

Fig. 6: Type Ia table

V is inserted after the last AES AddRoundKey operation. V is split into 128 × 8 strips and is followed by 4-bit to 4-bit non-linear input decodings and output encodings (Figure 7).

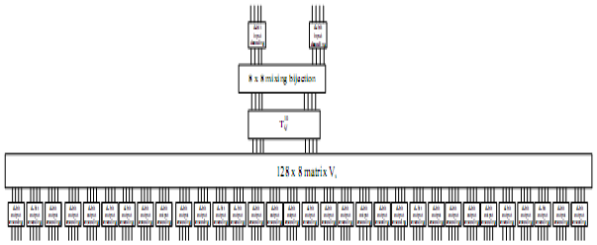

Fig. 7 : Type Ib table

B. See Appendix A for an overview of the white-box tables, and Appendix B for an overview of how the white-box tables are connected.

Security in transparent cryptography

As with the different obfuscation techniques, it is difficult to claim something about the security.However, it is possible to count the number of different possibilities for the tables of each type. This enables us to say something about the possibility of a brute force attack. We start by giving the number of different possible tables without looking at the underlying structure.

The type Ia tables and the type Ib tables have an input of 8 bits and an output of 128 bits. This means that an upper bound for the number of possibilities for those tables is: 228×128 = 232768. The type II tables and the type III tables have an input of 8 bits and an output of 32 bits. An upper bound for the number of different tables is 228×32 = 28192. The type IV tables have an input of 8 bits and an output of 4 bits. The upper bound for the number of possibilities for those tables is 228*4 = 21024. We have 16 type Ia tables, 16 type Ib tables, 144 type II tables, 144 type III tables, 2688 type IV tables, and 16 type Ib tables. The total complexity becomes: (232768)32 × (28192)288 × (21024)2688 = 26160384. This is much too high for a brute force attack to be effective. However, if we look at the underlying structure, the actual number of different tables can be much lower.

CONCLUSION

White-box cryptography can be used for hiding keys in an untrusted host environment. The resultis a functionally equivalent program in which the key is no longer visible. This prevents malignant people for finding their own keys and distributing those keys. The advantage of distributing keys compared to distributing content is that keys are usually much smaller than content and they can be distributed more easily.

White-box cryptography also has some drawbacks. By using white-box cryptography more memory is needed and it causes a slowdown of the program. Whenever a key needs to be updated, the whole set of white-box tables needs to be updated too. This can be a problem if the amount of storage space is limited. Another drawback is that the whole white-box implementation can be used as a key. Moreover, the lack of both security metrics and security proof is also a drawback. More research is needed on this area.Recently, an attack on the described white-box AES implementation was published in [4] by Billet et al.. They explain a technique for obtaining the key from the lookup tables.

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Automatic Navigation and Optimization of Robot using Optical Character Recognition Without Human Intervention

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Abstract - In this paper text detection and recognition features with the help of a technique optical character recognition an attempt is made for a robot to navigate automatically by itself. In General, consider places such as the office environments, Hospitals, museums we can find labels such as directions to proper locations, room numbers, symbols to help navigation in the entire building. Deploying such a system get the results is not an easy job because there is always exists difficulty in reading text from non-document images. Despite these difficulties we present a way to help navigate a robot module to navigate using the concept of neural networkto create highly usable results. This enables robot module to navigate precisely to its destination

Keywords - *Image Processing, optical character Recognition, Autonavigation.*

I. INTRODUCTION

Autonomous navigation is an essential prerequisite for successful service robots. In contexts such as homes and offices, places are often identified by text on signs Posted throughout the environment, such as room numbers or the names of people that work in a particular office or cubicle. Unfortunately, robotic mapping systems do not presently capture this information and thus are unable to take instructions from users that refer to these places [1] by their names (e.g., “Room 120” or “John Smith’s office”).

But by using the concept of the OCR, textual data can be extracted from the image and navigate the robot to particular place. Landmarks such as door signs make labeling particularly easy, as the appropriate label can be read directly from the landmark using optical character Recognition (OCR), without the need for human assistance.

Basically, there are three types of OCR. Offline Handwritten Text where the text produced by a person by writing with a pen/ pencil on a paper medium and which is then scanned into digital format using scanner is called Offline Handwritten Text. Next one is Online Handwritten Text [2] where the online handwritten text is the one written directly on a digitizing tablet using stylus. The output is a sequence of x-y coordinates that express pen position as well as other information such as pressure (exerted by the writer) and speed of writing. Finally the Machine Printed Text where the Machine printed text can be found commonly in daily use. It is produced by offset processes, such as laser, inkjet and many more.

II. CURRENT STATE OF OCR TECHNOLOGY

The accurate recognition of Latin-script, typewritten text is now considered largely a solved problem. Typical accuracy rates exceed 99%, although certain applications demanding even higher accuracy require human review for errors. Other areas—including recognition of hand printing, cursive handwriting, and printed text in other scripts (especially those with a very large number of characters)--are still the subject of active research.

Optical Character Recognition (OCR) is sometimes confused with *on-line* character recognition. OCR is an instance of off-line character recognition, where the system recognizes the fixed *static shape* of the character, while on-line character recognition instead recognizes the dynamic motion during handwriting.

Recognition of cursive text is an active area of research [1], with recognition rates even lower than that of hand-printed text. Higher rates of recognition of general cursive script will likely not be possible without the use of contextual or grammatical information. For example, recognizing entire words from a dictionary is easier than trying to parse individual characters from script. Reading the *Amount* line of a cheque (which is

always a written-out number) is an example where using a smaller dictionary can increase recognition rates greatly. Knowledge of the grammar of the language being scanned can also help determine if a word is likely to be a verb or a noun, for example, allowing greater accuracy. The shapes of individual cursive characters [2] themselves simply do not contain enough information to recognize all handwritten cursive script accurately (greater than 98%).

It is necessary to understand that OCR technology is a basic technology also used in advanced scanning applications. Due to this, an advanced scanning solution can be unique and patented and not easily copied despite being based on this basic OCR technology.

For more complex recognition problems, intelligent character recognition systems are generally used, as artificial neural networks can be made indifferent to both affine and non-linear transformations.

III. EXISTING METHOD

Service robots need to have maps that support their tasks. Traditional robot mapping solutions are well-suited to supporting navigation and obstacle avoidance tasks by representing occupancy information. However, it can be difficult to enable higher-level understanding of the world's structure using occupancy-based mapping solutions. One of the most important competencies for a service robot [1] is to be able to accept commands from a human user. Many such commands [2] will include instructions that reference objects, structures, or places, so our mapping system should be designed with this in mind.

IV. PROPOSED METHOD

This system that allows a robot to discover names automatically by detecting and reading textual information in signs located (Instruction board) around a building by using OCR. Here text-extraction component developed is a valuable addition to the usual mapping pipeline commonly used on mobile robots. In particular, our system allows the robot to identify named locations throughout the building with high reliability, allowing it to satisfy requests from a user that refer to these places by name. Just remember that OCR (optical character recognition) is, as of now, an inexact science and you won't get flawless transcription in all cases.

V. ALGORITHM

The basic steps involved in OCR [6] are mentioned in figure:

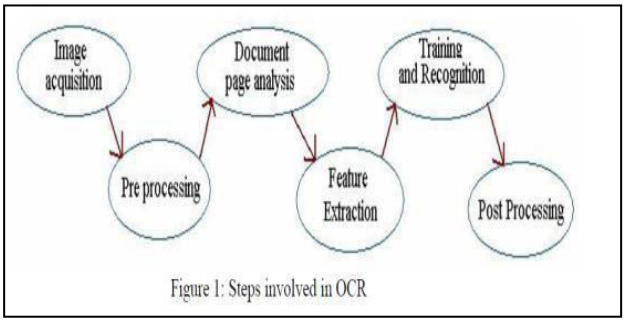

Figure 1: Steps involved in OCR

The Character recognition of Kohonen Neural Network [7] is as follows:

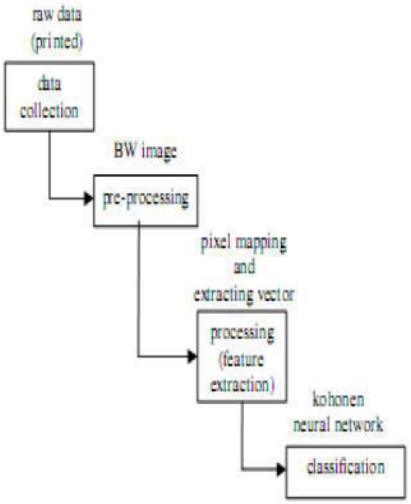

Figure 2: Character Recognition Procedure using Kohonen Neural Network

VI. WORKING

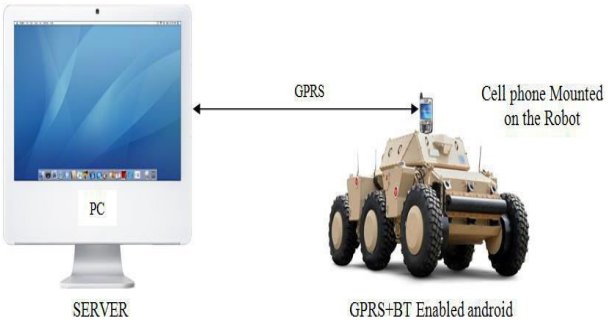

Fig. 3: Working model of the Navigation of robot

a. Detection

The output from the mapping module includes a set of images that need to be scanned for text. A Significant body of work focuses on detecting text in natural scenes and video-frames. In this work, logistic regression classifier [4] that uses a variety of text features; our system computes a set of features known to be

associated with the presence of text. The features are computed in 10x10 pixel windows (each 3 pixels apart) across the entire image, yielding a vector of features for each 10x10 patch. These feature vectors are then used as input to the classifier. Several text features from the text detection literature: Local variance, local edge density, and horizontal and

Vertical edge strength. The features provided to our classifier are the given this set of features and a hand-labeled training set, training a logistic regression classifier to distinguish between text [5] and non-text image patches. For each 10x10 window, this classifier outputs the probability that the region contains text. Running this classifier across an image and thresholding yields a binary image where the positive-valued pixels represent regions identified as likely to contain text. These pixels are then grouped together into connected components. We reject regions whose areas are less than a predefined threshold

b. Recognition

The text detection module outputs a set of image regions believed to contain textual information. The next step is to extract text strings from these regions. Binarization of the image and then pass its output to an off-the-shelf OCR engine. In our experiments we use the freely available Tesseract engine [8]. Given a candidate image region containing text, it is usually possible to separate the text from the background using a simple constant threshold across the image. This is because signs intended for humans are generally monotone text on monotone backgrounds (as opposed to posters and stylized logos). Due to lighting conditions and variation in color choices, however, a fixed binarization threshold for all regions often yields poor results that confuse the OCR Engine. Instead, computation multiple candidate binarizations (nine in our experiments) and run the OCR engine on each [3]. We then choose to keep the resulting text string whose

Confidence score (output by Tesseract) is highest. Testing the performance of our text recognition module using two datasets. The first is a dataset of our own construction consisting of images of hand-cropped text from a wide variety of nameplates Note that the latter dataset contains script, handwritten, and other non-standard text styles which make no explicit effort to handle.

This project provides the way to navigate the robot without any human intervention. A robot serves the purpose here. Mount the camera on the robot. The communication between the robot and the PC is thru GPRS. So, distance between the control unit and the robot does not matter and between cell phone and robot through Bluetooth.

Java Application running at the server side and Android application in mobile. At the source point cell phone will take the snap of the Instruction board then this image will be sent to sever. The server will process this image by OCR and decides the path. Instructions regarding the path will be sent to mobile through GPRS, the mobile intern will send this data to Robot through Bluetooth. Micro controller reads this data and navigates the robot to particular destination. Once the destination is reached it sends back confirmation to server.

Fig. 4 : Text extraction

VII. GREY SCALE CONVERTION FROM THE COLOURED IMAGE [4]

First we perform the pre-processing in the beginning stage and we convert the RGB image into grey scale .

VIII. BINARY IMAGE CONVERTION DONE FROM GREY SCALE [4]

Binary level with Histogram eith two level histogram is done from the binary image then we perform the feature extraction and apply the concept of Neural network get the final image

IX. USES OF OCR

Optical Character Recognition is used to convert different types of documents, such as scanned paper documents, PDF files or images captured by a digital camera into editable and searchable data, navigating the robot automatically.

X. PITFALLS OF OCR

It only works on certain font size and they are difficulty in making it functional for all font sizes. There is also possibility of losing certain pixels. It becomes difficult in scanning the documents with lot of boxes.

XI. CONCLUSION

Our system allows the robot to identify named locations and texts automatically in places such as Hospitals, museums where there are labels such as directions to proper locations, room numbers, symbols to help navigate with high reliability, allowing it to satisfy requests from a user that refer to these places by name. This system becomes highly useful in carrying navigation activities where there is a threat to human life such as military missions thus auto navigation becomes highly useful

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Improved Architecture for Maximizing System Lifetime of Wireless Sensor Network using Clustering Algorithm

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Abstract - Real time implementation of Ad-hoc Wireless Sensor Network has increased with great potential. Application areas of WSN's are military warfare, disaster management, battle field, forest fire detection and other several monitoring area. Key challenge in WSN is to minimize the use of limited battery resources. Several energy efficient routing algorithms have been proposed till date. LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering protocol that divides the network into logical clusters and keeps rotating the cluster head selection to send data to sink. In this paper we propose a new technique of cluster formation based on organizational setup structure. New Network structure proposed will show an efficient increase in minimizing the node energy dissipation of signal transmission and will lead to maximize the system lifetime. We also propose a mix of Round-Robin algorithm into the cluster head selection for data transmission to base station. We compare the newly proposed clustering algorithm with the traditional LEACH algorithm.

Keywords - *LEACH, Clustering, Cluster Head (CH), Round-Robin algorithm, residual energy.*

I. INTRODUCTION

An Ad hoc network has a characteristic of non central administration network in which all nodes function as routers or user and self-organize to form a dynamic network. Basic part of a Wireless ad-hoc sensor network consist of sensor nodes which may be installed in remote areas for sensing and collecting the information from places which are not easy in reach by human being. Micro Electronic Mechanical Systems (MEMS) and wireless communication have emphasized on the development of tiny, low-cost, low-power and multi functional smart sensors. These smart sensor nodes are deployed in several areas for monitoring purpose for example sensor nodes have huge application in military area for battled surveillance, may be deployed in border areas or hilly regions to monitor any unwanted physical activity or any disastrous natural phenomenon, in traffic control to detect presence of high speed vehicle, in security systems to detect any unwanted motion. Sensor networks also have environmental application like forest fire detection, green house monitoring, landslide detection, flood detection. Key challenge in wireless sensor network is to minimize the power dissipation of the battery as it could be impossible or inconvenient to recharge the battery, because nodes may be deployed in a hostile or unpractical environment. Various routing algorithms have been proposed with a motive to maximize the system lifetime some of them are Minimum total energy routing (MTE), minimum hop routing (MH), Minimum residual energy path routing [1], flow redirection algorithm (FR) [2], flow augmentation algorithm (FA) [3], etc. Some of the examples of Hierarchical routing algorithms are LEACH [4] (Low-Energy Adaptive Clustering Hierarchy), HEED [5] (hybrid energy efficient distributed clustering), EEDC (Dynamic clustering and energy efficient routing), etc. In our algorithm we use the concept of clustering the whole sensor network into three different levels based on function of minimum residual energy, after selection of cluster heads at different level we manage the round robin scheduling between the cluster heads at their own level for transmission of data from lower level cluster head to the upper cluster head or to base station.

The rest of the paper is organized as follows. In section 2, we review the existing LEACH routing protocol, in section 3, we review the related work over LEACH. In section 4, we discuss the newly designed architecture using clustering algorithm proposed by us.

II. OVERVIEW OF LEACH

In [4], communication protocol based on Low Energy Adaptive Clustering Hierarchy (LEACH) is first proposed by MIT's Heinzelman, Chandrakasan & Balakrishnan designed for wireless sensor network. LEACH is a self-organizing, adaptive clustering protocol

that uses randomization to distribute the energy load evenly among the sensors in the network. If the process of cluster head selection was static and fixed throughout the system lifetime, then it is easy to see that the unlucky sensors chosen to be cluster head would die quickly, ending the useful lifetime of all nodes belonging to that cluster. Thus LEACH includes randomized rotation of the high-energy cluster-head position such that it rotates among the various sensors in order to not drain the battery of a single sensor. A LEACH protocol runs several rounds where each round consists of two phases: Set-up Phase and Steady state Phase.

In set-up phase clusters are organized and selection of cluster head was done, followed by the steady state phase in which schedule for communication with the cluster head was created and data transmission to the base station will takes place. In order to minimize the routing overhead of broadcasting request messages steady state phase is longer than setup phase. Set-up phase consist of: Advertisement phase and Cluster setup phase.

Advertisement Phase: Initially all the sensor nodes are randomly deployed in the network. Now nodes have the turn to decide whether it will become the cluster head for that particular round or not. A random number will be generated by each node between 0 to 1. If the number generated is less than a threshold value (T_n) then the node will become a cluster head in that particular round. The Threshold value may be calculated as:

$$T(n) = \begin{cases} \frac{p}{1-p*\left(r*\mathrm{mod}\frac{1}{p}\right)} & n \in G \\ 0 & n \notin G \end{cases}$$

where p is the desired percentage of cluster heads, r is the current round, and G is the set of nodes that have not been cluster-heads in the last 1/p rounds. Each node that has elected itself a cluster-head for the current round broadcasts an advertisement message to the rest of the nodes. For CH_ADV_MSG, the cluster-heads use a CSMA MAC protocol, and all the cluster-heads transmit their adv_msg using the same transmit energy. The leaf nodes must keep sensing the messages during the setup phase to hear the advertisement. After this phase completed, each non-cluster-head node decides to join the cluster head to which it belong for this round.

A. Cluster Setup Phase:

Leaf node will sense the adv_msg from the cluster head nodes and will decide to become the member on the basis of received signal strength of message. Node receiving the adv_msg from largest signal strength will become the cluster member under that particular cluster. After the decision made by the leaf node to become the member of cluster, each node will send information back to the cluster head using CSMA MAC protocol.

B. Steady state phase:

This phase involves two rounds schedule creation and data transmission. In schedule creation phase the cluster head will create a schedule for data transmission for all their leaf nodes based on TDMA scheduling. This schedule will be then broadcast back to leaf nodes. In data transmission phase, leaf node or non-cluster head member will transmit the data to cluster head in particular time slot allotted to them. After a certain time interval which is decided earlier, the next round starts for selection of new cluster head.

Limitations of LEACH Protocol:

Cluster head selection criteria in LEACH are random and depend upon some probability instead of minimum residual energy of node or any cost function or path function i.e. distances between the node and the base station or sink node.

III. RELATED WORK

A lot of routing protocols have been proposed to prolong the lifetime of WSN by making some improvement in cluster head selection criteria and cluster formation process. In order to overcome the shortcomings of LEACH, Heinzelman presents LEACH-C protocol. LEACH-C (LEACH-Centralized) is a protocol that uses a centralized clustering algorithm to produce better clusters .This protocol has the same steady-state as LEACH, while it select CHs considering information of node location and energy lever to determine the near-optimal clusters. In [5], nodes belong to the same cluster form a chain, where nodes only communicate with their nearest neighbors. The mechanism is a combination of Leach and PEGASIS but it is only a simple combination and lack of the consideration of the energy consumption of the chain. In [6], Two modified LEACH protocols: energy-LEACH protocol and Multihop-LEACH protocol are presented Energy-LEACH protocol considers residual energy in the phase of cluster head selection. Multihop-LEACH protocol adopts multi-hop communication between cluster and sink. Simulation results show that energy-LEACH and Multihop-LEACH protocols have better performance than LEACH protocol. In [7], partition-based LEACH (pLEACH) algorithm was explained that ensure the consistent number and uniform distribution of cluster heads. The pLEACH algorithm achieve significant improvement in terms of collision in cluster head set-up phase, the variance of residual energy consumption, the number of survival nodes and the

quality of communication. . In [8], Time-based Cluster-Head Selection Algorithm (TB-LEACH) was explained which modifies the cluster-head selection algorithm of LEACH to improve the partition of cluster. In TB-LEACH, competition for cluster-heads (CHs) no longer depends on a random number as in LEACH, and a random time interval instead. Nodes which have the shortest time interval will win the competition and become cluster heads. In order to obtain a constant number of cluster-heads, a counter was set. When the number of the counter has reached specified value, nodes no longer continue competition for cluster-heads.

IV. PROPOSED ARCHITECTURE

In this section, we shall explain our network and assumptions made, which will be used in the simulation section. In the wireless sensor network we assume that a large no of sensor nodes are randomly deployed in the square field to continuously monitor the area. Main assumption of the network is that energy level of battery of all the sensor nodes are known in priori. T(sys) denotes the system lifetime which is equivalent to the lifetime of the node having minimum residual energy E(min) in the whole network. The proposed algorithm also works in two phase: Set-Up Phase and Steady state Phase

Steps involved in Set-Up Phase: The given steps are to be followed in the beginning of each round.

- In our proposed system we divide the whole network into three different levels based upon minimum residual energy of node. The three levels are local cluster level, zonal level, network level. There will be three types of cluster head: local cluster head (LCH), zonal cluster head (ZCH) and network cluster head (NCH). The necessary condition for the given model is given below: E(LCH) < E(ZCH) < E(NCH), E(NCH) = The node having highest residual energy in the network.

- Node having highest value of residual energy level will be selected as Network cluster head (NCH) for that particular round.

- Now network will be divided into four different zones depending upon the geographical location of the sensor nodes as well as node density (assumptions).

- Now node having highest value of residual energy level within that particular zone will be selected as Zonal cluster head (ZCH) also now ZCH will not participate into the cluster formation at lower level.

- At the lowest level logical clusters will be created, where each cluster will have a cluster head and limited no of nodes belongs to that particular cluster. Local cluster head (LCH) selected should have more residual energy as compare to all leaf nodes.

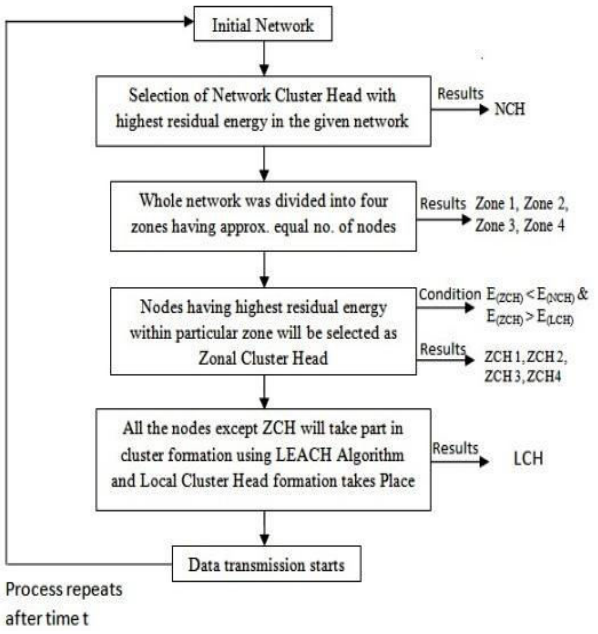

Fig. 1 : Data flow chart

Steps involved in Steady state Phase:

Once the formation of cluster was completed, the process of data sensing and transmission started. Nodes which are deployed in remote areas for some specific purpose will start sensing the information. Now node with in a cluster will transmit the data to its own cluster head, where local cluster head will receive the data from nodes on the basis of TDMA scheduling. Similarly, ZCH will receive the data from all LCH's on the basis of TDMA Again, NCH follow the same process as that of ZCH. NCH will responsible for transmitting data to sink node.

The process of new NCH, ZCH and LCH selection was repeated every time after the completion of time interval decided at the starting of the algorithm.

Also if condition occurs of more than one node having energy value equal to value of cluster head at their level then round-robin scheduling algorithm will takes places so that the load distribution among the nodes having high value of residual energy will takes places and there will be less probability of single node drainage from the system

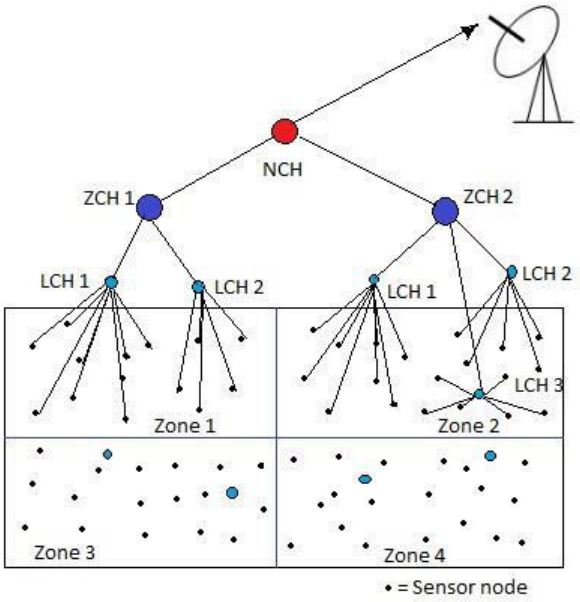

Fig. 2 : 3D Data flow diagram

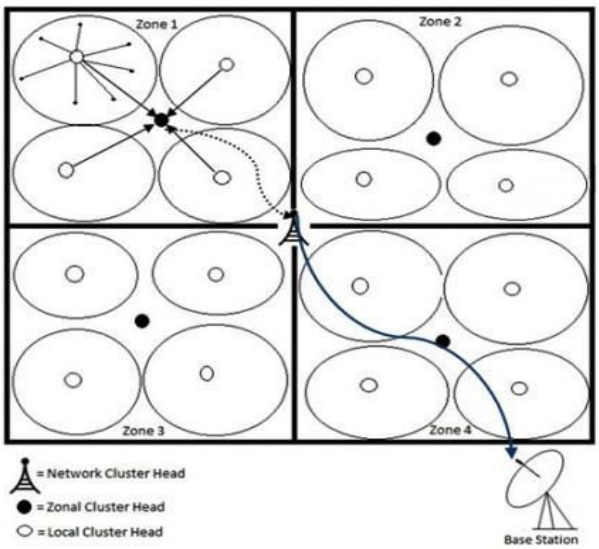

Fig. 3 : Ideal Data flow diagram

Fig 1 shows the step by step data flow chart and fig 3 shows the flow of data step by step from lower level to the upper level.

V. CONCLUSION & FUTURE WORK

A new network model for WSN based on clustering algorithm was proposed which may tends to maximize the system lifetime by minimizing the energy dissipation of nodes for data transmission. This newly proposed algorithm would be compared with the traditional LEACH algorithm and the results would be analyzed. In future, simulation of the proposed architecture on WSN will be performed using ns-3(network simulator version 3) and pros and cons of the algorithm would be analyzed, so that the algorithm may be used for highly scalable network with more reliability and hence overall lifetime of the system increases. In addition encryption can be done during different level of data transmission to make the algorithm more secure and efficient.

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Study and Survey of Security Issues in Cloud Computing

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Abstract - In the recent era of development where the demands of the business and consumers are rising many organizations are forced to adapt or to find a new way to reallocate their resources for the better support, growth and the new technology trends. One such technology which is known for its dynamic scalability, virtualized usage of resources as service through Internet is '**cloud computing'**. Cloud computing is an emerging technology which is used for efficient computing by centralizing storage, memory, processing and all the other fundamental computing resources which results in the reduction of cost. Cloud computing has emerged as a prominent hosting platform that performs an intelligent usage of a collection of services, application, information and infrastructure consisting of pool of different resources.

Today, cloud computing is marketed as one of the cheapest and efficient solutions to replace client/ server technology. This rapid development has gained tremendous popularity for cloud computing technology. In spite of all these advantages, cloud computing has to focus and highlight the new levels of security and privacy for the data.

This paper tries to bring out the various characteristic, advantages and services of cloud computing. It also focuses on the various security threats and challenges of cloud computing and tries to present methods to handle these security challenges.

Keywords - *Organization, cloud computing, resources, characteristic, services, security, challenges.*

I. INTRODUCTION

Cloud computing is a new emerging paradigm of information technology which is been derived for the drawings of Internet [1]. Cloud computing allows the user to access the remote servers which is used to maintain data and application through Internet. It also allows the application to be accessed without their physical installation. Moreover to access the cloud computing technology, user does not require a high knowledge or expertise to control the infrastructure of the cloud.

National Institute of Standards and Technology (NIST) [2], defines cloud computing as "a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (such as networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or cloud provider interaction". It is highly based on the virtualization and distributed computing architecture in which the services can be provided to the user with 'pay as you go' (PAYGO) or service-on-demand strategy.

A. Characteristic of Cloud Computing

Following are the essential characteristic of cloud computing [3] [4];

a. On-demand self service: with very less human intervention user can make use of computing capabilities.
b. Broad-Network Access**:** with the help of Internet technologies and a standard mechanism over the network which allows to access the various capabilities and wide range of devices.
c. Resource Pooling**:** the providers various computing resources are shared across and are transparent to the user.
d. Rapid Elasticity**:** capabilities can be scaled up and down on demand of the user to meet his requirements.
e. Measured Service**:** all the used services and capabilities can be monitored and metered and can be charged depending on their usage.

B. Advantages of Cloud Computing

Following are the major advantages of cloud computing [4] [12];

1. Reduced Cost: since services are used on demand.
2. Portability of Application: users can use the application from anywhere.

3. Location Independent: applications or resources can be accessed from any location.
4. Virtualization: it is defined as decoupling and separation of the business service from the infrastructure needed to run it.
5. Elasticity: it allows allocating and de-allocating of resources on demand.
6. Flexibility to choose vendor: any cloud service provider can be chosen to provide the service.

II. SERVICES

Cloud computing services benefits from economics of scale achieved through versatile use of resource and specialization. There are 3 types of service available [2] [4];

a. Infrastructure-as-a-Service (IaaS)
b. Platform-as-a-Service (PaaS)
c. Software-as-a-Service (SaaS)

Following table shows all the three cloud service features;

	IaaS	PaaS	SaaS
What is it?	Virtual servers and storage are provided through a cloud infrastructure	Pre-configured environment are provided, allowing the user to deploy their own applications.	Software applications are provided through a cloud infrastructure
Exampl	Amazon EC2, Rack space	Force.com, Microsoft Azure	Salesforce.com, Google Apps
Purpose	To avoid purchasing, housing, and managing the basic hardware and software infrastructure components.	To reduce cost and complexity of buying, housing and managing the underlying hardware and software components of the platform	To reduce the total cost of hardware and software development , maintenance and operations.
Risks	Pricing model, potential lock-in, security and privacy, proliferation	Exit strategy, pricing model, upgrade issues	Minimal customization, data integration, security and privacy, no control over upgrades.

Table 1: Cloud services

III. KEY SECURITY THREATS AND ISSUES OF CLOUD COMPUTING

Security and privacy are considered to be the most vital and critical aspect of the information technology. Due to the emergence of cloud computing which is grown out as an amalgamation of various technologies, services, architecture and virtualization a high level of attention is required for the security and privacy of data, since both the user data and program are residing on the provider premises.

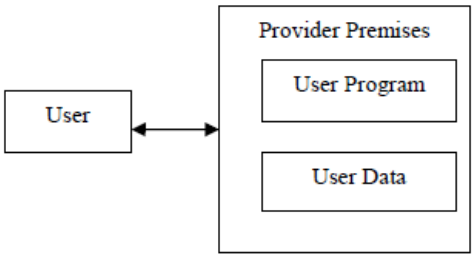

Fig 1: Data Access

Following are the cloud computing security threats and issues [3][13];

1. Abuse and Immoral use of cloud computing: it is one of the major threats to cloud computing, which uses botnets to spread spam, malware, harvesting login credentials, to launch denial of service (DoS) attack against the infrastructure of cloud provider. These type of threats can be reduced by,
   a) Stricter initial investigation and validation process b) Enhanced fraud monitoring and coordination c) Comprehensive introspection of customer network traffic d) Monitoring public blacklist network.
2. Insecure Application Programming Interface (API): applications used by the consumer which interact with various cloud services should be highly secure and authenticated, strong access control and encryption mechanisms should be implemented.
3. Malicious Insider: it is a threat that gains its importance by not revealing the hiring of people, granting access and monitoring them. This threat can be reduced by having,
   a) A good level of transparency b) Enforcement of strong supply chain management and should have a proper assessment of suppliers c) Proper and legal contracts for human resource d) Should follow the proper laws and regulations.
4. Shared Technology Vulnerabilities: since IaaS providers allows the sharing of infrastructure high level of monitoring and compartmentalization should be done so that the consumer does not leave each other territory. These threat can be reduced

by, a) Best security practices for installation and configuration b) Monitor for unauthorized changes and activity c) Should have strong authentication and access control d) Good service level agreement (SLA) should be made e) Regular audits should be carried out.

5. Data Loss or Leakage: this type of threat is creating a major concerns and worries for many organization and business and always has the danger for stealing the data; data can be deleted without proper backups, unauthorized access. These threats can be reduced by,

   a) Encrypting and protecting the integrity of data b) Analyze data protection at both design and run time c) Implementation of strong key generation, storage and management and destruction practices d) Implement strong API access control e) To understand the providers backup and retention strategies.

6. Account, Service and Traffic Hijacking: it is another type of attack where the consumers should be very careful. It ranges from attacks, phishing, spam and denial of service. These type of threats can be reduced by,

   a) Prohibit the sharing of account credentials between user and service b) Implement 2-level authentication if possible c) High level of monitoring to detect the unauthorized access and users d) Develop good SLA and security policies.

7. Unknown Risks: as security is highest priority for the consumer and business, proper log for the use of data should be maintained, should have full description of infrastructure used, regularly monitoring and alerting mechanism should be incorporated.

8. Failures in Provider Security: cloud providers should control the hardware and storage on which the data and application are stored and run. Hence a high level of security is needed while designing the cloud.

9. Legal and Regulatory issues: when the information crosses the border of national or international, many legal and regulatory issues raises the concerns as the information crosses the jurisdiction. Hence a data protection law must be imposed.

10. Infrastructure Security issues: the issues of infrastructure security and cloud computing can be addressed by clearly defining trust boundaries by understanding which party provides which part of security.

11. Identity and Access Management issues: data sensitivity and privacy of information have become increasingly an area of concerns for organization. At the same time unauthorized access to the information and resources in the cloud is also a serious concern. Using cloud based 'Identity-as-a-Service' will help the provider for outsourcing some identity management capabilities and facilitating federated identity management with cloud providers.

12. Privacy issues: it is one of the important aspects for cloud computing in terms of legal compliance and user trust which is used in every phase of design. The key challenges to design cloud services is to reduce the privacy risks and to ensure legal compliance. Privacy can be obtain by,

    a) Minimizing personal information sent to and stored in the cloud b) Protect information in the cloud c) Maximize user control d) Allow user choice e) Specify and limit the purpose of data usage f) Provide regular feedback.

IV. METHODS TO HANDLE SECURITY CHALLENGE

The challenges of cloud computing are very much similar to those of any organization. The cloud providers have internal and external threats that can be eased or accepted.

Following table shows risk and solutions of cloud computing [6];

Risk/ Threats	**Solutions**
Multi-tenancy	Infrastructure / data segregation
Ever-developing risk	Continuous risk assessment program
Relaxation of security	Periodic assessment and audit
Service provider tries	Contract pass-through, coordinated security assessment
Contractor access	Background checks, contracts, segregation, surveillance
Disasters	SLA, multi facility provisioning
External Physical	Secure facility, escort, surveillance
External Logical	IPS, firewall, secure coding, secure architecture, host hardening
Incidents	Facility and per customer, incident response plan
Application bugs	Layered security, patching, secure coding practices, assessments, segregation
Data leakage	Encryption, segregation, assessment, host hardening

Table 2: Risk and Solutions of Cloud Computing

A. Other Solutions for Security Threats

1. Image Management System: Integrity and security of the images are the primary concerns of cloud providers since they are used and shared by many users. It consists of four major components [17];
   a. Access control: it regulates in sharing the image. Each image has a unique owner who can share images with trusted and authorized users by granting them the permission.
   b. Image transformation by running filters: Filters removes all the unwanted information from images during publishing or retrieval time.
   c. Provenance tracking: This mechanism shows the history of images.
   d. Image maintenance: By doing periodic virus scanning can detect and fix virus discovered once the image is published.
2. Client Based Privacy Manager: It helps to reduce the risk of data leakage, loss of sensitive data and provides additional privacy related benefits. Its features are [18];
   a. Beclouding: this feature automatically hides the meaning of the data or field before it is communicated to the cloud.
   b. Preference Setting: this method allows the user to set the preference about handling the personal data which is stored in a cloud in beclouded manner. Hence it allows the greater control over the usage of the data.
   c. Data Access: this method allows an auditing mechanism which will help in detecting the privacy violations.
   d. Feedback: this method tries to manage and display all the feedback of the user regarding the usage of his personal information which is in the cloud.
   e. Personae: this feature allows the user to choose between different personae when interacting with cloud service.
3. Transparent Cloud Protection System (TCPS): this method is continuously monitoring the integrity of the cloud components. It basically focuses on the integrity of the virtual machines and distributed computing devices. It can easily detect any modification made to the information or cloud's integrity. It can also detect any intrusion made by the guest and then notify to the remote security management components [19].
4. Secure and Efficient Access to Outsourced Data: all the data and information which is an important component of cloud computing and which forms the basic foundation for any information system has to be secured before they are outsourced. The consumer of the service stores a large amount of data in the cloud which is accessed by different users all over the network. The unauthorized users can tamper the outsourced data.

   Solution to this problem is [20];
   a) Encryption and decryption method on all the outsourced data.
   b) Block deletion
   c) Block updates
   d) Block insertion and appending

V. CONCLUSION

In today's modern world of innovation technologies are becoming inevitable to satisfy the business requirements and consumer demands. To satisfy all the needs, requirements and to increase the productivity organizations are collaborating, innovating and adapting to new technology trends such as cloud computing. Cloud computing is a way of delivering various computing resource which is still struggling in its infancy. To be competitive and access the latest resources and platforms organization should adapt to the latest trend cloud computing technology.

Since data security and privacy are crucial factors and elements of any organization a detail study and survey of cloud computing regarding its benefits, deficiencies, SLA's and all the other factors should be carried out before making a decision to adapt and implement cloud computing services.

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Role of Metadata in the Datawarehousing Environment

(Life Cycle of Meta Data)

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Abstract - In order for a well functioning data warehouse to succeed many components must work together. Metadata, usually called data about data, is an important part. A more detailed description is that metadata is a documentation, description and explanation about the contents of the data warehouse. Metadata is supposed to be a helping hand to all co- workers in an organization that work directly or indirectly with the data warehouse.

The main purpose of this research is to determine through feedback from the business end users and the other knowledge workers (like data base administrators), if metadata is needed for achieving the data quality, and hence the role of metadata in the data warehousing environment. To answer that question a qualitative survey has been carried out. Two different types of employees from two organizations have been interviewed.

Keywords - *Dataware house, metdatadata quality indicator,*

I. INTRODUCTION

THE LIFE CYCLE OF METADATA

(Data warehouse Practical advice from the experts, Joyce Bischoff, Ted Alexander) There are three stages in metadata life cycle.

1. Collection – in this stage the metadata is identified and captured in the central repository.
2. Maintenance – in this phase the metadata must be kept up to date with the changing data architecture.
3. Deployment – this phase provides metadata to users in the right form and with the right tools.

1. Metadata collection: The metadata that can be useful for a data warehouse spans a wide variety of domains, from physical structure data, to logical model data, to business usage and rules. Each of these types requires its own strategy to collect. Some can be automated to a great degree, while others will involve more manual effort. Four distinct categories of metadata –

Warehouse data sources – the most fundamental types of metadata that can be collected is from the operational systems, external data that available, and the information that is currently maintained manually.

Ex: PC-based spread sheet maintained by the finance department, some purchased sales data acquired from a vendor, and some customer contact logs that are currently maintained on paper by the customer service department.

Even though these data sources are on different platforms and are stored in very different formats, we have a consistent need to understand both the physical structure of the data and the meaning of the data. We need to document what the record structures and discrete data elements are, including specific data types.

Data models – the second type of metadata that plays an important role is data warehousing information about the data models. In designing the data warehouse it is important to understand the logical model that defines the business entities, relationships, and the rules that exist in the operational environment. Usually the enterprise data model is used as starting point for creating the warehouse data model and then modifications and transformations are applied to that model.

An Enterprise Data Model (EDM) represents a single integrated definition of data, unbiased of any system or application. An EDM is a data architectural framework used for integration. It minimizes data redundancy, disparity, and errors; core to data quality, consistency, and accuracy.

Warehouse mappings – the third category of metadata

that must be captured in designing the warehouse is the mapping of operational data into the warehouse data structures. Elements from the operational systems, external data, and other sources are mapped into the warehouse structures. Each time a data element from one of the sources is mapped to the warehouse the logical connection between these data elements and also any transformation or alteration that takes place should be recorded. These mappings can be recorded in a form that is easy to understand for the developers who will implement the mapping and will also be easy to integrate into the metadata store. Often, a spread sheet or any relational database can be used to record these mappings.

Warehouse usage information – this information can be captured only after the warehouse has been rolled out to users. This information is very important for several reasons that include better performance tuning of the warehouse, greater reuse of existing queries, and understanding of how information in the warehouse is being used to solve business problems.

To understand each query executed against the warehouse, one has to depend upon the database monitoring tool to intercept and interpret each query executed. The data from tool is stored in the central metadata store so that it can be analyzed and tracked. And also these queries which are executed can be reused in future. An end user can simply retrieve an existing query and execute it if it meets the requirement or else he can make simple changes to existing query and execute it.

2. Maintaining metadata : after the collection of metadata it has to be maintained to reflect the changes in data. Automation is only the key to maintain the current and high quality information. The best approach for maintaining each type of metadata depends on how it was originally collected, and how often it changes, and the volume of metadata generated.

A high level of automation can be achieved for the physical data that reflects the structure of data sources and of the data warehouse itself.

For the business rule information and data models, the metadata will probably have to be maintained manually. Even with an interface between a CASE tool and the metadata repository, it is probably not desirable to have model changes propagated to the repository automatically.

Data warehouse mapping and transformation information should also be maintained. If the mapping is done with the data warehouse construction tool and there is an interface tool between the tool and the metadata store, then the maintenance of this information is inherent and automatic.

Data warehouse usage information is the final type of information that must be maintained. Since the usage of specific tables and data structures by warehouse queries is dynamic, it should be periodically appended, rather than changing existing information. The periodic addition of information is usually inherent in the tool used to capture database access information. For higher level usage information that specifies the description and business purpose of each query stored in the data warehouse environment a purely manual approach must be taken.

3. Metadata deployment : supplying the right metadata to the right audience is the key to success of the data warehouse initiative. There are distinct groups of people who use metadata, and their needs are different.

Warehouse developers – Warehouse developers require sophisticated access to detailed metadata. The primary forms of metadata that they will use are the physical structure information for the data sources, the enterprise data model, and the warehouse data models. They use the information about the data sources to perform analysis and to map those sources to the warehouse.

Developers are primarily concerned with the accuracy and the completeness of the metadata that they use.

Maintaining the warehouse – If the structure of an application database is being changed, the warehouse team needs to respond to that change. Warehouse data structures may have to be changed. Data marts may have to be altered. End-user queries may have to be rewritten. Using the metadata the maintenance team could perform relevant operations accordingly.End users – Without proper metadata in easy to access format, end users cannot explore the warehouse, create queries, and correctly interpret the data they find in the warehouse. Users of the warehouse are primarily concerned with two types of metadata. The first type tells them what is in the warehouse and the where it came from. That is., they want to be able to see an inventory of the warehouse by subject area or high level topic. Then they want to select a table or an element and be presented with its full definition, business meaning, valid values, and usage rules. They also want to see, at high level, the sources of data. The second type of the metadata that is critical to end-users is information about what queries already exist that they might reuse. If users identify a table that they wish to query then they should be able to view a list

of queries that access that table, along with descriptions of those queries. If the existing queries can meet the requirements of the userthen they can reuse the queries instead of starting from scratch. There are number of indicators of data quality.

(Data warehouse Practical advice from the experts, Joyce Bischoff, Ted Alexander).

1. The data is accurate – Data accuracy confirms to the correctness of the data. For example the customer name is spelt correctly and the address is correct. If the marketing department does not have the correct profile for the customer, marketing will attempt to sell the customer the wrong products and present a disorganized image of the organization. When the data on the company vehicle is entered in to the system, it may be valid (a vehicle number that is in the database), but it may be inaccurate (the wrong vehicle number).

2. The data is stored according to data type –

If the field of the data is given as a type (integer or character) the entered values should be of the same type.

3. The data has integrity –

Referential integrity rules will be properly defined in the logical data models and implemented in the physical data models. The data will not be accidentally destroyed or altered.

4. The data is consistent –

This allows for data to be integrated and shared by the multiple departments across multiple applications and multiple platforms.

5. The databases are well designed –

It performs satisfactorily for intended applications, it is extendible and exploits the integrity capabilities if the DBMS.

6. The data is not redundant –

No organization has ever totally eliminated redundant data. The data redundancy should be intentional in the data warehouse. The redundant data to be minimized is the following data-The creator of the data is unaware of existence of such data.

The redundant data is created, as the available data is unacceptable to the new system.

The owner of the primary data would not allow the new developer to view or update the data.

Lack of control mechanism for data update indicated the need for a new version of the data.

The lack of security controls dictated the need for the redundant subsets of the primary data.

7 . The data is well understood –

It does no good to have accurate and timely data if the users do not know what they mean. Naming standards are a necessary condition for well-understood data.

8. The data is integrated –

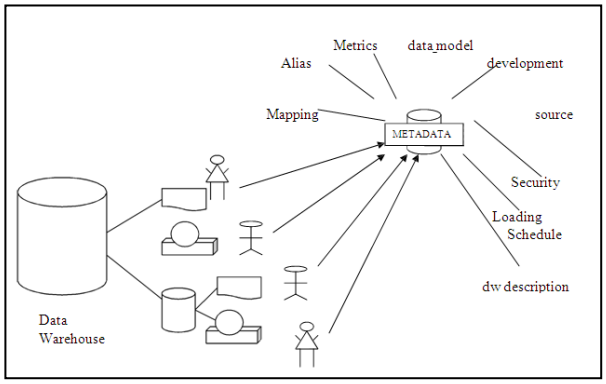
Database integration requires the knowledge of the characteristics of the data, what that means, and where the data resides. This information would be kept in the data dictionary/repository.

9. The data is timely –

Timeliness is subjective and can only be determined by the users of the data. The users will specify that monthly, weekly, daily, or real-time data is required.

The end User and MetaData:

As the main aim of data warehouse is to serve the DSS (Decision Support System) analyst or end user in making right decisions in the business operations. In order to access the data from the data warehouse this end user required to know what data is available and where is this data available in the data warehouse. At this point of view metadata is much useful in accessing the data warehouse and so in making business decisions.



There is a wide variety of metadata that needs to be available to the end user analyst. Some of the important components of the data warehouse metadata are (Using the data warehouse - W. H. Inmon) –

The source of the data in the data warehouse – the identification of "the system of record" : Knowing what the original, unintegrated operational systems are for the tables in the data warehouse is very useful when the source of data for the data warehouse is called into question.

The transformation that has occurred from the time the resided in the unintegrated, operational environment until the data arrived in the data warehouse : In some cases, very little is done to the data as it passes into the warehouse; in other cases much processing is done. In order to the end user to understand what data really represents and what the best source for analysis in the data warehouse is, transformation data is needed.

The actual description of data in the data warehouse : This is the simplest of the data metadata requirements. The end user needs to know what tables are available, and what fields are in the tables, the descriptive information about the fields, and the physical characteristics of the fields in order to formulate the requests.

"Versioning" to the storage of the essential metadata over time : From January to February there may be one source of data for a table, but in March the source may have changed. Since data is stored in the data warehouse continuously, there is a need to keep track of metadata overtime. In other words, in order to do effective analysis, the end user needs to know that at one point in time there was one source of data and at another point in time there was another source of data for the same table in the data warehouse.

Data model information : the data model is useful to the end user analyst in that it provides a high level road map for finding out what data is in the warehouse. The linkage of the data model and the tables of the data warehouse can be very important in the strategic usage of the data in the data warehouse.

Development : the data warehouse is in the constant state of development. Keeping track of what has been implemented and what is in the works is important to the end user analyst.

Security : data warehouse requires a more fundamental level of security than other forms of databases. The end user analyst needs some indication of what data is protected and where to look if access to protected data is required.Loading schedule: while accessing data is important, the end user also needs to know when the data was last refreshed (last night, today, or last month?).

Basic components:

The basic components of the data warehouse metadata include the tables that are contained in the warehouse, the keys of those tables, and the attributes.

