

Applied Engineering and Technologies

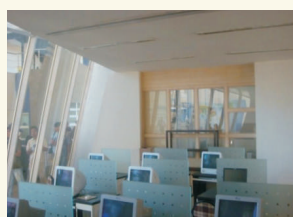
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About VIT

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Foreword

Dear Readers,

Vidyalankar Institute of Technology's technical journal titled 'Applied Engineering and Technologies' aims to promote the advance of engineering and technology through an intellectual exchange of ideas of people from academic, industrial and research backgrounds, who will get a forum to effectively present and share their research initiatives. It is a proud moment indeed for all of us at the Institute to present the fifth issue of the technical journal. Being a part of an engineering and management institute, it is imperative for us to share our ideas with others to increase the visibility of our technological research findings and in turn to learn more about the advancements in our disciplines. VIT has always encouraged its faculty and students to not just excel in the dissemination of current knowledge, but to also reach out to newer horizons and explore technology in a broader context.

The theme of the journal focuses on applications in the areas of Computers and Information Technology, Electronics, Communication and Bio-Medical Engineering. This year's issue includes 45 papers which have been reviewed by an eminent editorial team comprising highly experienced faculty. Further the papers have been checked for content originality on IEEE cross check web portal. This will ensure that good quality reviewed research papers are included.

The target readers are research students, undergraduate and postgraduate students and practicing upcoming professionals from industry and academia. This will further serve to facilitate their interaction and exchange of ideas with academia, industry and research personnel and help them to chisel and hone their talents to become better-informed professionals.

Technology standards within the industry are evolving rapidly as new innovations continue to emerge over the years. At the Institute, formal research is highly encouraged among faculty as well as students, as it empowers them to enrich their corpus of knowledge. This initiative takes the Institute one more step forward in realizing the dream of being an innovative research-based educational centre, envisaged by its visionary founder Prof. C. S. Deshpande. Through the ideas generated by 'Applied Engineering and Technologies', we hope to contribute to the thought aptly put forth by Dr. A. P. J. Abdul Kalam: "Educationists should build the capacities of the spirit of inquiry, creativity, entrepreneurial and moral leadership among students and become their role model." The success of this initiative depends on your response and we would appreciate your feedback.

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Survey Paper on Detection of replication code in Java

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ABSTRACT

Software code theft or software code duplication is the issue which has been faced by software industry. Experts have worked on the problem by giving approaches like software watermarking and software watermarking. For detection of software code we are proposing a system where a graph is generated for original program and suspect program. Then comparison is performed to detect software code theft.

Keywords : Software Piracy, Code Replication

1. Introduction

Over past years it has been a serious issue that the code is copied or duplicated in software. A developer who has actually written the program or software does not get the credit. The proposed system aims at detecting the duplication or copy of code in software so that the real software developer will get the credit.

There are two ways by which graphs can be generated. They are static and dynamic. In static approach syntactic nature of the program is taken into the consideration. As sequence of code such as identifier etc. can be altered by the attacker, thus the system may not give output as software theft is present. In the proposed system Program which possesses similar functionality is taken into consideration.

In proposed system a tree is generated dynamically for the original program. As for generation of the graph compiler takes whole program at a time. From the suspected program also tree is extracted. By comparing graph of these programs, if similarity found it is said that there is replica of code in a given program otherwise it is said to be an original one.

2. Related Work

As some programming languages are easy to get copied there is need to prove the authorship of the code. Experts have done lot of work in the related field. The work done in the same area is put up in the following table.

Sr. No.	Title	Source	Purpose	Implications	Result	Comments
01	Software Theft Detection for JavaScript programs based on dynamic birthmark extracted from runtime heap graph	IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727, Volume 17, Issue 3, Ver. II (May - Jun. 2015), PP 34-39 www.iosrjournals.org	To detect code theft of JavaScript Code	1. JavaScript Code theft detection 2. Used Dynamic Birthmark approach.	1. Snapshot of original and suspect of JavaScript code which possess same functionality has been taken for object of only OBJECT and CLOSURE type. 2. If birthmark is found in suspect graph then there exists software theft code.	1. The work has been done using Google Chrome 2. Other browsers should be taken into consideration 2. Work has been done for only JavaScript code.
02	Dynamic software birthmark for java based on heap memory analysis	in Proc. 12th IFIP TC 6/TC 11 Int. Conf. Commun. and Multimedia Security (CMS'11), Berlin, Heidelberg, 2011, pp. 94-106, Springer-Verlag.	Detection of Partial theft of code for Java Programs	1. Dynamic Birthmark 2. Partial Code Theft 3. Object Reference Graph	Experts implemented Library theft detection system for original program and suspect program using Object Reference Graph	1. Experiments had been carried out on Programs limited to tens of Megabytes 2. There must be sufficient number of heap objects especially for strongly referenced Objects in Large Programs. 3. Heap Objects which are input dependent should be taken into consideration.
03	JavaScript Dynamic Birthmark based on the run-time heap	in Proc. 2011 IEEE 35th Annu. Comput. Software and Appl. Conf. (COMPSAC), Jul. 2011, pp. 407-412.	Detection of JavaScript code theft.	1. Dynamic Birthmark 2. JavaScript Code theft 3. JavaScript System using Runtime Heap 4. Partial Theft code	Experts made modification to Google Chrome browser to generate dump files of runtime heap. Then comparison module compares two dump files of similar functionality JavaScript code.	1. System involves modification of browser as experiments had been carried out on browser which is modified. 2. This approach is not effective where programs does not include Custom Objects. 3. An approach where system uses both API or system calls and heap dumps will be more effective
04	Behavior based software theft detection	in Proc. 16th ACM Conf. Comput. and Commun. Security (CCS'09), New York, 2009, pp. 280-290, ACM.	Detection of partial theft of code	1. System Call 2. Dependence Graph (SCDG) based software birthmark 3. Effective against attacks based on different compilers 4. Implementation of Off Hawk, an dynamic analysis tool for system call traces and SCDG 5. First system that detects partial theft code	1. Experts implemented a dynamic analysis tool called Hawk to trace system calls and SCDGs. 2. Also experiments were done on various compilers and various optimization levels of compilers	1. This approach is not applicable where programs does not include sufficient system call. 2. This approach requires original and suspect program fed with the same input 3. Birthmark remains invalid if a software goes under version updation
05	A dynamic birthmark for java	in Proc. 22nd IEEE/ACM Int. Conf. Automated Software Eng. (ASE '07), New York, 2007, pp. 274-283, ACM.	It was used to see how program uses objects provided by the Java API.	1. They used approach of making compact call sequence set as traces of per object is very difficult to compare. 2. The birthmark analysis was done on similar functionality.	1. An experiment was done for evaluating birthmark on six programs which read PNG images and was used during development of birthmark. 2. Second part of evaluation carries six XML parsers and was used to check the results obtained for PNG readers	1. An attacker could add additional sequence by creating unused objects from API classes and invoke methods on them 2. An attacker could add some parts of API code to the program 3. In this paper experts did not focus on detection of library theft.

Fig.1. Literature Survey

3. Existing System

To overcome the issues of software or program code theft or copying or replicating lines of code several techniques were used such as Software Birthmark. Some developer might copy or use some lines code in their application without the knowledge of real programmer. Then the real programmer does not get the credit. There has been a need to still work on some areas of existing systems to give more appropriate results.

4. Proposed System

Software piracy or software replica occurs when any individual or a group makes duplication of existing software code or sequence of code. There have been many cases launched worldwide about software code replica. In order to give the credit to the real originator of the software the proposed system will generate graph. This graph will show the exact execution of the program. The proposed system will generate graph for suspect program and the real program. If there exists similarities in these two graphs, we say that there is replica of the code. Here we are plan to target Java code since it widely used in today's programming areas. The proposed system works as per following modules:

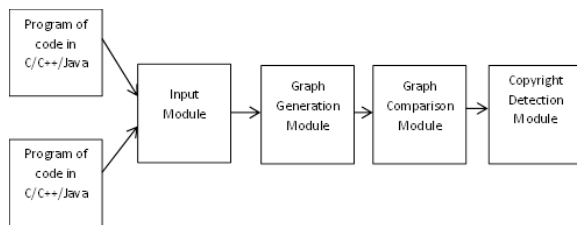


Fig.2. Proposed System

A. Input Module

Input module takes input as two logically similar programs for which we need to check the detection of copyright. This module separates keywords, identifiers and literals.

B. Graph Generator Module

This module will generate graph dynamically. The Graph Generator module will traverse through the program. It will discard the unwanted elements from the program. Then it generates graph for programs.

C. Graph Comparison Module

This module compares graph of original program with the suspect program. Any one element from the generated graph will be taken into consideration and its connectivity with all other elements in the same graph will be compared with the graph of suspected program. Structure wise the graph will always remain the same even if programmer tries to change the sequence of code.

D. Copyright Detection Module

If similarity is found in the Graph comparison module then we say there exist replica. If similarity is not found then replica does not exist

5. Conclusion

There has been lot of work done in the area of software copy, for preventing duplication and software code theft. The work has been done on static path based watermarking. Also the work has been done on how a programs, uses objects provided by the Java Standard API, but library theft was not proposed. Experts have also worked on modification of the Google Chromium and generating heap of code at runtime. Still these

approaches need to work more such as combining System call traces and heap approach and the code which includes custom objects into them. We have proposed new method of dynamic birthmark. We are proposing a system that takes lines of code of the suspect program and original program which possesses same functionality then generates graph for these two programs. These graphs can be: Data dependency and Control flow dependency which will help in the detection of copyright in the software by method of dynamic generation of graph and discovers by comparing two graphs.

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“MOBOWLRAIL”- Wi-Fi Based Local Railway Ticketing System

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ABSTRACT

Wi-Fi based local railway ticketing system is used to take a railway ticket on android mobile without standing in the queue. This will save lots of time of the user of standing in the long queue and there is no need to carry the paper ticket for user. We are using WI-FI router as a medium for communication between android client and vb.net server Wi-Fi router is capable of handling multiple user request and also there is no need of internet required for router. Wi-Fi Based Local Railway Ticketing System is a very powerful technique for taking railway ticket on own android device in very short amount of time. In this technique, no additional functionalities such as GPRS, SMS and Bluetooth are required, and only WI-FI router is needed.

Keyword : WiFi, CRIS, ATVM, R-Wallet

1. Introduction

WI-FI Ticketing refers to booking tickets using WI-FI. This will be made available through web applications on mobile devices. This project is aimed at developing a Website and mobile application that enables users to book tickets to and fro local stations. There will be a source and destination option on the android application on each user's mobile device. Once the user enters the options he will be shown the amount and this amount will be deducted from the users account. The user will have an account created beforehand. This account will be present in the database individually for each user with a unique ID and password. The user can add, delete, modify and access the transaction with the help of this account.[1]

The android application will work with the help of internet connection. This connection will be provided with the help of Wi-Fi hotspots available on each railway station. The number of hotspots will vary depending on how much load is there at each station. If there are more number of users more, more hotspots will be needed. Wi-Fi Ticketing refers to booking tickets using WI-FI. This will be made available through web applications on mobile devices. This project is aimed at developing a Website and mobile application that enables users to book tickets to and fro local stations. There will be a source and

destination option on the android application on each user's mobile device. Once the user enters the options he will be shown the amount and this amount will be deducted from the users account. The user will have an account created beforehand. This account will be present in the database individually for each user with a unique ID and password. The user can add, delete, modify and access the transaction with the help of this account. The android application will work with the help of internet connection. This connection will be provided with the help of Wi-Fi hotspots available on each railway station. The number of hotspots will vary depending on how much load is there at each station. If there are more number of users more, more hotspots will be needed.[2][3].

In this system the user will visit the source station ticket counter and then he/she will open our android application. For the first time the user is needed to open an account with railways through which they get unique user id and should keep their account funded.

On the other side railway will create a master database with the user id and the amount of that particular user.

The software will do the calculation of ticket amount will be done after checking the available account balance of that user and verify the user account. If everything found acceptable, then user will receive the message which is act as a ticket. In case of, recharging an account of a user, he can recharge his account by directly going to ticket counter or for user convenient we can developed one website with the help of user can recharge his account. Registration for a new user facility can also be provided online. To reduce the cost associated with printing the tickets and maintaining the traditional coupon vending machines and smart card machines. To reduce the labor associated with printing tickets which are required at each ticket counter to provide tickets to the local commuter. To provide ease to passengers for purchasing tickets who otherwise have to stand and wait in long queues. To strike down the paper usage for printing purpose. This application enables user to buy local ticket of any class through his/her mobile using WI-FI and android application. User can manage his/her account by viewing their account balance in their registered account on the website so he/she can recharge it to avail uninterrupted service. Can keep the track of most recent ticket bought by requesting the last transactions from the server.

2. Problem Definition

This proposed system enables a revolutionized idea that propagates easier ticket generation. With the help of an android application, a user will be able to login with ID and password. The user then enters important details. This information gets stored in the database, which can also be accessed even via the website.

Wi-Fi hotspots will be made available for travelers at each station which will provide connection to use the application and experience hassle free ticketing. The account will be debited from the main database when the user books the ticket from the application.

The ticket will then be available on the mobile device, preventing paper wastage, enabling easy ticket generation and safe generation of ticket [7].

3. Feasibility of an Application

1. Economic Feasibility : Being a software application, it has the development cost to be negligible. But the WIFI-hotspot on each railway station do incur a cost. The cost per person is very less and can be fitted in the current cost factors of the traditional ticketing systems.
2. Technical Feasibility : The language and the platforms used for the application development are easily available from the organization itself. The team also suffices the requirements of technical IQ required for the proposed system to be completed.
3. Operational Feasibility : If the system is practically implemented, then it will for sure solve the problems' posed in the problem definition and it can be proved with the initial phases of the prototype that'll be downloaded. The proposed system is easily scalable and hence can support the additional users that would be added after every year of the organization's admission.

4. Flow of Application :

The currently existing systems for ticket booking process are as follows:

1. Window Ticket : This is the oldest and the most widely used system until today. A passenger stands in a queue and the vendor issues the paper printed ticket.
2. Coupon System : A passenger firstly has to buy coupon booklet. Then, he/she punches the coupon in the Coupon Vending Machines according to the corresponding fare.
3. Smart Card System: A smart card is purchased by the passenger on which specific recharge is to be done. By placing the card into the machine the passenger provides the source and destination and a ticket is printed .Recently, Indian railways have taken an initiative to provide ticket to user through web portal and mobile but still no application has been made for local commuters.
4. R-wallet Ticketing System : The application has been developed in-house by Centre for Railway Information Systems (CRIS).The passenger has to book the ticket in the mobile phone and print the ticket on the ATVMs installed at the journey

originating (Source) stations. The passenger has to maintain a Railway Wallet(R- Wallet) with Railways to avail the facility.

Drawbacks of these Systems :

In the Window Ticket System a commuters need to stand in a long queue. This is a tedious task and there is unnecessary wastage of time involved. The major drawback with the existing ATVM is the scalability issue. Only 6-7 tickets can be issued per minute through a ATVM. Another major issue with this system is the cost of installing the machine. Each machine costs around 175,000 INR excluding the maintenance costs which vary according to the usage intensity.

Another issue is that there are various public grievances reported regarding the functioning of the ATVM. Instead of hopping from machine to platform, passengers have to hop from one machine to another as most are non-functional.

In the R-wallet app, being something technical, could experience some glitches in the service. This has indeed been reported by some users who have not received any SMS intimation after having booked the ticket. Commuters have also complained that the R-wallet recharge facility is no available at all counters. They have had to pay a service charge & tax to do it online. Then there are the non-functional ATVM machines when one needs to take a print out of the railway ticket.

5. Implementation

Mobile Ticketing application is developed to help people to buy ticket through their Mobile via Wi-Fi hotspot provided at every station. Here user has to create his account at the service provider website and install the application on their mobile. Application launches with display page asking for ID and password. For authentication they need to come in the Wi-Fi range and connect their mobile to it. After authentication they will be redirected to page wherein they can select various options they want to perform such as (buy ticket, check balance, view ticket info, extensions, etc). It will also display the last ten transactions on the client side. All the client systems (in a Wi-Fi range) are connected to the central server placed in the zonal headquarters for data transfer [4].

In this system the user will visit the source station ticket counter and then he/she will open our android application. For the first time the user is needed to open an account with railways through which they get unique user id and should keep their account funded.

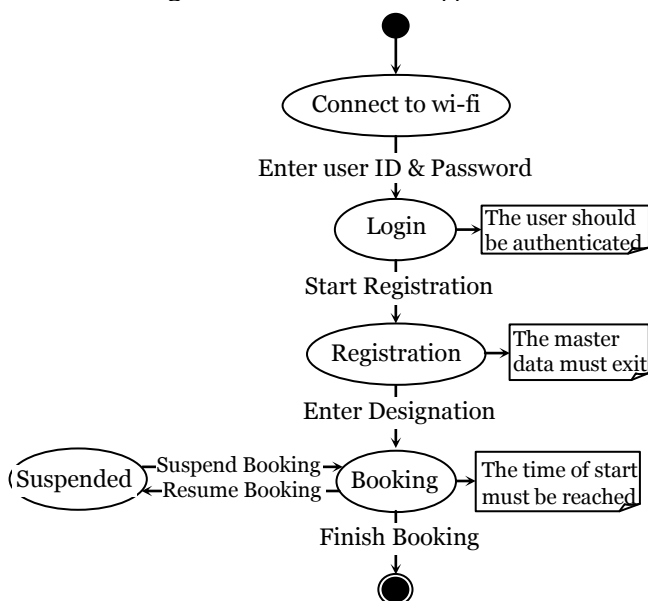
In case of, recharging an account of a user , he can recharge his account by directly going to ticket counter or for user convenient we can developed one website with the help of user can recharge his account. Registration for a new user facility can also be provided online [6].

Client Side:

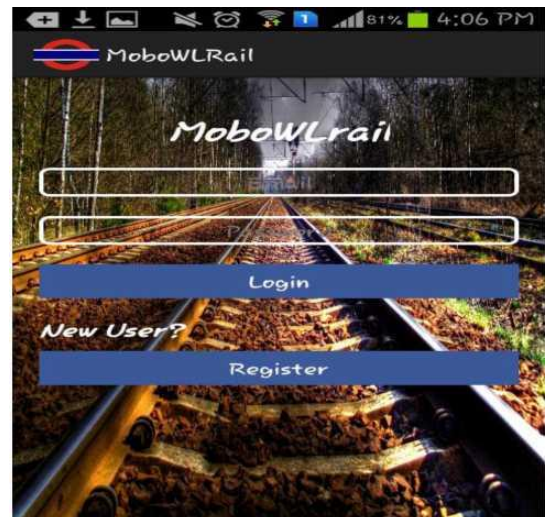
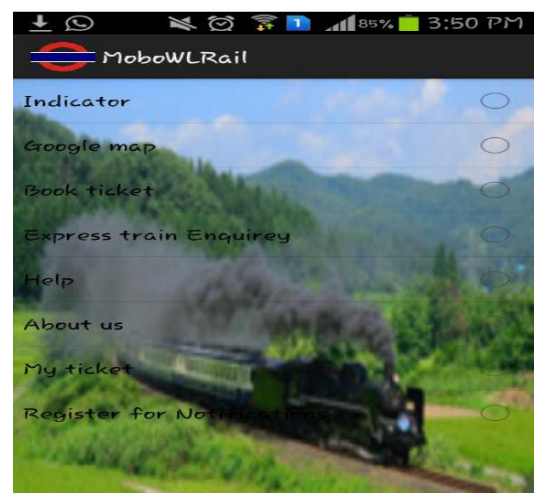
- Register Client:
- Basic detail form
- Turn On Wi-Fi
- Local railway Ticket application
- Do login(providing user id and password)
- Buy ticket using application
- Select destination via route
- Enter number of ticket
- Download ticket in mobile

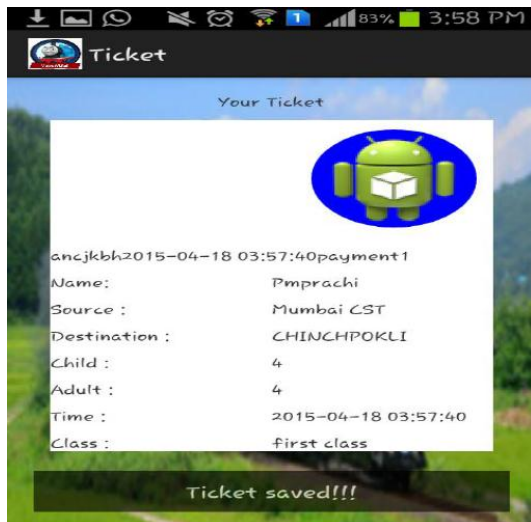
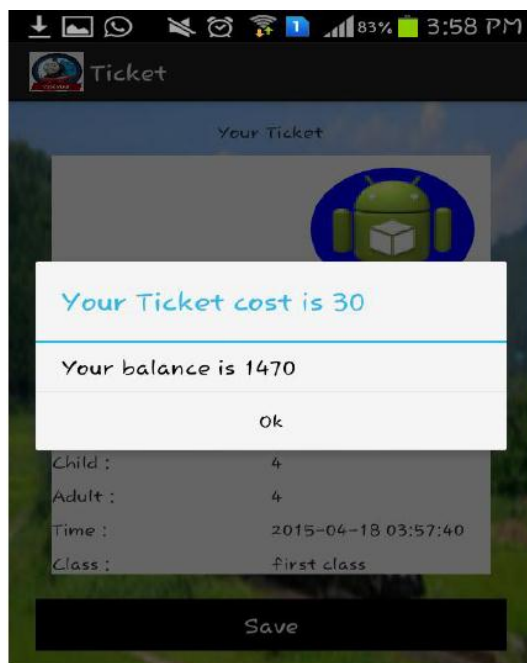
Server Side:

- User authentication
- Send error message to client(for wrong data)
- Checking the available account balance
- Display the ticket

**Fig 5.1 : Process Flow of Application****Fig 5.2 : Data Flow Diagram for ticket booking****6. Test Cases****Grahical User Interface**

Graphical User Interface (GUI) is a type of user interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation, as opposed to text-based interfaces, typed command labels or text navigation [4] [5].

i. Login Window**Fig 6.1 : Login Window****ii. Choice Window****Fig. 6.2 : Choice Window****iii. Book Ticket****Fig. 6.3 : Ticket Booking Window**

iv. Ticket Savedv. Balance7. Applications

The main application of the proposed system is to reform the current season ticket booking process (Ticket) for local travelling, i.e., with the help of this application travellers will be able to book tickets through their mobile using Wi-Fi connectivity. User can manage its account by viewing its account balance so he/she can recharge it to avail uninterrupted service. It can also keep track of most recent tickets bought. This is an effort towards queue less ticketing system and make passengers utilize their time which they waste awaiting in the queue.

It can also keep track of most recent tickets bought. This is an effort towards queue less ticketing system and make passengers utilize their time which they waste awaiting in the queue.

8. Conclusions

This new ticket booking process of the project is designed to encourage the take up of Wi-Fi mobile ticketing by dramatically reducing set ups and running costs while simultaneously creating a highly scalable, easy to deploy infrastructure. The key to success is integration: mobile ticketing systems must integrate their customers preferred communication channels into a cohesive customer experience, and further integrate those channels with the existing systems and processes that support the ticketing process.

9. Acknowledgement

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Efficient Detection & Clearance of Malware in OS Level Virtual Machines

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ABSTRACT

A virtual machine provides the software implementation process where any task is created and closed. Basically virtual machines are of two types 1) Process virtual machine and 2) System virtual machine. The process or OS level virtual machine provides the environment for single program execution and system platform. The problem of virtual machines is that there is no malicious activity detection, only the benign updates are sent to the Virtual Machine host environment. For the detection of malicious activities, we classify the suspicious processes into clusters through our efficient SECOM method. It reduces the false-positive rate when identifying malicious clusters. OS-level virtual machines have less hardware requirements as they are created based on need and are closed after the task completion. In the existing project SECOM is implemented on entire OS level changes. Any kind of malicious event affects the entire OS level VM, so if n number of VM services are running and let's assume every 2 min a malicious event is observed then after 10 minutes a OS SECOM need to update all the running VM services $n \times 5$ times which will affect the SECOM process and also generate high overhead as we need to check all the VM services running. We present SECOM to each individual VM Service instead of entire OS based on classified malicious attack types in relation to the application service. For example, a web server is mostly targeted by http attacks, so one should tune the detection classifier to detect http attacks to prevent more precisely. Antivirus can detect major of intrusion detection but it is not precise to a particular VM service attacks. If an antivirus compromises any one of the attack, then it can affect the entire OS VM services. It is highly effective if we secure VM service at individual level rather than OS level to provide high secure commitment.

Keywords : Virtual Machines, Malware clearance, secure commitment, Antivirus

1. Introduction

A virtual machine (VM) is a software implementation of a machine (i.e. a computer) that executes programs like a physical machine. Virtual machines are isolated into two noteworthy groupings, in view of their utilization and level of correspondence to any real machine: A system virtual machine gives a complete framework stage which underpins the execution of a complete working framework (OS). These more often than not copy a current design, and are worked with the motivation behind either giving a stage to run programs where the real equipment is not accessible for use (for instance, executing programming on generally outdated platforms), or of having various occurrences of

virtual machines prompting more productive utilization of registering assets, both as far as vitality utilization and cost viability (known as equipment virtualization, the way to a distributed computing environment), or both. A process virtual machine (likewise, language virtual machine) is intended to run a solitary project, which implies that it underpins a solitary procedure. Such virtual machines are generally firmly suited to one or additionally programming languages and worked with the motivation behind giving project transportability and adaptability (amongst different things). A fundamental normal for a virtual machine is that the product running inside is restricted to the assets and deliberations gave by the virtual machine—it can't break out of its virtual surroundings [4].

Malicious software (or malware) is one of the most pressing and major security threats facing the Internet today. Anti-virus companies typically have to deal with tens of thousands of new malware samples every day. Because of the limitations of static analysis, dynamic analysis tools are typically used to analyze these samples, with the aim of understanding how they behave and how they launch attacks. This understanding is important to be able to develop effective malware countermeasures and mitigation techniques [2]. Researchers have extensively studied the malware problem domain. One line of research has focused on the extent to which certain classes of malware have penetrated the Internet. For example, there have been studies that quantify the size of botnets, the number of executable infected with spyware, and the number of malicious web sites that launch drive-by downloads. Another line of research deals with tools to collect and study malware. Here, researchers have introduced various forms of honey pots, static analysis techniques, and dynamic monitoring tools. Finally, there are proposals to detect and remove malware once it has infected a machine, using either signature-based or behavior-based approaches. Proliferation of malware poses a major threat to modern information technology. According to a recent report by Microsoft, every third scan for malware results in a positive detection. Security of modern computer systems thus critically depends on the ability to keep anti-malware products up-to-date and abreast of current malware developments. This has proved to be a daunting task. Malware has evolved into a powerful instrument for illegal commercial activity, and a significant effort is made by its authors to thwart detection by anti-malware products. As a result, new malware variants are discovered at an alarmingly high rate, some malware families featuring tens of thousands of currently known variants [3]. Malware is one of the most serious security threats on the Internet today. In fact, most Internet

problems such as spam e-mails and denial of service attacks have malware as their underlying cause. That is, computers that are compromised with malware are often networked together to form botnets, and many attacks are launched using these malicious, attacker-controlled networks. With the increasing significance of malware in Internet attacks, much research has concentrated on developing techniques to collect, study, and mitigate malicious code. Without doubt, it is important to collect and study malware found on the Internet. However, it is even more important to develop mitigation and detection techniques are based on the insights gained from the analysis work. Unfortunately, current host-based detection approaches (i.e., anti-virus software) suffer from ineffective detection models. Host-based malware detectors have the advantage that they can observe the complete set of actions that a malware program performs. It is even possible to identify malicious code before it is executed at all. Unfortunately, current host-based detection approaches have significant shortcomings. An important problem is that many techniques rely on ineffective models. Ineffective models are models that do not capture intrinsic properties of a malicious program and its actions but merely pick up artifacts of a specific malware instance. As a result, they can be easily evaded. For example, traditional anti-virus (AV). Programs mostly rely on file hashes and byte (or instruction) signatures. Unfortunately, obfuscation techniques and code polymorphism make it straightforward to modify these features without changing the actual semantics (The behavior) of the program. Another example is models that capture the sequence of system calls that a specific malware program executes. When these system calls are independent, it is easy to change their order or add irrelevant calls, thus invalidating the captured sequence. Malware detection approach is both effective and efficient, and thus, can be used to replace or complement traditional AV software at the end host [1].

2. Literature Survey

Clemen et al. [1] proposed models that concentrate on the features of a specific malware instance, and are often easily evadable by obfuscation or polymorphism. Also, detectors that check for the presence of a sequence of system calls exhibited by a malware instance are often evadable by system call reordering. In order to address the shortcomings of ineffective models, several dynamic detection approaches have been proposed that aim to identify the behavior exhibited by a malware family. Although promising, these approaches are unfortunately too slow to be used as real-time detectors on the end host, and they often require cumbersome virtual machine technology. A novel malware detection approach that is both effective and efficient, and thus, can be used to replace or complement traditional anti-virus software at the end host. Their approach first analyzes a malware program in a controlled environment to build a model that characterizes its behavior. Such models describe the information flows between the system calls essential to the malware's mission, and therefore, cannot be easily evaded by simple obfuscation or polymorphic techniques. The drawback associated with this technique is that it is inefficient to be used as real-time detectors on end user machines.

There are many innovative ideas that exploit VMs to secure work environments on laptops, detect virus attacks in real-time, determine the cause of computer break-ins, and debug difficult to track down system failures. Today, VMs are predominantly used by programmers to ease software development and testing, by IT centers to consolidate dedicated servers onto more cost effective hardware, and by traditional hosting organizations to sell virtual private servers. Other emerging, real-world scenarios for which people are either considering, evaluating, or actively using VM technologies include HPC clusters, the Grid, and distributed hosting organizations like PlanetLab and Amazon EC2. Soltez et al. [5] focuses on these three emerging scenarios, for which efficiency is paramount. Compute farms, as idealized by the Grid vision and typically realized by HPC clusters, try to support many different users (and their application's specific software configurations) in a batch-scheduled manner. While compute farms do not need to run many concurrent VMs (often just one per physical machine at a time), they are nonetheless very sensitive to raw performance issues as they try to maximize the number of jobs they can push through the overall system per day. As well, experience shows that most software configuration problems encountered on compute farms are due to incompatibilities of the system software provided by a specific OS distribution, as opposed to the kernel itself. The drawback associated with this technique is that the absence of malware detection which introduces difficulties in host commitment. Lanzi et al. [6] has designed an approach for analyzing kernel-level code that can extract information about the malicious goals and capabilities from the kernel rootkits through the stimulation of the data-flow events. Such rootkit behaviors are not revealed by hooking behavior analysis in existing research. They propose a new technique that is a combination of backward slicing and chopping techniques on selective stimulated execution paths in the kernel that identifies all possible data sources that the malware uses to influence sensitive data, and all possible instructions that are influenced by these sources, for example malicious triggers. To the best of their knowledge, they are the first to develop a dynamic kernel level analysis engine for the Windows OS. They have tackled several design and implementation challenges in order to make their system handle a large variety of rootkit techniques. They have performed experimental evaluation on different real world rootkits, showing that their system is able to automatically extract detailed information about the malicious capabilities. They describe the limitations of their system against some newer rootkit techniques, and discuss how their system can be further improved to counter these new rootkit techniques. The drawback associated with this technique is that it introduces storage overhead because committing to operating system requires storing all snapshots of the system. The paper on malware clearance for secure commitment of OS level virtual machine [7] focus on idea on developing a VM commitment system called Secom to automatically eliminate malicious state changes when merging the contents of an OS-level VM to the host. Secom consists of three steps: grouping state changes into clusters, distinguishing between benign and malicious

clusters, and committing benign clusters. Secom has three novel features. First, instead of relying on a huge volume of log data, it leverages OS-level information flow and malware behaviour information to recognize malicious changes. As a result, the approach imposes a smaller performance overhead. Second, different from existing intrusion detection and recovery systems that detect compromised OS objects one by one, Secom classifies objects into clusters and then identifies malicious objects on a cluster by cluster basis. Third, to reduce the false-positive rate when identifying malicious clusters, it simultaneously considers two malware behaviours that are of different types and the origin of the processes that exhibit these behaviors, rather than considering a single behavior alone as done by existing malware detection methods. The drawback associated with this technique is that they did not provide the high performance in the multi virtual machine environment and in the existing project SECOM is implemented on entire OS level changes. Any kind of malicious event affects the entire OS level VM, and if n number of VM Services are running and let's assume every two minutes a malicious event is observed then after ten minutes a OS SECOM needs to update all the running VM services $n \times 5$ times which will affect the SECOM process and also generate high overhead.

3. Proposed System

We present SECOM to each individual VM Service instead of entire OS based on classified malicious attack types in relation to the application service. For example, a web server is mostly targeted by http attacks, so one should tune the detection classifier to detect only http attacks to prevent more precisely. Antivirus can detect major of intrusion detection but it is not precise to a particular VM services attacks. If an antivirus compromises any one of the attack, then it can affect the entire OS VM service. It is highly effective if we secure VM service at individual level rather than OS level to provide high secure commitment. The advantage associated with this technique is that it provides more accurate results and less time complexity for malicious activity detection.

A. Implementation:

Before we start understanding the actual process of the proposed system lets first understand some basic concepts that are a pre requisite.

TABLE I. CONFUSION MATRIX

Condition	A	NOT A
Test Says "A"	True Positive	False Positive
Test Says "NOT A"	False Negative	True Negative

The other performance measurement parameters can be calculated as follows:

- $TPR = TP / (TP + FN)$
- $FPR = FP / (FP + TN)$
- $TNR = TN / (FP + TN)$
- $FNR = FN / (TP + FN)$
- $ACCURACY = TP + TN / (TP + FP + TN + FN)$

Where,

TPR – True Positive Rate, FPR – False Positive Rate, TNR – True Negative Rate, FNR – False Negative Rate

The technique proposed provides more accurate and less time complexity for the malicious activity detection.

B. Modules

1. Detection of VM Services Running in the OS:

There can be many VM services running in the OS serving different types of services and applications. We have to first identify which VM services are running and on which port so that further monitoring and detection can be done. In this module, hence the software detects for different VM Services running on different ports on the OS.

2. Monitor the OS Level Activities of the VM Service detected:

After detecting the active services running in the OS we can decide on which ports that represent a VM service we have to monitor the events that take place and detect for malicious activities. As stated earlier the software can be tuned for specific VM service for more precise and efficient detection so as to increase TPR and FPR. In this module, all the OS Level activities of the detected VM are monitored to later classify the desirable and undesired changes made to the Service. All the possible events by the processes like creation, deletion, modification, reading of the files is monitored so that suspicious activities can be traced and malicious objects can be removed.

3. Run the Multi Secure Service and identify the desired and undesired OS Level changes in the VM Service:

3.1 Run Training Process:

Before the actual detection of the malicious objects SECOM needs to be trained with real time tested data so that it is familiar with the signature and prototypes of the malicious and benign data. It has to detect all the malicious objects and at the same time do not detect and benign process as malicious to reduce the false positive rate. We have collected the training data rigorously to increase the performance and efficiency.

Every process has 42 attributes and the following are the data attributes for any process:

A1 'duration' real
 A2 'protocol_type' {'tcp','udp', 'icmp'}
 A3 'service' {'aol', 'auth', 'bgp', 'courier', 'csnet_ns', 'ctf', 'daytime', 'discard', 'domain', 'domain_u', 'echo', 'eco_i', 'ecr_i', 'efs', 'exec', 'finger', 'ftp', 'ftp_data', 'gopher', 'harvest', 'hostnames', 'http', 'http_2784', 'http_443', 'http_8001', 'imap4', 'IRC', 'iso_tsap', 'klogin', 'kshell',

- 0,icmp,eco_i,SF,18,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,1,1,0.00,0.00,0.00,0.00,1.00,0.00,0.00,1,16,1.00,
0.00,1.00,1.00,0.00,0.00,0.00,0.00,ipsweep,18
- 0,tcp,private,REJ,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,2,1,0.00,0.00,1.00,1.00,0.50,1.00,0.00,255,1,0.0
0,0.31,0.28,0.00,0.00,0.00,0.29,1.00,portsweep,20

3.2 After SECOM is trained it produces the results by classifying the types of attacks based on their signature attributes.

Some of the attacks it classified are: Apache2, back, buffer_overflow, ipsweep, imap, pod etc. One example of the attributes it identified of ipsweep attack is given below:

```
f1=[0, 6, 5, 1, 2, 12743] ,f2=[icmp, tcp] ,f3=[eco_i, private, link, finger, gopher, ssh, ftp, smtp, mtp, time, ecr_i, whois, http, ftp_data, telnet, ctf, name],f4=[SF, REJ, RSTO] f5=[18, 8, 0, 4113],f6=[0, 133, 15, 89, 4, 61, 82, 51633],f7=[0],f8=[0] f9=[0], f10=[0], f11=[0], f12=[0, 1], f13=[0, 4],f14=[0],f15=[0] f16=[0, 4], f17=[0,18],f18=[0], f19=[0], f20=[0], f21=[0] f22=[0], f23=[1, 2], f24=[1, 12, 44, 46, 50, 21, 23, 35, 45, 18, 27, 28, 7, 15, 39, 41, 36, 22, 2, 26, 34, 9, 20, 24, 52, 30, 51, 4, 42, 29, 11, 14, 25, 33, 6, 40, 32, 13, 48, 8, 3, 5, 47, 49, 37, 31, 19, 17, 16, 10, 43, 38] ,f25=[0.00], f26=[0.00], f27=[0.00, 1.00, 0.50],f28=[0.00, 1.00],f29=[1.00, 0.50],f30=[0.00, 1.00],f31=[0.00, 1.00],f32=[1, 2, 37, 4, 27, 19, 62, 36, 68, 59, 3, 60, 50, 51, 26, 70, 46, 6, 53, 64, 10, 39, 32, 44, 38, 14, 48, 63, 18, 9, 15, 47, 30, 20, 21, 24, 16, 61, 45, 13, 25, 35, 7, 54, 33, 69, 43, 28, 5, 12, 41, 57, 65, 49, 23, 72, 214, 205],f33=[16, 53, 95, 15, 25, 123, 60, 63, 111, 61, 11, 2, 255, 200, 41, 35, 59, 28, 1, 225, 33, 183, 129, 17, 153, 139, 73, 62, 68, 106, 75, 29, 79, 120, 117, 58, 226, 137, 51, 9, 24, 39, 32, 239, 66, 14, 143, 69, 150, 31, 191, 76, 37, 107, 77, 222, 125, 84, 30, 26, 156, 91, 131, 23, 8, 48, 202, 36, 20, 100, 70, 46, 192, 89, 108, 172, 249, 102, 199, 152, 130, 44, 47, 80, 138, 6, 18, 40, 101, 141, 38, 88, 109, 87, 96, 208, 110, 50, 45, 162, 244, 56, 86, 67, 54, 5, 167, 72, 97, 74, 145, 85, 176, 135, 7, 22, 142, 155, 27, 180, 81, 250, 240, 82, 104, 57, 98, 10, 140, 149, 43, 113, 52, 207, 49, 218, 241, 188, 116, 118, 234, 147, 13, 223, 185, 158, 245, 127, 119, 198, 55, 94, 206, 90, 83, 231, 193, 4, 247, 71, 148, 154, 159, 213, 21, 64, 92, 42, 212, 132, 178, 161, 173, 160, 201, 133, 134, 151, 34, 12, 181, 3, 184, 219, 65, 99, 112, 177, 93, 242, 19, 136, 114, 169, 205, 121, 233, 237, 217, 195, 126, 157, 246, 105, 211, 175, 253, 166, 146],f34=[1.00, 0.03, 0.04, 0.05, 0.02, 0.01, 0.33, 0.50, 0.17, 0.10, 0.07, 0.06, 0.11, 0.29, 0.08, 0.14, 0.25, 0.20],f35=[0.00, 1.00, 0.14, 0.99, 0.04, 0.03] ,f36=[1.00, 0.03, 0.04, 0.05, 0.02, 0.01, 0.33, 0.50, 0.17, 0.10, 0.07, 0.06, 0.11, 0.29, 0.08, 0.14, 0.25, 0.20],f37=[1.00, 0.51, 0.53, 0.56, 0.50, 0.55, 0.25, 0.54, 0.00, 0.52, 0.22, 0.26, 0.03, 0.80, 0.57, 0.40, 0.60, 0.27, 0.08, 0.67, 0.05, 0.33, 0.04, 0.62],f38=[0.00] f39=[0.00, 0.01],f40 = [0.00, 0.86, 0.89, 0.84, 0.92, 0.91, 0.95, 0.96, 1.00, 0.85, 0.67, 0.83, 0.90, 0.98, 0.87, 0.93, 0.94, 0.07, 0.88, 0.97, 0.80, 0.71, 0.77, 0.60, 0.70],f41= [0.00, 1.00, 0.50, 0.05, 0.02, 0.67, 0.03],f42= [ipsweep] .
```

- 0,tcp,ftp_data,SF,491,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,2,2,0.00,0.00,0.00,0.00,1.00,0.00,0.00,150,25,
0.17,0.03,0.17,0.00,0.00,0.00,0.05,0.00,normal,20
- 0,udp,other,SF,146,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,13,1,0.00,0.00,0.00,0.00,0.08,0.15,0.00,255,1,0.
00,0.60,0.88,0.00,0.00,0.00,0.00,0.00,normal,15
- 0,tcp,private,S0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,123,6,1.00,1.00,0.00,0.00,0.05,0.07,0.00,255,26,0.
10,0.05,0.00,0.00,1.00,1.00,0.00,0.00,neptune,19
- 0,tcp,ftp_data,SF,334,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,2,2,0.00,0.00,0.00,0.00,1.00,0.00,0.00,2,20,1.0
0,0.00,1.00,0.20,0.00,0.00,0.00,0.00,warezclient,1

3.3 The attacks are basically classified into clusters based on the type of attack namely:

- Data Attacks
- Application Attacks
- System Attacks
- DOS Attacks

4. Detect the different type of malware based on the trained data and classify the type, and map to respective cluster based on the categories.