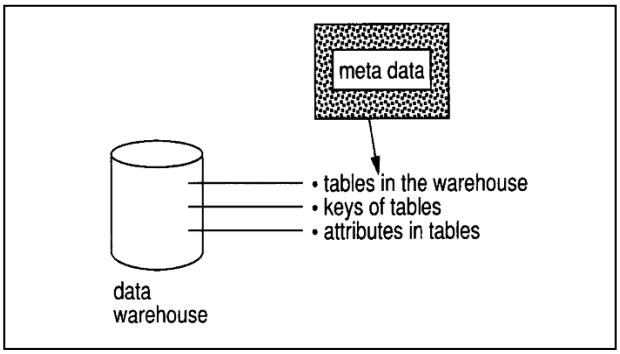


Figure 6: The simplest components of meta data in the warehouse.

The basic components of the data warehouse contain information of the tables in the data warehouse, the keys of those tables and the attributes. If any of the information about the tables, keys and attributes of those tables are given wrong in the data warehouse metadata then the end user who access the information encounter some invalid data which is data accuracy problem.

Mapping information:

When the data flows from the operational environment to the data warehouse some information is stored in the data warehouse metadata store. Like, identification of source fields, attribute conversions, physical characteristic conversions, encoding/reference table conversions, naming changes, key changes, information about multiple sources etc.

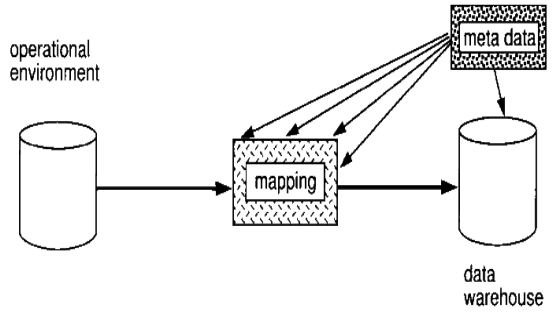


Figure 3: The mapping between the two environments is extremely important.

(White paper METADATA IN THE DATA WAREHOUSE BY W.H.Inmon)

Figure 2.4

The mapping information like identification of source fields, attribute conversions, physical characteristic conversions, encoding\reference table conversions, naming changes, key changes, information about multiple sources etc. is stored in the data warehouse metadata store.

If any of the mapping information are given wrong in the data warehouse metadata store then the end user who access the information encounter some invalid data, wrong data which are data accuracy, data consistency problems

Extract history:

Using this information an end user analyst can know when the particular data is entered the warehouse and when the data in the warehouse was refreshed last time.

If the extract history information is wrongly stored or not updated then the end user encounter wrong data which is data accuracy problem.

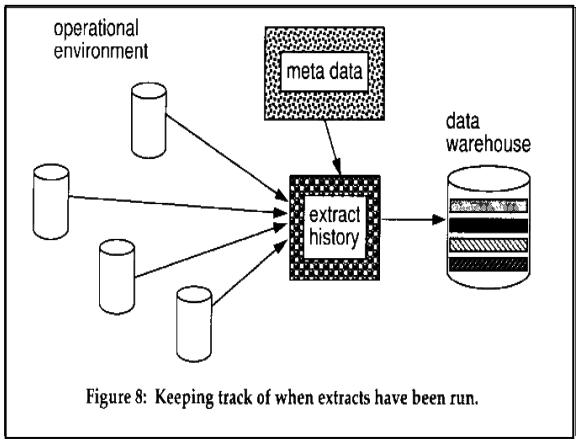


Figure 8: Keeping track of when extracts have been run.

(White paper METADATA IN THE DATA WAREHOUSE BY W.H.Inmon)***Figure 2.5***

Alias information:

Alias information is an attribute and key information that allows for alternative names. In some cases one department names for data have been entered into the warehouse, and another department would like to have their names for the data imposed. Alias' are a good way to resolve these issues.

Status information : in some cases a data warehouse table is undergoing design. In other cases the table is inactive or may contain misleading data. The existence of a status field is a good way to resolve these differences.

Volumetric information : Volumetric information is measurements about data in the data warehouse, i.e, number of rows in a table, the growth rate of the table, the statistical profile of the table, the usage characteristics of the table, indexing for the table and its structure, the byte specification for the table etc.

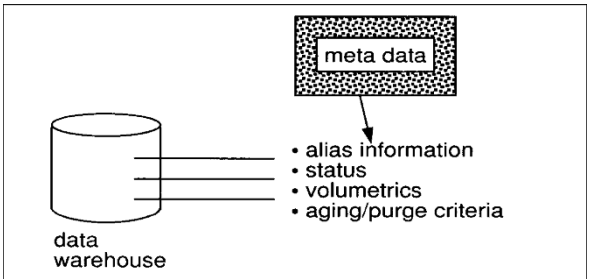


Figure 9: Other useful meta data.

These data retrieval errors are mapped to the data quality indicators like data accuracy, data consistency, and the data timeliness. To do this we have come up with the following hypothesis in the form of a table shown below.

Data quality / Metadata	Data accuracy	Data Consistency	Data Timeliness
Basic components	***X***	***X***	-
Mapping information	***X***	***X***	-
Extract history	***X***	-	-
Versioning	***X***	-	***X***

In the above table shows the dependency of data quality indicators on the particular metadata. Here 'X' denotes the dependency and the '-'denotes that particular situation is "not applicable".So according to our hypothesis –

I. Data accuracy depends upon the all the metadata shown in the table. That is., it depends on the basic components (the tables that are contained in the warehouse, the keys of those tables, and the attributes), mapping information, extract historyand the versioning.

i. Basic components : basic components of the data warehouse are the tables that are contained in the data warehouse, the keys of those tables and the attributes. If these components are defined wrong or altered the retrieved data may not be correct. So the data accuracy is not maintained.

ii. Mapping information : mapping information is stored in the metadata store contains identification of source fields, attribute conversions, physical characteristic conversions, encoding/reference table conversions, naming changes, key changes, information about multiple sources etc. if this information is mismanaged or wrong then the end

user can not trace the source correctly. And also the retrieval data may be erroneous. So the data accuracy is not maintained.

iii. Extract history : Using this information an end user analyst can know when the particular data is entered the warehouse and when the data in the warehouse was refreshed last time. If this information is not updated the end user may not know the details of the data correctly, so retrieved data may not be accurate.

iv. Versioning : In order to do effective analysis, the end user needs to know that at one point in time there was one source of data and at another point in time there was another source of data for the same table in the data warehouse. So versioning metadata tell the end user about the source of data overtime. If this is defined wrong by the definition of versioning the analyst can not be able to do effective analysis. In other words, retrieved data is not accurate, is the data accuracy problem.

II. Data consistency depends upon the basic components and data mapping metadata.

i. Basic components: basic components of the data warehouse are the tables that are contained in the data warehouse, the keys of those tables and the attributes. If these components are not updated properly data retrieved from the different departments of the organization may not be the same. This is thedata consistency problem

Mapping information: mapping information is stored in the metadata store contains identification of source fields, attribute conversions, physical characteristic conversions, encoding/reference table conversions, naming changes, key changes, information about multiple sources etc. if this information is not managed properly the data retrieved from different departments of the organization may yield different data. So the data may not be consistent.

III. Data timeliness depends upon the versioning metadata as this metadata keeps track of the change of data source overtime.

i. Versioning: From January to February there may be one source of data for a table, but in March the source may have changed. Since data is stored in the data warehouse continuously, there is a need to keep track of metadata overtime. If this versioning metadata is not updated or managed properly the end user analyst can not make the efficient analysis of the retrieved data. That in turn results in the remake of the whole analysis from the scratch which is the data timeliness problem.

CONCLUSION

In this chapter we give our conclusion to the question this master thesis seek to address

The main purpose of this research is to determine through feedback from the business end users and the other knowledge workers (like data base administrators), if metadata is needed for achieving the data quality.

Research Question:

The aim of this chapter is to find the answer to our research question ***"What will be the impact of metadata on the data quality in the data warehousing environment?"***

To answer this we redesign and examine the data quality-metadata table (from the frame of reference) according to the empirical findings.

Data quality Metadata	Data accuracy	Data Consistency	Data Timeliness
Basic components	***X***	**-**	**-**
Mapping information	***X***	**-**	**-**
Extract history	***X***	**-**	**-**
Versioning	***X***	**-**	**-**

As shown in above table the data quality indicator "data accuracy" depends upon the all the metadata like basic components, mapping information, extract history, and versioning. And the other data quality indicators may not depend upon the metadata shown in the table.

As the most end users are not much aware of the concepts of the metadata even though they are using the related tools, organizations make them learn by creating interest in them.

FURTHER RESEARCH

Further research can be done to provide the greater understanding about the end user metadata and respective data quality. There is still need for much research in this subject. As there is very little research has been carried out about the end user metadata has to be researched further.

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A Fuzzy Based Divide and Conquer Algorithm for Feature Selection in KDD Intrusion Detection Dataset

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Abstract - This paper provides a fuzzy logic based divide and conquer algorithm for feature selection and reduction among large feature set of KDD intrusion detection data set, since a reduced feature set will help to evolve better mining rules.This algorithm introduces a fuzzy idea of dividing the normal record by attacks records or vice-versa, and then considers the feature sets for every attack type separately. Actually, this algorithm is applied on KDD CUP 99 dataset having 37 attack types and selecting important feature among 41 feature of KDD dataset. The selected features are used in TANAGRA [11, 12] data mining tool to classify the dataset (i.e. KDD 99) for every attack vs. normal using various classification algorithms [5, 6]. The result for feature selection and classification shows a reduced set and maximized classification rate respectively.

Keywords - *KDD CUP 99 intrusion data set, TANAGRA data mining Tool, intrusion detection, classification, divide-conquer with fuzzy based.*

I. INTRODUCTION

Performance of an intrusion detection system generally depends on the length of dataset having a lot of features used to identify attack or normal type. So, the reduced dataset with relevant features help an IDS [13] to perform its' task easily with a better use of memory and time. During the process of the reduction of data or features, the main work is to find the hidden relationship among data or features. For finding out the hidden relationship among data or features, fuzzy logic based reduction approaches can be used. In this paper, a fuzzy based divide conquer approach is used to find the relationship.

An IDS [13] is responsible to provide a better security for a system from an attack. But it fails sometime to identify the different type of attack, due to the dynamic behavior of attack types. So, for dynamic behavior of attacks, the KDD 99 [3] dataset provide records of data with 41 features [10] of 37 types of attack with their dynamic behavior. KDD dataset for any security work is very useful to gain information for attacks and normal type.

This paper has also found a hidden relation among the dataset of KDD 99 to select the important feature set using a fuzzy based divide conquer approach. It is found that this approach reduced the features and maximized classification rate and minimized misclassification rate using various classification algorithms [5, 6] in TANAGRA.

The rest of this paper is kept as follows: section 2, describing about related work, section 3, giving fuzzy based divide conquer algorithm, section 4, providing fuzzy based experimental results, section 5, concludes about this work.

II. RELATED WORK

Wanli Ma [14] in his paper described a technique for feature selection by grouping the features in the four categories: Group I contain the basic network traffic features; Group II is not network traffic related, but the features collected from hosts; Group III and IV are temporally aggregated features. In this paper [15] Adetunmbi A.Olusola and others proposed an algorithm for selection of relevance feature set of KDD intrusion detection dataset using rough set degree of dependency and dependency ratio of each class employed to determine the most discriminant features for each class. In 2009 Shailendra Singh and Sanjay Silakari in their paper [16] designed a feature selection algorithm using filter phase for highest information gaining and guides the initialization of search process for wrapper phase and finally feature subsets are passed through the K-nearest neighbor classifier for classification of attacks. In paper [17], Gulshan Kumar and Krishan Kumar proposed feature selection methods for (1) reduction in

number of features; (2) performance of Naïve Bayes classification model trained on reduced set of features. Iago Porto-D´ıaz and others describes [18] method consists of a combination between feature selection methods and a novel local classification method. This classification method –called FVQIT (Frontier Vector Quantization using Information Theory)– uses a modified clustering algorithm to split up the feature space into several local models, in each of which the classification task is performed independently.

III. FUZZY BASED DIVIDE AND CONQUER ALGORITHM

The proposed algorithm is named as divide and conquer as it divides the normal record by attack record or vice-versa depending on the length of the records i.e. greater length record would be divided by lesser length record, then important features are selected taking deviation for every feature set using the result of matching values for every feature of attack with respect to normal. So, this algorithm selects the important feature set based on the non-similarity of attack vs. normal using the concept of deviation. Initially, the KDD dataset is preprocessed as follows.

(a) Divide the whole KDD data set into attack vs. normal records.

(b) Separate each attack and normal records in KDD 99 dataset, so that total number of files should be 38 (i.e. one normal record + 37 attack record).

Algorithm

1. Input the file containing normal records and another file containing attack records.
2. Calculate or find the greater length among the two input file (i.e. normal and attack file). Let Solution [] be a vector that will contain selected features, Mismatch [] will contain number of mismatch, deviation [] will have value for every set of mismatch count and min_support will be initialized before execution of algorithm as a threshold.
3. Divide the greater length file by using the size of the lesser length file, i.e. if the greater length file is G and lesser length file is L, then divide G by L resulting in $G_1,G_2,\ldots,G_n$ each of length L. Here each division G_d or file L have 41 features and they are represented as G_1 $(G_{d1},G_{d2},\ldots G_{d41})$, $G_2(G'_{d1},G'_{d2},\ldots,G'_{d41}),\ldots,G_n$ $(G'''_{d1},G'''_{d2},\ldots,G'''_{d41})$ and $L_1,L_2,L_3,\ldots,L_{41}$ respectively.
4. Perform One-to-one comparison with every attribute value of each record in G_d and L, i.e. $L(L_1,L_2,L_3,\ldots,L_{41})$ to G_1 $(G_{d1},G_{d2},\ldots,G_{d41})$, $L(L_1,L_2,L_3,\ldots,L_{41})$ to G_2 $(G'_{d1},G'_{d2},\ldots,G'_{d41})$,…, and $L(L_1,L_2,L_3,\ldots,L_{41})$ to G_n $(G'''_{d1},G'''_{d2},\ldots,G'''_{d41})$.

   For i←1 to size of lesser file L do

   If $(L(L_i) \neq G_i(G_{di}))$ then ,do

   Mismatch[i]←Mismatch[i] + 1;

   End if

   End for
5. Calculate deviation of Mismatch [] for every features which we got from step 4 and keep it in deviation [] array.
6. Considering or keeping the features in the Solution [] array, should obey the following consideration:-
   1. Value of deviation [] > min_support and deviation []<= 1and Minimum value of Mismatch [] – deviation [] > min_support.
   2. Value of deviation []=minimum value of Mismatch[].
   3. Value of deviation [] =0.
7. Repeat step 4 until all records have finished their one to one corresponding comparison.
8. Display the features in Solution [] which are taken using the step 6 consideration.
9. End.

IV. EXPERIMENTAL ANALYSIS AND RESULT

The result of fuzzy based divide and conquer algorithm give the important features for every attack with respect to the normal. The result is analyzed in two stages:

- Using the fuzzy based divide conquer algorithm to the KDD dataset to select the important and reduced feature set.
- Classifying the KDD records into attack and normal records using the reduced feature set with the help of various classification algorithms [5, 6] in Tanagra.

4.1 Feature Reduction Using Fuzzy Based Divide and Conquer Algorithm:

The reduced feature set for the 37 attacks in KDD 99 dataset are selected using proposed fuzzy based divide and conquer algorithm, given in Table1.

Table1. List of selected features using fuzzy based divide conquer algorithm.

Attack Name	Selected Feature using Fuzzy based divide and conquer algorithm
Apache2	8,11,13,14,15,16,17
Back	8,11,14,15,16
Buffer Overflow	4,25,26,27,28
Ftp write	23,24,39
Guess passwd	7,9,11,15,18,20,21
Http tunnel	8,17,19
Imap	12,23,24,31,32,36,37
Ip Sweep	8,13,14,16,17
Land	27,28
Load Module	23,24,31,37
Mailbomb	7,9,15,18,20,21
Mscan	8,11,13,14,15,16
Multihop	4,25,26,27,28
Named	25,26
Neptune	7,9,18,20,21,30,40
Nmap	19,28
Perl	23,24,31
Phf	23,24,31,37
Pod	4,19,27,28
Portsweep	8,13,14,16,17
Process Table	8,11,13,14,15,16,17
Ps	4,25,26,27,28
Root Kit	4,25,26
Saint	8,11,13,14,15,16,17
Satan	13,15,16
Sendmail	25,26
Smurf	5,7,9,18,20,21
Snmpget	7,9,15,18,20,21
Snmpguess	7,9,15,16,18,20,21
Sql	23,24,31,37
Teardrop	25,26,39
Udpstorm	2,3,12,23,24,31,37
Warez master	13,15
Worm	23,24,31,37
Xlock	25,26
Xsnoop	24,38,40
Xterm	4,25,26

4.2 Classification in Tanagra:

The selected feature set acquired from fuzzy based divide and conquer algorithm are utilized to classify the KDD records in TANAGRA [2, 12]. In TANAGRA various classification algorithms like KNN, Naïve Bayes, ID3, C4.5, SVM, and LDA [5, 6] are used to classify and results are compared with discriminant based algorithm [1] given in Table2. From the Table2 it is found that the misclassification rate of the proposed algorithm is lesser than the discriminant based techniques.

Table2 List of classification and misclassification rate for fuzzy based divide and conquer and Discriminant analysis based algorithm.

	Fuzzy Based Divide Conquer Algorithm		Discriminant Analysis Based Algorithm	
Attack Name	Classification rate (%)	Misclassification rate (%)	Classification rate (%)	Misclassification rate (%)
Apache2	99.96	0.04	99.7	0.3
Back	99.94	0.06	99.4	0.6
Buffer Overflow	99.99	0.01	68.2	31.8
Ftp write	99.99	0.01	33.3	66.7
Guess passwd	99.83	0.17	100	0
Http tunnel	99.99	0.01	96.8	3.2
Imap	99.99	0.01	100	0
Ip Sweep	99.98	0.02	97.1	2.9
Land	99.99	0.01	100	0
Load Module	99.99	0.01	100	0
Mailbomb	99.80	0.20	100	0
Mscan	99.95	0.05	95.7	4.3
Multihop	99.99	0.01	22.2	77.8
Named	99.99	0.01	17.6	82.4
Neptune	99.91	0.09	100	0
Nmap	99.99	0.01	100	0
Perl	99.99	0.01	100	0
Phf	99.99	0.01	100	0
Pod	99.99	0.01	100	0
Portsweep	99.98	0.02	100	0

Process Table	99.96	0.04	97.2	2.8
Ps	99.99	0.01	31.3	68.8
Root Kit	99.99	0.01	23.1	76.9
Saint	99.96	0.04	81.9	18.1
Satan	99.92	0.08	99.8	0.2
Sendmail	99.99	0.01	35.3	64.7
Smurf	99.78	0.22	100	0
Snmpget	99.72	0.28	100	0
Snmpguess	99.89	0.11	100	0
Sql	99.99	0.01	100	0
Teardrop	99.99	0.01	66.7	33.3
Udpstorm	99.99	0.01	50	50
Warez master	99.93	0.07	95.2	4.8
Worm	99.99	0.01	100	0
Xlock	99.99	0.01	33.3	66.7
Xsnoop	99.99	0.01	50	50
Xterm	99.99	0.01	76.9	23.1

V. CONCLUSION

Thus this paper describes the proposed fuzzy based divide and conquers algorithm and how it has been applied to KDD 99 dataset. The reduced feature set thus obtained yields maximized classification rate in Tanagra tool. The fuzzy based divide conquer technique used here easily finds the relationship among dataset and features. This algorithm is simple, flexible, and generic and could be used for any dataset apart from KDD dataset. The results of the classification algorithms in TANAGRA shows that the proposed approach produces very less misclassification rate i.e. 0.01%. The generated results are better than other existing algorithms in literature.

VI. ACKNOWLEDGEMENT

This work is a part of the AICTE funded project titled „Bio-inspired Intrusion Response System through feature relevance Analysis on Attack Classification", Under the Research Promotion Scheme (RPS), Ref. No: 8023/BOR/RID/RPS-59/2009-10.

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Study and Analysis of Open Cloud Computing Standards

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Abstract - In the current scenario of cloud computing, we are given wide range of choice in selecting the platform for our services. Each of these platforms uses its own set of standards and models for carrying out its services. This creates an atmosphere in which the clouds of multiple platforms differ from each other greatly. The issues of interoperability and flexibility arise due to difference of standards. If seamless cloud interaction can be provided by employing uniform standards, that will facilitate in a wider and efficient deployment of cloud services. In this paper, various open cloud computing standards are analyzed, their functions are described and their status and future are discussed.

Keywords - *Cloud Computing; Open standards;*

I. INTRODUCTION

A. Cloud Computing

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. [1].

B. Need for Open Standards

In today's age the usage of cloud computing has increased exponentially. There are several proprietary and open cloud computing platforms available for the user's choice. However the standards of various cloud providers are unique to their implementation and hence are not interoperable or portable. Hence there is dire need to have uniform standards for cloud computing.

Many experts believe that the lack of open standards in cloud computing is a roadblock to its wider adoption. There is a general consensus that there should be uniform cloud standards, like the TCP/IP protocols, accepted and implemented by all cloud providers.

Open source and standards accelerate the adoption of technology , which is evident by the growth of the world wide web, Linux, and J2EE etc. In the same way, incorporating standards for interoperability and open source implementations in cloud computing will ensure wide adoption of cloud computing.

There are a number of organizations working for the development, ratification and adoption of open standards. Some of the prominent organizations are : Distributed Management Task Force (DMTF), Object Management Group (OMG), Open Cloud Consortium (OCC), Open Grid Forum (OGF), Storage Networking Industry Association (SNIA), Cloud Management Working Group (CMWG) etc.

All these organizations are working together to develop cloud interoperability and security standards. They are committed to driving the rapid evolution and adoption of applied distributed computing. As a collaboration, they coordinate and communicate standards for Cloud computing [2].

Some of the important cloud standards proposed and ratified by these organizations are : Open Virtualization Format (OVF), Cloud Infrastructure Management Interface (CIMI), Open Cloud Computing Interface (OCCI), Cloud Data Management Interface (CDMI). In this paper we present a detailed study and analysis of these standards.

II. OPEN CLOUD STANDARDS

A. Open Virtualization Format (OVF)

This specification describes an open, secure, portable, efficient and extensible format for the packaging and distribution of software to be run in virtual machines. It has been developed and ratified by the Distributed Management Task Force (DMTF) .

It provides platform independence. It helps facilitate mobility, package VMs together with applications and operating systems and calls to any other applications and hardware as needed. This meta data includes information about VM images, such as the number of CPUs and memory required and network configuration information.

The OVF enables simplified and error-free deployment of virtual appliances across multiple virtualization platforms. OVF is a common packaging format for independent software vendors (ISVs) to package and securely distribute virtual appliances, enabling cross-platform portability. By packaging virtual appliances in OVF, ISVs can create a single, pre-packaged appliance that can run on customers' virtualization platforms of choice.

The OVF standard is not tied to any particular hypervisor or processor architecture. The unit of packaging and distribution is an OVF Package which may contain one or more virtual systems each of which can be deployed to a virtual machine. The OVF supports content verification and integrity checking based on industry-standard public key infrastructure, and it provides a basic scheme for management of software licensing.

It has been optimized for a simple, automated user experience. It supports validation of the entire package and each virtual machine or metadata component of the OVF during the installation phases of the virtual machine (VM) lifecycle management process. It also packages with the package relevant user-readable descriptive information that a virtualization platform can use to streamline the installation experience.

The OVF is virtualization platform neutral, while also enabling platform-specific enhancements to be captured. It supports the full range of virtual hard disk formats used for hypervisors today, and it is extensible, which allow it to accommodate formats that may arise in the future. Virtual machine properties are captured concisely and accurately.

The OVF is Vendor and platform independent. It does not rely on the use of a specific host platform, virtualization platform, or guest operating system. It does not provide all of the independence needed for cloud interoperability. The OVF supports user-visible descriptions in multiple locales, and it supports localization of the interactive processes during installation of an appliance. This capability allows a single packaged appliance to serve multiple market opportunities.

The OVF has been received positively. Several virtualization players in the industry have announced support for OVF, including VirtualBox, Red Hat Enterprise, VMware, Oracle VM etc [3].

B. Cloud Infrastructure Management Interface (CIMI)

The CIMI defines a logical model for the management of resources within the Infrastructure as a Service domain. This specification is not a standard. It has been proposed by the Cloud Management Working Group (CMWG). It is still work-in-progress and has not been ratified yet. It is an HTTP/REST-based protocol.

It proposes an abstract, service offering model by defining a set of logical entities that are shared between consumers and service providers. At its core there are four basic CRUD (Create, Read, Update and Delete) operations. The manner in which these are used is consistent across all resources within the model; therefore, their use is defined once and is to be applied consistently.

Some resources support specialized operations that do not fit well into a CRUD style of operation and those will all follow a similar high-level pattern but each operation is allowed to have slight variations to accommodate its specific needs. The specifics of these special operations are detailed within the section that defines the resource. When appropriate some of the resource representations will include "link" properties. These either provide URI references that can be used to perform operations on the resource, or they are URI references to other resources that are related to the current resource. Providers shall only include "link" properties when the specified operation or related resource is accessible to the current client for that particular resource. This means that based on many factors (e.g. authorization rights of the clients, current state of the resource, etc.) a different set of "link" properties might be returned on each serialization of the resource [4].

C. Open Cloud Computing Interface (OCCI)

The Open Cloud Computing Interface (OCCI) is a RESTful Protocol and API for all kinds of management tasks. OCCI was originally initiated to create a remote management API for IaaS1 model-based services, allowing for the development of interoperable tools for common tasks including deployment, autonomic scaling and monitoring. It has since evolved into a flexible API with a strong focus on interoperability while still having a high degree of extensibility.

It comprises a set of open community-lead specifications delivered through the Open Grid Forum, which define how infrastructure service providers can deliver their compute, data, and network resource offerings through a standardized interface.

OCCI has a set of implementations that act as proofs of concept. It builds upon World Wide Web fundamentals by using the REST (Representational State Transfer) approach for interaction and delivers an extensible model for interacting with "as-a-Service" services.

OCCI is a boundary API that acts as a service front-end to an IaaS provider's internal infrastructure management framework. OCCI provides commonly understood semantics, syntax and a means of management in the domain of consumer-to-provider IaaS.

It covers management of the entire life-cycle of OCCI-defined model entities and is compatible with existing standards such as the Open Virtualisation Format (OVF) and the Cloud Data Management Interface (CDMI). It also serves as an integration point for standardization efforts including DMTF, IETF and SNIA.

The current release of the Open Cloud Computing Interface is suitable to serve many other models in addition to IaaS, including PaaS and SaaS.

In order to be modular and extensible the current OCCI specification is released as a suite of complimentary documents which together form the complete specification. The documents are divided into three categories consisting of the OCCI Core, the OCCI Renderings and the OCCI Extensions.

- The OCCI Core specification consist of a single document defining the OCCI Core Model. The OCCI Core Model can be interacted with renderings (including associated behaviors) and expanded through extensions.
- The OCCI Rendering specifications consist of multiple documents each describing a particular rendering of the OCCI Core Model. Multiple renderings can interact with the same instance of the OCCI Core Model and will automatically support any additions to the model which follow the extension rules defined in OCCI Core.
- The OCCI Extension specifications consist of multiple documents each describing a particular extension of the OCCI Core Model. The extension documents describe additions to the OCCI Core Model defined within the OCCI specification suite

The Open Cloud Computing Interface is a boundary protocol and API that acts as a service front-end to a provider's internal management framework. Figure 1 shows OCCI's place in a provider's architecture.

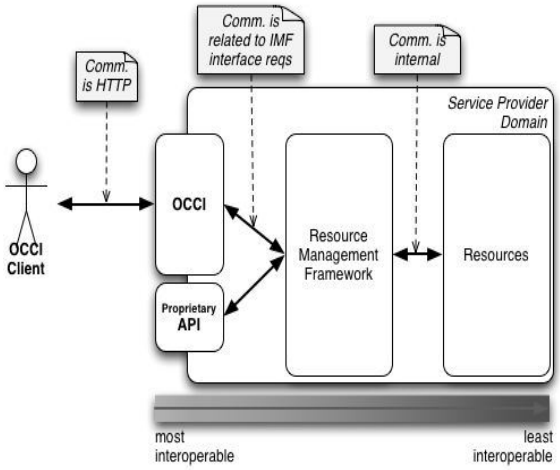

Fig. 1 : OCCI's place in a provider's architecture

Service consumers can be both end-users and other system instances. OCCI is suitable for both cases. The key feature is that OCCI can be used as a management API for all kinds of resources while at the same time maintaining a high level of interoperability.

The OCCI Core Model is a representation of instance types which can be manipulated through an OCCI rendering implementation. It is an abstraction of real-world resources, including the means to identify, classify, associate and extend those resources.

A fundamental feature of the OCCI Core Model is that it can be extended in such a way that any extension will be discoverable and visible to an OCCI client at run-time. An OCCI client can connect to an OCCI implementation using an extended OCCI Core Model, without knowing anything in advance, and still be able to discover and understand, at run-time, the various Resource and Link sub-types supported by that implementation. What Mixins are supported is also discoverable in the same fashion. For example, a web-based OCCI client could easily be reused as the management tool for a wide variety of services. Service consumers can be both end-users and other system instances. OCCI is suitable for both cases. The key feature is that OCCI can be used as a management API for all kinds of resources while at the same time maintaining a high level of interoperability.

The OCCI is supported by many open source cloud platforms like OpenNebula and OpenStack [5].

D. Cloud Data Management Interface (CDMI)

The Cloud Data Management Interface (CDMI) is the functional interface that applications will use to create, retrieve, update and delete data elements from the cloud. It has been developed by the Storage Networking Industry Association (SNIA) and is now a SNIA Architecture standard and will be submitted to the INCITS organization for ratification as an ANSI and ISO standard as well.

As part of this interface the client will be able to discover the capabilities of the cloud storage offering and use this interface to manage containers and the data that is placed in them. In addition, metadata can be set on containers and their contained data elements through this interface.

This interface is also used by administrative and management applications to manage containers, accounts, security access and monitoring/billing information, even for storage that is accessible by other protocols. The capabilities of the underlying storage and data services are exposed so that clients can understand the offering.

The CDMI standard specifies the interface to access cloud storage and to manage the data stored therein. This international standard is applicable to developers who are implementing or using cloud storage.

It allows clients to discover the capabilities available in the cloud storage offering and manages containers and the data that is placed in them. It also allows metadata to be associated with containers and the objects they contain.

CDMI defines both a means to manage the data as well as a means to store and retrieve the data. The means by which the storage and retrieval of data is achieved is termed a "data path". The means by which the data is managed is termed the "control path". CDMI specifies both a data path and control path interface.

CDMI does not need to be used as the only data path and is able to manage cloud storage properties for any data path interface (e.g., standardized or vendor specific).

Container metadata is used to configure the data requirements of the storage provided through the exported protocol (e.g., block protocol or file protocol) that the container exposes. When an implementation is based on an underlying file system to store data for a block protocol (e.g., iSCSI), the CDMI container provides a useful abstraction for representing the data system metadata for the data and the structures that govern the exported protocols.

A cloud offering may also support domains that allow administrative ownership to be associated with stored objects. Domains allow the standard to determine how user credentials are mapped to principles used in an Access Control List (ACL) They also allow granting of special cloud-related privileges, and delegation to external user authorization systems (e.g., LDAP or Active Directory). Domains may also be hierarchical, allowing for corporate domains with multiple children domains for departments or individuals. The domain concept is also used to aggregate usage data that is used to bill, meter, and monitor cloud use. Finally, capabilities allow a client to discover the capabilities of a CDMI implementation.

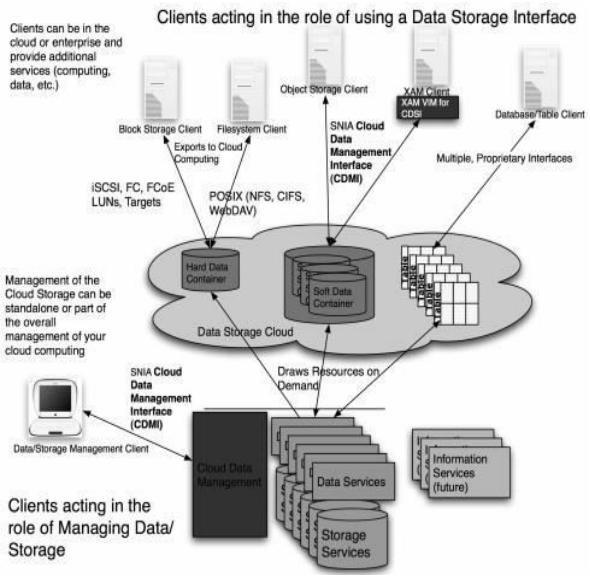

Fig. 2 : CDMI in cloud storage

CDMI uses many different types of metadata, including HTTP metadata, data system metadata, user metadata, and storage system metadata. HTTP metadata is metadata that is related to the use of the HTTP protocol (e.g., content-length, content-type, etc.).

CDMI data system metadata, user metadata, and storage system metadata is defined in the form of name-value pairs. Vendor-defined data system metadata and storage system metadata names shall begin with the reverse domain name of the vendor. Data system metadata is metadata that is specified by a CDMI client and is a component of objects. Data system metadata abstractly specifies the data requirements associated with data services that are deployed in the cloud storage system. User metadata is arbitrarily-defined JSON strings that are specified by the CDMI client and is a component of objects. Storage system metadata is

metadata that is generated by the storage services in the system (e.g., creation time, size) to provide useful information to a CDMI client.

CDMI defines RESTful HTTP operations for assessing the capabilities of the cloud storage system, allocating and accessing containers and objects, managing users and groups, implementing access control, attaching metadata, making arbitrary queries, using persistent queues, specifying retention intervals and holds for compliance purposes, using a logging facility, billing, moving data between cloud systems, and exporting data via other protocols such as iSCSI and NFS.

The CDMI has been implemented by various vendors like SNIA , NetApp, VENUS-C and OpenNebula [6].

III. ANALYSIS

The open standards like OVF, CIMI, OCCI and CDMI provide uniform representation of cloud infrastructure across multiple cloud platforms. Thus, they enable interoperability, mobility , portability and flexibility.

They provide the end-users the ability to establish and adopt universal cloud computing paradigms. They also aid the business organizations by increasing the viability of cloud investments by reinventing business models and creating new markets.

However there are a few considerations to be made about adopting the open standards. The first is to utilize the existing standards by incorporating them into the open standards, thereby avoiding duplicating them. The cloud vendors should not lock-in their customers and limit their choices. The open organizations and cloud providers should work in collaboration to develop the standards in order to avoid conflict, overlapping and creating too many standards [7].

IV. CONCLUSION

With the rapid advance of cloud computing, numerous cloud providers have arisen in the field. This has led to a vast number of standards that are incompatible and not interoperable. It has become imperative to develop uniform standards for widespread adoption of cloud computing and choice of end-users. Open cloud standards like OVF, CIMI, OCCI, CDMI etc. are the need of the time that can provide universal access to the cloud. These standards give flexibility, uniformity, interoperability and portability to the cloud infrastructure. As such common standards are gradually adopted by the cloud providers, the management and utility of the cloud becomes easier and more profitable. Thus, the open cloud standards provide the opportunity of seamless cloud integration.

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Development of an Embedded Web Server System for Controlling and Monitoring of Remote Devices Based on ARM

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Abstract - The paper presents the design of an embedded Web server system, which takes mini ARM920T-S3c244O processor as its core and WIN CE as its operating system. This is because Win CE can be reduced and transplanted. The method used to transplant the web server which is developed in ASP.Net on the embedded WIN CE platform, and through ASP.Net technology functions of dynamic Web page is successfully realized. After the successful development of the embedded web server system it will be used for controlling and monitoring of remote devices. dynamic page interaction can be achieved between the Web server and the embedded system via the browser in the Windows environment.

Keywords - *Embedded web server,ASP.Net,ARM,AVR.*

I. INTRODUCTION

In comparison with PC, the embedded system is greatly improved in stability, reliability and safety etc. The embedded system transplanted web server can be called embedded web server. Through web page released by embedded web server, remote users can obtain the real-time status information and control remote equipments without time and space restriction. It's easy to implement, and it is an effective way of leading Internet into embedded system. In this paper Embedded systems and Internet technology are combined to form a new technology - the Embedded Internet Technology, which developed with the popularization of computer network technology in recent years. This technology could function in the hardware and software as long as they are connected. Only by using web browser through the Ethernet and TCP/IP protocol users can get access information of remote devices. It brings great convenience to remote equipment control and management. The main advantages of using embedded Web server system mainly include: (1) the client can be freely set and the browser can be used directly without installing additional client software; (2) the operating system Win CE, which can be reduced and transplanted, provides a convenient, fast and simple method for embedded systems and Internet access.(3) Small size, low power consumption, low cost and flexible designed.

II. EXPERIMENTAL PLATFORM FOR THE EMBEDDED WEB SERVER SYSTEM

The design in this paper applies MINI2440 32-bit ARM microprocessor which takes ARM920T as its core. The MINI2440 Development Board is based on the Samsung S3C2440 microprocessor.

Fig.1: Friendly ARM with running Win CE Operating system

Its PCB is 4-layer boarded, equipped with professional equal length wiring which ensures signal integrity. The MINI2440 development board is a 100 x 100(mm) board equipped with a wide variety of connectors, interfaces and ports. This microprocessor has rich resources, including Clock, USB, SDRAM, UART, Nand Flash, Nor Flash LCD, RS232 Interface, Ethernet Interface, JT AG, Power, etc. These modules can help achieve Internet services.

The logical structure of the system hardware is shown in Figure 2

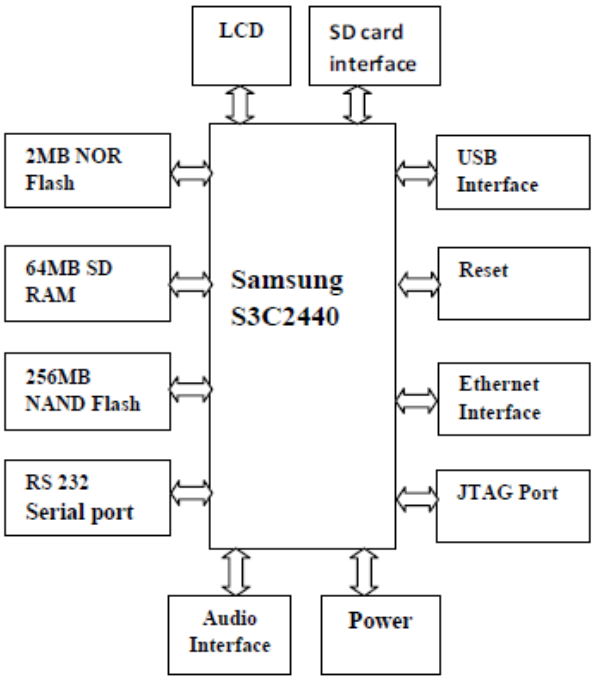

Fig. 2 : Structure of the system hardware

III. SYSTEM ARCHITECTURE AND WORKFLOW

System architecture of An Embedded Web Server System which controls and monitors the remote devices is presented. The system uses 32-bit RISC processor Samsung S3C2440 with various features and peripherals. It's based on ARM 920T core and supports embedded Linux, WinCE, VxWorks and other embedded operating system. In this system Win CE Operating system is transplanted of S3C2440 processor. The system architecture is designed in four parts, the first that is the core of the architecture embedded web server system. The second part of the system architecture is the sensor expansion board this board is based on AVR ATmega 32 bit microcontroller. Atmega32 has a special feature of power on reset. It is connected with Embedded web server system via RS232 serial interface and send the information regarding the remote devices to the web server. The data of the remote devices transmitted wirelessly through RF module which is connected to the AVR ATmega 32 microcontroller.

The third part of the system architecture is the wireless communication module. In this module remote devices are connected to the sensor expansion board via RF module. RF transceiver is different from general wireless transceiver for broadcasting in the respects of small size, low power consumption, support for battery-powered devices. RF transceiver is mainly responsible for modulation, demodulation, sending and receiving of signal. AVR ATmega 8bit Microcontroller connects with the RF transceiver through the SPI bus. It is mainly used in RF signal processing, control, coordinating all parts of the device and communicating with external devices through the serial port. The user interface will be developed in ASP.Net Web pages. Web server further will be transplanted to the S3C2440 ARM processor. In the fourth part the embedded web server system will be connected to the internet via Ethernet interface. On the client browser remote user can access the information of the remote devices through the web pages which will be transmitted by the web server. System is based on Browser/server architecture.

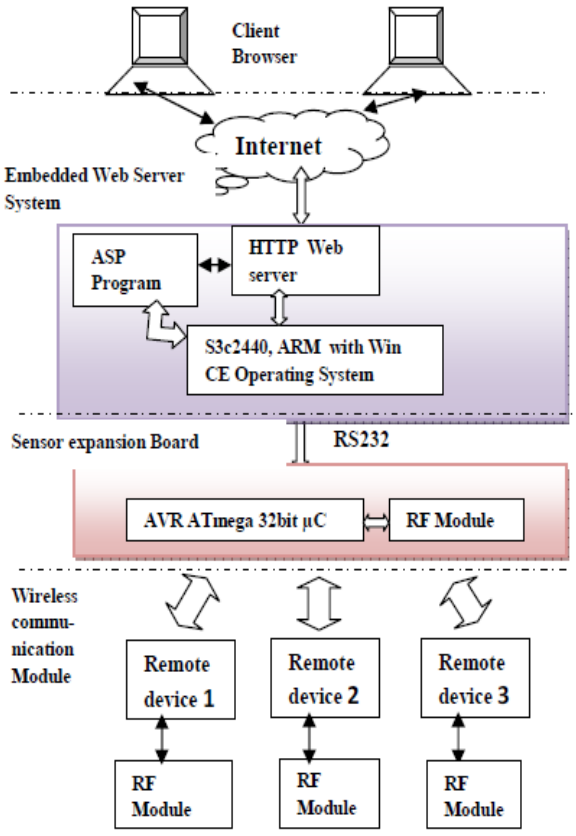

Fig. 3 : The system architecture of the embedded web server system

IV. DESIGN OF THE SYSTEM SOFTWARE

A. Acquisition of the real time information

As for the design of the Embedded web server System, we need to implement the dynamic update of the data collected by sensor expansion board for the achievement of the remote publishing of device information, which can be implemented through an embedded web server. The client browser posts a HTTP request and then ASP programs gets this request and send it to the sensor expansion board via RS232 interface. The AVR ATmega32 send this request to the remote devices via RF module, and at the receiver side the Atmega8 receive this request and send the information regarding the device via RF module ie. Whether the device is on or off. The System software architecture is shown in figure:

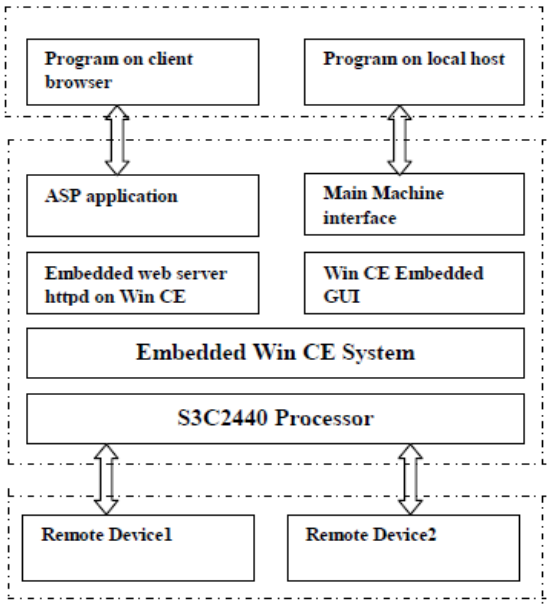

Fig. 4: System software architecture

B. Implementation of Dynamic Web Pages:

There are many different technologies to achieve dynamic Web page, commonly used with CGI, ASP, PHP ,and JSP and so on. In Win CE, ASP often used to achieve dynamic page.ASP.Net is language independent..Net is the ease with which it allows the exchange of data between various software applications. .Net proves to be useful when applications stored on remote systems have to communicate with each other through standard internet protocols like XML, SOAP . The .Net improves the speed of communication between devices and web server.

ASP provides an access to execute external program for Web server, this server technology can be made to interact between the browser and server. ASP programs can be written by any programming language, for example VB, VC, C and so on. VB is used for ASP program design in this paper.

Work process of ASP

a) Users in the client browser make a request to the Web server about the remote device.

b) Web server will make a judgment on the request. Web server will transfer file directly to the client browser if the request is a static file, else Web server will activate the ASP program.

c) Daemon of Web server create a sub process which establishes two standards I/O data channels between the server and the external ASP process.

d) Web server startup the ASP program that URL specified. ASP program reading and processing client's request, if user wants to switch off the remote device by just on clicks on the switch off button on client browser web page.

e) ASP will pass the result through the standard output to the server daemon after processing, and then daemon transfer results back to the client browser in HTML format.

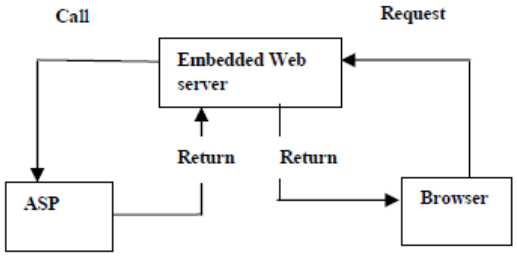

Fig. 5 : Work process of ASP

C. Result:

OUTPUT OF ASP WEB PAGE:

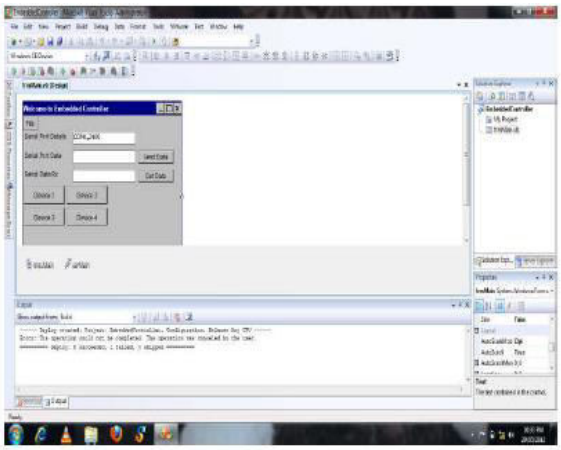

Fig. 6: Output of the ASP web page

The code developed in the ASP.Net is deployed on friendly arm9 board. This code is used to control and monitor the wired devices. This paper presents the intermediate result of proposed work.

D. CODE for sensor expansion board:

The AVR ATmega 32 programmed with the device programmer by this code .The communication is done via Port B. When ch='1' then 0x01 is sent on Port B and LED 1 glows. When ch='2' then 0x02 is sent on Port B and LED 2 glows. If ch='3' then 0x04 is sent on port B and LED 3 glows. If ch='4' then then 0x08 is sent on port B and LED 4 glows. The code represents the communication between web server and the wired device via RS232 interface.

```
/* vi:set et ts=4 sw=4 ai ft=c ff=dos: */
#include "EmbeddedWebServer.h"
#include "UART.h"
#include "avr/delay.h"
#include "LCD_4Bit.h"
/* Global variables */
/* Function prototypes */
int
main(int argc, char *argv[])
{
    int count = 0;
    int ch;
    DDRB = 0xFF;
    uartInit();
    lcd_init();
    lcd_display("Embded Wb Server",LINE1);
    /* your code goes here */
    while(1)
    {
        ch=receiveByte();
        if(ch == '1')
        {
                PORTB = 0x01;
        }
        if(ch == '2')
        {
                PORTB = 0x02;
        }
        if(ch == '3')
        {
                PORTB = 0x04;
        }
        if(ch == '4')
        {
                PORTB = 0x08;
        }
    }
    return 0;
}
```

IV. CONCLUSION

In this paper an Embedded Web Server system design is present through which remote devices can be controlled and monitored via Sensor expansion board. The paper present the LED as device and via clicking on the web page LED can be switched on or off . The design will overcome the drawbacks of Java Applet. In place of Java Applet ASP.Net will be used for development of user interface. User can control, monitor, and diagnose the problem with the remote devices.

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Association Rule Mining for KDD Intrusion Detection Data Set

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Abstract - Network intrusion detection includes a set of malicious actions that compromise the integrity, confidentiality and availability of information resources. Several techniques for mining rules from KDD intrusion detection dataset [10] enables to identify attacks in the network. But little research has been done to determine the association patterns that exist between the attributes in the dataset. This paper focuses on the association rule mining in KDD intrusion dataset. Since the dataset constitutes different kinds of data like binary, discrete & continuous data, same technique cannot be applied to determine the association patterns. Hence, this paper uses varying techniques for each type of data. The proposed method is used to generate attack rules that will detect the attacks in network audit data using anomaly detection. Rules are formed depending upon various attack types. For binary data, Apriori approach is used to eliminate the non-frequent item set from the rules and for discrete and continuous value the proposed techniques are used. The paper concludes with experimental results.