In this module, the identified changes are classified into the respective type of malicious cluster as listed in the above types or into benign cluster so that the malicious clusters can be dumped and only benign clusters updated. Malicious activities are mapped to their type cluster based on the threshold of matching data attributes. Attacks can be monitored on real time basis that penetrate through the network. For testing purpose we have exhaustively collected the malware data from different sources which contains thousands of real data. Some of the examples of malware data are:

- 801,tcp,http,RSTR,74024,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,26,26,0.00,0.00,1.00,1.00,1.00,0.00,0.00,255,252,0.99,0.01,0.00,0.00,0.00,0.00,0.12,0.12,anomaly
- 0,tcp,private,REJ,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,205,2,0.00,0.00,1.00,1.00,0.01,0.07,0.00,255,2,0.01,0.08,0.00,0.00,0.00,0.00,1.00,1.00,anomaly
- 0,tcp,http,SF,232,198345,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,1,8,0.00,0.00,0.00,0.00,1.00,0.00,0.38,114,255,1.00,0.00,0.01,0.01,0.00,0.00,0.00,0.00,normal
- 0,tcp,ftp_data,SF,687,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,1,0.00,0.00,0.00,0.00,1.00,0.00,0.00,69,19,0.16,0.06,0.16,0.11,0.00,0.00,0.00,0.00,normal
- 0,tcp,http,SF,54540,8314,0,0,0,2,0,1,1,0,0,0,0,0,0,0,0,0,0,5,8,0.00,0.00,0.00,0.00,1.00,0.00,0.25,255,248,0.97,0.01,0.00,0.00,0.00,0.00,0.06,0.06,anomaly

In this module, the identified changes are classified into the respective type of malicious cluster as listed in the above types or into benign cluster so that the malicious clusters can be dumped and only benign clusters updated.

Malicious activities are mapped to their type cluster based on the threshold of matching data attributes.

Attacks can be monitored on real time basis that penetrate through the network.

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Some of the examples of malware data are:

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- 0,tcp,private,REJ,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,205,2,0.00,0.00,1.00,1.00,0.01,0.07,0.00,255,2,0.01,0.08,0.00,0.00,0.00,0.00,1.00,1.00,anomaly

- 0,tcp,http,SF,232,198345,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,1,8,0.00,0.00,0.00,0.00,1.00,0.00,0.38,114,255,1.00,0.00,0.01,0.01,0.00,0.00,0.00,0.00,normal
- 0,tcp,ftp_data,SF,687,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,1,0.00,0.00,0.00,0.00,1.00,0.00,0.00,69,19,0.16,0.06,0.16,0.11,0.00,0.00,0.00,0.00,normal
- 0,tcp,http,SF,54540,8314,0,0,0,2,0,1,1,0,0,0,0,0,0,0,0,0,0,5,8,0.00,0.00,0.00,0.00,1.00,0.00,0.25,255,248,0.97,0.01,0.00,0.00,0.00,0.00,0.06,0.06,anomaly

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- 0,tcp,private,REJ,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,205,2,0.00,0.00,1.00,1.00,0.01,0.07,0.00,255,2,0.01,0.08,0.00,0.00,0.00,0.00,1.00,1.00,anomaly
- 0,tcp,http,SF,232,198345,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,1,8,0.00,0.00,0.00,0.00,1.00,0.00,0.38,114,255,1.00,0.00,0.01,0.01,0.00,0.00,0.00,0.00,normal
- 0,tcp,ftp_data,SF,687,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,1,0.00,0.00,0.00,0.00,1.00,0.00,0.00,69,19,0.16,0.06,0.16,0.11,0.00,0.00,0.00,0.00,normal
- 0,tcp,http,SF,54540,8314,0,0,0,2,0,1,1,0,0,0,0,0,0,0,0,0,0,5,8,0.00,0.00,0.00,0.00,1.00,0.00,0.25,255,248,0.97,0.01,0.00,0.00,0.00,0.00,0.06,0.06,anomaly

5. Update only the benign clusters discarding the malicious clusters.

Only the benign clusters are updated with the help of SECOM.

After the process of commitment is over we measure the performance of the system with the help of evaluation data. While evaluating the performance we need to set the threshold based on the level of accuracy we need SECOM to maintain.

We present the details of evaluation and results in the results section. The training data can be modified to train the detector with new attack data as it arises.

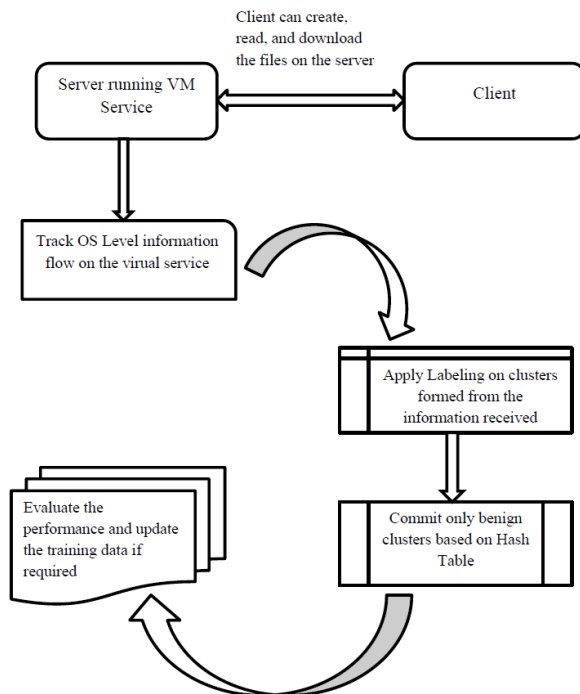


Figure 1 : Architecture Diagram

C. Results

Table 1. Result

Threshold	TP	TN	FP	FN	Accuracy	TPR	FPR
50	278	326	45	351	62	46	11
60	457	163	24	372	81	74	6
70	441	135	24	372	81	77	6
80	474	122	17	379	85	80	4
90	485	110	14	382	87	82	4
100	498	96	13	383	88	84	3

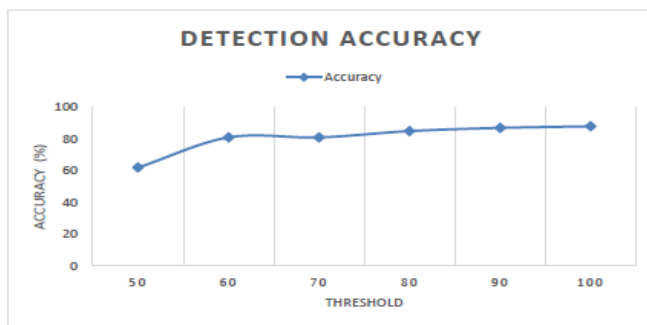


Figure 2: Detection Accuracy based on Threshold

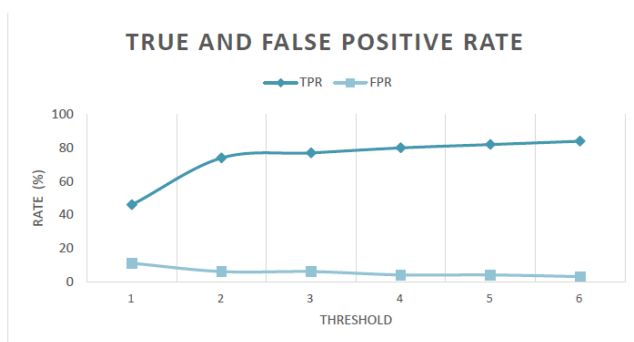


Figure 3: TPR and FPR based on Threshold

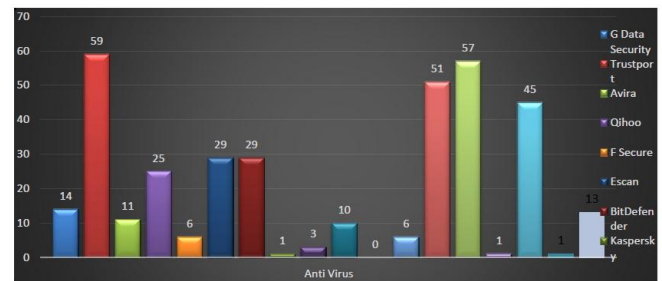


Figure 4: Comparison of false positives of various antivirus tools and SECOM

Anti Virus	FP
G Data Security	14
Trustport	59
Avira	11
Qihoo	25
Panda	1
F Secure	6
Escan	29
BitDefender	8
Kaspersky	1
ESET	3
Avast	10
McAfee	0
Trend Micro	6
AVG	51
Symantic	57
Microsoft	1
PC Tools	45
K7	23
SECOM	13

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Computational Chemistry

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ABSTRACT

Computational science is the congregation of computational and numerical techniques to solve lengthy and complex problems. Computational chemistry is the application of chemical, mathematical and computing skills to the solution of multifaceted chemical problems. It uses computers to generate information such as identification, physicochemical properties and reactions of molecules or overall design of a molecule. Computational methods are extensively used in simulations to simplify chemical engineering problems also. It provides another way of obtaining information that would be expensive or time-consuming to get experimentally. It enables to make accurate predictions of experimental measurements as a test of the validity of a theory. It helps manufacturers to design more productive and efficient processes.

Keywords : computational chemistry, simulations, validity of theory

1. Introduction

Chemistry is a branch of science that focuses prominently on the composition, structure and change of matter [1- 4]. It deals with the area such as the properties of individual atoms, formation of chemical bonds in a compound, chemical reactions to form different substances [5]. It has great implication as it is a bridge for all branches of science and technology [6 - 8]. All the outcome of Chemistry is utilized in the form of vital things like in pharmaceutical product, textile or dyes, polymers, nano-materials, electronics or computer devices, building materials etc. The chemical properties of a substance are determined by the electronic configuration of the atoms. The combination, nudging and caressing of the electrons of an atom and distantly related atoms of the substance, determines the Chemistry of the substance [9, 10]. The bulk of electrons determine the nature of the chemical properties. Principles of Chemistry are incorporated into computer programs to solve mystery of chemistry therefore it is called as Computational Chemistry [11, 12].

Computational learning theory is an exploration of theoretical aspects of machine learning from data [13]. In particular, the computational efficiency and limitations of learning from large (and small) amounts of data as well as in understanding the theoretical aspects of using unlabeled data. Computational learning theory is a multidisciplinary area bringing together techniques and approaches of

computer, science, statistics and applied mathematics [14, 15]. It can predict the structures, properties of molecules [16, 17] and its mechanism [18, 19]. Computational methods are extensively used for modeling and simulations of chemical reactions [20, 21].

2. Aspects of Computational Chemistry

There are two different but closely related, aspects of computational chemistry:

(1) The computations are carried out in order to find a starting point for a laboratory synthesis, or to assist in understanding experimental data, such as the position and source of spectroscopic peaks.

(2) Studies that predict the possibility of so far entirely unknown molecules or to explore reaction mechanisms that are not readily studied by experimental means. The objective of using computational chemistry, in principle, indicates that this tool can assist the experimental chemist or it can challenge the experimental findings.

The computations are carried out in order to find a starting point for a laboratory support. The computations that can predict entirely unknown molecules or to explore reaction mechanisms that are not readily studied by experimental means [22]. Chemically different molecules such as ethanol and dimethyl ether or different conformations of for example butane. Understanding experimental data such as the position and source such as spectroscopic peaks.

Identifying correlations between chemical structures and properties. . The prediction of the molecular structure of molecules by use of the simulation of forces, or more accurate quantum chemical methods to find stationary points on the energy surface as the position of the nuclei is varied [23, 24]. Computational chemistry approaches to design molecules that interact in specific ways with other molecules for example in drug design & catalysis.

3. Applications of Computational Chemistry

Computational approach helps in storing and searching for data of chemical entities [25 - 27]. It designs molecules that interact in specific ways with other molecules as in drug designing. The objective of using computational chemistry, in principle, indicates that this tool can assist the experimental chemist or it can challenge the experimental findings. After the bench scale experiments, conclusions, explanations and predictions are related finally into the production at large scale. It is pre-requisite for the precise understanding of wide range of molecular processes that cannot be completely understood with experiments. Over the past few years, researchers developed he methods to create a large database of

materials and their computed properties. Several major areas may be distinguished within computational chemistry. The prediction of the molecular structure of molecules by the use of the simulation of forces, or more accurate quantum chemical methods, to find stationary points on the energy surface as the position of the nuclei is varied. Storing and searching for data on chemical entities. Computational approaches to help in the efficient synthesis of compounds. [28 - 34]

4. Conclusion

The rapid and extensive uses of computing devices and technologies, conventional activities going online produces revolution in life as ever more. These developments have already affected most sectors of society, including the nature of scientific activity. In this era researchers believe that computers are the future.

Computational chemistry focuses on solving chemical problems by developing new theoretical methods. This theoretical methods and results from calculations enables new problems to improve the underlying theory be studied may reveal limitations and suggest

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Survey Paper on “The Room of Technology : Wireless Personal Area Network

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ABSTRACT

Wireless personal area network is an emerging technology for future short range communication. IEEE has standardized two groups namely: High data rate WPAN(HR WPANs) and low data rate WPAN(LR WPANs). These devices are designed for inexpensively connecting low power devices located within 1m to 100m. In this paper the detailed study of each WPAN network is discussed and also the comparison is given.

Keywords : WPAN, Bluetooth, ZigBee, FHSS, RFID.

1. Introduction

WPAN is a personal area network which is used around an individuals workspace. It permits the communication within 10meters. Wireless network standards like 802.11b and WiMax typically focus on providing PC to PC or PC to ISP connectivity over building or metropolitan area. However many devices require less range therefore PAN are a perfect fit for these applications since the kind of devices we wish to equipment with PANs are often mobile and lightweight, power is at premium. Thus it is widely accepted [6].

The Bluetooth technology has been already deployed on millions of devices which offers a data rate up to 3 Mbps and 100m range. Its low power consumption and interoperability guarantee Bluetooth's acceptance in mobile community 802.11b.

The second technology 802.15.4 goes even further than Bluetooth in speed for power. According to IEEE WPAN are used to convey information over short distances among a private group of participant devices.

Unlike WLAN connections made through WPAN involves little or no infrastructure or direct connectivity to the world. Therefore it allows small, power-efficient, inexpensive solutions to be implemented for a wide range of devices.

There are various WPAN technologies for ex: Bluetooth, ZigBee, HR WPAN, LR WPAN etc.

2. Bluetooth Technology:

Bluetooth is primarily a WPAN technology. It is a wireless replacement for many cable which we currently use to transmit voice and data signals. The Bluetooth specification is ideal for mobile professional. Bluetooth provides three low power

modes to conserve battery life: sniff mode, hold mode and park mode. It provides low power consumption and provides security for both mobile and stationary devices. Bluetooth uses GFSK for modulation and employs FHSS spreading technique. Signals can be transmitted through walls and briefcases thus it does not need for line-of-sight. It promises to significantly to change the way we use machines. Bluetooth technology is the result of joint achievement of 9 leading companies: 3com, Lucent technologies, IBM, Intel, Microsoft, Motorola, Nokia, Toshiba, and Ericson. Bluetooth is used in phones, pagers and headsets, modems and LAN access devices, notebook computers. A Bluetooth chip takes the information normally carried by cable and transmits it at a special frequency to receiver. Bluetooth chip which will then give the information received to the computer or phone whatever.

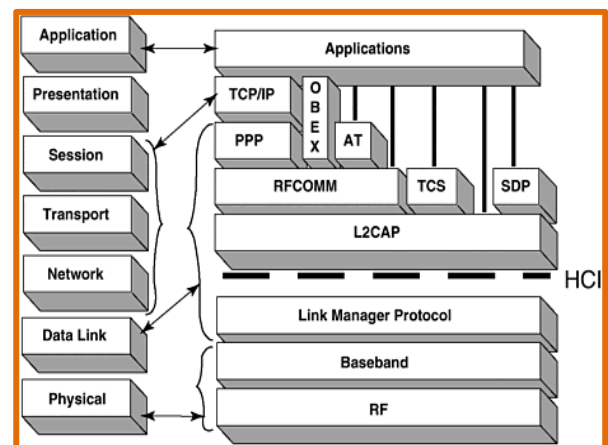


Fig 1: Bluetooth protocol stack

The definitions of the protocol used in Bluetooth stack are as follows:

1. Physical radio layer receives and transmits data and voice.
2. Baseband layer enables the physical RF link between Bluetooth units that form a piconet.
3. Link manager handles the establishment between Bluetooth device which include authentication and encryption.
4. Logical link control implements multiplexing. It relies on a device-to-device baseband link provided by Bluetooth hardware.
5. The audio profile is responsible for managing connection, sending/receiving audio devices etc.
6. The control block processes various control operations for connectivity management of the devices.

7. Other LLC are optional in devices are cordless telephony, intercom, headset etc.
8. Radio frequency communication serves as a base for COM port emulation facilities and derived point-to-point protocols.
9. Service discovery protocol(SDP) is a Bluetooth SDP hat handles publishing and discovery of services running on top of Bluetooth stack.
10. Application profile supports audio applications, network applications, telephony service applications and management application.

3. IEEE 802.15.2(Coexistence)

It is concerned with coexistence issues that arise when two wireless systems share an environment of operation. It has two goals:

- i) To quantify the effect of mutual interference between WPAN and WLAN devices
- ii) To establish mechanism for coexistence of WLAN and WPAN at both MAC and PHY layers.

4. LR-WPAN(IEEE 802.15.4) : ZigBee

ZigBee i.e. IEEE 802.15.4 offers full wireless mesh networking capable of supporting more than 64,000 devices on single network. It has two implementation options or feature sets: ZigBee and ZigBee PRO. The ZigBee feature st is designed to support smaller ntwork with hundreds of devices in a single network. The ZigBee PRO feature is the most popular choice of developers. Both feature sets are designed to operate with each other ensuring long term use and stability. ZigBee devices are the combination of applications such as: light sensor, lighting control etc.

Some characteristics of ZigBee network are:

- Global operation in 2.4GHz.
- Frequency agile solution operating over 16 channels in 2.4GHz frequency.
- Incorporates power saving mechanism for all standards.
- Multiple star topology and inter personal area network (PAN) communication.
- Security key generation mechanism.

5. ZigBee Network:

There are three categories of nodes in ZigBee system:

- Coordinator
- Router
- End devices

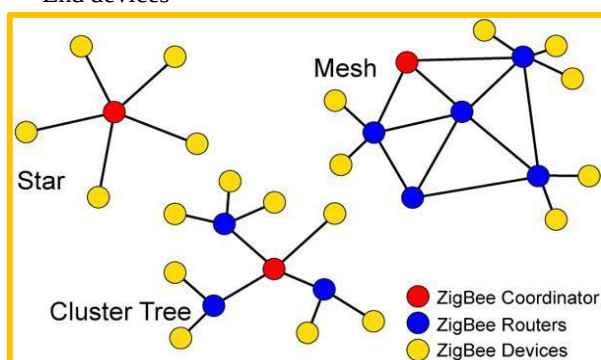


Figure 2: ZigBee Network

- Coordinator: forms the root of network tree and might bridge to other network. In each network there is one coordinator. It also stores the information about network, security keys.
- Router: it acts as intermediate nodes relaying data from other devices. Network may be extended through the use of ZigBee router.
- End devices: They can be low-power battery powered device. They can collect various information from sensors and switches. They support better low power models each end devices can have up to 240 end nodes which are separate applications sharing the same radio[1].

6. ZigBee protocol Architecture:

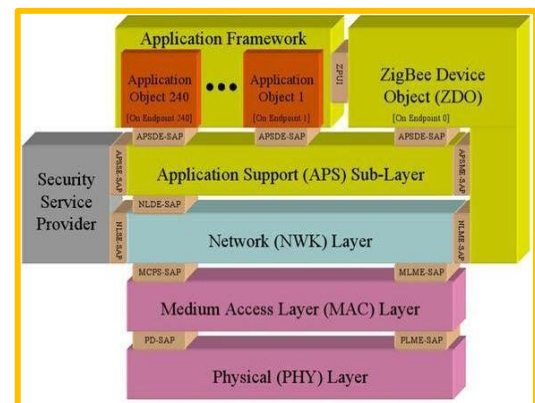


Figure 3: ZigBee architecture

Physical layer: it defines the radio characteristic and supports the 2.45GHz and 868/915 MHz radio bands. It employs DSSS on PHY layer and it is operated in three frequency bands.

MAC layer: it uses carrier sense multiple access with collision avoidance channel access mechanism. IEEE 802.15.4 MAC defines four frame structures:

- A beacon frame
- A data frame
- An acknowledgement frame
- A MAC command frame

Network Layer : It handles network address and routing by invoking actions in the MAC layer. It tasks including starting network, assigning network, adding an removing network devices, routing messages, applying security etc.

Application layer: the top layer consists of application framework, ZigBee device object(ZDO) and application support sublayer.

6. HR WPAN (IEEE 802.15.3):

IEEE 802.15.3 is a standard for high rate WPANs. It is also an ad hoc network standard similar to Bluetooth that specifies MAC/PHY layers only. It focuses on power management, QoS and security. Its main aim is to provide low complexity, low cost, low power consumption and high data rate connectivity.

Its main vision is “to promote wireless multimedia connectivity and interoperability between devices in a personal area network”. [3]

Some characteristics:

- Simplicity of use
- Advanced QoS
- Low complexity
- Low cost
- Support long battery life
- Sufficient data rate
- High bandwidth
- Secured network.

7. Comparison of various Technologies:

Feature(s)	IEEE 802.11b	Bluetooth	ZigBee
Power Profile	Hours	Days	Years
Complexity	Very Complex	Complex	Simple
Nodes/Master	32	7	64000
Latency	Enumeration upto 3 seconds	Enumeration upto 10 seconds	Enumeration 30ms
Range	100 m	10m	70m-300m
Extendability	Roaming possible	No	YES
Data Rate	11Mbps	1Mbps	250Kbps
Security	Authentication Service Set ID (SSID)	64 bit, 128 bit	128 bit AES and Application Layer user defined

Figure 4: Comparison table

8. Conclusion:

After studying various wireless personal area network we can conclude that these network are a great benefit to smaller network where we need to connect multiple devices within a short range.

A Comparative Study on different Automation Tools : QTP, Selenium and RFT

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ABSTRACT

Software Testing is crucial activity in SDLC(Software development life cycle process). It helps to find out bugs and defects in software and thereby improves the quality of the product. Testing is carried out by Manual testing and Automation Testing. Automation tools provide wide range of advantages to carry out testing effectively. This research paper evaluates and compares three significant automation tools: Selenium, Quick Test Professional and Rational Functional Tester on basis of 15 parameters. This paper also gives overview of other automated as well as mobile testing tools.

Keywords : Software Testing, QTP, Mobile Testing, RFT

1. Introduction

Software Testing is a process of conducting investigation in order to find bugs in the system and also to provide information to stakeholders about the quality of software under test. Apart from finding bugs, Software testing also involves validating and verifying the application on key points like: To check whether software meets the technical and business requirement and whether it works as expected.

Also, human beings tends to make mistakes. Some of these can be ignored while some can cause a huge loss. Hence Software testing is important to deal with these mistakes. Moreover if software is well tested it provides customer satisfaction.”

Software testing is also used to test the software for other software quality factors like reliability, usability, integrity, security, capability, efficiency, portability, maintainability, compatibility, etc [1].

2. Testing

A. Types of Testing

The types of testing is broadly classified as :

Manual Testing :

Manual Testing is the basic testing type which is used to find bugs. This type of tool doesn't involves any automation script to test the software. The testers develop the test cases based on the functionality of the application under test (UAT). Manual Testing does not require knowledge of any testing. The advantage of manual testing is that it is very cost effective. Not much technical knowledge is required. Manual testing can be become repetitive and boring. On the contrary, the boring part of executing same test cases time and again, is handled by automation software in automation testing.

In manual testing, a tester requires to play the role of an end user and use most of all features of the application to ensure its correct behaviour. They follow a written test plan that leads them through a set of important test cases [2]. Manual Testing does not require knowledge of any testing tool. As it doesn't uses any automation tool the effort taken in manual testing is more.

The problems with manual testing are, it is very time consuming process, not reusable, has no scripting facility, great effort required, and some errors remain uncovered [3].

Manual testing can be become repetitive and boring. On the contrary, the boring part of executing same test cases time and again, is handled by automation software in automation testing[4].

Automation Testing:

Automation Testing is use of tools to execute test cases whereas manual testing requires human intervention for test execution. In this type of testing, the application is tested with the help of automation scripts that tests the software repeatedly. The automation software can also enter test data into the System Under Test , compare expected and actual results and generate detailed test reports. This type of testing is efficient and fast. This type of testing involves investment of money and resources. Not much human intervention is required. Automation testing takes less time and increases speed of execution. Some of the testing tools are QTP, Selenium, BugZilla, WinRunner, Rational Robot, etc.

Thus, manual testing is preferred to review the application requirements, and to create the High Level Design Documents and Low level design documents. Automation testing is done for graphical user interfaces and the flow control of the application [5].

2. Testing Tools

Automation Software testing is gaining much importance. These tools cover maximum test coverage in short period of time.

Because of the more advantages of the automation testing over manual testing, various companies are engaged in developing various automated test tools for various applications. There are two types of test tools.

- Open source test tools
- Commercial test tools

Open Source Test tools- These test tools are free for the users to use. It can be downloaded from the internet or can be obtained by the vendor without any charges e.g. Selenium, test tools such as QTP and TC are not free they involve the license cost [6].

This section provides the brief study of various leading automation testing tools:

- **Telerik Test Studio:**

Telerik Test studio is windows based software testing tool for web and desktop functional testing [7]. It offers codeless and productive way to test application. It is suitable for regression and functional testing. This tool is best for web based applications which uses ASP.NET, AJAX, PHP, MVC, HTML5. It is free of cost.

- **Selenium:**

Selenium is a free (open source) automated testing suite for web applications across different browsers and platforms. It is quite similar to HP Quick Test Pro (QTP) only that Selenium focuses on automating web-based applications. Selenium is not just a single tool but a suite of software's, each catering to different testing needs of an organization [4].

- **Test Complete:**

Test Complete supports Web Automation, Desktop and Mobile Application testing tool. It is a commercial tool. It works on various devices and platforms efficiently. It supports JavaScript, Python, VBScript, JScript, DelphiScript, C++Script, and C#Script to create tests [8].

- **Quick Test Professional (QTP)**

Quick Test Professional is a commercial tool provided by HP. Quick Test Professional is a graphical interface record-playback automation tool. Trial version of QTP can be downloaded from the official web site of HP [6]. It is an icon based tool that automates the regression and functional testing of an application both technical as well as non-technical tester can use QTP. It provides both features- Record as well as Playback. We can test Desktop as well as the Web based applications. It allows Business Process Testing (BPT). QTP is based on scripting language VB script. It supports largest pool of software development environments like SAP, Oracle etc [9].

- **SOAPUI**

SOAP-UI is the leading open source cross-platform API Testing tool. SOAP-UI allows testers to execute automated functional, regression, compliance, and load tests on different Web API. SOAP-UI supports all the standard protocols and technologies to test all kinds of API's. SOAP UI interface is simple that enables both technical and non-technical users to use seamlessly.

- **RFT**

IBM Rational Functional Tester is an automated functional testing and regression testing tool. This tool provides automated testing capabilities for functional, regression, GUI, and data-driven testing. Rational Function Tester supports a range of applications, such as web-based, .Net, Java, Siebel, SAP, terminal emulator-based applications, PowerBuilder, Ajax, Adobe Flex, Dojo Toolkit, GEF, Adobe PDF documents [10].

- **eggPlant Functional**

This tool is suitable for the teams that work on Linux and MAC or mixed mode. It supports basic code and one can easily add loops, statements and variables easily. Most testers are able to pick up this kind of programming very easily, although it is possible for testers to get out of their depth very easily, creating complex test code that is hard to maintain and debug. Eggplant Functional is a commercial tool and has free trial.

- **JUnit**

JUnit is a testing framework used by developers for Unit testing in JAVA. It increases efficiency. It also supports Regression Testing. It can integrate with IDE's like Eclipse, Ant, Maven. It works best with small tests.

2. Summary Of Tools Based On Parameters

Selecting a right automation tool there are a number of open source web testing and window application tools available in the software market. Although the core functions of these tools are similar, they differ in functionality, features, usability [6]. This paper shows the comparative study of three significant automation tools Quick Test Professional, Selenium and Rational Functional testing.

TABLE I.COMPARISION OF QTP, SELENIUM AND RFT

Parameters	QTP	Selenium	RFT
Cost	Licensed .Ten users license costs approx. 60L.	Open Source. No cost	License cost
Speed of Execution	Faster than Selenium and RFT	Slow	Slow
Browser Support	Internet Explorer 7.0,Netscape ,Firefox	Firefox, Chrome, safari, Opera	NA
Usability	Easy to use	Needs little expertise	Need expertise
Recording Types	5	1	1
OS Support	Windows	Windows MAC, Linux, Solaris	Windows XP, vista, Linux, Ubuntu
Application Support	Desktop and Web applications	Web Applications only	Desktop and Web applications
Paradigm Type	Descriptive Programming approach	Support for OOP	Descriptive and OOP approach
Report Generation	Easily generates reports. Supports HTML and XML formats	No Support for Report Generation	Generates report. Supports HTML. Custom coding for other formats
Support for IDE's	QTP IDE	Visual Studio, Eclipse, Netbeans.	Eclipse and Visual Studio
Language Support	Supports VB Script	Java, C#, PHP, Python Perl, Ruby	Supports Java and Visual Basic .NET
Integration with other tools	HP Quality Center	No Integration with any tool	IBM Rational Quality Manager
Support for Mobile Device	Requires 3 rd Party Software	Readily supports Mobile Device	No Support
Product Support	Customer Support provided by HP	No Support provided since Open Source	Customer Support provided by IBM
Learning Curve	Being GUI based, it is easy to learn	Needs lots of expertise	Needs expertise, compared to QTP

3. Some Other Mobile Testing Tools

Appium

Appium is an open source tool which provides support for Android and IOS applications. It is written in Node.js. It uses Web Driven Framework

MonkeyTalk

This is also an opensource tool and supports Android and IOS. MonkeyTalk has its own IDE. It is robust and cross platform. The advantage of this tool is that you can test the app on real hardware as well as emulator.

Robotium

Robotium supports Android only. It is easy to use. One can write User acceptance test cases easily. This tool aims to support test cases to stimulate user actions like touching, clicking, etc.

Seetest Automation

Seetest automation is a commercial tool. It supports Android, IOS, BlackBerry and also Windows phones. The free trial for this tool is available.

4. Conclusion

One can select the tool based on various criteria's like cost, application type, expertise skills, etc. Thus, we have compared 15 parameters for the tools which will help in selecting the proper tool based on testing requirements. This research work can be enhanced further by comparing various mobile testing tools.

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Survey on Object Tracking in Wireless Sensor Networks

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ABSTRACT

Wireless Sensor Network (WSN) is collection of distributed sensors which collectively work together for sensing environmental data. Technological advancements drag an attention towards Target tracking applications of Wireless Sensor Network (WSN). Target tracking plays crucial role in Military operations, Surveillance, Research of Wildlife habituate etc. Wireless Sensor Network consists of sensors. These sensors collaborate to sense, collect, and process the information of the sensing area and transmit the processed information to the Sink Node. In target tracking application, Sink Node has all data regarding path travelled by target. This paper aims to discuss comparative study of different mechanisms used for tracking moving target in wireless sensor network with respect to purpose, architecture, use of sink node and results.

Keyword: Wireless Sensor Network, Object Tracking, Object Tracking Mechanisms

1. Introduction

Wireless Sensor Networks have gained worldwide attention in recent years. Target tracking in WSNs is an important aspect which covers various WSN applications such as surveillance, natural disaster relief, traffic monitoring, the presence of certain objects, detecting ambient conditions such as temperature, movement, sound etc. Use of sensor networks for target tracking presents challenges like limited energy supply and communication bandwidth, Distributed control and performance.

2. Need of Object Tracking in WSN

A. Diversified Application Domains

Wireless sensor Network usage cover a wide range of applications, which includes military, environment monitoring, surveillance and security, animal tracking, smart fencing and intrusion detection system etc. which requires object tracking mechanism. Monitoring becomes more and more challenging, as the number of sensors in a surveillance network increases. Therefore, surveillance systems must be automated to improve the performance and eliminate such operator errors. Ideally, an automated surveillance system should only require the objectives of an application

B. Growing awareness about WSN and Internet of Things (IoT)

Boundary between use of wireless sensor network and Internet of Things is narrowed down due to rapid

technological advancements. Many Internet of Things (IoT) applications require target tracking functionality. For example-Medicine Management System used in Smart Healthcare.

3. Architectures for Object Tracking in WSN

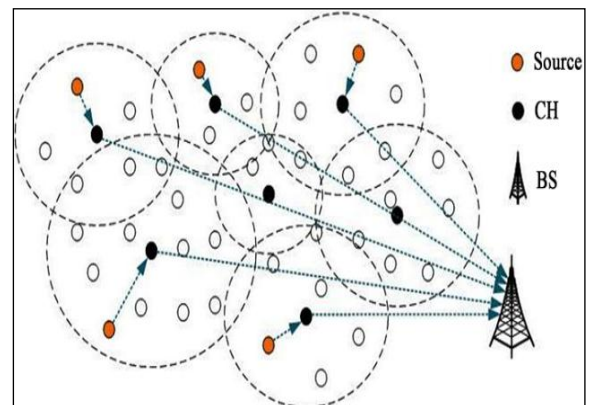
Positioning of sensor nodes in a wireless network, capability of sensor nodes and roles assign to sensors while designing of topology plays an important role for selection of a particular architecture for object tracking application. Following architectures can be used for object tracking in wireless sensor networks.

A. Single-Hop Centralized Architecture

In this architecture a centralized high capacity and powerful sink node is at the center of processing and logical network. All other nodes are assumed to be one-hop distance away from the sink and are always in active state for detection of the target.

B. Hierarchical Clustered Architecture

Figure 1.1 Single-Hop Centralized Architecture [10]



A higher capacity node may be deployed uniformly in the area to act as Cluster Head and the cluster nodes chose to elect their Cluster Head locally on rotational basis. There can be a Sink node which centrally receives all data given by Cluster Heads.

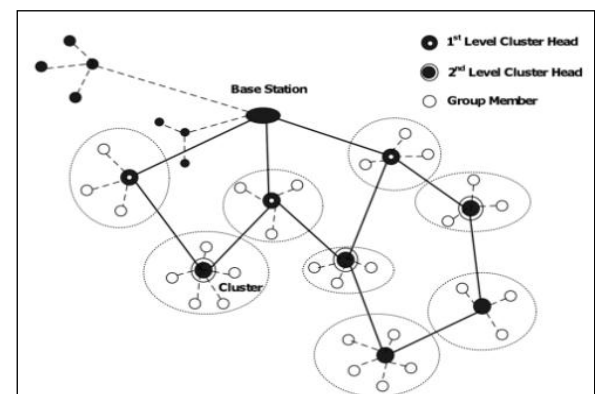


Figure 1.2 Hierarchical clustered Architecture [11]

4. Mechanisms used for Object Tracking in WSN

Over the decades, many mechanisms were proposed and implemented by researchers for tracking moving objects in wireless sensor networks. Each tracking mechanism has a different architecture, purpose and method.

A. Research related to Object Tracking mechanism in Wireless Sensor Network:

Cuijuan Shang et al. proposed Efficient Target Tracking (ETT) mechanism. It uses Dynamic Clustering Method for Cluster Head selection. It is distributed target tracking approach to awake appropriate sensors for monitoring and tracking mobile targets. This mechanism consists of three phases – Network Initialization Phase, Target Detection Phase, and Target Tracking Phase.

Target Not detected neighbor selection strategy (TND-NS) and target –Detected neighbor Selection (TD-NS) strategy are used for obtaining better tracking accuracy. It minimizes number of working sensors. The performance is tested for snake path and zig-zag path traveled by moving object. [1]

G. Wang et al. proposed tracking framework, called Face Track, which employs the nodes of a spatial region surrounding a target, called a face. Instead of predicting the target location separately in a face, it estimates the target's moving toward another face. Common edge between two faces (i.e., the target is about to cross) is called a brink and the end nodes are the couple nodes. Detecting a brink is a way of making a rectangular /square space around the target as it moves toward the brink. Brink Detection algorithm is used for detecting target crossing from one face to another.

Face tracking algorithm has three phases –

- Square detection phase- This implies that the target is preliminarily detected by any two nodes inside face but does not guarantee that the target may cross the brink between them.
- Rectangular detection phase- This implies that the target may cross the brink between the nodes.
- Crossing phase-This implies that the target is about to cross the brink between the nodes.

Further research can be done on Tracking is extended for impact of the target's dynamic movements, brink detection, and real-time polygon forwarding in target tracking. [2]

Efren L. Souza et al. A Distributed Tracking Algorithm for Target Interception (TATI) algorithm .It reduces energy consumption since fewer faces are active during the tracking task. It also reduces the route traveled by the tracker by using query points. These points are the shortest distance between tracker position and the communication area of beacon nodes. Future directions include development of a recovery mechanism that avoids flooding to recover a lost target and evaluation of the impact of node localization errors. [3]

Prof. Sachin Deshpande has discussed Target tracking in Wireless Sensor Network in detail along with cluster tree generation. It gives mechanism to determine target position .The paper also gives a brief insight about OMNeT++ and Castalia framework which will be used for implementation of target tracking in wireless sensor

network.[4]

Wen-Hwa Liao et al. proposed Object Tracking Scheme for Wireless Sensor Networks Using Data Mining. Data mining algorithm is applied to the past movement logs of the object and the useful association rules are excavated to increase the accuracy of the tracking. Missing rate of this scheme is less. [5]

Zijian Wang et al. have extended their previous work on Omni-directional binary sensornetworks. They proposed directional binary sensing networks for which authors have introduced a real-time distributed target tracking algorithm. Performance of this was better than their previous work. [6]

B. Comparative Study of Object Tracking mechanism

Object tracking mechanisms are studied in comparative manner on the basis of parameters including Source, Purpose, Architecture, Results, Presence of sink node etc. Shown in Table1.1 and Table 1.2

As shown in Table 1.1, majority of mechanisms use Distributed Architecture for tracking moving target in Wireless Sensor Network. An Efficient Target Tracking Mechanism [1] has no Sink node and it detects object movement by Master handoff Procedure. Face Tracking Mechanism [2] has sink node and it detects object movement by Brink crossing method. A Distributed Tracking Algorithmfor Target Interception [3] has sink node and it detects object by Tracker query procedure. Target Tracking in Wireless Sensor Network [4] has sink node and it detects object by Data Collection Tree Architecture. An Object Tracking Scheme for Wireless Sensor Networks Using Data Mining Mechanism [5] has no sink node and it use Apriori Algorithm for target tracking sensor prediction.

As shown in Table 1.2 majority of mechanisms has Sink node in Wireless Sensor Network. Efficient Target Tracking [1] and Object Tracking using Data mining Mechanism [5] does not use sink node .

TABLE 1.1: COMPARATIVE STUDYOF OBJECT TRACKING MECHANISMSINW S N

Paper Name	COMPARISON OF OBJECT TRACKING METHODS			
	Source	Purpose	Architecture	Result
An Efficient Target Tracking Mechanism for Guaranteeing User-Defined tracking Quality in WSNs[1]	IEEE SENSORS JOURNAL, VOL.15, NO. 9, SEPT 2015	Forreducing the energy consumption of sensors	Distributed Architecture	No. of working sensors less and energy consumption less as compared with face tracking
Detecting Movements of a Target Using Face Tracking in Wireless Sensor Networks[2]	IEEE Transactions on Parallel & Distributed Systems, VOL. 25, NO. 4, APRIL 2014	Use of an edge detection algorithm to generate each face.	Distributed Architecture	The target is always detected Inside a polygon by means of brink detection.
A Distributed Tracking Algorithm for Target Interception in Face-structure Sensor Networks[3]	39th Annual IEEE Conference on Local Computer Networks	This algorithm is applied to assist tracker In chasing a target.	Distributed Architecture	Using this algorithm Tracker will always close to target.
Target Tracking in Wireless Sensor Network[4]	IJETA, ISSN 2250-2459, ISO 9001:2008, Volume 3, Issue 9, September 2013	Target Tracking using cluster tree generation	Distributed Architecture	Omnet++ and Castalia Framework used for tracking single object.
An Object Tracking Scheme for Wireless Sensor Networks Using Data Mining Mechanism[5]	2012 IEEE Network Operations and Management Symposium (NOMS)	Use of data mining for forecasting next sensor numbers while tracking object	Cluster Based Architecture	It reduce the number of active sensors
Distributed target tracking with directional binary sensor network[6]	IEEE Global Communications Conference, 2009	It is extension of work on Omni-directional binary sensor network	Distributed Architecture	Better performance ,accuracy than omnidirectional sensor network

TABLE 1.2 : COMPARATIVE STUDY OF OBJECT TRACKING MECHANISMS IN WSN IN TERMS OF SINK NODE

MECHANISMS	PARAMETERS		
	Sink Node	Distributed	Object Movement detected by
An Efficient Target Tracking Mechanism[1]	No	Yes	Master handoff Procedure
Face Tracking Mechanism[2]	Yes	Yes	Brink crossing method
A Distributed Tracking Algorithm for Target Interception[3]	Yes	Yes	Tracker query procedure
Target Tracking In Wireless Sensor Network[4]	Yes	Yes	Data Collection Tree Architecture
An Object Tracking Scheme for Wireless Sensor Networks Using Data Mining Mechanism[5]	No	Yes	Apriori Algorithm

C. Scope for Improvement

- Efficient Target Tracking (ETT) mechanism can be improved by adding prediction mechanism for forecasting next sensor list.
- Face Track mechanism implementation with variable brink length may improve performance
- Distributed Tracking Algorithm for Target Interception (TATI) algorithm should add recovery mechanism for discovery of lost target.
- Target tracking in Wireless Sensor Network can be extended for tracking multiple object detection.
- Object Tracking Scheme for Wireless Sensor Networks Using Data Mining can be implemented for different algorithms and their performance can be analyzed.
- Object tracking in directional binary sensor network can be improved by adding prediction mechanism.

5. Conclusion

This comparative study gives insights about findings and shortcomings of some object tracking mechanisms. Considering the limited energy associated with a wireless sensor and urge of sensor energy harvesting, there is a scope to extend this mechanism by applying data mining on historical path traversal data of different targets. Prediction about probable Sensors which can detect target can help for keeping those many sensors only in active state. Existing Efficient Target Tracking (ETT) mechanism shows improvement over Face Tracking Algorithm in terms of –tracking accuracy and number of active sensors. But still there is a scope for reducing number of active sensor which can detect the moving object by applying prediction on historical path traversal data of region under monitoring. The combination of Efficient Target Tracking (ETT) for tracking the target and modified A-priori Algorithm for forecasting probable

sensors which can detect that target, will lead to reduce count for no. of active sensors, which in turn reduce Energy cost and improve network life time. Future work can be aimed for implementing Hybrid ETT and checking its performance for different scenarios of target tracking.

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Personalizing Education through Gamified Learning

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ABSTRACT

E-learning industry is growing rapidly as more and more data is published online. Analysis on learner's behaviour, prediction on future results, cognitive learning and level of fundamental knowledge/ skill acquired are some of the major analysis done on E-learning data. This paper focuses on (1) the distinction between Game-based learning, Gamification, PBL and Simulation [2] and (2) How the above three work together for Educational Data Mining and Learning Analytics for personalizing educational experience for learners.

Keywords : E-learning, Gamification

1. Introduction

Over several years there has been extensive research in improving the way knowledge is conveyed in an efficient manner. A combination of visual responsiveness, analytical skills etc. can be captured through a game based environment. Game based learning has seen an increase in market adoption over the years.

- 1) Expected market growth: The market growth of gamified learning is expected to grow exponentially from \$1,707 billion in 2015 to 5,500 billion in 2018 [3].
- 2) Market players: Most of the developed countries such as North America and Europe are widely using this strategy of e-learning whereas the developing economies such as India and China are huge markets with untapped potential.
- 3) Expected Demand: Gartner in their analysis have projected that around 50% of education industry is going to be engaged in learning through games [5].
- 4) Expected revenue: Revenue for organizations selling game based learning and simulation products will increase by atleast 23% by 2017 [4].

2. Architecture

Various factors are considered for overall knowledge attainment and analysis of the user. The overall process flow for e-learning environment can be viewed as below :

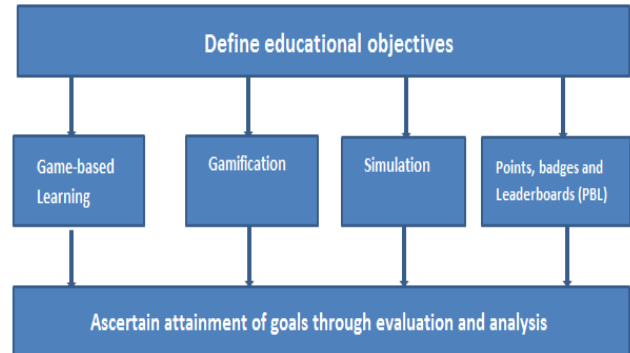


Fig. 1 : Process flow for E-learning using Gamified approaches

3. Educational Objectives

The educator must be clear about the objectives for the learner and what can he/ she gain from the use of Gamified Learning. The objectives can be stated as [6]

- i) Create a student model to infer and reason about learners' emotions based on behavior patterns to make classroom sessions more effective and interactive
- ii) Analyze student responses and feedback that maximize students' learning, understanding and motivation and enables educators to evolve teaching methodologies.
- iii) Audit/ review evaluation mechanisms for effectiveness.

4. Mediums of Gamified Learning

There are varied mediums through which the above mentioned objectives can be achieved. Table 1 provides a comprehensive summary of tools used in Gamified learning.

Table 1: Comprehensive summary of tools used in Gamified learning

	Concept	Objective	Medium	Technique	Skills honed
Game-based learning	Using Games to meet Learning outcomes	Fun-based learning; Breaking the ice amongst divergent learner groups	Games in areas where games can be implemented easily and widely used.	Learning comes from playing the game	Fast paced learning; memorization
Gamification	Adding game inspired elements to the course	Making theoretical concepts more visual	Games developed especially for non-game environments	Progressing to different levels; Reward programs; Role plays	boosts student engagement; sharpens core fundamentals
Simulation	Scenario-based interaction with multiple-choice, branching decisions as the primary activity	Practical approach to problem solving; Learning by doing	Real time decision making about a particular problem; learning through mistakes	Evaluating real time choices and choosing optimum option based on concepts learned in classroom	Problem solving; critical thinking; evaluates risks in decision making; strategic learning
PBL	Points: encourage people to do things by collecting them Badges: visual representation of some achievement Leader boards: Performance tracking relative to peers	Motivation to learners	Points; Scorecards; star badges; leaderboards	Learner Feedback; improved overall assessment technique	Competitive spirit amongst learners; motivation to excel; team building

5. Ascertain Attainment of Goal Trough Evaluation

Traditional tools used for assessment of learner performance take inspiration from Bloom's Taxonomy and are as stated below :

- Written tests on subject matter- Recall facts and basic concepts
- Pop quiz- Hones critical thinking and explains ideas or
- Mini projects - Apply theoretical information in new situations; design and create new applications
- Beyond Syllabus Learning - Analyze and draw connections among ideas and varied industry domains
- Assignments - enable understanding of ideas and concepts in greater detail. The nature of assignments can be varied such as Video assignments, Poster Creations, Application oriented and thought provoking assignments.

Multiple questions arise when we review our traditional methods of assessment:

- Are these evaluation techniques good enough measures to weigh the performance of learners?
- How can educators be certain that the problem of biasness has been addressed?
- How accurate will the assessment be, considering the all-round development of the learner?
- How can educators identify precisely the needs of individual learners?
- Which parameters can be observed to classify learners in pre-defined categories such interested learners, fast

learners, distracted learners, practical-oriented learners, below par learners and so on.

- How can education be personalized to meet the needs of individual learners?

5. Ascertain Attainment of Goal Trough Analysis

In order to address the above questions, two methods of analysis are used for assessment of learner performance namely Educational Data Mining and Learning Analytics. Both these areas are concerned with the collection, analysis, and interpretation of educational data [7]. Both are used to advance the educational environment and reflect on learning processes [8].

Table 2: Difference between Educational Data Mining and Learning Analytics

Educational Data Mining	Learning Analytics
Develops new tools and algorithms for discovering data patterns.	Applies tools and techniques to answer big picture questions in the education sector.
Analytical thinking required to better understand educational data, retrieve patterns, predict learner performance, identify outliers in student data and forecast learner behaviour	Ability required to evaluate tools and choose the right one as well as suggest actionable measures to uplift learner performance

The iterative process flow derived on our understanding of gamified learning tools and its impact on EDM/LA is as shown in Figure 2.

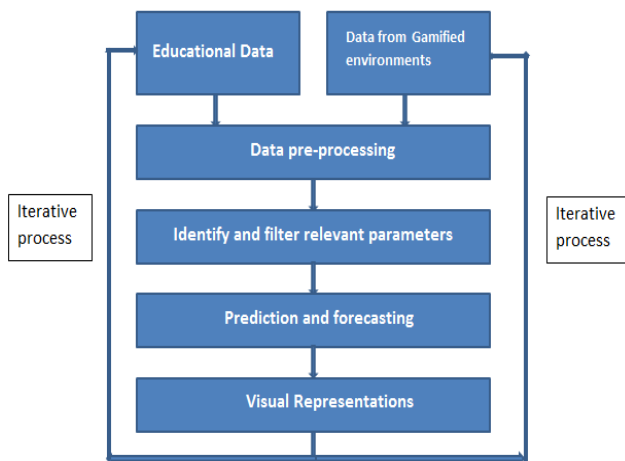


Fig. 2 Process flow for Personalising Education through Gamified Learning

1) Data Sources :

- i) Educational Data can be obtained from empirical student data available with the college. These may include factual data such as examination results, attendance history, placement records, and affiliation with technical student organizations etc.
- ii) Data from Gamified environments tap on the intangible attributes associated each student such as learning potential, strengths and weaknesses, pace of learning, learning methodology adopted etc. These are oriented towards collecting data from game-based learning, gamification, simulation and PBL.

2) Data pre-processing : Techniques such as handling missing values, noisy data and repetitive data is a pre-requisite to obtaining accurate result set.

3) Identify and filter relevant parameters : Classification classifies learners in pre-defined categories such interested learners, fast learners, distracted learners, practical-oriented learners, below par learners and so on. Clustering groups similar performing students and students with shared interests. It also helps in coming up with recommender systems for learners. Classification and Clustering algorithms can be used to identify relevant data and mine meaningful and useful data patterns.

4) Prediction and forecasting: Based on factual empirical data, prediction can be done for already existing sample of learners whereas real time continuously evolving gamified learning data can be used for forecasting new categories of learners.

5) Visual Representations: Dashboards, progress charts, alerts are some of the visual mechanisms used to represent mined data. This gives personalized interpretations of results and targeted actions for different learners.

5. Conclusion

Impact of Gamified Learning in today's education sector especially in the STEM (Science Technology Engineering and Mathematics) subjects has been observed to grow exponentially. With the online educational data growing day by day, the education industry is moving towards a Big Data explosion. New technologies and extensive research in this domain will help enhance the education experience for learners.

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An Innovative Approach to Safeguard Doors from Intruder using Mobile Interfaced Embedded System.

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ABSTRACT

In today's world it is highly appreciable to make use of mobile technology very efficiently, remote Controlling already exists in our daily life and is not a new concept. This paper comes with a new technology in the controlling door locks via Mobile phones. As mobile is now days very common device that every person carries all the time, taking the advantage of this phenomenon; we are going to use this as remote for controlling home doors increasing the luxury of life with some added security.

Keyword : Android, Mobile Phone, Micro-controller, GSM Module, Gas and Infrared Sensors.

1. Introduction

Mobile phones were intended as the name describes for one basic function: portable communication, but the fast technological development turned it to a very important multi-purpose personal device serving as camera, radio, audio and video player, personal organizer, internet and mail browser, also as geographical positioning device and much more. At the same, we use keys in every step in our daily life to unlock various doors and gates, our car, home, office, store and in every one of such places there are more internal doors. In the big organizations, factories, managing a key system is complicated process and mostly lacks proper security.

Wireless communication has been a great transmission of voice and data has a continuous evolution arising to new standards, like Bluetooth Wi-Fi Technologies [1].

The physical key is an integrated and natural part of most people's life. It is a well-tested part of most people's life. But has flaw, in particular, for companies needing access too many different private building with its own lock and key, the distribution of keys to the right employee at the time is a complex and costly affair. Furthermore, carrying a large number of keys is a burden for each employee and increases the chance of keys getting stolen or lost.

2. Traditional System

The problem with physical keys has even bigger implication for companies in the business of goods and inventory warehouse. These companies need access to many different private parts of their properties.

Doors spread over a wide geographical areas and govern by many different owners. Individual need to carry keys for each single door to access the inventory. Carrying all this keys is a hassle in the daily use and the vulnerable to theft. Even securing our homes from unauthorized access is essential, with increasing thefts it is primary concern.

Security is the main concern for everyone. Everybody wants themselves to keep safe or secure from various incidents like theft in their house or accidents caused due to gas leakage .Now days many times we hear news about house robbery or theft in some houses, bungalows, flats. These robberies or thefts take place when nobody is in house or in some cases we find that robbery take place even if people are in their houses. Another problem is about accidents caused because of gas cylinder leakage. Also in case of robbery it would be beneficial if we can get some alert. Let's take an example that we are not in our home and intruder attacks, in such case if we are intimated about theft then we can take necessary security steps.

To overcome all the above stated disadvantages of existing system we have designed a GSM based home security system. It can avoid these undesirable situations, hazardous conditions like LPG gas leakage and theft alerts.

To tackle the above issue, we proposed to replace physical keys with digital keys that:

- Can easily be distributed to user
- Can only be used by the correct user
- Can be specialized for each user so each key will be unique
- Allows many keys to be contained in the same small device.

With advancements in technologies we can also make use of fingerprint scanners to open the locks. Even though fingerprint scanners are implemented for opening locks, we are going one step further and interfacing every activity with mobile phone which would be belonging to owner who can easily keep track of person accessing the property.

3. The Proposed System

System Description:

The Paper proposes to design a system that will have mobile application integrated with the system that will be handling the lock and other security aspects of the design.

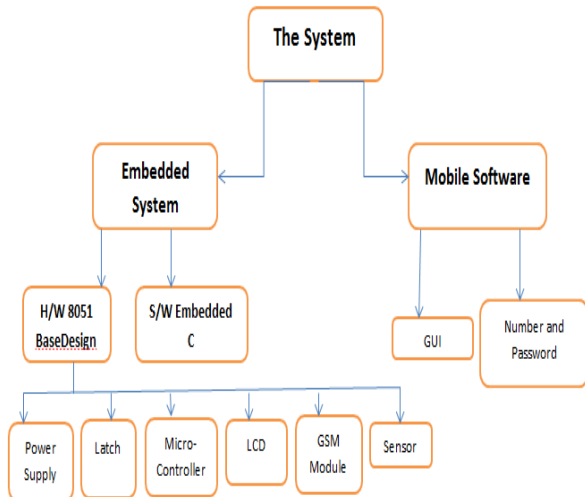


Figure 1: System flow

Initially, we would allow total 5 people to get registered on mobile, the database in which the password and fingerprint will be stored and encrypted

The system will be equipped with microcontroller for managing and processing the signals. The controller will be interfaced with various peripherals like:

1. Keypad
2. Fingerprint scanner
3. GSM module
4. Sensors
5. A to D Convertor

Keypad is required to take password from user, finger print scanner is required for scanning purpose, GSM module is required to interact with the mobile device of the registered users. We would propose to use gas detection sensors to detect gas leakage and intimate the user through GSM module for the preventative measure.

4. Phases of System

Following are the different scenarios user will be using the system:

1. Registering

The user who wants use the system, initially should install our system and download android application of our

system [2][3][4]. User will then get options to register themselves, set a password and fingerprint, which will be stored in the database. The first user would be an administrator, this user will decide which users should be given a notification on opening of door, and will be permitted to store their mobile number for the same.

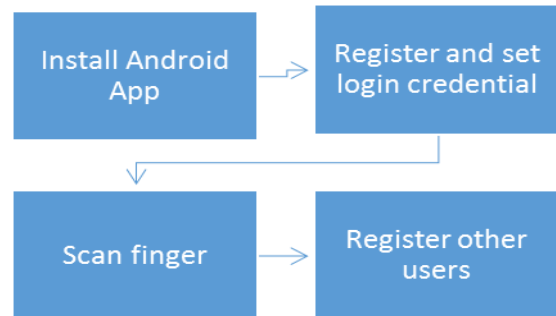


Figure 2: System Flow for Registering user

2. Opening Lock

Any person who wants to open the lock should be firstly a registered user, person needs to scan the finger and enter password on the system, all this credentials will be then verified and a notification will be sent to all the registered users[5][6]. If there is unauthorized access, that user will be denied from accessing the system and notification will be sent to the original user.

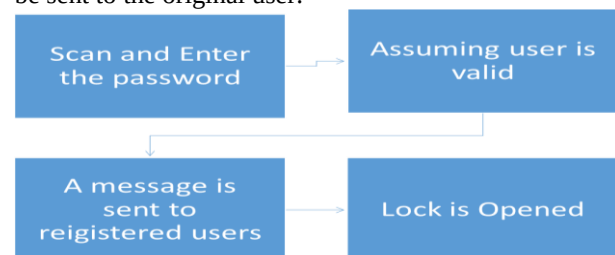


Figure 3 : System Flow for Opening law



Figure 4: A Prototype of the system

3. Theft Detection

Any person to open lock should prove their identity by giving the required credentials, but obviously the user will fail to prove the identity and hence will not be granted access to enter the room. Even if the attacker tries to break the device, there would be provision which will send the notification that the intruder has broken the circuit and is trying to enter the room. Even if attacker without breaking the device tries to enter the room, there would be infrared sensors that would detect the same and send notification to the administrator.

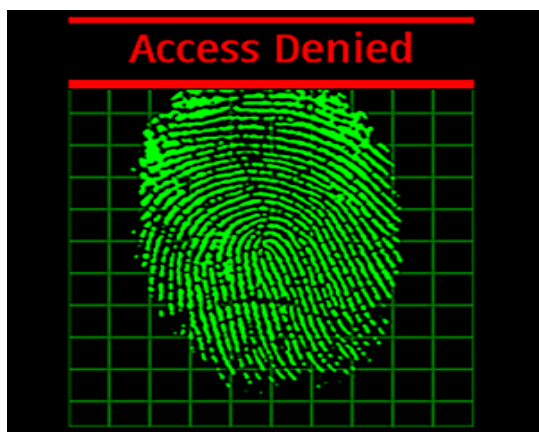


Figure 5: Access Denied

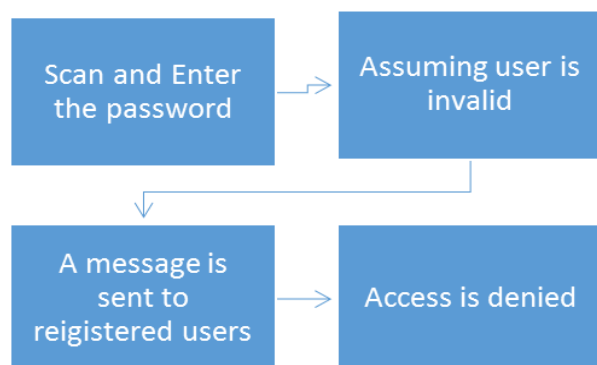


Figure 6: System flow for Access Denied

4. Gas leakage Detection

This is one added feature which provide information to administrator whenever there is gas leakage in the home or in office [7][8]. We would be using gas leakage sensors for the same and intimating the owner about the leakage so that preventive action can be taken[9].



Figure 7: Gas Detection Sensor

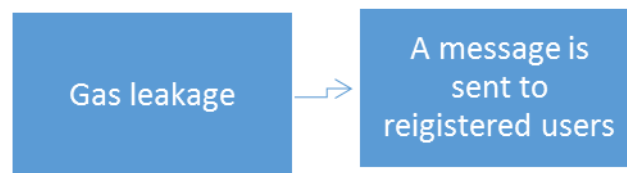


Figure 8: System flow for Gas Leakage Detection

5. Conclusion

In the paper low cost, secure, ubiquitously accessible, auto-configurable, remotely controlled solution for automation of homes has been introduced. The approach discussed in the paper is novel and has achieved the target to control door guarding system remotely using the SMS-based system satisfying user needs and requirements. GSM technology capable solution has proved to be controlled remotely, provide home security and is cost-effective as compared to the previously existing systems. Hence we can conclude that the required goals and objectives of our idea have been achieved. The system is extensible and more levels can be further developed using automatic motion/glass breaking detectors so the solution can be integrated with these and other detection systems.

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Identifying a Set of Phrases for Relationship Predicates

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ABSTRACT

Our main aim is to map predicates to a set of phrases in a knowledge base. The system identifies relationships between entities. It can be used to organize a large number of relational patterns into sets of synonymous patterns. Using this, we can boost Information Extraction (IE) and knowledge-based population tasks by means of its repository of paraphrases for a given relation or predicate. It can also, potentially, enable advanced search techniques over “subject-predicate-object” data.

Keywords : *phrases, relationship predicates, patterns, subject, predicate, object.*

1. Introduction

In recent years, it has become clear that for most information extraction tasks, manually constructed systems are inadequate, because adapting such systems to domain changes is very expensive and time consuming. Thus, there is a growing interest in using machine learning techniques. The main aim of our system, using Information Extraction (IE), is to understand the semantic equivalence of phrases and map them to a canonical form.

Many years of research into Natural Language Processing (NLP) and Machine Learning have resulted in a suite of freely available algorithms capable of extracting information from general text. The specialized nature of text requires the development of new algorithms or modification of existing algorithms.

Our system will deal with the issue of comprehensive gathering and systematic organization of patterns for an open set of relations. The system can then be queried to show a relationship between entities.

Consider the following example:

ENTITY $\rightarrow$ *Dhoni plays for team* $\leftarrow$ ENTITY

↑
RELATION

In the example above, ‘*Dhoni*’ is an entity with ‘*team*’ as the category of the associated entity and their association is described by the relation ‘*plays for*’.

Our main aim is to detect and disambiguate named entities in text and extract binary relations between entities based on patterns in textual or semi-structured contents. The patterns are organized into synonyms and

subsumptions. We aim to join entities which are related to each other by mapping them, for example, sources may use the verbal phrases “*received*” or “*was honoured with*” to say that a person won an award. Also, we make an effort to systematically harvest textual patterns from text corpora, to group similar patterns into sets, resulting into a set of subsumptions. In order to achieve the goals mentioned above, we make use of a dictionary of entity-class pairs such as those provided by knowledge bases like Freebase, or DBpedia.

2. Identifying Relationships

Issues with the Existing Methodology

The information available on the web, with regard to certain entities is in latent, unstructured form. The overall searching process is designed in an absurd manner, and hence, we make an effort to ameliorate this searching process. Consider the following example:

In the existing system, if we enter “*Dhoni plays for team*” as a query, the search engine displays the following as results:

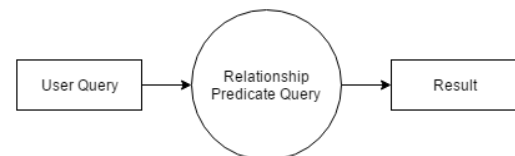
- *Indian National Cricket Team*
- *Chennai Super Kings*
- *Jharkhand Cricket Team*

Now, if fire the query – “*Dhoni is a member of team*”, the search engine fails to produce the same results even though the meaning of the two queries is the same.

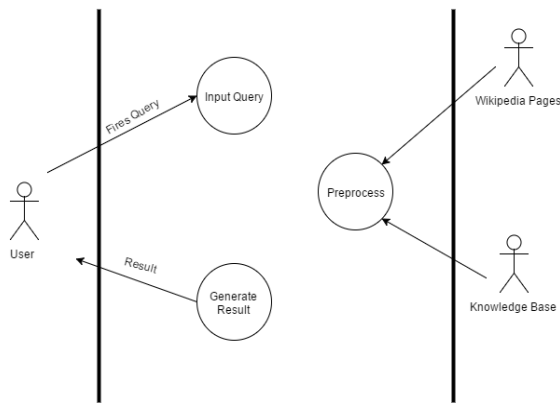
Thus, we can conclude that the existing system fails to understand that both “...*plays for*...” and “...*member of*...” essentially have the same meaning and as a result fails to provide the desired output.

To solve this problem, we propose our model.

Model Architecture



The system will take the user query or phrase, search the various predicate sets (which we will call a “bag” of predicates) and display that set of phrases. All phrases contained within the bag will have the same meaning.



Basic Working

The implementation of our system can be subdivided into two categories based on time of execution – (i) *pre-processing phase* and (i) *real-time phase*. Both phases have a number of steps that have been described in the subsequent section.

Pre-Processing Phase

1. Extract the Relevant Sentences from Wikipedia Articles Using the Knowledge Base

The knowledge base contains facts in a tuple format of the form:

subject-predicate-object

We use these facts to extract similar predicates from Wikipedia. Using Lucene, we search for the object in the subjects Wikipedia page. Pick up the sentence(s) containing the object.

2. Extract Predicates from Sentences

In the previous phase, we have broken down the raw text into a set of sentences. Each item of the set may contain may contain one or more sentences. The main task of this phase is to extract predicates given the subject and object. The OpenNLP library is used extensively to achieve this goal.

Input	Output
Sentences, subject, predicate	A set of predicates

Each sentence is divided into a group of tokens or words. Subsequently, each word is tagged by a “*Parts-of-speech Tagger*” or “*POSTagger*”. Token matching is carried out to detect the position of the object in the sentence. Using this reference, the words preceding the object are picked up as predicates by evaluating their tags.

3. Collection of Predicates

Our main objective is to group synonymous predicates. We work under the assumption that all possible predicates which serve as a relation between a specific subject-object pair must have the same meaning. Thus, for every such pair, we gather all the predicates into a *bag* of synonymous predicates.

This process is repeated for all the different subject-object pairs until we have a bag for every pair.

4. Assigning Weights to Predicates

Now that we have a bag of predicates, we will assign a ‘*weight*’ to each predicate. It is likely that a particular phrase or predicate may have been found more than once. As a result, the bag will contain duplicates. So, we sum up the count of all duplicate occurrences for a specific predicate and associate the sum with it as the *weight* of the predicate. Thus, we have eliminated duplicates and, by means of the weighting system, ordered predicates by likelihood of their occurrence.

Real Time Phase

1. Accept User Queries

This is the initial phase of execution from the user’s point of view. The user will provide the system with a query via the graphical user interface (GUI) of the system. The query will be a predicate that the user wishes to find all other forms of.

Examples:

- *plays for*
- *member of*
- *acted in*
- *had a role in*
- *worked for*
- *employed by*

2. Running the Algorithm

Using the predicate or phrase provided by the user, the system will start searching the collection of multiple bags. Once a match is found within a bag, we return all other predicates the bag contains as a result. The speed of search is reduced because of the weighting system that we have employed.

Input	Output
User query – predicate/phrase	A set of synonymous predicates

3. Software Used

Enlisted below, are the software we use to achieve our goal.

Hadoop

Hadoop is an open-source software framework for storing data and running applications on clusters of commodity hardware. It provides massive storage for any kind of data, enormous processing power and the ability to handle virtually limitless concurrent tasks or jobs.

Virtuoso

Virtuoso Universal Server is a middleware and database engine hybrid that combines the functionality of a traditional RDBMS, ORDBMS, Virtual Database, RDF, XML, free text, web application server and file server functionality in a single system. Rather than have a dedicated server for each of the functionality realms, Virtuoso is a universal server; it enables a single multithreaded server process that implements multiple protocols.

4. Advantages of the System

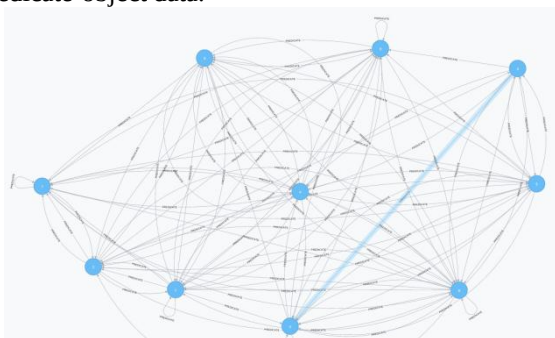
The system proposed by us will provide the following advantages:

- We are able to organize a huge number of relational patterns into sets of synonymous patterns that could potentially be ordered as a hierarchy.
- The system can boost Information Extraction (IE) and knowledge based population tasks by its repository of paraphrases for the various relations.
- It can also (potentially) enhance IE by associating type signatures with patterns.
- The system can enable advanced searching over subject-predicate-object data.

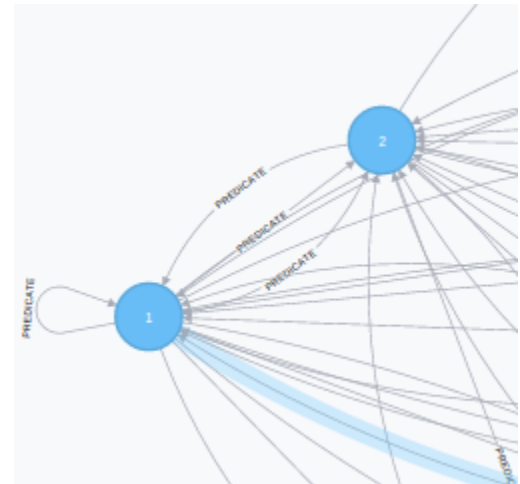
5. Applications

Our system can prove to be a very useful tool in the field of Machine Learning (ML) and Natural Language Processing (NLP). As of this moment, computers are unable to understand that humans can say one thing in different ways. This system makes significant progress in combating that problem by collecting and organizing all the possible phrases (predicates) that can be used to show a relationship between a specific subject-object pair.

Currently, our system collects its data from the DBpedia database. However, we can employ the system on a larger scale such as the web, in order to develop a more comprehensive repository of synonymous phrases. This repository can be made more efficient by sorting the subject and object related by a given predicate into a specific category of entity. A hierarchy of categories can be created to that end. Thus, instead of simply having a collection of synonymous predicates, we can now have graph like structure where each node will represent a category of entity and each edge will comprise of a bag of predicates that have been found to be associating entities of those two categories (nodes). Such a structure can significantly enhance searches over subject-predicate-object data.



The image above shows a potential structure of the aforementioned graph.



6. Results

Query – published in

Output – written in, appeared in

Query – supported by

Output – taught by, advocate of

Query – established by

Output – commissioned by, founded

Query – comprises of

Output – constitutes of, contained within

7. Conclusion

This paper proposes a model which aims to detect and disambiguate named entities in text and extract binary relations between entities based on patterns in textual or semi-structured contents. It maps the predicates to phrases in the knowledge base and thus develops a repository of synonymous relations.

8. Acknowledgement

We would like to thank Prof. Pankaj Vanwari (Professor, VIT) for guiding us in writing this paper. We would also like to thank Prof. Sachin Deshpande, head of Computer Engineering Dept. for motivating us.

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An Intelligent System for Tourism Management using k-medoids Algorithm

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ABSTRACT

Nowadays most of us have a small computing device that is always with us. Mobile devices with GPS receiver are also used to find paths in navigation. Tourists have access to a lot of different web sites in order to find information about destinations, accommodation, means of transport etc. The main disadvantage of those systems is that we have to know places, which we want to visit. Already existing systems do not give the consolidated plan of a trip. The main idea of "An intelligent System for Tourism Management" is to design a system that will run on most of phones and will be helpful when visiting some new places and cities. This system should be able to create a dynamic itinerary, which satisfies user constraints. Those constraints should be simple like duration of a trip, health constraints, user interests etc. It should be able to estimate time needed to travel from one object to the next and the hotel at which user should stay. The system will generate the most cohesive itinerary which fulfils the user constraints. It should be helpful for people that want to visit a city without having much information about it.

Keywords : Intelligent Systems, k-medoids Algorithm, Knapsack Problem, Tourism, Travel Itinerary, Travelling Salesperson Problem

1. Introduction

To make a successful trip one must prepare for it. At the beginning, a city, which will be visited, should be chosen. After that those places, buildings and monuments, which are important and will be seen need to be selected to include in the trip. It is very important to calculate the trip cost and the time needed for it. Sometimes people do not have enough time for planning. Most of them ask friends or go for trips organized by tourist companies where a professional guide is involved. It will be very helpful if a system that provides all information needed to visit a city is available. This system should have the data about the places to visit in a particular area. It can be difficult for some people to decide the sequence of activities to do after reaching a particular place, but if there a system, which gives an itinerary based on his constraints, it will be useful.

Today, we have GPS (*Global Positioning System*) receivers and navigation programs, various informative websites and portals which allow ticket booking etc which are very useful but none of them can prepare a travel plan if we feed

them with information like this "I want to visit famous museums in this city and I can only give 4 hours/day. But I have cardiac problems". "An Intelligent System for Tourism Management" is an expert system, which will take above user constraints as input. The constraints will like his likes and dislikes, time constraints, health constraints etc. The system will generate the most cohesive itinerary based on his constraints. The system will display an optimal itinerary inclusive of transport and suggest the hotel at which user can stay.

The system will be developed on Web as it's the most convenient way for users to interact with the system.

2. Overview

Normally, a customer would have to go to a tourist agency and sit with an agent. This process is not only time consuming but also expensive. With the help of the expert system, he just has to enter his constraints: preferred places, time, health issues etc. and the system will create the most cohesive itinerary for him. Thus, this application aims to eliminate the involvement of third party.

Another point as to why this application is much needed is because of a lack of a single application, which provides all the details. For example, a site like makemytrip.com provides hotel details scattered throughout the particular city of interest. It may not provide the best-fit place of stay, which are application aims to provide (best-fit here, refers to easily accessible from all places of travel). Also, existing sites do not provide personalized tours for each user; rather they do not provide any tours at all. Our application aims at doing so, keeping in mind the users constraints. Hence, it is a viable application just for its cost-effectiveness, time-saving and easy-to-use, goal-oriented approach.

3. Related Work

The idea behind 'An Expert System for Tourism Management' was conceived on referencing the technical paper 'An Expert System for Tourism Information Management' by Ritu Chauhan, published in the International Journal of Computer Science and Communication [1].

The basic constraints are analyzed in this paper. Trip features associate to user interests in tourist programs, they are as follows:

1. Trip Duration is numbers of days offering by each trip.
2. Trip Categories is type of trip including shopping, eco tour, and scuba diving and trekking.
3. Trip Lowest Price is the lowest prices for trip expenses.
4. Trip Highest Price is the lowest prices for trip expenses.
5. Trip Destination is the country of visitation.

Instead of taking the country of visitation as the trip destination, we will be taking the city of visitation as the destination.

Another paper titled ‘Mobile Tourist Guide – An Intelligent Wireless System to Improve Tourism, using Semantic Web’ presented by Samir A. El-Seoud and Hosam F. El-Sofany in the ICL2010 Conference provided some pointers [2], which support the main concept provided in the first paper.

The following are some services and functionality provided by the proposed research study:

1. The system provides general information of hotel, restaurant, shops, hospitals, and companies. As well as the newest events of the plaza and shops.
2. The system provides service of hotel, restaurant and cinema-ticket reservations.
3. The system provides service of displaying the shortest path between the sources and destinations the visitors specify.

Though all of the above functionalities do not correspond to our project, the above points provide a basic framework of services that could be included in our project like general information of tourist spots, hotel reservation, displaying the most convenient path between the source and destination.

PROPOSED DESIGN

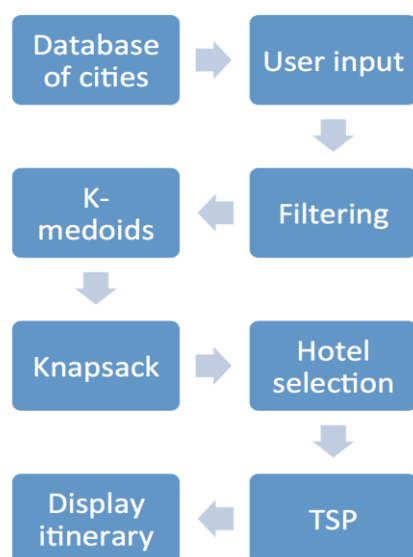


Figure 1 : Block Diagram of System

Phase 1: Database of cities

In this phase, we have built the database of each city in the following fashion:

Table 1 : Description of Database

Name of the table	Purpose
Distance	Stores all the physical distances of one place to every other place.
Detail	Stores the constraints for every place (category, time, budget, health, age, gender, popularity)
Cars	Stores the capacity and rent/km for every car
Form	Stores all the user entered data
Age	To identify the age group of user
Gender	To identify gender of user
Preferred	To identify the preferred places by user
Hotels	Stores the physical distances of every hotel with every other place
Hotelprice	Stores the price, capacity for every hotel
Finalpids	Stores the pids of the places after filtering based on user constraints

Phase 2: User Input

The user will provide his inputs via a simple form. In this form, we have asked the user to enter his preferences with regards to the kind of places he would like to visit (whether they should be places of adventure, relaxation, etc.). The user also, specifies details about himself/herself like his age, sex, health preferences, number of days he would be visiting the city, the duration he would like to spend travelling every day, etc. These constraints, which are both implicit and explicit in nature, will be analyzed in the next phase.