Keywords - *KDD CUP 99, intrusion detection system, Apriori approach, association rules mining.*

I. INTRODUCTION

KDD [10] dataset covers four major categories of attacks: Denial of Service (DOS), user-to-root (U2R), remote-to-local (R2L) and probing attack. KDD dataset is divided into labeled and unlabeled records. Each labeled record consisted of 41 attributes and one target value. Association rule mining is generally used to find the interesting rules from a large database depending upon the user defined support and confidence. In market basket analysis it finds relationship among the items present in the transactional database. A frequent item set is defined as one that occurs more frequently in the given data set than the user given support value. One more threshold confidence is used to restrict the association rules to a limited number. Confidence also includes the item sets having low support but from which high confidence rules may be generated. However the market basket analysis always works with binary values which means if item is present then the value is 1, otherwise value is 0(zero). But in reality or in KDD intrusion dataset, all the values may not be in binary. The dataset includes binary data, discrete and continuous data. Hence a generic technique will not work on all these data. So Association rule mining has to consider the type of data also. In general Association rule mining could be explained as follows:

Let I= $\{i_1, i_2, i_3, \ldots i_n\}$ be a set of items and T be a set of transactions. Each transactions is a set of items such that I_i subset of $_I$. An item set X is a set of items $\{i_1,i_2,\ldots\ldots i_k\}(1\leq k\leq n)$ such that X subset of I. An item set containing k number of items is called k-item set. An association rules is an implication of the form, A=>B, where A subset of I, B subset of I & A∩B=Ø. The rules A=>B holds in T with support s if s% of the transactions in T contain both A and B. Similarly the rule A=>B holds in T with confidence c if c% of the transactions in T support A also support B. To discover association rules from T having support and confidence greater than min_support and min_confidence.

$$\text{Support,}\quad S\ (A=>B) = \frac{\varphi(AUB)}{\varphi(N)}$$

$$\text{Confidence}\quad C\ (A=>B) = \frac{\varphi(AUB)}{\varphi(A)}$$

It was felt that identifying association patterns in KDD intrusion data set will help to design better Intrusion Detection System (IDS). Since the dataset is very large comprising of variety of data ranging from binary, discrete and continuous, these different association rule mining have been proposed in this paper. The rest of the paper is organized as follows: Section -2 describes the background and related work, Section-3 describes proposed association rule mining algorithm, Section-4 describes experimental result, Section-5 contains the conclusion followed by the reference section.

II. BACKGROUND AND RELATED WORK

M.Sulaiman khan, Maybin Muyeba and Frans Coenen[1] described weighted association rule mining

from fuzzy data in their paper. Then some other proposed association rule mining for weighted value not necessarily binary value. The value should be continuous or discrete value to be presented in the database. In 2009 Flora S. Tsai [9] described network intrusion detection system using association rule mining in his paper. This helped to generated interesting rules from the KDD data set. The intrusion detection system contains various types of attacks. The KDD dataset contains variety of data starting from binary, discrete and continuous data. So, it is very difficult to generate rules for a particular attack using same approach. To find the association rules from the KDD dataset, different approaches should be applied for different kind of dataset as follows.

2.1. Association Rule Mining for Binary Value

For binary weighted value it is easy to find out the frequent item set. Apriori algorithm generates the frequent item set from a large number of data set. In association rules mining weights are considered as the highest priority. Apriori algorithm can be imagined as two steps. Firstly it generates candidate sets. Secondly, it prunes the entire non-frequent item set after each step using the minimum support and the weight of the item from the data base. Pruning process can eliminate many item sets which are not frequent.

2.2. Association Rule Mining for Continuous Value

If a particular attribute takes a value in the range [0…1] it is considered to be a continuous attribute in the Tanagra tool. This could be taken as Fuzzy data and hence fuzzy weighted Association rule mining as described in [5] could be used here. The weight of fuzzy data can be defined as Fuzzy Item Weight (FIW). Now Fuzzy Item set Transaction Weight (FITW) is the aggregate weights of all the fuzzy sets associated with the items in the item set present in a single transaction. From this FITW support and Confidence value can be calculated as per [5].

2.3. Association Rule Mining for Discrete value

If the range of values that an attribute in the data set can take is very large then normalization of the data becomes very difficult. The traditional approach to deal with this type of data in association analysis is to convert each value into a set of binary values. The discrete attributes are normalized i.e. we find a set of thresholds that can be used to convert the attributes into a categorical variable. This kind of normalization affects the accuracy of the rule generation technique which may lead to higher misclassification rate.

III. PROPOSED ASSOCIATION RULE MINING ALGORITHM FOR KDD IDS

3.1. Binary value

To find the association rules from binary data set already many algorithm have been proposed. For KDD data set Apriori algorithm is used to calculate the support and confidence value for various attributes. Apriori algorithm find the frequent item set from the database depending upon user define support and confidence. Here the rules can be generated for strong support and confidence value of the attributes. The item set having less support and confidence are automatically pruned. By this approach the number of generated rules can be restricted.

3.2. Continuous value

A continuous dataset D consists of transaction $T=\{t_1,t_2,\ldots t_n\}$ associated with each item in $I=\{i_1,i_2,i_3,\ldots.i_n\}$, which can contains the attributes weighted fuzzy value as $L=\{l_1,l_2,\ldots l_n\}$. Here we can assign weight for each attributes which are associated with i. Each attribute $t_i[i_j]$ is associated with several fuzzy set. The value of the attributes are between [0, 1] as fuzzy set. The "k th " weighted set for the "jth " item in the "ith" fuzzy transaction is given by $t_i[i_j[l_k[w]]]$ as mentioned in [1] .

Weighted Support(X) = $\frac{\sum_{i=1}^{n}\prod_{k=1}^{|x|}\left(\forall\left[i\left[l[w]\right]\right]\in x\right)ti\left[ij[lk[w]]\right]}{n}$

Fuzzy Weighted Confidence is the ratio of sum both satisfying XUY to the sum of X. Here Z can be defined as Z=XUY.

Weighted Confidence(X=>Y)= $\sum_{i=1}^{n}\frac{\prod_{k=1}^{|z|}(\forall[z[w]]\in z)ti[zk[w]]}{\prod_{k=1}^{|x|}(\forall[i[w]]\in x)ti[Xk[w]]}$

3.3. Discrete value

As the value of the attributes falls in a wider range, it is very difficult to find the support value of such data without any fixed range. Unlike the traditional normalization method that is applied to the data set, in this approach, first the sum of the values for a particular attribute is calculated. Then the individual value is divided by the aggregate value. The newly calculated value is always between the range [0, 1].For one item set the methodology is same as the traditional one, but when we consider multiple item sets at a time, the minimum of the calculated value is taken as the support value. Now we can generalize it for any number of discrete values, where in the attributes should be paired to get the support and confidence value. This is explained as follows:

Let I= $\{i_1,i_2,\ldots,i_n\}$ be set of item sets in a transaction data base with transaction sets T = $\{t_1,t_2,\ldots.t_n\}$. Each transaction contains the weighted value as W= $\{w_1,w_2,w_3,\ldots.w_n\}$. Now support can be calculated as, Support(X)=$\frac{T[wj]}{\sum_{j=1}^{|N|} T[wj]}$

For calculating support of more than two attributes the minimum value from the two item sets can be considered. The average should be taken from the minimum value to get the desired support. In table 1 it describes the item sets with the discrete values. In table 2 the calculated support value for each item set is shown. The support value for item A and item B, taken at a time, can be calculated by selecting minimum value from each row of the table. The set will contain the value as

T_{min}={Min(0.08,0.12),Min(0.08,0.16),Min(0.12,0.12),Min(0.16,0.16),Min(0.14,0.12),Min(0.08,0.06),Min(0.14,0.16),Min(0.12,0.07)}
={0.08,0.08,0.12,0.16,0.12,0.06,0.14,0.07}

Support= 0.83/8=0.10

Table1: discrete data set to find the support.

TID	A	B	C	D	E
t1	12	33	34	18	78
t2	12	45	54	32	99
t3	18	34	32	23	32
t4	25	45	55	11	22
t5	21	33	56	27	90
t6	12	18	54	29	99
t7	21	45	32	34	97
t8	18	21	11	23	22

Table2: calculated support for each item set.

TID	A	B	C	D	E
t1	0.08	0.12	0.10	0.09	0.14
t2	0.08	0.16	0.16	0.16	0.18
t3	0.12	0.12	0.09	0.11	0.05
t4	0.16	0.16	0.16	0.05	0.04
t5	0.14	0.12	0.17	0.13	0.17
t6	0.08	0.06	0.16	0.14	0.18
t7	0.14	0.16	0.09	0.17	0.17
t8	0.12	0.07	0.03	0.11	0.04

3.4. Rule Generation Algorithm

After finding the frequent item set, support and confidence vale, rules have to be generated for each attack types. The following algorithm is general for any kind of data set. Here F contains the largest frequent item set. Min_supp defines the user define support and Min_conf defines the user defines confidence. RULE contains the desired rules generated from data set. The algorithm is as follows:

Algorithm:

1. Take the largest frequent item set F with Min_Supp and Min_Conf value.
2. Generate all possible subsets of F and store it in SUB.
3. Count SUPP and CONF value for each elements of SUB.
4. If (SUPP>=Min_Supp && CONF>=Min_Conf) then
   a. Choose the particular elements of SUB and store in RULE
   b. Generate various rules and store in RULE.
5. Else reject the particular element of SUB and go to step 3.
6. Return RULE.
7. End.

IV. EXPERIMENTAL RESULT

The rules are generated using the proposed approach and are showed in the table3. The result shows sample rules for a particular attack .The attributes with high confidence and support values are considered to generate the rules. The attributes having very low support and confidence value are rejected automatically.

Table3: Generated rules with support and confidence

Attack Type	Attributes Selected	Rules
1. Neptune Attack	29,30,34,35, 38,39	29=>30 support=0.004 confidence=0.065 29,30=>34 support=0.0002 confidence=0.054 29=>30,34 support=0.0002 confidence=0.0030 34=>29,30 support=0.0002 confidence=0.0047 30=>29,34

Attack Type	Attributes Selected	Rules
		support=0.0002 confidence=0.05 29,34=>30 support=0.0002 confidence=0.038 29,34=>30,35 support=0.000016 confidence=0.0030 30=>34 support=0.003 confidence=0.0714 30,34=>29 support=0.0002 confidence=0.66
2. Apache2 Attack	25,26,27,28, 40,41	25=>26 support=0.28 confidence=0.903 25=>27 support=0.03 confidence=0.096 25=>28 support=0.03 confidence=0.096 26=>28 support=0.03 confidence=0.044 26=>40 support=0.157 confidence=0.234 25,26,27 support=0.01 confidence=0.032 25,26=>27,28 support=0.00464 confidence=0.0165
3. Back Attack	34,35,38,39, 40,41	34=>35 support=0.005 confidence=0.005 34=>38 support=0.00156 confidence=0.00157 34=>39 support=0.00156 confidence=0.00157 35=>39 support=0.0015 confidence=0.2727 35=>34 support=0.005 confidence=0.9090 38=>34 support=0.00156 confidence=0.99 39=>34 support=0.00156 confidence=0.99
4. Mail bomb Attack	34,35,40	34=>35 support=0.0399confidence=0.042 34=>40 support=0.038 confidence=0.040 35=>40 support=0.0048 confidence=0.106 35=>34 support=0.039 confidence=0.88 34,35=>40 support=0.00236 confidence=0.059 35=>34,40 support=0.00236 confidence=0.052 40=>34,35 support=0.00236 confidence=0.042 34,40=>35 support=0.00236 confidence=0.062
5. Smurf Attack	34,35,36	34=>36 support=0.999 confidence=0.999 36=>34 support=0.999 confidence=0.999 34=>35 support=$4.66E^{-5}$ confidence=0.00046 35=>36 support=$4.66E^{-5}$ confidence=0.848 35=>34,36 support=$4.25E^{-5}$ confidence=0.77
6. Ware master Attack	34,35,37	34=>35 support=0.0238 confidence=0.033 35,37=>34 support=0.00178 confidence=0.0679 34,35=>37 support=0.000178 confidence=0.074 35=>37 support=0.00262 confidence=0.029 37=>34 support=0.0624

Attack Type	Attributes Selected	Rules
		confidence=0.088
7. Process table Attack	34,35,38,39, 40,41	34=>35 support=0.062 confidence=0.11 34=>38 support=0.2090 confidence=0.37 34=>39 support=0.259 confidence=0.46 35=>39 support=0.084 confidence=0.49 35=>40 support=0.0802 confidence=0.42

V. CONCLUSION

In this paper a generalized approach for mining the weighted association rules from KDD intrusion detection dataset with binary and fuzzy attributes has been proposed. Different techniques to count the support and confidence value from the dataset have been used. A number of association rules have been derived for each type of attack. The approach used here is effective to analyze the database containing discrete and continuous attributes with weighted settings. Here the poor rules having less support and confidence value have also been removed. The association rules thus generated will guide the IDS in evolving better rules to identify various attacks.

VI. ACKNOWLEDGEMENT

This work is a part of the AICTE funded project titled „Bio-inspired Intrusion Response System through feature relevance Analysis on Attack Classification", Under the Research Promotion Scheme (RPS), Ref. No: 8023/BOR/RID/RPS-59/2009-10.

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Test Case Generation for Data Flow Testing Using Particle Swarm Optimization with Adaptive Mutation

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Abstract - In this paper we propose a novel technique to optimize test cases using Hybrid Particle Swarm Optimization (HPSO). The HPSO is a combination of Particle Swarm Optimization (PSO) technique and Genetic Algorithms (GA), to widen the search space for the solution. The proposed HPSO technique accepts an instrumented version of the program to be tested, the list of def-use paths to be covered, the mutation probability, and the number of input variables as input. Also, it accepts the swarm size, maximum number of iterations, values of inertia weight factor, self-confidence and swarm-confidence as input. The algorithm will produce a set of test cases and the set of def-use paths covered by each test case. GA will be combined with PSO for improving the diversity and the convergence. The evolutionary and swarm intelligence techniques are both combined in our work. It is observed that HPSO outperforms PSO in 100 percent def-use coverage.

Keywords - *software testing; data flow testing; particle swarm optimization; hybrid particle swarm optimization.*

I. INTRODUCTION

Quality assurance is an important issue for software development. Even though many quality assurance techniques, such as design reviews, formal specifications, model checking, and inspections are available today, testing is still the primary means for achieving quality at industrial and government sites. Software testing has two main aspects: test data generation and application of a test data adequacy criterion. A test data generation technique is an algorithm that generates test cases, whereas an adequacy criterion is a predicate that determines whether the testing process is finished. Several test data adequacy criteria have been proposed, such as control flow-based and data flow-based criteria. One of the major difficulties in software testing is the automatic generation of test data that satisfy a given adequacy criterion. Recently, the use of genetic algorithms GAs in test data generation became the focus of several research studies.

Since firstly described by Holland, Genetic Algorithms (GA) has been applied to a virility of learning and optimizations. GA is an optimal algorithm which is based on the principle of natural selection and genetic mechanism. It simulates natural evolution mechanism of life, achieving the specific goals in the artificial system. Particle Swarm Optimization (PSO) applies to concept of social interaction to problem solving.

PSO was developed in 1995 by James Kennedy and Russ Eberhart [13]. It has been applied successfully to a wide variety of optimization problems [7][8][9][10]. In this paper we have proposed an algorithm that combines PSO and GA for better performance.

II. BASIC CONCEPT

In this section we discuss basic concepts used throughout this paper.

A. Data Flow Analysis

This section describes the all-uses criterion and the data flow analysis technique [2][4] used to implement it. Firstly, some definitions used in describing this technique are resented. The control flow of a program can be represented by a directed graph with a set of nodes and a set of edges. Each node represents a group of consecutive statements, which together constitute a basic block. The edges of the graph are then possible transfers of control flow between the nodes. A path is a finite sequence of nodes connected by edges. A complete path is a path whose first node is the start node and whose last node is an exit node. A path is def-clear with respect to a variable if it contains no new definition of that variable. Fig. 2 presents the control flow graph of the example program, shown in Fig. 1, which

determines the middle value of three given integers A, B, and C. Data flow analysis focuses on the interactions between variable definitions (defs) and references (uses) in a program. Variable uses can be split into 'c-uses' and 'p-uses' according to whether the variable use occurs in a computation or a predicate. Defs and c-uses are associated with nodes, but p-uses are associated with edges. The purpose of the data flow analysis is to determine the defs of every variable in the program and the uses that might be affected by these defs, i.e. the def-use associations. Such data flow relationships can be represented by the following two sets: dcu(i), the set of all variable defs for which there are def-clear paths to their cuses at node i; and dpu(i,j), the set of all variable defs for which there are def-clear paths to their p-uses at edge (i,j) [1]. The *all-uses* criterion requires a def-clear path from each def of a variable to each use (c-use and p-use) of that variable to be traversed. It should be noted that, the *all-uses* criterion includes all the members of the family of the data flow criteria.

B. Example

Fig. 1 represents an example program which calculates the middle value among 3 variables A, B, and C. In Fig. 1, the 1st column represents statement numbers, and the 2nd one represents block numbers.

```
1    1    INTEGER A, B, C
2    1    READ (5,*) A, B, C
3    1    MID=C
4    1    IF (B.LT.C) THEN
5    2    IF (A.LT.B) THEN
6    3    MID=B
7    4    ELSE
8    4    IF (A.LT.C) THEN
9    5    MID=A
10   6    END IF
11   7    END IF
12   8    ELSE
13   8    IF (A.GE.B) THEN
14   9    MID=B
15   10   ELSE
16   10   IF (A.GT.C) THEN
17   11   MID=A
18   12   END IF
19   13   END IF
20   14   END IF
21   14   PRINT*,'MIDDLE VALUE= ', MID
22   14   END
```

Fig.1: Example program

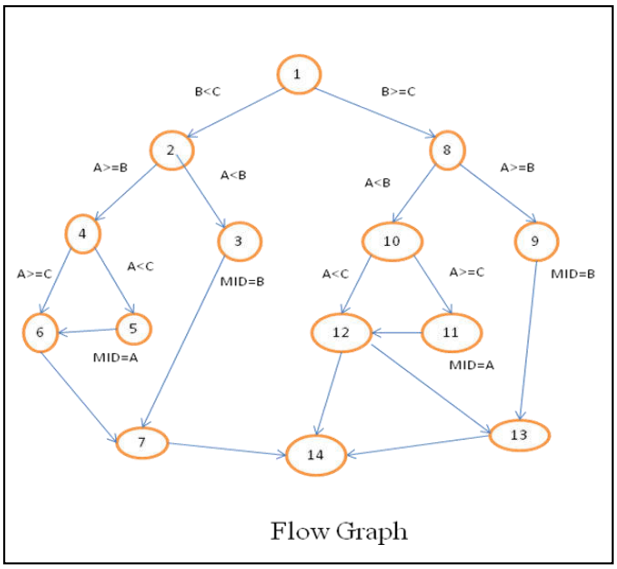

Fig. 2: Control Flow Graph of Figure1

Table 1: List of DCU paths given in example program in Fig.1

DCU-PATH NO.	VARI-ABLE	DEF-NODE	C-USE NODE	KILLNG NODES
1	B	1	3	None
2	A	1	5	None
3	B	1	9	None
4	A	1	11	None
5	MID	1	14	3,5,9,11
6	MID	3	14	1,5,9,11
7	MID	5	14	1,3,9,11
8	MID	9	14	1,3,5,11
9	MID	11	14	1,3,5,9

C. Particle Swarm Optimization

PSO is a population based stochastic optimization technique developed by Eberhart and Kennedy [13] in 1995 inspired by social behavior of birds flocking or fish schooling. PSO is designed and proved to be very effective in solving real valued global optimization problems. In PSO, population is called swarm and individuals (i.e. the points) are called particles. Each particle moves with an adaptable velocity within search space and retains in a memory the best position ever encountered. This best position is shared with other particles in the swarm after each iteration. Two variants of the PSO algorithm were developed, one neighborhood. According to the global variant, each particle moves towards its best

Table 2: List of DPU paths given in example program in Fig.1

DPU-PATH NO.	VARIABLE	DEF-NODE	P-USE NODE	KILLING NODE
1	B	1	1-2	None
2	C	1	1-2	None
3	B	1	1-8	None
4	C	1	1-8	None
5	A	1	2-3	None
6	B	1	2-3	None
7	A	1	2-4	None
8	B	1	2-4	None
9	A	1	4-5	None
10	C	1	4-5	None
11	A	1	4-6	None
12	C	1	4-6	None
13	A	1	8-9	None
14	B	1	8-9	None
15	A	1	8-10	None
16	B	1	8-10	None
17	A	1	10-11	None
18	C	1	10-11	None
19	A	1	10-12	None
20	C	1	10-12	None

previous position with global neighborhood, and towards the best particle in its restricted neighborhood [5].

PSO Algorithm

1. Initialize a population (array) of particles with random positions and velocities of d dimensions in the problem space.
2. For each particle, evaluate the desired optimization fitness function in d variables.
3. If the fitness value is better than the best fitness value personal best (*pbest*) in history set current value as the new *pbest*.
4. Compare fitness evaluation with the populations overall previous best. If the current value is better than global best (*gbest),* then reset *gbest* to the current particles array index and value.
5. Update the velocity and position of the particle according to equations (1) and (2) respectively. v_{id} *a*nd x_{id} represent the velocity and position of particle with d dimensions respectively and $rand_1$, $rand_2$ are two uniform random functions.
6. Repeat step (2) until a criterion is met, usually a sufficiently good fitness or a maximum number of iterations or epochs.

$$v_{id}^{k+1} = w * v_{id}^{k} + c_1 * rand_1 * (pbest_{id}^{k} - t_{id}^{k}) + c_2 * rand_2 * (gbest_{id}^{k} - x_{id}^{k}) \quad (1)$$

$$x_{id}^{k+1} = x_{id}^{k} + v_{id}^{k+1} \quad (2)$$

Where i=1….n, n is population size, c_1 and c_2 are acceleration constants, *w* is inertia weight, $rand_1$ and $rand_2$ are random values in range [0,1]

D. The Basic Concept of Genetic Algorithm

Genetic algorithms were formally introduced in the United States in the 1970s by John Holland at University of Michigan. The continuing price/performance improvements of computational systems have made them attractive for some types of optimization. A GA [3] starts with guesses and attempts to improve the guesses by evolution. GA has well-defined steps:

A basic algorithm for a GA is as follows:

```
Initialize (population);
Evaluate (population);
While (stopping condition not satisfied) do
  {   Selection (population);
      Crossover (population);
      Mutate (population);
      Evaluate (population);
  }
```

The algorithm will iterate until the population has evolved to form a solution to the problem, or until a maximum number of iterations have taken place [6].

III. TEST CASE GENERATION USING HYBRID PARTICLE SWARM OPTIMIZATION

We propose a novel technique to optimized test cases generation using Hybrid Particle Swarm Optimization (HPSO). HPSO is a combination of PSO and GA technique. In the next section the formulae for evaluation function and adaptive mutation are given.

A. *Evaluation Function*

The HPSO algorithm evaluates each test case by executing the program with it as input, and recording the def-use paths in the program that are covered by this test case. The evaluation function value eval(x_i) for each particle *xi* (*i* = 1,2,….., *n*) is calculated as follows:

$$eval(x_i) = \frac{No.of\ def-use\ path\ covered\ by\ (x_i)}{total\ no\ of\ def-use\ path} \quad (3)$$

B. *PSO with Adaptive Mutation*

The conventional Particle Swarm Optimization was inspired by the social and cognitive behavior of swarm. According to the analysis of various research [11][12], particles are largely influenced by its previous best particles and the global best particle. Once the best particle has no change in a local optimum, all the rest particles will quickly converge to the position of the best particle. If the searching neighbors of the global best particle would be changed in each generation, it would be helpful for the global best particle to jump out local minima. It is expected that the non-trapped global best particle will lead the rest particles moving to better positions. This can be accomplished by conducting a mutation on the global best particle in each generation. However, the mutation size is very difficult to control and dominated by the characteristics of problems. Many methods adjust the parameters of mutation size according to different problems, while few works focus on adaptive mutations. Jun tang et al. [11] proposed an adaptive mutation with dynamically adjusting the mutation size in terms of the size of current search space.

$$gbest_i(t+1) = gbest_i(t) + [b_j(t) - a_j(t)] * rand() \quad (4)$$

$$a_j(t) = \min(x_{ij}(t)), b_j(t) = \max(x_{ij}(t)) \quad (5)$$

i= 1,2,……popsize , j= 1,2,…n

where $gbest_i$ is is the *i*th vector of the global best particle, and $a_j(t), b_j(t)$ are the minimum , maximum values of the *jth* dimension in current search space respectively, *rand*() is a random number within [0,1] and *k* = 1, 2,…, indicates the generations.

C. *Proposed work*

In this section, we discuss the proposed approach to generate optimized test cases for data flow testing using Hybrid Particle Swarm Optimization. The proposed HPSO technique accepts an instrumented version of the program to be tested, the list of *def-use* path to be covered, the number of input variables as input. Also, it accepts the swarm size, maximum number of iterations, values of inertia weight factor, self-confidence and swarm-confidence as input. The algorithm will produce a set of test cases and the set of *def-use* paths covered by each test case. GA will be combined with PSO for improving the diversity, and the convergence.

Input:

Instrumented version P'of the program P to be tested;

List of the def-use paths to be covered;

Domain of input data;

Number of input variables;

Swarm size;

Number of maximum iteration;

Inertia weight factor ω and Acceleration Constants c_1 and c_2

Output:

Set of optimized Test cases for P and the set of

Def-use paths covered by each test case.

List of uncovered def-use paths, if any.

Begin

Step1: Initialization

Initialize the def-use coverage vector to zero;

Create Initial Swarm;

Create velocity for each particle;

Set of test cases for *P* ← 0*;*

Coverage _Percent ← 0;

No_Of_Iterations K← 0;

nCases ← 0;

Step 2: Generate test cases

For each member of swarm do

Begin

Execute P' with data set as input;

Evaluate the current test case;

If (some def-use paths are covered) then

nCases ← nCases + 1;

Add test case to set of test cases for P;

Update the def_use coverage vector;

Update Coverage _Percent by using Eq. 3;

Find $gbest^o$, $pbest^0$;

End If

End For

While (Coverage_Percent ≠ 100 and No_Of_ Iterations ≤ Max_Iter) do

Begin

K=K+1;

Update velocity of each particle by using (1);

Update position of each particle by using (2);

Update *pbest* as follows:

If $eval(x_i^k) > eval(pbest_i^{k-1})$ then $pbest_i^k = pbest_i^{k-1}$
Else $pbest_i^k = pbest_i^{k-1}$
Update *gbest* as follows:
If $eval(gbest_i^k) > eval(gbest_i^{k-1})$ then $gbest_i^k = gbest_i^k$
Else $gbest_i^k = gbest_i^{k-1}$
Calculate $aj(t)$ and $bj(t)$ according to (5);
Mutate *gbest* according to (4);
Update *gbest* as follows:
If $eval(gbest_i^k) > eval(gbest_i^{k-1})$ then $gbest_i^k = gbest_i^k$
Else $gbest_i^k = gbest_i^{k-1}$

For each particle of current swarm

Begin

Execute P' with data set as input;

Evaluate the current test case;

If (some def-use paths are covered) then

nCases ← nCases + 1;

Add test case to set of test cases for P;

Update the def_use coverage vector;

Update Coverage _Percent by using Eq. 3;

Find $gbest^o$, $pbest^0$;

End If

End For

End while

Step 3: Produce output

Return set of test cases for *P,* and set of def-use paths covered by each test case;

Return on uncovered def-use paths, if any;

C. Working of proposed HPSO Algorithm

Now, we explain the working of our HPSO algorithm. First, we instrument the program P to be tested to P'. We then calculate the number of *def-use* path to be covered to satisfy our *all uses* criteria of data flow testing. Next the initial swarm is generated. After that the velocity of each particle in the swarm is generated. The instrumented program is executed with the particles in the swarm and evaluates the test cases. If some of the *def-use* paths are covered, then we update the def-use coverage vector and the coverage percentage. We calculate *pbest* value and *gbest* value and update the velocity and the position of the particles. Then, we update the *pbest* and *gbest* value. The value of *gbest* is again updated through the mutation operator. This process will continue until the coverage percentage is equal to 100 or the number of iteration are less than or equal to the maximum iterations.

Below, we show the test cases for the example program given in Fig. 1.

HPSO Started…

Initialization

Domain of input data=1-20, 1-20,1-20;

Mutation probability=0.25;

Number of input variables=3;

Swarm size=12;

Initial swarm= 8, 9, 10
10, 12, 8
6, 8, 11
15, 16, 17

Velocity= -2, 2, -4
1, 3, 2
3, 5, 4
4, -1, -3

Test case 1:

Traversed path=1, 2, 3, 7, 14

Covered dcu-path=1, 6

Covered dpu-path=1, 2, 5, 6

DEF-USE coverage=20.68%

Accumulated DEF-USE coverage=20.68%

Test case 2:

Traversed path=1, 8, 10, 11, 12

Covered dcu-path=4

Covered dpu-path=3, 4, 15, 16, 17, 18

DEF-USE coverage=24.13%

Accumulated DEF-USE coverage=44.81%

Test case 3:

Traversed path=1, 2, 3, 7, 14

The above test case traversed the same path as the Test Case 1. So this test case is not considered for DEF-USE Coverage calculation and the Accumulated DEF-USE Coverage value will not be changed. It is same as Test Case 1.

Test case 4:

Traversed path=1, 2, 3, 7, 14

The above test case traversed the same path as the Test Case 1. So this test case is not considered for DEF-USE Coverage calculation and the Accumulated DEF-USE Coverage value will not be changed. It is same as Test Case 1.

Gbest=8, 9, 10

Pbest= 8, 9, 10

10, 12, 8

6, 8, 11

15, 16, 17

New swarm= 6, 7, 8

5, 14, 10

5, 6, 16

7, 15, 13

Velocity= -2, -2, -2

-5, 2, 2

-1, -2, 5

2, -1, -4

Test case 5:

Traversed path=1, 2, 3, 7, 14

The above test case traversed the same path as the Test Case 1. So this test case is not considered for DEF-USE Coverage calculation and the Accumulated DEF-USE Coverage value will not be changed. It is same as Test Case 1.

Test case 6:

Traversed path=1, 8, 10, 11, 12

The above test case traversed the same path as the Test Case 2. So this test case is not considered for DEF-USE Coverage calculation and the Accumulated DEF-USE Coverage value will not be changed. It is same as Test Case 2.

Test case 7:

Traversed path=1, 2, 3, 7, 14

The above test case traversed the same path as the Test Case 1. So this test case is not considered for DEF-USE Coverage calculation and the Accumulated DEF-USE Coverage value will not be changed. It is same as Test Case 1.

Test case 8:

Traversed path=1, 8, 9, 13, 14

Covered dcu-path=3, 8

Covered dpu-path=3, 4, 13, 14

DEF-USE coverage=20.68%

Accumulated DEF-USE coverage=65.49%

Again the *pbest* and *gbest* values are calculated according to the above algorithm. The iteration process will be stopped when the Accumulated DEF-USE Coverage becomes 100% or iteration is equal to maximum iteration. For the above Example Program 100% Accumulated DEF-USE Coverage is achieved in 10th iteration.

D. Result

We present the results of the examples that have been carried out to evaluate the effectiveness of the proposed HPSO compared to PSO. A set of 5 small programs are used.

Table 3 shows the result of applying the HPSO technique to 5 programs. As can be seen HPSO technique outperformed the PSO technique in all programs. In these programs, the HPSO technique required less number of generations than PSO technique to achieve same def-use coverage percentage.

Table 3: Comparison between PSO and HPSO Techniques

Ex. Program No.	No. of Var	Population Size	Number of Generation		Def-Use Coverage	
			PSO	H-PSO	PSO	H-PSO
1	3	4	15	10	100	100
2	3	6	12	7	100	100
3	3	8	9	5	100	100
4	4	4	21	14	100	100
5	4	6	33	17	100	100

IV. CONCLUSION

In this paper, we have proposed HPSO algorithm that aims to offer a review of the field and the challenges. The PSO which has slow convergence rate and is easily trapped in local optimum region is modified by adding the mutation operator to the PSO algorithm so that the performance of the hybrid proposed HPSO algorithm outperforms conventional PSO with 100% def-use coverage. In three example programs, the proposed HPSO reached 100% coverage percentage in less generation than the PSO technique.

Our future work will be to study the test case generation using combination of PSO and ACO algortihm for data flow testing.

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SECTION-II

Electronics and Communication Engineering

Iris Recognition Systems Biometric Identification Using Wavelet Maxima Components for Feature Extraction

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Abstract - A biometric system provides automatic identification of an individual based on a unique feature or characteristic possessed by the individual. Iris recognition is regarded as the most reliable and accurate biometric identification system available. There is strong scientific demand for the proliferation of the systems, concepts and algorithms for iris recognition and identification. Most commercial iris recognition systems use patented algorithms developed by Daugman, and these algorithms are able to produce perfect recognition rates. Especially it focuses on image segmentation and feature extraction for iris recognition process. The performance of iris recognition system highly depends on edge detection. The Canny Edge Detector is one of the most commonly used images processing tools, detecting edges in a very robust manner. For instance, even an effective feature extraction method would not be able to obtain useful information from an iris image that is not segmented properly. We used a fusion mechanism that amalgamates both, a Canny Edge Detection scheme and a Circular Hough Transform, to detect the iris' boundaries & edges in the eye's digital image in robust manner. Experiments are performed using iris images obtained from CASIA database (Institute of Automation, Chinese Academy of Sciences) and Matlab application for its easy and efficient tools in image manipulation.

Keywords- *Canny edge detection; Iris recognition; image processing; segmentation.*

I. INTRODUCTION

A. Overview

Biometrics deals with automated methods of recognizing individuals based on the features derived from their Physiological and behavioral characteristics. A higher degree of confidence can be achieved by using unique physical or behavioral characteristics to identify a person; this is biometrics. A physiological characteristic is relatively stable physical characteristics such as face, fingerprints, palm prints, iris, and hand geometry. Biometric authentication technique based on iris patterns is suitable for high level security systems. Iris recognition systems, in particular, are gaining interest because the iris's rich texture offers a strong biometric cue for recognizing individuals. We consider that the probability of finding two people with identical iris pattern is almost zero. The uniqueness of iris is such that even the left & right eye of the same individual is very different [1] [2]. That's why iris recognition technology is becoming an important biometric solution for people identification. The uniqueness of every iris parallels the uniqueness of fingerprint, but the iris enjoys further practical advantages over fingerprint & other biometrics for automatic recognition. A front-on view of the iris is shown in Fig.1. No effects of aging, the small scale radial features of the iris remain stable & fixed from about one year of age throughout life.

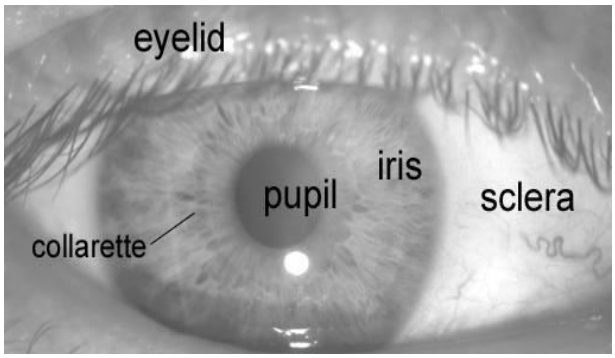

Fig. 1 – A front-on view of the human eye.

B. Outline

This paper, presents an iris recognition system by composing the following four steps. Firstly, an image containing the user's eye is captured by the system. Second step consists of preprocessing the acquired image. Image preprocessing mainly involves iris localization, segmentation, normalization, and image

enhancement. Once the preprocessing step is achieved, it is necessary to detect the images [3]. After that, we can extract texture of the iris.Finally, we compare the coded image with the already coded ris in order to find a match & make decision as shown in fig.2.

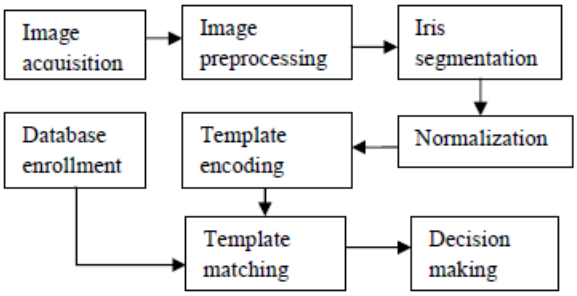

Fig. 2 Iris Recognition System Components

II. IMAGE PREPROCESSING

An iris image as shown in Figure 1 contains not only the region of interest (iris) but also some 'unuseful' parts (e.g. eyelid, pupil etc.). Since it has a Circular shape when the iris is orthogonal to the sensor, iris recognition algorithms typically convert the pixels of the iris to polar coordinates for further processing. An important part of this type of algorithm is to determine which pixels are actually on the iris, effectively removing those pixels that represent the pupil, eyelids and eyelashes, as well as those pixels that are the result of reflections [4]. In this algorithm, the locations of the pupil and upper and lower eyelids are determined first using edge detection. This is performed after the original iris image has been down sampled by a factor of two in each direction. The best edge results came using the canny method [5].The pupil clearly stands out as a circle and the upper and lower eyelid areas above and below the pupil is also prominent. Before extracting features from the original eye image, the image need to be preprocessed to localize iris, normalize iris, and reduce the influence of the factor mentioned above.

A. Localization

For the preprocessing step i.e., inner and outer boundaries of the iris are located. Integro-differential operators are then used to detect the centre and diameter of the iris, then the pupil is also detected using the differential operators, for conversion from Cartesian to polar transform, rectangular representation of the required area is made [6]. The first preprocessing step consists in locating the inner & outer boundaries of the iris [8]. The first method proposed to localize the iris was proposed by John Daugman who is considered the father of iris recognition technology because his system was the first developed and implemented.. In the Daugman's system, Integro-differential operators are used to detect the center & diameter of the iris and pupil respectively. These operators exploit both the circular geometry of the iris or the pupil. Indeed they behave as a circular edge detector since the sclera is always lighter than the iris, and pupil generally darker than the iris for healthy eye.

$$max_{(r,x_0y_0)} \left| G_\sigma(r) * \frac{\partial}{\partial x} \int_{r,x_0y_0} \frac{I(x,y)}{2\pi r} ds \right| \quad (1)$$

Where I(x, y) is the eye image, *r* is the radius to search for, Gσ*(r)* is a Gaussian smoothing function, and *s* is the contour of the circle given by *r*, *x0, y0*. This operator iteratively takes an x,y coordinate and makes circles of various radii centered at that coordinate and sums up (integrates) the intensity values in the circular contour of radius r. It then moves to the next radius and integrates that contour, and the derivative is taken between the changes of the intensity of the two radii, and so on. The circle that is found to have the maximum rate of change between circular contours is then determined to be the circle defining the iris-sclera boundary. This process is then run again with a higher sensitivity just inside the circle containing the iris to find the boundary between the iris and pupil. The sensitivity of the operator is set by the σ factor of the Gaussian function.

B. Segmentation

Segmentation is the important phase in the Iris Recognition process. Segmentation refers to the process of partitioning a digital image into multiple regions (sets of pixels). The main objective of segmentation is to remove nonuseful information, namely the pupil segment and the part outside the iris (sclera, eyelids, skin). Image segmentation is typically used to locate the objects and boundaries (lines, curves etc).The segmentation stage is critical to the success of an iris recognition system, since data that is falsely represented as iris pattern data will corrupt the biometric templates generated, resulting in poor recognition rates. The result of image segmentation is a set of regions that collectively cover the entire image or a set of contours extracted from the image. Iris segmentation method is providing more efficient way of locating the Iris boundaries. We applied canny edge detector algorithm. By using this detector, we can easily see the gradient value by applying the local threshold in the area of interest [9].

C. Canny Edge Detection

Canny edge detection is the most commonly used image processing tool, detecting edges in very robust manner. The Canny edge detection algorithm is known to many as the optimal edge detector. Canny's intentions were to enhance the many edge detectors already out at

the time he started his work. He was very successful in achieving his goal and his ideas and methods can be found in his paper, "*A Computational Approach to Edge Detection*"[10]. In his paper, he followed a list of criteria to improve current methods of edge detection. The first and most obvious is low error rate. It is important that edges occuring in images should not be missed and that there be NO responses to non-edges. The second criterion is that the edge points be well localized. A third criterion is to have only one response to a single edge.

Based on these criteria, the canny edge detector first smoothes the image to eliminate and noise. It then finds the image gradient to highlight regions with high spatial derivatives. The algorithm then tracks along these regions and suppresses any pixel that is not at the maximum (nonmaximum suppression). The gradient array is now further reduced by hysteresis. Hysteresis is used to track along the remaining pixels that have not been suppressed. Hysteresis uses two thresholds and if the magnitude is below the first threshold, it is set to zero (made a nonedge). If the magnitude is above the high threshold, it is made an edge. And if the magnitude is between the 2 thresholds, then it is set to zero unless there is a path from this pixel to a pixel with a gradient above T2. The canny operator is optimum even for noisy images as the method bridge the gap between strong & weak egdes of the image by connecting the weak edges in the output only if they are connected to strong edges. Therefore compared to other edge detection methods, this canny operator is less fooled by spurious noise.

D. Hough Transform

The Hough transform is a standard computer vision algorithm that can be used to determine the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform can be employed to deduce the radius and centre coordinates of the pupil and iris regions[11]. The main advantage of the Hough transform technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise. The circle is simpler to represent in parameter space, compared to the line, since the parameter of the circle can be directly transfer to the parameter space. The equation of the circle is:

$$(x-a)^2 + (y-b)^2 = r^2 \qquad (2)$$

Where a & b are the centre of the circle in the direction x & y respectively and r is the radius. Circle has three parameters: two parameters for the centre of the circle and one for the radius of the circle. For ellipse & other parametric objects the algorithm is quite similar. But the computation complexity increases (dimensions of the Hough space) with the number of the variables.

III. NORMALIZATION

Irises from different people may be captured in different size, and even for the iris from the same person, the size may change because of the variation of the illumination and other factors. For the purpose of achieving more accurate recognition results, it is necessary to convert the segmented portion of the iris into a standard form, so that two pictures taken at different times and different conditions can still be recognized as from the same eye. Normalization takes the variable-sized circular iris image (because of pupil dilation and image resolution) and transforms it into a fixed size rectangular image to be encoded. This transformation is accomplished by a conversion from polar coordinates into rectangular coordinates, with a fixed number of pixels taken from each angle (φ). The transformation is described by Yu et al and is presented in equation:

$$I\big(x(r,\varphi), y(r,\varphi)\big) = I(r,\varphi) \qquad (3)$$

Where x(r,φ) are the linear combinations of points on the pupil-iris boundary ((φ)Xinner,(φ)Yinner), and points on the pupil-sclera boundary ((φ)Xouter,(φ)Youter).

IV. FEATURE EXTRACTION

In order to provide accurate recognition of individuals, the most discriminating information present in an iris pattern must be extracted. Only the significant features of the iris must be encoded so that comparisons between templates can be made. It must be encode mathematically into some numerical representation of the unique features of the iris. This conversion is called feature encoding The distinctive spatial characteristics of the human iris are manifest at a variety of scales [12]. To capture this range of spatial detail, it is advantageous to make use of a multi scale representation. Some works have used multi resolution techniques for iris feature extraction [13] and have proven high recognition accuracy. A Gabor filter bank has been shown to be most known multi resolution method used for iris feature extraction. In this paper, we have investigated the use of wavelet maxima components as a multi resolution technique alternative for iris feature extraction.

A. Proposed method

1. Compute wavelet maxima components in horizontal and vertical directions using five scales.
2. For each component, special Gabor filter bank is applied with 4 scales and 6 orientations to obtain

   $((4 \times 6) \times 5) \times 2 = 120 \times 2 = 240$ filtered image.

3. The feature vector is presented by using two different techniques, the first is a statistical measure (mean and variance) and the second experience is moment invariants (Fig.2).

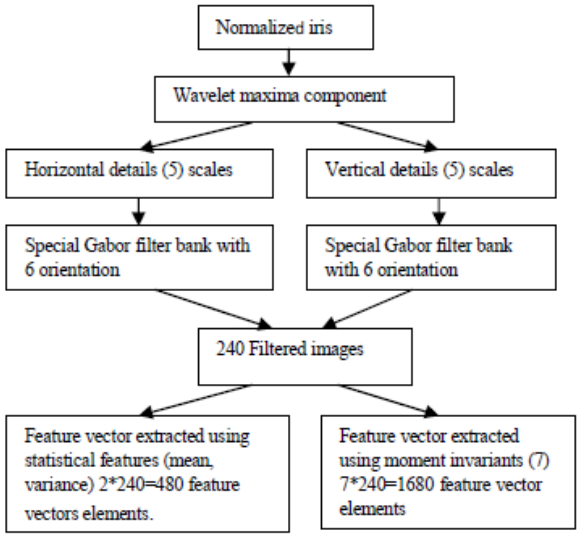

Fig.3. Proposed combined multiscale feature extraction technique diagram

B. Wavelet maxima for feature extraction

Wavelet decomposition provides a very good approximation of images and natural setting for the multi-level analysis. Since wavelet transform maxima provide useful information about textures and edges analysis [20], we propose to use this technique for fast feature extraction by using the wavelet components. Wavelet maxima have been shown to work well in detecting edges which are likely the key features in a query; moreover this method provides useful information about texture features by using horizontal and vertical details.

C. Algorithm

As described in [19] to obtain the wavelet decomposition a pair of discrete filters H, G has been used as follows:

TABLE I RESPONSE OF FILTERS H, G

H	0	0	0.125	0.375	0.375	0.125	0
G	0	0	0	-2	2	0	0

At each scale s, the algorithm decomposes the normalized iris image I(x,y) into I(x, y, s) ,

$W_v(x,y,s)$ and $W_h(x,y,s)$ as shown in figures (4,5) .

- I(x, y, s): the image smoothed at scale s.

- $W_h(x,y,s)$ and $W_v(x,y,s)$ can be viewed as the two components of the gradient vector of the analyzed image I(x,y) in the horizontal and vertical direction, respectively.

At each scale s (s=0 to s=S-1 where S is the number of scales or decomposition) image I(x, y) is smoothed by a lowpass filter:

$$I(x.y.s+1) = I(x,y,s) * (H_s, H_s) \qquad (4)$$

The horizontal and vertical details are obtained respectively by:

$$W_h(x,y,s) = \frac{1}{\lambda_s} I(x,y,s) * (G_s, D) \qquad (5)$$

$$W_v(x,y,s) = \frac{1}{\lambda_s} I(x,y,s) * (D, G_s) \qquad (6)$$

- We denote by D the Dirac filter whose impulse response is equal to 1 at 0 and 0 otherwise

- We denote by A * (H, L) the separable convolution of the rows and columns, respectively, of image A with the 1-D filters H and L.

- G_s, H_s are the discrete filters obtained by appending $2^s - 1$ zeros between consecutive coefficients of H and G.

-λ_s, as explained in [19] due to discretization, the wavelet modulus maxima of a step edge do not have the same amplitude at all scales as they should in a continuous model. The constants λ_s compensate for this discrete effect.

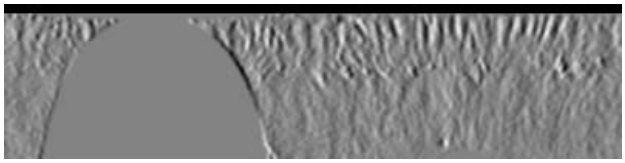

Fig.4. Wavelet maxima vertical components at scale 2 with intensities along specified column.

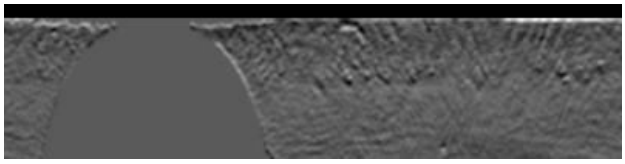

Fig.5. Wavelet maxima horizontal components at scale 2 with intensities along specified column.

D. Special Gabor filter bank

The two-dimensional Gabor Wavelets function *g(x, y)* can be defined as follows

$$\boldsymbol{G(x,y)} = \boldsymbol{e^{-\pi\left\langle[(x-x_0)^2|\alpha^2+(y-y_0)^2|\beta^2\right\rangle} e^{-2\pi i[u_0(x-x_0)+v_0(y-y_0)]}} \qquad (7)$$

Where (x_0,y_0) specify position in the image, (α,β) specify the effective width and length, and (u_0, v_0) specify modulation, which has spatial frequency $w_0 = \sqrt{u_0^2 + v_0^2}$. A 2D Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave. The Gabor filters are self-similar: all filters can be generated from one mother wavelet by dilation and rotation. A set of Gabor filters with different frequencies and orientations may be helpful for extracting useful features from an image.

E. Moments invariant

The theory of moments provides an interesting series expansion for representing objects. This is also suitable to mapping the filtered image to vectors so that their similarity distance can be measured [21]. Certain functions of moments are invariant to geometric transformation such as translation, scaling, and rotation. Such features are useful in identification of objects with unique signatures regardless of their location, size, and orientation [21]. A set of seven 2D moment invariants that are insensitive to translation, scaling, rotation have been computed for each image analysed by wavelet maxima horizontal and vertical component and Gabor filters. 240 filtered images have been obtained, for each image from those a seven element row vector containing the moment invariants just defined means our feature vector has a size (240×7) = 1680 elements.