The following implicit and explicit constraints will help decide the structure of the itinerary:

1. Implicit constraints:
 - a. Age:

Age is a constraint because interests sometimes depend on age. For example, old people are less likely to go for trekking, children would prefer going to parks etc. Also, there can be health or safety issues related to age.
 - b. Sex:

There can be places where people of a particular sex are abandoned to go or would not prefer to go. For example, there are some temples where ladies cannot go.
2. Explicit constraints:
 - a. Likes and dislikes:

This is a very important constraint. If user has some constraints like he wants to visit museums or does not want to visit parks etc., the itinerary must take care of it.
 - b. Time constraints:

Number of days user wants to stay in some city and how much time per day he wants to spend in visiting places must be considered.

- c. Health constraints:
User may have some health issues so he may not be able to perform some activities.

Phase 3: Filtering

In this phase, we have filtered the places in the database on the basis of the implicit and explicit constraints [3] which have been discussed in the previous step.

The user input is compared with the values in the database to give the desired output. Simple MySQL queries are fired and result for every constraint is stored. An intersection of these results yields the places the user can visit according to the constraints he provided.

Phase 4: K-Medoids

Finally, the filtered places are provided as input to the program which will yield the final itinerary. These places will be grouped together based on their physical distance to one another. In order to perform this task, the K-Medoids algorithm is used [4]. The purpose of using the K-Medoids algorithm is that the places are grouped together based on their distance to the medoid, which is the centrally located element in the cluster.

The following are the steps in the K-Medoids algorithm:

- Step-1: Initialize: randomly select (without replacement) k of the n data points as the medoids
Step 2: Associate each data point to the closest medoid. ("closest" here is defined using any valid distance metric)
Step 3: For each medoid m
For each non-medoid data point o
Swap m and o and compute the total cost of the configuration
Step 4: Select the configuration with the lowest cost.
Step 5: Repeat steps 2 to 4 until there is no change in the medoid.

Here, 'k' corresponds to the number of days the user wants to visit the city.

Phase 5: Knapsack

It may so happen that after the clustering has been done, a particular cluster may have a number of places, which is high, thus, becoming extremely unreasonable to visit. Thus, in order to filter places in such a scenario, we have implemented the knapsack algorithm.

In the knapsack problem, we are given a knapsack of capacity 'm' along with 'n' objects. Every object has some weight and profit associated with it. Knapsack problem is nothing but selection of some or all given objects such that their total weight does not exceed the capacity of knapsack and at the same time, profit should be maximum.

The following are the steps in the Knapsack algorithm:

- Step 1: Find p/w ratio of all 'n' objects
Step 2: Arrange objects according to descending order of their p/w ratio
Step 3: Fill knapsack less than or up to its capacity

In correspondence to our scenario:

Capacity 'm' corresponds to the duration that the user wants to travel per day.

'n' objects are the number of places in the particular cluster.

The weight corresponds to the time spent at each place.

The profit corresponds to the relative popularity of the place.

Phase 6: Hotel Selection

We aim to provide a hotel which is located at the least distance from each of the clusters. This is done by comparing the distances of all the hotels in the databases with the medoids of the k-clusters, as the medoid is the centrally located element in the cluster. In this manner, we find a hotel which minimizes travel time on each day.

Phase 7: TSP

The traveling salesman problem consists of a salesman and a set of cities [5]. The salesman has to visit each one of the cities starting from a certain one (e.g. the hometown) and returning to the same city. The challenge of the problem is that the traveling salesman wants to minimize the total length of the trip.

In our application, the places of interest, which are present in each cluster correspond to the cities in the TSP problem and the hotel found in phase 6 is the start and end point.

The solution to the TSP problem is the minimum distance order of visitation on each day.

Phase 8: Display itinerary

The final itinerary, which contains the day-wise, time-wise order of visiting the places is displayed along with the estimated budget. The estimated budget contains the hotel stay cost, the car rental cost and any surplus charges that may be encountered while visiting a particular place.

2. Conclusion and Future Scope

At present, our application gives as output a day-wise itinerary which adheres to the specifications of the user. The fact that an application which provides an optimal solution based on time and expenses does not already exist is a prime reason for the existence of this application. It takes into consideration various constraints like the users preferences, health limitations, age, sex, popularity, etc. Generally, applications suggest a variety of hotels but these hotels may not be optimal in the sense that they may be close to only a few places and far away from most. We have aimed to provide a hotel accommodation which minimizes the travel time on any given day. At the end, we have an estimated budget, which comprises of the cost of the hotel stay, the car rental and any surplus charges that may be encountered at the place of visit. The application minimizes the efforts of a user as the user only has to fill out a simple form to get an optimal itinerary. It also, eliminates any third party involvement, hence, saving the time and money of the user.

Future Scope

In the future, we are looking at extending our application to cover the following features:

1. Expansion of cities
Currently, our database fully covers Pune city. We are looking at expanding the database to cover various other cities across the state and then, in the country.
2. Constraints satisfaction percentage
While travelling in a group, different people may suffer from different ailments and have different preferences. Thus, instead of generating a single itinerary, we are planning on generating multiple itineraries which satisfy different constraints. Each itinerary will be displayed with the percentage of constraints it satisfies. The user can choose the itinerary which he finds most favorable.
3. Past user mapping
In case of any similarity in inputs with respect to the past users, an itinerary can be instantly generated.
4. Dynamic Hotel Booking
While suggesting the hotel, we will consider the available rooms and the number of people in the future.
5. Budget consideration
In the future, we will consider the lower and upper limit of the budget and make modifications to the itinerary and chosen hotel appropriately.
6. Public transport option
Currently, the default transport option is a car rental service. In the future, alternative public transport likes buses, trains, etc. will be suggested.
7. Dynamic condition analysis

In the future, the exact dates of travel will be taken and correlated against the actual calendar to account for hoidays, etc. Special conditions like the weather, public holidays, timings for a place will be considered and the itinerary will be revised.

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YouTube Sentimental Analysis and Cyber Surveillance

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ABSTRACT

Over the years, the evolution of Web 2.0 such as social-networking sites, video sharing sites, wiki & blogs, etc. has been witnessed which has remarkably added on the volume of community-shared textual & media resources which includes posts, comments, videos and images.

Furthermore, Web 2.0 has become a competent communication platform for people to communicate among each other where they promote their ideas, creativity, share resources etc. Due to this reason, various destructive users have also been fascinated towards video social networks. Among all the above video sharing sites, YouTube is the most famous and the largest free video social network. An important percentage of data uploaded on YouTube contains deplorable content and they offend the YouTube community guidelines. In today's scenarios, YouTube contains several copyright violated videos, spam's, hate and extremism promoting videos, cyber bullying which consist of vulgar and indecent material. This is primarily due to more ambiguity and low disclosure barriers to content uploaded. In this paper we have studied the current ways for recognizing cyber bullying promoted through video social networks like YouTube.

Keywords : YouTube; video social network; video sharing sites; cyber bullying; harassment.

1. Introduction & Research Motivation

We can post and look for infinite amount of videos in YouTube and other social networks for free of cost. Along with it, they support a lot of social networking features. For example, a user can like or dislike a video, they can place it on any social networking sites such as Facebook, Twitter, LinkedIn, Instagram etc. Along with these a user can put various comments in textual form, subscription for a particular channel can also be done as well as look out for any video with the help of keywords & categorical classification and combine with other users by comments and replying on the comments.

According to YouTube data analysis, YouTube has 1 billion unique users. In each day people watch thousand millions of hours of videos on YouTube and develop billions of views. YouTube has various community guidelines[10] given on its website in order to restrict users to post improper or irrelevant content. In spite of these community guidelines, large number of inappropriate content is available on YouTube[1]. Enormity, low publication obstacles and high reachability of videos worldwide has led

users to post various cyber bullying, malignant, inappropriate content on the website. This shows cyber bullying & harassment as major problem for YouTube.

In YouTube and other video social networks, we can explain cyber bullying as unauthenticated video shooting of a person and posting it on website. If the content in the video are negative or bad (such as vulgarity, harassment, violence and abuse) then public acknowledgement disclosure of such content can be considered as harassment of the person in the video. There are two types Cyber Bullying and they are intentional and unintentional. Many a times users upload videos on a website and due to various threats to them and this affects one or more number of people. For example, violent, abusive, harassed and humiliating act that destructs the claimant's Ethics and self-respect. And many times users upload various clips and videos of the any person without having any intent to hurt them.

Table I shows analysis of few videos uploaded on YouTube. These analysis are collected in August 5th 2016. Table I shows that large number of cyber bullying videos are liked and shared on YouTube. We also noticed several key words that are present in the title and description revealing that the videos are repulsive according to YouTube policy.

There are many papers that are published on cyber bullying. But so far no review paper in this existing research has been published consolidating this topic. Our paper aims to provide an analysis of the intellectual research and work done in this section by various researchers. This paper is structured as follows: Section II describes methodology used to carry out this analysis; followed by cyber bullying theory which have been described in Section III & Section IV; Features differentiating cyber bullying videos have been encapsulated in Section V; Section VI covers the present ways for cyber bullying detection; Further, Research directions and future challenges are noted in Section VII; lastly Section VIII concludes the analysis.

2. Methodology

This is an general view approach for cyber bullying on YouTube has been done after a systematic review with main approach in major digital world for computer science have been searched as IEEE, Google, for concerned topic. We focused on papers which were released in 2009, as new implementation of web technology was augmented and became famous later.

YouTube was launched in February 2005, which got a boost when it was introduced by Google in 2006. People faced some difficulties with YouTube & other social video website for communication and hence making inappropriate use of it.

Papers were revised on the basis of titles and abstracts of all the papers. Papers which are relevant to the topic were selected on the basis of the revision Papers. Though every paper is based on Detection of Cyber Bullying Concept.

Looking in to the previous results new researchers can easily evaluate what work is to be done, and how to carry out the work form this point which will help in accurate results.

TABLE I. Sample of few cyber bullying & harassment videos (posted on you tube) and their statistics. (* = number of)

Sr.	Video ID	Category	*View	Duration (Sec)	*Like	*Comments	Key Terms	Uploaded Date
1	Fz_AxXR	Entertainment	81,205	344	70	20	Ragging, kissing	27/01/2014
2	jtnLIExFb	Entertainment	667	39	10	1	ragging, seniors	29/12/2014
3	Brg9vZaJq	Entertainment	1,823,	547	468	125	ragging, girls,	01/12/2010
4	kxQwb5n	People & Blogs	2,737,	80	1,106	41	girls, hostel,	17/12/2013
5	RwN9OY	People & Blogs	252,01	772	91	54	ragging, juniors	05/09/2012

3. Cyber Bullying Defined

Cyber bullying is the use of cell phones, instant messaging, e-mail, chat rooms or sites such as Facebook and Twitter to harass, threaten or intimidate someone. Cyber bullying is often done by children, who have increasingly early access to these technologies. The problem is compounded by the fact that a bully can hide behind pseudonymous user name, disguising his or her true identity. This secrecy makes it difficult to trace the source and encourages bullies to behave more aggressively than they might in a situation where they were identified.

Because the use of mobile and online communications has grown so rapidly and the crime is relatively new, many jurisdictions are deliberating over cyber bullying laws. However, the crime is covered by existing laws against personal threats and harassment.

4. Types of Cyber Bullying

Cyber bullying can be simple by continuously sending emails or text messages, harassing someone in response to some action. In addition of public actions such as repeated threats, sexual remarks, pejorative labels (i.e., hate speech) or false allegation, ganging up on a victim in online forums, posting false statements as fact aimed discrediting or humiliating a targeted person. Nine different types of cyber bullying were identified from the literature [8]; these are listed below:

1. *Flooding* consists of the oppressor that takes control of the media so that the victim cannot post a message.
2. *Masquerade* involves the oppressor logging in to a website, or program using another user's name to either oppressor a victim or damage the victim's reputation.
3. *Glomming*, or *blazing*, includes more than two users attacking each other on a personal level.
The communication consists of a violent, short lived argument, and there is bullying language in all of the users' posts.
4. *Trowling*, also known as *baiting*, includes intentionally posting comments that disagree with other posts for the purpose of annoying a fight, even if the comments don't necessarily reflect the poster's actual opinion.
5. *Harassment* most closely focuses on traditional bullying with the stereotypical bully victim relationship. This

type of cyber bullying involves repeatedly sending displeasing messages to the victim over an extended period of time.

6. *Cyber stalking* and *cyber threats* involve transferring messages that include threats of harm, are intimidating or very destructive, or include extortion
7. *Denigration* involves discussing about someone who is online. Writing sexual or false rumors about someone to another user or uploading them to a public community or website falls under denigration.

5. Features Distinguishing Cyber Bullying Videos

Table II lists the category of various characteristic used for detecting of cyber bullying content on YouTube. Features on the basis of which cyber bullying content discriminated are user based content and contextual based content. User based features are the properties of the profile of the user & the behaviour in social network and content based features are the properties of the text posted by users.

User based has various features like:

1. **Subscribers:** Cyber bullying promoters have very less number of subscribers.
2. **Subscriptions:** Cyber bullying promoters always tend to have very large number of subscriptions.
3. **Reputation:** It is the ratio of subscribers to the addition of subscribers and subscriptions. Cyber bullying promoters have comparatively very less reputation.
4. **Age of promoters account:** It is obtained from present date and account creation or registered date. Cyber bullying promoters encouraging such things will have generally new accounts so this feature has less value for cyber bullying promote content based features divide this metadata into four main categories:

Features Extraction

This step deals with fetching all the meta-data of available features of a video on YouTube using YouTube API and dividing the feature set into four categories: linguistic based feature, temporal and popularity based feature, YouTube category feature. Popularity based features include ratio of likes by view count, ratio of subscribers by view count etc. YouTube category feature tell us about the category of the video such as entertainment, music, sports etc and temporal based feature include duration of the video.

Text Preprocessing

In this step the fetched (linguistic based) datasets are pre-processed. Text preprocessing involves tokenization and stop-words removal. Tokenization is a process (word level) of breaking up the complete sentence or line into smallest meaningful elements called as tokens. Stop words are very common words used in a sentence which are filtered out prior to, or after processing of text. Since the presence of stop words affect the performance of the algorithm. So, after tokenization the Standard English stop- words list given on the Web is used to remove such words from the token list.

Textual Similarity

In this step similarity between the token of title, description and comments of sub-problems with their respective lexicon list have been calculated. To compute the similarity of cyberbullying (dirty) terms, a standard bad- word lexicon [32] given over the Web is used. For some categories like violence terms in educational area and in public places, ragging related terms, people type etc own lexicon list is made.

Identification and Characterization of Discriminatory Features

Characterization is a process by which features can reveal the behaviour of an object (video). In- depth analysis of the meta-data of YouTube video has been conducted to identify patterns which can be used as markers for the classification task. The analysis concludes the high importance of retrieved meta-data for the classification task.

6. Approaches For Cyber Bullying Detection

Different techniques have been used by researchers to find out the cyber bullying in various online social networks. We are focusing on work that has been done to search cyber bullying in video social networks & few popular online social networks. Table III indicates the summary of some papers reviewed regarding the detection of cyber bullying in these social networks.

Significant work has been completed by Nisha Aggarwal et. al. [1] in year 2014, which used one class classifier approach and characterization study on number of sub-problems: vulgar video detection, abuse and violence in public places and ragging video detection in school and colleges to search privacy invading harassment and misdemeanor videos by mining YouTube video metadata. The result shows that identified content based discriminatory features can be used to exploit the harassment detection on YouTube up to a equitable accuracy. Whereas, linguistic features and temporal based features seems to be more influential for precision.

Vidushi Chaudhary et. al. [2] define the problem of video response spam detection as a one-class classification problem (a recognition task) and partition it into three subproblems: promotional video recognition, pornographic or dirty video identification and

automated script or botnet uploader recognition. The empirical analysis for each classifier of sub-problems based on certain linguistic characteristics, temporal characteristics, popularity based features, time based features opt-out with the 80% accuracy display only the metadata of the YouTube video is discriminatory enough to recognize spam on YouTube

Maral Dadvar et. al. [4] applies comments feature for detection of cyber bullying in MySpace corpus with the help of content based and user based features. One restriction of this approach is the limited size of the dataset. A larger and more different information can help in automatic cyber bullying detection.

Close analysis of the language used in cyber bullying has been done by April Kontostathis et. al. [5] and spreading his work by using supervised machine learning approach in cyber bullying detection.

It is more clearer that cyber bullying occurs via offensive messages posted on social media. Since, the textual data on online social media are highly unstructured, informal, and often misspelled; Ying Chen et. al. [6] offer the Lexical Syntactic Feature (LSF) architecture to identify displeasing content and identify potential offensive users in various online social media like YouTube

Searching of online harassment is feasible when Term Frequency Inverse Document Frequency (TFIDF) is supplemented with contextual features and attributes; this has been proved in the research by Dawei Yin et. al.

A. Contextual features are divided in two categories:

1. *Similarity Feature [9]*: In this feature, each post checked with its k neighbors, also compared it with the first uploads of a comments thread. This is based on the heuristic that the first uploads shows the topic of the thread. Along with that, it also compared with the average information of a thread. The potential to be cyber bullying positive are the post which are different from thread average.
2. *Contextual Post Feature [9]*: In this feature, each one is represented as the vector sum of its neighboring uploads. This was shown based on the assumption that there will be a reaction in posts which are near a cyber-bullying post. So, the cluster of them near a cyber-bullying post should look distinguished from the cluster of posts which are near normal posts.

7. Conclusion

Cyber bullying is a serious problem on video social networks like YouTube and becoming a major threat to teenagers and adolescents. The main goal of research was to design a system for automatic detection of cyber bullying and misdemeanor incidents on YouTube & similar video sharing websites and to discuss the performance of cyber bullying and misdemeanor detection algorithms.

This research presented Shark Search algorithm and Naïve Bayes algorithm based classification approach for automatic identification of videos and users promoting cyber bullying. Research findings and performance evaluation results revealed that the Shark Search algorithm based approach correctly able to identify cyber bullying and misdemeanor promoters with 83.65% accuracy.

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Density Based Traffic Controlling Systems using Artificial Neural Networks

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ABSTRACT

The worst adversary of the masses dwelling in an urban lifestyle is commute. The exponential rise in the number of vehicles and public transport options has led to an inevitable increase in congestion of pathways, which has, necessitated the need for an efficient traffic congestion control mechanism. The existing system is static and works at static intervals of time. Hence, if the density of vehicles increases on one of the roads, manual intervention is required. The proposed system not only takes into consideration the density of vehicles on the roads, but also the road condition, accidents, catastrophic events and festivals in a city which lead to traffic congestion. These scenarios are handled intelligently to manage the traffic by using Fuzzy Logic and Artificial Neural Networks. Depending on the traffic scenarios, the system will make decisions of routing the traffic through the non-congested path. Fuzzy logic will be used in combination with neural networks for recognizing traffic patterns and decision making. The proposed algorithm will optimize the flow of traffic, reduce fuel consumption and result in a congestion free drive.

1. Introduction

Transportation is one of the most fundamental systems in the world today. Individuals increasingly rely on the ability to travel longer distances in shorter amounts of time to accomplish their personal and professional tasks. Among all forms of transport, vehicle transportation through the road network is perhaps the most important for people in many parts of the world particularly India. The condition of roads plays a vital role in having a smooth ride. Commuters seek not only for less waiting time at junctions but also for minimal fuel emissions. The startling fact about fuel consumption states that fuel worth Rs.1,000 crore is wasted every year in Delhi by vehicles idling at its 600 traffic signals. Back of the envelope calculations show that each vehicle owner in the city can save over Rs.3,100 annually just by ensuring that his or her car is switched off at every red light that lasts for more than 14 seconds. The statistics for fuel consumption (in millilitres) are illustrated in table 1.1 for three categories of vehicles namely light motor vehicles, medium motor vehicles and heavy motor vehicles [10][11].

Vehicle Range	Vehicle Type	Idle fuel consumption (mL for diesel/petrol)			
		1 hr	15 sec	30 sec	60 sec
Low Motor Vehicle	Motorcycle	162	0.675	1.35	2.7
	Motorcycle	241	1.004	2.008	4.016
Medium Motor Vehicle	Tata Indica	590	2.458	4.916	9.833
	Tata Sumo	717	2.987	5.975	11.95
	Esteem	740	3.083	6.166	12.33
High Motor Vehicle	Bus	3210	13.37	26.75	53.50
	Truck	942	3.925	7.850	15.70

Table 1.1 Idle Fuel Consumption

2. Literature survey

Madhavi Arora and V. K. Banga [5], have evaluated morphological edge detection and fuzzy logic techniques that are used to solve traffic congestion by developing an intelligent traffic control system which measures the density of vehicles on the roads and controls the traffic. Morphological operations and fuzzy rule base was used in controlling traffic. S. Rajeswari [6], developed an Intelligent Traffic Light Controller (ITLC) to reduce the traffic congestion by using microcontroller AT89c51 and infrared sensors. Farheena Shaikh and Dr. Prof. M. B. Chandak [8], have focused on two objectives of sensor networks. Firstly, calculating the density of vehicles using IR sensors and secondly priority based signalling for emergency vehicles using GPS. V Vaidhehi and Sonam Somarajan [9], have proposed RFID chips that allow emergency vehicles like ambulances to move faster and also incur the use of IR sensors which contribute in invigilating whether the road is idle or jammed and thereby control the traffic lights.

3. Process overview

Methodology

A distributed set of agents known as traffic signals, arranged in topology which mimics the neural network, are connected to the central server. Each neuron or node senses the traffic information using sensors and sends it to central system. So the central system has a bird eye view of traffic signal network due to which it can perform analysis and provide

solution according to the changing traffic scenarios. After receiving data from agents, it is computed using fuzzy logic. The outputs of this data are some patterns. These patterns are then learned and recognized to identify situations and take relevant action. Any catastrophic condition leading to increase in the density of vehicles is handled by the supervised algorithm. The system will simulate traffic scenarios and showcase different catastrophic situations where the algorithm will take the best fit to handle the Traffic menace. It will take best effort in minimizing the time taken in decision making thereby providing a smoother ride for vehicles.

4. Proposed system

Traffic control system Architecture

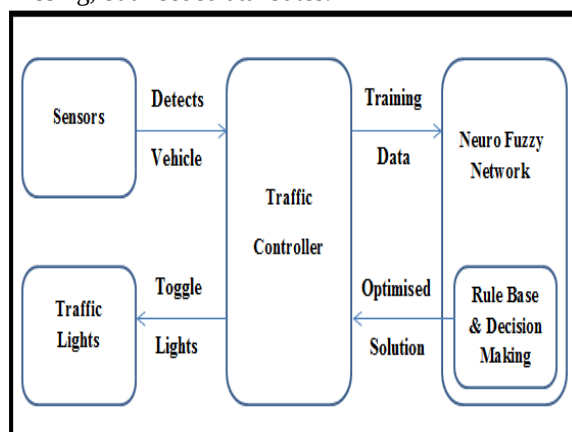
Figure 3.1 shows Traffic control system architecture. First the data is collected from the node or agents which are the signalling systems, arranged in topology which mimics neural network. Each neuron or node collects traffic information and sends it to central system. Here neural structure of grid helps data to be collected in parallel and in specific form which indeed helps to process data using fuzzy logic algorithms. After receiving data from agents, it is computed using fuzzy logic. The outputs of this data crunching are some patterns. These patterns are then learned and recognized to identify situation and take relevant action. Utilizing artificial intelligence to adapt traffic dynamics and to renew traffic control strategies, the system will support a highly efficient, self-organized and self-coordinated traffic control mechanism.

Design

The detailed design consists of various steps which are illustrated as follows :

1. Pre-Processing Map Data

SUMO is a traffic simulator and a suite of applications, which helps to prepare and perform the simulation of a traffic scenario. SUMO uses its own formats for road networks and traffic demand, both have to be imported or generated from existing sources of different kind. Having the simulation of large-scale areas as the major application for sumo in mind, much effort has been put into the design and implementation of heuristics which determine missing, but needed attributes.



With SUMO there are different possibilities for importing a map. One of these possibilities is importing an OSM file. An OSM file is an extract from the service OpenStreetMap. OpenStreetMap (OSM) is a place to create a free editable map of the world. By using the website of OpenStreetMap, it is possible to export a square area to an OSM file. But sometimes a map from OpenStreetMap does not have sufficient information relevant to user specific needs. Hence other software's like JOSM are used to edit the map attributes according to user's specific needs. (Java OpenStreetMap Editor) is an editor for OpenStreetMap data.

2. Extraction

Once the road network and traffic descriptions are ready, the simulation can be run. For the simulation to be useful the user needs some kind of output. The most obvious output is the visualization generated by the SUMO GUI. One way to extract information in real-time (during sumo run time) is through TraCI interface. TraCI is the short term for "Traffic Control Interface", which gives access to a running road traffic simulation and allows to retrieve values of simulated objects and to manipulate their behaviour in real time.

3. Neural Network

Once the data is extracted out of the SUMO simulator, it is given to the Neural Network for training. This part of the neural network is really crucial in training networks as it helps to rectify bad prediction and overcome erroneous prediction. This makes prediction better. One way to compute an overall cost is to take each error value, square it, and add these values together. Multiplying by one half will make things simpler down the road. Now that we have a cost, our job is to minimize it. When someone says they're training a network, what they really mean is that they're minimizing a cost function. The cost is a function of the weights on the synapses. Cost is minimized by changing the weights. Evaluating cost function for a specific value of w . If w is 1.1 for example, we can run the cost function, and see that J is 2.8. What if we could figure out which way was downhill? If we could, we would know whether to make W smaller or larger do decrease the cost. We could test the cost function immediately to the left and right of the test point and see which is smaller. This is called numerical estimation, and is sometimes a good approach.

4. Conclusion

Traffic congestion is becoming a serious problem with the increasing number of vehicles plying on the roads. Many techniques have been developed to automate human intervention but machine learning technique has eliminated the problems observed in the manual and conventional traffic control system as the flow density was varied according to real life traffic situations. As the waiting time of the vehicle increases, a lot of noise pollution is caused and fuel is

also wasted. The proposed system is trained with traffic scenarios and these scenarios will be handled intelligently when traffic congestion occurs. In the fixed time controller which is a closed loop system, the green time is not extended no matter what the density of the cars at the junction is. The proposed system will reroute the traffic if one signal is heavily jammed with traffic. Since efficiency of any service facility is measured in terms of how busy the facility is, we therefore deemed it imperative to say that the system under question is not only highly efficient but also has curbed successfully the menace of traffic deadlock which has become a phenomenon on our roads as less waiting time will not only reduce the fuel consumption but also reduce air and noise pollution.

5. Future Work

Further enhancement to the proposed system can include development of Intelligent Traffic Controlling systems that can be used to manage traffic congestion across the complete city rather than a '+' junction. Re-routing the traffic can be known well in advance during taking off from the source point. Emergency vehicle's presence can be tracked and other vehicles can be directed to an alternative route. The proposed system can be extended to unsupervised learning.

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Career Counselling and Prediction

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ABSTRACT

With the increase in the number of career paths in various fields, the problem of deciding a single career path has become very much common. According to survey conducted by the Council of Scientific and Industrial Research's (CSIR), about 40% of students are confused about their career options. As a result of this confusion, many people land up in a career path which was not meant for them and realize this at a very later stage in life. Thus, it becomes important to get to know which subject / career path is most suitable for them. The system will evaluate the student's personality trait, interest and capacity and based on the results of evaluation, it will suggest an appropriate career path using data mining. Thus, this project aims at developing a web application using data mining that would help students to select an appropriate career path for themselves using their personality traits, interests and their capacity.

Keyword : Career prediction; Data mining; Personality traits; Decision tree.

1. Introduction

Selecting the appropriate stream of subject is one of the most important aspect in the career of a student. Many students do not know at the school level that which is the most appropriate career path/ stream that they should take up in high school. Also, there are many sub-sections in each subject which many students can neglect. The reasons for choosing a wrong career path maybe as follows: unawareness of self-talent and self-personality trait, unawareness of the various options available, equal interests in multiple fields, less exposure, market boom, assumed social life, peer-pressure etc. There are numerous fields like arts, accountancy, literature, medicine, engineering, management etc. in which a student can prosper. But knowing the career which is most suitable for them is an important decision to be made at an early stage. At a nascent age, a student tends to make the wrong choice because he or she is completely clueless about what they want to pursue. Long term consequences of selecting a wrong career could be work dissatisfaction, poor performance, anxiety and stress, social disregard etc. Therefore, knowing it early that

what course is suitable for the student in the long run is very important.

Apart from these academics, there are other fields also like music, dance, drama, sports, arts, fine arts etc. If students get to know well about it, then they can direct their focus in that field to achieve success in the long run such interest can be revealed through psychological traits.

2. Previous Work

There are various websites and web apps over the internet which helps students to know their suitable career path. But most of those systems only used personality traits as the only factor to predict the career, which might result in an inconsistent answer. Similarly, there are few sites that suggest career based on only the interests of the students. The systems did not use the capacity of the students to know whether they would be able to survive in that field or not.

Also, the suggestions provided by the system are very much generalized and not specific to a particular university or country/state. The suggestion for course is also generalized. For example, the results of few systems were a group of courses like data analyst, accountant, law etc. Thus, if a student gets such a recommendation then he/she might again get confused as the above specified course belong to different streams.

3. Overview

The idea of this project is to develop a career counselling and prediction system which would be a web application, using which any student of a particular state/country can get to know which career path is the most suitable for them. For this purpose, three set of questionnaires will be provided to the students based on personality, interests and capacity.

1. **Personality traits :** A personality traits are characteristics that are distinct to an individual and are based on the psychology of a person.

2. Interest: Interest in this context implies that how much a student likes a subject and is keen to learn about it.
3. Capacity : Capacity implies that how efficiently a student can learn their interested subject and survive in that particular career path.

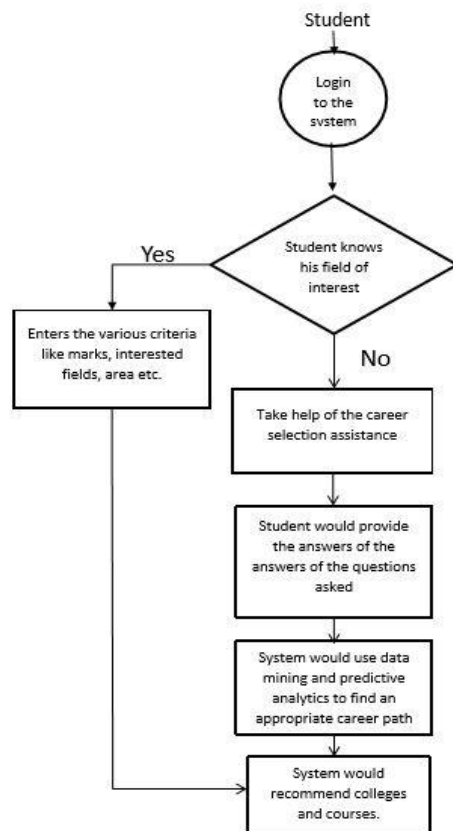


Fig.1. Decision Model

Based on the answers obtained from them, the system will generate the final result. The system will be developed using data mining algorithms like decision tree and MCDM (Multiple criteria Decision Making) method to select one particular course among many courses using multiple criterion like personality trait, interest and capacity of the students. The basic architecture of the system is as shown in fig. 1.

4. Methodology

The system will be generating the results based on the answers of the three question sets which are personality traits, interest and capacity. It will be using MCDM and decision tree algorithms. Multiple-criteria decision-making (MCDM) is a sub-discipline of operations research that explicitly evaluates multiple conflicting criteria in decision-making. Decision tree learning uses a decision tree as a predictive model which maps observations about an item (represented in the branches) to conclusions

about the item's target value (represented in the leaves). It is one of the predictive modelling approaches used in statistics, data mining and machine learning.

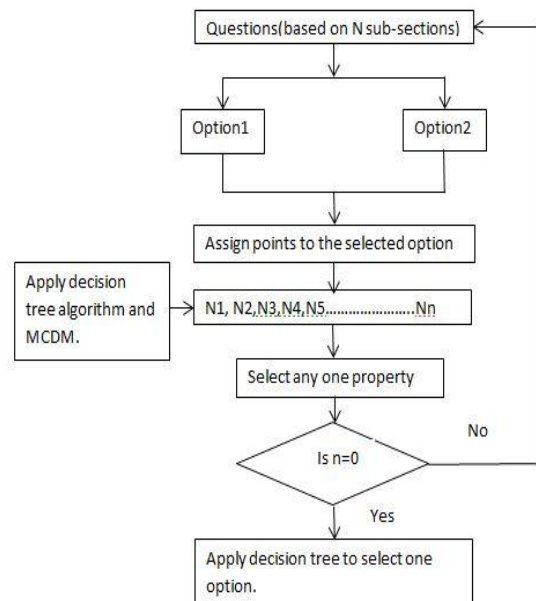


Fig.2. Process Flow and Methodology

i) Personality Trait.

The first part of this system would provide set of questions based on psychology of the person and each question would have two options. From answers obtained by every question, there will be comparison of every two personality property at a time as shown in Fig.2. Thus, by comparing two personality traits at a time, the system would discover the one personality trait that most appropriately describe the student using the decision tree algorithms.

ii) Interest

Interest of the student related to particular subject is also very important in deciding the career path. Referring to Fig.2 the system would first ask set of questions related to the three basic streams i.e. science, commerce and arts. This way every field/stream will be explored in detail.

iii) Capacity

Every question would have a timer and after answering all the questions, the average time taken by the student would be determined. Here the two important aspects are the correctness of the answer and the time taken to solve the question which will be evaluated at the end.

5. Algorithm

1. Personality trait determination

N= total number of traits of personality

n= sub sections of questions

from i = 1 to n{

From i = 1 to p (p= number of questions in each section) {

- i) Questions with two options will be asked
- ii) Points for each property will be assigned }
- Trait for each property will be discovered }

Decision tree used to determine the one personality trait of the student from n.

2. Interest based question

From i=1 to 3(i.e. Arts, science and commerce) {

- i) Ask questions with two options each, comparing i and i+1)
- ii) Each stream will be given points based on the preference given by the student.
- iii) Max= stream getting more points }

Preferred stream= max

For the preferred stream, from I = 1 to n (n= number of sub-sections/subject in each stream)

- i) Compare subject at i with subject at i+1 by asking questions with 2 options each
 - ii) Assign points to each subject.
 - iii) Max= subject with more points}
- ### 3. Determine capacity of the student
- i) Questions based on the subject selected by the student will be asked.
 - ii) Timer for each question.
 - iii) Time taken and the correctness of the answers will be stored.

- 4. Finally using decision tree algorithm, the appropriate course for the student will be determined using the results of the above the tests.

6. Conclusion

The system would thus help students to select a particular course and also the appropriate college for that course using data mining and they would also thus get to explore more about their personality and capacity. It would thus reduce the confusions faced by the students during admission process and it would thus reduce the rate of wrong career path selection and improve human resource productivity.

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Incorporating a degree of Trust in Opinion mining for Online Product Reviews

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Abstract

Due to enormous development in the field of Internet as well as web technology, doors have opened for several e-commerce websites to market and sell products online. They also provide opportunity for the users to post opinions or reviews based on their experience in buying the products. So the trend has been set by buyers to go through these reviews before buying any products and make decisions accordingly. But are these opinions genuine? It is the main question that comes into picture. Nowadays due to review's capacity to change buyer's decision, there are people or firms whose only job is to write spam reviews either to falsely defame or to promote a product which is unethical. This paper mainly deals with a trust system through which the genuineness of the review is checked, which is based on the behavior of its reviewer towards other pre-fabricated reviews. Only those proved trustworthy can publish their reviews in the webpage so that those review are considered for opinion mining.

Keywords : Trust reputation system, Opinion mining, feedback, Reviews.

1. Introduction

Nowadays Internet offers an effective platform for e-commerce, communication, opinion sharing. There are several blogs, sites devoted only for opinion sharing i.e. views on politics, finance, religion, culture, history, sports, education etc. So enormous information is available online and mining has huge scope here. Mining of these terabytes of data is challenging task. Making use of these data is important to understand people's need, to make marketing strategies etc.

These days, the trend is online shopping i.e. purchasing the products online buy placing orders in their respective websites and doing the financial transaction and getting the product delivered to our door step. Prior to making a purchase, buyer typically browses through several similar products and goes through the previous buyers reviews and compares different products and then comes to a conclusion as to go for that product or not. In short the opinion plays vital role in buyer's decision.

But there will be thousands of reviews for a product, which is very difficult for a person to go through one by one. This is where mining comes into picture. Web mining or more specifically Opinion mining is that area of data mining which deals with reviews or opinions which extract the desired information from the unstructured user review.

Main question that comes next is whether these reviews which are used for mining activities are genuine? This is an important issue with respect to reviews which are present online. Trust is an important factor in any

relationship, be it social. There are firms or people dedicated to deceive others. They are called spammers . There are different kinds in spammers. But the one who writes fake review are review spammers and the unethical activity is called review spamming.

These spammers fill the websites with fake reviews i.e. writing more number of positive reviews for a product which may not be good at all, so that the buyers are encouraged to buy that product. On the other hand posting negative comments to some other rival organization's product there by building negative image in the market which in turn discourages the buyer's decision of buying it.

Fake reviews are very difficult to deal with. Because reviewers are expert in writing fake reviews so that one cannot say a particular review is a fake just by manually reading them.

The idea of this paper is to combine Opinion mining activity along with the concept called Trust. We are using Trust Reputation System (TRS) [2] and Opinion miner. TRS which will ensure trustworthy feedback is passed to opinion miner. And an Opinion miner will extract features from the review and classifies it based on the opinion obtained from the user. Finally summarization of the mining activity is done.

2. Literature survey

Jeyapriya and Selvi [4] created a system which does extraction of features at aspect level. Frequent Item set Mining is used to find all frequent sets using minimum support count. Sentence and Aspect orientation are implemented using Naïve Bayesian Algorithm using supervised term based approach. Sharma, Nigam and Jain [5] also dealt with opinion mining at aspect level which used dictionary based approach of the unsupervised technique for aspect orientation. WordNet is used as a Dictionary to determine the opinion words and their synonyms and antonyms. Seed list preparation is done here for storing the extracted opinions and their polarity.

The polarity of the sentence is decided on the basis of majority of opinion words. Khushboo, Vekariya and Mishra [6] mainly created a mining system for sentence level. They used Supervised Term weighted approach of Naïve Bayesian Algorithm for creating the table of opinions and knowing their polarity. With respect to spam reviews, Manali S. Patil and A. M. Bagade [8] proposed a system to detect untruthful spam reviews using n-gram language model and detect review on brand spam detection using feature selection technique. Many authors such as the authors of [9], [10], [11] propose in their work several TRS architectures with different algorithms to calculate reputation score related to the product.

3. Basics of Opinion mining and Trust

Opinion mining also called as sentiment analysis. It is a process of finding users opinion about particular topic or a product or a problem. A topic can be anything a news article, product, movie etc.

The goal of Opinion Mining is to make computer able to understand and express emotions. A thought or attitude based on emotions instead of a reason is called sentiment.

Opinion mining is extracting people's opinion from the web. It analyzes people's opinions, appraisals, attitudes, and emotions toward organizations, entities, persons, issues, actions, topics, and their attributes [12].

Opinion is quintuple($e_j, a_{jk}, so_{ijkl}, h_i, t_l$), where e_j is the target entity, h_i is opinion holder, a_{jk} is aspect of entity t_l is the time when the opinion is expressed, so_{ijkl} is sentiment orientation of opinion holder h_i on feature a_{jk} of entity e_j at time t_l [4].

There are three different types in Opinion mining based on the level of data extraction. Document level, Sentence level and Aspect level Opinion mining. Document level classifies whole document as positive document or a negative document. Sentence level opinion mining breaks the document into individual sentences and then classifies each sentence into positive or negative. Last and the most effective mining is the Phrase or Aspect level mining where each individual sentence is broken so that each aspects or features are extracted along with their respective polarity.

Trust is an important factor in any kind of relationship. It can be personal, professional, social etc. As e-commerce transactions usually involve finance, proper on time delivery of goods, maintaining the customer relationships, this Trust factor plays a vital role. People should have Trust in whichever the product, site they are dealing with. If trust is built then the reputation builds which in turn benefits the product or the website.

To define Trust it is the firm belief in the competence of an entity to act dependably, reliably and securely within a specific context [7]. TRS helps people detect the trustworthy parties and influence the buyer's decision in doing purchase.

4. Problem statement

Nowadays buyer's buying decisions are dependent on reviews or feedbacks given by other customers. So there is a lot of spamming that is occurring in this area. Spammers are paid in huge amounts by some organization just to mislead the buyers. The opinion spammer's objective is to promote or to demote the reputation of some targeted products. There is a huge demand in identifying these fake reviews and reviewers. On the other hand there is lot of scope in opinion mining field. Usually huge reviews are taken as it is from the websites and mining activity is performed on them. In this collection of reviews there may be lot of spam reviews in it which may hamper the actual result. It may give excellent results but their genuineness is not guaranteed. If these online reviews on which our purchases, decisions, money depends are not real then we will definitely feel cheated.

5. Proposed work

This project aims to combine concepts of trust with opinion mining. Incorporating a certain degree of trust in opinion mining may improve the quality of the reviews published in the websites and mining those reviews will lead into getting actual opinion of the customer. We try to use TRS algorithm [2] to find genuineness of the buyer and then trustworthy user's feedback is made to publish in the respective sites. For mining we take the reviews which are obtained from TRS and true opinion for the products based on their features are found.

6. Methodology

This section mainly dedicates itself to the whole strategy of this project.

The whole strategy can be divided into 2 modules:

(a) TRS module (b) The Opinion Miner

(a) TRS Module

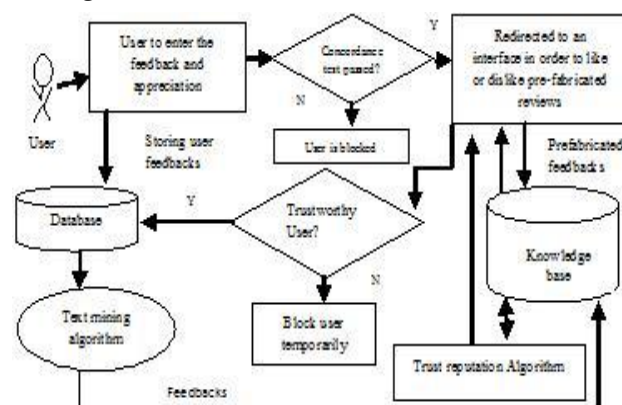
Architecture of TRS:

Fig.1 below shows the architecture of TRS

- Initially user logs in and gives feedback and appreciation (rating).
- Next step involves concordance test which checks whether there is a match between user's textual feedback and user rating.
- Once concordance test passed, user is taken to a page containing random pre-fabricated feedbacks where user is asked to click either like or unlike button based on their opinion on those feedbacks.
- The trustworthiness of those pre-fabricated feedbacks is already calculated and stored using trust reputation algorithm. Using this user's behaviour toward other feedbacks is checked and user's trustworthiness is calculated.
- Once the user crosses the limit of untrustworthiness he is proved trustworthy. Hence we can trust that feedback.
- Storing all reviews in the database whose users are proved trustworthy.

These feedbacks are used for Opinion mining. Hence to a certain extent may not be completely, we can filter out the untrustworthy feedbacks.

Fig. 1. Architecture of TRS



(b) The Opinion miner

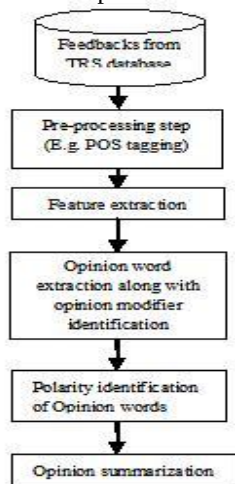
Steps involved are:

- Select the product whose reviews are to be mined.
- Project aims two types of mining. User can go for an individual review mining. Where

individual reviews are mined. Or we can mine all reviews together.

- Initially as part of pre-processing Parts Of Speech (POS) tagger applied which tags all the words in a sentence.
- We extract the feature, Opinion based on POS tagger where Noun is for feature and Adjective stands for opinion.
- Opinions are checked against SentiWordNet, a lexical resource for determining the polarity of these opinions.
- Finally result is displayed.

Fig.2 below depicts the Opinion miner used in this paper.
Fig. 2. Architecture of The Opinion miner



7. Result Analysis

For result analysis we have taken 5 mobile phone reviews as review objects. And at this stage of project we couldn't take lot of reviews per mobile phones. So the numbers of reviews are limited here. The further project work will analyse the quality of the result in a more effective manner by considering a lot of reviews per product. So results may vary.

At this stage we get 82.7% accuracy and Precision 96%, Recall 91.3%, F-measure 93.14% with respect to the sentiment polarisation. But this will be affected once we check with more reviews.

Trust is not a quantitative measure and hence we cannot measure it. But even if the result of miner is not satisfactory we can say that the reviews considered for mining were to a certain degree genuine, which is the aim of this paper.

8. Conclusion and future work

Opinion mining with the trust reputation can be a great boon to the customers who usually depend on doing e-commerce applications. But opinion mining is not an easy task to perform as it deals with natural Language Processing. To understand what people write and understand, the emotion or the sentiment behind it is a challenging task. Here this paper deals with simple opinion mining procedure by giving priority to genuineness of the feedbacks.

In future work, we plan to analyze the result more critically by posting many more reviews of various kinds and then check how the TRS and Opinion miner work. This paper has limited itself with respect to the number of reviews for result analysis. But we believe system should work more effectively with more & more reviews.

We also plan to improve the project by having an effective handling measure for those users who are proved.

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Universal online booking Android Application

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ABSTRACT

In this paper, we propose to develop an android application for integrating all areas which will help users to book their entire plan for the day which includes travelling, entertainment, etc. It even provides users with E-wallet for transactions and gives optimal path to users from source to their destination with respect to time, distance and cost. This exempts user from downloading multiple android applications for booking and hence avoiding the legacy process.

Keywords : *Optimal paths w.r.t time distance and cost efficient*

1. Introduction

Technological development has resulted in a boundary free digital world. This development has resulted in transaction through virtual money instead of real ones. Android Phones can reduce the trouble of the customers to stand in queue and book the tickets.

Now-a-days different Android Apps provide online ticket booking for particular areas like travelling, entertainment. Therefore, users have to download multiple applications for ticket booking.

Our aim is to develop an android application for integrating all areas which will help users to book their entire plan for the day which includes travelling, entertainment, etc. It even provides users with E-wallet for transactions and gives optimal path to users from source to their destination with respect to time, distance and cost.

2. Literature survey

The path finding technique mainly works on different types of algorithms. There are various types of algorithms which are used for finding shortest path. [1]

Considering the travel time reliability in the path finding problem, several methods have been proposed.

There are various algorithms for find path like Floyd Warshall's algorithm, Dijkstra's algorithm, A* algorithm.

The Dijkstra's Algorithm [7] is a basic method for finding the shortest path. It is applicable for two terminal problems. This algorithm delivers the shortest path from a given node 'i' to a single destination node or all other nodes within a graph with non-negative path costs. In Dijkstra's algorithm, initially all distances are infinity. The start node 's' is the initial current node. Then next node is selected when the shortest distance is considered. Similarly, all nodes in the graph are to be travelled which gives the destination node 'd' with minimum cost path. Dijkstra's algorithm stores nodes in a linked list or an array. The time complexity of Dijkstra's algorithm is $O(n^2)$.

Floyd-Warshall's Algorithm [6] gives compute path from given start node to multiple nodes. From a single node to all other nodes are computed within a single loop. The time complexity is $O(n^3)$

A* Algorithm [5] is a general approach of Dijkstra's Algorithm. A* algorithm is based on AI (Artificial Intelligence). The A* algorithm is suitable for finding not only the shortest path but also the better routes, namely suboptimal routes. It uses Heuristic Function for path finding. The time complexity is $O(b^d)$ which depends upon the Heuristic Function.

Since A* is more efficient algorithm as compared to others, we choose to go with A* algorithm for implementing optimal path.

3. Finding optimal path

What are the things that would strike to your mind when you hear of travel??? First you would figure out the place, the map, the ways and means to reach there, you would draw a complete picture of your trip/ journey. To begin with the first friend, you would remember to solve all these problems is 'GOOGLE'. Being of an E-age era there are various applications, websites and Tours & Travel agencies available for helping people commute from one place to another. Now these all decisions will be taken based keeping in mind many factors such as cost, time, comfort to reach the desired destination etc. So in order to deal with all such issues, one System is required which would overcome all these problems at a stroke with optimized resources. If a person wants different means of travel like bus, train, taxi or any other which are

available in that city then this is the basic task for solving the travelling problems. Also he/she can travel in less time or in less cost. The common man can get a solution to his daily life transportation. Common man can use Internet browser through which he will find a solution to travel from one place to another based on different parameter like distance or cost or time.

For implementing optimal path, we are using A* algorithm [5]. A* Algorithm is a general approach of Dijkstra's Algorithm. A* algorithm is based on AI (Artificial Intelligence). The A* algorithm is suitable for finding not only the shortest path but also the better routes, namely suboptimal routes. It uses Heuristic Function for path finding.

$$f(n) = g(n) + h(n)$$

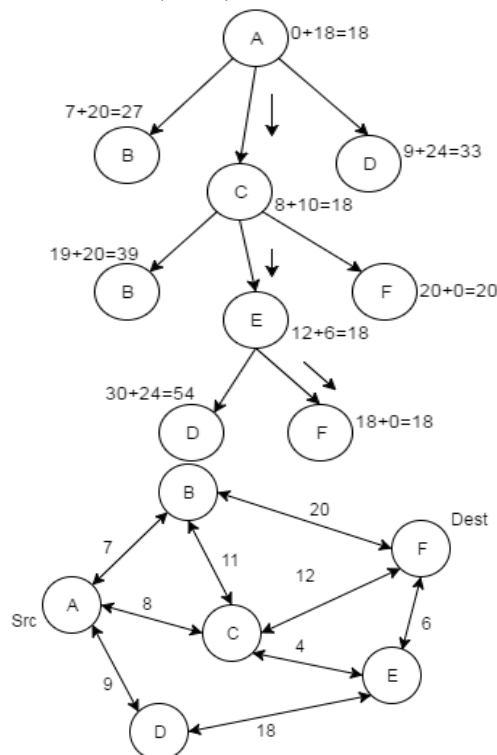
Above function consist of $g(n)$ which is an actual cost of the given graph and $h(n)$ is a heuristic function it gives the minimum cost path from $f(n)$.

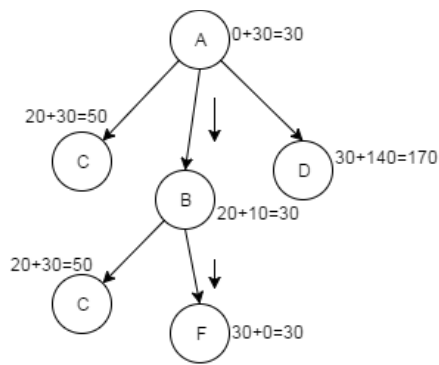
The time complexity is $O(b^d)$ which depends upon the Heuristic Function. Here 'b' is a branching factor. It is more efficient than Dijkstra's Algorithm. It does not explore all paths during searching. Optimization of path is depending upon Heuristic Function. It requires more memory than Dijkstra's algorithm. It does not search deeper on the opposite direction to the destination.

For e.g. Consider the following graph where user wants to go from A to F.

There are many possibilities of covering this distance based on different mode of transportation. Hence, let's consider one of the possibility w.r.t distance, time and cost.

1. Distance (in km)





Hence from the above solution the optimal path would be A-B-F with minimum time Rs.30.

As explained above users will be given all possible optimal paths changing w.r.t mode of transportation. Even the corresponding cost and time required for that path will be mentioned for users to make their choice.

4. Online booking

Once the user has selected his path among the all possible optimal paths w.r.t time, distance and cost he would be directly directed to the booking area where his whole journey would be booked instantly.

Let's consider the same, e.g. mentioned above:
The paths would be

1. A-C-E-F
2. A-C-B-F
3. A-B-F

Here along with the path the total expenditure, distance, time etc. would be mentioned. If user wants to save his time irrespective of the money spend and accordingly he chooses a time optimal path 2 then all the travelling and the destination tickets would be booked accordingly.

5. E-Wallet

Many wallets today are cluttered with several cards, cash and more. Keeping track of all these items can be difficult. The electronic wallet (e-wallet) will provide all of the functions of today's wallet on one convenient smart card eliminating the need for several cards. The e-wallet will also provide numerous security features not available to regular wallet carriers. Identification is required for every credit card transaction and the card is equipped with a disabling device if the card should be tampered with. These increased security measures and the convenience make this a worthwhile project [3].

This is an additional provision given to the users. E-Wallet allows the users to deposit their money so that whenever they want to book, the expenses would be deducted from their e-wallet. The user can credit his account at first using credit/debit card.

For e.g. A user wants to go from Andheri to Dadar at plaza movie theatre. From the given optimal paths, he chooses the path as Andheri to Dadar by train and 5 min walk to plaza. Hence his total expense for the journey would be Rs.20 by train and 200 for the movie. Hence he has to spend Rs.220 which would be directly deducted from his e-wallet account. Many it convenient not to give his debit/credit card details every time he books for journey.

6. Conclusion

The legacy system where user have to personally book the ticket or have to download multiple apps for booking, this app can reduce the trouble of the customers to stand in queue and book the tickets for their whole journey (may be bus, train, taxi, movies as per user's choice etc.).

Since the app provide users with all the optimal path from his source to destination user can decide his path and directly book for his entire journey including his destination (if requires booking for e.g. Movie theatre).

E-wallet can prove to be a convenient way for the users as they do not have to make payment through debit/credit card whenever they want to book for journey. E-wallet can be credited once a while and can be use till there is money available in user's e-wallet account

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Eradication of Proxy Takers in Online Examinations

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ABSTRACT

A modern and well established education system is a backbone of any nations success. High reputation in international platform can only be achieved when best and deserving students represent your country and earn reputation on their ability and dedication. First criteria which should be met is the candidates' verification i.e. who is going to take the test. As many cases of proxy exam takers have floated in the past and is still not eradicated. To put an end to this illegal practice we are developing a security arrangement dedicated to protect the genuine candidates against fraudsters. In our proposed arrangement, exam takers identity (i.e. face) will be captured using a webcam or a mobile device at the candidates end while filling the exam form. The system connected to a webcam will capture faces of the exam takers and match with the existing faces in the stored database (i.e. through face recognition technique) on the day of exam. After the confirmation of valid face detected, the OTP (One- Time Password) is generated and send to the candidates registered mobile number or email id. Then the candidate is validated and he/she is allowed to take the test. This is very fast and helpful technique to do the verification of the candidates. This will also reduce candidates time to stand in queue for the verification and validation process and completely eliminating any sort of illegal activities happening on proctors (verifier) part. This will ultimately eliminate cheating related to proxy takers across all domains where examinations are conducted.

Keyword : Eigen Face, Face Recognition, PCA, OTP

1. Introduction

Most of the people on earth knows the term Face Recognition. This recognition technique is well known even today and is used in case of Camera Applications, Banks and other services. Majority of the people finds Face Recognition as a useful technique, because it is easy to access and saves a lot amount of time. Our project deals with the introduction of such system in Online Examination System such as JEE Mains, TOEFL, GRE, GATE etc. by eliminating the usage of Username and password technique and replacing it with Face Recognition technique. First criteria which should be met is the candidate's verification i.e. who is going to take the test. As many cases of proxy exam takers have floated in the

past and is still not eradicated. To put an end to this illegal practice we are developing a security arrangement dedicated to protect the genuine candidates against fraudsters.

As most of the examinations are pen and paper based the security process here can be easily tampered. So online based examinations can be a solution to this problem. But again, there is need of username and password for performing login so as to Start the test. So, the main moto of maintaining high level security while giving test is again on risk as the students can share their login credentials to third parties to boost their grades. So, the candidates have to wait in a queue to get their documents verified which is again a tiresome process. Also, the candidate can forget the username and password for a particular exam as there are many exams conducted. So, face recognition can be a solution to this problem as it do not require the candidate to memorize his/her username and password and the process of candidate verification can be even be much faster. And if OTP added as second level of security to the process face recognition can guarantee absolutely no proxy exam taker.

2. Motivation

Nowadays a lot of institutes and number of test organizers are trying to adopt online assessment methodology because of the advantages and effectiveness of such a system compared to a traditional method of exam. And an online exam is more effective and important when the exam is to be conducted over a large scale where the candidates number many and are located at different locations all over the world. That is the reason why GRE, GMAT, TOEFL etc. exams are conducted online.

Another advantage of online exam is that a candidate can give the exam at the comfort of his home and this is helpful during online coding competitions like Code Vita. But the authentication model for an online exam are just valid credentials and hence the system can be cheated by a user who can give the credential to someone else or the hall ticket to enter the exam hall of online test can be tampered so that a fraud candidate can give the exam on the original candidates behalf.

Hence, we saw that this system can be improvised to make it more effective against the tampering of hall tickets. Hence, we saw that the one and only way that this can be done is to authenticate the candidate before the computer itself so that only the genuine candidate can give the online test. And we wanted an authentication system that is very unique to a person and cannot be tampered with. Hence the solution was to implement a facial recognition software that stores the facial details via image processing to store a candidates full facial identity into a database.

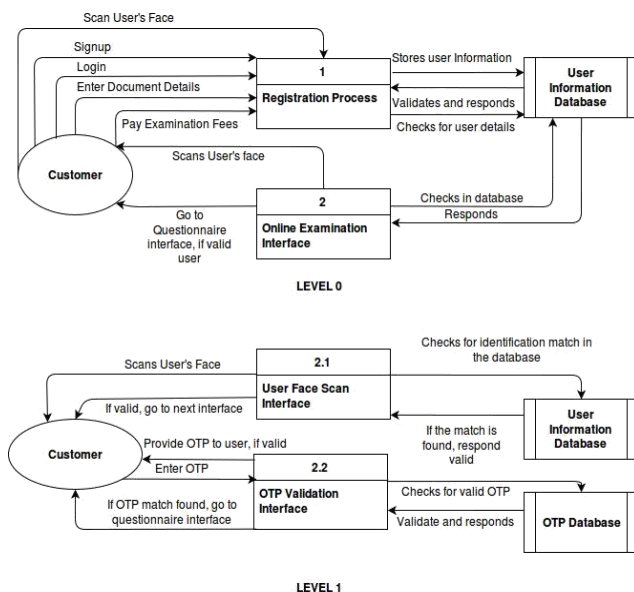


Fig 1. Data Flow Diagram for the Proposed System

And before starting the online test via login credentials the candidate is authenticated with his facial identity and if the face matches the facial identity stored in the database then the candidate can start with his exam. And hence the system becomes fool proof to be very effective against fraud candidates trying to cheat with the system and gives a fair chance for every candidate who are giving the exam.

3. Literature Survey

India is shifting for the online examination process for various academic, competitive and recruitment related exams. Online examination provides major advantage of scalability and cost saving compared to traditional pen and paper based process. However, it also brings security related challenges in this process. And first and prior most security concern is that of the candidates' verification. Candidates authentication is very important online environment issue.

Chula G. Kings research study shows that 73.6% of students thought that it was easier to cheat online than in traditional courses in. the authentication of online exam takers, it is very important to make sure that the exams are given fairly, user authentication is a widely discussed subject in. online environment[1] and online exams follow identifications such as username, password and biometric identification[2]. In general, user authentication is classified into three main categories:

- something the user knows known as knowledge based authentication (e.g., password, PIN, pattern)
- something the user has known as possession based authentication or token (e.g., ATM card, smart card, mobile phone) and
- something the user is known as biometric based authentication (e.g., biometric characteristics such as fingerprints and face).

A. Knowledge based authentication

The most widely used types of authentication are knowledge- based [6], commonly referred to as KBA as a

method of authentication that seeks to prove the identity of someone accessing a service such as a website. KBA requires the knowledge of private information of an individual to grant access to protected material. User ID, password and challenge questions are a commonly used. KBA is a common authentication method because passwords are memorable in. expensive, simple to use and attractive to users [6]. However, due to the nature of online examinations, students may share their login. credentials to third parties to boost their grades. Hence, online examinations rely on a knowledge base that is susceptible to collusion and malicious attacks. KBA can be summarized as the following statement: what the user knows.

B. Possession based authentication (token)

Authentication based on private objects that the user has is referred to as Possession-Based Authentication (PBA) or token-based authentication. PBA includes tokens and tickets. A token is typically a hardware device that can be stored in. a pocket or on a key chain. and carried with the user. However in general, presentation of a valid token does not prove ownership because it may have been stolen or duplicated by sophisticated means [6]. Based on the nature of online exams, PBA can be useful if the exam is conducted in a specific place such as a university lab or in accredited testing centres, etc. However, if the exam is conducted at home or in an uncontrolled environment, PBA is useless. The most common examples of PBA are memory cards, smart card tokens, dongles and keys [6] and can be summarized as the following statement : what the user has.

C. Biometrics based authentication

Biometrics is a rapidly developing technology that is used to improve security in a wide range of applications [7]. It is also defined as the identification of a user that depends on physiological and behavioral characteristics. Behavioral biometrics are based on the users behavioral attributes that are considered as learned movements [6]. Commonly used physiological characteristics include face (2D/3D facial images, facial IR thermograms), hand (fingerprints, hand geometry, palm prints, hand IR thermograms), eye (iris and retina), ear, skin, odour, dental and DNA. Commonly used behavioral characteristics include; voice, gait, signature, mouse movement, keystroke and pulse [6]. Biometrics can be classified as soft biometrics or hard biometrics. Soft biometrics, e.g., clothing colour, voice, skin, hair colour, signature, height and tattoos are able to be easily changed [8]. They can still be used to identify a person quickly but they cannot be used as distinguishing features as they exhibit a low discriminant power for recognizing persons [8]. Meanwhile, hard biometrics including facial features, fingerprints, palm prints, retinas, iris and vein patterns as strong features for identifying a person. They are not easily changed in a short time. And it can be summarized as the following statement: what the user is.

Mostly knowledge based authentication is used in almost all the cases and hardly biometric based authentication is used due to the extra cost related to the devices used for authentication viz. iris scanner, finger print scanner, etc. In our proposed system face recognition will be done using a USB camera which is available at a much cheaper cost compared to other biometric recognition devices. Among all the biometric techniques, face recognition approach possesses one great advantage, which is its user-friendliness (or non-intrusiveness). Along with OTP (one time password) the process of verification and validation yields more fruitful results.

Kin and Robert [3] proposed a face detection system on the basis of feature extraction. They used many probabilistic models to extract the features of face. This system uses many spatial filters to find the feature points from the face and group them into different groups and then classify those features based on many probabilistic models. This system gives very satisfying results based on probabilistic models.

Pawan, Benjamin, Yuri, and Richard [4] proposed a system for face recognition and get very satisfying results. They have tried to match the performance of the system to match with the human perception rate. All those points are considered and a model is formed which can easily recognize faces. They study all the basic building blocks of human visual system which gives them the basic points which uses to recognize the human faces. In this paper they show 19 different results which give the results and implications involved in this research.

Face Recognition Using Eigen face Approach [5], this will capture the faces and then it compares with the stored faces. Here Eigen face uses PCA algorithm for face recognition. Also it recognizes the gender of a person according to the frontal view, scaled frontal view, 45 view.

4. Need

The main purpose of this project as mentioned in the introduction, is to introduce Face Recognition technique in place of existing Username and Password Entry Technique. The latter technique runs in the following way,

- Go to the Online Examination website
- Enter the user's Username and Password
- Start the exam.

What if someone knows your Username and Password and then start your exam from different location before yours? There are several cases in which some intelligent people are only meant for giving the exams of others and they earn money through this. Such kind of proxy exam takers can be eradicated by introducing this technique.

System	Description	University Where Implemented
Secure exam Remote Proctor (SRP)	Fingerprint for student identification. Video surveillance /audio recording with SRP device.	Troy University Alabama University NewYork University
BioS	Users log into the authentication system by providing the username, first name and last name. Then they select the pointing device that will be used to draw their signature (behaviour biometric). It could be a mouse, a stylus or a touch pad.	University of Maryland University of Texas Systemsand Houston Community College
Webbassessor	Facial recognition software and pat-terns of keystroke rhythms	Penn State University

Fig. 2. Existing commercial products dealing with online exam user authentication

The steps that is required for Online Examination System using Face Recognition Technique is,

- Go to the Online Examination Website
- Let the system captures user's face and recognizes it.
- After successful recognition, the OTP is sent to the user's mobile
- User enters OTP and the exam gets started

By using this technology, no fraud users can get access as the system compares the captured face with that of the face that was captured during registration process. So, this eliminates more amount of time spending on entering Username and Password and then verifying it.

5. Existing Work

With many educational institutes trying to adopt online assessment methodology and some are still favoring traditional method of exam. But most of the assessment methodology is traditional method as of now and the system has some loopholes. But even the existing system of online assessment has some loopholes and the existing system is as follows. A candidate appearing for an online exam initially displays his/her hall ticket before entering the exam room and then if the hall ticket photo matches the candidate's face then he/she is allowed to enter the exam room. If the photo doesn't match then the candidate is asked his/her ID and if the photo still doesn't matches then they are not allowed to take the exam. If the candidate is successfully authenticated then to start the online exam he/she has to enter the valid credentials to enter into the online exam system and the exam starts.

6. Architectural Diagram

Fig. 3 shows the overall architecture of proposed security arrangement for exam takers using face recognition and OTP (One Time Password). In the first step exam taker need to fill the exam form during which the candidate will have to scan his face using a webcam. And then our web application will capture candidates personal identity (i.e. face) which will finally get stored in the central database corresponding to his/her exam form.

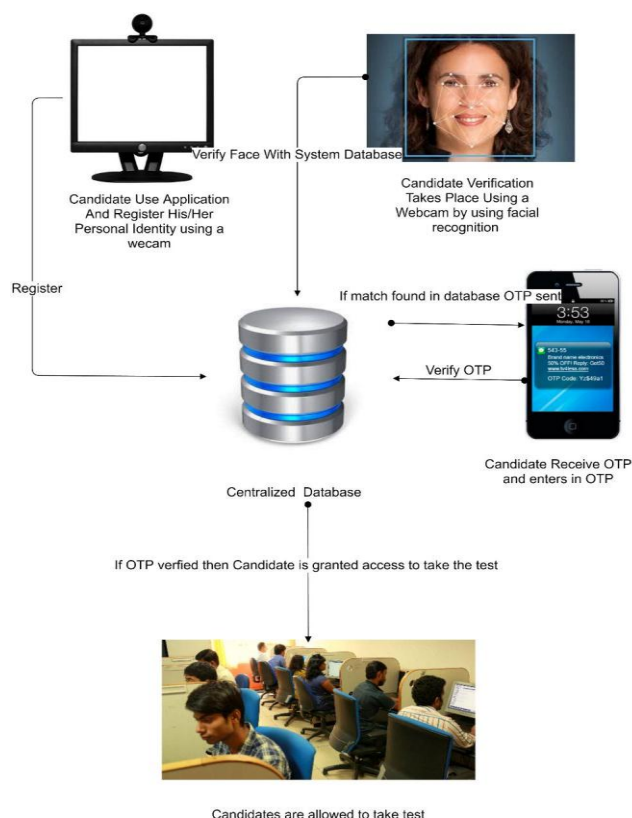


Fig 3. System Architecture

Then in the second step the web application will start its process. It first captures the face of the exam taker using a webcam. Then that image is sent to the existing database. Here we use already existed database or centralized database, which contains exam takers information with photos which were entered during exam form filling. Then system compares the send images with already stored images in centralized database. Once the image is recognized successfully or matched with the existing images of the database then the server sends the OTP (One-Time Password) to the candidates registered mobile number or email id. Then voter enters that OTP, then database again verifies that entered OTP by voter and if it is correct that means it is valid candidate and he/she is allowed to take the test. All this happen on the day of exam.

Here security is also necessary to protect the system. For that session level security mechanism is being used. First client need to request valid session id to server. Once server validate client it will respond with session id. By handshaking this session id communication takes place. On each request session id will be send and validate. Once client logout from system it will destroy session id.

7. Project Scope

The project concentrates on replacing the existing manual entry of username and password system with face recognition technique. Moreover, this project will take around 6 months to complete, considering the initial preparation, algorithm design and implementation process. The face recognition technique can be used in various fields like Passport and Visa Verification, Voting Systems, Live Cameras on roads, high security prisons, investigation chambers, security agencies, printing press, coin minting, banks, jewellery stores, hotels etc. The Face recognition

technique embedded in Online Examination System can be used in various exams like Online Aptitudes, JEE Mains and Advanced, CAT, GMAT, GRE, GMAT, TOEFL, and other competitive exams.

8. Conclusion

The distance from a university campus is no longer a barrier in the education of students. It the same for an online exam too that many candidate's gives today like Code Vita. Today's generation have the advantage of utilizing time effectively, since there are numerous choices in distant online education for them. For the student to access online education, all he or she needs is a personal computer with internet access with which he or she can find the desired courses online and enroll. The online education systems ensure that the student's put all their energies into studies. Travel is a one of the major issue that is associated with taking on-the-campus classes if the students reside in remote rural areas. Online education has provided a remedy for issues with those residing remotely. Now, they can attend online classes and save time and money. For example, a child of a farmer can help the family out in the morning with the farming chores then go to an online class later on. And an online test is the final assessment to give the certificate to a student. But it is very important that only genuine and deserving candidates are given the rewards and not a fraud candidate. Hence online student authentication via facial recognition will make the entire online education systems including exams, courses more effective and fool proof to reward the deserving ones. Hence online facial recognition is a starting stone to make the online ecosystem more secure and effective.

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Review on Bus Pass Renewal System

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ABSTRACT

This project aims to provide an effective solution for maintaining Bus pass information using a database. The system has two logins, one for user and other for admin. Online bus pass Generation system is a application for people to get renew Bus passes. This system was intended to develop an application to perform functionalities like accessing the basic information for authentication and provide renewal pass to a particular person without placing him/her in a queue for a long time. Bus pass renewal system is helpful as it reduces the paper work, time consumption and makes the process of getting bus pass in simple and faster way. User can refill their account and extend the validity every time when the pass expires. Admin can view all users' details and balance through its login. This system is helpful to people to get bus pass from anywhere.

Keywords : Login, Apply, Payment, Generation, Notification

1. Introduction

This project was created to provide "safe, reliable, time-saving, efficient, comfortable and affordable" services for people is seen as having accomplished this objective, although the cost for providing this service has been substantial. It is heavily subsidized by the government and is reportedly in the red, like most of India's state run road transport undertakings. Because of the drawbacks that are present in the existing system, we got this idea that would help people in a better way. As per the previous system people had to do each and every process manually, but this system helps people to make the work a bit faster. Customer can renew the bus ticket over the application, 24 hours a day throughout the week, this solves the issue of bus pass. Current system allows user to stand in the queue for a long period of time that leads to waste of time. By developing this application user can renew their passes through their mobile, that reduces the work effort and passenger can able to their time and manual work also reduces.

2. Related Work

Bus pass renewal system is helpful as it reduces the paper work, time consumption and makes the process of getting Bus pass simple and fast. The only drawback is the pass application form is available online. It is to be downloaded, get a print, and then it can also update in bus pass database. And it can update while scanning card in bus.

The transaction facility is available. Bus pass renewal system is helpful as it reduces the paper work, time consumption and makes the process of getting Bus pass simple and fast. The user can recharge the wallet and then it can be renew their pass. The recharge can be done through admin account.

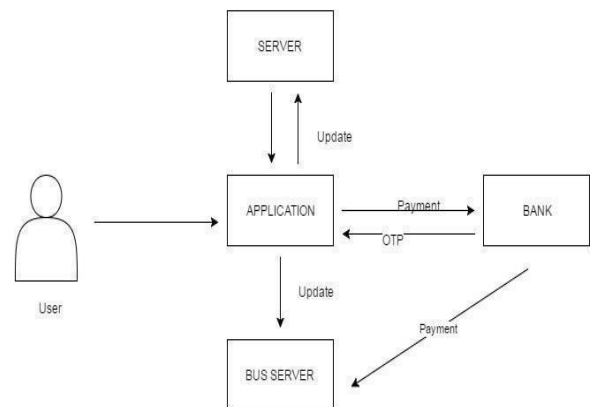


Fig 1: Architecture of System

In Fig 1, the user can renew their pass through the application the application has server like bus server and other is application server and also different kind of information is provided about the buses, eligibility criteria, fare, stop information etc.

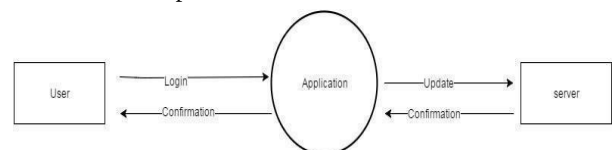


Fig 2: Design of System (DFD – Level 1)

In Fig 2, user can register and login within the application and also the user has bus pass, then application can update the database then confirmation can be done using the application. The Application can check the wallet balance, if the balance available then it can be processed. The more details can be drawn in next diagram.

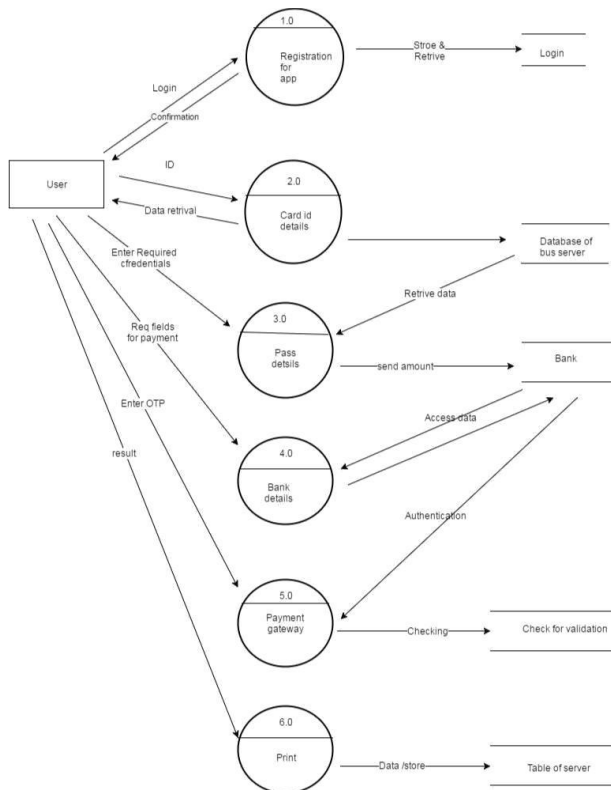


Fig 3: Design (DFD – Level 2)

In Fig 3, we will get the ticket renewal facility of the bus pass. first user self-register in application then database can be updated with new user but user has the bus pass. Then user can select proper bus pass details and renew their pass and payment can be done through the wallet, the wallet can be recharge by admin

3. Proposed System

Our work introduces a new method of generating the Bus pass through online. There are several modules:

In Fig 1, we will get the bus pass renewal facility of the buses which were developed in this application. There are four modules that can be:

- 1) Registration Module
- 2) Authentication Module
- 3) Payment
- 4) Bus Pass Renewal

1) Registration Module

Registration on the application is the first phase in this project. The user has to give complete details about him/her to create a new account. After successfully completion of account creation only the user can able to perform the renew their bus pass facility. All the transactions are performed based on their user id.

2) Login and change password

Authentication is the important module in this project. Once the user submit their details their information are accepted and the user can login with their username and password for renewing their bus pass. Only the registered users can do the renewal process.in this module it checks whether the authorized persons is accessing and it does not allow other user to access.

3) Payment

Payment can be done through the wallet. Mobile wallet is the digital equivalent to the physical wallet in which we carry money. It is an online platform which allows a user to keep money in it, just like a bank account. A user needs to make an account with a mobile wallet provider. After which money is added to the 'mobile wallet' account from admin via cash. unlike banks mobile wallet does not charge any amount of money on every transaction and saves the customer from the hassle of entering card details and pin number for each and every transaction. It is easy and convenient as the user just needs to sign in the account and make the payment.

Advantages

1. **Ease of use** – It's like a one click pay with no need to fill in card numbers and passwords every time. One can link their credit cards, debit cards and bank accounts and pay immediately with no hassle to enter the details each time.
2. **Ease of access** – There will be no need of physical wallet like we do in the case of cash or cards. Also mobile wallets are upgrading to allow you to store your documents digitally like your Driving License, Aadhar Card, Pan Card, etc.
3. There will no issue of asking or searching for change which we have while handling cash.
4. It will be possible to make instant payments. Just like we can exchange cash at any moment, we can exchange and transfer money anytime.

Disadvantages

1. Mobile network connectivity is the biggest impediment. Network problems and reliable and fast internet connectivity is not available in most of the developing countries.
2. More than connectivity, security issues are at the forefront nowadays. People are always under the fear of misuse of their money by hackers and frauds.
3. Replacing day-to-day transactions with money is easier.

4. Conclusion

It is project which is useful for the public who are facing problems with the current manual work of bus pass renewal. It also increases the validity period, frequently warns to the people before completion of his validity period by sending Short Message Service or mails. Their renewal can be done using a wallet in the due course of time if the user expects more than what this system provides, i.e. if the new requirements can be easily satisfied by enhancing the system without making much of changes. The places and the information relating to the place can be updated. We can use E-Cash system.

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Mood Based E-learning using EEG

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ABSTRACT

The traditional E-learning system is limited with monitoring attention level of students. The online instructor cannot monitor whether the students remain focus during online autonomous learning. Along with the attention, emotions are also intrinsically related to the way that individuals interact with each other as well as machines. The behavior and emotions can be better understood by a human being to improve the communication but a machine cannot. This gives rise to lack of interest and knowledge gain. To overcome this limitation of the traditional E-learning system EEG sensors are been introduced. Using, EEG we can detect the emotion of the user, by actually looking inside the users brain to check user's mental state and signal waves are generated accordingly as an output which can be used to improve users learning experience. The proposed system is a smart E-learning system which makes use of EEG signal to predict the emotion state of the learner. The emotion can thus help to improve the learning system using algorithm and database. The system uses Correntropy Classification and Euclidean distance method to classify the waves to predict appropriate emotions.

Keywords : E-learning, Correntropy spectral density, Classification, Electroencephalogram (EEG), Emotion detection.

1. Introduction

Electronic learning has given a new boon to education system. E-learning allows students to learn at anytime and anywhere. Web is the platform where E-learning is executed worldwide with its increasing space and hence users are attracted for a fast search approach. Mohamed Kouthair [1] perform personalization in e-learning platform by applying web usage mining technique. The system uses Nutch's automated crawling system for search engine and collaborative filtering and content based filtering for recommendation phase. P. Campanella [2] proposes e-learning recommendation system based on collaborative filtering where the user's tags the resources based on its interest and content based filtering for recommendation of resources based on the tags. The approach is beneficial when recommendation is done on randomly basis and emotional aspects are not considered.