In this context, we have analyzed iris textures in both horizontal and vertical directions especially that the iris has a rich structure with a very complex textures so that it makes sense to analyze the iris texture by combining all information extracted from iris region by Considering all orientations in terms of horizontal and vertical details.

V. MATCHING

Several matching algorithms were described in previous research. The most accessible of these is the Hamming distance, which depends upon the XOR operator. As feature encoding outputs a binary matrix, in order to compare two individuals, one can merely perform the XOR operator over the entire matrix. The Hamming distance is then applied in which the number of nonzero entries in the resulting matrix is summed and the result is divided by the number of overall entries in the matrix. The two iris code templates are compared by computing the hamming distance between them using equation [14].

$$HD = \frac{1}{N}\left[\sum_{i=1}^{N} X_j (XOR)\, Y_j\right] \qquad (7)$$

Where, Xj and Yj are the two iris codes (bit patterns), and N is the number of bits in each template. The Hamming distance gives a measure of how many bits are the same between two bit patterns. Using the Hamming distance of two bit patterns, a decision can be made as to whether the two patterns were generated from different irises or from the same one. And hence Hamming Distance matching classifier is chosen as it is more reasonable [15] compared with Weighted Euclidean Distance and Normalized correlation matching classifiers, as it is fast and simple.

VI. CONCLUSION

We describe in this paper efficient techniques for iris recognition system with high performance. The iris recognition system is tested using CASIA image database. The segmentation is the crucial stage in iris recognition. We have used the global threshold value for segmentation. In the above algorithm we have not considered the eyelid and eyelashes artifacts, which degrade the performance of iris recognition system. We have presented a novel method for iris recognition. Further development of this method is under way and the results will be reported in the near future. Judging by the clear distinctiveness of the iris patterns we can expect iris recognition system to become the leading technology in identity verification.

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Implementation of Speech Recognition System Using DSP Processor ADSP2181

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Abstract - While many Automatic Speech Recognition applications employ powerful computers to handle the complex recognition algorithms,there is a clear demand for effective solutions on embedded platforms.Digital Signal Processing (DSP) is one of the most commonly used hardware platform that provides good development flexibility and requires relatively short application development cycle.DSP techniques have been at the heart of progress in Speech Processing during the last 25years.Simultaneously speech processing has been an important catalyst for the development of DSP theory and practice.Today DSP methods are used in speech analysis,synthesis,coding, recognition,enhancement as well as voice modification,speaker recognition,language identification.Speech recognition is generally computationally-intensive task and includes many of digital signal processing algorithms. In real-time and real environment speech recognisers applications, it's often necessary to use embedded resource-limited hardware. Less memory, clock frequency, space and cost related to common architecture PC (x86), must be balanced by more effective computation.

Keywords-*Automatic speech recognition,Digital signal processing,Mel frequency cepstral coefficient*

I. INTRODUCTION

The objective of human speech is not merely to transfer words from one person to another, but rather to communicate, understanding a thought, concept or idea. The final product is not the words or phrases that are spoken and heard, but rather the information conveyed by them. In computer speech recognition, a person speaks into a microphone or telephone and the computer listens. Speech processing is the study of speech signals and the processing methods of these signals. The signals are usually processed in a digital representation. So speech processing can be regarded as a special case of digital signals processing applied to speech signals. Automatic Speech Recognition technology has advanced rapidly in the past decades.

We know that the heart of every computer is a microprocessor, commonly it's Intel IA-32 (x86) or compatibile. When using an algorithm, e.g. predictive filter for the processing of speech signals, we assume that it is somehow calculated. We simply write a function in Matlab (or Octave): and we are not at all interested, how sophisticated calculation is made the optimization for the platform x86, and therefore that the calculation is as **fast as** possible. And even if it was not, we do not mind, because in Matlab on Intel x86 platform, we usually work out of real time, so we just wait a while to calculate.To keep at disposal with Quad-Core processor running on clock frequency of 3 GHz and with 8 GB of RAM is certainly convenient. There are, however, tasks, in which such an achievement we can't afford, for example for the following reasons:There is a requirement for a low power device,there is a requirement for small size and device portability,there is a small budget or need to minimize the cost of the device. Therefore, it is necessary to choose another hardware platform that is other than the x 86 microprocessor and apparently also other instruments for programs development. For real-time signal processing, it is obviously appropriate to choose a digital signal processor.

II. LITERATURE SURVEY

Every speech recognition application is designed to accomplish a specific task. Examples include: to recognize the digits zero through nine and the words "yes" and "no" over the telephone, to enable bedridden patients to control the positioning of their beds, or to implement a VAT (voice-activated typewriter). Once a task is defined, a speech recognizer is chosen or designed for the task. Recognizers fall into one of several categories depending upon whether the system must be "trained" for each individual speaker, whether it requires words to be spoken in isolation or can deal with continuous speech, whether its vocabulary contains a small or a large number of words, and whether or not it operates with input received by telephone. Speaker

dependent systems are able to effectively recognize speech only for speakers who have been previously enrolled on the system. The aim of speaker independent systems is to remove this restraint and recognize the speech of any talker without prior enrolment. When a speech recognition systems requires words to be spoken individually, in isolation from other words, it is said to be an isolated word system and recognizes only discrete words and only when they are separated from their neighbours by distinct interword pauses. Continuous speech recognizers, on the other hand, allow a more fluent form of talking. Large-vocabulary recognizers are defined to be those that have more than one thousand words in their vocabularies; the others are considered small-vocabulary systems. Finally, recognizers designed to perform with lower bandwidth waveforms as restricted by the telephone network are differentiatedfrom those that require a broader bandwidth input.[4]Digital signal processors are special types of processors that are different from the general ones.Some of the DSP features are high speed DSP computations,specialised instruction set,high performance repetitive numeric calculations,fast and efficient memory accesses,special mechanism for real time I/O,low power consumption,low cost in comparison with GPP.The important DSP characteristics are data path and internal architecture, specialised instuction set,external memory architecture,special addressing modes,specialised execution control,specialised peripherals for DSP.[6]At the beginning of each implementation process is an important decision: the choice of appropriate hardware platform on which a system of digital signal processing is operated. It is necessary to understand the hardware aspects in order to implement effective optimized algorithms. The above hardware aspects imply several criteria for choosing the appropriate platform: It is preferable to choose a signal processor than a processor for general use. It may not be decisive a processor frequency, but its effectivenes.DSP tasks require repetitive numeric calculations,alternation to numeric, high memory bandwidth sharing, real time processing.Processors must perform these tasks efficiently while minimizing cost,power consumption,memory use, development time. To properly select a suitable architecture for DSP and speech recognition systems, it is necessary to examine well the available supply and to become familiar with the hardware capabilities of the “candidates”. In the decision it is necessary to take into account some basic features, in which processors from different manufacturers differ. Most DSPs use fixed-point arithmetic, because in real world signal processing the additional range provided by floating point is not needed, and there is a large speed benefit and cost benefit due to reduced hardware complexity. Floating point DSPs may be invaluable in applications where a dynamic range is required. To implement speech recognition different algorithms like Linear predictive coding, Mel Frequency Cepstral coefficient, HMM can be utilized. Here is an attempt to implement the speaker independant speech recognition system with small vocabulary and isolated words based on MFCC algorithm using a Fixed point DSP processor ADSP2181. Advantags of MFCC method are it is capable of capturing the phonetically important characteristic of speech, band limiting can easily be employed to make it suitable for telephone application.[5]

III. FUNCTIONAL DESCRIPTION

Speech Recognition is the process of converting an acoustic signal, captured by microphone or telephone to a set of words. The main requirement for speech recognition is extraction of voice features which makes distinguish different phonemes of language. The second part is matching of parameters for recognition purpose. Voice is a pressure wave, which is afterwards converted into numerical values in order to be digitally processed.Fig.1 gives the theme of the system.

A microphone allows the pressure sound p(t) to be converted into an electrical signal xc(t). Then a sampler at T time intervals (i.e. at a sampling frequency f=1/T) yields voltage values xc(nTc)=x(n), and finally an analog to digital (A/D) converter quantizes each x(n), n=0,1,….. N-1 into a specific number.[4]

This project is an implementation of Speech Recognition algorithm on a fixed point digital signal processor(DSP). Digital signal processors are designed to be especially efficient when executing algorithms common to real time signal processing like speech processing. DSPS are designed to efficiently handle high precision, high throughput arithmetic operations that must be executed in typical signal processing algorithm.The work is based on the detailed analysis of Mel Frequency Cepstrum Coefficient (MFCC) algorithm.Digital Signal Processing approaches the problem of speech recognition in two steps:Feature Extraction followed by Feature Matching.

Windowing-Traditional methods for spectral evaluation are reliable in the case of a stationary signal (i.e. a signal whose statistical characteristics are invariant with respect to time). For voice, this holds only within the short time intervals of articulator stability, during which a short time analysis can be performed by "windowing" a signal x1(n) into a succession of windowed sequences x1(n), 1 = 1, 2 ...T, called frames, which are then individually processed [3,4]

$$x1(n)=x1(n-t.Q), \quad 0\leq n \leq N,\ 1 \leq t \leq T \qquad (1)$$

$$x1(n)=w(n)x1(n) \qquad (2)$$

Where w(n) is the impulse response of the window. Each frame is shifted by a temporal length Q. If Q = N, frames do not temporally overlap while if Q < N, N -Q samples at the end of a frame x1(n)are duplicated at the beginning of the following frame x1(n). Fourier analysis is performed through the Fourier transform that for discrete time signal x1(n) is :

$$x1(e^{jw}) = \sum x1(n).\ e^{-jwn} \qquad \text{for n=0 to N-1} \qquad (3)$$

In ASR, the most-used window is the Hamming window whose impulse response is a raised cosine impulse:

$$w(n)=0.54-0.46\cos(2n/n-1) \text{ for } n=0,\ 1\ldots.\ N-1 \qquad (4)$$
$$= 0 \qquad \text{otherwise}$$

The side lobes of this window are much lower than the rectangular window (i.e. the leakage effect is decreased) although resolution is appreciably reduced. This is because the Hamming main lobe is wider.The Hamming Window is a good choice in speech recognition, because a high resolution is not required, considering that the next block in the feature extraction processing chain integrates all the closest frequency lines.

Once sampling frequency fc is fixed, the spectral resolution is inversely proportional to the sequence length N.A narrow-band spectrum is the one obtained when resolution is high, while a wide-band one is obtained when the resolution is low.

Moreover, larger windows (about 70 ms) have a higher frequency resolution. This allows identification of each single harmonic. However, in such a case, fast transitions in the spectrum (as for instance the pronunciation of stop consonants) are not detected. Narrow windows have been proposed to estimate the fast varying parameters of the vocal tract; while large windows are used to estimate the fundamental frequency. A 20-30 ms long window is generally a good compromise.

Spectral Analysis- The standard methods for spectral analysis rely on the Fourier transform of $x_1(n)$: $X_1(e^{jw})$, Computational complexity is greatly reduced if $X_1(e^{jw})$ is evaluated only for a discrete number of w values.The characteristics of the vocal tract may be estimated by the period gram of $X_1(n)$ that is simply the square magnitude of the DFT: $[X_1k)]^2$.

Filter bank processing -Especially analysis reveals those speech signal features which are mainly due to the shape of the vocal tract. Spectral features of speech are generally obtained as the exit of filter banks which properly integrate a spectrum at defined frequency ranges. A set of 24 band-pass filter is generally used since it simulates human ear processing.

Filters are usually no-uniformly spaced along the frequency axis. As a rule, the part of the spectrum which is below 1KHz is processed by more filter- banks since it contains more information on the vocal tract such as the first formant. The frequency response of the filter banks simulates the perceptual processing performed within the human ear there fore such filtering is called perceptual weighting. In ASR, the most widely used perceptual scale in recognition is the Mel scale whose filter-bank characteristics are outlined. The central frequency of each Mel filter bank is uniformly spaced before 1 KHz

Log Energy Computation-The previous procedure has the role of smoothing the spectrum, performing a processing that is similar to that executed by the human ear. The next step consists of computing the logarithm of the Square of magnitude of the coefficients. Because of the logarithm algebraic property which brings back the logarithm of a power to a multiplication by a scaling factor.

Mel frequency cepstrum coefficient computation (MFCC)- The final procedure for the Mel Frequency cepstrum coefficient computation (MFCC) consists of performing the inverse DFT on the logarithm of the magnitude of the filter bank output.

$$y1^{(m)}(k) = \sum \log \{ | Y_t(m)| \}.\cos(k(m-1/2)\prod/m) \quad k=0,\ldots\ldots L \qquad (5)$$

The procedure has great advantages. First note that since the log power spectrum is real and symmetric then the inverse DFT reduces to a Discrete Cosine Transform (DCT).

Technical Specification of the System:1)Processor ADSP2181-16-bit fixed point CORE operating at 5V,Internalmemory-DM-16KWords(16bits),PM-16KWords(24bits),External memory- DM-16K Words (16-Bits)PM-16k Words (24-bits),Clock-24.576MHz 2)UART-16C550 (19200 Baud rate used) 3) CODEC-HD44233 4)Power Supply-SMPS 5V,500mA with EMI filter.

General Specifications of the System**:**1)Speaker Independent Programmable Speech recognition system.2)Small vocabulary, isolated word system 3)System based on Mel Frequency Cepstral Coefficient algorithm.4)Implemented using fixed point DSP processor ADSP2181.

The proposed system is operated in two phases1.Training phase 2.Testing phase:In training phase the system is trained for a particular word. The

speech samples are converted into MFCCs and are stored in database.In testing phase the word uttered is recognised by the system.The speech samples are converted into MFCCs and are compared with the database. Recognition is observed on the display by having the serial number of the word that is spoken.In the proposed system, to convert the speech signal to its electrical equivalent mono type of microphone is used. The output of a microphone is sampled with 8KHz sampling frequency. This sampling freq. is generated from the serial clock of the DSP processor. Serial clock freq. is generated from the clock out freq. of the processor..To generate the sampling freq. SCLK is divided .CODEC IC HD44233 converts the input analog signal to its discrete time signal.The output is digital in magnitude .This discrete signal is received by the processor through UART ST 16C550.Serial port 1 of ADSP2181 is used to receive the data.For every utterance 2000 samples are taken. Samples are taken in Rx register. Everytime when Rx receives a sample, count is decremented and Rx is saved in DM. This takes place until the count 2000 comes to zero.Once all the samples are taken into data memory, processing of the samples starts by taking first 256 samples .One frame consists of 256 samples. The signal of 256 samples is windowed by Hamming window. The frames are overlapped by 100 samples. The overlapping is done to ensure that all the speech events influence the block calculation.The windowed frame is undergone 256 point FFT. Here DIT algorithm is used. The magnitudes are important as they carry the information related to speech. From the magnitude spectrum power spectrum is estimated.It is passed through a series of 20 mel spaced bandpass triangular filters. The lower cut off freq of the first triangular filter is kept at 100Hz and the upper cut off freq. of the last triangular filter is at 4KHz.Upto 1KHz the bandwidth of the filters is kept100Hz and the scale along freq. axis is linear but after that Log scale is used on the freq. axis. It is a MEL scale. This resemble human hearing system. By using a bank of triangular filters we get spectrum of a spectrum. The energy in a single bin is calculated.As per frame 20 filters are used we get 20 such numbers for a single frame. We get the spectrum mapped on the MEL scale. This is a MEL spectrum. Then the log power spectrum is calculated by taking the log of the sums. It is real.To convert that to again time domain Discrete Cosine Transform is carried out.It is a conversion of a MEL spectrum to MEL Cepstrum. For a single utterance 240 MFCCs are estimated.This whole procedure is executed for a single utterance in the training and testing phases. For recognition, the MFCCs of the utterances in the training phase are compared with the MFCCs of the utterance in the recognition mode The best match is the identified word.

IV. PERFORMANCE ANALYSIS

Wide range of problems in accuracy arise when common automatic speech recognition systems are tested under operating conditions different from those existing in the laboratory when the acoustic models are trained. Also systems designed to work with many speakers there is a worsening of recognition performance when some changes in environmental parameters.The sources of variation are categorized like noise, distortion, articulator effects and pronunciation. [1,2] The proposed system is tested in various conditions like1)Noise level-The system is tested in Silent room where the noise level is very low,Living room where there is considerable amount of noise like the noise of a telephone ring or that of a type-writer and Noisy room where the noise level is very high like the exhibition hall.The system is also tested with varied levels of noise in Training and Testing phase.2) Distance between a speaker and a microphone-The system is tested with variation in microphone distance in training and testing phase.3)Different Speakers- The system is trained for a single word by a particular speaker and tested it for the same word by different male and female speakers. Table I gives the accuracy of the implemented system under various conditions.

Table I System accuracy under various conditions of noise,speakers,microphone dist.

Training	Testing	Speaker	Mic. Distance	Accuracy %
L	L	Same	Less than 5cm	95
M	M			85
H	H			65
L	H			75
L	L	Different	Less than 5cm	85
L	L	Same	Less than 5cm	95
L	L		More than 10cm	50

L,M,H are the Low,Medium,High levels of Noise

On the basis of performance analysis carried out for the proposed system,it is concluded that the accuracy of the system is high when the system is trained and tested in the silent room,with microphone distance of less than 5cm.The accuracy is moderate with different speakers when the system is trained by the third person. It is further concluded that the accuracy of this system degrades because of the change in the noise level in the training phase and testing phase. Also the accuracy is much low when the distance between the speaker and the microphone is greater than 5 cm. The accuracy is

affected when different speakers are using the system which is trained by some different speaker.

Thus it is concluded that wide range of problems in accuracy arise when Common Automatic Speech Recognition System are tested under operating conditions different from those existing in the laboratory when the acoustic models are trained. Also systems designed to work with many speakers there is a worsening of recognition performance when some changes in environmental parameters.

V. ACKNOWLEDGMENT

I feel great pleasure in submitting this paper "Implementation of Speech Recognition System using DSP Processor ADSP 2181". I express my sincere thanks to my dissertation guide Prof. N. R. Kolhare for guiding me at every step in making of this project. She motivated me and boosted my confidence and I must admit that the work would not have been completed without her guidance and encouragement.

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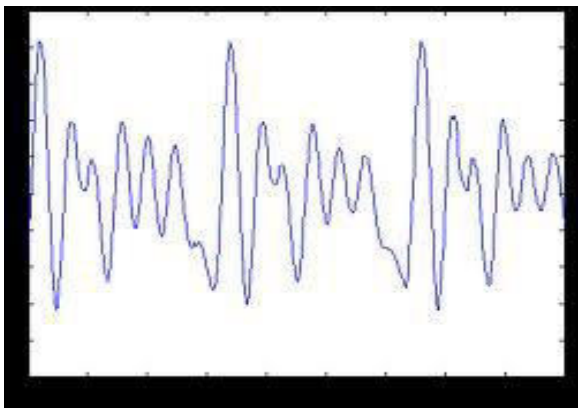

Fig.1.Speech signal in time domain

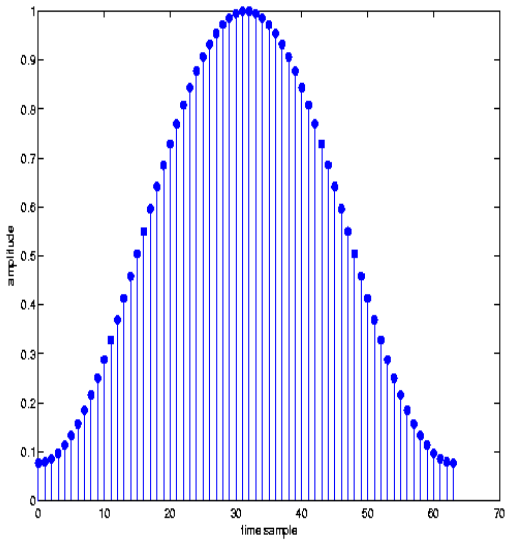

Fig. 2.Hamming window

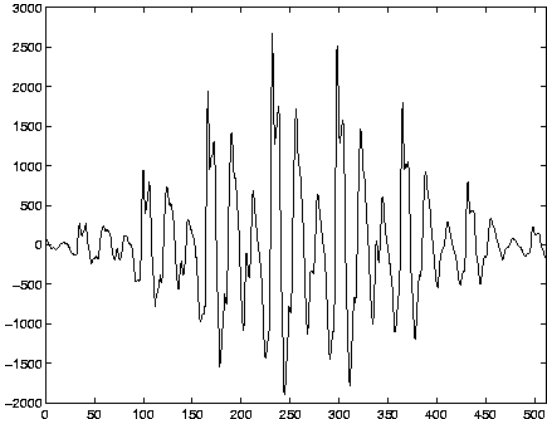

Fig.3.Windowed speech

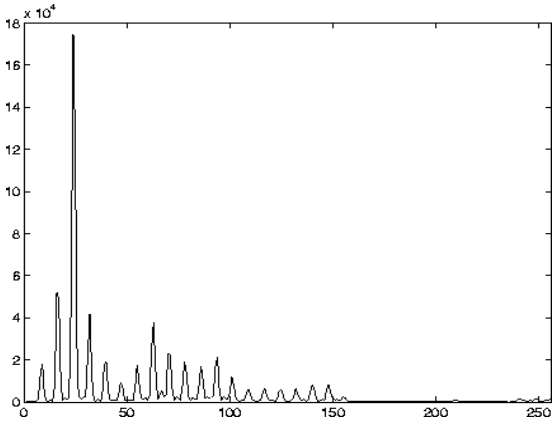

Fig. 4 : Magnitude spectrum

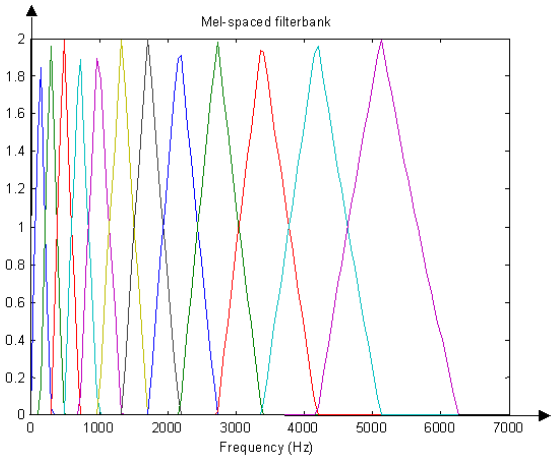

Fig.5.Mel spaced filter bank

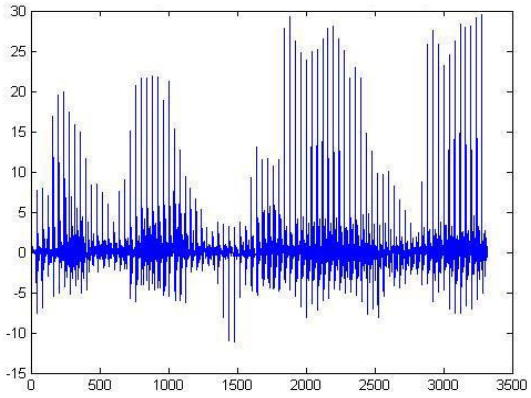

Fig.6.MFCC after DCT

◈◈◈

LDA Based Face Recognition Using DCT and Hybrid DWT

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Abstract - In this paper we present a hybrid approach for efficient human face recognition. The proposed method is based on linear discriminant analysis of image in DCT domain with a combination of details of DWT. And the similarity measure Minkowshi is used here. This approach reduces the storage requirement and computation time while preserving the data. The approach LDA - DCT-hybrid DWT is evaluated on Matlab using ORL face database. Compared to previous methods the proposed method improves feature extraction and retrieval rate.

Keywords - *Face recognition; Discrete Cosine Transform; Discrete Wavelet transform;Linear discriminant Analysis.*

I. INTRODUCTION

During the past two decades, Face recognition [4] bound its importance as the necessity of security levels increasing. This makes the researchers to work for an efficient system of face recognition. The methods of face recognition is mainly divided into two major categories, appearance based (PCA, LDA, IDA etc.,) and feature based, in which the former one is more popularized.

In general face images are captured with very high dimensionality, which is above 1000 pixels. As dimensionality increases the complexity also increases which makes difficult to recognize faces based on the original images. This makes the feature extraction as an important step and base to the face recognition.

In appearance based methods, LDA shows most prominent results than PCA because LDA focus on most discriminant features extraction in both inner classes and outer classes, so that it optimizes the low-dimensional representation of face images. Where as in PCA which is also an Eigen face method, projects the image data into a subspace based on the variance between data. And it treats the inner class and outer class as same.

Also, some of the frequency domain methods have been adopted in face recognition such as Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT).Here features are extracted by first transforming images (spatial domain) into frequency domain. Since frequency domain methods are data independent (basis vectors are constant) and also they require only low frequency components which contain the most information to represent the image, these are more efficient than PCA and LDA.

Here we go through a combination of frequency and spatial domains for feature extraction. Frequency domains such as DCT and DWT reduce the redundant data and make the input into an efficient form. Features are extracted by Linear Discriminant Analysis of image in DCT domain, there by calculating the DWT details of transformed image coefficients. Since the DCT only reduces the correlated data in blocks, using DWT after DCT reduces the redundant data between blocks also.

II. DISCRETE COSINE TRANSFORM

The Discrete Cosine Transform is the most widely used lossy image compression technique, which forms basis for international standard compression algorithm called “JPEG”. Directly using face images having high redundant and correlation data causes heavy burden and complexity in terms of storage and processing speed.

Therefore, a 2D-DCT [1] [6] is applied to an image. It segments the image into a nonoverlapping blocks and DCT is applied to each block separately. This results a transformed image with same dimensions as input image.

For 1D case, DCT is defined as

$$y(k)=\alpha(k)\sum_{n=0}^{N-1}x(n)\cos\left[\frac{\pi(2n+1)k}{2N}\right],$$

$$k=0,1,.....N-1 \qquad (1)$$

Where

$$\alpha(k) = \begin{cases} \frac{1}{\sqrt{N}}, k = 0 \\ \sqrt{\frac{2}{N}}, k = 1,2,.....N-1 \end{cases}$$

The vector form of equation (1) can be written as $y = C^T x$ .The elements of matrix C can be derived from equations shown below.

$$c_{n,k} = \frac{1}{\sqrt{N}}, k = 0, n = 0,1,....N-1$$

$$c_{n,k} = \sqrt{\frac{2}{N}} \cos\left[\frac{\pi(2n+1)k}{2N}\right],$$

K=1, 2 …N-1, n=0, 1 …N-1

Since the transform matrix C is an orthogonal matrix ($C^T = C^{-1}$), the 2D-DCT can be computed as

$$Y = C_M^T X C_N$$

Where X is the input image with M rows and N columns and Y is the 2D- DCT coefficients matrix.

A. Block DCT

In JPEG standard images are divided into blocks (8x8) where each block is independently applied in DCT. For a given image of size pnxqn, with sub images of size nxn, the DCT is applied.

Since the transformation matrix is also an orthogonal matrix, JPEG DCT coefficients are directly used for the LDA approach and the inverse DCT which increases the computation time is skipped.

III. DISCRETE WAVELET TRANSFORM

Most commonly used frequency domain approach for image analysis is discrete wavelet transform and also become a part of "JPEG2000" standard. A signal is decomposed into a set of basis functions called "wavelets" in DWT [2]. Here decomposition means resolution of signal. In DWT multi resolution analysis is performed with localization in both frequency and time domains.

Mathematically DWT can be expressed as:

$$DWT_{x(n)} = \begin{cases} d_{j,k} = \sum x(n) h_j^*\left(n - 2^j k\right) \\ a_{j,k} = \sum x(n) g_j^*\left(n - 2^j k\right) \end{cases} \quad (2)$$

The coefficients $d_{j,k}$ are called detail components of signal x(n) and coefficients $a_{j,k}$ are called approximation components .the functions g(n) and h(n) refer to the coefficients of low pass and high pass filters with parameters j and k as wavelet scale and translation factors.

In case of 2D images ,DWT is done as a set of filter banks (combination of low pass and high pass filters).Finally image is decomposed into four non-overlapping ,multi-resolution sub bands: LL,LH,HL,HH where, LL corresponds to approximation details(coarse scale) and LH,HL,HH corresponds to horizontal, vertical and diagonal details(fine scale) respectively. Size of each band is quarter to the original image size .The next level of DWT is obtained by further decomposition of LL sub band. We can repeat the DWT multiple times for multiple level of resolution as shown in Fig.1.

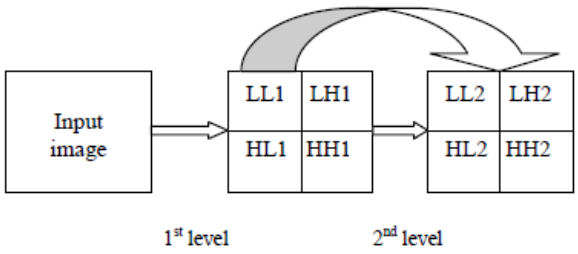

Fig. 1 : Decomposition levels in DWT.

Size of each band in 1st level =1/4th of original.

Size of each band in 2nd level=1/4th of LL1 (approximation).

IV. LINEAR DISCRIMINANT ANALYSIS

Linear Discriminant Analysis (LDA) [3] is one of the best dimensionality reduction and feature extraction technique, it prove its importance in image analysis. The main objective of LDA [6] is to find a set of projecting vector that best discriminate the different classes. So that the ratio of between class scatter matrix and within class scatter matrix increases.

In LDA the equations for between class and within class scatter matrix is given as

$$s_b = \sum_{i=1}^{c} n_i \left(\overline{X_i} - \overline{X}\right)\left(\overline{X_i} - \overline{X}\right)^T \quad (3)$$

$$s_w = \sum_{i=1}^{c} \sum_{X_j \in C_i} \left(X_j - \overline{X_i}\right)\left(X_j - \overline{X_i}\right)^T \quad (4)$$

Where n is the number of samples in class C_i, c is the number of classes, and $\overline{X_i} = \left(\frac{1}{n_i}\right)\sum_{k=1}^{n_i} X_k$ is the mean of class C_i and $\overline{X} = \left(\frac{1}{c}\right)\sum_{k=1}^{c} X_k$ is the mean of all samples.

The goal of LDA is to maximize the ratio of between-class measure to with-in class measure so that it best discriminates the classes, and it is determined as:

$$E_{opt} = \arg\max_{E} \frac{\left|E^T S_b E\right|}{\left|E^T S_w E\right|} = \left[e_1, e_2, ...e_m\right] \qquad (5)$$

Where $e_1, e_2, ...e_m$ are the m largest eigenvectors with respect to the m largest Eigen values $\lambda_i, i = 1,2,....m$ .i.e.,

$$S_b e_i = \lambda_i S_w e_i, i = 1,2,....m. \qquad (6)$$

And the projection matrix is given as

$$Y = E_{opt}^T X. \qquad (7)$$

It has to be proven that, the ratio is maximized even for the projection matrix, which calculated by using the eigenvectors of $S_w^{-1} S_b$.

V. METHODOLOGY

The block diagram for proposed method of hybrid face recognition is as shown in Fig.2. A combination of DCT, DWT and LDA is used for feature extraction of images. Images are finally retrieved by comparing the features extracted from query and database.

The system performance is evaluated by using database ORL (Olivetti Research Laboratory), Cambridge, U.K. The database contains images of 40 people, with each person having 10 different poses (400 images).

The face recognition model presented in this paper is developed using MATLAB 2009a.

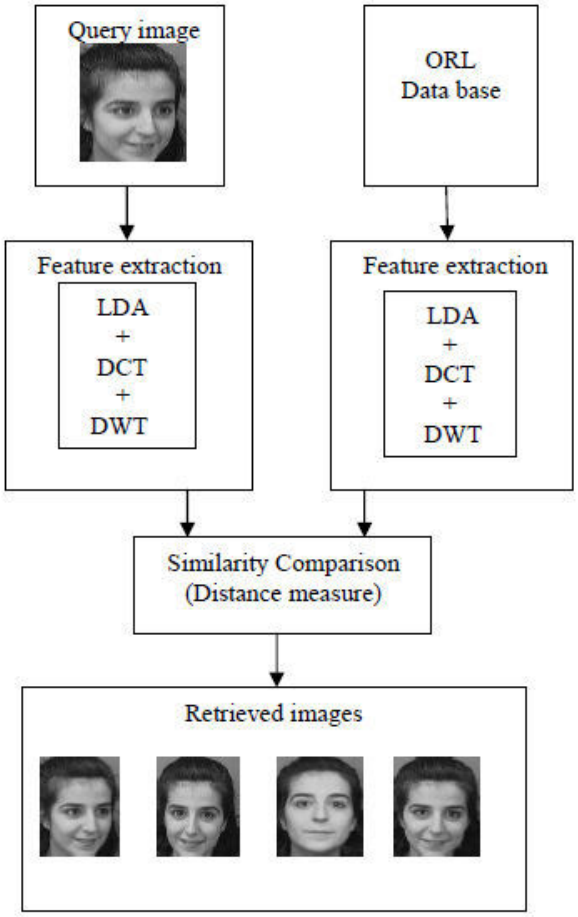

Fig. 2 : Face Recognition system for proposed method.

A. *Feature Extraction*

Before finding the projection result, the within class scatter matrix and between class scatter matrix are transformed in DCT domain using orthogonal matrix Q, i.e.,

$$\overline{S_b} = Q^T S_b Q \qquad (8)$$

$$\overline{S_w} = Q^T S_w Q \qquad (9)$$

Now these transformed matrices are taken as input to the DWT.A wavelet function called “haar” which is very simple and orthogonal is used in DWT [7]. In DWT, decomposition of matrices makes the output with four details, out of which most of the information in approximation details (smooth information), except the sharp edge information. To maintain the data efficient, instead of using all four sub bands the diagonal details which contain the sharp edge information is merged with approximation details. The new modified/transformed with-in class and between-class

scatter matrices are used for further procedure in LDA [6] for feature extraction. Finally a projection matrix with Eigen vectors [5] correspond to highest Eigen values [5] is obtained.

B. Similarity measure

Similarity measure is the step done after extracting features. The similarity between the query image and images in database can be obtained by simply measuring the distance. The distance used in this method is Minkowski [8], which is given as

$$\text{Minkowski Distance}=\left(\sum_{i=1}^{n}|x_i - y_i|^p\right)^{\frac{1}{p}}$$

Where n is the number of samples and p is the order.

p=1 for Manhattan distance and

p=2 for Euclidean distance.

VI. EXPERIMENTAL RESULTS

The results shown here are obtained by using the ORL database having 400 images with each image size of 112x92. The results shows that the proposed method performs better when compared to some of the existing methods. The number of features is taken constant throughout all the methods.

The results that obtained by comparing the recognition rates with different methods are as shown in Table 1.

TABLE I : COMPARISION OF RECOGNITION RATES

Method	Recognition rate(%) per samples				
	1	3	5	7	10
LDA	100	63.4	52.5	48.92	42.25
LDA in DCT domain	100	86.6	81.5	71.42	65.5
LDA in DWT/DCT domain [7]	100	94.16	82.5	74.64	63.5
LDA in DCT/DWT domain (proposed method)	100	86.6	78.5	75	67.5

As from the above table it can be consider that the recognition rate will be increased when DWT is done after DCT.

VII. CONCLUSION

A new framework for face recognition is presented in this paper. This method uses a combination of DCT and DWT frequency domains with LDA spatial domain for feature extraction. DCT extracts the efficient transformed information for which DWT is applied to extract major features of LDA class matrices. Because of merging the details of smooth and sharp information in DWT the feature size is reduced with increasing efficiency.

Experiment results obtained reveal that the proposed method shows good recognition accuracy compared to previous proposed techniques.

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Audio to Text Conversion
Using Mel Frequency Cepstral Coefficient Based on HMM

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Abstract - This paper presents an approach to the recognition of speech signal using frequency cepstral information with Mel Frequency for the improvement of speech feature representation in HMM based recognition approach. On a recent contribution by authors, it has been shown that the Inverted Mel Frequency Cepstral Coefficients (IMFCC) is useful feature set for speech recognition, which contains complementary information present in high frequency region. This paper explains the basic concept of using Mel-cepsrtum for speech recognition while calculating MFCC and IMFCC in place of typical triangular shaped bins.

Mel scale is a better approximation of mapping perceived frequency to a linear scale. Mel-cepstral coefficients corresponding to short term correlation in speech signal are significant is obtaining a better model for the speech data.The mapping factor between the real frequency scale and the perceived Mel frequency scale is an important parameter which finds a significant use in speech recognition. This paper also provides details about feature extraction of two words i.e. “Light on” and “open door”, for different windowing technique such as hamming, hanning, blackman and rectangular window using three speakers for a speech recognition system.

Keywords *— Speech-recognition, MFCC, IMFCC, Hidden Morkov Model(HMM), Guassian filter(GF), Triangular filter, speaker(spk).*

I. INTRODUCTION

The field of Automatic Speech Recognition(ASR) is about 60 years old. There have been many interesting advances and developments since the invention of the first speech recognizer at Bell Labs in the early 1950’s.The development of ASR increased gradually until the invention of Hidden Morkov Models(HMM) inearly 1970’s. Researchers’ contribution were to make use of ASR technology to what can be seen nowadays of various advancements in fields like multi-modal, multi-lingual/cross-lingual ASR using statistical techniques such as HMM, SVM, neural network, etc[1].Automatic Speech Recognition(ASR)is a technology that allows a computer to identify the words that person speaks into microphone `or telephone. It has a wide area of applications: Command Recognition (voice user interface with computer), Dictation and interactive voice response. It can be used to learn foreign language. ASR can help handicapped people to interact with society. It is a technology which makes life easier and very promising[1]. Speech Recognition task split into two phases, Database Creation/Training phase and Recognition/Testing phase. The Training phase transforms the speech signal into feature vectors containing spectral and / or temporal information using Mel-frequency cepstral coefficients (MFCC). Recognition / Testing phase matches unit’s of features, unit’s can be word’s, subwords. For this project we will implementing two commands “open door” and “lights on” or English digits (from zero to nine). In general, all ASR systems aim to automatically extract the string of spoken words from input speech signals as illustrated in figure 1.

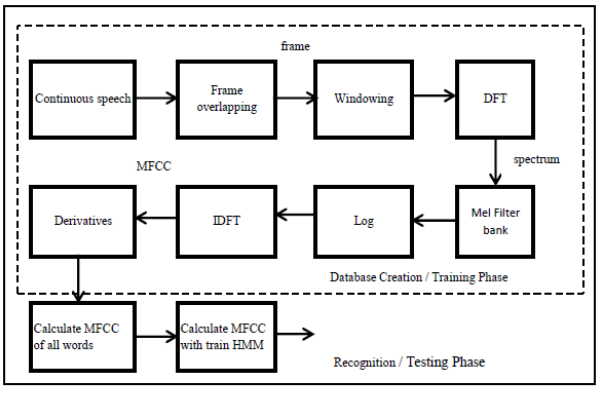


Fig.1 Block diagram of Audio to Text Conversion Speech Recognition based on HMM

Any speech recognition system consists of a feature extractor as a front-end for module followed by a robust speaker modeling technique for generalized

representation of extracted features. MFCC is considered as a reliable front-end for speech recognition application as it can describes the vocal tract characteristics and easy to extract. In a recently contributed artical[7] by present authors, it has been shown that complementary information[9] can be captured easily from the high frequency part of the energy spectrum of a speech frame via reversed filter bank methodology.The work has been proposed a new feature set called IMFCC to capture speaker specific information lying in higher frequency part of the spectrum and usually ignored by MFCC. The complementary information are pitch, residual phase, prosody, dialectical feature etc. Feature selection is generally considered a process of mapping the original measurements into more effective features. If the mapping is linear, the mapping function is well defined and our task is simply to find the coefficients so as to optimize based on a criterion.

II. MEL CEPSTRUM APPOROACH

Spectrum is the representation of the signal with which we can assess the "separation" of the component parts and perhaps derive needed information about the components and also, the representation of the component signals are combined linearly in the spectrum. The shape of spectrum provides the maximum information present in speech signal. Information like high frequency (high or low), resonance, noise information can be obtained using spectrum[10].
On the other hand, the "cepstrum" represents a transformation on the speech signal with two important properties:

1. Representatives of component signals are *separated* in the cepstrum.

2. Representatives of component signals are *linearly combined* in the cepstrum.

The cepstrum provides the needed information to assess the properties of the component signals. The cepstrum derived from homomorphic processing (cepstral analysis within a general class of methods) is usually called the complex cepstrum and real part of complex cepstrum within a scale factor is called real cepstrum. At a certain time in speech research the cepstrum features began to supplant the direct use of the Linear Prediction parameters as the important feature obtained from hidden Morkov modeling strategy because of two convenient enhancements that were found to improve recognition rates. First, is the ability to easily smooth the Linear Prediction based spectrum using the liftering and weighting process.

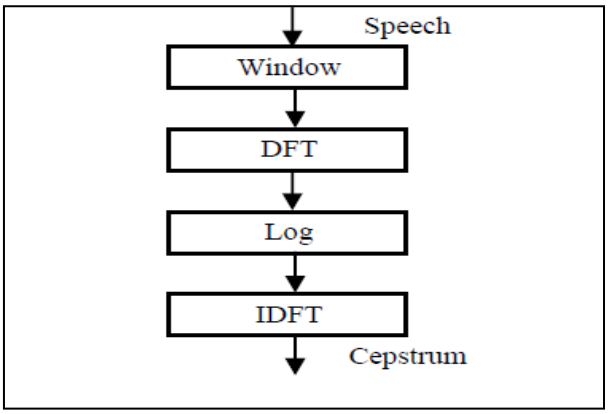
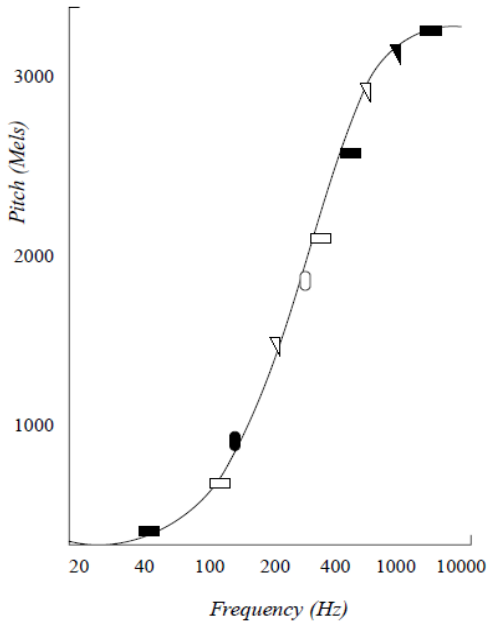


Fig .2 Block diagram demonstrating process of obtaining cepstrum features from speech signal

Liftering is a useful process with the real cepstrum for obtaining an estimate of the log spectrum of either of the separated components of the cepstrum Weighting is a procedure wherein the Euclidean distance between cepstral coefficients for which each term of the sum is multiplied by a predetermined weighting coefficient However when constant weighting is used this reduces to the standard cepstral distance, comprise the subclass of weighted cepstral distance measures for which the weighting factor increases linearly with the index (k).



For triangular weighted cepstral distance measures recognition performance is best when the number of cepstral difference terms are approximately equal to the order of all-pole model. This process removes the inherent variability of the Linear prediction based spectrum due to the excitation and improves recognition

performance. The other method of improvement over direct use of the Linear prediction parameters is use of so called "Mel-based cepstrum".

A Mel is a unit of measure of perceived pitch of frequency of a tone, as the human auditory system apparently does not perceive pitch in this linear manner. The precise meaning of mel scale becomes clear by examining the experiment by which it is derived. With several experiments in speech research it was concluded that linear relationship exists between the real frequency scale(Hz) and the perceived frequency scale (Mels). The graph demonstrating the linear relationship between these parameters is shown in figure2 The equation illustrating the relationship between the frequency scale and perceived frequency scale is shown in equation1.

$$F_{mel} = \frac{1000}{\log 2} + \frac{F_{Hz}}{1000} \qquad (1)$$

III. MEL FREQUENCY CEPSTRAL COEFFICIENTS AND THEIR CALCULATION

A. Mel-Frequency Cepstral Coefficients using triangular filters

According to psychophysical studies[17], human perception of the frequency content of sounds follows a subjectively defined nonlinear scale called the Mel scale[18].

This is defined as,

$$f_{mel} = 2595 \log_{10}\left(1 + \frac{f}{700}\right) \qquad (2)$$

where *fmel* is the subjective pitch in Mels corresponding to *f*, the actual frequency in Hz. This leads to the definition of MFCC, a baseline acoustic feature [19] for Speech and Speaker Recognition applications, which can be calculated as follows

Let $\{y(n)\}_{n=1}^{N_s}$ represent a frame of speech that is preemphasized and Hamming-windowed. First, *y(n)* is converted to the frequency domain by an M_s-point DFT which leads to the energy spectrum,

$$|Y(k)|^2 = \left|\sum_{n=1}^{M_s} y(n)\cdot e^{\left(-\frac{j2\pi nk}{M_s}\right)}\right|^2 \qquad (3)$$

where, $1 \le k \le M_s$. This is followed by the construction of a filter bank with *Q* unity height TFs, uniformly spaced in the Mel scale (eqn.1). The filter response $\Psi_i(k)$ of the *i*th filter in the bank, (fig.3) is defined as,

$$\Psi_i(k) = \begin{cases} 0 & for \quad k \le k_{b_{i-1}} \\ \dfrac{k - k_{b_{i-1}}}{k_{b_i} - k_{b_{i-1}}} & for\ k_{b_{i-1}} \le k \le k_{b_i} \\ \dfrac{k_{b_{i+1}} - k}{k_{b_{i+1}} - k_{b_i}} & for\ k_{b_i} \le k \le k_{b_{i+1}} \\ 0 & for\ k \ge k_{b_{i+1}} \end{cases} \qquad (4)$$

Where $1 \le i \le Q$, Q is the number of filters in the bank, $\{k_{b_i}\}_{i=0}^{Q+1}$ are the boundary points of the filters and *k* denotes the coefficient index in the *Ms*-point DFT. The filter bank boundary points, $\{k_{b_i}\}_{i=0}^{Q+1}$ are equally spaced in the Mel scale which is satisfied by the definition.

$$k_{b_i} = \left(\frac{M_s}{F_s}\right)\cdot f_{mel}^{-1}\left[f_{mel}(f_{low}) + \frac{i\{f_{mel}(f_{high}) - f_{mel}(f_{low})\}}{Q+1}\right] \qquad (5)$$

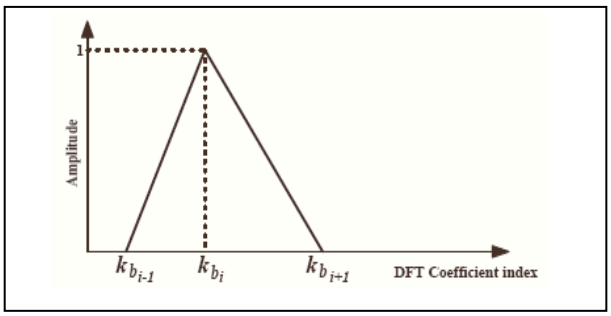


Fig.3 Response i(k) of a typical Mel scale filter defined as in eqn.

where the function $f_{mel}(\cdot)$ is defined in eqn 1, *Ms* is the number of points in the DFT (eqn.3),*Fs* is the sampling frequency, f_{low} and f_{high} are the low and high frequency boundaries of the filter bank and f_{mel}^{-1} is the inverse of the transformation in eqn.1 defined as,

$$f_{mel}^{-1}(f_{mel}) = 700\cdot\left[10^{\frac{f_{mel}}{2595}} - 1\right] \qquad (6)$$

The sampling frequency Fs and the frequencies f_{low} and f_{high} are in Hz while f_{mel} is in Mels. For both the databases considered in this work, Fs are 8 kHz. *Ms* was taken as 256,

$f_{low} = F_s/M_s = 31.25$ Hz while $f_{high} = F_s/2 = 4$ kHz.

Next, this filter bank is imposed on the spectrum calculated in Eqn.3. The outputs $e(i)_{i=1}^{Q}$ of the Mel-scaled band-pass filters can be calculated by a weighted summation between respective filter response $\Psi_i(k)$ and the energy spectrum $|Y(k)|^2$ as

Finally, DCT is taken on the log filter bank energies $\{log[e(i)]\}_{i=1}^{Q}$ and the final MFCC coefficients *Cm* can be written as,

$$C_m = \sqrt{\frac{2}{Q}} \sum_{i=0}^{Q-1} log\left[e(i+1)\right] \cdot cos\left[m \cdot \left(\frac{2l-1}{2}\right) \cdot \frac{\pi}{Q}\right] \quad (7)$$

Where, $0 \leq m \leq R\text{-}1$, R is the desired number of cepstral features. Fig.4 shows the structure of MFCC filter bank using triangular.