Effective learning depends on sustained attention, and sustained attention plays a major role in aggregating, acquiring, and applying knowledge [14]. Along with attention, emotion also evolves during learning process and emotion feedback could be used to improve learning experiences. [5] Yiaweihi et al [6] proposes a SAM model (self-assessment manikin) which assess emotion on valence and arousal using EEG. The proposed system results that valence i.e. attention and inattention are best effective then arousal i.e. active thinking and thinking suspending in an e-learning environment. Emotion is a complex set of interactions among subjective and objective factors governed by neural/hormonal systems resulting in the arousal of feelings and generate cognitive processes, activate physiological changes such as behavior. [16]

Emotions can be recorded using emotion detection technologies from biophysical signals. Saromporn Charoenpit [4] makes use of eye tracking biological signals to track the emotion of the learner. This system cannot be used when the contents are changing continuously, the learner need to be constantly focused to capture the eye signals which can affect the understanding and emotion. Ning-Han Liu et al. [8] in a human brain neurons are continuously active, which expel a small amount of electromagnetic waves. These electromagnetic waves are used as electroencephalogram (EEG) signals. The fluctuation of EEG signals cannot be controlled without training. Hence, the EEG signals can be used to examine the attentiveness of the learner. EEG also has been popularly used for BCI implementation due to its low cost, non-invasive nature, and it's comparatively easily recording brain signals [7, 6, 4, 3].

With this study develops a smart e-learning system that will exhibit videos according to the learner's emotion and detect the attention level of the learner on the basis of the captured biological signals to enhance the learning experience. The basic process of determining whether the learner is attentive involves classifying the biological signals. The proposed system adopted correntropye as the classification algorithm and Euclidean distance method to estimate the video according to the emotion.

2. System Design

The system aims at mood based e-learning system with mapping of attention level. The Figure1 shows block diagram of the proposed system.

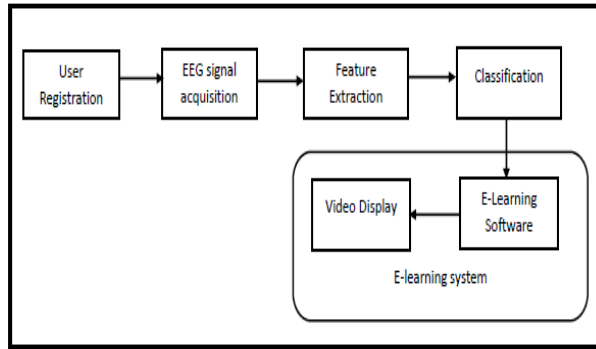


Figure 1: Block diagram of the proposed system

3. Components of the implemented system:

i) User Registration:

The new user registers itself by entering the basic details. This phase is the first step of the system. The data will be saved in separate table. There will be required mandatory fields. Necessary validations will be done and that will complete a successful registration.

ii) EEG signal acquisition:

Once the user registers itself, he can login with its credentials. After the user login's, the EEG headset is set on and brain waves are captured using Neurosky Mindwave Mobile. It uses Bluetooth as an interface to connect with PC. The Signals are then acquainted using MATLAB. The EEG data is saved into database for future requirement.

iii) Feature Extraction

The acquired signals are then sorted on the basis of sampled emotions from the database. Cluster of emotion are made, the type of clusters are given in table1. They are stored to form the emotion database.

Table1: Table of emotional database

Sr. No.	Emotion Type	Meaning
1.	Happy or Excited	Positive-Excited
2.	Concentrated or Focused	Positive-Clam
3.	Confused or Worried	Negative-Excited
4.	Sleepy	Negative-Clam
5.	Anger	Frustration

iv. Classification

The EEG signal of the learner are captured using EEG headset is then processed to classify under which class the emotion of the learner fits. This

is done using classification algorithm. The algorithms that used for emotion detection are Correntropy Spectral Density and Euclidean Distance.

4. Correntropy Spectral density:

Correntropy is introduced by Santamaria et al. [9]. Correntropy uses kernel parameter space. It provides information on both the time as well as the statistical distribution. Correntropy is efficient since it can be computed directly from the data. The Correntropy spectral density is a generalization of the conventional power spectral density. It is based on the Fourier transform [9],

$$P_v(\omega) = \sum_{m=-(N-1)}^{N-1} V_c(m) \cdot e^{-j\omega m}, \quad \dots (1)$$

where $V_c(m)$ is the centered correntropy function, in which the root mean square (rms) is used to subtract the output DC component that affects the CSD [9].

It is estimated by $V_c(m) = V(m) - \bar{V}$

where $V_c(m)$ is the correntropy function and V the correntropy mean [9]:

The Correntropy function is defined as:

$$V(m) = \frac{1}{N-m+1} \sum_{n=m}^N \kappa(x(n) - x(n-m)), \quad \dots (2)$$

The Correntropy mean is defined as:

$$\bar{V} = \frac{1}{N^2} \sum_{m=1}^N \sum_{n=m}^N \kappa(x(n) - x(n-m)). \quad \dots (3)$$

The Gaussian kernel function, is given by,

$$\kappa(x(n) - x(n-m)) = \frac{1}{\sqrt{2\pi}\sigma} e^{\left[-\frac{(x(n) - x(n-m))^2}{2\sigma^2}\right]}, \quad \dots (4)$$

Where σ is the kernel parameter [9].

5. Euclidean Distance

The Euclidean distance is the ordinary distance between two points in the Euclidean space. It is the distance between point's p and q is the length of the line segment connecting them. The minimum distance is considered to map the emotion.

The equation is given by

$$dist = \sqrt{\sum_{k=1}^n (p_k - q_k)^2}$$

where 'n' is the number of dimensions (attributes) and p^k and q^k are, respectively, the k^{th} attributes (components) of records p & q. [11]

6. E-learning system:

Once the emotion of the learner is detected by using the classification algorithm, the e-learning system displays the video according to the learner emotions. It also shows the graph of attention level of the learner. If the attention level is dropping down then at certain point the system detects and displays a refreshment video. A database is maintained to store the data of the learners watched videos.

7. Requirements:

The project is implemented on MATLAB environment. The following are the requirements of the proposed system.

Hardware Specification:

Operating System: Windows 7

CPU: Intel(R) Core(TM) i3

Speed: 1.70GHz

Ram: 4GB

EEG Headset: Neurosky Mindwave

Software Specification:

MATLAB 7.1

Video convertor

Termite

8. Experimental Setup

A. Technology used:

ElectroEncephalogram (EEG)

Electro Encephalogram (EEG) is a biological sensor that directly reflects the activities of hundreds and millions of neurons residing within the brain. Special sensors are attached to your head and are connected by wires to a computer. [12] It is an interface that connect the human brain with the computer. Different emotion states create distinct EEG signals in different brain regions. Therefore EEG provides reliable technique to identify the underlying emotion information. The proposed system uses Neurosky MindWave Mobile headset to measure the brain wave of the learner. The data is transferred using Bluetooth. It provides processing and output of EEG power spectrums (Alpha, Beta, etc.) [16]. Our brainwaves change according to what we're doing and feeling. Due to slower brainwaves we feel tired, sleepy and drowsy. The higher frequencies make us feel alert and active. [17] The specification of the headset is given below.

- 1mV pk-pk EEG maximum signal input range
- 3Hz 100Hz hardware filter range
- 12 bits ADC resolution
- 512Hz sampling rate
- 1Hz eSense calculation rate
- AAA battery.

B. Programming Environment:

MATLAB

The name MATLAB stands for MATrix LABoratory. MATLAB was written originally to

provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. The MATLAB platform is optimized for solving engineering and scientific problems. The matrix-based MATLAB language is the world's most natural way to express computational mathematics. A vast library of prebuilt toolboxes lets you get started right away with algorithms essential to your domain. The desktop environment invites experimentation, exploration, and discovery. It has built-in apps for curve fitting, data classification, signal analysis, and many other domain-specific tasks, add-on toolboxes for a wide range of engineering and scientific applications. [13]

9. Implementation And Result

i) Implementation

The paper is based on making affective e-learning system by detecting learner's emotion. The brainwaves are captured using NeuroSky MindWave Mobile headset. They are interfaced to the computer using Bluetooth. ThinkGear.dll is used to obtain the EEG signals in the form of numerical value. The EEG emotion database is made which are in the form of '.mat' files. Around ten samples of data related to every emotion will be considered. To create the emotion's database user's emotions are captured by displaying the related videos to the user. For example, the user is shown a Tom and Jerry video to detect the happy or positive-excited emotion, a strategic video is shown to detect confused or negative-excited data samples. For each type of emotion minimum 10 data samples of different user is considered and an average of these sample is valued as the particular emotional range. The student database consists of students' year, semester and roll number. It is used to store the information of number of video lectures viewed by the students of particular subjects. The subjects are numbered in between 1 to 5 which also represents the type of emotions. The video lectures are of '.avi' format converted using XiliSoft video converter and stored in form of conventional file system i.e. folder – file system.

The learner logs in with the provided credentials. The EEG headset is placed on his forehead and the brainwaves are recorded, which is named as current EEG data. Correntropy Spectral Density algorithm is applied on these current recorded brainwaves and kernel value is calculated. Similarly Correntropy Spectral Density algorithm is also applied on the emotion database and kernel value is calculated. Now the Euclidean distance is calculated between the each kernel value of the emotion data and the current data value. The minimum distance result is taken into consideration which is considered as the emotion. Depending upon the emotion detected a number between 1 to 5 corresponding to that emotion is

selected. Now, taking the student's year, roll number and the number selected the video is shown. In between when the video is on, the EEG signals are recorded and if the EEG signal are weak then a pop-up message is shown which plays a refreshment video. After the refreshment video the original video is resumed from where it was been paused. The record is kept of all the videos watched and report is generated. The student database is also updated.

ii) Result

Initially, the brainwaves of the user are captured using NeuroSky MindWave Mobile and plotted, as shown in figure 2. This data is then fitted into polynomial function of degree 5, figure 3. Using this recorded data, we use correntropy function on it and the database of EEG samples. This is then compared with each dataset present in EEG database to get the minimum distance. The first minimum distance is considered and corresponding emotion is taken into account. Semester and roll number of that user is taken. Depending upon the information entered by the user and the emotion detected the corresponding video will be played, shown in figure 5.

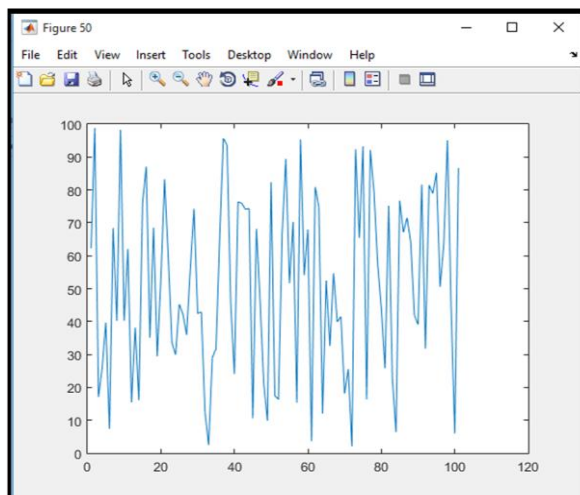


Figure 2. Brainwaves of learner

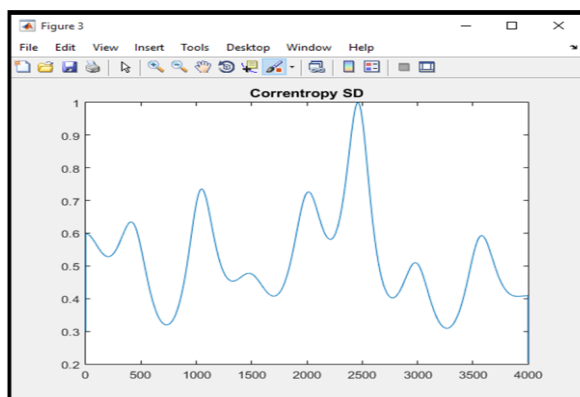


Figure 3. Correntropy applied to the EEG signal.

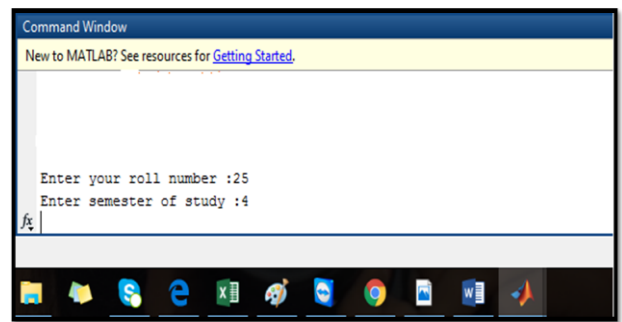


Figure 4. Learner entering his Roll No. and Semester.



Figure 5. Video displayed

iii) Analysis

The 25 data samples were given as an input EEG signals to the E-learning system. These 25 data samples are divide into 5 for each respective type of emotion (i.e. happy, concentrated, confused, sleepy and anger). Precision and recall is calculated for these 5 types of emotion. The result are depicted graphically.

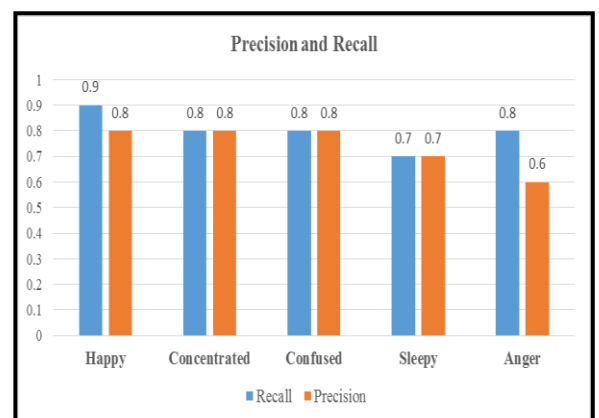


Figure 6. Graph depicting Precision and Recall values

As shown in the above graph, using the proposed E-learning system the Recall rate is approximate. That is all the emotion are identified and none of them are missed.

The Precision rate also goes up to 80%. That is some of the emotion are not identified correctly, some are falsely identified. The overall prediction accuracy calculated is 84%. For a good system both the precision and recall values should be good. The Proposed System achieves the same.

10. Conclusion

What significantly causes disadvantages in e-learning system is learners' negative emotions. In this thesis, the goal is to design and construct a new e-learning system focusing on the learners' emotion during their learning using biological signals. In this research, designed a new e-learning system.

The conceptual and framework design were described to generate an understanding of the strength of the system. It consists of five modules: learners, biological signals, feature extraction, analysis of learner's emotion and display of video. The system detected learner's emotion using Correntropy classification method and Euclidean distance that improves the accuracy rate, hence enhancing the prediction analysis of the emotion of learner.

The project design aims to build an environment which will result in full knowledge gain on the bases of mood change. Also the system is made to work very efficiently for the betterment of humankind by providing excellent learning environment.

11. Acknowledgement

I wish to express my sincere thanks to people who helped and encouraged me throughout the research. I am grateful to my guide Prof. Ajitkumar Khachane for his continuous support from initial advice in the early stages to date. I would like to extend my thanks to my parents for their undivided support, inspiration and encouragement and also to my friends who appreciated me for my work and motivated me.

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Virtual Reality Websites (VR Web)

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ABSTRACT

Virtual reality or virtual realities[1] (VR), also known as immersive multimedia or computer-simulated reality, is a computer technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment to allow for user interaction. This paper aims to bring to the foreground, advancements in the field of Virtual Reality in the domain of web development, for building virtual reality enabled templates which can be used to create Softwares as a service (SaaS). Consumers can utilize these templates and create their own virtual reality based webpage. Our system will be implemented using WebVR, a language that can access the gyroscope sensor present in smartphones to calculate the co-ordinates of the phone with respect to the surroundings. It combines HTML and JavaScript like functions to provide a strong set of tools for creating VR enabled websites.

1. Introduction

Virtual reality aims to 'emulate' human like reality using various devices, mainly, virtual reality viewers like Google Cardboard and Oculus Rift. We know the world through our senses and perception systems. In school we all learned that we have five senses: taste, touch, smell, sight and hearing. These are however only our most obvious sense organs. The truth is that humans have many more senses than this, such as a sense of balance for example. These other sensory inputs, plus some special processing of sensory information by our brains ensures that we have a rich flow of information from the environment to our minds.[2]

Virtual reality, in technical terms, is used to simulate a three-dimensional, computer generated environment which can be explored and interacted with by a person. The person, in essence, becomes a part of this environment and whilst there, he can manipulate objects or perform actions.

Virtual Reality, also known as Virtual Environment(VE), enables the user to completely feel immersed in the environment simulated by the technology. He is also able to interact to a great extent with the environment in meaningful ways. This combination of sense of immersion and interactivity is dubbed as telepresence.[3]

According to computer scientist Jonathan Steuer there are two main components of immersion: depth of information and breadth of information. Depth of information refers to the quality and amount of information received by the user while he is interacting with the system. For example, it could be the resolution or the complexity of the graphics.

Steuer defines breadth of information as the "number of sensory dimensions simultaneously presented." A virtual environment experience has a wide breadth of information if it stimulates all your senses.[4]

Other sensory output from the VE system should adjust in real time as a user explores the environment. If the environment incorporates 3-D sound, the user must be convinced that the sound's orientation shifts in a natural way as he maneuvers through the environment. Sensory stimulation must be consistent if a user is to feel immersed within a VE. If the VE shows a perfectly still scene, you wouldn't expect to feel gale-force winds. Likewise, if the VE puts you in the middle of a hurricane, you wouldn't expect to feel a gentle breeze or detect the scent of roses.

An immersive experience suffers if a user becomes aware of the real world around him. Truly immersive experiences make the user forget his real surroundings, effectively causing the computer to become a non-entity. In order to reach the goal of true immersion, developers have to come up with input methods that are more natural for users. As long as a user is aware of the interaction device, he is not truly immersed.

2. Why Virtual Reality?

Virtual Reality is currently among one of the hottest topics in Computer Science. It is an exciting field for developers and consumers alike. The technology which is being developed, has only been seen of or heard in movies or Sci-Fi television shows.

Currently, Virtual Reality is still in its infancy. The scope for development is huge. Based on the initial research conducted us, the advancements in the web development area of Virtual Reality are barely extant. Aside from a few APIs and VR Support in beta versions of web browsers, there isn't much progression. We aim to create a working prototype of a website which incorporates the elements of Virtual Reality into them. [5]

What's so special about virtual reality? The answer is presence. VR gives you the ability to feel present in another place without actually being there. It allows you to experience different things in the comfort of your house, with just a simple device and a compatible mobile phone/ computer system. It is because of this very reason that many big companies like Facebook , Google (creators of Google Cardboard, Daydream and Cardboard APIs), Mozilla (developer of few APIs), etc. are showing presence in the field of Virtual Reality.

Since it is yet an untrodden down path, the companies are really excited to get their toes wet since the very beginning. There are great challenges ahead, and even bigger potential in the future of VR. So many innovations yet to be discovered.

Likewise, there are significant practical concerns. Google, Facebook, Samsung and others are investing heavily in building development tools, distribution platforms and the overall technology infrastructure of VR but navigating this evolving environment requires content creators to thoughtfully consider not just what goes on inside their VR experiences, but how people discover and access those experiences.[6]

3. Current Technologies in Virtual Reality

A. Oculus Rift

Oculus VR, released on March 28, 2016.

Oculus Rift is perhaps the most prominent example of the progress Virtual Reality has made. Oculus Rift provides a completely immersive experience for the user. It uses high quality displays and surround sound along with optics designed specifically for the Rift to provide maximum entertainment for the user. It provides whatever Johnathan Steuer defined as requirements of virtual reality.

B. A-frame

A-Frame [8] is an open-source framework for easily creating WebVR experiences with HTML. It is designed and maintained by the Mozilla VR team (MozVR). A-Frame wraps three.js and WebGL in HTML custom elements. This enables web developers, designers, and artists to create 3D/VR scenes without having to learn WebGL's complex low-level API. Because WebGL is ubiquitous in modern browsers on desktop and mobile, A-Frame experiences work across desktop, iOS, Android, and Oculus Rift headsets.

A-Frame features a smooth learning curve between beginner ease of use and advanced developer flexibility. Beginners start with easily understood primitives like cubes, videos, models, and skies. Advanced users can use JavaScript to imperatively create interactive scenes or dive into its underlying entity-component-system pattern, a design pattern popular in the game industry that favors composition over inheritance. Because A-Frame is built around building blocks that can be extended and combined into limitless combinations, it provides a high degree of creative freedom. And being just an abstraction layer, A-Frame is capable of doing anything that three.js can.

C. MozVR

MozVR[9] is an API developed by the Mozilla team (Developers of the popular web browser, Firefox), to enable support for the Oculus Rift to allow it to view non-native content. It is still in its infancy and is very unstable at the moment. But it sets a precedent for all further technologies which are going to be developed for VR.

The API comes bundled with experimental iterations of Chromium or beta builds of Firefox. Beta builds are used for testing out new features before they can be unveiled to all consumers.

D. Daydream and Cardboard

Google[10] provides developers with two virtual reality (VR) platforms: Cardboard, the world's most popular and accessible mobile VR platform, and

Daydream, a new platform for low-latency, immersive, and interactive mobile VR. The Google VR SDKs include everything needed to develop for these platforms, including libraries, API documentation, developer samples & design guidelines.

Daydream is a platform for high quality, mobile virtual reality. Coming in Fall 2016, Daydream provides rich, responsive, and immersive experiences with hardware and software built for VR.

Cardboard lets you experience virtual reality in a simple, fun, and affordable way. Cardboard is built for bite-size VR experiences and works with almost any smartphone on Android or iOS.

Currently, the technologies implemented for Virtual Reality are scarce. YouTube has plugin to enable videos on their website to be viewed in 'Cardboard mode', an immersive theatre-like experience.

4. Proposed System

Our proposed system is to create a working template based web page incorporating the elements of virtual reality. We will be using sources from Aframe.to and the javascript APIs developed by WebVR[11], an open community for virtual reality devices, for this purpose[12]. Users will be able to use these templates created to develop pages for their own purposes like E-commerce, entertainment etc. A sample prototype of the final webpage will be made to provide user with a more in-depth knowledge about virtual reality websites.

The website will be fully compatible with mobile phones (accessories like virtual headset will be needed for full immersive experience) and with desktop web browsers. In case there is an unsupported browser, an option to view the webpage normally will also be provided. For non-mobile devices, the webpage will be visible as a normal webpage, with virtual reality elements being disabled.

The templates will be like regular HTML/Bootstrap templates but with added VR content (referenced from Squarespace templates)[13].

Along with the templates, users will be given access to some of the open source frameworks as well that would allow users to make only some parts of the website virtual reality ready, but not all.

Since VR Viewers are also easily affordable, the technology won't be limited to a precious few. It can be widespread and used by all kinds of people.

5. Future Scope

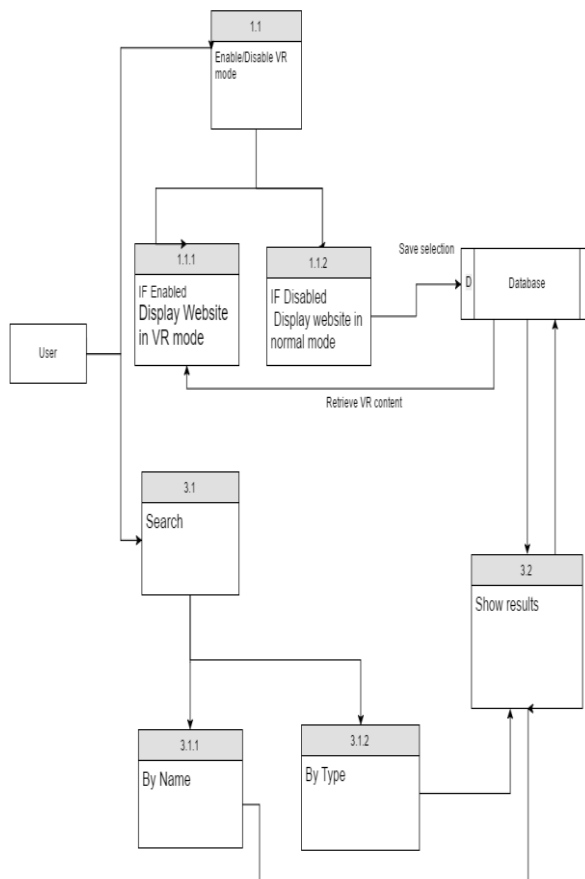
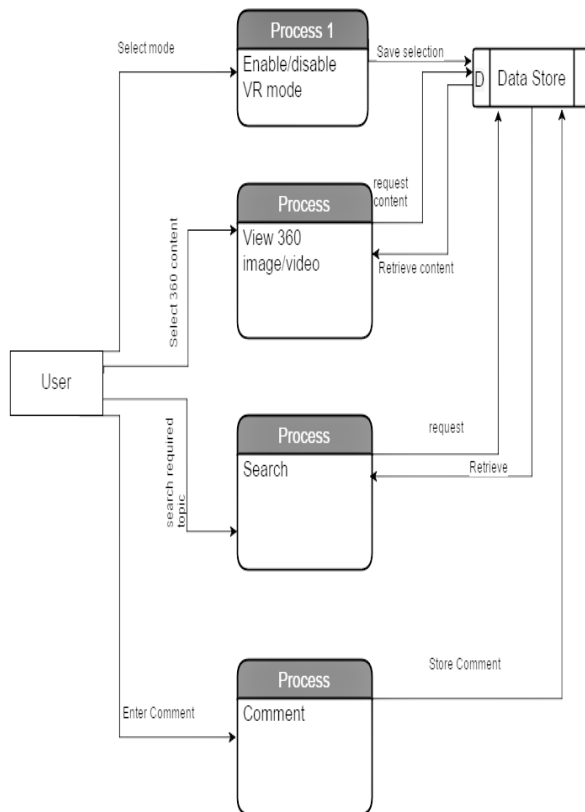
Google is also developing certain APIs (Daydream and Cardboard) to enable faster and more integrated development of VR based applications like Games, Video renders, etc.

The Daydream API allows an existing Unity package to be ported and developed for VR enabled systems. The SDK developed by Google allows development to go leaps and bounds ahead of the contemporaries. It will allow VR applications to be developed using Objective C. It is expected to be released soon.

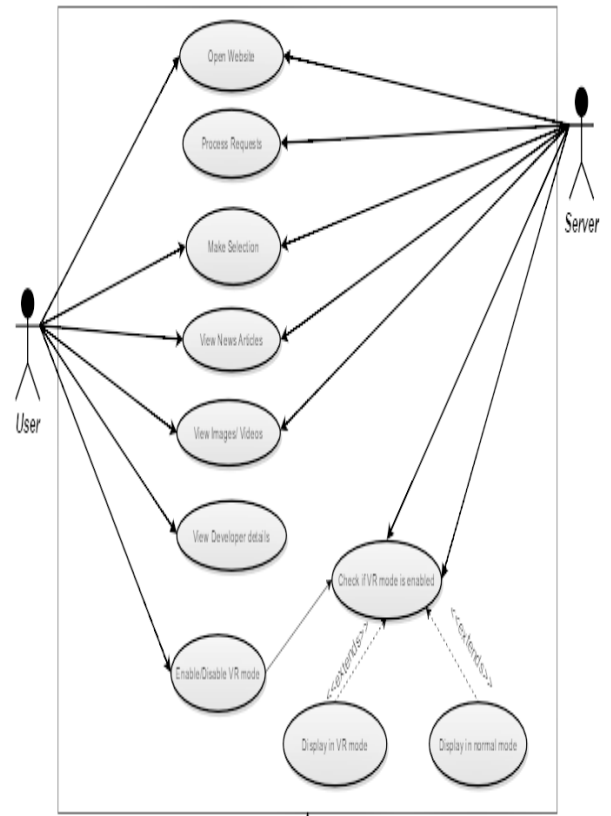
6. UML Diagrams

A. Data Flow Diagram

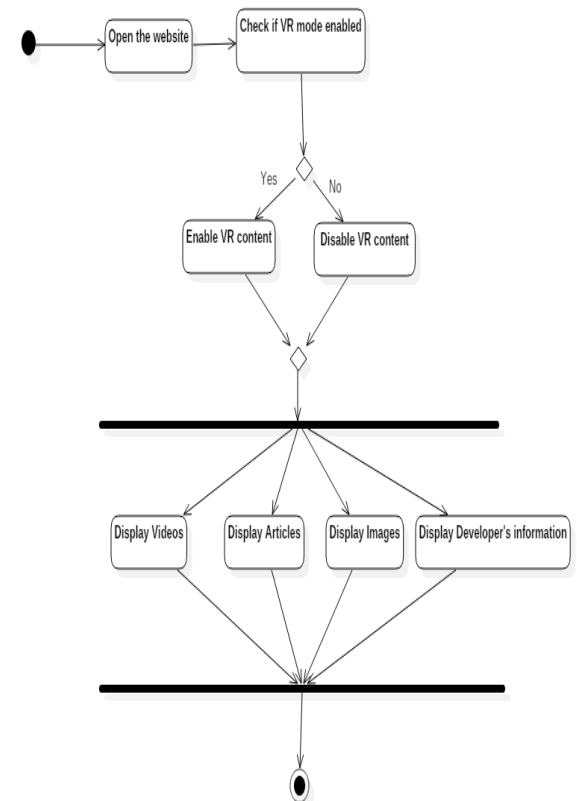
The basic functions to be implemented in the system are illustrated in the UML diagrams.



B. Use-Case Diagram



C. Activity Diagram



7. Conclusion

We believe that Virtual Reality is one of the most up and coming research areas in the field of Computer Science. Virtual Reality websites serve to revolutionize how interactive web user space can be. We aim to understand the tenets of WebVR, the developmental language of VR and aim to create fully working web pages. We further plan to use this as a base for further development into VR by creating templates, much like those created by Squarespace to be released as Software as a Service.

8. Acknowledgment

The authors would like to thank Vidyalankar Institute of Technology for affording us this opportunity to work on one of the hottest topics in Computer Science. We would also like to thank Prof. Suvarna Bhat for her unending support throughout all phases of our research.

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- 3) Squarespace templates - <https://squarespace.com>

ProVision - Head-Up Display for Car Navigation

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ABSTRACT

This project focuses on making a device which is a HUD - Head Up Display for car which will project the navigation route, mobile notifications and other trip details on the windshield of the car. It consists of a hardware device having a projector and this device will be connected to a mobile application via Bluetooth that will project the desired routes on the car's windshield with the help of mobile's Application. The mobile application will use the mobile's GPS for tracking location. The user will select the desired route on the application and connect the phone with the device, the device will then project the route on the windshield in front of the driver along with other details and notifications which will make it easier for the driver to drive.

Keywords : HUD, Heads-Up Display, Automobile, Car Navigation, Projector display.

1. Introduction

A head-up display (HUD) system for automobiles enables drivers to obtain useful information without lowering their heads to look at a secondary device on the dashboard. As, a result the driver's eyes remain focus on the road as the display will be projected directly in the line of sight, which improves the driving safety and comfort. HUD's provide useful data such as GPS information for navigation, road sign recognition, an object recognition on the road. HUD's have been used in aircraft for several decades. They are now appearing in more and more models of cars.

Identifying and presenting road condition information in a vehicular environment can be a daunting process, which, if handled improperly, can place great strain on the drivers satiated attention. Various technological advances have been employed in the past in a view of improving this process by prioritizing information and presenting it in a meaningful manner. Such a task becomes more difficult under adverse weather conditions where human spatial awareness is reduced significantly, increasing the probability of collision.

Head-Up displays(HUD's) may be viewed as a potential solution to this problem as they provide the user with information directly on the field of view, keeping the eye

gaze focused on the road. Drawing on the conclusion of previous work on this issue we have proposed a full windshield HUD interface design for collision avoidance under low visibility conditions-such conditions typically hinder the driver's decision making process and performance. In this work, we present an evolution of that HUD design, which improves upon the original both in terms of deployment cost and, as we aspire more future trials will show, efficiency.

Automotive safety has been stated as the main driving force for implementing HUDs, which are capable of displaying information without requiring the user to take their eyes off the road, e.g. content from night vision cameras, navigation systems, and others. Studies of driving behaviour found that improper lookout, inattention and distraction [2], as well as "eyes-off-road durations of greater than two seconds", have significant impact on crash risks [3].

2. Principle of Operation

In this display a virtual image is formed in front of the car (shown in fig.1). In here, the windshield reflects light of certain wavelengths while transmitting other visible wavelengths. A real image showing information such as the navigation route, speed indication, notifications such as text messages and calls, arrows indicating the turns is projected on the windshield. A virtual image is seen by the driver and is generated in front of the vehicle.

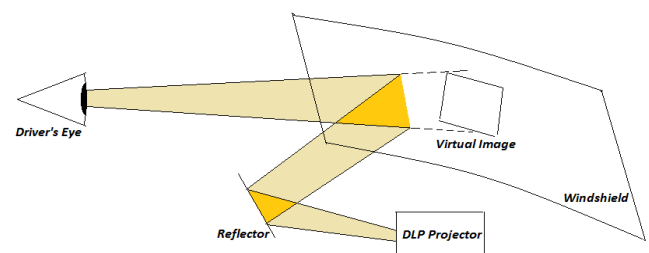


Fig.1

As shown above in fig.1, the light of certain wavelength is emitted by the DLP Projector, this light falls on the reflector which reflects it at a particular angle on the windshield. Some of the light passes through the windshield and some is captured, thus forming a virtual image at about approximately 1.5 to 2 m from the windshield.



Fig. 3: Driving Symbols used in the HUD

This projector is connected to a mobile device through wireless connection. The mobile device consists of an android application which will take the input from the user such as the desired source and destination. The route then will be projected on the windshield by the projecting device. The android application makes use of the google map API's and only the desired path is shown remaining undesired path is cut out. This device makes the driving experience much better.

3. Hud Symbols and Notifications

The main aim of the HUD is to guide the driver in situations when it becomes nearly impossible to take the eyes off the road. Certain symbols are being created in order to give notifications to the driver regarding the road while driving. Some of the symbols are projected path, upcoming road turns, speed limit, etc.

In the above fig. 3 the various driving symbols are being shown which will notify the route to the driver. The Projected path symbol (fig. 3a) is the actual path that is going to be projected. The desired path input will be taken by the driver i.e. the source and the destination and only the required path will be shown on the windshield. This path will be transparent and will not cause opacity or distraction while driving.

The upcoming road turns symbols (fig. 3b) indicates the turns to be taken to reach the destination. These turns are very accurate and are of different variations depending upon the turns. This symbol appears mere 500m or more prior to the curve negotiation a pops up every 100m when the curve is at a distance less than 500m.

The Speed limit symbol (fig. 3c) indicates the speed of the vehicle. It will be display this symbol continuously. But when the speed limit crosses the minimum limit on the highway then a notification pops saying reduce the speed with a beep sound and the screen will turn red.

More notifications will be designed in the future for better experience in adverse weather conditions where the road is not clearly visible.

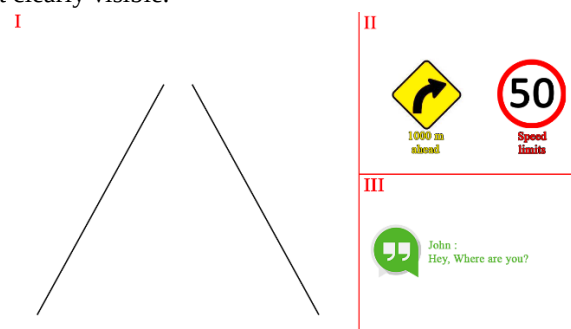


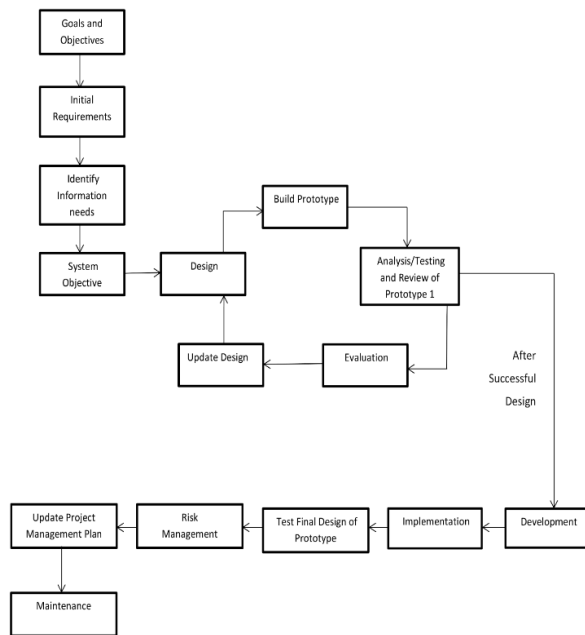
Fig. 4: Sample display of windshield projection

The above fig.4, shows a sample display of the projection. The screen will be divided into 3 parts. The major part of the display is the desired route and the remaining part is further divided into two parts, where the notifications such as turns and speed limits will be displayed in the upper half and text messages and call notifications will be displayed in the lower half.

While there are no text messages or call notifications, the weather conditions will be displayed on the screen. There are many cases in which road accidents occur wherein the driver is either busy talking on the phone while driving or is reading the messages oh his cell. To avoid such accidents, the text and call notifications are being displayed on the windshield. The driver can read the messages easily without having to take his eyes off the road. If an urgent call appears then he can pull the car over and attend the important call. This avoids 80% of the road accidents occurring due to distraction from cell phones [10].

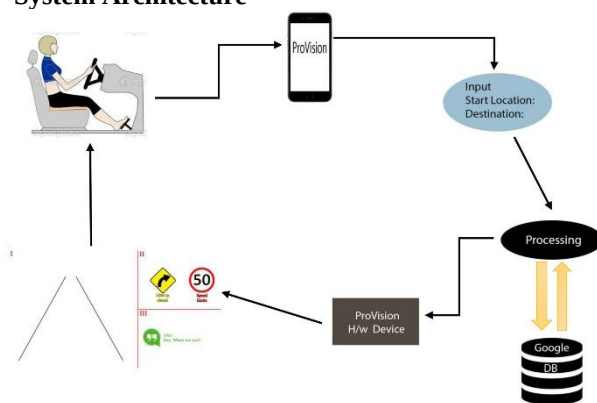
4. Working

Development of the HUD consist of Research & Development, so the project will be of Prototype process model. At development stage, various prototypes will be generated for project testing and analysis. Synchronization of H/w & S/w will be checked at every stage and the design may vary in the development process.



The Hardware Component consists of a DLP pico projector. DLP(Digital Light Processing) is a competing HUD technology which is similar to LCDs but offers better resolution. DLP has thousands of micromirrors arranged in a two-dimension (2D) array. Each mirror in the 2D array serves as a pixel, and each mirror is modulated to reflect the incident light to create the desired pixel intensity. A 100% bright pixel will have zero modulation, while a dark pixel will have the mirror set to reflect the light out of the imaging path. To give a uniform image result, the incident light source is collected and focused onto the 2D array, with equal intensity on each pixel. The reflected image is then magnified, refocused and projected to a folding mirror, and then onto the windshield, a process similar to the LCD HUD implementation.

5. System Architecture



In this system, the Driver opens the ProVision mobile application and if he is not a registered user then he has to first register. The user is then redirected to a page where input such as start location and destination is been taken. The route is then retrieved from the Google DB and a connection is made with the Hardware, i.e., projector. The route is projected on the windshield as shown in (fig.4), sample display.

The driver then can continue their journey with safety and comfort.

6. Conclusion

In this paper, a HUD for car navigation is being proposed to make the driving a better experience. In the future work, we plan to implement a fully functional car navigation system with a working prototype and test other factors including driver distraction, alternate pointing techniques, etc.