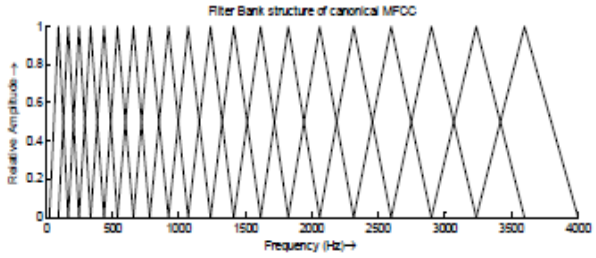


Fig.6 Filter Bank structure for canonical IMFCC

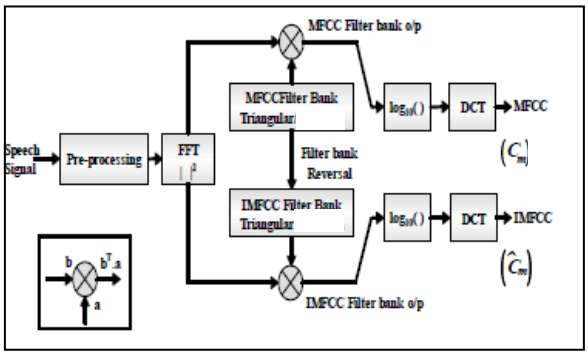


Fig.7 Plot showing extraction of Triangular MFCC and Triangular IMFCC features

IV. EXPERIMENTAL EVALUATION

A. Pre-processing stage

In this work, each frame of speech is pre-processed by i) silence removal and end point dection using an energy threshold criterion, followed by ii) pre-emphasis with 0.97 pre-emphasis factor, iii) No. of MFCC coefficient is 13, and finally iv)Windowing techniques used are ,Hamming, Hanning, Blackman & Rectangular for feature extraction using triangular are plotted. v) Window length with 10 & Window overlap is 25. Vi) Lowest frequency is 200 & Highest frequency is 4000.

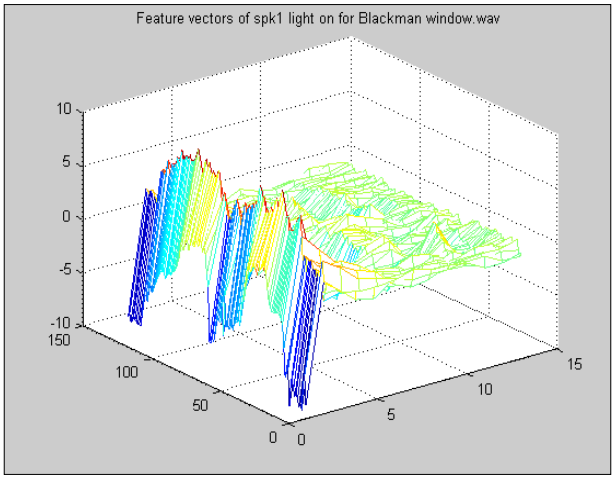
B. Databases for experiments

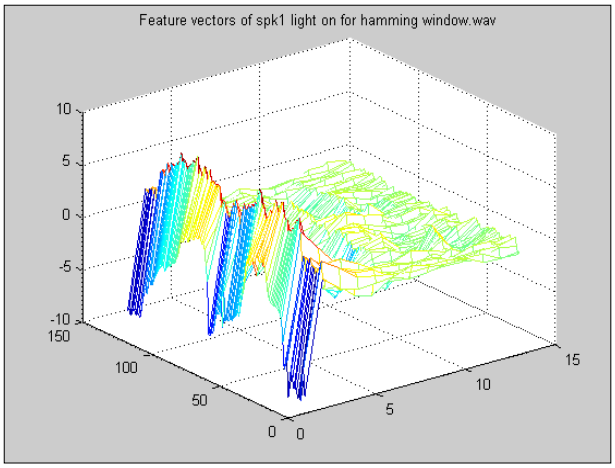
The database consist of 30 words for 3 speakers. It also contains 30 sound files for training and from 30 sound files, 1 sound file used for testing the Continuous Speech Recognition module. Speaker 1, Speaker 2 and Speaker 3 consist of 10 sound files as "Light on" and 10 sound files as "Open door."

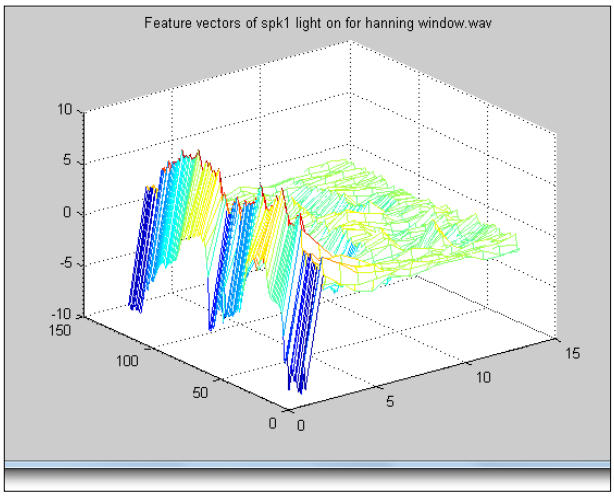
C. Experimens results

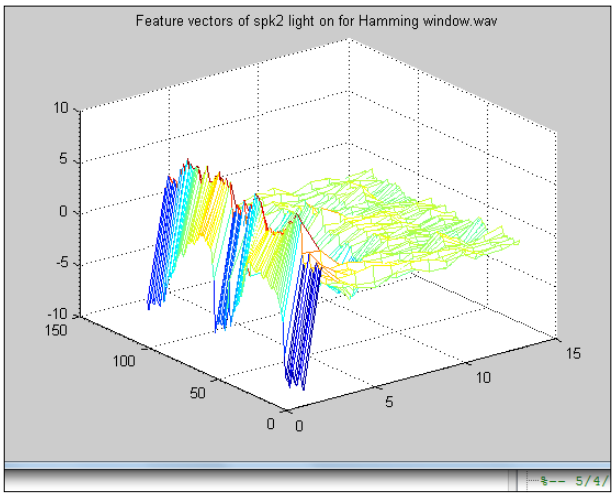
We are presenting two experiments results by using MFCC Feature Extraction Technique for two speakers. The first experiment is for word "Light on" and second experiment is for word "Open door." For different windowing techniques.

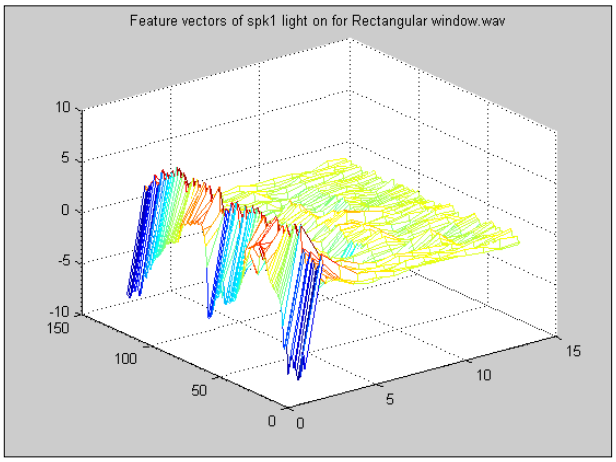
1. Results for "Light on" Database for spk1 and spk2

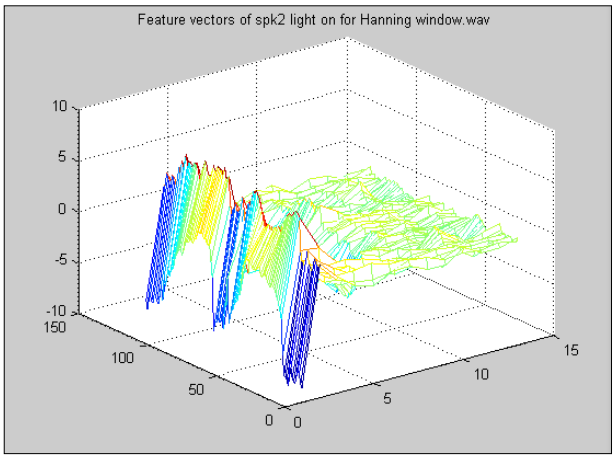


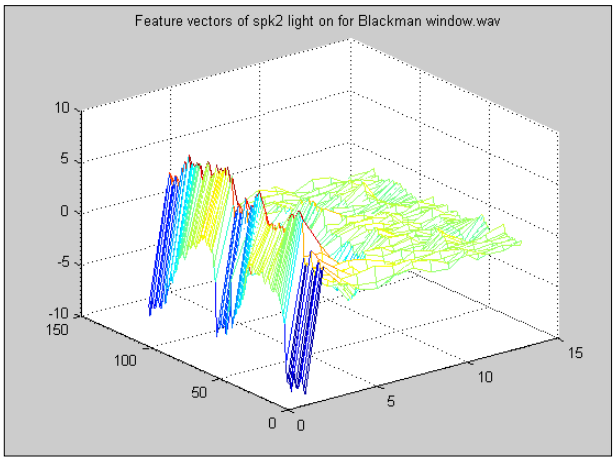


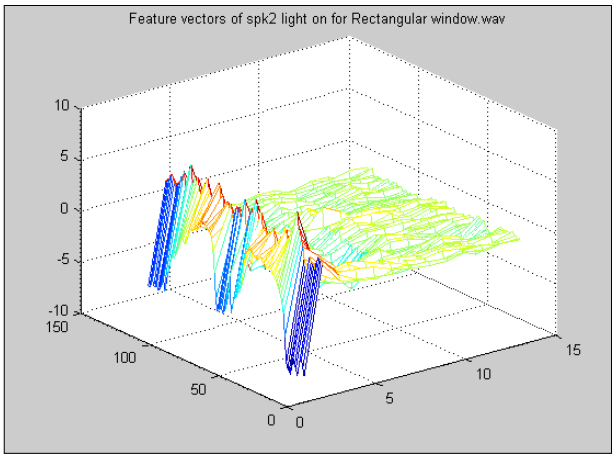

Feature vectors of spk1 light on for hanning window.wav


Feature vectors of spk2 light on for Hamming window.wav

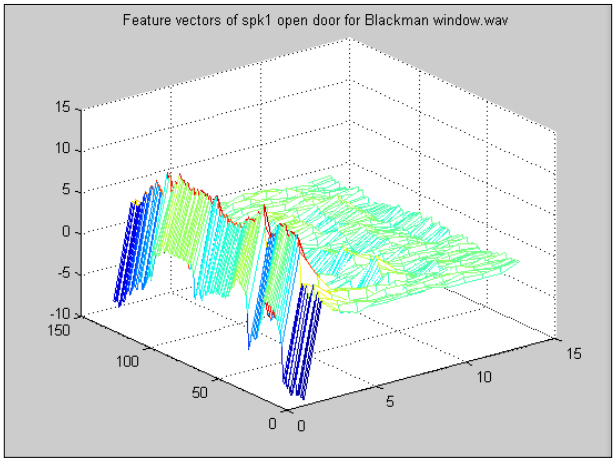

Feature vectors of spk1 light on for Rectangular window.wav

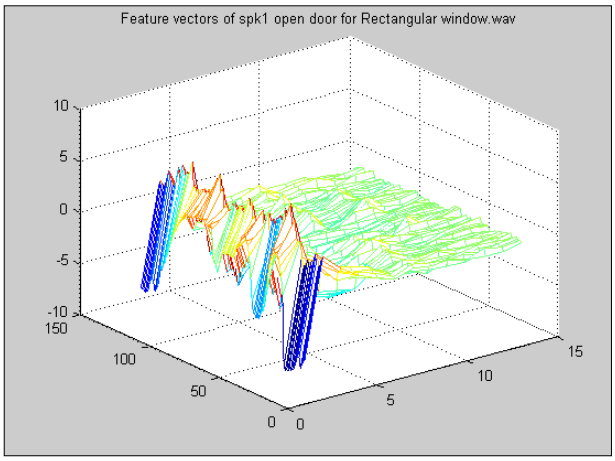

Feature vectors of spk2 light on for Hanning window.wav

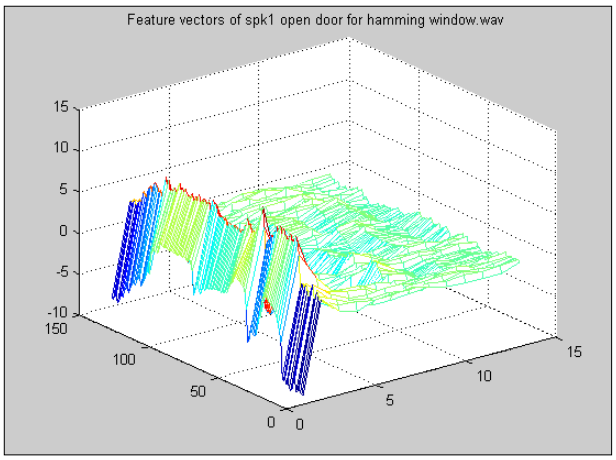

Feature vectors of spk2 light on for Blackman window.wav

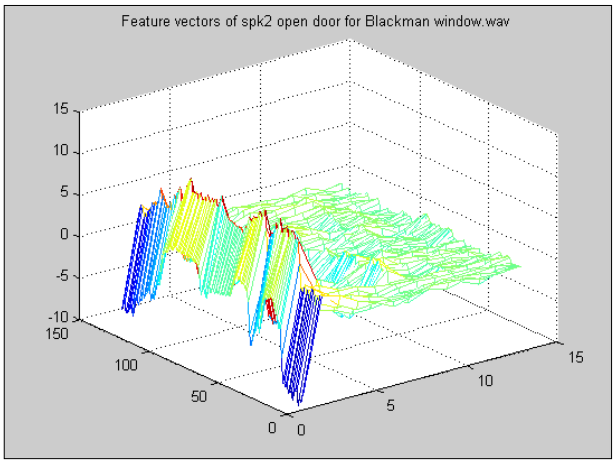

Feature vectors of spk2 light on for Rectangular window.wav

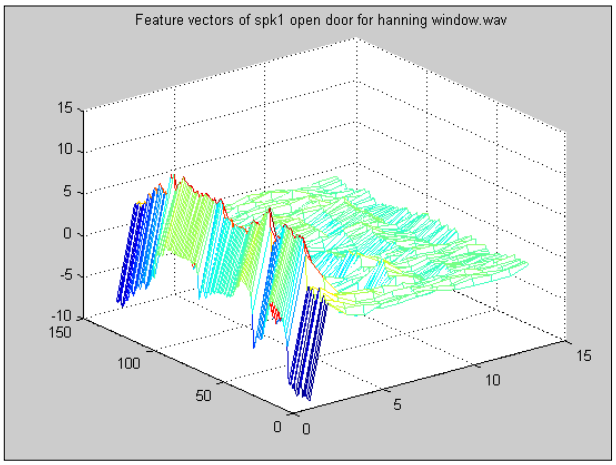
2.Results for “Open door” Database for spk1 and spk2

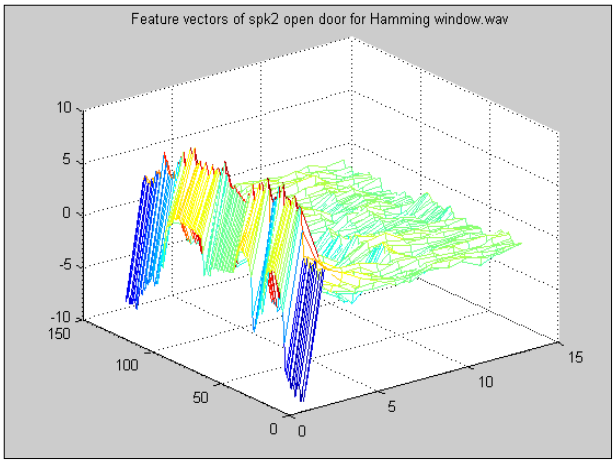


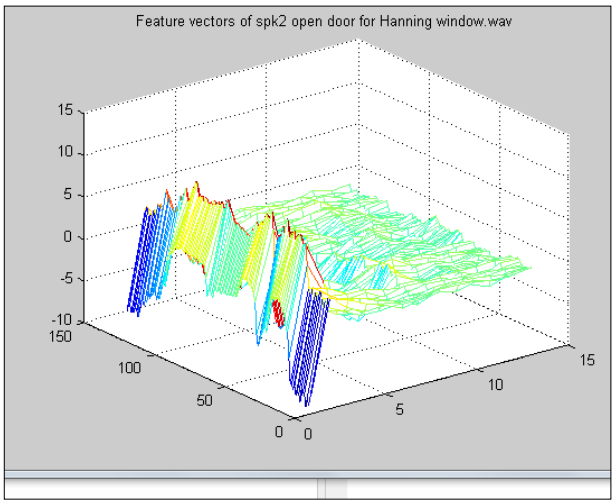


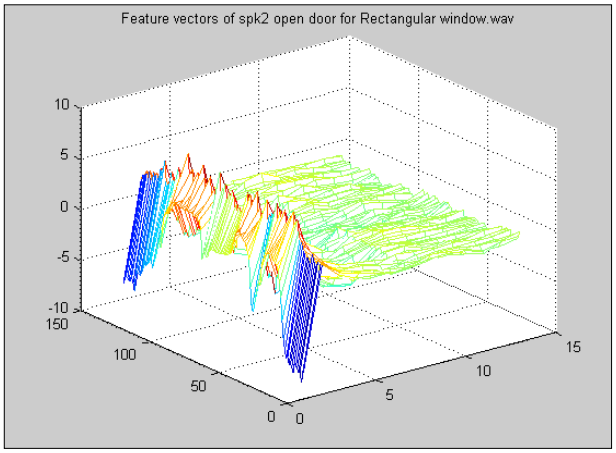












V. CONCLUSION

In this project we successfully managed to identify the person speaking and what they were saying. We successfully differentiated between two different words. The system would not be accurate on every word spoken, but the overall there was about an 80% success rate with a false alarm rate below 10%.

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Design and Realization of Unequal Power Divider

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Abstract - Antennas are used in almost all of the communication systems in the world. For antennas to be compact and yet effective, power dividers with efficient power distribution are to be used for feeding the array of antennas. The paper deals with the design of an efficient 8-way power divider for both equal and unequal power distribution. The unequal 8 way power divider uses Taylor Line Source distribution where the centre element is fed with more power and decreases with hierarchy. It has the capability of transmitting input power to output ports with close accordance with the theoretical values. The design starts with finding the array coefficients using a Taylor distribution and designing of a 2-way power divider for equal and unequal power distribution and analyzing the results. There after designing a 4-way i.e., 2-way 2-stage power dividers having 4 output ports. After the analysis we design an efficient 8 output power divider i.e. a 2-way 3-stage power divider for equal and unequal power division. The 2-way 3-stage unequal power divider with Taylor type power distribution can be used for feeding antenna arrays where directivity of antenna is of concern. The designed structure has to be simulated in AWR Microwave office and later verified in CST studio suite.

I. INTRODUCTION

As the single element will have wide radiation pattern, have less directivity, there is need for antenna array where multiple elements are arranged in a specific order to get high directivity. There are several factors that affect the antenna array elements like the relative displacement between elements, phase, amplitude of individual elements and geometrical configuration.

To supply power to array elements we need to have a power divider network. There are several methods to generate the array coefficients for the power divider. They are:

1. *Binomial Array*: The excitation coefficients are generated using a binomial series of expressions or a Pascal's triangle. Binomial array do not exhibit any minor lobes provided the spacing between the elements is equal or less than one half of a wavelength. As there are very low minor lobes, they exhibit larger beam widths. A major practical disadvantage of binomial arrays is wide variation between the amplitudes of different elements of an array which leads to very low efficiency.

2. *Dolph Tschebyscheff Array*: It is another type of array used for practical applications where excitation coefficients are related to Tschebyscheff polynomials. A Dolph Tschebyscheff array with no sidelobes results to Binomial array. The major disadvantage of the Dolph Tschebyscheff array is that the side lobes are maintained at a constant level.

3. *Taylor Line source (one parameter*): As the minor lobes are maintained at constant level in Dolph Tschebyscheff array, Taylor designed this method where the side lobes reduce monotonically. It is an optimum compromise between the beam width and side lobe level.

II. POWER DIVIDER

Power dividers are passive microwave components used for power division. In power division, an input signal is divided into two or more signals of lesser power.

There are several forms of power dividing networks such as the

i) T junction power divider,

ii) Resistive power divider and

iii) Wilkinson power divider.

Power dividers are often of the equal division type, but unequal power division ratios are also possible.

The lossless T-junction divider suffers from the problem of not being matched at all ports and in addition does not have any isolation between output ports.

The resistive divider can be matched at all ports, but even though it is not lossless, isolation is still not achieved. The lossy three port network can be made

having all ports matched with isolation between the output ports.

III. WILKINSON POWER DIVIDER

The Wilkinson power divider is such a network. It has the useful property of being lossless when the output ports are matched, i.e. only reflected power is dissipated. It has extremely useful properties like matched at all ports, large isolation between output ports, reciprocal, lossless when output ports are matched.

A. Equal Power Divider:

The Wilkinson power divider can be made with arbitrary power division but we will first consider the equal split case. The divider is often made in micro strip line form. We analyses the circuit in two very special configurations (symmetric and asymmetric) then add these two solutions for the total solution.

This mathematical process is call and Even-Odd mode analysis. It is a technique used in many branches of science such as quantum mechanics, antenna analysis etc.

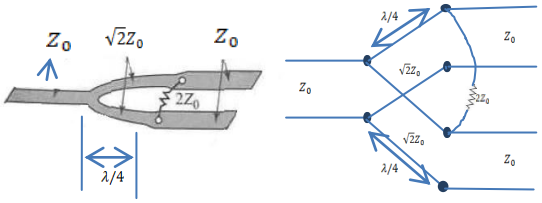


Fig.1 : An equal split Wilkinson power divider in micro strip form and its equivalent transmission line circuit.

B. Even Mode Analysis:

For the even mode excitation V_{g2}=V_{g3}= 2V, and so V_2^e=V_3^e and there is no current flow through r/2 resistors or short circuit between the inputs of the two transmission lines at port 1. Thus by bisecting the network of the fig.2.2 with open circuits at these points to obtain the network of fig. Looking into port 2, impedance seen is

$$Z_{in}^e = \lambda Z^2/2$$

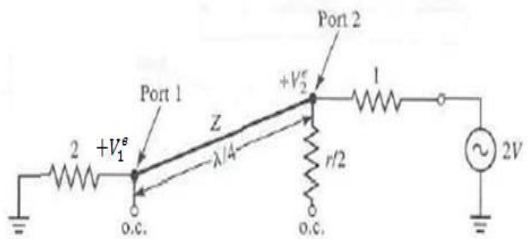


Fig. 2 : Bisection of circuit for even mode excitation.

Since the transmission line looks like a quarter wave transformer. Thus if Z=$\sqrt{2}$, port 2 will be matched for even mode excitation; then V_2^e=V since Z_{in}^e=1. The r/2 resistor is superfluous in this case, since one end is open circuited and find V_1^e from the transmission line equations. Let x=0 at port 1 and x = -ʎ/4 at port 2, the voltage on the transmission line section can be written as

$$V(x) = V^+(e^{-jBx} + e^{jBx})$$

Then

$$V_2^e = V(-\lambda/4) = jV^+(1-\Gamma) = V \quad .$$

$$V_1^e = V(0) = V^+(1+\Gamma) = jV\frac{\Gamma+1}{\Gamma-1}.$$

The reflection coefficient Γ is that seen at port 1, looking toward the resistor of normalized value 2, so

$$\Gamma = \frac{2-\sqrt{2}}{2+\sqrt{2}}$$

And

$$V_1^e = -jV\sqrt{2}$$

C. Odd Mode Analysis:

For the odd mode excitation, and there is a voltage null along the middle of the circuit. Thus, bisecting the circuit by grounding it at two points on its mid place to give the network. Looking into port2, an impedance of r/2 can be seen, since the parallel connected transmission line is ʎ/4 long and shorted at port 1, and so looks like an open circuit at port2. Thus port 2 will be matched for odd mode excitation if r=2. Then V_2^o = V and V_1^o = 0; for this mode of excitation all power is delivered to the r/2 resistors, with none going to port1.

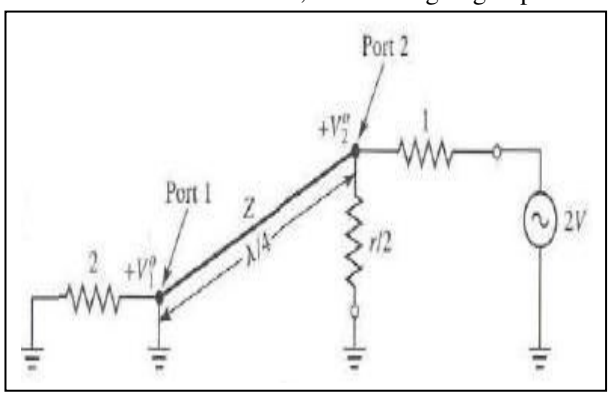


Fig. 3 : Bisection of circuit for odd mode excitation.

D. Unequal Power Divider:

Wilkinson power divider can also be made with unequal power splits a microstrip version is shown. If the power ratio between ports 2 and 3 is $k^2 = \frac{P3}{p2}$,then following design equations apply.

$$Z_{03} = Z_0\sqrt{\frac{1+k^2}{k^3}}$$

$$Z_{02}=Z_0\sqrt{k(1+k^2}$$

$$R=Z_0(k+\frac{1}{k})$$

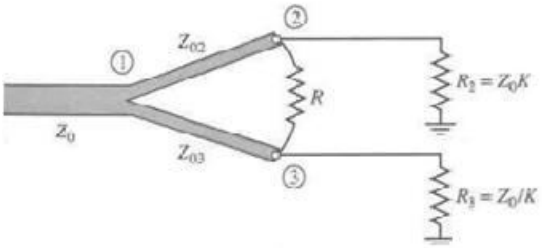


Fig. 4 : Schematic of Wilkinson Unequal power divider and its formulae

In the case of equal division K=1 for above formulae. The output lines are matched to the impedances $R_2 = Z_0$K and $R_3 = = Z_0$/K, as opposed to the impedance Z_0 ; matching transformers can be used to transform these output impedances.

E. N-Unequal Power Divder:

The Wilkinson power divider can also be made for two or more output ports of lesser power. It can be generalized to an N-way divider. This circuit can be matched at all ports, with isolation between all ports. A disadvantage, is the fact that the divider requires crossovers for all the resistors if N>3. The Wilkinson divider can also be made with stepped multiple sections, for increased bandwidth. The Wilkinson power divider can be made to N number of output ports in either direct way or in stage by stage. The following fig. shows the N-way Wilkinson power divider.

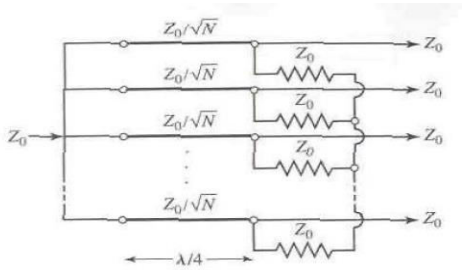


Fig. 5 : N-Way Wilkinson power divider

F. Advantages:

i) Simplicity : The Wilkinson divider is particularly simple and can easily be realized using printed components on a printed circuit board.

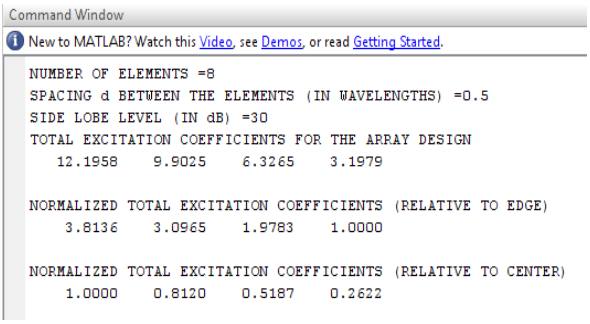
ii) Cost : When the Wilkinson power divider is realized using printed circuit board elements, the cost is very low - possibly the only increase above that of the single resistor used results from an increase in the board area used as a result of the printed elements.

iii) Isolation : The Wilkinson divider provides a high degree

G. Dolph-Tschebyscheff Antenna Array:

Another array, with many practical applications, is the Dolph-Tschebyscheff array [9]. The method was originally introduced by Dolph and investigated afterward by others. It is primarily a compromise between uniform and binomial arrays. Its excitation coefficients are related to Tschebyscheff polynomials. A Dolph-Tschebyscheff array with no side lobes (or side lobes of $-\infty$ dB) reduces to the binomial design. The excitation coefficients for this case, as obtained by both methods, would be identical.

Matlab command window output:



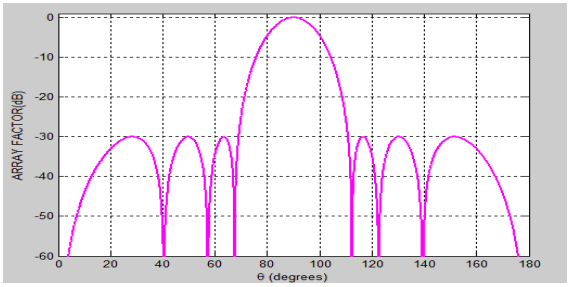


Fig. 6 : Graph for Dolph Tschebyscheff design for the given side lobe level

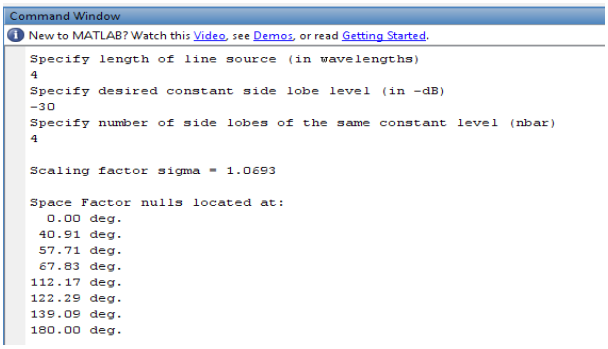
H. Taylor Line Source(Tschebyscheff Error):

Dolph-Tschebyscheff array design which yields, for a given side lobe level, the smallest possible first-null beam width (or the smallest possible side lobe level for a given first-null beam width). Another classic design that is closely related to it, but is more applicable for continuous distributions, is that by Taylor (this method is different from that by Taylor which will be discussed in the next section). The Taylor design yields a pattern

that is an optimum compromise between beam width and side lobe level. In an ideal design, the minor lobes are maintained at an equal and specific level. Since the minor lobes are of equal ripple and extend to infinity, this implies an infinite power. More realistically, however, the technique as introduced by Taylor leads to a pattern whose first few minor lobes (closest to the main lobe) are maintained at an equal and specified level; the remaining lobes decay monotonically. Practically, even the level of the closest minor lobes exhibits a slight monotonic decay. This decay is a function of the space *u* over which these minor lobes are required to be maintained at an equal level. As this space increases, the rate of decay of the closest minor lobes decreases. For a very large space of *u* (over which the closest minor lobes are required to have an equal ripple), the rate of decay is negligible. It should be pointed out, however, that the other method by Taylor yields minor lobes, all of which decay monotonically. The details of the analytical formulation are somewhat complex (for the average reader) and lengthy, and they will not be included here. The interested reader is referred to the literature. Instead, a succinct outline of the salient points of the method and of the design procedure will be included. Ideally the normalized space factor that yields a pattern with equal-ripple minor lobes is given by

$$SF(\theta) = \frac{\cosh[\sqrt{(\pi A)^2 - u^2}]}{\cosh(\pi A)}$$

$$u = \pi \frac{l}{\lambda} cos\theta$$



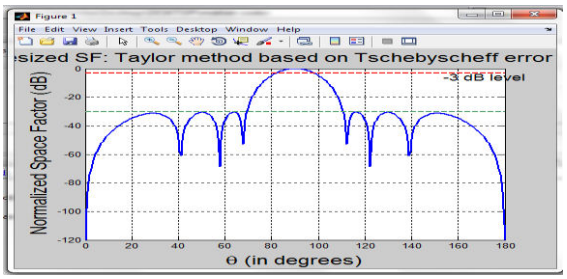
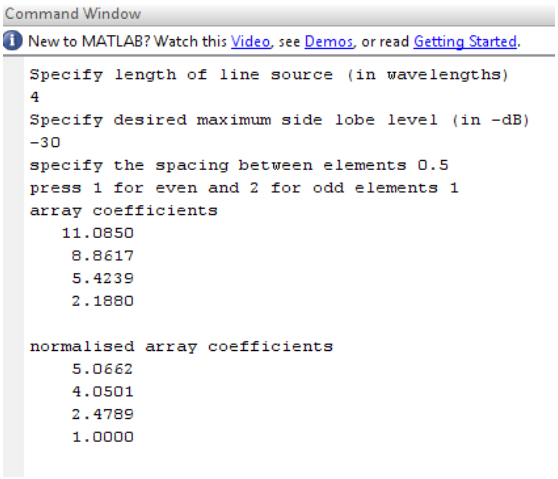


Fig.7: Graph for taylor line source tschebyscheff error for given number of elements and sidelobelevel

H. Taylor Line Source (One Parameter):

The Dolph-Tschebyscheff array design yields minor lobes of equal intensity while the Taylor (Tschebyscheff-error) produces a pattern whose inner minor lobes are maintained at a constant level and the remaining ones decrease monotonically. For some applications, such as radar and low-noise systems, it is desirable to sacrifice some beam width and low inner minor lobes to have all the minor lobes decay as the angle increases on either side of the main beam. In radar applications this is preferable because interfering or spurious signals would be reduced further when they try to enter through the decaying minor lobes. Thus any significant contributions from interfering signals would be through the pattern in the vicinity of the major lobe. Since in practice it is easier to maintain pattern symmetry around the main lobe, it is also possible to recognize that such signals are false targets. In low-noise applications, it is also desirable to have minor lobes that decay away from the main beam in order to diminish the radiation accepted through them from the relatively "hot" ground.

Mat lab Command Window:



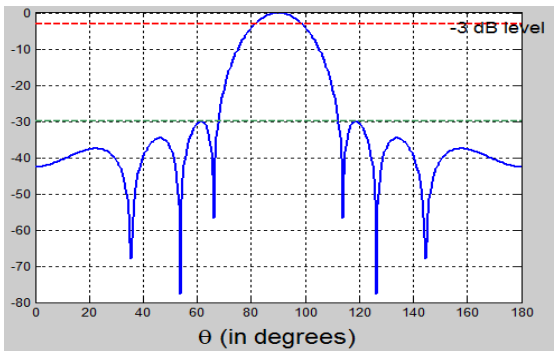


Fig. 8 : Array coefficients and corresponding graph with a side lobe level of -40dB.

IV. CONCLUSION:

The binomial design process the smoothest amplitude distribution (between 1 and 0) from the centre to the edges (the amplitude toward the edges is vanishingly small). Because of this characteristic, the binomial array displays the smallest side lobes followed, in order, by the Taylor, Tschebyscheff, and uniform arrays. In contrast, the uniform array possesses the smallest half power beam width followed, in order, by the Tschebyscheff, Taylor, and binomial arrays. As a rule of thumb, the array with the smoothest amplitude distribution (from the centre to the edges) has the smallest side lobes and larger half power beam widths. The best design is a tradeoff between side lobe level and beam width.

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Design and Implementation of Solar Tracking System on Vehicle

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Abstract - Renewable Energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate. One of the most popular renewable energy sources is solar energy. Solar panels are quite inefficient in their ability to convert sunlight to energy. More energy is produced by tracking the solar panel. In order to maximize power output from solar panels, one needs to keep the panels aligned with the sun. This paper presents the implementation of a dual-axis solar tracking system on vehicle. In this sun rays fall at right angle onto the solar panels to maximize the capture of the rays by pointing the solar panels towards the sun. As it is implemented on vehicle, the battery efficiency of vehicle is increased. Thus electricity and efficiency is increased.

Keywords - *Solar Panel, Tracking System, Vehicle*

I. INTRODUCTION

Solar power is an amazing technology in the sense that it converts sunlight into electricity through the semiconductor material alone. The uses of different kinds of semiconductor materials, crystal structures, and Manufacturing methods , all have a different affect on the efficiency and cost of the solar panel[]. Rather than focusing on the issues relating to the design and semiconductor physics behind the solar panels, this paper focuses on increasing efficiency of solar panels by using solar tracker. Our task is to design a device that will extract the maximum amount of power from the solar panels, regardless of how efficient or inefficient the solar panels may be.

Generally panels are fixed at the optimum angle for their specific latitude. Fixing solar panels at the optimum angle yields an improvement of around 15% compared with simply laying them flat. Trackers adapt to both the daily passage of the sun and potentially the changing seasons.

The use of tracking technology allows solar panels to follow the course of the sun and to optimize the incident angle of sunlight on their surface by which electricity production can be increased by around a third, and some claim by as much as 40% in some regions, compared with modules at a fixed angle.

The conversion efficiency is improved when the solar panels are continually adjusted to the optimum angle as the sun traverses the sky. The improved efficiency means improved yield as use of trackers can make quite a difference to the income from a large plant. Energy Conversion is most efficient when the rays fall perpendicularly onto the solar panels.

Transport is the most essential feature of the modern society. The solar tracking system is implemented on vehicle so that solar panels track the movement of the sun throughout the day. There are two basic types of tracker system. Single-axis trackers simply rotate about one axis, azimuthally moving from east to west over the course of a day. Double-axis trackers rotate both east to west and zenithally i.e. vertically.

Compared with modules fixed at the optimum angle, single-axis trackers typically increase electricity output by between 27%–32% [4]. Meanwhile, dual-axis trackers add a further 6% on performance and see a 35%–40% improvement in output when compared to fixed panels [4].

One of the first decisions is the choice between active or passive tracking systems. Active trackers, which use motors, gear trains or hydraulics to move the module, consume energy, while passive trackers use a low boiling point compressed fluid to move the system. Driven by solar heat creating gas pressure in the system, passive systems do not consume any energy, but they are also less precise than driven systems which rely on light-sensing technologies.

In this paper, Solar panel is mounted on a vehicle which moves to track the movement of the sun throughout the day. Here we are using Active trackers to move the solar panels [7].

II. SOLAR RADIATION ANALYSIS

The rate at which solar energy arrives at the top of the atmosphere is called the solar constant I_{SC}. This is the amount of energy received in unit time on a unit area perpendicular to the sun's direction at the mean distance of the earth from the sun. Because of the sun's distance and activity vary throughout the year, the rate of arrival of solar radiation varies accordingly .The earth is closest to the sun in the summer and the farthest away in the winter. This variation in distance produces a nearly sinusoidal variation in the intensity of solar radiation I that reaches the earth. This can be approximated by the equation

$$\frac{I}{Is_c} = 1 + 0.033\cos\frac{360(n-2)}{365} \quad (1)$$

$$= 1 + 0.033\cos\frac{360*n}{365} \quad (2)$$

Where n is the day of the year.

Solar radiation that has not been absorbed or scattered and reaches the ground directly from the sun is called 'direct radiation' or beam radiation. Diffuse radiation is that solar radiation received from the sun after its direction has been changed by reflection and scattering by the atmosphere. Because of the solar radiation is scattered in all direction in the atmosphere, diffuse radiation comes to the earth from all parts of the sky. The total solar radiation received at any point on the earth's surface is the sum of the direct and diffuse radiation. This is referred to as the insolation at that point. The insolation is defined as the total solar radiation energy received on a horizontal surface of unit area on the ground in unit time. The insolation at a given location on the earth's surface depends on the altitude of the sun in the sky. The altitude is the angle between the sun's direction and the horizontal.

In solar radiation analysis, the following angles are useful [10]:

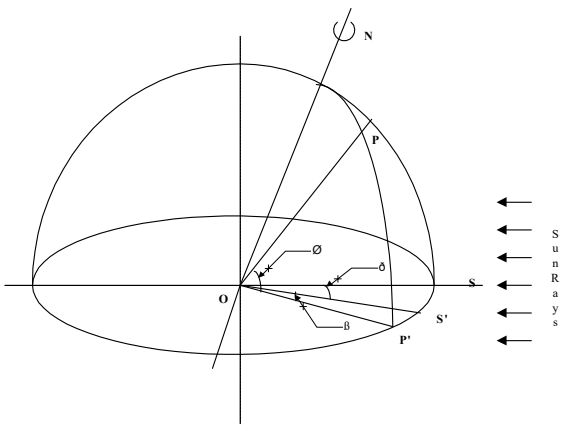


Fig. 1:Latitude Φ_l , hour angle ω, and sun's declination δ

In figure1, $Ø_l$ = latitude of location, δ = declination, ω = hour angle, α = altitude angle, θ_z = zenith angle, γ_s = solar Azimuth angle, s=slope. If θ is the angle between an incident beam radiation I and the normal to the plane surface, then the equivalent flux or radiation intensity falling normal to the surface is given by I cosθ . θ is called incident angle. The altitude $ø_l$ of a point or location is the angle made by the radial line joining the location to the centre of the earth with the projection of the line on the equatorial plane. It is the angular distance north or south of the equator measured from centre of earth. The declination δ is the angular distance of the sun's rays north (or south) of the equator and is also defined as the angle between a line extending from the centre of the sun to the centre of the earth. At the time of winter solstice the sun rays would be 23.5° south of the earth's equator(δ=-23.5°). At the time of summer solstice, the sun's rays would be 23.5° north of the earth's equator (δ=23.5°). At the equinoxes the sun's declination would be zero.

$$\delta \text{ (in degrees)} = 23.45\sin[\frac{360}{365}(284+n)] \quad (3)$$

The hour angle ω is the angle through which the earth must turn to bring the meridian of a point directly in line with the sun's rays and is equivalent to 15° per hour. Altitude angle α (solar altitude) is defined as a vertical angle between the projection of the sun's rays on the horizontal plane and the direction of sun's rays (passing through the point). Zenith angle θ_z is a vertical angle between the sun's rays and a line perpendicular to the horizontal plane through the point i.e. the angle between the beam from the sun and the vertical $\theta z = \frac{\pi}{2} - \alpha$. Solar Azimuth angle γ_s is the solar angle in degrees along the horizon east or west of north or it is a horizontal angle measured from north to the horizontal projection of the sun's rays. The slope(s) is the angle made by the plane surface with the horizontal. Surface Azimuth angle (γ) is the angle of deviation of the normal to the surface from the local meridian. Incident angle (θ) is the angle measured between the beam of rays and normal to the plane. From Spherical geometry the relation between θ and other angles is given by the equation:

$$\cos\theta = \sin ø_l(\sin\delta\cos s + \cos\delta\cos\gamma\cos\omega\sin s) + \cos ø_l(\cos\delta\cos\omega\cos s - \sin\delta\cos\gamma\sin s) + \cos\delta\sin\gamma\sin\omega\sin s \quad (4)$$

Where $ø_l$ = latitude (north positive)

δ = declination (north positive)

ω = hour angle, it is positive between solar mid-night and noon, otherwise negative.

For vertical surfaces, s=90°, equation (4) becomes

$$\text{Cos } \theta = \sin ø \cos \delta \cos \gamma \cos \omega - \cos ø \sin \delta \cos \gamma + \cos \delta \sin \gamma \sin \omega \quad (5)$$

For horizontal surfaces s=0°, $\theta = \theta_z$ zenith angle

$$\text{Cos } \theta_z = \sin \delta \sin ø + \cos \delta \cos ø \cos \omega = \sin \alpha \quad (6)$$

i.e. $\text{Cos } \theta = \cos \theta_z = \sin \alpha$

For surface facing due south $\gamma = 0$,

$$\text{Cos } \theta_T = \sin ø (\sin \delta \cos s + \cos \delta \cos \omega \sin s) = \cos ø (\cos \delta \cos \omega \cos s - \sin \delta \sin s) = \sin \delta \sin (ø-s) + \cos \delta \cos \omega \cos (ø-s) \quad (7)$$

Vertical surfaces facing due south (s = 90°, γ = 0)

$$\text{Cos } \theta_z = \sin ø \cos \delta \cos \omega - \cos ø \sin \delta \quad (8)$$

III. HARDWARE DESCRIPTION

The aim of this paper is to build dual axis solar tracking on vehicle . Chronological Solar tracker is used . It is timer based tracking system where the panel is moved at a fixed rate throughout the day . This is because sun moves across the sky at a fixed rate. Therefore the motor is programmed to rotate at a 'slow average rate of one revolution per day (15 degree per hour)'. This paper focuses on the fabrication and installation of a solar panel mounting system with dual – axis solar tracking controller to be installed on vehicle. The system is then connected to a battery via a charge controller.

A. Light Sensor theory

The sensor system consists of two sensors; one to determine the position of the sun in the sky and other to determine the position of the sun's movement from east to west. LDR or light dependent resistors is used as light sensor. Figure 2 shows LDR and figure 3 shows the characteristics of LDR. It is used to determine daylight then the solar panel moves from east to west. Magnetic sensors are used to determine the direction of vehicle considering east direction as reference.

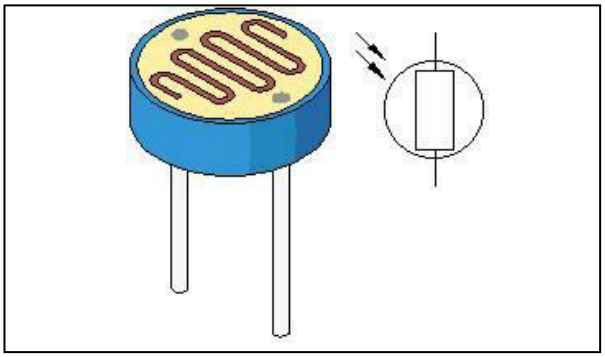


Fig. 2: Schematic structure of LDR

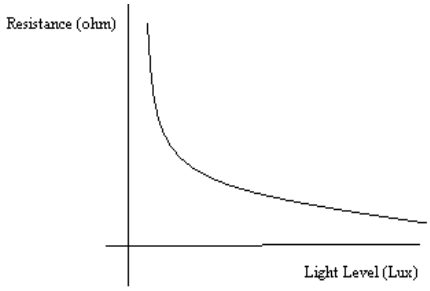


Fig. 3: Characteristic of LDR

B. Solar System Tracker

A Solar Tracker is an electro-mechanical system used for moving the solar panel in the direction of sun. To decide the movement of tracker, it is important to consider the movement of the sun in the sky throughout the year. The sun path diagram of figure 4 shows the annual variation of the path of the sun in Nagpur, India [4].

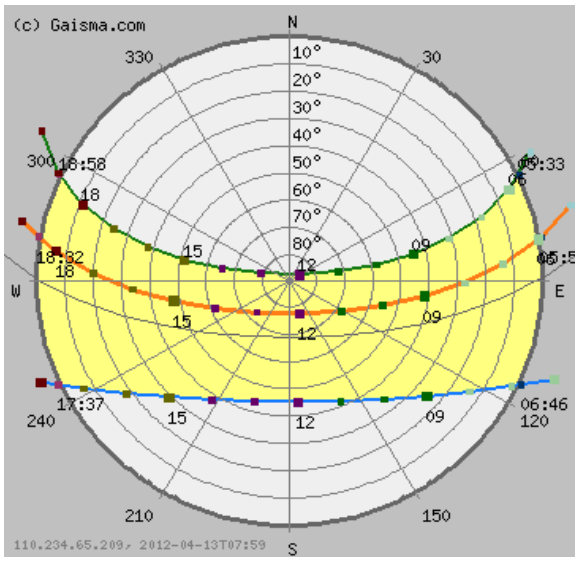


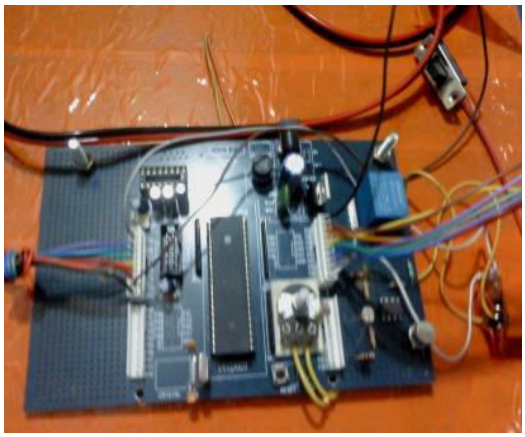
Fig. 4 : Sun path diagram for Nagpur, India

In Nagpur, the movement of the sun in the sky throughout the year can be divided into three different scenarios. As the sun rises from the east to sets to the west, the sun path may move in the southern or northern region, or it may move almost directly overhead.

IV. FABRICATION AND INSTALLATION

Solar Panel

Robotic Arm With 2 DC gear Motor



Solar Tracker Circuit

Fig. 5 : Fabrication Parts

Fig. 6 : Complete Model

The first part to be fabricated was the frame of the structure. At front end of the frame two 12V, 45 RPM , 100mA DC Gear Motor are used and on rear end two dummy motor are used to enable the frame to move. The upper part of the structure is designed to hold the solar tracking system. The solar tracking system consists of solar panel and tracker control circuit. Solar panel is of 10 watts and has Vmp=16.5 , Imp = 0.61, Vsc = 20, Isc = 0.7. Solar Panel is horizontally rotated with help of 12 V, 3.5RPM, 50 mA and vertically rotated with the help of 12 V, 10 RPM,60 mA. Figure 5 shows the fabrication parts which are combined together to form complete model. Figure 6 is the complete model.

A. Solar Tracker Control Circuit

Figure 7 shows the schematic for the solar tracker control circuit. A Voltage supply of 12 V is applied to the circuit which is then passed through a 5 V regulator. The regulated voltage is then supplied to the 89C51. The LDR's sensor circuit check whether the daylight is present or not. Port 0 of the 89C51 is output and port 1 is Input. Pin 1.0 to 1.7 are the inputs. In order to supply power to the 89C51, Pin 20 is set to ground whereas pin 40 is connected to positive 5v.

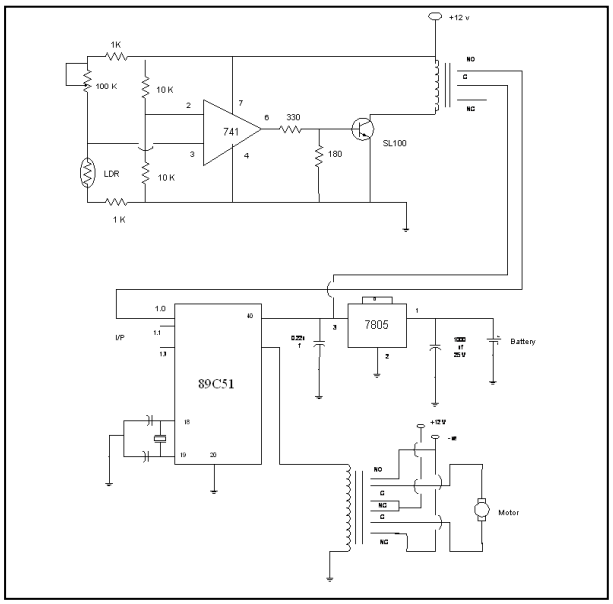


Fig. 7 : Solar tracker control Circuit.

B. Programming

The microcontroller used in this solar tracker system is 89C51. Figure 8 shows a flowchart of 89C51 program. In this Vehicle reference position is taken as East direction. The LDR will sense daylight. If vehicle takes turn towards right or left then the motor on which solar panel is mounted will move anticlockwise or clockwise respectively.

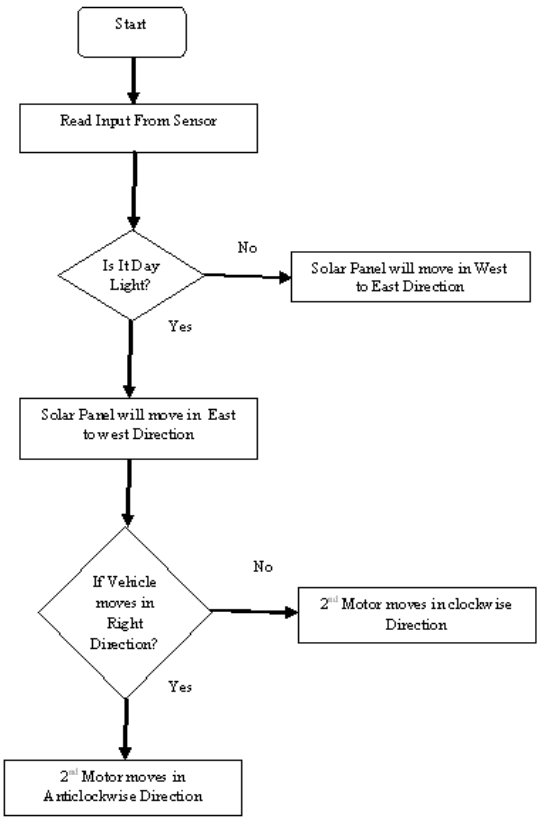


Fig. 8 : Flow Chart Of 89C51 Program

V. CONCLUSION

In this paper a dual-axis solar tracking system on vehicle is implemented. In this sun rays fall at right angle onto the solar panels to maximize the capture of the rays by pointing the solar panels towards the sun and the sunlight is detected using sensors .An 89C51 microcontroller is used to control the movement of the solar panel. The 89C51 is the brain of the entire tracking system, and it is programmed to detect the sunlight through sensors and then actuate the motor to position where maximum sunlight could be illuminated onto the surface of the solar panel. The system is designed such that energy generated by the solar panel is used to charge two batteries.

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SECTION-III

Mechanical & Industrial Engineering

Performance and Emission Characteristics of a Kirloskar HA394 Diesel Engine Operated on Fish Oil Methyl Esters

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Abstract - The high viscosity of fish oil leads to problem in pumping and spray characteristics. The inefficient mixing of fish oil with air leads to incomplete combustion. The best way to use fish oil as fuel in compression ignition (CI) engines is to convert it into biodiesel. It can be used in CI engines with very little or no engine modifications. This is because it has properties similar to mineral diesel. Combustion tests for methyl ester of fish oil and its blends with diesel fuel were performed in a kirloskar H394 DI diesel engine, to evaluate fish biodiesel as an alternative fuel for diesel engine, at constant speed of 1500 rpm under variable load conditions. The tests showed no major deviations in diesel engine's combustion as well as no significant changes in the engine performance and reduction of main noxious emissions with the exception on NOx. Overall fish biodiesel showed good combustion properties and environmental benefits.

I. INTRODUCTION

Some 3.5 million gallons of fish oil is produced annually from processing pollock in the Alaskan Aleutian slands community of Unalaska/Dutch Harbor [1], even more when other parts of coastal Alaska are included in the list of producers. This oil has minimal commercial value, especially considering the cost of transporting it to markets in the Pacific Rim and continental U.S. Because fish oil contains approximately 90% of the energy content of diesel fuel and is easy to process into usable biodiesel blend fuels, this clean burning bio-oil could be used to reduce dependence on imported fuel and improve air quality in the region. With funding from the U.S. Department of Energy's Regional Biomass Energy program (RBEP), the Alaska Energy Authority, and the Alaska Science & Technology Foundation, seafood producer UniSea, Inc., has undertaken a demonstration project to test the practical use of blended fish oil and diesel fuel as generator engine fuel. One of the beauties of fish oil is that it requires minimal processing to be made usable as fuel. At a cost of 25 cents per gallon for fish oil compared to $1.19 per gallon for diesel fuel, it is easy to see why fish biodiesel blend make good economic sense. Future efforts will focus on assessing, (1) the long-term effects of fish oil fuel blends on the equipment, (2) the suitability of fish oil biodiesel blends for use in the most common engines in the region, and (3) the amount of fish oil available for processing into fish oil biodiesel blends. Locally produced fish oil biodiesel blend fuels have the potential to create a sustainable energy supply for use in remote regions of Alaska, yielding dramatic cost savings and reducing dependence on imported petroleum. products. Easy to manufacture, cleaner-burning fish oil biodiesel blends could potentially replace millions of gallons of traditional diesel fuel now used in rural Alaska.

From 1994 to 2003, a number of tests involving the use of liquid biofuels in medium-speed Diesel generating sets were conducted at workshops of MAN B&W Diesel Holeby's genset factory in Denmark Several different fuels like rapeseed oil, palm oil, fish oil and frying fat have been tested in different engine types. Ken Araya et al. converted sunflower and fish oil to their methyl esters, tested in a single cylinder diesel engine and concluded that, the maximum output with both methyl esters was higher (0.11 kW, 3%) than the diesel fuel. Hulya analyzed qualitatively and quantitatively, the crude commercial fish oil, by gas liquid chromatography. The major fatty acids detected in this oil were as follows: 24.8% stearic, 23.6% palmitic, 9.84% pyritic, and 6.56% octadecatetraenoic acids. The physical and chemical properties of crude commercial fish oil were established. Steigers demonstrated the use of fish oil as fuel in a large stationary diesel engine.

Halifax stirred up a brew of 80 percent diesel fuel and 20 percent fish oil for its fleet of buses. The Alaska Biodiesel Demonstration Project is showing that biodiesel can be produced from fish oil widely produced as a byproduct of the Alaska seafood processing

industry. Worldwide commitment to the continuous growth of renewable energy production is giving increasing room for the use of liquid biofuels in internal combustion engines. Heavy-duty medium speed diesel engines are best suited to burn low cost liquid biofuels such as some crude vegetable oils, waste oils and biodiesels. Previous results have shown methyl esters to be a suitable replacement for diesel fuel. A complete set of fuel properties and a comparison of each biodiesel in engine performance tests are reported. The purpose of this research is to examine the effects of fish methyl ester inclusion in Diesel fuel on the break specific fuel consumption (bsfc) of a medium-speed diesel, its brake thermal efficiency and emission composition changes of the exhaust.

II. EXPERIMENTAL

2.1. Fuel properties

The fish oil methyl ester contained no suspended matter but had an undesirable smell peculiar to fish oil. The color was transparent, light yellow. The test fuel sample of Fish oil biodiesel was obtained directly from Tinna Oils & Chemicals Ltd Latur (India), manufacturers and suppliers of karanja and fish oil biodiesel to TATA Motors. The physical characteristics of fish oil methyl ester are closer to diesel oil. The fuel properties were tested in Bangalore Test House Bangalore (India), and listed in Table 1, for fish biodiesel and diesel fuel.

2.2. Experimental setup

Tests have been conducted on a Kirloskar Engine HA394, four strokes, three cylinders, air-cooled direct injection, and naturally aspirated diesel engine with displacement of 2826 cc, bore 100 mm, stroke 120 mm, compression ratio of 17:1 and runs at constant speed of 1500 rpm. The engine was coupled to a generator set and loaded by electrical resistance to apply different loads on the engine. The specification of the engine and generator is demonstrated in Tables 2 and 3. The voltage, current and power developed by engine were directly displayed on control panel. The layout of experimental test rig and its instrumentation is shown in Fig. 1.

2.3. Experimental procedure

The series of exhaustive engine tests was carried out on Kirloskar HA394 diesel engine using diesel and fish oil biodiesel blends separately as fuels at 1500 rpm. Performance and emission tests were conducted on various biodiesel blends in order to optimize the blends concentration for long-term usage in CI engines. To achieve this, several blends of varying concentration were prepared ranging from 0 percent (Neat diesel oil) to 80 percent through 10 percent, 20 percent, 40 percent 60 percent and 80 percent by volume. The performance data was then analyzed from the graphs recording power output, fuel consumption, specific fuel consumption, thermal efficiency for all blends of biodiesel.

Table 1. Fuel properties of diesel and Fish oil biodiesel.

Properties	Diesel	Fish oil biodiesel
Density (kg/m3)	850	880
Specific gravity	0.85	0.88
Kinematic viscosity at 40 _C (Cst)	3.05	4.0
Calorific value (KJ/kg)	42,800	42,241
Flash point (_C)	56	176
Fire point (_C)	63	187
Oxygen content	Nil	10.9%

Table 2. Engine specifications.

Make	Kirloskar engine
Model	HA394
No. of cylinders	3 Inline
Aspiration	Natural
Bore & stroke	100 mm X 120 mm
BHP/BP	32.5/20 kW
Rated power	25 kVA
Displacement	2826 cc
Type of cooling	Air-cooled
Fuel consumption at 90% load	5 l/h
Firing order	1–3–2
Speed	1500 rpm
Compression ratio	17:1

The optimum blend was found out from the graphs based on maximum thermal efficiency. The major pollutants appearing in the exhaust of a diesel engine are carbon monoxide, hydrocarbon and oxides of nitrogen. For measuring exhaust emissions, QRO-402 analyzer was used. The brake specific fuel consumption is not a very reliable parameter to compare the two fuels as the calorific value and the density of the blend fallow a slightly different trend. Hence, brake specific energy consumption is a more reliable parameter for comparison. For an optimum biodiesel system, the blend concentration has been determined based on maximum thermal efficiency at all loads and minimum brake specific energy consumption.

III. RESULTS AND DISCUSSIONS

3.1. Fuel properties

The color was transparent, light yellow. The various fuel properties of fish biodiesel were determined. The characteristics of biodiesel are close to mineral diesel, and therefore biodiesel become a strong candidate to replace the mineral diesel if need arises. Table 1

summarizes the results of fuel tests of diesel fuel and fish oil methyl ester.

3.2. Engine performance

The engine performance with Fish oil biodiesel was evaluated in terms of brake specific fuel consumption, brake specific energy consumption, thermal efficiency and exhaust gas temperature at different loading conditions of the engine.

3.2.1. Brake specific fuel consumption

The BSFC of Kirlosker engine obtained for different fuels is shown in Fig. 2 as a function of load for C.R. of 17.6:1. The BSFC in

Table 3. Generator specification.

Model	Genset model
Genset rating	25 kVA
Current (A)	34.8
Voltage	380/415
RPM/frequency	1500/50 Hz
No. of phases	3
Power factor	0.8

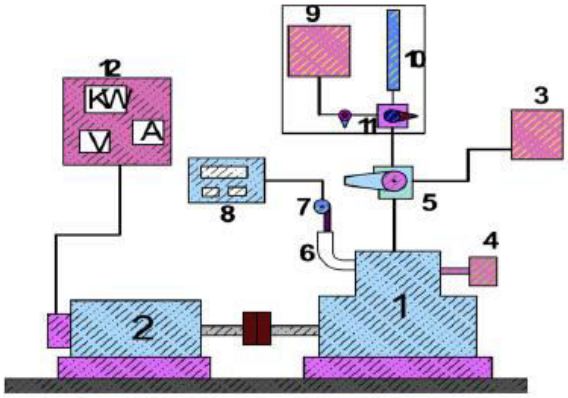

Fig. 1. Layout of experimental setup with instrumentation. 1, Kirloskar HA394 2, alternator; 3, diesel tank; 4, air filter; 5, three way valve; 6, exhaust pipe; 7, probe; 8, exhaust gas analyzer; 9, biodiesel tank; 10, burette; 11, three way valve; 12, control panel.

General was found to increase with increasing proportion of B100 in the fuel blends with diesel, where as it decreases sharply with increase in load for all fuels. The main reason for this could be that percent increase in fuel required to operate the engine is less than the percent increase in brake power due to relatively less portion of the heat losses at higher loads. As the BSFC was calculated on weight, basis obviously higher densities resulted in higher values for BSFC. As density of fish biodiesel was higher than that of diesel, which means, the same fuel consumption on volume basis resulted in higher BSFC in case of 100% biodiesel. The higher densities of biodiesel blends caused higher mass injection for the same volume at the same injection pressure. The calorific value of biodiesel is less than diesel. Due to these reasons, the BSFC for other blends were higher than that of diesel. Similar trends of BSFC with increasing load in different biodiesel blends were also reported by other researchers while testing biodiesel obtained from karanja, mahua and honge oils. Different trends observed by researcher.

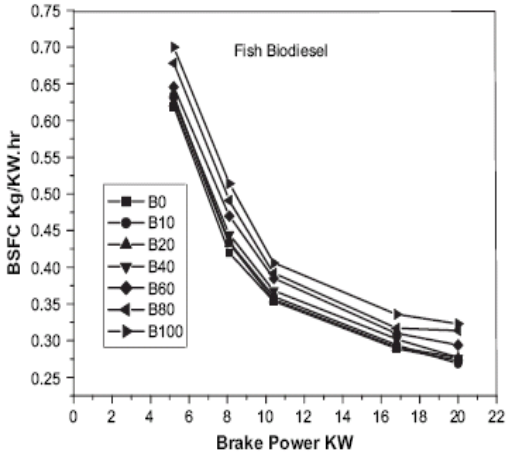

Fig. 2. Comparison of brake specific fuel consumption with brake power for diesel, methyl ester of fish oil and its blends.

3.2.2. Brake specific energy consumption

Brake specific energy consumption (BSEC) is a more reliable criteria compared to BSFC for comparing fuels having different calorific values and densities. The variation in BSEC with load for all fuels is presented in Fig. 3. In all cases, it decreased sharply with increase in percentage load for all fuels. The main reason for this could be that percent increase in fuel required to operate the engine is less than the percent increase in brake power due to relatively less portion of the heat losses at higher loads. The BSEC for B20 was observed lower than diesel. In case of B40, B60, B80 and B100, the BSEC was higher than that of diesel. This reverse trend was observed due to lower calorific value with increase in biodiesel percentage in the blends. Different trends of BSEC with increasing load in different biodiesel blends were also reported by some researchers while testing biodiesel obtained from linseed, mahua, and rice bran oils.

3.2.3. Brake thermal efficiency

The variation of brake thermal efficiency with load for different fuels is presented in Fig. 4. In all cases, it increased with increase in load. This was due to reduction in heat loss and increase in power with

increase in load. The maximum thermal efficiency for B20 (31.74 %) was higher than that of diesel [30.78%]. The brake thermal efficiency obtained for B40, B60, B80 and B100 were less than that of diesel. This lower brake thermal efficiency obtained could be due to reduction in calorific value and increase in fuel consumption as compared to B20. This blend of 20% also gave minimum brake specific energy consumption. Hence, this blend was selected as optimum blend for further investigations and long-term operation. Based on the results it can be concluded that the performance of the engine with biodiesel blends is comparable to that with diesel, in terms of brake thermal efficiency. The maximum value of BTE for B20 is comparable with the maximum values of 32% for B10 and 34% for B20 by other researcher when test conducted on MEMO and LOME respectively.

3.2.4. Exhaust gas temperature

The variations of EGT with respect to engine loading are presented in Fig. 5. In general, the EGT increased with increase in engine loading for all the fuel tested. The mean temperature increased linearly from 167 _C at no load to 407 _C at full load condition. This increase in exhaust gas temperature with load is obvious from the simple fact that more amount of fuelwas required in the engine to generate that extra power needed to take up the additional loading. The exhaust gas temperature was found to increase with the increasing concentration of biodiesel in the blends. The mean EGTs of B10, B20, B40, B60, B80 and B100 were 7.8%, 12.1%, 19.28%, 27.14%, 37.14% and 12% higher than the mean EGT of diesel, respectively.

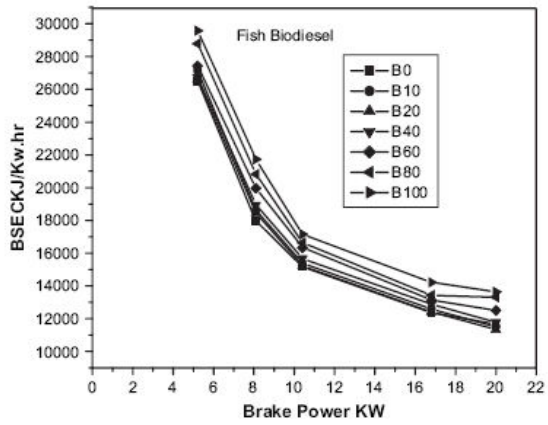

Fig. 3. Comparison of brake specific energy consumption with brake power for diesel, methyl ester of fish oil and its blends.

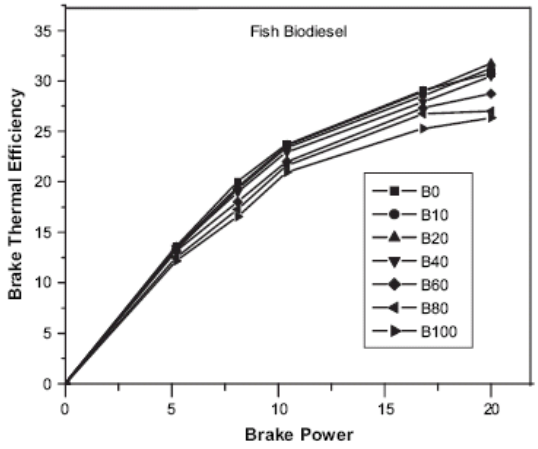

Fig. 4. Comparison of thermal efficiency with brake power for diesel, methyl ester of fish oil and its blends.

This could be due to the increased heat loss of the higher blends, which are also evident from, their lower brake thermal efficiencies as compared to diesel. Similar findings were obtained by other researchers while testing different biodiesels.

3.2.5. Carbon monoxide

Variation of CO emissions with engine loading for different fuel is compared in Fig. 6. The minimum and maximum CO produced was 0.015–0.06 % for B100. These lower CO emissions of biodiesel blends may be due to their more complete oxidation as compared to diesel. Some of the CO produced during combustion of biodiesel might have converted into CO2 by taking up the extra oxygen

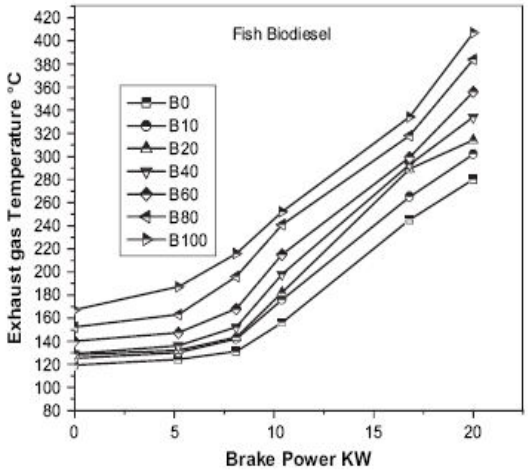

Fig. 5. Comparison of exhaust gas temperature with brake power for diesel, methyl ester of fish oil and its blends.

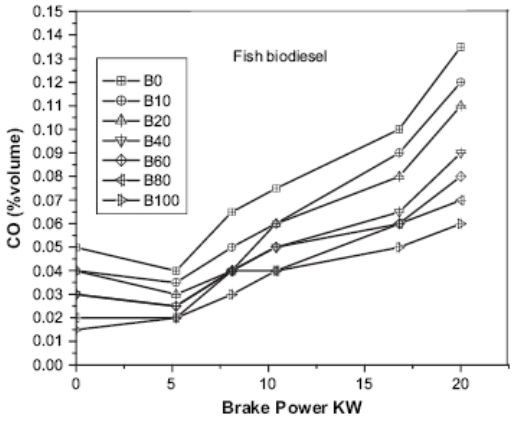

Fig. 6. Comparison of carbon monoxide with brake power for diesel, methyl ester of fish oil and its blends.

Molecule present in the biodiesel chain and thus reduced CO formation. It can be observed from Fig. 6 that the CO initially decreased with load and latter increased sharply up to full load. This trend was observed for all the fuel blends tested.

3.2.6. Hydrocarbon

It is seen in Fig. 7 that there is a significant decrease in the HC emission level with blends of methyl ester of mahua oil as compared to pure diesel operation. There is a reduction from 75 ppm to 49 ppm at the maximum power output. These reductions indicate that more complete combustion of the fuels and thus, HC level decreases significantly. The reduction in HC was linear with the addition of biodiesel for the blends.

3.2.7. Nitrogen oxides

The NOx values as parts per million (ppm) for different fuel blends of diesel and B100 in exhaust emissions of Kirlosker HA394 are plotted as a function of load in Fig. 8. The amount of NOx produced for B10 to B100 varied between 124 and 497 ppm as

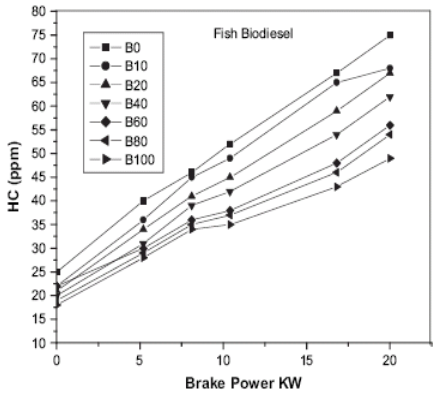

Fig. 7. Comparison of hydrocarbon with brake power for diesel, methyl ester of fish oil and its blends.

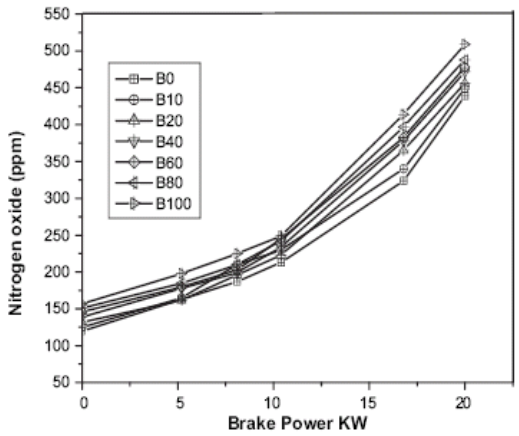

Fig. 8. Comparison of NOx with brake power for diesel, methyl ester of fish oil and its blends.

compared to 157–509 ppm for diesel. From Fig. 8 it can be seen that the increasing proportion of biodiesel in the blends was found to increase NOx emissions, when compared with that of pure diesel. This could be attributed to the increased exhaust gas temperatures and the fact that biodiesel had some oxygen content in it which facilitated NOx formation. In general, the NOx concentration varies linearly with the load of the engine. As the load increases, the overall fuel–air ratio increases resulting in an increase in the average gas temperature in the combustion chamber and hence NOx formation, which is sensitive to temperature increase.

IV. CONCLUSIONS

Based on the results of this study, the following specific conclusions were draw:

1. In terms of fuel properties and exhaust emission characteristics, fish biodiesel can be regarded as an alternative to diesel fuel.
2. Brake specific fuel consumption for B100 is higher than the diesel fuel and it is decreased in blended fuels. In B20, fuel the BSFC is lower than the diesel fuel and all other fuel.
3. The maximum thermal efficiency for B20 (31.74%) was higher than that of diesel. The brake thermal efficiency obtained for B40, B60, B80 and B100 were less than that of diesel.
4. The exhaust temperature increased as a function of the concentration of biodiesel blend i.e. higher the percentage of FOME.
5. Increase in the exhaust temperature of a biodiesel-fuelled engine led to increase in NOx emissions for B100. This is due to the higher temperatures and presence of oxygen molecules present in biodiesel.

6. The reduction in CO and HC was linear with the addition of biodiesel for the blends tested. These reductions in CO and HC indicate the complete combustion of the fuel.

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Analysis of One Dimensional Inverse Heat Conduction Problem: A Review

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Abstract **-** A procedure to solve inverse heat conduction problem (IHCP) is to derive surface heat flux and temperature from temperature change inside a solid. The method proves to be very useful and powerful when a direct measurement of surface heat flux and temperature is difficult, owing to several working condition. The literature reviewed here discussion one dimensional inverse heat conduction problem. Procedure, criteria, methods and important results of other investigation are briefly discussed.

I. INTRODUCTION

The heat conduction problem involves determining the surface heat flux and temperature distribution in the body from transient measured temperature history at one or more internal locations. The problem is faced frequently instrumentation systems. Typical instances include the monitoring of thermal stress in thick-walled pressure parts of power plants based on temperature measurements at the element outside the surface, and predictions of heat flux and temperature from calorimeter type instrumentation. Changes in the surface condition are damped in the solids owing to the difference of heat conduction process. Conversely, as on inverse analysis procedure extrapolates from the interior to the exposed surface, the little experimental errors in the data are magnified at the surface and can lead to oscillations in the calculated surface conditions. Several procedures have been presented to lessen the sensitivity to measurement errors.

In evaluating new heat-shield materials, developing transient calorimeters and trial and testing of rocket nozzles, it is at times necessary to determine the transient surface heat flux and the surface temperature from a temperature history measured at some location inside the body. In distinction of the conventional diffusion or transient heat conduction problems this one has been termed the 'inverse problem'. If the thermal properties are functions of temperature, the inverse problem becomes nonlinear. The classical 'direct problem' in heat conduction is to determine the interior temperature distribution of a body from the data given on its surface. However, applications need arise in which data is not available over the entire surface but is attributed at interior points. In such situations, it is necessary to calculate the surface temperature.

A procedure to solve the inverse heat transfer problem (IHTP) is extremely important in determining unknown surface temperature and heat flux from known values in the body, which are usually measured as a function of space and time, specifically under several surface conditions such as re-entry of space vehicle and accidents involving coolant breaks in the plasma facing components, a direct measurement of surface temperature change or the heat flux on the surface is almost impossible to measured, so that prediction of these values can help, depending of the solution of IHTP. Additionally numerous studies about IHTP have been carried out to conjecture the transient surface conditions during quenching of a hot body.

However, the exact solution for IHTP is mathematically examined and verified that does not exist within a contain time depending on the position at which the known value is given.

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Table 1: A comparative study of procedure and method used for IHCP by several investigations.

Investigators	Procedure used	Method used	Results
[1]Stolz (1960).	(a.)His procedure was unstable if the time intervals are made too small. Small time scales in the calculations were needed to obtain more information about the surface.	(a.)He used integral method but he did not report any problem with stability.	(a.)Using different approximations he found the average heat flux for a succession of short intervals.
[2]Frank (1963).	(a.)The least squares method has been used and he assumed an analytical form for time variations of the surface heat flux for the duration of the experiments.	(a.)Finite-difference method (FDM).	(a.)Least squares method was applied to the solution of heat conduction problem to get the results.
[3]Burggraf (1964).	(a.)Paper using least squares in quite different ways was written by him. (b.)He had contributed significantly to the theory and understanding of the problem, but were usually restricted to applications with constant physical properties.	(a.)The linear inverse problem in conduction heat transfer can be solved using an exact method.	(a.)He clearly found the exact solution for the investigations surface heat flux for given continuous temperature and heat flux histories at a given internal point. (b.)When Burggraf equation was utilized with discrete or experimental results.
[4]Sparrow et al. (1964).	(a.)They used another approach and had contributed to the theory and understanding of the problem, but were usually restricted to applications with constant physical properties. (b.)They introduced arbitrary function and their analysis was for one dimensional problem only.	(a.)Integral method using FDM. (b.) They used a skill fully introduced arbitrary function. The values of this function are given with time. (c.)Minimum interval of time was recommended to be 0.01sec.	(a.)They reported results of the inverse problem in transient heat conduction. They did not report any problem with stability.
[5]Back et al. (1965).	(a.)They attacked the nonlinear inverse heat conduction problem, but their method was not involved using the ideas of nonlinear.	(a.)Finite-difference method.	(a.)This was the only method sufficiently powerful to solve the non linear problem.
[6]Davies (1966).	(a.)He assumed an analytical form for the time variation of the surface heat flux for the duration of the experiment.	(a.)Finite-difference method.	(a.)They did not report any problems with stability and his method was not designed for determining heat fluxes.
[7]Beck (1968).	(a.)The method was not developed using the ideas of nonlinear estimations. (b.)Much smaller time steps were found by him to be possible by using least squares.	(a.)Integral method.	(a.)He found surface heat flux using an integral method.
[8]Beck (1970).	(a.)He presented a method which could be conveniently heat a composite body with temperature-variable thermal conductivity and specific heat. (b.)Discrete approximation by finite difference was applicable to nonlinear problems, but the success of this method was limited in many cases by the inherent ill-posed mass. (c.)Although good results had been obtained in some situations, discrete methods were usually not capable of handling more complicated problems without some correction.	(a.)A new finite difference method is given. It was based in part upon the concepts of a general technique or solving inverse problems called nonlinear estimation. (b.)This was the most successful and consistent approach in use.	(a.)An objective of this paper was to present a method suitable for use with a digital computer for heating composite body. (b.)Another objective was to derive the methods using nonlinear estimation in order to demon striate the applicability of nonlinear estimation to determine time dependent quantities at a boundary.

[9]Imber and Khan (1972).	(a.)He employed an approximate function expressed by a polynomial function to estimate the known temperature change with time in place of the discrete values which were used and applied it to the sub soldiery equation to achieve the inverse solution explicitly.	(a.)In his method a relationship between temperatures measured at two different points is assumed to avoid divergences of the inverse solution.	(a.)He obtained transient temperature distributions with embedded thermocouples.
[10]Shofi (1973).	(a.)He started from the same inverse solution in a subsidiary form as Sparrow et al. (1964) and achieved two different types of solutions as functions of time in two different ways. He verified that one of the two solutions corresponds to the solution proposed by Burggraf (1964) and the other to one obtained by Sparrow et al. (1964). He employed the data including uncertainties in the known values to evaluate the predictive accuracy of the inverse solutions. He numerically calculated the inverse saluting using a finite difference method an exhibited a relationship between the accuracy of the predicted values and the level of the uncertainties included and also between minimum predictive interval level of the uncertainties.	(a.)Finite-difference method.	(a.)He finally pointed out that Laplace transformation was promising in treating one IHTP.
[11]Garifo et al. (1975).	(a.)They described a procedure to approximate that the actual solution by solving a sequence of well-posed (b.)Success of this method was limited as narrated by Beck (1970).	(a.)Finite-difference method.	(a.)They presented solution of the inverse heat conduction problem by finite difference method (FDM).
[12]Ott and Hedrick (1977).	(a.)Finite-difference procedure was employed by them.	(a.)Finite-difference method.	(a.)They reported results of a one-dimensional implicit approach to heat conduction problem.
[13]Weber (1981).	(a.)A detailed analysis of ill-posed nature was carried out by him. The reformulation procedure was described clearly. (b.)He presented skillfully four same problems, representing slab, cylindrical, spherical, geometries as well as constant and temperature dependent physical properties. (c.)The inverse problem was closely approximated by him by a well-posed problem where solution was easily obtained. (d.)He developed clearly a complete formulation of the problem. Additionally a great knowledge existed concerning the behavior of this new problem and stable, high order numerical methods which were available. (e.)This procedure naturally incorporated future times in the analysis. The space marching procedure utilized exact matching of the calculated temperature with the experimental temperature at a location while	(a.)He used space marching difference method.	(a.)He presented the results of the analysis and solution of the ill-posed inverse heat conduction problem.

	temperatures were measured. Thus this procedure was sensitive to measurement error. The number of past and future time steps was dependent of the number of spatial grid nodes.		
[14]Henset and Hills (1986).	(a.)An initial value approach to the inverse heat conduction problems was used.	(a.)Space marching difference method was used by them.	(a.)They obtained results by an initial value approach.
[15]Raynaud and Bransier (1986).	(a.)Their procedure involved a new finite difference method for nonlinear inverse heat conduction problem.	(a.)Space marching difference method was used.	(a.)They achieved results by a new finite-difference method for the nonlinear heat conduction problem.
[16]Cheng and Chang (1990).	(a.)They showed good agreement between estimates and the exact solution for non-dimensional time of t = 1sec and 5sec, although it was not mentioned that what kind of uncertainties were merged into the temperatures used. From the view point that the inverse solution for short time may be usually required during a transient heat conduction, non dimensional times t = 1sec and 5sec seem to be too large because heat transfer process may reach steady state, corresponding to a change in the temperature with time.	(a.)Use of hybrid method	(a.)They showed vividly the application of hybrid method, to inverse heat conduction problem.
[17]Serra et al. (1993).	(a.)Space marching difference method naturally incorporated future times in the analysis.	(a.)Space marching inverse conduction method was used. (b.) The equations for surface temperature and heat flux in space marching methods were numerical analogs of the exact solution [Burggraf (1964)] in which time derivatives were replaced by finite difference approximations.	(a.)They presented experimental results of heat transfer in a gun barred based on a space marching inverse conduction.
[18]Taler (1996).	(a.)He described the unified mathematical procedures of transient method for measuring surface heat transfer rates.	(a.)The interior temperature measurements were converted into local instantaneous heat transfer coefficient by solving the inverse heat conduction problem for the gauge. The effect of the inaccuracies in the measurement of the interior temperature was eliminated by cubic spine smoothing of digital filtering of the raw interior temperature data prior to using it in the heat conduction analysis.	(a.)The aim was to present a method for a simple and accurate determination of the time varying heat transfer coefficient (or heat flux) given an accurate temperature history of the body at a selected point beneath the surface. (b.) General case closed from equation for instantaneous surface heat flux or heat transfer coefficients were developed.
[19]Taler (1996).	(a.)He presented a simple and accurate method without sequential stepping forward in time. Additionally it was not necessary to compute all the nodal temperature at each time step. The surface heat flux and temperature distribution can be calculated at anytime	(a.)He used a simple method without sequential stepping forward in time.	(a.)A semi-numerical method was presented for solving the inverse heat conduction problem in homogeneous and composite bodies. The present solution did not

	without knowing of initial temperature distribution.		require both the initial temperature distribution in the body and the whole temperature time history at the temperature sensors locations.
[20]Monde (2000).	(a.)This method first approximates the temperature data with a half polynomial power series in time. The resultant expression for an objective temperature or heat flux was explicitly achieved in the form of power series of time. (b.)This procedure was for one dimensional problem only. (c.)This procedure used Laplace transform technique.	(a.)A theoretical method has been developed for the inverse heat	(a.)An analytical method has been developed for the inverse heat conduction problem. (b.)The main differences from the former researchers were to employ equation expressed by a half polynomial series of time to approximate the known values. As a result inverse solution can be obtained explicitly so that no iterative calculation was required and the calculations of the solution become very quick.

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CONCLUSIONS

An understanding of a procedure to solve inverse heat transfer problem is very important in determining unknown surface temperature and heat flux from known values in the body. The literature survey presented here is by no means complete. However, it is desired to serve as an indication of the scope of the research completed so far and to draw attention to the deficiency of our knowledge on the subject of ill posed inverse heat conduction one dimensional problem. As our understanding of this subject increases, the analytical approach will add more to our basic knowledge of ill-posed inverse heat conduction problem in single dimension.

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Experimental Investigation of Diesel Engine Performance Neat and Preheated Transesterfied Cotton Seed Oil

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Abstract - The paper describe the comparative performance of single cylinder diesel engine with direct use of cotton seed oil methyl ester and preheated condition at variable temperature such as 50, 70 and 90oC.The properties such as viscosity, flash point, pour point were experimentally measured of COME, thus obtained are comparable with ASM biodiesel standards. The COME has been tested in single cylinder four stroke diesel engine coupled with rope brake dynamometer, such as BSFC, BTE, B.S.E.C. are calculated and exhaust gas temperature were measured. The experiment was carried out varying load at constant speed. The results revealed that preheating COME up to 90oC at higher load lead to increase in brake thermal efficiency is 2 % as compared to diesel fuel and brake specific fuel consumption increases at higher load as compared to diesel fuel. There is no significant change found in brake power where as exhaust gas temperature of all preheated biodiesel COME is high and break specific energy consumption required to preheat COME is high as compared to diesel. However, the optimum conditions for biodiesel production are suggested in this paper. A maximum of 76% biodiesel was produced with
20% methanol in presence of 0.5%pottasium hydroxide.

Keywords*: Alternative fuel; Cottonseed oil methyl ester, preheated biodiesel.*

I. INTRODUCTION

Biofules are renewable and reduce gases emissions. They is increasingly used as alternative to petroleum fuels. Cottonseed oil and its methyl esters are expected to become one of these biofuels. In countries where cottonseed oil is plentiful such as India it may become an important alternative fuel. Many researchers have experimentally investigated the performance and emissions characteristics of both the cottonseed oil [2-4] and cottonseed oil methyl ester [5-8] In general it has been reported by some researches [2-4] that if raw cotton seed oil is used as diesel fuel, engine performance decreases.CO, and HC emissions increase and NOX emissions also decrease accordingly. Geyer et al.[5] reported on cottonseed oil methyl ester as a fuel in a direct injected diesel engine and concluded that the thermal efficiency was increased, smoke opacity was reduced and NOX emissions was increased. Llkilic and yucesu[6] have studied the effects of cotton seed oil methyl esters on engine performance in a single cylinder diesel engine. Their experiments showed that there was little or no significant difference between the torque and power output of CSOME and diesel fuel usage especially at medium and higher speeds. Carraretto et al[7] reported that the performance were slightly reduced with SFC was notably increased with the use of CSOME.CO emissions were reduced but NOX were increased. Rakopoulos et al.[8] made a study to evaluate and compare the use of a high variety of vegetables oils or biodiesels of various origins including cottonseed as supplements to conventional diesel fuel at blend ratios of 10/90 and 20/80 in a direct injection [di] diesel engine. Results showed that the smoke density was significantly reduced with the use of biodiesel blends of various origins with respect to that of the neat diesel fuel. On the contrary, it was increased with use of vegetables oil blends of various origins, with this increase being higher the percentage of vegetable oil the blend. on the contrary to[5,7],the emissions were slightly reduced with the use of biodiesel or vegetable oil blends [8].the CO emissions were reduced with the use of biodiesel but increased with the use raw vegetable oil. The engine performance with the biodiesel and vegetable oil blends of various origins was similar to that of neat diesel fuel with nearly the same brake thermal efficiency, showing higher specific fuel consumption.

II. PRODUCTION OF COME

COME was prepared as shown in figure No.1.The transesterification process of cottonseed oil was performed using 5 g potassium hydroxide as catalyst and 200 ml methyl alcohol per 1L, Pure cottonseed oil. First, the cottonseed oil was heated to about 70 0C in a reactor then; the catalyst was mixed with methyl alcohol to dissolve and added to the heated cottonseed oil in the reactor. After the mixture was stirred for 1 h at a fixed temperature of about 70 0C, it was transferred to another

container and the separation of the glycerol layer was allowed. Once the glycerol layer was settled down, the methyl ester layer formed at the upper part of the container was transferred to another vessel. After that, a washing process was carried out to remove some unreacted remainder of methanol and catalyst using distilled water and blown air. Then, a distillation process at about 1100 C was applied for removing water contained in the esterified cottonseed oil. Finally, the produced cottonseed oil methyl ester (COME) was left to cool down.

A. Experimental Investigation of Diesel Engine Performance

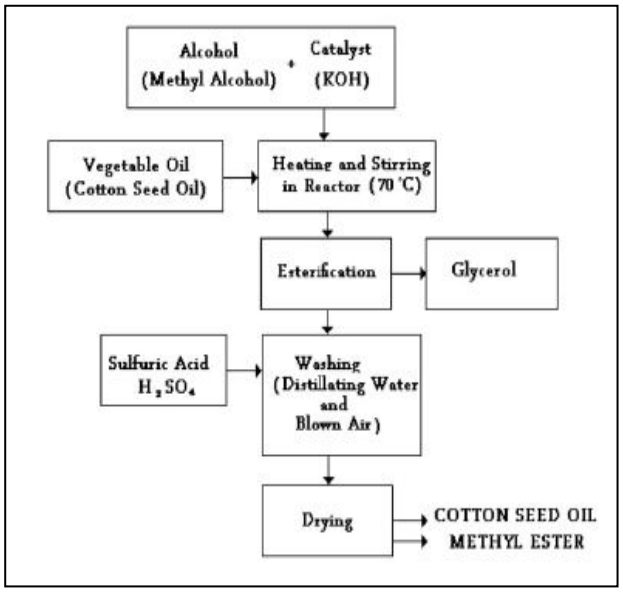

Figure 1: Flow chart COME.

B. Optimization of different parameters for biodiesel production

The rate of conversion from CSO to COME depends upon the different parameters like oil temperature, reaction temperature, catalyst percentage, methanol percentage, purity of reactants, etc. In this work, reaction temperature, catalyst percentage and methanol percentage have been investigated.

C. Reaction temperature and biodiesel Production

The effect of methanol percentages on biodiesel production. The volumetric percentages of methanol were varied from 15% to 25%. The weight percentage of catalyst (KOH) was fixed at 0.5%. The reaction temperature was varied from 45 to 600C. The maximum bio-diesel yield was noticed at 20% methanol. This was due to the fact that the 20% methanol has a favorable influence on maximum biodiesel production. A maximum of 76% biodiesel production was observed at 20% methanol and at a temperature of 550C.

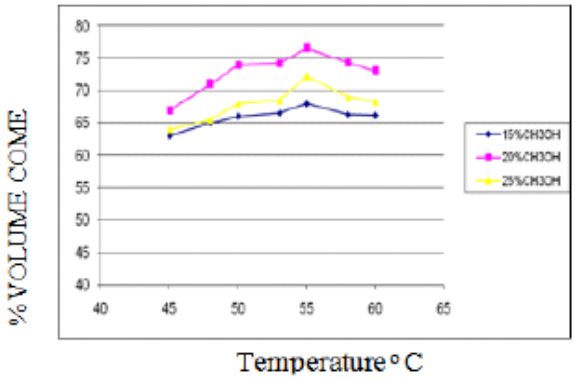

Figure 2: Effect of Temperature on Bio-Diesel Production (KOH=0.5%).

D. Influence of Catalyst Percentage on Biodiesel Production

Depicts the influence of catalyst percentages on bio-diesel production. The weight percentages of catalyst were varied from 0.5 to 0.75%. The optimum methanol percentage was kept constant to 20%. It can be seen from the figure that with theincrease in lye catalyst, bio-diesel yield decreases. This may be associated with the increase in the formation of wax. The vegetable oil used in transesterification process contains many free fatty acids. The catalyst reacts with these free fatty acids and produces wax. A maximum of 76% bio-diesel yield was found at 0.5wt%.Catalyst and at a reaction temperature of 55oC. If the weight percentage of catalyst is used below 0.5% the bio-diesel production was found minimum. Thus 20% methanol and 0.5% KOH were chosen as the optimum percentages for biodiesel

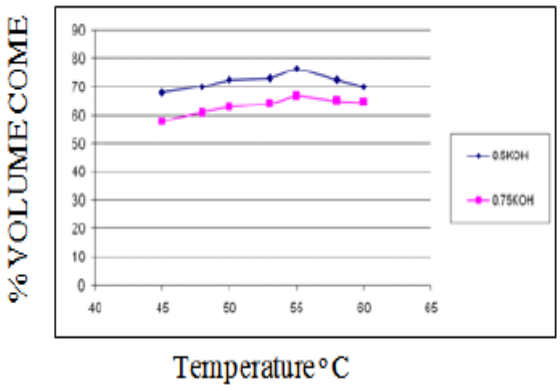

Figure 3: Effect of Catalyst (KOH) Percentages on Bio-Diesel (CH3OH=20%).

E. Influence of Reaction Time on Biodiesel Production

The effect of reaction time on bio-diesel production. The catalyst percentage was set to 0.5. The reaction temperature was kept at 55oC. It was found that when

reaction time increases, the bio-diesel production increases and reaches maximum at about 8hrs. Then bio-diesel production decreases with the increase in reaction time. When the mixture of CSO, methanol and catalyst was kept for 24hrs, the bio-diesel production was reduced to 70%. This was due to the fact that the tendency of soap formation increases with the increase in reaction time. It was found that for 8hrs the maximum bio-diesel production was 76.5%.

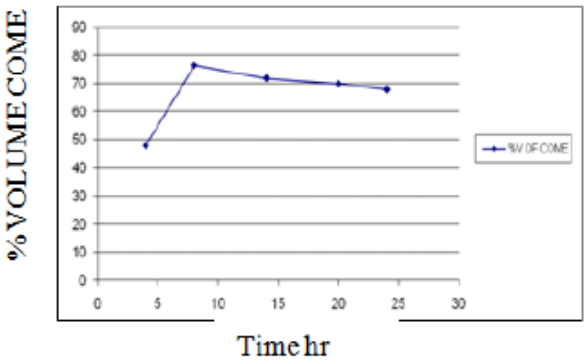

Figure 4: Effect of Reaction Time on Bio-Diesel Production

(CH3OH=20%KOH=0.5%, Reaction Temperature 60°c).

F. Kinematics Viscosity

The kinematics viscosity of the COME gradually decrease with increase in temperatures. By increasing the temperature of the fluid, the intermolecular attraction between different layers of the fluid decreases, thus viscosity decreases. For proper functioning of the engine, it is necessary to reduce the viscosity of a fuel. Fuel with relatively higher viscosity will not break into fine particles when sprayed. Large particles will burn slowly resulting in poor engine performance. On the other hand, if the viscosity is too low, the fuel will not lubricate the moving parts of the injection pump and injection nozzle. It is seen that the kinematic viscosity is 6.54 cSt at 30^0 C and decreases gradually to 2 cSt at 90^0C. At 70^0C the kinematic viscosity of COME was fond to be 3.8 cSt which is much comparable to that of diesel fuel at 40^0C.

III. EXPERIMENTAL SETUP

The experimental setup consists of a single - cylinder, four stroke, naturally aspirated diesel engine, data acquisition software [DAS] and COME heating tank fitted electric heater with proper temperature control as shown in fig 3. The specifications of the test engine are given in Table 1. Engine is coupled with rope brake dynamometer with cooling water arrangement.

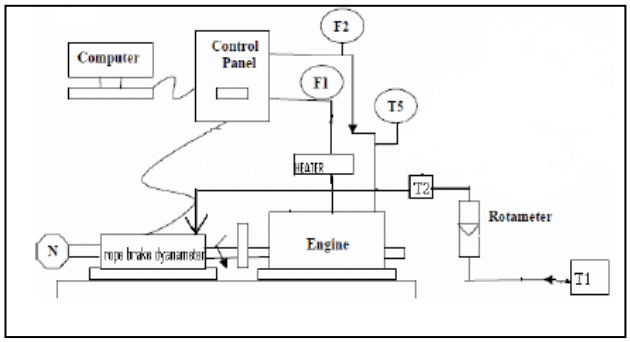

Figure 5: Experimental set up of engine.

IV. PROCEDURE

Experiments were performed with diesel fuel and neat biodiesel preheated up to four different temperatures, namely 30, 50, 70 and 90 0C. The properties of the fuels employed are shown in Table 2. The fuel consumption measurement was performed by gravimetric sensor. Exhaust gas temperature was measured by K type thermocouple submerged into exhaust pipe. Windows based Engine Performance Analysis Software Package; DAS was taken for performance evaluation. The tests were conducted at the rated speed of 1500 rpm at different loads. For this investigation the kinematic viscosity was measured with redwood viscometer, at above temperatures. Then fuel consumption, exhaust gas temperature were measured. Brake power, brake specific fuel consumption, brake thermal efficiency are calculated.