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Automated Logistic Car

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ABSTRACT

The Global Positioning System (GPS) technology has proved to be helpful with its advent in the field of communication and transportation. Every autonomous vehicle is based on three principles, viz. navigation, control and guidance. The use of a GPS module with Compass module in an automated car provides navigation. In addition to navigation, collision detection and prevention is provided with the assistance of sensor network. Planning algorithm acts as a controlling mechanism which governs the motion of the device. Fuel efficiency is achieved as power consumption is on the electronic battery circuitry which is implemented. This paper discusses the aspects of various controlling methods, their performance, characteristics, cost analysis, and user preference. Along with the research about various types of controlling mechanisms, the reach, advantages, and brief insights about the basic elements of the Automated Logistic Car is discussed.

Keywords : Autonomous Logistic vehicle, Global Positioning System(GPS), autonomous navigation, Compass module, collision detection, collision avoidance, fuel efficiency, sensor network, Planning algorithm.

1. Introduction

According to the study conducted by Geospatial technology 'in their website named Geospatial World' it was estimated that between the years 2012-2015, GPS based devices will grow to 1015 million devices.[1]. The modernization of the systems used for ground and space surveillance with this technology is a significant advancement.[2]. Most of the everyday products like smart phones, sport gears, watches and automobiles are equipped with the GPS-SPS(Standard Positioning System)tracking facilities. The classification of vehicles can be achieved broadly as driverless vehicles and driver based vehicles. The driverless system can be further classified as the wirelessly controlled systems, memory mapped systems and self/auto-navigation systems. Various leading industries are entering into the field of developing Autonomous cars. This has led to the amalgamation of technologies which impart scope in delivering high performance and less system failure.[3]. The problem statement of the project discussed in this paper is to design a fundamental cost efficient self-piloted transportation vehicle.

The autonomous GPS-controlled car navigates using GPS-defined way points. The device is enabled with collision-detection and avoidance system. The input given is the

Destination point to which the way points guide the vehicle. The basic model involves-digital compass module, GPS receiver module which consists of GPS antenna, motor drivers which acts as H-Bridges, high torque motors, multiple sensors for collision detection and avoidance, and power supply

2. Implementation

A. BLOCK DIAGRAM

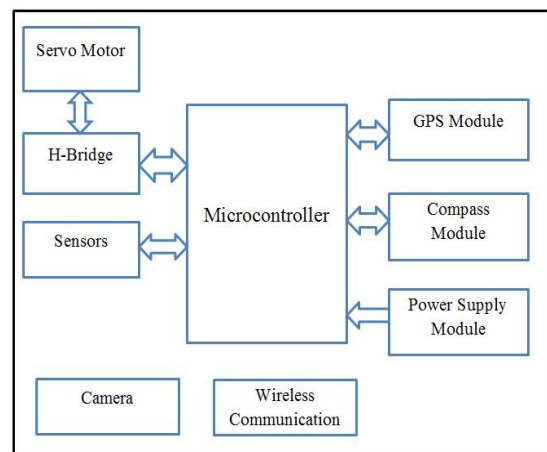


Figure 1: Basic Block Diagram of the vehicle

The basic elements of the GPS navigated vehicle are-

1. Controller
2. GPS module
3. Compass module
4. Motor control circuitry
5. Power module
6. Sensor network
7. Software

GPS module :

The GPS module includes GPS receiver antenna and GPS chip. The antenna receives data from the satellites. The number of channels available for communication varies with type of GPS module. The data acquired from the antenna is processed and transmitted to the controller. The transmission takes place by using any one type of communication like-UART (Universal Asynchronous Receiver, Transmitter), I2C (Inter-Integrated circuit), SPI (Serial Peripheral Interface Bus) etc. The widely used protocol is I2C where the data is transmitted in NMEA (National Marine Electronics Association) format. [6]. There are different modes in which the GPS functions. According to the requirement

and accuracy expectations one of the modes is used.[4]. The GGA (Fixed Location) and GLL (Geographic Latitude and Longitude) strings are relevant to be used in the proposed system. [5].

Compass module

Compass module is nothing but a low-field magnetic sensing element. The module consists of Inertial Measurement Unit which measures the body's angular rate. The operation of compass module in this project is also significant as it is able to trace the direction of the motion. [6],[13]. The output of the compass module is in the form of voltage. The market offers dual axis as well as triple axis devices, which provide information of the heading in either 2 axes or 3. The accuracy (in degrees) varies with the device used / required.

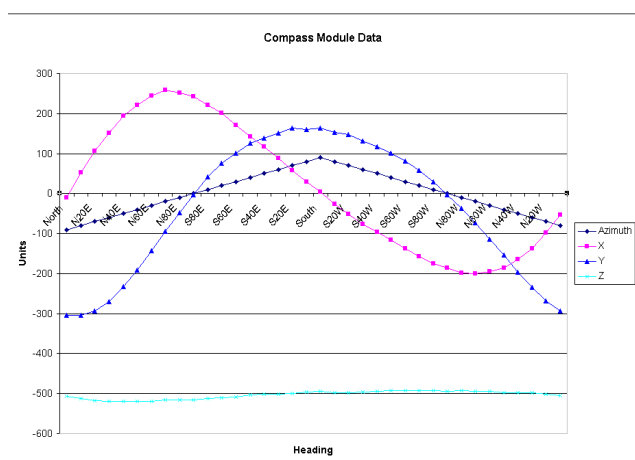


Figure2:3 Axes Compass module showing variation in the 3 axes with respect to the device's heading
Source-www.tymkrs.tumblr.com

Power Module

The overall power required for the peripherals of the device varies as per the load on the device. The power consumed by the Motor circuitry is the one which varies as the weight on the device changes. The batteries implemented can be either rechargeable (LiPo, Solar cells) or normal high voltage batteries called as Primary batteries. If rechargeable power supply is used the batteries need to be recharged time to time whenever the value goes below the minimum required value. Fixed value batteries need to be of low cost for the reason that if consumed to fullest value they will be replaced with another one. Frequently replacement of batteries will be inefficient.

Motor System

The motor system is responsible for the device's mobility. The type of motor implemented depends on the resources available (power supply), amount of load on the device, and precision required.[7]. The motor circuitry is made up of servo motors and motor drivers. Motor driver acts as a H-Bridge and power supply controller. H-bridge performs a significant task of providing direction to the motors. The motors are responsible for the vehicle's left, right, forward and

reverse motion. This action is contributed by the H-bridge on command from the controller.[6].The speed of the vehicle is determined by the amount of power given to the motors.

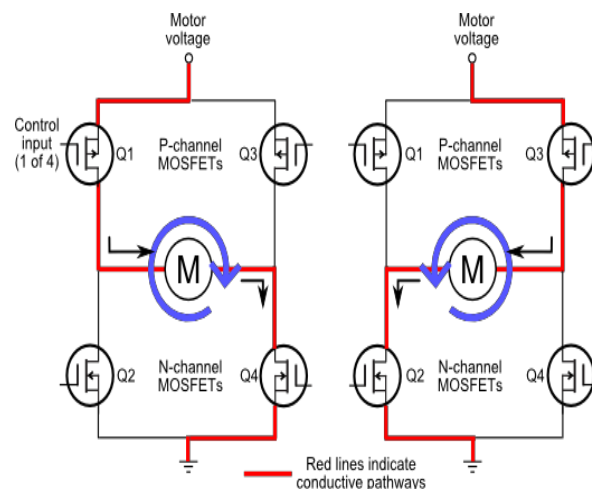


Figure 3: Working of an H-bridge
Source-www.robotoid.com –Image of H-bridge

Sensor Circuitry

The sensor circuit is implemented to avoid obstacles present in the path. Distance sensors are sensors used to determine the distance at which an obstacle is present. According to the resolution and accuracy the sensors are classified. [8]. There are numerous high performance sensors which help in monitoring obstacles-LiDARS, Ultra sonic sensors, Proximity sensors, IR sensors.[9], [14]. The output of the sensors is variation in the voltage value which indicates the change or alteration. The action taken after the detection of a barrier is based the algorithm of the device. Obstacle detection and avoidance are achieved by incorporating multiple sensors arranged in spatial variance on the device to measure the distance between the vehicle and the obstacle. Computer Vision fundamentals provide advanced sensing action. Stereo Camera captures the surrounding movements. This image information is then processed to yield information about the motion of surrounding objects.

Controller and Software

The controller and software together form the brain of the device. Both should be compatible with each other as they synchronize the actions of the peripherals. The software part in this project is the most vital one as all the functions are synchronized by the user required/implemented algorithm. Planning algorithms are techniques by which the motion of the vehicle is defined. These algorithms include motion determination and interrupt handling. Interrupts are special cases where in important decision are taken like power supply crisis, connection error between peripherals etc. Motion prediction of the obstacles is carried out for smooth travel. BUG 0, BUG 1,BUG 2arethefundamental algorithms in robotics. [16]. One of many languages namely C, C++, Python, and Embedded C can be used to instruct the controller to take actions.

A. Flowchart

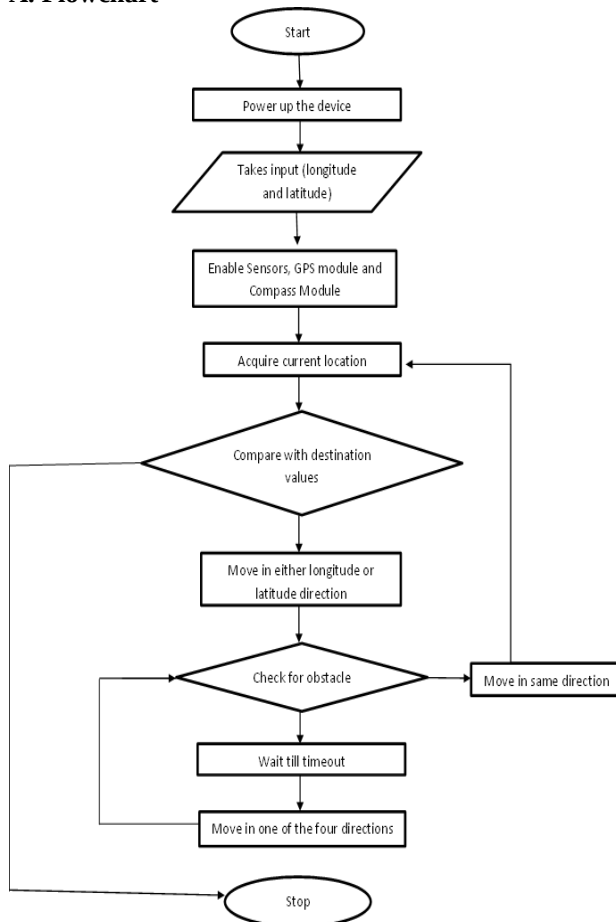


Figure 4: Flowchart of the project

Case study

The existing autonomous vehicle technologies pave the path to the future inventions, but the inventions are analyzed by comparing them with the existing technologies. If the comparisons yield positive results then the modern technology is said to be significant.

The comparison study is observed on the basis of cost, performance and user preference.

B. Cost

The cost of the components used is proportional to its complexity and performance. The analysis is made on the local observations and the value assigned is relative to the classifications considered. The following observations are noticed from the tabular analysis.

The cost of the controller in driver dependent vehicle is low as most of the decisions regarding the direction and motion are made by the human intervention.

The cost of the elements is medium in the wirelessly controlled and memory mapped vehicles. The human dependence is virtually present in the wireless controlled systems. In the memory mapped systems the amount of memory utilized is huge.

In the GPS piloted vehicles/memory less systems the cost of the controller is comparatively large as entire synchronization is done by the software and the controller.

The cost of the system varies with the area covered, manufacturing and the precision required.

Devices Used	Cost			
	Driver based	Driver-less		
		Wirelessly Controlled	Memory mapped	Memory-less
Controller	Low	Medium	High	High
Navigation	(Human) High	(Human) Medium	(Counters) Medium	(GPS) Medium
Guidance	(Human) High	(Human) Medium	(Large memory) High	(Sensors) Medium
Power Supply	Medium	High	High	High

Table1: Cost analysis of various elements

C. Performance

The performance analysis is noted with respect to each block, its behavior and precision in the various classified vehicles. The performance analysis is mentioned below

Devices Used	Performance/Error Resistance			
	Driver based	Driver-less		
		Wirelessly controlled	Memory mapped	Memory less
Controller	Low	Medium	Medium	High
Navigation	(Human) Medium/High	(Human) Medium	(Counters) Medium	(GPS) High
Guidance	(Human) Medium/High	(Human) Medium	(Large memory) High	(Sensors) Medium
Precision	Medium(in cm/m)	Medium (incm/m)	Medium (incm/m)	High(in cm/mm)

Table 2: Performance analysis of different elements

Driver dependent vehicles 'performance is dependent on various factors like contours in the region, machine complexity, and driver-skills and thus cannot be generalized to a particular result.

The errors in the wirelessly controlled devices are mostly due to the data inconsistencies between the receiver and transmitter during the motion.

The precision issues in the memory mapped systems occur in case there are huge differences between the physical environment and the desired one. The memory less system/auto navigated vehicle is expected to be time consuming because of the comparison between the current and final location at each step.

3. Future scope

In the past year, the United States 'National Highway Traffic Safety Administration (NHTSA) released a formal classification of automated systems. The vehicles were categorised on the level of self-dependency. The levels defined were 4 starting from 0. The last level vehicle is stated to be driver independent from its START to STOP including parking the vehicle[12]. The vehicle defined in this paper comes under level 4. Additional to the basic facilities of self-navigation, data acquisition and visual acquisition can also be equipped in the vehicle. These acquisitions will

enable security. The path travelled will be monitored with the acquisition mechanisms which will restrict the assessment only to the defined user. Emergency Braking system can provide advanced real time braking functions. If manufactured on large scale its application is found in large factories where logistics transfer or heavy weight load needs to be transferred from one location to other. It can also be implemented in golf courses, residential blocks for commercial uses.

4. Conclusion

In this paper various aspects regarding different vehicle technologies is discussed. Along with the operation of each element of the GPS navigated vehicle, the analysis of different vehicle technologies is also seen. The GPS navigated automated car is a fuel efficient and performance effective vehicle which can be utilized wherever the applications of transportation and communication appear. The performance is enhanced as it involves less human intervention; error accounted is less as well as user's time is saved. The disadvantages accounted by the vehicle are low as compared to the other models, hence can prove to be an efficient vehicle in the market.

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Review Paper on Desktop Modular CNC Machine

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ABSTRACT

In modern manufacturing, computer numerical control machines, popularly known as CNC machines, play a vital role. Industries use CNC machines for various applications. The CNC machines provide a faster and more efficient workflow. The products designed using CNC machines are highly accurate and precision is one of the most attracting features of the products designed by CNC machine. The accuracy and precision of the CNC machine is obtained because of the special type of controllers, which control the machine, generally microcontrollers. Microcontrollers play an important role in providing accuracy to the CNC machine as the process parameters need to be monitored and adjusted automatically. CNC machines are controlled by an innovative controlling method, which converts the CNC machine language, which is also called as GCODE into C programming. In the given paper, we are going to present an idea where we are going to combine the various applications into a single machine just with the change of modules. Thus, developing such a machine will be affordable for engineering students who wish to design a PCB or project implementation and for electronic entrepreneurs.

Keyword: CNC Machine; Desktop-Modular; GCODE; GRBL; Milling; Carving; Cutting; CNC Simulator Pro

1. Introduction

The CNC machines used for milling, laser cutting and PCB designing using flat-end cutting tools and multi-axis machines offer the benefits of higher removal rate and better accessibility. The first CNC machine was designed by John T. Parsons during 1940-1950s. Over all these years, CNC machines have undergone a lot of development in all the aspects. The CNC machines available in industry today are

highly accurate. Geometric factors as well as kinematic, dynamic and thermal properties of the machine tool determine the quality of the machined surface.

In the present paper, we present an idea of desktop modular CNC machine. We call it modular because the modules are going to be specific according to an application and hence we can change it accordingly. Modular machine tool is a special purpose machine tool that is made up of universal parts, which are designed, by serialization and standardization. Initially we wish to implement only two applications, which are PCB designing and 3D printing with subtractive method. Hence, we need five-axis movement of the machine. To get the multi axis movement we need more number of motors, which could be stepper motors or spindle motors, depending on the position of the motor in a machine. To control all these motors we need a controller, which can support enough number of input/output devices, also the speed of the milling has to be more so that the production rate is more and accuracy is more. One of the most encouraging factors behind the development of CNC machines is the progresses and the reduction on the cost of sensors, cameras and computer technologies.

The input to the controller is through a GCODE, which is a language understandable by the CNC machine. A special software GRBL is used to obtain the GCODE, which controls movement of all the motors along with timings or delays. GRBL will enable us to convert the desired image into the Cartesian co-ordinates of the images where the motors actually need to move in the direction of the required cut.

2. Review of the CNC Machine

In today's modern industry, high-tech gadgets with short lifetimes, and fast-changing fashion products, flexible manufacturing systems are emerging as a heart of the production. On the other hand computer aided design (CAD), computer aided manufacturing (CAM), computer integrated manufacturing (CIM) are being crucial in Indian engineering colleges, polytechnics and it is. Thus, there is a wide scope for the development of computer-based manufacturing. In addition, there is a wide scope in employment when it comes to CNC machines. According to a report, in US and UK 70% of modern manufacturing depends on the use of CNC machines and skilled machinist jobs are well-played and abundant in number. It is because the variety in the applications of the CNC machine, such as milling, laser/plasma cutting as well as emerging 3D printing. The working principle of all these applications is the same, which is use of stepper motors, motor drivers, controllers and computer software for executing motion control commands. However, the only difference is the mechanical design and the use of the tool for end operations such as material removal, cutting, carving, etc. CNC simulation tools also provide students an idea about the working of the machine before they actually implement it. In addition, they can verify if the CNC code written will work properly on the machines, to do the desired task or not. Thus, CNC machine simulation tools such as CNC Simulator Pro is an essential tool for the beginners. However, simulation of CNC machining is safe and flexible but the results do not provide the students the feel and satisfaction of directly operating physical machines. Hence, building a CNC machine from scratch is provides students a good idea about the controlling mechanism of the overall system and other instrumentation.

As far as manufacturing a CNC machine is concerned, the main design specifications of a machine tool are as follows:

- The kinematics should provide sufficient flexibility in orientation and position of tool and part.
- Orientation and positioning with the highest possible speed.
- Orientation and positioning with the highest possible accuracy.

The CNC machine consists of operating and stationary parts. The operating parts include electro-spindle, driving unit and stepper motor. The selection

of the operating parts is very critical. Because if the required components don't provide required torque in the given direction the cutting or milling or carving task will not be fulfilled successfully. The stationary body includes base and spindle holder. The material used for the base and body should be compatible in the sense that thermal deformation should not be an issue when a heat is generated by the motors or other components. Working range of the motor is flexible and could be adjusted as per the application.

3. Selection of the Material

The main components in a CNC machine we are designing include spindle motor, stepper motors, driving unit, controller, etc. Let us see the approach of component selection in detail:

- Spindle motors: Spindle motor is the key component in the precision machine tool. Hence, the performance of spindle motor has a great impact on the surface quality of parts being fabricated. The maximum rotating speed of the stepper motor is also an important deciding factor, as it will decide the speed of the overall production. The motor torque and power are essential when it comes to selecting a motor and it can be done using simple calculations as:

$$\text{Torque} = \text{Grinding force} \times \text{Radius}$$

$$\text{Power} = \text{Torque} \times \text{rotational speed}$$

- Stepper motors/Servo motors and driving unit: The driving unit the assembly of rotator/linear driving unit and ball screw system. The combination is usually used in the machine tool system. The driving unit being directly responsible for the precision and smoothness of the machine axis movements, should be given more importance as far as choosing a right driving unit or motor is concerned. Choosing a stepper motor over servo motor is a much better approach to control motion. The principle of choosing a stepper motor should meet following demands such as:

1. Maximum speed
2. Torque required
3. The inertia of the axis converted from the load

4. Methodology

In this section, an overview of the entire system, which includes hardware and software, is discussed. As mentioned before, the controlling unit for the CNC machine is a Microcontroller. The basic block diagram of the controller unit along with motors and other parts is given below.

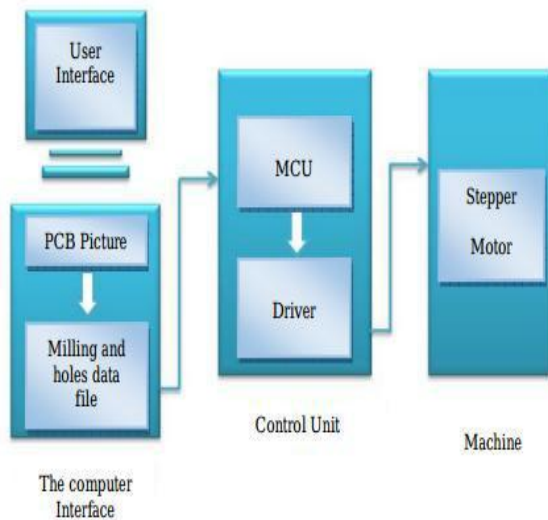


Fig. 1 System Flow of CNC Machine

Fig. 1 shows the overview of the whole system. The user draws the circuit diagram layout desired to be printed on PCB or the image of the 3D printed object. This layout or design is converted into machine level instructions, which are embedded with the holes and drill information. The control unit then receives this information and generate the sequence of pulses to the stepper motors mounted on the machine axis. The approach of creating the current path is different for different applications. However, as far as PCB designing is concerned, the drill is pressed down in the Z-plane or vertical plane onto the surface of the board, which is a copper-clad board and is then moved in the other two axes, which are X and Y planes. As the drill moves over the surface of the board, it removes copper thus creating an isolation channel. A path for current is created when two isolation channels are milled on either side. When the drill moves to the desired X, Y position, the head of the drill is pressed down and a hole is created.

5. Software Design

Software plays an important role in the CNC machine manufacturing. The milling or drilling process begins with the Gerber file containing drill information. Specialized software is used to convert these files into a set of instructions that indicate where the spindle motor connected to the drill or cutter should travel in

order to get a desired output. A separate controller program reads these instructions and sends commands to the microcontroller over a serial connection.

6. Software Process Steps

First user needs to draw the PCB circuit diagram or the 3D image of the image to be printed using any simulation program. The exported file will be inserted as an input to another program, which converts it to the machine instruction file (GCODE). After the GCODE of the file is obtained, it will be transferred to the microcontroller using some compatible interface using serial communication port. The code will be sent line by line to the microcontroller where each part of the GCODE line will trigger the suitable C language function. These C language functions then generate step pulses to the driver of the stepper motors to start milling or drilling or cutting the desired circuit diagram or design.

7. GCODE

GCODE is a standard machine language used to operate the standard CNC machine, only special and commercial drivers can work with this type of machine language, and it is the only language that the simulation software exports their files to. It is used to carry the instruction for mill or drill or cut for any type of materials with required dimensions. In addition, word that begins with the letter 'G' is generally a code telling the machine tool what type of action to perform, and by which speed. Various words can be combined to achieve specific multi-axis moves.

8. Conclusion

The Desktop Modular CNC Machine so designed is equipped with multi-dimensional movements and expected to have good precision accuracy in all the applications. A machine is designed with a novel approach of modular cutter. The machine is called modular as according to the application the cutter attached to the spindle motor is allowed to change. For PCB drilling, a drill bit is attached to the motor and for 3D printing and laser cutting a cutter is attached to the motor. The layout of the PCB circuit or object is given to the controller in the form of GCODE, which is then converted to C code, understandable by the microcontroller. The microcontroller used such that it provides more number of input output operations and supports MIPS (Million Instruction per Cycle). The CNC machine designed is small and hence called 'Desktop' and could be used in the small-scale manufacturing industries.

9. Acknowledgement

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FPGA Based Sine-wave PWM Drive

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ABSTRACT

In the modern power electronic converters, the Voltage Source Inverter (VSI) is the most widely utilized power converter in Industrial Drive Systems. PWM techniques for control of these inverters involve DSPs. However, hardware solutions such as Field Programmable Gate Arrays (FPGAs) have recently received special attention, mainly because of their ability to allow designers to build efficient dedicated hardware architectures by means of flexible software.

This work basically deals with replacing the complex, relatively slower and power consuming triggering circuit with a FPGA based control circuit. The control circuit designed is a sine wave PWM circuit where sine wave is used as modulating signal. The sine wave is first digitized and stored in the form of a lookup table. The sine lookup table is transferred to FPGA by designing and implementing UART Receiver. Data obtained from the UART is stored in the designed memory unit. Further, the sine wave stored in the memory unit is compared with the internally generated triangular wave, to get SPWM signals. A variable frequency output is obtained which can then be used to achieve voltage control in single phase inverters.

Keywords : FPGA, Lookup table, Sine PWM

1. Introduction

1.1 Motivation

In the modern power electronic converters, the Voltage Source Inverter (VSI) is the most widely utilized power converter in Industrial Drive Systems. In the widely utilized Pulse Width Modulation (PWM) methods for these inverters, the inverter output voltage approximates the reference value through high frequency switching. Most components of a state of the art PWM-VSI drive involve advanced technologies using IGBT and DSP devices. The advent of microprocessors made the vector control increasingly acceptable from the 1980's followed by DSP-based solutions for the implementation of digital control laws. However, hardware solutions such as Field Programmable Gate Arrays (FPGAs) have recently

received special attention, mainly because of their ability to allow designers to build efficient dedicated hardware architectures by means of flexible software. Therefore, FPGAs can now be considered as an appropriate solution to boost the performances of controllers, by enabling the implementation of new control methods and/or by designing concurrent architectures.

The PWM techniques have been described in details in various resources. The basic study and analysis of Sine PWM techniques is given in [1]. In [2], authors have developed control circuit for a single phase inverter which produces a pure sine wave with an output voltage that has the same magnitude and frequency as a grid voltage. The technique used is the sinusoidal pulse width modulation signal (SPWM) which is generated by microcontroller.

Authors in [3] describe a variety of topologies of multi-level inverters. Multi-layer inverter increases the output voltage by fewer harmonics. Multiplexed PWM generation can be divided into 5 parts: divider module, triangular wave generation module, modulating wave generation, comparing module and dead time module.

Authors in [4], have proposed a method to harvest the solar energy with the help of photo-voltaic (PV) cells and battery. This DC Voltage stored in the batteries are then supplied to the rural areas during power cut-offs and will be used as source of power. For designing this system, VHDL code for SPWM generation was developed and implemented on FPGA. Further the FPGA was integrated with power converter to generate PWM signals. The PWM adaptive intelligent Power inverter has been designed and developed to produce a sequence of PWM pulses at output of power convertor and deliver power to load. Comparison between traditional method and FPGA based implementation is done. The advantages of FPGA based implementation have been mentioned such as :

- Optimization and control of various parameters like voltage, frequency, no. of pulses etc.
- With more no. of pulses, THD values are 3%-5% less.
- PWM generated in this study is closer to sinewave.

In [5], a single phase matrix converter is modeled in MATLAB Simulink environment; controlled with sinusoidal pulse width modulation technique, control scheme is implemented in a Xilinx system generator environment and interfaced with power circuit in MATLAB Simulink. Based on simulation results, this converter is suitable for variable frequency power supplies, varying load conditions and variable speed electrical drives.

In [6], authors present a high speed FPGA implementation of fully digital controller for three phase Z-Source Inverter (ZSI) with two switching strategies include simple boost control and maximum boost control. To get a high speed and effective ZSI controller, a novel digital design for pulse width modulation control have been implemented for simple and maximum boost control of the ZSI. The proposed digit controllers have been successfully synthesized and implemented by Quartus II 9.1V and Cyclone II FPGA, to target device EP2C20F484C6. Achieved result demonstrates that the proposed method has features including reconfigurable, low-cost, high speed and also it is very accurate.

In [7], authors describe a V/f controller on a FPGA kit and test the speed control of the 3 phase squirrel cage induction motors. The speed control program has been developed in Xilinx 13.1 software using VHDL language to provide a wide range of speed control for the induction motors.

In this paper, a technique to generate a Sine wave PWM signal on FPGA board by using a lookup table approach is presented. The frequency control algorithms are developed with Xilinx ISE 14.7 software. The next section briefly describes the Sine PWM technique used for inverter control. Section III describes the methodology to implement SPWM in FPGA. In Section IV, the various results of implementation are discussed. Section V gives the future scope and conclusion.

2. Sine PWM

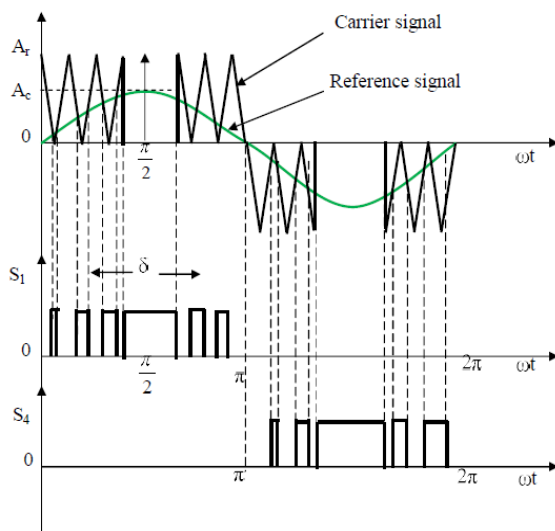


Fig 1: Sinusoidal Pulse Width Modulation

Figure 1, explains the generation of a sinusoidal PWM signal, having more applications in industries. In SPWM, the gating signal can be generated by comparing a sinusoidal reference signal with a triangular carrier wave and the width of each pulse varied proportionally to the amplitude of a sine wave evaluated at the center of the same pulse. The output frequency (f_o) of the inverter can be found by using the frequency of the reference signal (f_r). The rms output voltage (V_o) can be controlled by modulation index M and in turn modulation index is controlled by peak amplitude (A_r). The output voltage can be calculated by $V_o = V_s(S_1 - S_4)$. The number of pulses per half cycle depends on the carrier frequency. The gating signal can be produced by using the unidirectional triangular carrier wave.

These pulses are then used to achieve voltage and frequency control in inverter circuits.

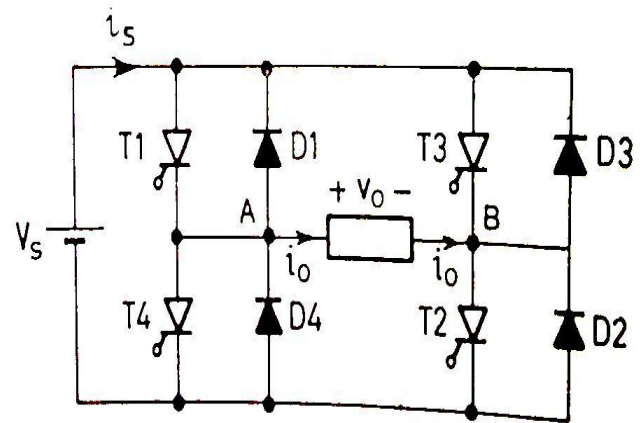


Fig 2: Basic Inverter Circuit

Figure 2 shows Basic inverter circuit. It has four thyristors which are connected in anti-parallel. During operation of the circuit, diagonal two thyristors remain ON (T1 and T2) and other two remain OFF (T3 and T4), since 180° phase shift trigger signals are given to the gate of diagonal thyristors. Output is taken in between the points A and B.

In sine PWM inverters voltage control can be obtained as shown in equation 1

$$V_{rms} = V_s \sqrt{\sum_{m=1}^{2N} \frac{\delta_m}{\pi}}$$

V_{rms} – RMS value of inverter output voltage

V_s – DC supply voltage

δ_m – Pulse width of m^{th} pulse

N – Number of pulses/cycle

Sine Wave Generation

The most common and popular technique for generating true Sine Wave is Pulse Width Modulation (PWM). Sinusoidal Pulse Width Modulation is the best technique for this. This PWM technique involves generation of a digital waveform, for which the duty cycle can be modulated in such a way so that the average voltage waveform corresponds to a pure sine wave. The simplest way of generating the SPWM signal is through comparing a low power sine wave reference with a high frequency triangular wave. This SPWM signal can be used to control switches. Through an LC filter, the output of Full Wave Bridge Inverter with SPWM signal will generate a wave approximately equal to a sine wave. This technique produces a much more similar AC waveform than that of others. The primary harmonic is still present and there is relatively high amount of higher level harmonics in the signal.

To obtain Sine PWM, there are two techniques:

(a) By giving analog signal as input :

Figure 3 utilizes a triangle wave generator and comparator to generate a PWM waveform with a duty cycle that is inversely proportional to the input voltage. An op amp and a comparator generate a triangular waveform which is passed to the inverting input of a second comparator. By passing the input voltage to the non-inverting comparator input, a PWM waveform is produced. Negative feedback of the PWM waveform to an error amplifier is utilized to ensure high accuracy and linearity of the output.

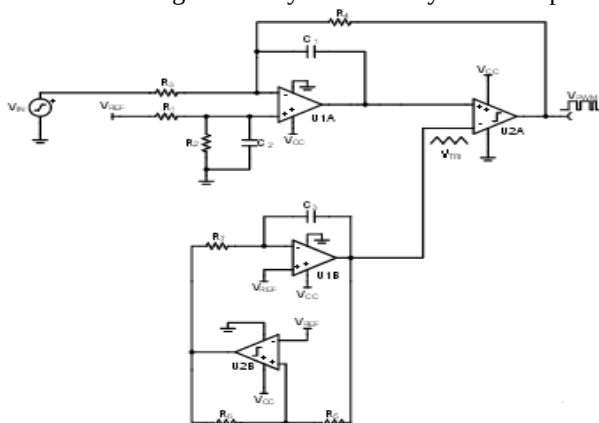


Fig 3: Circuit using Analog Sinewave to generate PWM

PWM combined with an analog filter can be used to generate analog output signals, i.e. a digital to analog converter (DAC). A digital pulse train with a constant period (fixed base frequency) is used as a basis. To generate different analog levels, the duty cycle and thereby the pulse width of the digital signal is changed. If a high analog level is needed, the pulse width is increased and vice versa.

b) By using a lookup table approach :

The values of amplitude and frequency of the desired sinewave are calculated and approximated to generate a lookup table. These values are fed to the FPGA board by using a UART communication protocol and stored in the memory of the FPGA, thus generating the

sinewave. The triangular wave is generated by designing counters. These triangular wave and the sinewave can be compared and a PWM signal is generated. The entire process takes place on FPGA at a very high speed.

3. Methodology

FPGA Based Implementation

In this work, SPWM is implemented with Field Programmable Gate Arrays, FPGA. In addition to the compact size, FPGA also provides very high processing speed, thus making it suitable for high frequency switching circuits [8].

This work shows the implementation of SPWM using a Lookup table approach. This technique was selected as it provides less delay, high accuracy and less power consumption.

The sine lookup table was generated by finding out values of sine at each angle from 0° to 360° and then approximated the entire sine wave into 8 bits and 16 bit values. Thus the sine wave was stored in the form of a lookup table as text file in the computer.

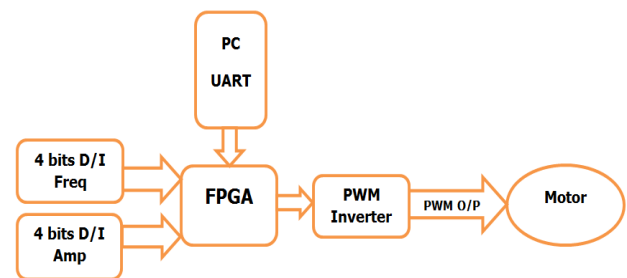


Fig 4: Schematic Diagram

Figure 4, shows the schematic diagram of the system. It has various blocks like PC, UART, FPGA, PWM Inverter.

To transfer this sine lookup table into the FPGA, UART (Universal Asynchronous Receiver Transmitter) was used. Computer/laptop acts like the transmitter and UART receiver was designed inside the FPGA using state machine logic. The H-Term software was used to send the data via UART. The data gets received and can be seen from the variable 'DataRX' in figure 7. It is then saved in memory i.e. RAM of 1024×8 bits, designed inside the FPGA.

Sine PWM generation requires two main signals, one is a sine wave and the other is triangular wave. The sine wave was obtained and stored in the designed memory.

Further, a triangular wave of 8 bits resolution was generated which acts as the reference wave of fixed frequency and fixed amplitude. This wave was generated by designing counters. Now both the sine wave values from RAM and triangular wave values are read at clock frequency and given to the 8-bit comparator to generate the PWM signal having fixed amplitude and frequency. Now, to vary the width of PWM wave, a 4-bit frequency value was given as input

to the system. Depending upon the 4 bit 'freq' input, the frequency of sine wave was varied and accordingly 2^4 i.e. 16 SPWM signals was generated. The SPWM signals thus generated will be used to obtain voltage and frequency control in the inverter circuits.

4. Results and Discussion

The implementation of the system was done using Xilinx ISE 14.7 software [9]. The design flow of the system was divided into three stages namely design, implementation and simulation.

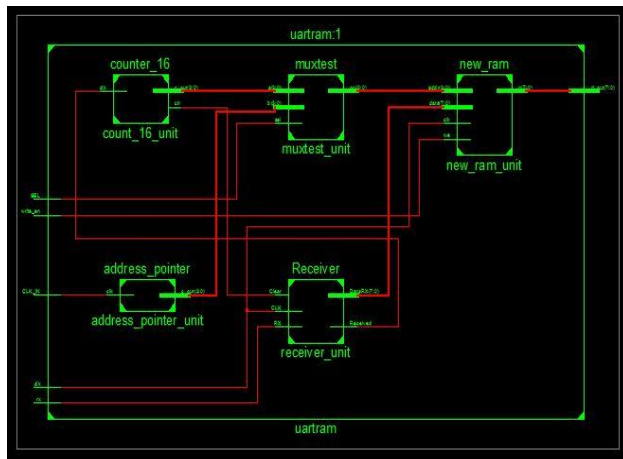


Fig 5: Register Transfer Level (RTL) schematic of UART Receiver

Figure 5 is the RTL schematic of UART Receiver. ‘Receiver’ block obtains the data from the RX line, which has the data coming from the PC/laptop and stores it in the ‘new_ram_unit’ block. ‘address_pointer_unit’ block generates the addresses of the ram unit. ‘count_16_unit’ and ‘muxtest_unit’ together comprises of the logic which stores the data in RAM depending on the data received from RX line of Receiver.

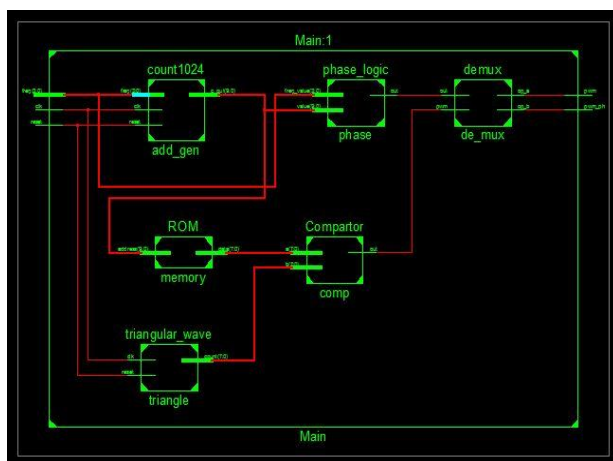


Fig 6: RTL schematic of SPWM signal generation circuit

Figure 6 is the RTL schematic of the SPWM signal generation circuit. It has memory component which stores the sine lookup table containing the sine wave. ‘Triangular_wave’ block generates the triangular wave. Both these waves are compared using the ‘comparator’

block to give SPWM output. The SPWM signals is given a phase shift of 180° by the 'phase_logic' block. So, two signals are obtained at the output. The two signals are 'pwm' and 'pwm_ph'

The data (sine lookup table values) was sent using H-Term Software on the RX line. First '01010101' was sent on 'RX', the UART Receiver sampled these bits on and recovered the data. This recovered data can be seen on the 'DataRX' bus in figure 7. Further, '01010111' was sent on 'RX' and again the data was successfully recovered.