Table 1: Test engine specifications.

Parameter	Value
Type of Engine	4 Stroke
No. of Cylinders	1
Cylinder diameter (D)	0.08Mtrs
Cylinder Stroke (L)	0.11Mtrs
Rated output	3.5kw at 1500 rpm
Rated Speed	1500 rpm

Table 2: The properties of diesel fuel and COME.

Fuel	Diesel Fuel	COME
Specific gravity at 15^0C	0.84	0.885
Kinematic viscosity at 40^0C (Cst)	3.25	5.94
Lower heating value (kj/kg)	42,550	36,896
Flash Point (^{0}C)	55	200

V. RESULTS AND DISCUSSION

A. Brake thermal efficiency of preheated COME and diesel

It can be observed from Fig. 4.1 that the thermal efficiency of COME50 and COME90 were 1.4% and

2% at higher load was higher than mineral diesel respectively. Preheating the fuel samples, which have higher viscosity than mineral diesel at room temperature, reduces the viscosity and increases the volatility. This enhances the fuel atomization leading to improved fuel air mixing. Oxygenated fuel gives a better fuel combustion delivering improved thermal efficiency. The unheated fuel samples show comparatively lower thermal efficiency possibly due to larger droplet size in the fuel spray.

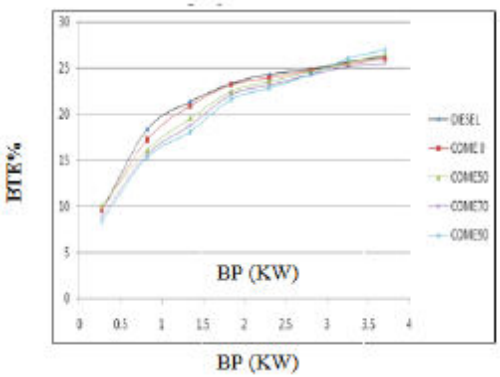

Figure 6: BP VS BTE.

B. Brake Specific Fuel Consumption diesel and preheated COME

Brake specific fuel consumption (BSFC) is a measure of volumetric fuel consumption for any particular fuel. The BSFC for preheated COME and diesel. BSFC for COME90 preheated up to 7.8% is higher than diesel at higher load. This is mainly due to the combined effects of the fuel density, viscosity and lower heating value of COME. Higher density of COME leads to more fuel flow rate for the same displacement of the plunger in the fuel injection pump, thereby increasing BSFC. However on preheating, it is observed that all COME show higher BSFC compared to diesel.

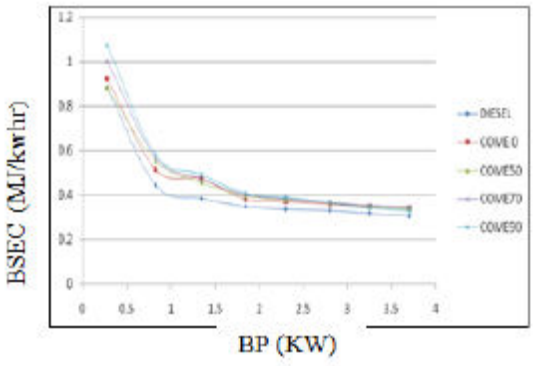

Figure 7: BP VS BSFC.

C. Brake specific energy consumption diesel and preheated COME

The variation of brake specific energy consumption (BSEC) for the engine using diesel, COME 0, COME50 C0ME70 and COME90 with respect to brake power output. Brake specific energy consumption (BSEC) is an ideal parameter for comparing engine performance. These figures show that the BSEC is lower for COME90 compared to diesel at higher load is 2.8%. The reduction in viscosity leads to improved atomization, fuel vaporization and combustion. It may also be due to better utilization of heat energy, and better air entrainment. It can also be seen that the minimum BSEC attained using COME90 at higher load was closer to that of diesel. This result indicates that the engine performance is approaching that of conventional diesel by preheating COME90.

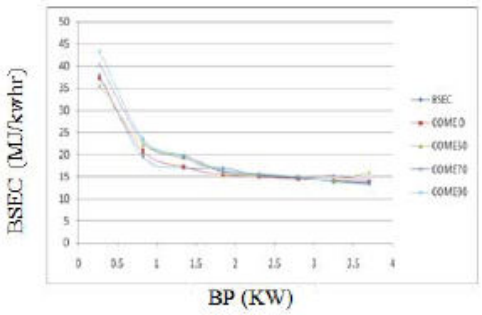

Figure 8: BP VS BSEC.

D. Exhaust gas temperature (EXGT) of preheated COME and diesel

The variation of exhaust gas temperature with respect to brake power for the engine using diesel, COME 0, COME50, COME70 and COME90 The exhaust gas temperatures were higher for COME 0 (without preheating) than diesel as COME 0 contains constituents of poor volatility, which burn only during the late combustion phase. Figure also indicates the effect of increasing the inlet temperature of COME on exhaust gas temperature. It can be seen that the exhaust gas temperature was increased with preheating COME. This may be due to the increase in the combustion gas temperature.

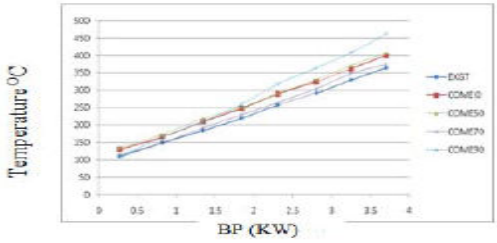

Figure 9: BP VS EXGT.

VI. CONCLUSIONS

Cottonseed oil methyl ester COME was produced by means of trans-esterification process using cottonseed oil, which can be described as a biomass based and renewable energy source. The viscosity of COME was reduced by preheating it before supplied to the test engine.

- Kinematics viscosity of COME is higher than those of diesel fuel. The heating value of COME lower while its flash point is higher than diesel fuel.
- Preheating of the COME caused a considerable decrease in its kinematics Viscosity thus causing them to approach the values of diesel fuel.
- A higher BTE was found with the preheated COME due to improved combustion compared to diesel fuel. Particularly COME 90 gives improvement in the BTE of the order of 2 % as compared to diesel.
- Compared to diesel fuel Exhaust gas temperature of COME 0, COME 50, COME 70 and COME 90 is high compared to diesel fuel
- Compared to diesel fuel, brake specific fuel consumption for preheated COME90 7.8% is found higher.
- Break specific energy consumption required for COME 0 is 4.4% high and preheated COME90 is 2.8% low as compared to diesel fuel respectively.
- A maximum of 76% Bio-diesel production was found at 20% of methanol and 0.5% KOH and 550 c reaction temperature.

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Non Linear Analysis and Weight Optimization of Split Dish Reactor Using FEA

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Abstract - A vertical split dish reactor with leg supports is modeled using ansys workbench. Thereafter, external loads, such as self – weight, internal pressure and temperature are applied to the model. Pressure and temperature has been continuously a concern which may lead to structural failure if the resulting stresses are severe and excessive. It is a significant study which requires in-depth investigation to understand the structural characteristics. This paper presents and focuses on some Finite Element (FE) analysis of a split dish reactor will be carried out and maximum stresses in the structure will be determined.

Keywords*-FEA;Modal FEA; Non-Linear, Dish Reactor.*

Nomanclatures-

T= Minimum required thickness (in.)
P = Design pressure (psi)
R = Inside radius (in.)
S = Allowable stress (psi)
D = Inside diameter (in.)
E = Weld joint efficiency factor, determined by joint location and degree of examination.
[E=1 for full radiographic examination]

I. INTRODUCTION

Pressure vessels with many more utilization in reactor technology, the chemical industry, and marine and space engineering, operating under extremes of high and low temperatures and high pressures, are becoming highly sophisticated and therefore also need advanced methods for their analysis. Advances are also made with materials applied for their fabrication. Concrete and composite materials are used in pressure vessels and their components more frequently to replace in some cases conventional steels.

Industrial pressure vessels are usually structures with complex geometry containing numerous geometrical discontinuities and are often required to perform under complex loading conditions (internal pressure, external forces, thermal loads, etc.). The design and manufacturing of these products are governed by mandatory national standards, codes and guidelines that ensure high safety performance. Most pressure vessel design codes (e.g. EN13445, BS550, and ASME Div III) assume a membrane stress state condition for the determination of the minimum shell thickness and large safety factors at areas of geometric discontinuities such as openings, change of curvatures, nozzle intersections, thickness reduction, etc. It should be noted that large safety factors lead to increasing the material thickness, while safety is not necessarily increased; recall that fracture toughness decreases with increasing thickness, and stress corrosion cracking at components operating in corrosive environments is expected to be higher in thicker parts.

During the last three decades considerable advances have been made in the applications of numerical techniques to analyze pressure vessel problems. Among the numerical procedures, the finite element methods (FEMs) are most frequently used.

Pressure vessel analyses may have some/all phases as: elastic stress and deformation analysis where thermal loads may be applied; heat transfer analysis; dynamic analysis; plastic and creep analysis. There is inexistence a large number of general and special purpose finite element programs available to cope with each phase of the analysis.

In the design/fabrication of pressure vessels, geometric discontinuity (abrupt change in radius of curvature due to misalignment and angular distortion,

and/or thickness of the shell) induces additional bending stress which may alter the stress distribution at the regions of the discontinuity. Determination of discontinuity stresses is an important problem. Finite element analysis (FEA) utilizing the commercial software packages (viz., ANSYS, NISA, MARC, etc.) will be more appropriate for shell structures involving elements of arbitrary thickness and curvature to obtain the stress distribution around discontinuities.

In this paper, first, the process and model is explained in a detailed manner. Afterwards, the results of the analysis are presented. Finally, the main conclusions of the investigation are drawn.

II. BRIEF OVERVIEW OF SOME RESEARCH

C.C. Manu et al. [1] have studied that pressure vessels made of ASME SA 455 steel can fail by high temperature stress rupture in less than 100 min when exposed to accidental fire heat loads. A three dimensional finite element analysis (FEA) model was develop which is capable of predicting structural failure in pressure vessels to assess the effects that various parameters have on vessel failure. These parameters included wall thickness, vessel dimensions, and wall temperature and vessel internal pressure. Also, the effect of local hot spots on failure time was investigated. The FEA were conducted on 500, 1000 and 33,000 US gallon pressure vessels using ABAQUS. From the results it was found that shorter and/or thicker walled (with respect to vessel diameter) pressure vessels have greater fire survivability then longer and/or thinner walled pressure vessels. It was also found that if peak wall temperature and internal pressure were the same, pressure vessels exposed to fully engulfing fires would fail sooner than pressure vessels exposed to a local fire impingement. Also, it was shown that the MPC Omega method could be used to predict fast stress ruptures.

Alwyn S. Tooth et al.[2] investigated the saddle support design to support horizantal pressure vessels subject to thermal loading. When storing liquids at high temperature in horizontal vessels, the current design methods aim to minimise the thermal stresses by introducing a sliding surface at the base of one of the twin saddle supports. However, regular site maintenance is required to ensure that adequate sliding is achieved. This may be difficult and costly to carry out. With the saddle designs which, although fixed to the platform or foundation, do not result in the storage/pressure vessel being overstressed when thermal loading occurs. It provides general recommendations for the most appropriate saddle geometries, and details the way in which design-by-analysis and fatigue-life- assessments may be carried out using the stresses that arise from these designs. For reducing the thermal stresses in pressure vessel it recommands that tall saddles should be used since they introduce axial flexibility. The distance between the two fixed saddle supports should be reduced as far as possible, thereby reducing the value of the axial thermal expansion to be restrained. The saddle embracing angle should not exceed 120 degree, since using the smaller angle of support provides flexibility to rotational movement.

J.Y. Zheng et al. [3] have done the investigation on bursting pressure of flat steel ribbon wound pressure vessels. The flat steel ribbon wound pressure vessel, invented by Professor Zhu in the People's Republic of China, has shown lots of advantages; namely, flexible design, convenient manufacture, safe use, wide feasibility and easy inspection. The material and manufacturing cost of using the flat ribbon wound technology may be 40% reduced from other methods in use for constructing large pressure vessels. The flat steel ribbon wound pressure vessel may burst either in the circumferential direction or in the longitudinal direction, which depends on the thickness of the inner core and the helical winding angle. By considering the additional strength caused by friction between ribbon layers in the model and ignoring dimensional changes resulting from plastic deformation, the authors deduced equations for the prediction of circumferential and longitudinal bursting pressures. From the comparison between test results and calculated values of longitudinal bursting pressure it can notice that calculation values have a good agreement with test values, maximum relative error is 5.1%, average relative error is 2.5%.It is easy in calculation and convenient to apply in engineering.

T. Aseer Brabinet al. [4] have carried out finite element analysis (FEA) to obtain the elastic stress distribution at cylinder-to-cylinder junction in pressurized shell structures that have applications in space vehicle design. Finite element analysis (FEA) has been carried out on cylindrical Pressure vessels having misalignment in a circumferential joint at unfilleted butt joint with equal thickness cylindrical

Pressure vessel was analyzed with 250 elements and 312 nodes, unfilleted butt joint with unequal thickness cylindrical pressure vessel was analyzed with 350 elements and 416 nodes, and filleted butt joint with equal thickness cylindrical pressure vessel was analyzed with 283 elements and 358 nodes. The peak stress values for these configurations obtained from FEA are close to that of test results. The peak stress value is found to reduce due to filleted butt joint and also confirmed through test results.

H. Darijani , R. Naghdabadi et al. [5] was derived an exact elasto-plastic analytical solution for a thick-walled cylindrical vessel made of elastic linear-hardening material By considering the Bauschinger

effect and the yield criterion of Tresca. For evaluation purposes, the material behavior was assumed to be a linear strain hardening that obeys Tresca's yield condition with associated flow rule. With the working pressure and geometric dimensions of the vessel, the distribution of the hoop and equivalent stresses are optimized in the way that the distribution of stresses becomes smooth in the vessel wall. Based on two optimizing methods of the hoop and equivalent stresses, the best autofrettage pressure is determined. It shows that this pressure is more than the working pressure and depends on the three following variables: Bauschinger effect, working pressure and geometric dimensions. In the next stage, it determines the wall thickness having the working pressure. For this, two different design criteria namely; optimizing the hoop stress distribution and assuming a suitable percent of yielding in the wall thickness are used. In the last step, for different types of structural materials under different working pressures, a number of different plots are given for the ratio of outer to inner radii and the best autofrettage pressure. It shows that the design of vessels based on the elasto-plastic methods is much more economic than elastic methods. Also, it is seen that for a non-hardening material, the design of vessel is only done for the working pressure less than unit value.

III. BASIC CHEMICAL PROCESS AND OPERATION OF PLANT

Early in the twentieth century, several chemists tried to make ammonia from atmospheric nitrogen. German chemist Fritz Haber discovered a process that is still used today. Ammonia was first manufactured using the Haber process on an industrial scale in 1913 in BASF's Oppau plant in Germany.

A. Chemical process

The Haber process combines nitrogen from the air with hydrogen derived mainly from natural gas (methane) into ammonia. The reaction is reversible and the production of ammonia is exothermic.

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -92\ kJ\ mol^{-1}$$

Fig (1) and Fig (2) shows a flow scheme for the Haber process.

Figure 1:Block daigram of ammonia generation palnt.

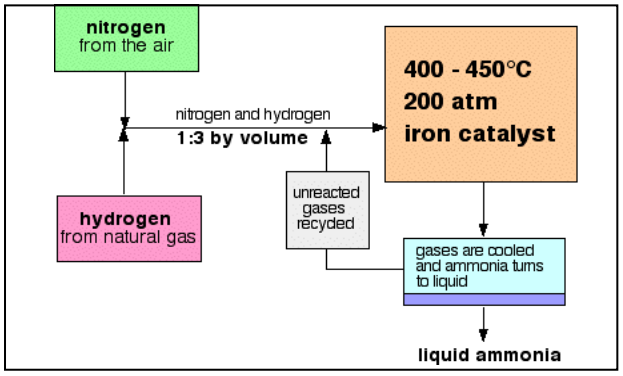

Figure 2:Layout of process of ammonia generation palnt.

By changing the conditions of temperature and pressure alters the position of equilibrium (proportion of nitrogen, hydrogen and ammonia will change). The speed at which equilibrium is reached is made much faster by using an iron catalyst. A reasonable rate of reaction is achieved at 450°c.The gas stream from the reactor is cooled and the ammonia liquefies and can be separated. The unreacted nitrogen and hydrogen gasses are recycled. The table I shows the yield of ammonia as a percentage at different temperatures and pressures in the Haber process.

Table I

Pressure(atm)	100°c	300°c	500°c
25	91.7%	27.4%	2.9%
100	96.7%	52.5%	10.6%
400	99.4%	79.7%	31.9%

B. Design challenges

The dish wall will take differential pressure of 5MPa. High temperature considerably lowers the yield capacity of the material. Hence while doing FEA, through check is required to see if there is any plastic deformation. Also since the process is reversible one, any alteration in pressure conditions will mean that product will reconvert into reactant causing production loss. Hence dish walls should not deform excessive, that they alter the concentration of reactants and cause the process to reverse. Deformation due to thermal expansion is direct function of distance from heated iron pallets, so it will be our optimization parameter. The thickness of wall will control the plastic deformation hence the thickness will be our another optimization parameter

IV. DIFFERENT TYPES OF NONLINEAR BEHAVIOUR

Although the process of changing stiffness is common to all types of nonlinear analyses, the origin of

nonlinear behavior can be different, making it logical to classify nonlinear analyses based on the principal origin of nonlinearity. Because it isn't possible to point out a single cause of nonlinear behavior in many problems, some analyses may have to account for more than one type of nonlinearity.

C. Nonlinear geometry

As already discussed, nonlinear analysis becomes necessary when the stiffness of the part changes under its operating conditions. If changes in stiffness come only from changes in shape, nonlinear behavior is defined as geometric nonlinearity. Such shape-caused changes in stiffness can happen when a part has large deformations that are visible to the naked eye. A generally accepted rule of thumb suggests conducting a nonlinear geometry analysis if the deformations are larger than 1/20th of the part's largest dimension. Another important factor to recognize is that in cases of large deformations, the load direction can change as the model deforms. Most FEA programs offer two choices to account for this direction change: following and non following load

D. Nonlinear material

If changes of stiffness occur due only to changes in material properties under operating conditions, the problem is one of material nonlinearity. A linear material model assumes stress to be proportional to strain. That means it assumes that the higher the load applied, the higher the stresses and deformation will be, proportional to the changes in the load. It also assumes that no permanent deformations will result, and that once the load has been removed the model will always return to its original shape.

Changes in stiffness due to shape can also occur when the deformations are small. A typical example is an initially flat membrane deflecting under pressure. Initially, the membrane resists the pressure load only with bending stiffness. After the pressure load has caused some curvature, the deformed membrane exhibits stiffness additional to the original bending stiffness.

V. ANALYTICAL METHOD TO DETERMINE THE THICKNESS OF SHELL

Following is the formula for determining the thickness of cylindrical shell

$$T = PR / [SE – 0.6P] \quad \text{.....(1)}$$

Following is the formula for determining the thickness of hemispherical head

$$T = PR / [2SE – 0.2P] \quad \text{.....(2)}$$

VI. THE FEM MODEL AND RESULTS

Finite element analysis (FEA) is one of the most popular engineering analysis methods for Non linear problems. FEA requires a finite element mesh as a geometric input. This mesh can be generated directly from a solid model for the detailed part model designed in a three-dimensional (3D) CAD system. Since the detailed solid model is too complex to analyze efficiently, some simplification with an appropriate idealization process including changing material and reducing mesh size in the FE model is needed to reduce the excessive computation time. The split dish reactor is made of special alloy SP-R4 (DNV).

Fig (3) shows the FEM model of the existing design. It typically is a spherical dish split by a concentric sphere. The existing design is supported on 8 legs .The material used for FE Analysis is Non Linear. The FEM Model having 6 freedoms: translations in the nodal x, y, and z directions and rotations about the nodal x, y, and z-axes.

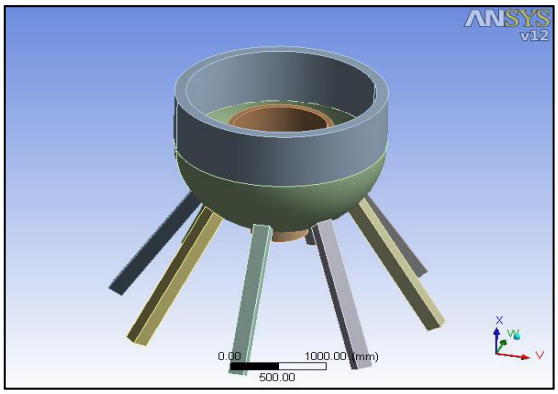

Figure 3: FE Model of Split Dish Reactor.

Material properties applied to the body contains

- Young's Modulus: 201GPa
- Poisson's Ratio: 0.23
- Yield Strength: 550MPa (Room Temperature)
- Allowable Stress: 450MPa
- Ultimate Strength: 650MPa (Room Temperature)

The boundary conditions applied for the body which contains

- The 8 legs are fixed at bottom.
- An internal pressure of 21Mpa was applied on inner face of dish and on outer face of split. Also, an internal pressure of 21.5Mpa was applied on inner face of split. Thus a differential pressure of 0.5Mpa was maintained between dish and split.

- The Conduction temperature of 260°c is applied to inside faces of split, dish and nozzle. Also, a Convection (atmospheric) temperature of 24°c is applied to outer faces of body including 8legs.
- There is also self weight (g), which was applied as standard gravity in FEA.

At first the FE model of split dish reactor with applied temperatures as only boundary condition was analyzed in FEA as steady state thermal for inducing thermal stresses. Fig(4) shows the FE model of split dish reactor under conduction(500F) and convection(75.2 F) temperatures.

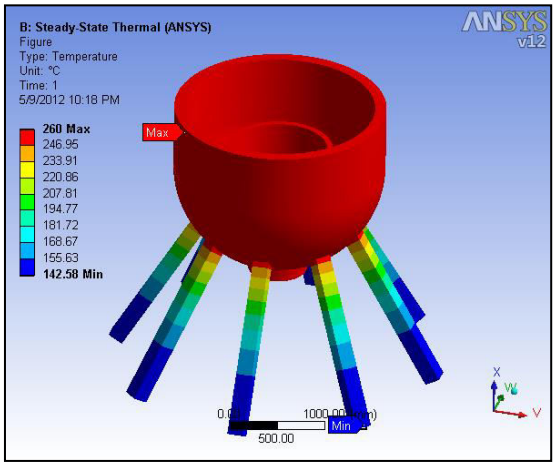

Figure 4: FE Steady- State Thermal Model of Split Dish Reactor.

A different type of meshing sizing is made for different parts of split dish reactor. For split dish reactor, we model and meshed only the middle and lower split dish reactor portion using Hex Dominant Quadrilateral and Triangular elements. Fig (5) shows FE Hexdominant Mesh Model of Split Dish Reactor.

Figure 5: FE Hexdominant Mesh Model of Split Dish Reactor.

In next stage, the solution obtained from thermal analysis is incorporated in setup of static structural analysis to analyze FE model of split dish reactor with applying all remaining boundary conditions except temperature, Fig (6) shows FE model with applied boundary conditions.

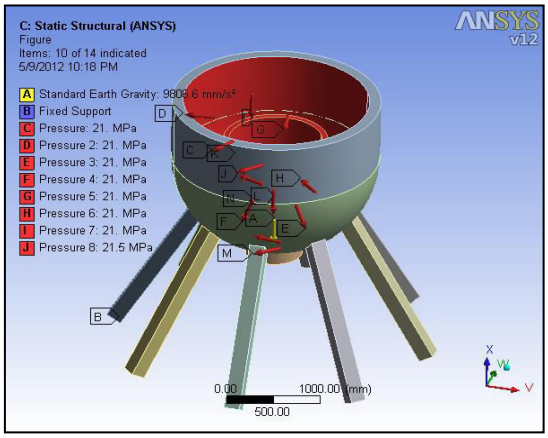

Figure 6: FE Boundary Conditioned Model of Split Dish Reactor.

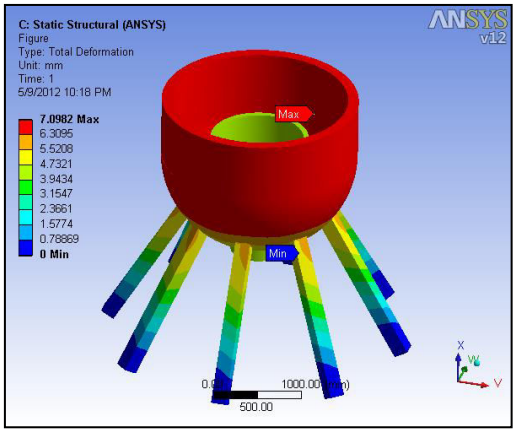

Figure 7: Deformation with Hexdominant mesh of Split Dish Reactor.

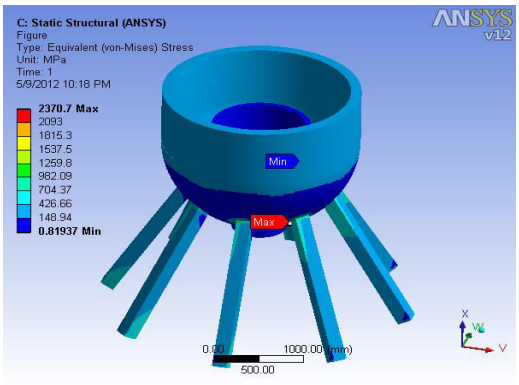

Figure 8: Equivalent (von misses) stresses with Hexdominant mesh of Split Dish Reactor.

Fig (7) and Fig (8) shows deformation and equivalent (von misses) stresses with hex dominant mesh of split dish reactor.

After doing no. of iterations we get different values of maximum stress corresponding deformations maximum load that can be sustain by the model. The results of analysis yields with No. of Nodes=115008; No. of Elements=22442; No. of Steps=5 as given in table

Table II FEA Results

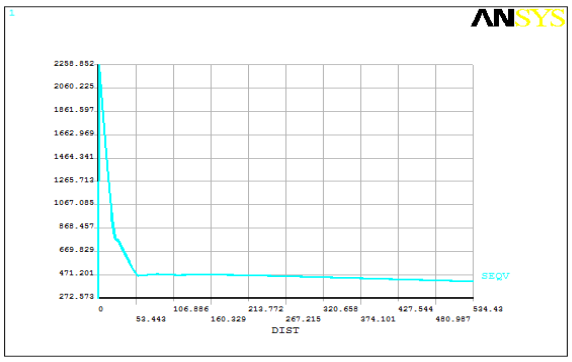

Figure 9: Graph of Distance vs Maximum stress (Stress Concentration at at tip of leg).

From above results it was found that the maximum stress concentration occurs at the tip corner of leg. So in order to find the nominal stress we plotted a graph (fig.9) distance verses maximum stress. It is found that the nominal stress is about 471.20MPa which is less than the yield strength of the material.

CONCLUSION

Split dish reactor plays a major role in production of ammonia which is used in production of fertilizers, explosives etc.

The analysis of split dish reactor brought a number of inadequacies in design. It is necessary that the dish wall will not deform excessive unless it alters the concentration of reactants and cause the process to reverse, results in production loss. So the dish wall and leg will not be so thin.

The optimum thickness of split dish reactor also changes with operating conditions such as temperatures and pressures used.

The exact distribution of stress and deformation is clear when we take out the component from assembly. From above analysis, it is found that the maximum stress concentration 2370.7MPa will be at the tip of leg.

It is found that the lower nozzle and inner split experiences very less stress than yield stress. So there is chance to minimize the thickness and in turns lowers weight of body.

Also it reduces the distance between dish wall and inner split that in turns reduces the deformation due to thermal expansion.

ACKNOWLEDGMENT

We would like to acknowledge the role of Mr. Rahul Lawand, of Vaftsy CAE for his guidance in some aspects of ANSYS solutions.

Sr. No	*Part*	*Thickness (mm)*	*Mesh Size (mm)*	*Max. Deformation (mm)*	*Average Stress Over part (MPa)*	*Max. Stress (MPa)*
1	Upper Cylinder	120	40	7.0962	185.22	211.09
2	Lower Dish	120	40	7.0982	272.48	524.23
3	Inner Split	60	30	4.7152	116.26	294
4	Lower Nozzel	60	30	4.5278	152.18	260.12
5	Legs	170	28.33	5.6947	471.20	2370.7

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Volume Of Fluid Method For Unsteady Multiphase Free-Surface Flows Inside Washing Machine Using CFD

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Abstract - A computational model to predict the unsteady, multiphase free-surface flows inside a washing machine has been developed in this work. The prevailing multi-phase flow computations are performed using the Volume of Fluid (VOF) method. Two phase (air-water) and three phase (air-water-detergent) simulations are conducted. Wash tub is held stationary and the agitator is given unidirectional rotary motion. Governing equations for continuity, momentum, swirl velocity, and volume fraction are solved. These equations are first integrated about a control volume and the resultant algebraic equations are solved numerically. Unsteady computations are performed using implicit scheme. Results obtained using two-phase simulations show that the velocity inside the washing machine fluctuates heavily sloshing up and down. The location of the free-surface was captured as a function of time. The free-surface was found to be going up and down as the agitator is rotating. Three-phase simulations indicate that the detergent mixed well with water in about 0.2 s. The proposed computational model could be used as a tool to design better and efficient washing machines.

Keywords*-volume f of fluid method(VOF),Turbulance, computational fluid dynamics (CFD),GAMBIT*

I. INTRODUCTION

Free-surface flows are encountered in several applications in our life ranging from simple flow inside a rotating bowl to as large as the flow of a river. Free-surface flows occur whenever a liquid comes in contact with a gas and there is a flow of any one or both the fluids. The liquid-gas interface exhibits a severe surface force (due to surface tension) and causes complexity in the flow structure. Several studies have been performed in the past to understand the physics of such flows. Recent developments in computational fluid dynamics (CFD) enabled the researchers to simulate almost all kinds of problems that can occur in real situations. Particularly, free-surface flows occurring in internal flows are of great importance. Flow inside a washing machine (WM) is an example of internal free surface flows. Understanding the flow structure and mixing pattern allows us to design efficient and economical washing machines. The objective of the present study is to develop a CFD model that can predict the unsteady free-surface flows inside a washing machine.

The development of the theoretical model is described in the next section. Solution procedure, grid generation and numerical techniques are given in the following section. Results obtained using the proposed model are described next followed by the conclusionsType Style and Fonts

II. GOVERNING EQUATIONS

Flow simulations in WM involve unsteady free-surface flows with multi-phase calculations. The Volume of Fluid (VOF) approach [1] has been adopted and a single continuity equation for volume fraction for (n-1) phases is solved.

A. Continuity Equation

Continuity equations for volume fraction for all the secondary phases are given below:

$$\frac{\partial \alpha_q}{\partial t} + \vec{v} \cdot \nabla \alpha_q = 0 \qquad (1)$$

The primary phase is calculated using:

$$\sum_{q=1}^{n} \alpha_q = 1 \qquad (2)$$

The transport coefficients are evaluated as follows:

$$\Gamma = \sum \alpha_q \Gamma_q \qquad (3)$$

B. Momentum equation

A representative velocity for all the phases is obtained by solving a single momentum equation throughout the domain. The resultant velocity is then shared among the phases. This is linked with volume fraction through density and viscosity [2].

$$\frac{\partial}{\partial}(\rho\vec{v}) + \nabla\cdot(\rho\vec{v}\vec{v}) =$$

$$-\nabla p + \nabla\cdot[\mu(\nabla\vec{v} + \nabla\vec{v}^{T})] + \rho\vec{g} + \vec{F} \tag{4}$$

C. Swirl velocity

Swirl velocity in the flow field (for an axisymmetric case) is calculated using the following equation:

$$\frac{\partial}{\partial t}(\rho w) + \frac{1}{r}\frac{\partial}{\partial x}(r\rho uw) + \frac{1}{r}\frac{\partial}{\partial y}(r\rho vw) =$$

$$\frac{1}{r}\frac{\partial}{\partial x}(r\mu\frac{\partial w}{\partial x}) + \frac{1}{r^2}\frac{\partial}{\partial r}(r^3\mu\frac{\partial}{\partial r}(\frac{w}{r})) - \rho\frac{vw}{r} \tag{5}$$

D. Turbulence

The rotary motion of agitator induces turbulence inside the washing machine. The turbulence is modeled using the standard k-ε turbulence model [3]. The governing equations used are similar to those found in Ref. 3.

III. SOLUTION METHODOLOGY

A. Grid generation

A 2D axisymmetric geometry (as shown in Fig. 1) of size 0.844 X 0.299 m is considered in the present work. The external dimensions correspond to a commercial washing machine P1405J [4]. A grid of triangular elements is generated using a commercial software *GAMBIT*. Shown in Fig. 2 is the computational grid employed in this study.

B. Solution procedure

Governing differential equations are integrated about each control volume. This process yields a set of algebraic equations that conserve a quantity on a control-volume basis. These algebraic equations are then solved numerically. Pressure and velocity coupling is achieved by using SIMPLE algorithm [5]. Momentum, swirl, and turbulence quantities are discretized using the Power law scheme.

TABLE I. Discretization Scheme

Sl. No.	Parameter	Method
1.	Pressure	Body-force weighted
2.	Momentum	Power law
3.	Swirl velocity	Power law
4.	Turbulent kinetic energy	Power law
5.	Turbulence dissipation rate	Power law
6.	Pressure-velocity coupling	SIMPLE
7.	Unsteady formulation	Explicit scheme

Unsteady calculations are performed using Explicit-time marching scheme with an automatic step refinement option. The Courant number is taken as 0.25. Various discretization schemes used in the study are summarized in Table 1.

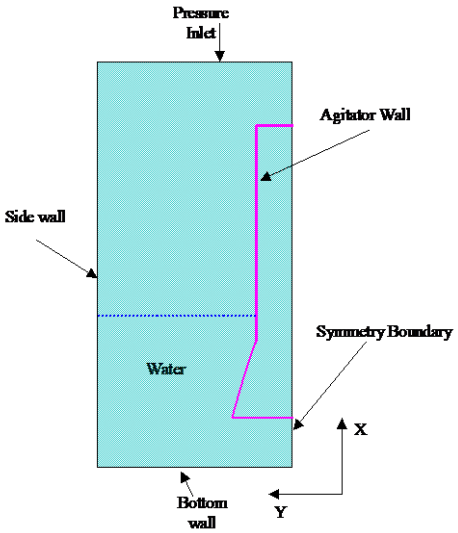

Figure 1. Physical Geometry

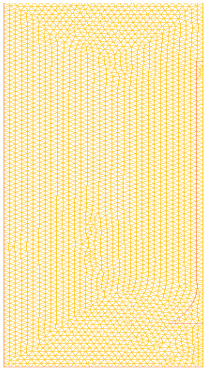

Figure 2. Typical Grid Used.

The under-relaxation factors and the initial guess values used in this study are summarized in Table 2 and Table 3 respectively.

TABLE II. Under-Relaxation Factors

Sl. No.	Parameter	Value
1.	Pressure	0.3
2.	Density	1.0
3.	Body forces	1.0
4.	Momentum	0.7
5.	Swirl velocity	0.9
6.	Volume fraction	0.2
7.	Turbulent kinetic energy	0.8
8.	Turbulence dissipation rate	0.8
9.	Turbulent viscosity	1.0

TABLE III. Initial Guess Values

Sl. No.	Parameter	Value
	Initial Guesses	
1.	Gauge pressure, Pa	0.0
2.	Axial velocity, m/s	0.0
3.	Radial velocity, m/s	0.0
4.	Swirl velocity, m/s	0.0
5.	Turbulent kinetic energy, m^2/s^2	0.0
6.	Turbulence dissipation rate, m^2/s^3	0.0
	Patch Values	
1.	Water volume fraction	0.95
2.	Detergent volume fraction (for 3-phase)	0.05

C. Boundary conditions

The various physical boundaries are mapped into relevant computational boundaries. The boundary mapping is shown in Table 4.

TABLE IV. Boundary Conditions

Sl. No.	Physical Boundary	Computational Mapping
1.	WM lid	Pressure inlet
2.	WM bottom	Wall
3.	WM tub	Wall
4.	Agitator	Rotating wall

D. Gas-liquid interface interpolation scheme

To obtain the properties at the interface, the Geometric Reconstruction procedure is adopted [2]. In this approach, when a control volume is completely filled with one phase or the other, the standard interpolation scheme is used. If an interface control volume is partially filled, the properties are obtained by assuming a piece-wise linear relationship.

E. Modeling outline in FLUENT

The mathematical model described in the previous sections can be solved using FLUENT. The steps involved in the modeling are outlined below:

Steps in GAMBIT:

1. Create the washing machine geometry
2. Generate mesh
3. Define boundary and continuum types
4. Export mesh

Steps in FLUENT:

1. Read the mesh file into FLUENT
2. Setup Multiphase model
3. Define boundary conditions
4. Specify wall rotary motion
5. Patch initial water and detergent levels
6. Solve
7. Post processing

IV. RESULTS AND DISCUSSION

The following assumptions are made in this study:

(1) In actual situations, the agitator inside the washing machine has a bi-directional rotary motion. However, for the sake of simplicity, it is assumed that the agitator has only uni-directional motion.

(2) The agitator geometry has kept small in order to avoid large-scale turbulence.

A. Grid sensitivity analysis

In order to demonstrate the gird independent nature of the results, three girds of different sizes have been generated. The following grid sizes are considered: (a) 3032 nodes, (b) 11764 nodes, and (c) 46328 nodes. The axial velocity variation at the bottom of the washing machine with respect to flow time was captured and the results are plotted in Fig3.

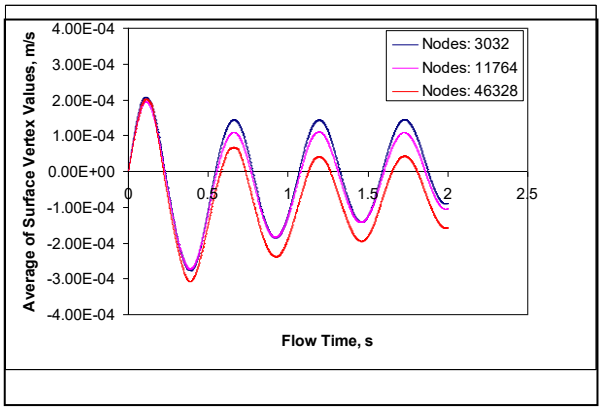

Figure 3. Grid Sensitivity Analysis

From Fig. 3, it can be seen that a slight variation occurs when grid size becomes finer. In this study, different grid sizes are obtained by using FLUENT's in-built grid adaptation facility. However, it is anticipated that the above-mentioned difference could be eliminated, if the grids were re-created using GAMBIT.

B. Validation of the model

The proposed numerical model has been qualitatively validated with those results obtained in a FLUENT tutorial case. FLUENT models the free-surface flow of water inside a rotating bowl and with no central disk or agitator. In the present study, an agitator was defined to model the flow inside a washing machine and a unidirectional motion was given and the tub (outer region) was kept stationary. However, it is appropriate to compare the results qualitatively. Summary of parameters considered for comparison is given in Table 5. Figs. 4 and 5 show the results of present model FLUENT calculations respectively. It can be seen that both the results agree well qualitatively.

TABLE V. Parameters For Comparison

Sl. No.	Parameter	FLUENT	Present Model
1.	Geometry	2-D, bowl	2-D washing machine
2.	Size	2 x 1 m	0.844 x 0.299 m
3.	Rotation type	Angular, 3 rad/s	Angular, 3 rad/s
4.	Rotating part	Bowl	Agitator
5.	Agitator availability	No	Yes
6.	Direction of gravity	Positive X direction	Negative X-direction

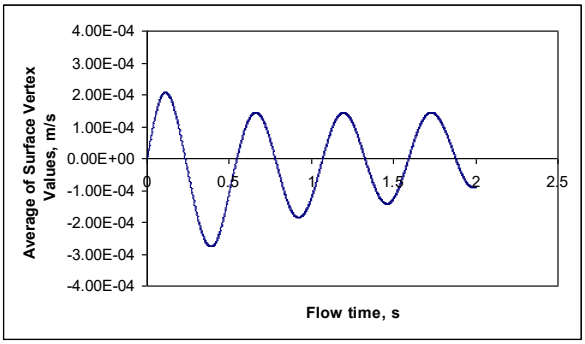

Figure 4. Results of Present Model

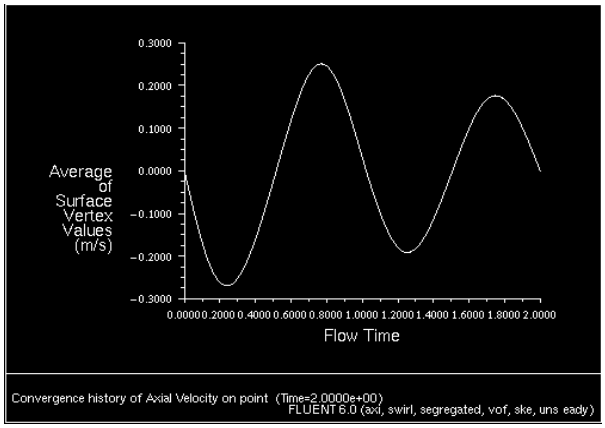

Figure 5. Results of FLUENT Calculations

C. Results of two-phase simulations

In this case, bottom 1/3 of the bowl was filled with water. A rotational speed of 3 rad/s was given to the agitator. The free-surface boundary was captured for the first 2 s. The water volume fraction contours have been obtained and presented in Figs. 6 - 11.

Results clearly show that the free-surface boundary is affected by the rotary motion of the agitator. According to Figs. 6(a) - 6(f), the free-surface boundary inside the washing machine goes down until 0.3 s and then starts to go up and returns to its original boundary. This process then repeats showing that there are severe oscillations present inside the washing machine.The variation of axial velocity inside the washing at a point has also been captured and shown in Fig. 7. It can be seen from Fig. 7 that the axial velocity changes it sign every 0.3 s. This means that the flow pattern inside the washing machine oscillates heavily. It is interesting to note that the peak value of the oscillations keeps decreasing. This indicates the water inside the washing machine is trying to reach equilibrium.

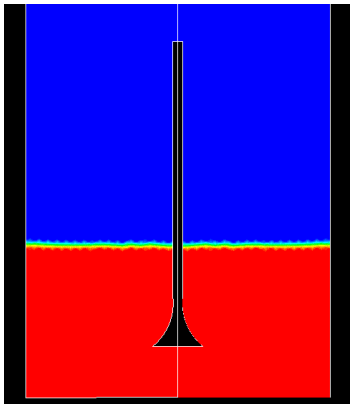

Figure 6. Water Volume Fraction at 0.02 s

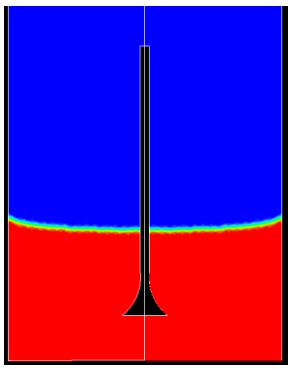

Figure 7. Water Volume Fraction at 0.1 s

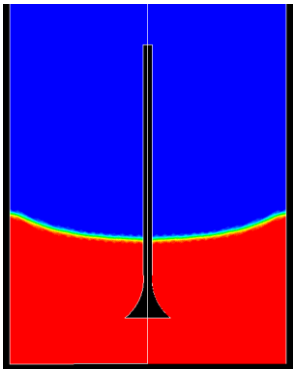

Figure 8. Water Volume Fraction at 0.2 s

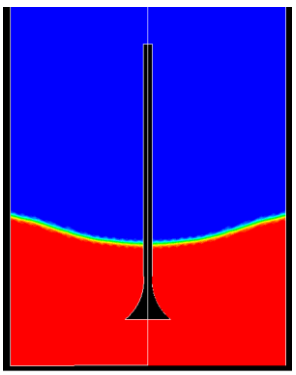

Figure 9. Water Volume Fraction at 0.3

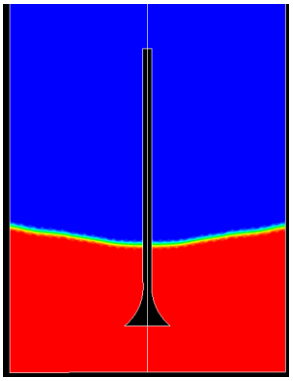

Figure 10. Water Volume Fraction at 0.4 s

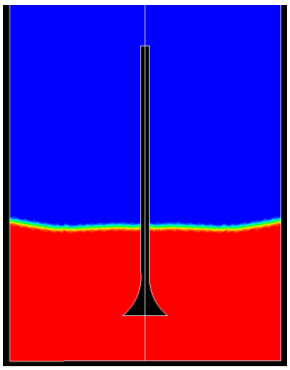

Figure 11. Water Volume Fraction at 0.5 s

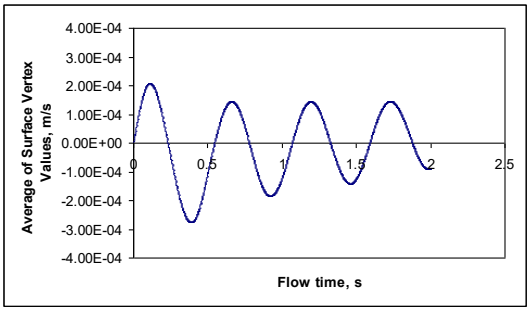

Figure 12. Variation of Axial Velocity with Flow Time

D. Results of three-phase simulations

The flow and mixing pattern inside the washing machine when filled with water and detergent are obtained. This would allow us to understand the free-surface boundaries as well as the effectiveness of the mixing. Liquid ammonia has been chosen to represent the detergent.

In this case also, bottom 1/3 of the bowl was filled with water. An initial volume fraction of 0.05 is given for detergent. A rotational speed of 3 rad/s was given to the agitator. The free-surface boundary was captured for the first 2 s. The detergent volume fraction contours have been obtained and presented in Figs. 13-18.

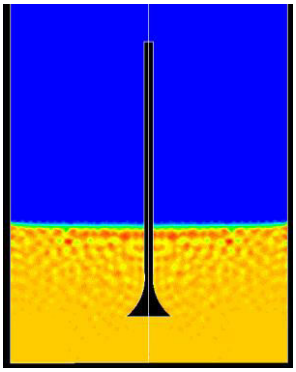

Figure 13. Detergent Volume Fraction at 0.02 s

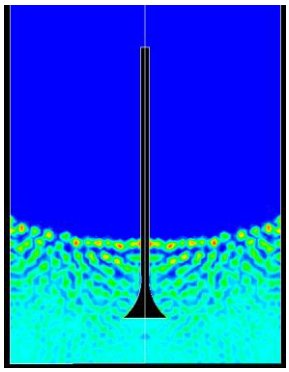

Figure 14. Detergent Volume Fraction at 0.1 s

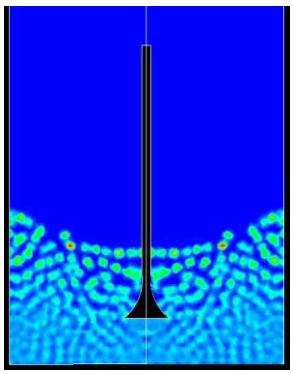

Figure 15. Detergent Volume Fraction at 0.2 s

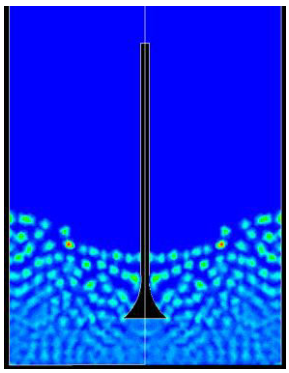

Figure 16. Detergent Volume Fraction at 0.3 s

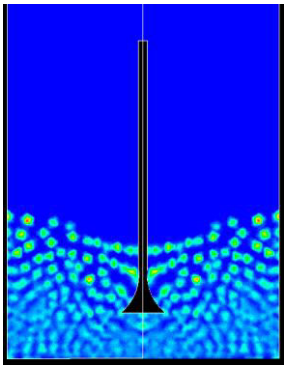

Figure 17. Detergent Volume Fraction at 0.4 s

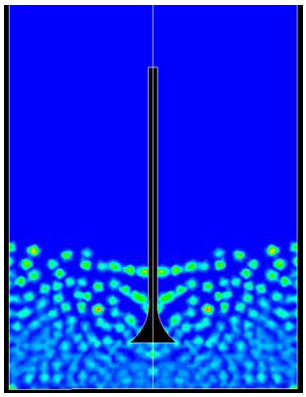

Figure 18. Detergent Volume Fraction at 0.5 s

The free-surface between water-detergent mixture and air is affected by the rotary motion of the agitator. According to Fig:13 - 18, the free-surface boundary inside the washing machine first goes down until 0.3 s and then starts to go up and returns to its original boundary. This process then repeats showing that there are severe oscillations present inside the washing machine.

It is also evident from the Figs. 13 - 18 that the detergent is able to mix well with the water and air produce a uniform environment for washing. As one could guess, higher the mixing is the more efficient the washing would be.

CONCLUSIONS

(1) A computational model to predict the flow and mixing pattern inside washing machine has been developed. The proposed model is capable of capturing the unsteady free-surface boundaries.

(2) Using this model, free-surface boundaries in water-air and water-air-detergent interfaces in a washing machine have been predicted.

(3) Results show that the water in the washing machine sloshes up and down and would reach a steady state eventually.

(4) This computational model could be used as a tool in designing better and efficient washing machines.

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Erosion Wear Behaviour of Bamboo/Glass Fiber Reinforced Epoxy Based Hybrid Composites

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Abstract - Now-a-days, there is an increasing interest in hybrid composites made by combination of two or more different types of fiber in a common matrix because these materials offer a range of properties that cannot be attained with a single type of reinforcement. The fibres are either natural or synthetic and both types of fiber have advantages and disadvantages. Therefore, in this work a new class of hybrid composite reinforced with a synthetic fiber and a natural fiber is developed to get the advantage of both the fibres in terms of superior tribological properties and economy. The present research work is undertaken to investigate the erosion behaviour of short bamboo and glass fiber reinforced epoxy based hybrid composites.

Keywords- *composites; bamboo fiber; glass fiber.*

I. INTRODUCTION

Natural fibers have recently attracted the attention of scientists and technologists because of the advantages that these fibers provide over conventional reinforcement materials. The advantages of natural fibers include low price, low density, unlimited and sustainable availability, and low abrasive wear of processing machinery [1-3]. These natural fibers are low-cost fibers with low density and high specific properties. These are bio-degradable and nonabrasive, unlike other reinforcing fibers. However, certain drawbacks such as incompatibility with the hydrophobic polymer matrix, the tendency to form aggregates during processing, and poor resistance to moisture greatly reduce the potential of natural fibers to be used as reinforcement in polymers. A number of investigations have been carried out to assess the potential of natural fibers as reinforcement in polymers [4-6]. Natural fiber exists in the form of vegetable fiber, animal fiber or mineral fiber. The reason that many studies focus on bamboo is because it is an abundant natural resource in Asia, and its overall mechanical properties are comparable to those of wood. Bamboo is a naturally occurring composite material which grows abundantly in most of the tropical countries. This is one of the oldest building materials used by human kind [7]. It has been used widely for household products and extended to industrial applications due to advances in processing technology and increased market demand. The erosion of materials caused by impact of hard particles is one of several forms of material degradation generally classified as wear. Bitter [8] defined erosion as "Material damage caused by the attack of particles entrained in a fluid system impacting the surface at high speed" while Hutchings [9] wrote " Erosion is an abrasive wear process in which the repeated impact of small particles entrained in a moving fluid against a surface results in the removal of material from the surface". Solid particle erosion is a serious problem in gas turbines, rocket nozzles, cyclone separators, valves, pumps and boiler tubes**.**

Based on the literature a lot of research work has been done on the synthetic fiber reinforced or natural fiber reinforced polymer composites. However, very less work has been reported on both the synthetic and natural fiber reinforced polymer hybrid composites. To this end, the present work is undertaken to study the erosion wear behavior of both bamboo and glass fiber reinforced epoxy based hybrid composites.

II. EXPERIMENTAL DETAILS

A. Composite Fabrication

The short bamboo fiber which is taken as reinforcement in this study is collected from local sources. The epoxy resin and the hardener (HY951) are supplied by Ciba Geigy India Ltd. Wooden moulds having dimensions of 180 x 180 × 40 mm^3 were used for composite fabrication. The short bamboo fiber and E-Glass fibers are mixed with epoxy resin by simple mechanical stirring and the mixture was poured into various moulds, keeping in view the requirements of various testing conditions and characterization standards. The composite samples of four different compositions (EBG-1 to EBG-4) are prepared. The composite samples EBG-1 to EBG-4 are prepared in

four different percentages of Glass and bamboo fibers (0wt.%, 15 wt %, 30 wt % and 45 wt %). This is done by varying the epoxy percentage (i.e. 100 wt % to 65wt.%). A releasing agent is used on the mould release sheets to facilitate easy removal of the composite from the mould after curing. The entrapped air bubbles (if any) are removed carefully with a sliding roller and the mould is closed for curing at a temperature of 30°C for 24 h at a constant load of 50 kg. Finally, the composites are cut using diamond cutter for further characterization and erosion tests. The composition and designation of the composites prepared for this study are listed in the Table 1.

TABLE 1. DESIGNATION OF COMPOSITES

Composites	Compositions
EBG-1	Epoxy (100 wt%)+Bamboo fiber (0wt%) +Glass fiber (0wt%)
EBG-2	Epoxy (75 wt%)+Bamboo fiber (7.5 wt%) +Glass fiber (7.5 wt%)
EBG-3	Epoxy (70 wt%)+Bamboo fiber (15 wt%) +Glass fiber (15 wt%)
EBG-4	Epoxy (65 wt%)+Bamboo fiber (22.5 wt%) +Glass fiber (22.5 wt%)

B. Erosion Test and Taguchi Experimental Design

The experimental set up for the solid particle erosion wear test (as per ASTM G76) used in this study is capable of creating reproducible erosive situations for assessing erosion wear resistance of the prepared hybrid composites. The solid particle erosion test rig consists of a compressor, drying unit, a conveyor belt-type particle feeder which helps to control the flow of sand particle and an air particle mixing and accelerating chamber. The compressed air is then mixed with the selected range of silica sand which is fed constantly by a conveyor belt feeder into the mixing chamber and then passing the mixture through a convergent brass nozzle of 3 mm internal diameter. The erodent particles impact the specimen which can be held at different angles with respect to the direction of erodent flow using a swivel and an adjustable sample holder. The conditions under which the erosion tests are carried out are listed in Table 2. In the present study, pyramidal shaped dry silica sand of sizes 125µm are used as erodent. After each experimental run the eroded samples are cleaned in acetone and dried for 5 mins and then weighed to an accuracy of ± 0.01 mg before and after the erosion trials using electronic balance. The weight loss is recorded for subsequent calculation of erosion rate. The process is repeated till the erosion rate attains a constant value called steady state erosion rate.

TABLE 2. LEVELS FOR VARIOUS CONTROL FACTORS

ontrol factor	Level				Units
	I	II	III	IV	
A: Impact velocity	35	45	55	65	m/sec
B: Fiber loading	0	15	30	45	wt %
C: Impingement angle	45	60	75	90	°C
D: Stand-off-distance	55	65	75	85	mm
F:Erodent Temperature	35	70	105	140	Deg.

In the present work, the impact of five such parameters are studied using L_{16} (5^4) orthogonal design. The operating conditions under which erosion tests are carried out are given in Table 2. The tests are conducted at room temperature as per experimental design given in Table 3. Five parameters viz., impact velocity, fiber loading, stand-off distance, impingement angle and erodent temperature, each at four levels, are considered in this study. In Table 3, each column represents a test parameter and a row gives a test condition which is nothing but combination of parameter levels.

III. RESULTS AND DISCUSSION

A. Effect of Impact Velocity on Erosion Rate of Composites

The speed of erosive particle has a very strong effect on the wear process. If the speed is very low then the stresses at impact are insufficient for plastic deformation to occur and wear proceeds by surface fatigue. When the speed increases it is possible that subsurface cracking occurs as untreated composites are brittle in nature. Effect of impact velocity of particle on erosion rate is studied and the results are represented in Figure 1.

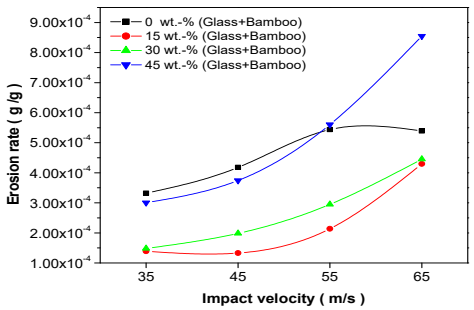


Figure1. Effect of impingement angle on erosion rate of hybrid composites

It is evident from the Figure 1 that at low impact velocity from 35m/sec to 45m/sec, there is not much variation in erosion rate. However, with the further increase in impact velocity, the erosion rate is significantly increasing i.e. up to 55m/sec. This may be due to the at higher impact velocity, the erosion rate is occurring due to plastic deformation and more amount of material is removed. On further increase in impact velocity all the composites show gradually increase in erosion rate except 0wt% bamboo/glass fiber reinforced epoxy composites shows quite reverse in trend as shown in Figure 1. This is due to the neat epoxy losses its properties and then starts melting. From Figure 1 it is also clear that neat epoxy shows maximum erosion rate and 15wt.% bamboo/glass fiber shows least erosion rate whereas 30 and 45wt.% hybrid composite lies in between the other two composites.

B. *Effect of Impingement Angle on Erosion Rate of Composites*

Impingement angle is one of the important parameters for the erosion behavior of composite materials. Dependence of erosion rate on the impingement angle is largely determined by the nature of the target material and other operating conditions. In the literature, materials are broadly classified as ductile or brittle, based on the dependence of their erosion rate with impingement angle [10]. The ductile behaviour is characterized by maximum erosion rate at low impingement angle i.e typically in the range of $15^0 < \alpha < 30^0$.

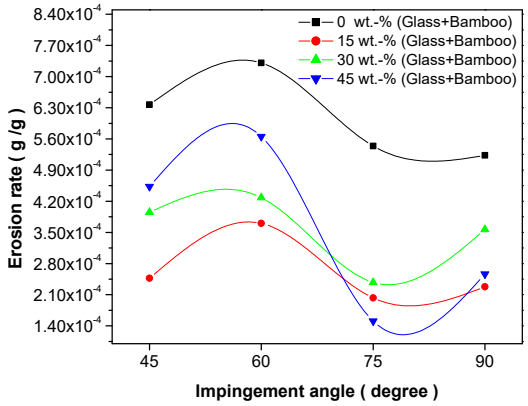


Figure 2. Effect of erodent temperature on erosion rate of hybrid composites

On the other hand, if the maximum erosion rate occurs at normal impact (*E*max at $\alpha=90^0$), the behaviour of material is purely brittle mode. The effect of impingement angle on erosion rate of untreated bamboo epoxy composite is studied and results are shown in Figure 2. The erosion rate increases with increase in fiber content. Sundararajan et al. [11] concluded that this behavior is attributed to the fact that the harder the material, larger is the fraction of the crater volume that is removed. In this investigation higher hardness values have been noted for composites with higher fiber loading and this is therefore the reason why the composites exhibit declining erosion resistance with the increase in fiber content. It is evident from the Figure 2 that impingement angle has significant influence on erosion rate and the maximum erosion is occurring at an impingement angle of 60° for all composite samples irrespective of fiber loading. So the mode of wear is neither a ductile erosion mode nor brittle erosion wear mode, it is behaving like semi-brittle mode of erosion wear.

C. *Taguchi Analysis*

Taguchi design of experiment is a powerful analysis tool for modeling and analyzing the influence of control factors on performance output. Tables 3 show the erosion rates of different composites for all 16 test runs and their corresponding S/N ratios. Each of the values in these columns is in fact the average of two replications. The detail of the Taguchi experimental procedure was presented in our previous article [12]. The overall mean for the S/N ratio of the erosion rate is found to be 70.66db for the bamboo/glass hybrid composites. The analysis is made using the popular software specifically used for design of experiment (MINITAB 15). Before any attempt is made to use this simple model as a predictor for the measure of performance, the possible significant control factors are presented in Figure 3.

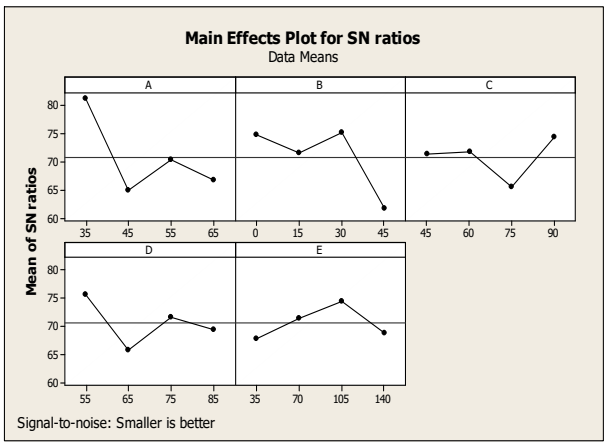


Figure 3. Effect of control factors on erosion rate for hybrid composites

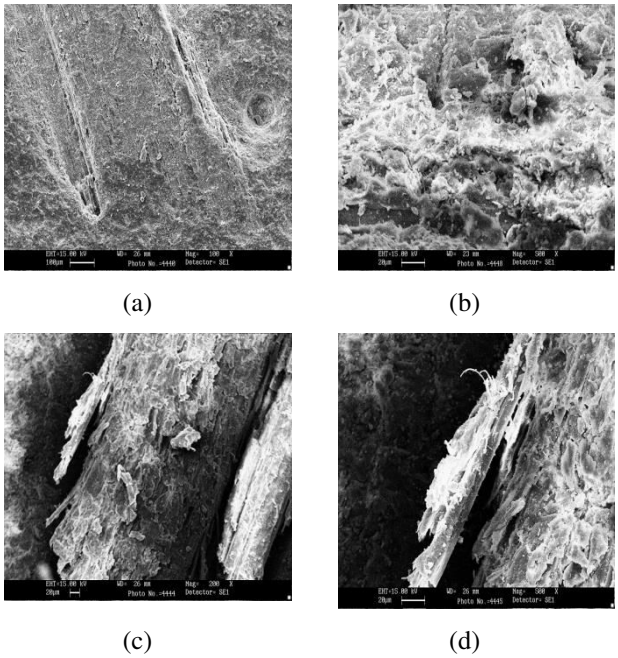
TABLE 3. EXPERIMENTAL DESIGN USING L_{16} ORTHOGONAL ARRAY

Sl. No	A (m/s)	B (wt %)	C Deg.	D (mm)	E (°C)	Er (gm/gm)	S/N
1	35	0	45	55	35	3.940E-05	88
2	35	15	60	65	70	1.167E-04	78
3	35	30	75	75	105	5.685E-05	84

4	35	45	90	85	140	2.363E-04	72
5	45	0	60	75	140	3.550E-04	68
6	45	15	45	85	105	3.670E-04	68
7	45	30	90	55	70	1.154E-04	78
8	45	45	75	65	35	7.239E-03	42
9	55	0	75	85	70	3.790E-04	68
10	55	15	90	75	35	2.256E-04	72
11	55	30	45	65	140	3.703E-04	68
12	55	45	60	55	105	2.856E-04	70
13	65	0	90	65	105	2.200E-04	73
14	65	15	75	55	140	5.392E-04	65
15	65	30	60	85	35	4.096E-04	67
16	65	45	45	75	70	1.001E-03	59

D. Surface Morphology

The SEM observations explain the results presented in the Figure 4 for bamboo/glass fiber reinforced epoxy composites under steady state erosion rate studied at constant impact velocity 45m/sec, erodent size 125µm and stand-off distance of 65mm at controlled conditions with variations of impingement angle (30 to 90°). Figure 4 shows the SEM of surfaces of the hybrid composite eroded under various test conditions. In Figures 4(a) and 4(b) show the 15wt.% fiber loading at lower impingement angle, it appears that composites under consideration exhibit several stages of erosion and material removal process. Very small craters and short cracks are seen on the eroded surface of the composite at 30° impingement angle. On increase in impingement angle to 45° under similar operating conditions shows slightly increased in erosion rate as evident from Figure 4b for 30wt% fiber loading. This indicated that the initiation of matrix material loss from the surface and the matrix is chipped off and the fibers are slightly visible beneath the matrix layer after the impact of dry silica sand particles. But as the erosion tests are carried out with further higher impingement angle (60°) at constant impact velocity 45m/sec, erodent size 250µm and stand-off distance 65mm the morphology of the eroded surface becomes different as in Figure 4(c) .Such cracks are clearly noticed in Figure 4(c) and distinctly illustrate a crater formed due to material loss and the arrays of broken/semi-broken fibers. Due to repeated impact of hard silica sand and higher impingement angle the sand particles tries to initiation of cracks on the matrix body and as erosion progresses gradually, these cracks subsequently propagate on the fiber bodies both in transverse as well as in longitudinal manner. But on further increase in impingement angle from 60° to 75° almost all the composites showed maximum erosion rate (Figure 2) as shown in Figure 4(d) for 45wt% fiber loading. As discussed earlier for ductile materials, repeated impacts lead to plastic deformation processes and heavily strained regions on the composite surface. In the case of brittle materials on other hand, the propagation of cracks grows towards the surface and their intersection to form a wear particle separated from the surface leads to additional mass loss of the composite.



(a) (b) (c) (d)

Figure 4. Surface morphology of eroded hybrid polymer composites

E. Analysis of Variance

Analysis of Variance (ANOVA) has been carried out from the experimental data for bamboo/glass fiber reinforced epoxy composites on erosion rate. Table 4 shows the ANOVA result for the erosion rate of hybrid composites under solid particle erosion. This analysis is undertaken for a level of confidence of significance of 5 %. The last column of the table indicates that the main effects are highly significant (all have very small p-values) [259]. From Table 4, it can be observed for the hybrid composites that impact velocity (p=0.120), fiber loading (p= 0. 142), stand-off distance (p= 0.564) and erodent temperature (p = 0.797) have great influence on erosion wear rate, whereas impingement angle shows least significant control factor in the present study.

TABLE 4. ANOVA TABLE FOR EROSION RATE OF HYBRID COMPOSITES

Source	**DF**	**Seq SS**	**Adj SS**	**Adj MS**	**F**	**P**
A	3	289.5	289.5	289.5	2.88	0.120
B	3	255.6	255.6	255.6	2.55	0.142
C	3	1.5	1.5	1.5	0.02	0.904
D	3	35.7	35.7	35.7	0.36	0.564
E	3	7.0	7.0	7.0	0.07	0.797
Error	0	1003.8	1003.8	100.4		
Total	15	1593.0				

IV. CONCLUSION

The experimental investigation of the present work has been lead to the following conclusions:

1. Successful fabrication of hybrid bamboo/glass fiber reinforced epoxy composites is possible by simple hand lay- up technique.
2. In steady state erosion rate is concerned with respect to impact velocity all the composites show gradually increase in erosion rate except 0wt% bamboo/glass fiber reinforced epoxy composites shows quite reverse in trend at higher impact velocity. This is due to the neat epoxy losses its properties and then starts melting. it is also clear that neat epoxy shows maximum erosion rate and 15wt.% bamboo/glass fiber shows least erosion rate whereas 30wt.% and 45wt.% hybrid composite lies in between the other two composites.
3. Similarly, as far as impingement angle is concerned all the hybrid composites show maximum erosion rate at 60° impingement angle irrespective of fiber loading. So the mode of wear is neither a ductile erosion mode nor brittle erosion wear mode, it is behaving like semi-brittle mode of erosion wear.
4. However, analysis of variance is concerned for hybrid bamboo/glass fiber composites impact velocity (p=0.120), fiber loading (p= 0. 142), stand-off distance (p= 0.564) and erodent temperature (p = 0.797) have great influence on erosion wear rate, whereas impingement angle shows least significant control factor in the present study.

ACKNOWLEDGMENT

The corresponding author is grateful to Department of Science and Technology, Govt. of India for providing the financial support for this research work under the research project Ref. No. SR/FT/ET-026/2009.

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Design and Fabrication of Pneumatic Four Axis Material Handling System

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Abstract - The technology of pneumatics has gained tremendous importance in the field of workplace rationalization and automation robots. Our attempt has been to develop a system which could be an exemplary unit of Material Handling Systems of future. The significance of this system lies in the fact that within a small confined space it has 4-axis of freedom and the ability to move materials as per the operator's choice. The design of the setup, the material selection for its fabrication, the component selection for its operation, and the control of its operation and accuracy of motion are amongst the critical factors of our thesis. The pneumatic material handling system, designed and fabricated by us is used to move components from one place to another with a maximum weight of 35N.

Keywords - *pneumatics; material handling system; 4 axis ; fabrication; accuracy; maximum weight 35N.*

I. INTRODUCTION

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

1.1. Need For Automation

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. Automation plays an important role in mass production.

For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa.

Material handling offers the opportunity for the reduction of production cost. The movement of the material may be horizontal or vertical or combination of both. It has been estimated that about 60 – 70% of the cost of production is spent in material handling activities.

1.2. Need For Material Handling

a) Reduction of labour and material cost

b) Reduction of overall cost

c) Increased production

d) Increased storage capacity

e) Increased safety

1.3. Need For Pneumatic Power

Pneumatic system use pressurized gases to transmit and control power, because air is a safe, low cost and readily available fluid. There are several reasons for considering the use of pneumatic system instead of hydraulic system. Liquid exhibit greater inertia than gases. Therefore, in hydraulic system the weight of the oil is a potential problem.

II. DESCRIPTION OF COMPONENTS

2.1 Major Parts

The major parts "Pneumatic Material Handling System" are described below [5] :-

1. Air compressor.
2. Pressure gauge.
3. Direction Control Valve.
4. Sleeve.
5. Cylinder.

6. Rack and pinion block.
7. Rack.
8. Pinion.
9. Connecting hoses.

2.1.1 Air Compressor

The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is 103105 to 12 3105 N/m^2. This is a two stages or two-cylinder reciprocating air compressor. The two cylinders are for low and high compression. The air pressure is measured at various places by the use of pressure gauges. V-belt and pulley are used to drive the compressor

2.1.2 Pressure Gauge

Pressure gauge is used for measuring the outlet pressure of air from the compressor. The gauge used is Bourdon type pressure gauge. The maximum capacity of this gauge is 10 310^5 to 12 310^5 N/m^2. The gauge is fitted at the outlet of the air compressor.

2.1.3 Pneumatic Valves

The pneumatic cylinder is regulated and controlled by pneumatic valves. These valves are actuated manually, mechanically, electrically, pneumatically, and by various combined mode of actuation.

Although various types of valves are available, they are mainly classified as below:

i. Direction control valves.
ii. Direction control check valves.
iii. Flow control valves.
iv. Pressure control valves.

The main purpose of a valve in a pneumatic circuit is to control outputs.

A) Actuators

An actuator is a device that is used to apply a force to an object.

Fluid power actuators can be classified into two groups:-

i. Linear actuators are used to move an object or apply a force in a straight line.

ii. Multi-point Actuators.

2.1.4 Seals

Seals are used to prevent leakage of fluid in a given component or device. This helps us in maintaining the required pressure in a given pneumatic system which would help in its efficient working.

Pneumatic Circuit

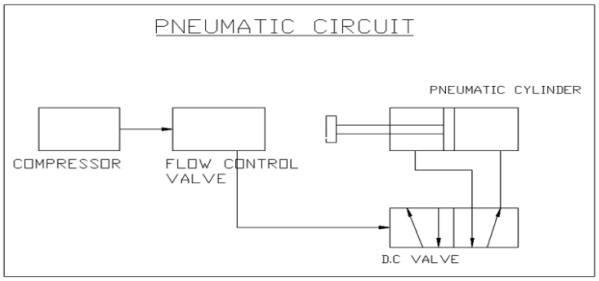

Fig. 1 : Pneumatic Circuit

2.1.5 Rack And Pinion Assembly:

The block is the central part of the unit as it houses the rack and pinion. This rack and pinion attachment gives the rotary motion to the pneumatic material-handling device. This block converts linear motion into rotary motion.

2.1.5.1 Pinion

This is a gear wheel which is provided to get mesh with rack to convert the linear motion into rotary motion. They are made up of Cast iron.

2.1.5.2 Rack

Rack teeth are cut horizontally about the required length to get the accurate turn of 360^o. This is made up of Cast iron.

III. DESIGN CALCULATIONS

3.1 Design of Horizontal, Vertical and Rotary cylinders

Force to be exerted is 40N.

Force = pressure×area

Pressure in the cylinder = 0.4 x10^5 N/m^2

Area of the piston, (πd^2)/4 = Force/Pressure

= 40/ 40000

= 0.001 m^2

Bore diameter = 0.0356 m

= 35.6 mm

From Janatics pneumatic products catalogue [3], we have selected 40 mm bore diameter cylinder.

For forward stroke:

For 40 mm bore diameter,

Corresponding rod diameter = 16 mm

Area of the piston $= (\pi d^2)/4$

$= (\pi \times 40^2)/4$

$= 1256.8 mm^2$

Force to be exerted = pressure ×area

$= 0.4 \times 10^5 \times 1256.8$

$= 50$ N

For return stroke:

On the return stroke, when the pressure is applied to the reverse direction, the force on the piston due to the pressure is $=P \times (A - a)$.

Therefore,

Area of the piston (A-a) $= \{(\pi \times d^2)/4\} - \{(\pi \times d_1^2)/4\}$

$= \{(\pi \times 40^2)/4\} - \{\pi (\times 16^2)/4\}$

$= 1256.6 - 201$

$= 1055 mm^2$

Force to be converted on the reverse direction

= pressure × area

$= 0.4 \times 10^5 \times 1050 = 42.2$ N

For working pressure of 0.4×10^5 N/m^2

Extending force = 50.3 N

Retracting force = 42.2 N

A. Design Of Arm Lifting Cylinder:-

Force to be exerted is 30 N.

Force = pressure×area

Pressure in the cylinder = 0.4×10^5 N/m^2

Area of the piston $= (\pi \times d^2)/4 = 30/0.4 \times 10^5$

$= 0.75 \times 10^{-3} m^2$

$= 750 mm^2$

Bore diameter = 27.38 mm

From Janatics pneumatic product catalogue we have selected 32 mm as bore diameter of arm lifting cylinder.

For forward stroke:

For 32 mm bore diameter,

Corresponding Rod Diameter = 12 mm

Area of the Piston $= (\pi \times d^2)/4 = (\pi \times 12^2)/4$

$= 804$ mm

Force to be Exerted = pressure × area

$= 0.4 \times 10^5 \times 804$

$= 32.2$ N

For return stroke,

On the return stroke, when the pressure is applied to the reverse direction.

The force on the piston due to the pressure is= P×(A- a)

Therefore,

Actual area of the piston (A - a)$= \{(\pi \times d^2)/4\} - \{(\pi \times d_1^2)/4\}$

$= \{(\pi \times 40^2)/4\} - \{\pi (\times 12^2)/4\}$

$= 804 - 114$

$= 690 mm^2$

Force exerted in the reverse direction, = Pressure× area

$= 0.4 \times 10^5 \times 690$

$= 27.6$ N

For working pressure of 0.4×10^5 N/m^2,

Extending Force =50.3 N

Retracting force = 42.2 N

3.2 Design of Pinion

From PSG design data book (page no.7.18),we select the following formulae which will give us the minimum diameter of the pinion gear [4]:

$$d_{min} > (0.59/\sigma_{c\text{-}max}) \times [[M_t] / ((1/E_1) + (1/E_2))^2]^{(1/3)} \quad (1)$$

$E_1 = E_2 = 1.1 \times 10^6$ N/m^2

$$\sigma_{c\text{-}max} = H_B \times C_B \times K_c \quad (2)$$

$$K_{cl} = \{[1 \times 10^7]/N\}^{1/6} \quad (3)$$

$N = 60 \times n \times t$

$t = 8000$ hours.

From P.S.G design data book (page no.2.4),

$C_B = 20$

$H_B = 200$

Substituting the values of N, n, t in the equation (3),

The value of K_{cl} is obtained as 1.139.

$K_{cl} = 1.139$.

Substituting the values in equation (2),

$\sigma_{c\text{-}max} = 20 \times 200 \times 1.1309$

$= 4520 \times 10^5$ N/m^2

Calculation of M_t,

$$M_t = 97420 \times (kW/n) \quad (4)$$

For power calculation:

Centrifugal force,

$$f_c = m \omega^2 r \quad (5)$$

M = 7kg

W = m x g

$\omega = 2\pi n/60$

R = 1m.

Substituting the values of m, ω, r in equation (5),

f_c = 7.56 N.

Downward force, f_d = m x g

= 7 x 9.81

= 68.6 N.

Centrifugal force, f= fc + fd

= 68.6 + 7.56

= 76.17 N

Torque = f x r = 76.17 x 1

= 76.2 Nm.

Power = Torque x angular velocity

= 76.2 x 1.05

= 79.7 W.

Substituting the value of kW and n in equation in [3],

M_t = 776.7

$[M_t]$ = 1.4 x M_t

= 1.4 x 776.7

= 1087.1 Nm

The minimum diameter of the pinion is calculated to be 78.7 mm.We have taken the standard diameter of pinion as 75 mm.

3.3 Design Of Rack

Pitch circle diameter of the gear is = 72 mm

Circumference of the gear is= π × pitch circle diameter

= π ×72

= 226 mm

The dimension is for 360° rotation.

For 180°rotation the rack length is 113 mm.

IV. WORKING PRINCIPLE

In this project there are four double acting cylinders used to perform four functions. They are-

Cylinder 1	-	Rotary
Cylinder 2	-	Arm Lifting
Cylinder 3	-	L-Bow
Cylinder 4	-	Gripper

A compressor supplies high pressure air to the cylinder, whose flow is controlled by a flow control valve. The air passes through a direction control valve. This is used to actuate the piston and to specify its direction of movement. When the air flows through the flow control valve, its volume is restricted to the specified amount. Then the direction control valves control the part of cylinder which it should occupy.

When it occupies part A of the cylinder, it moves the forward stroke. Next, direction control valves are actuated which makes the air to flow in part B of cylinder. Due to air in part A is released to the atmosphere by a valve. This makes the piston to move upwards.

V. DESCRIPTION OF ASSEMBLY

The assembly unit consists of a base block, cylinders, rack and pinion, base plate, tie rods, solenoid valves and gripper. Cylinder 1 is mounted on the base block with rack and pinion assembly connected with tie rods. The vertical cylinder is mounted vertically over the base plate to increase the height with a block and endplate provided at the end.

The horizontal cylinder is mounted on the block of the vertical cylinder horizontally to increase length of the arm with a block and end plate provided at the end position. The gripper cylinder is mounted on the horizontal cylinder block in an inclined position of angle 30°to actuate the gripper. The piston rod of gripper cylinder is connected to the one side of the gripper.

VI. EXPERIMENTAL FUNCTIONING AND TESTING

The experimental setup consist of four cylinders, all are of double acting type. The cylinder1 is used to actuate rack and pinion assembly, piston rod of cylinder1 is connected to rack, which is meshed with the pinion. By operating the cylinder1, rack and pinion turns the whole assembly for 260°. By varying the length of the rack the turning angle can be altered. Vertical cylinder or cylinder2 is used to increase the height of the setup. The height is limited to piston rod length. Horizontal cylinder or cylinder3 is used to increase the arm length; the working area of the arm is limited to length of the piston rod length. Gripper cylinder or cylinder4 is used to actuate the gripper.

VII. LIST OF TABLES

TABLE I. LIST OF MATERIALS

SL. NO.	PART	MATERIAL	QUANTITY
1	Cylinders	M.S.	4
2	Rack	C.I.	1
3	Pinion	C.I.	1
4	Frame	M.S.	1
5	Gripper	M.S	1

6	Nuts, Washers	M.S	-
7	Tubes	Polyurethene	10 meters
8	Tie Rod	M.S. Pipe	1
9	D.C. Valves	Aluminium	4
10	Hose Collar and Hose Connector	Brass	20
11	Block	M.S.	2

VIII. APPLICATIONS

A) The arm feed has a wide application in low cost automation industries. It can be used in automated assembly lines to pick up the finished product from workstation and place them in bins. it can also be used to pick raw material and place them on the conveyor belts.

B) This unit can also be used in clamping. Operation in certain areas of mass production where clamping and an clamping have to be done at high speeds. The application of these units is limited to operations which involved moderate clamping forces.

IX. ENGINEERING GRAPHICS

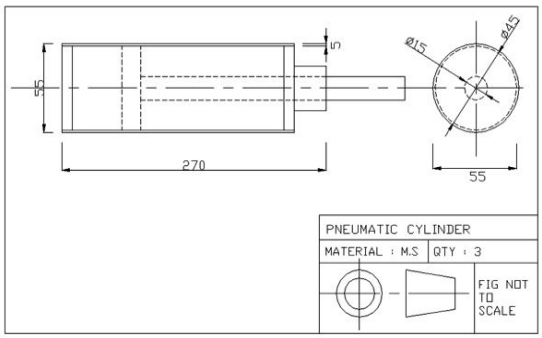

Fig. 2 : Pneumatic Cylinder Design

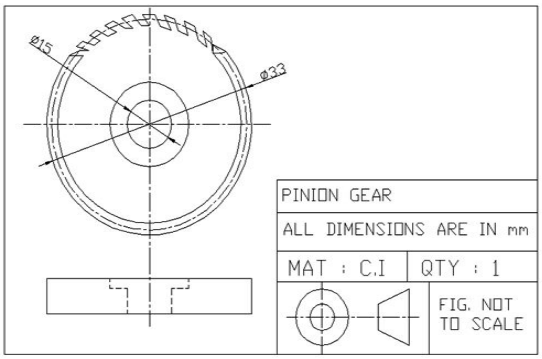

Fig. 3 : Pinion Gear Design

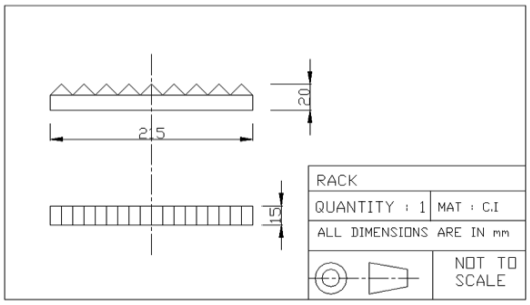

Fig. 4 : Rack Design

X. PRELIMINARY DESIGN SETUP

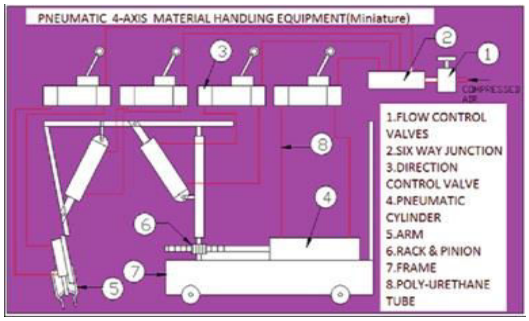

Fig. 5 : Preliminary setup

XI. FABRICATION AND TESTING

a. L-angles were considered best for the setup main frame because this has better load carrying capacity and provides a better rigidity to the setup

Fig. 6 : L-angles For Mainframe

Fig. 7 : Cylinder For Rocker-Front/Rear

Fig. 8 : Rack And Pinion Arrangement

Fig. 9 : Cylinder For Gripper

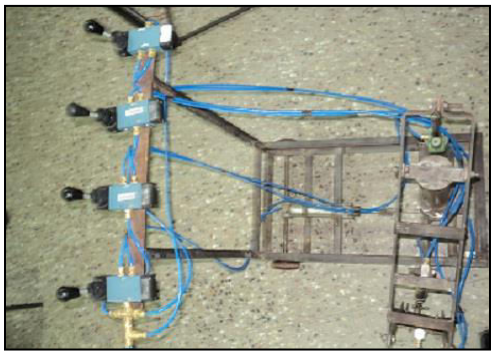

Fig. 10 : Full Setup

Fig. 11 : Cylinder for rotation of Arm

XII. ABBREVIATIONS

1. E_1, E_2 = Young's modulus (N/m^2).
2. M_t = Torque (Nm).
3. H_B = Brinell hardness number.
d. C_B = coefficient depends on hardness.
4. K_{cl} = life factor.
5. n = revolutions per minute.
6. N = life in no. of cycles.
7. t = life in hours.
8. Centrifugal force =f_c
9. Downward force =f_d

XIII. ACKNOWLEDGEMENT

We would like to take this opportunity to thank one and all who were instrumental in the success of this thesis. In particular, our heartfelt thanks to the **SRM UNIVERSITY** management for providing us with the necessary infrastructure for the successful completion of the project.

We express our profound gratitude to **Dr. P.PALANISAMY, (Ph.D)** who was a constant source of encouragement and for readily approving this thesis when the concept was proposed.

We also thank our guide **Mr. T. Maridurai,** M. Tech. for his constant motivation and guidance during the course of this project work.

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Computational Estimation and RANS Simulation of Free Surface Flow Around a Ship Hull

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Abstract - Ship hydrodynamics present many unique challenges due to complex geometry, environment, and operating conditions, which results in many complex physics and modelling issues. This is commonly studied through experiments in a towing tank and experiments in a sea keeping and manoeuvring basin. Recently hydrodynamicists have begun to venture into computational prediction of hydrodynamic behaviour of surface ships. Free surface phenomenon around a ship hull plays an important role in its resistance. Wave making resistance comes from the very presence of free surface. Therefore its accurate prediction is very essential for ship design.

The flow problem to be simulated is rich in complexity and poses many modelling challenges because of the existence of breaking waves around the ship hull involving two-phase flow, and because of the resolution of thin turbulent boundary layer. The paper aims to computationally estimate the effect of free surface for a moving ship.

Commercial software is used for grid generation and flow solution.

1. Solution of a Rudder of a ship in submerged condition.

Few different shapes of the rudders are examined.

2. Solution of flow- around a complete ship with free surface.

In the present work, flow through the ship hull is computed using a finite volume commercial code, ANSYS 12.1. The ship geometry is modelled using solid modelling software, CATIA V5R9. A three-dimensional structured hexahedral grid is generated using grid generating code, ICEM-CFD V10.0

Turbulence is modelled with Reynolds Stress model. The resistance of the ship is predicted, and compared against the experimental values. The rudder of the ship is also analyzed. Two different shapes, one wedge shaped and a standard NACA0012 foil, for which experimental results are available in literature, are analyzed. The lift coefficients and flow separation are predicted for different angles of attack using various turbulence models.

Computational results are in good agreement with the experimental ones.

I. INTRODUCTION

Advances in computing technology, software and hardware have revolutionized the design process of engineering vehicles such as aircrafts, automobiles and ships. Many commercial software packages are being used in the design as well as analysis processes which not only save lead time and costs of new designs, but also are used to study systems where controlled experiments are difficult or impossible to perform. In the area of fluid dynamics, there are many commercial computational fluid dynamic (CFD) packages available for modelling flow in or around objects. Computational fluid dynamics (CFD) has been constantly developed over the past few decades and now both commercial and research codes can provide more and more robust and accurate results. The waves have a big impact on the forces acting on the hull. As the shipbuilding industry moves to design hull forms that run faster and generate less noise, computer simulation is playing an increasingly important role.

The current study aims to capture the free surface flow around a ship hull and analysis of its rudder. Solution of flow around the rudder involve only one phase of liquid i.e., water and was solved first. Results were verified with the experimental data. A NACA foil was analyzed as an alternative shape. Both the shapes of the rudder, wedge and NACA0012 foil are analyzed at different angles of attack from 0o to 20o using various turbulent models and the results are in good agreement with the experimental ones.

II. OBJECTIVES

The objective of the present work is to

1. Validate the CFD results of NACA0012 against experimental data using different turbulence models and schemes.
2. Establish a numerical technique to simulate flow around the ship hull and estimate the resistance and compare the results with the experimental ones.

This aims to predict the following:

- Estimate the lift of NACA0012 and wedge section.
- Estimation of Pressure and viscous resistance of the ship.
- Capture the free surface around the ship hull
- Flow visualization

III COMPUTATIONAL METHODS

Computation fluid dynamics mainly depends upon three fundamental governing equations of fluid dynamics

- Mass conservation (Continuity equation)
- Momentum Conservation (Navier-Stokes Equation)
- Energy Conservation (Energy equation)

The various complex and interesting flows result form the solution of these equations subjected to different physical boundary conditions.

The numerical solution of these equations subjected to the boundary conditions can be obtained by the use of the following methods:

1. Finite Difference Method (FDM)
2. Finite Element Method (FEM)
3. Finite Volume Method (FVM)

There are a variety of other methods but the three above are mostly used in the fields of CFD research. In this work, we have used the commercial software, "FLUENT" which uses the FVM. In the following paragraphs, the FVM is very briefly described.

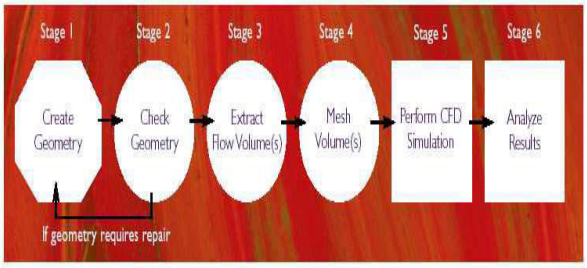
Finite Volume method often called the Control Volume Method is formulated from the inner product of the governing differential equations with a unit function. This process results in the spatial integration of the governing equations. The integrated terms are approximated by either finite differences or finite elements discretely summed over the entire domain.

One of the most important features of the FVM is its flexibility for unstructured grids. Designation of the components of a vector normal to boundary surfaces in FVM accommodates the unstructured grid Configuration with each boundary surface integral constructed between nodal points.

The principle equation in the CFD models for general viscous flow may be represented by the time averaged Navier-stokes equation.

IV. CFD FLOW

The fundamental method for creating a CFD model can be represented as a "pipeline" of six steps as illustrated in Figure below.



The process begins with the creation of an assembly of one or more parts (geometric shapes) that reflect the design under consideration. Because CFD deals with the flow through or around solid objects, the CFD model is built upon the inverse of the assembly and is referred to as the "Flow Volume Extract". This Flow Volume Extract is meshed to specification, a simulation is performed, and finally, the results of the simulation are analyzed. Because the CFD model deals with the inverse of the solid assembly, it is important that the original geometry is created using surfaces that are connected, with faces that about one another perfectly. Geometric models containing "cracks", "holes", or "gaps" will create problems farther down the CFD pipeline, at the meshing stage. Therefore, it is important to insert a geometry check stage into the process. This stage performs an analysis of the initial geometry to ensure that it does not contain features that will cause a failure later on. Geometric features that do not pass these checks are flagged and labelled for repair within a geometric editing environment, such as those found on popular CAD and PLM systems and in software supplied by Fluent. Fluent provides with a full range of tools to perform successful CFD analyses and meet your individual needs and goals.

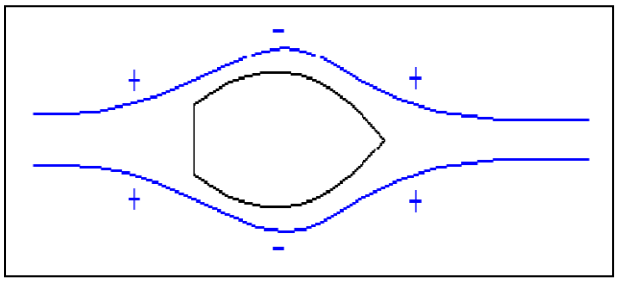
V . THEORETICAL CALCULATIONS OF SHIP RESISTANCE:

Ship resistance can be identified as reaction to the ship hull from water. From the experimental and numerical methodology, it can be said there are three components of the ship resistance:

1. Wave Resistance (Rw)
2. Viscous Resistance (Rf)
3. Viscous pressure Resistance (Rvp)

1. WAVE RESISTANCE:

A ship makes waves when it sails. In this wave energy is stored. This energy is the wave making resistance. A wave is produced by the curvature of a ship. Around a ship changing the direction of the water results not only in a pressure difference, but also in a change of water level. The more and the sharper the water is changed in direction, the bigger the waves .Positive pressure results in a higher level, negative pressure results in a lower level. Typical high pressure is built at the bow, where the water is deflected from the hull.



USING DIMENSIONAL SIMILARITY:

$$\frac{V_m}{\sqrt{L_m}} = \frac{V_p}{\sqrt{L_p}}$$

$$V_m = \sqrt{\frac{L_m}{L_p}} * V_p$$

$$V_m = \sqrt{\frac{150}{150000}} * 18$$

$$V_m = 0.569\, m/sec$$

$$R^* = \frac{R_w}{\frac{8}{\pi}\rho g B^2 \frac{T^2}{L}}$$

$$R^* = \frac{R_w}{\frac{8}{\pi} * 1027 * 9.81 * 0.0162^2 * \frac{0.0045^2}{0.15}}$$

$$R^* = \frac{R_w}{2.855 * 10^{-3}}$$

As wave resistance coefficient

$$C_w = \frac{R^*}{F_n{}^2}$$

Where F_n is Froude number

$$F_n = \frac{v}{\sqrt{Lg}}$$

$$F_n = \frac{0.569}{\sqrt{0.15 * 9.81}}$$

$$F_n = 0.47$$

Substituting F_n and R^* in wave resistance coefficient equation

Considering Cw =0.796

$$C_w = \frac{R^*}{F_n{}^2}$$

$$0.796 = \frac{R_w}{9.089 * 10^{-4} * 0.47^2}$$

$$R_w = 1.589 * 10^{-4}\, N$$

Similarly Viscous resistance (Rf) and Viscous pressure Resistance (Rvp) can be calculated.

S.NO	PARAMETERS	SCALED MODEL	UNSCALED MODEL
1	LOA	150mm	150m
2	BREADTH	16.2mm	16.2m
3	DRAFT	4.5mm	4.5m
4	VELOCITY	0.569m/sec	18m/sec
5	FROUDE NUMBER	0.47	0.47
6	WAVE RESISTANCE(Rw)	$1.589 * 10^{-4}\, N$	159.54KN
7	FRICTION RESISTANCE(Rf)	$1.84 * 10^{-3} N$	505KN
8	VISCOUS PRESSURE RESISTANCE(Rpv)	$1.8547 * 10^{-4} N$	51.32KN
9	TOTAL RESISTANCE(Rt)	$2.184 * 10^{-3}\, N$	715.83KN

VI. GEOMETRIC DETAILS OF WEDGE SHAPED RUDDER

The geometry of the wedge shaped rudder are described in figures 5.1 and tables 5.1 respectively. A 2D model is created in GAMBIT.

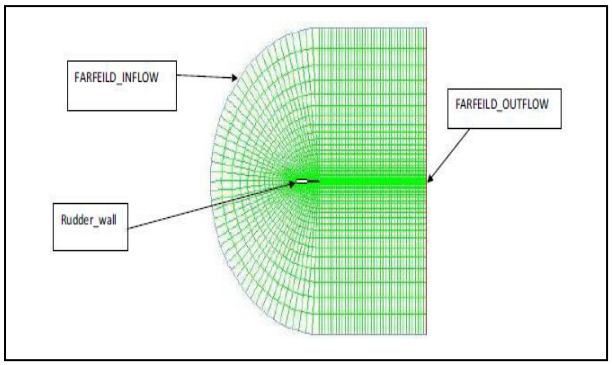


Fig 5.1 Geometry of Wedge Shaped Rudder

Length of the rudder	107 mm
Radius of the arc	7 mm
Velocity of rudder	25.72 m/s or 50 knotts

Table 5.1 : Geometry Details of Rudder

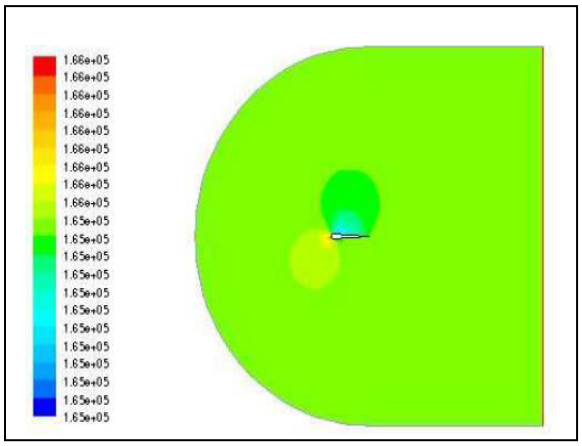


Fig. 6.1 : Pressure coefficent around the body of Wedge shaped rudder at 0deg

VII. RESULTS AND CONCLUSIONS

From the present study, the following conclusions can be drawn:

1. CFD results of rudder were in good agreement with the computational values. Wedge shaped rudder produced more lift forces. Flow separation for wedge shaped rudder was also delayed. So this rudder was selected as final design.
2. By using of turbulence models and wall functions resulted in wide variation to the final prediction. Mesh fineness requires being compatible with the turbulence model/wall functions being used to obtain meaningful results.
3. CFD predictions for ship resistance find good agreement with the experimental results. The work validates the use of commercial CFD software to study free surface flows. However, more exercises have to done in future to establish a better validation.
4. Literature survey reveals that at present, the subject of CFD estimation of free-surface flows has not reached to high levels of maturity. In view of this global status, present results are very encouraging.

The commercial CFD software FLUENT V6.3 was utilized for analysis. The VOF technique was used for capturing the free surface and Reynolds Stress

Model was adopted for turbulence closure. The mesh quality has proven to be an important issue in the computations. Future work should focus on employing a finer resolution grid than the one employed in present study. Different turbulence models can be tested in the simulations. Finer details of ship flow, as required by ship designers, like slamming, sea-keeping etc. can be studied in future.

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