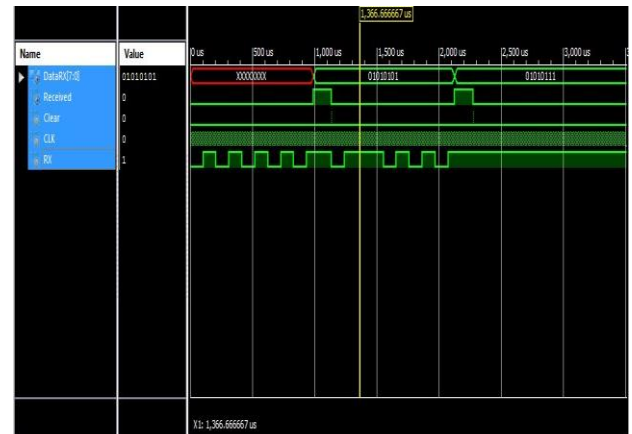


Fig 7: Data obtained from RX line



Fig 8: Data stored in RAM

The data received on 'RX' is first written in the memory location inside the 'new ram' block. Figure 8 shows the successful storage of data '01010101', by reading from the memory and displaying it on the 'd_out' bus. The 'd_out' bus is the output of the 'new ram' block.

The values of sine wave stored was compared with triangular wave and SPWM signals were generated. This designed system was implemented on Spartan 3E FPGA [10]. To display the output of the system, the output pins assigned on the FPGA were connected to the Digital Oscilloscope and the SPWM waveforms were displayed.

The frequency of the SPWM signal was varied by changing the 4 bit 'freq' input value.

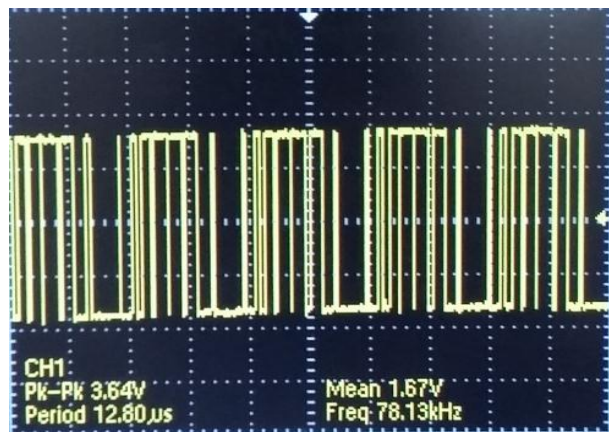


Fig 9: Output for frequency value '0100'

Figure 9 and 10, shows the SPWM signals for 'freq' value of '0100' and '1000' respectively

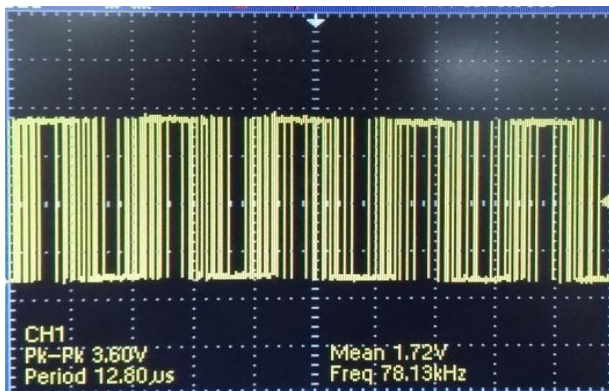


Fig 10: Output for frequency value '1000'

When the input 'freq' value increased, the pulses in the SPWM output also increase. Due to an increase in the number of pulses in SPWM output, higher order harmonics increase and lower order harmonics got reduced. Thus, as the 'freq' value of sinewave was varied, the harmonic content of SPWM wave also varied. So, the lower order harmonics were suppressed more for 'freq' value of '1000' than for '0100'.

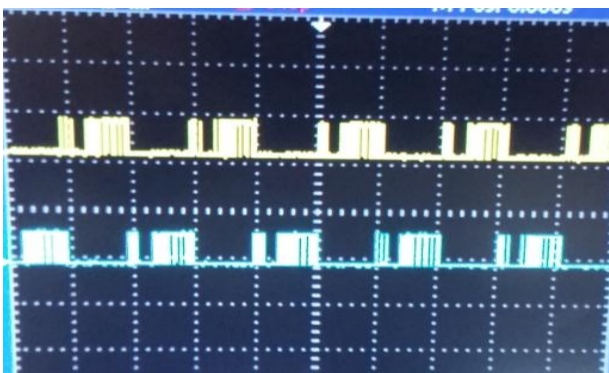


Fig 11: Phase shifted SPWM signals

The SPWM signals generated, when given as control signals to inverter circuit must be phase shifted. Figure 11 shows the PWM signals phase shifted by 180°.

Clock	Lowest Frequency	Highest Frequency
1MHz	0.976 KHz	15.625 KHz
5MHz	4.88KHz	78.125 KHz
10MHz	9.765 KHz	156.125 KHz
25MHz	24.414KHz	390.625KHz
50MHz	48.8 KHz	781.25 KHz

Table 1: Range of frequencies

Table 1 shows us the range of output frequency of SPWM signal that was achieved by operating the system at different clock frequencies from 1MHz to 50MHz and for 'freq' value '0000' which denotes the lowest frequency and '1111' which denotes the highest frequency. Thus, a frequency range of 780.275 KHz was obtained from 0.976 KHz to 781.25 KHz.

5. Conclusion and Future Scope

This work, shows the generation of SPWM with FPGA by storing a lookup table in the FPGA using UART and comparing it with a triangular wave using a comparator. The frequency of the sine wave was varied resulting in 16 distinct SPWM signals. These SPWM control signals generated, can be used for voltage control in inverters. The quality of sine wave can be improved by increasing the data points used for representing the sine wave in the form of lookup table. Future work includes designing SPWM based VFD for laboratory purpose and implementation of more sophisticated control algorithm like Space Vector Modulation Technique on FPGA.

6. Acknowledgement

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Automated Vehicle Surveillance and Security

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ABSTRACT

We have proposed a solution for automated vehicle tracking and surveillance. We aim to track the speed of the vehicle in addition to constant tracking of the automobile via GPS. The system has been devised with the yield of an 'Embedded System' mechanism. In addition to automated tracking of the automobile, the security facet of tracking that has been introduced is to keep a track of doors, bonnet and engine operations in addition to deciphering any discrepancies rolled into the operation. Also, we have devised an encrypted mechanism to lock the engine of the automobile via a command in case of automobile robbery. In addition to the above mentioned tasks the system is designed to alert the user about various critical deadlines regarding the maintenance of the automobile.

Keywords : Automated Car Surveillance System, Embedded Systems, Encrypted automobile security feature, Smart car security.

1. Introduction

The demand for a secure and smart vehicle tracking system with secure encryption has been the prime motivation behind this project. Factors that we deemed crucial with regards to implementing this idea are cost effectiveness, secured operation, efficient usage of available space and a simplistic approach towards obtaining the desired results. The need for such a system is high in demand amongst commercial cab and vehicle services.

This facet of secured and encrypted tracking of an automobile is of utmost importance as it yields several answers to existing questions about automobile tracking. First and foremost, tracking a vehicle and its speed is of utmost importance for commercial units that lease vehicles. Any tampering with the engine system or tracking door movements can further provide a better clue as to what are the intentions behind discrepancies. In case of peculiarly suspicious movements, locking of the engine with immediate and prompt effect can be achieved.

It is a challenging task to achieve the above-mentioned results in real time whereas real time analysis is very much manageable. Certain approaches have been implemented but very few are as simplistic and efficient as the one under discussion.

One key aspect of our approach is that is cost effective and particularly effective given the kind of challenges that we face in real time operations. It is particularly inclined towards providing brisk and prompt results at the behest of requirements associated with the ideology. We have keenly tried to adopt a very simplistic and holistic approach. Perhaps, the only challenge that we behold is to free this application of any internet usage. Our results have held true to distinct test conditions and adversities.

As an additional feature, the system is configured to act as a reminder system regarding various maintenance deadlines. The system maintains all deadlines and physical maintenance tasks performed in its memory and alerts the user and owner whenever deemed appropriate as per crucial deadlines.

2. Approach

We have worked towards keeping a simplified and holistic approach. We break down the entire concept into following major parts:

- Vehicle tracking & Vehicle speed tracking
- Vehicle safety measures
- Vehicle encryption
- Vehicle Maintenance

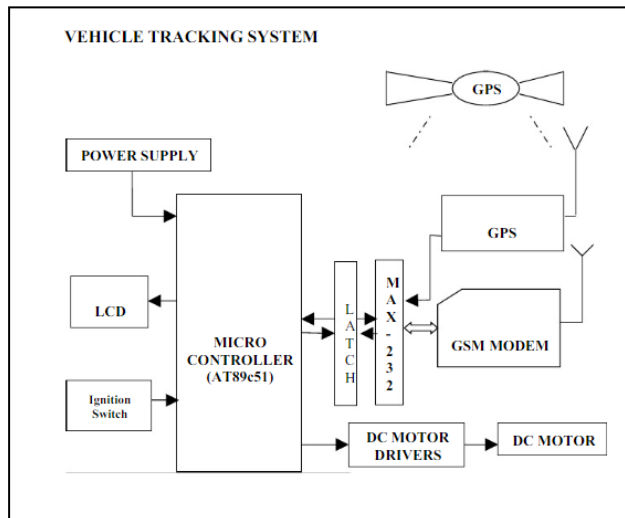
3. Vehicle Tracking

The position of the vehicle is traced with the help of GPS and GSM technology. This part is aimed to track the vehicles by giving the position/ location of the vehicle.

This obtained location of the vehicle is indicated by using Global Positioning System technology.

Communication link required for the transceiver system is made possible by using a GPS transceiver. GPS will give information regarding parameters like longitude, latitude and altitude and these parameters can be sent towards viewing system/ backend where we can show the location of vehicle by mapping the required parameters as needed. With this system, we can easily identify vehicle thefts based on the location and other parameters. GSM is used for receiving and sending messages according to the software program written to perform this operation. GSM is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz.

The Global Positioning System (GPS) is a satellite-based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides you with information. By application of GPS technology, we can determine location, velocity, and time, 24 hours a day, in any weather conditions anywhere in the world—for free. This information is logged on to our IoT based server which keeps a log of every detail that is being monitored.



Consider the vehicle tracking system as shown below in the figure 1.

Figure 1: Vehicle Tracking System

Here we pre-dominantly have two different blocks, viz. tracking and location. Firstly, we are concerned regarding the tracking system methodology. In this process, we will place this vehicle tracking system in vehicle. The block diagram of the system consists of a GPS modem, a micro controller, an ignition switch, DC motor, a LCD Display and power supply.

These hardware components have functionalities as follows: A GPS modem is used to get the signals and receive the signals from the satellites. In this process, GPS modem gets the signals from the satellites and those parameters are given to the microcontroller. The signals may be in the form of the coordinates; these are represented in form of the latitudes, longitudes and altitudes.

A GSM modem is used to get the messages from the mobile transmitter as also for reading the message. Thereafter the acknowledgement signals will be sent. Before this, we initially are needed to insert the SIM card in the modem. Then the process of receiving and sending the messages will be done. First the concerned client will register for that SIM card. And at the server/backend, viewing and controlling of the automobile is carried out autonomously. This section focuses on objectives such as vehicle tracking and speed monitoring. In this system, we have chosen a microcontroller, power supply, LCD, GSM, Server, the server is used as the sole requester for tracking and blocking/ locking of vehicle.

Here we implement two switches one for sending request for tracking the vehicle location and another for blocking the vehicle. A micro controller is the heart and driving unit behind this process. The total controlling action will be done through this microcontroller. Based on the signals given to the micro controller the security action will be totally and autonomously controlled at the output section. If we send the message like “TRACK” to the GSM modem at the viewing and controlling section it will be received by the tracking section which is placed in the vehicle, it will send signals to the micro controller to trace the vehicle and if we send a message such as “LOCK” the automobile will get locked by the micro controller because of the controlling operation. Upon receiving the signals, the micro controller will switch off the ignition part of that vehicle. Then the vehicle does not move any further. An ignition switch plays the key role in the vehicle, for moving. If it is in off condition, the vehicle does not move at all and ceases motion. In this process, for completely stopping the vehicle we just switched-off the ignition switch with the help of the micro controller.

A LCD display is used at the output section. To display the status of the GSM and GPS. Additionally, the LCD display maybe extraneous due to flexibility of IoT server and maybe removed.

The server that we intended to implement in the scheme of things is an IoT server. The IoT server not only enables us to keep a log of events but it also enables the micro controller interface set up to execute the required output at the behest of real time operations. The IoT platform is on the upsurge and it is a very good advocate of performing condition specific actions. Also, the massive memory storage provided by the mentioned server is an additional advantage in our scheme of things.

4. Vehicle Safety Measures

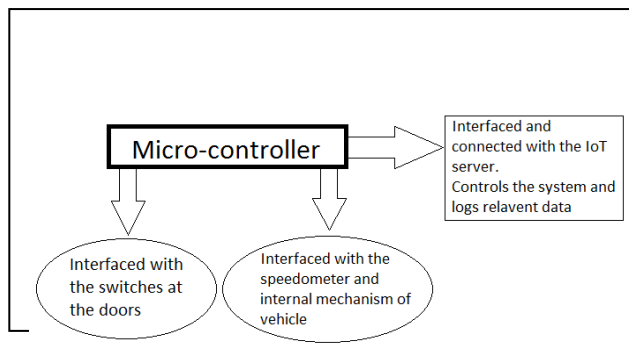
Tracking door and bonnet activities may enable the owner to enhance his track of what the automobile is being used for. This facet is of particular significance for commercial vehicle leasers.

We have executed above mentioned task using the concept of digital switches. Digital switches provide us with either a high or a low reading/ output. Depending on our application, we have implemented pull down switches. For a closed door, these switches will be at a digital low state, whereas for an open door, the switches will feedback a digital high state output. The system is configured so as to log an entry for every digital high output. Thus, a configuration capable of logging actions of the door is set up. The switches are connected by means of physical or wireless networks to the microcontroller which logs the data onto the IoT server.

The microcontroller also enforces the ignition switch to turn off in case of prolonged digital high state (indicating that the door is open) thereby enabling fuel consumption in case of stationary vehicle or preventing any fatalities if the car is in motion.

The system is also capable of monitoring the speed of the automobile based on received signals from speedometer of the automobile. The microcontroller is interfaced with the speedometer of the vehicle and in addition to the other information it also logs the speed values of the automobile onto the server. As the speed crosses a particular threshold, the microcontroller prompts the server and driver about the high speed, thus keeping a check on the speed limits of the vehicle.

Consider the interfacing of microcontroller as shown below in the figure 2.



The system thus implemented is beneficial in terms of real time operations and real time operations also. The system can be easily reconfigured and is very flexible to be implemented into operation.

5. Vehicle Encryption

Vehicle encryption is a very keen concept that we are dedicated towards for the process under discussion. We aim at introducing a degree of encryption despite the humongous logs of data that we receive. Encryption is pre-dominantly a security measure ensuring greater degree of privacy.

This process aims at maintaining the client's data in an encrypted manner. Thus, the choice of an IoT server.

To ensure no tampering with the hardware used at the automobile side, the switches are installed carefully so as to camouflage with the door mechanism and the micro controller setup is placed in similarity to the black box of an aero plane. The setup is locked with a digital password only known to the owner.

The IoT server is authenticated to serve the owner with his own personal credentials.

6. Vehicle Maintenance alert

Vehicle maintenance is another important facet of our idea. Fuel consumption, vehicular check-ups, pressure check for vehicular tires are important aspects with respect to daily chores which we aim to solve autonomously with the aid of our system.

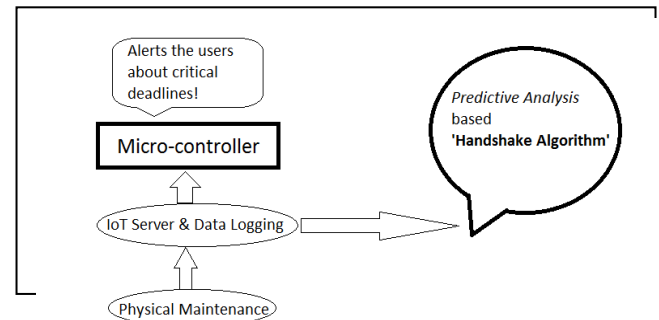
We implement the idea using a holistic and simplistic approach towards object oriented problem solving.

Following figure 3 is the block diagram used to set-up uC:

The micro controller set up is interfaced with an alert system, typically a LCD or a SSD to alert the user regarding various maintenance related deadlines.

It is a handshake type of process that is performed by the configuration. Initially all the required credentials regarding the maintenance works are entered into the server at the backend. At the front end, the micro controller updates its calendar and as per the deadline it enforces the alert.

Figure 3: Block Diagram for microcontroller set up



The

performed such as tire pressure check, fuel tank refill, etc. the micro controller updates its directory with the concerned parameters and this data is then fed to the server for further analysis.

This further analysis implies the study and analysis of data and the server further comprehends an approximate deadline for the supposed next maintenance check-up. The analysis is done by means of the technique of 'Machine Learning' and 'Predictive Analysis'. The following algorithm is put in place for the comprehension of the data:

- Data input feed
- Sample data feed
- Ambient and vehicular feedback regarding atmospheric temperature, humidity, vehicular age, type of roads (highway/ city roads) and other miscellaneous features with regards to consumption of fuel and pressure of tire
- Reading various parameter and on comparison with identical/ similar sample data processing further theoretical consumption of fuel and providing a further insight into the required time before the next maintenance is due
- Processed results to be matched with earlier occurrences and to be checked for similarity in pattern
- Based on above comparison and processing, alert user about required parameter with 25% fault tolerance

In addition to maintenance this idea yields the user a detailed analysis of vehicular performance.

7. System at a glance & LAN/ WLAN

The IoT server forms the backbone of the system in addition to the micro controller. The principle that distinguishes our system from the systems currently in use is the robustness and real time efficiency of the system. The IoT server plays a detrimental role in the real-time operations. The IoT platform enables the brisk pace of tasks at stake and ensures encryption and storage of data log.

The micro controller should have high computational capability and a tolerable response time to achieve the operations and to prevent any chances of failures. Since it is interfaced with several components it is required to have good ADC resolution. Communication between the GSM module and the microcontroller is serial communication.

Thus, the microcontroller should support UART protocol. Also for further IoT communication and to make the system flexible, the microcontroller should be able to communicate using ESP module and should support I2C and SPI protocols.

A critical requirement is the availability of LAN/ WLAN connection for the IoT communication to occur in real-time. An alternative to this requirement would be a local server connected by means of GSM to a smart phone. That would however impact the storage capacity of system to log data.

The following blocks work in harmony simultaneously to yield the required output in real-time:

- Vehicle tracking & Vehicle speed tracking
- Vehicle safety measures
- Vehicle encryption
- Vehicle Maintenance alert

The resultant is a compact and efficient system capable of handling diversities in performance.

8. Performance Experiments & Results

The preliminary results have shown encouraging results and the observations tabulated have been able to achieve desired objectives.

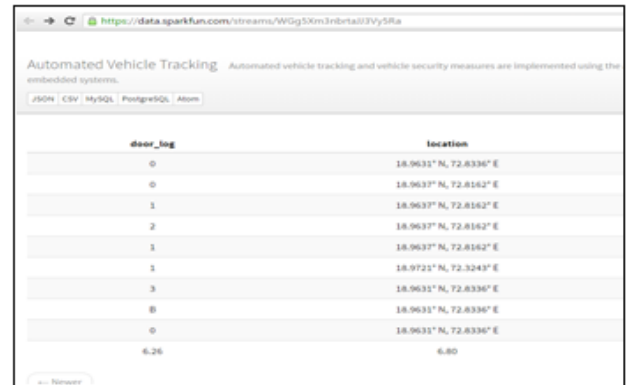
The performance is to be graded based on following parameters:

- Efficiency of vehicle tracking
- Accuracy of speed reported
- Logging data onto the server
- Blocking/ Locking of the engine as per commands sent from owner at the backend and response time for the same
- Predicting capability of the system with regards to maintenance features
- Accuracy of logged data based on actions at the doors

Observed results indicate the following:

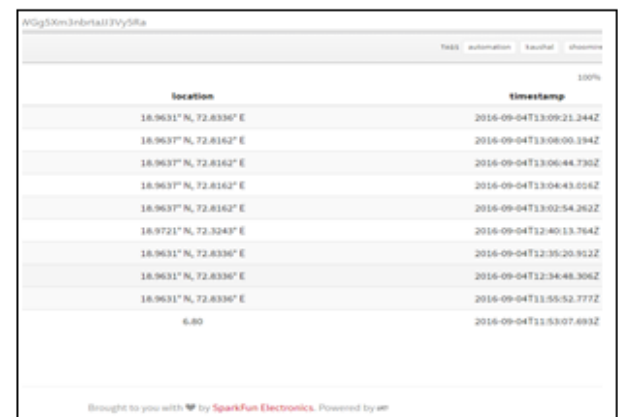
- The absolute performance indicated the system is acceptable
- The performance is comparable to previous approaches and our results are found to be more objective oriented

The results are indicative of the location and door activity logging system as follows:



door_log	location
0	18.9631° N, 72.8336° E
0	18.9637° N, 72.8162° E
1	18.9637° N, 72.8162° E
2	18.9637° N, 72.8162° E
3	18.9637° N, 72.8162° E
1	18.9721° N, 72.3243° E
3	18.9631° N, 72.8336° E
B	18.9631° N, 72.8336° E
0	18.9631° N, 72.8336° E
6.26	6.80

Figure 4: Results (Logging of required parameters)



location	timestamp
18.9631° N, 72.8336° E	2016-09-04T13:09:21.244Z
18.9637° N, 72.8162° E	2016-09-04T13:08:00.194Z
18.9637° N, 72.8162° E	2016-09-04T13:06:44.730Z
18.9637° N, 72.8162° E	2016-09-04T13:04:43.056Z
18.9637° N, 72.8162° E	2016-09-04T13:02:54.262Z
18.9721° N, 72.3243° E	2016-09-04T12:40:13.764Z
18.9631° N, 72.8336° E	2016-09-04T12:35:20.912Z
18.9631° N, 72.8336° E	2016-09-04T12:34:48.306Z
18.9631° N, 72.8336° E	2016-09-04T11:55:52.777Z
6.80	2016-09-04T11:53:07.893Z

Figure 5: Results (Logging with associated time-stamp)

The keys for door log reading are as follows:

- 0 All doors shut, is indicated only when door is shut and owner requests for location of vehicle
- 1: Indicates driver door is open
- 2: Indicates door adjacent to driver's door is open
- 3: Indicates door behind the driver's door is open
- 4: Indicates door adjacent to door behind the driver's door is open
- B: Indicates bonnet of vehicle is open

The results thus obtained are tabulated by interfacing the switches for actuating the door logging mechanism. The locations in terms of the latitude and longitude is also logged onto the IoT server. The results have shown minor aberrations due to discrepancies in the WLAN used for the analyses.

The LED is indicative of the action to be taken on the ignition switch.

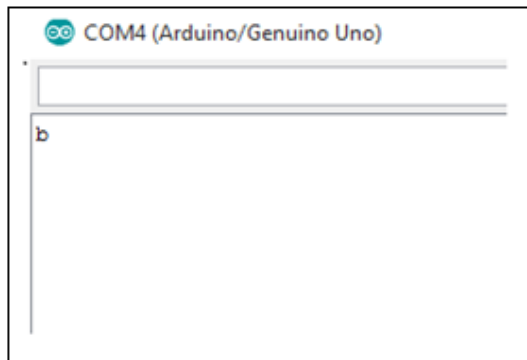


Figure 6: Results (Simulation of vehicle locking)



Figure 7 : Result of simulation

LED in ON state implies ignition switch to be turned off whereas LED in OFF state implies no action to be taken on current state of ignition switch. The LED will glow only as per user's instructions to turn off the ignition switch on receiving instruction "b" or "block".

The above simulation yields following results:

The location and door log is logged onto the server and on receiving command 'b' or 'block' the ignition switch will be turned OFF as per instructions from the user.

9. Conclusion

Vehicle tracking and real-time blocking of vehicles based on commands from server at the backend were successfully implemented. Data was logged onto the server with respect to actions at the doors and maintenance alerts were generated and found to be true. The results thus obtained stand to be within acceptable limits thereby ensuring reliability of the system.

10. Future Work

Given that the preliminary results have shown encouraging signs, the idea is under development to fully revolutionize the automobile tracking segment, by converting single server concept to a full-fledged call center with mass usage of the system and mass management of the systems under one roof. Also special emphasis is laid upon the predictive analysis capability of the system.

11. Acknowledgements

We would like to extend our generous gratitude to Prof. Atul Oak for his constant guidance and encouragement.

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Virtual Tongue -Flex Sensor based Speaking Assistance System for Hearing Impaired Persons.

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ABSTRACT

Generally speechless persons communicate with sign language which is not known to most of the normal person. Hence, to reduce this barrier we are proposing an Electronic system which converts hand gestures to speech. Based on the electronic system that hand gesture can translate into a speech in order to convey a message from speechless person to normal person. The system is based on ATMEGA AT89S52 microcontroller which uses a glove embedded with flex sensors for acquiring hand gestures and to convert it to voltage. This is given to FN-RM01 an MP3 recorder player system which converts these voltages to voice messages. This system can be implemented in the real time to complete the basic needs of communication.

Keywords : Flex sensor, Hearing impaired, AT89S52, FN-RM01

1. Introduction

In our country more than 6.3% of peoples are hearing impaired and most of them cannot speak. The communication between a hearing impaired speechless persons and a normal person possess is more difficult compared to communication between blind and visual people. In recent years hand gestures have been used for developing applications in the field of robotics. Authors have tried to explore the possibility of sign language and hand gestures for developing aids for hearing impaired speechless people.

Gestures are some forms of actions which a person expresses in order to express information to others without saying it. In [1] authors have discussed ATmega328 based speaking glove. This uses use flex sensors which are fitted with glove to sense the finger movements and can provide a smooth communication between speechless patient and normal people. In [2] authors have discussed a wireless data glove , which is normal cloth driving gloves fitted with flex sensors along the length of each finger. Also it can be used to control appliances using hand gesture. [3] Describes about Gesture recognition that can be seen as a way for computers to understand human body language. Also they discusses about gesture recognition which enable humans to interface with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, they have described how finger can be used as a cursor on computer screen. This could potentially make Conventional input devices such as mouse, key boards and even touch-screens redundant.

In [4] authors mentioned about a glove based system for the detection of the movement of fingers, which natural human hand utilizes and is synthesized to speech. In [5] a description about communication skill that uses gestures instead of sound to convey meaning simultaneously is done. This combines hand shapes, orientations and movement of the hands, arms or body and facial expressions to express fluidly speakers thoughts which mainly uses Flex Sensor .These are sensors that change its resistance depending on the amount of bend on the sensor. This digital glove aims to lower the barrier in communication. It is electronic device that can translate Sign language into speech in order to make

The communication [6] gives a study about how most deaf individuals with various degrees of deafness can lip-read and understand someone speaking. However they always communicate with each other in sign language. They have considered a typical situation where a person (student) who wants to use sign language to give a presentation to other students who do not understand the sign language. To enable this type of communication, they have built an experimental system for the automatic translation of sign language into text and speech.

In [7] authors explained about electronic gloves that can be useful for the speechless patients with half of their bodies paralyzed but are able to move their fingers. In [8] authors describes about how speech disorders affect the content of speech and the function of language in communication. According to authors the disorders associated with speech are articulation deficiency, speech disturbances, dysfluency, aphasia, dysphonia & dysarthria.

They have also mentioned that these aids are categorized in two types namely, low tech and high tech communication aids. Low tech communication aids are non-electronic form of communication by means of books, words and letters. High tech communication aids are in the form of electronic communication which permits the storage and retrieval of electronic messages. [9] Discusses about the implementation of gesture recognition system and the different kinds of devices required for capturing and tracking image/ video image such as camera(s), instrumented (data) gloves, and colored marker. Those devices are used for modeling the communication between human and environments rather than traditional interface device such as keyboards, and mice which are inconvenient and unnatural for HCI system.

In this paper we propose to have an Electronic glove which can be used for communication between speechless hearing impaired patients who are partially paralyzed and hospital staff/doctors /normal public. We are using flex sensors for gesture recognition along with a speech synthesizer and zigbee to develop the system.

Section II describes the block diagram description and scope. Section III discusses the circuit diagram and implementation. Section IV describes the application and expected results and section V future scope and conclusions.

2. Block Diagram & Description

This device is useful for the Paralyzed or ICU patients who cannot speak and express their feelings or who are unable to talk with other people.

Key features of the project are:

- Portable
- Wireless gloves
- Less weight
- Fully embedded
- Rechargeable Battery

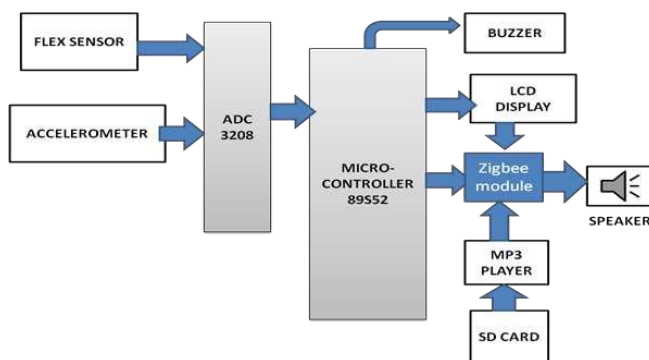


Fig.1 : Block Diagram of the system

A. Flex Sensor :

Flex sensors refers to transducer which changes resistance when shape of sensor changes [4]. The main use of flex sensors is to measure the resistance changes due to bending of sensor. The more the bend, the more will be the change in resistance. Inside the flex sensor there are carbon resistive elements within a thin flexible substrate. They are usually in the form of a thin strip from 1"-5" long that vary in resistance from approximately 10KΩ to 50KΩ. The flex sensors are used as input and are placed inside the glove that is to be worn. The sensor is so flexible that it bends easily even with a small bend. It generally requires a 5V Input power supply and Output varies between 0V and 5V, the resistivity will alter with the degree of bending of sensors the output voltage changing consequently.

Calculations are as following : Formula for voltage divider circuit:

$$V_0 = V_{cc} \frac{R_2}{R_1 + R_2}$$

Electrical characteristics of flex sensors are :

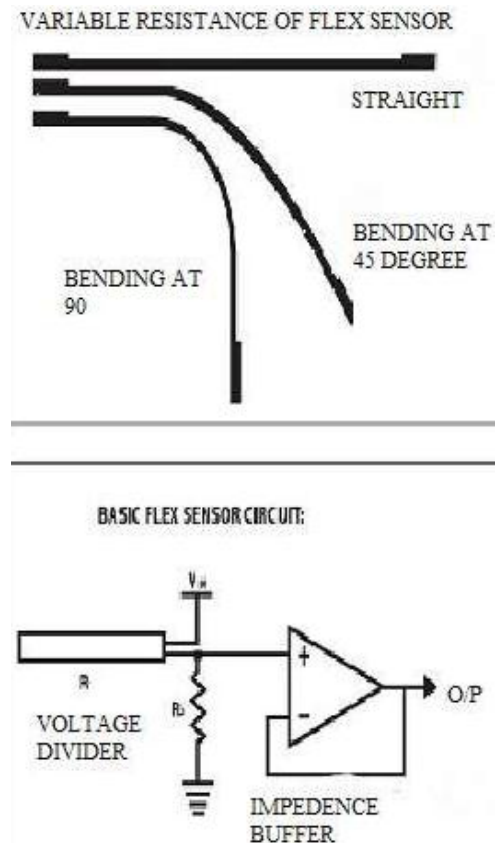
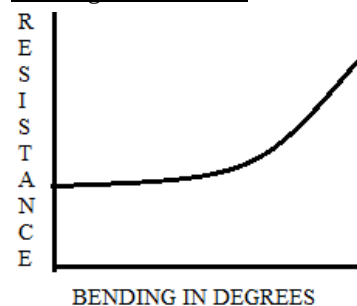


Fig. 2 : Flex sensor circuit

Characteristics of flex sensors

1. Bending vs Resistance



2. Resistance vs Voltage



Drawbacks of Flex Sensors are:

- Strong logic levels are not obtained so we use pull-up
- Resistors in order to obtained strong logic level
- Analog output from flex sensor is in low range.
- Analog output from flex sensor is less accurate.
- Highly unstable analog output from flex sensor
- Expensive

A. ACCELEROMETER

An accelerometer is an electromechanical device used to measure acceleration forces. It is a dynamic sensor capable of a vast range of sensing. The basic principle of operation behind the MEMS accelerometer is the displacement of a small proof mass etched into the silicon surface of the integrated circuit and suspended by small beams. They are of two types:

- Capacitive Accelerometer.
- Piezoelectric Accelerometer.

The project is aimed to use capacitive accelerometers.

Size	Approx. 0.28" wide and 1"/3"/5" long
Resistance Change	Approx. 0.28" wide and 1"/3"/5" long
Life Time	Lifetime Greater than I million life cycles
Temperature Range	-35 to +80 degrees Celsius
Hysteresis	7%
Voltage	5 to 12 V

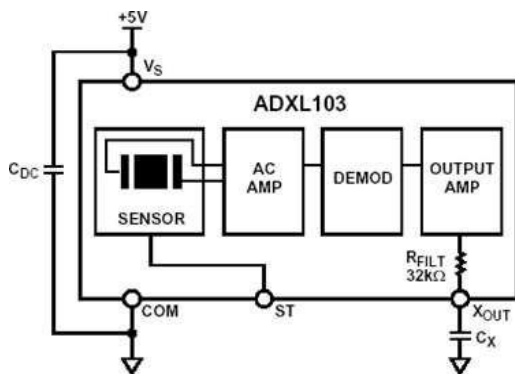


Fig.3 : Block Diagram of Accelerometer

B. ADC 3208 :

The MCP3208 12-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications.

The MCP3208 features:

- 100k samples/second
- 8 input channels
- low power consumption (5nA typical standby, 400 μ A max. active)
- Is available in 16-pin PDIP.

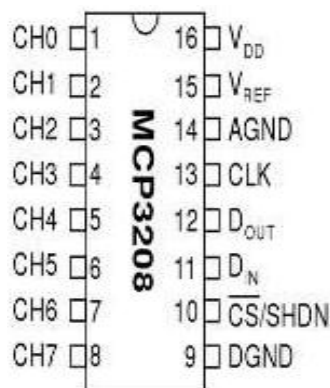


Fig.4 : Pin Diagram of ADC

C. MICROCONTROLLER 89S52:

We are planning to use microcontroller 89S52 because of it consists of features like:

- 8K bytes of Flash
- 256 bytes of RAM,
- 32 I/O lines,
- Watchdog timer
- Two data pointers
- Three 16-bit timer/counters
- A six-vector two-level interrupt architecture
- A full duplex serial port
- On-chip oscillator
- It has 4 different ports
- Each port has 8 Input/output lines providing a total of 32 I/O lines. Those ports can be used to output DATA and orders other devices, or to read the state of a sensor, or a switch.
- The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.
- Atmel AT89S52 is a powerful microcontroller which provides a highly- flexible and cost- effective solution to many embedded control applications.

D. LCD :

A LCD consists of two sheets of polarizing material with a liquid crystal solution between them and does not emit light. The LCD panels are back-lit to make them easier to view in bright environments, provide a higher resolution, are slim in construction and light in weight, and have low power consumption. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is An instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling Display

E. BUZZER :

Buzzer plays important role to alert the operator about undefined condition, to take immediate action to prevent the unwanted process. Gesture will convey the audio message to the receiver but in case of any emergency the buzzer alarms and aware doctor or relatives of patient.

F. MP3 PLAYER- FN-RM01:

FN-RM01 is a high quality MP3 audio recorder and player module.





Fig.5 : Pin Configuration of FN-4M01(MP3 Player)

Features are:

- Supports microphone(mono),line-in(mono),and Aux- in(stereo) audio recording modes
- Supports USB sound card modes.
- Use micro SD card as a storage device; supports maximum 32GB micro SD card.
- 32 level adjustable sound volume.
- Supports playback of mp3, WMA audio files with a great sound quality.
- DC 5V power supply.

H. SPEAKER :

For the audio output in this proposed system is 50mm audio speaker with 8Ω is most suitable

3. Circuit Diagram and Implementation

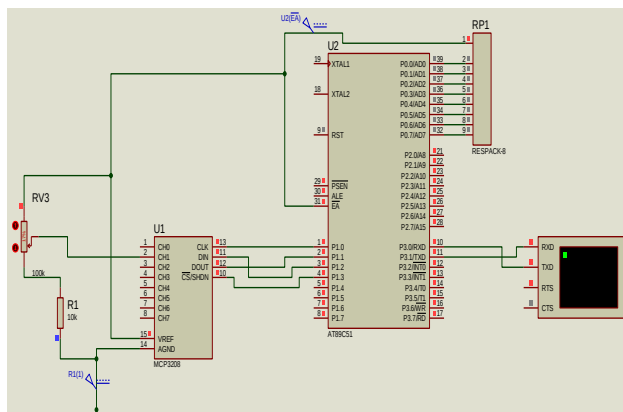


Fig 6: Implementation of circuit diagram by using Proteus software

According to the circuit diagram, Supply voltage is applied on the divider circuit having resistance in series with flex sensor as load resistance. When it is bent, its resistance increases that causes increase in voltage, which is termed as an analog voltage change. A flex sensor is a resistance strip, which is kept on finger, used to measure the change in resistance based on the motion of fingers. For example, when we keep our finger straight resistance will be different and when finger is bent the resistance changes. Accelerometer sensor detects the signal based on hand motion in two axes i.e. x axis (up and down) and y axis (up and down). The inputs from the flex sensor and accelerometer sensor is then transmitted to a ADC, which

converts the analog signal from the flex sensor and accelerometer sensor to digital signal so that it makes comprehensible for the microcontroller to proceed further.

The output of the signal conditioning (ADC) is then fed to AT89S52. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The data is transmitted in Full Duplex UART Serial Communication. It takes data from each finger and accumulates all five fingers data in 12-bit resolution data from ADC, a register is used to store cumulative data in 12 bits dedicated for five fingers which consequently gives maximum 4096 combinations. Every number which is detected by hand gestures that can be seen in has predefined meaning a certain 12-bit code for particular phenomenon is sent through USART (Universal Synchronous Asynchronous Receiver and Transceiver) at baud rate i.e. 9600 to MP3 player block.

FN-RM01 is a high-quality MP3 audio recorder and player module. It supports standard UART serial communication control mode. It uses micro SD card and USB flash drive as the storage devices. The specific set of instructions is stored in the module and is accordingly played as per the predefined gesture of hand allotted to that specific gesture. The player module is then connected to a speaker to obtain the output as audio signal.

The output is also displayed on LCD display as well as it can be conveying through audio signal. Buzzer is used for emergency if at all any problem occurs with the device.



Fig. 7 : Examples of Gestures.

4. Application & Expected Output

We are implementing the circuit to convey the audio sound, which is to be sensed by flex sensor and the accelerometer sensor. These sensors are located in hands of the patients. Nurses in the ward can communicate with the patients using this system.

5. Future Scope & Conclusion

This project can be expanded by adding server connection and android application development to provide wireless access for the doctor to the patient. The voice messages can be sending through internet to doctor and doctor can suggest medication/treatment. The application can also b extended to hearing impaired people who can do public interactive jobs.

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Microcontroller Based Control of Devices using a Sophisticated Control System

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ABSTRACT

In this paper, we present the algorithms & the methodology of the control of the developed system using a microcontroller along with the main objectives of the system that is developed and its applications.

Keyword : Microcontroller, DACS, Parameters, ADC, DAC.

1. Introduction

Companies are finding various methods and installing new systems, even adopting or completely changing the existing system to be in the race to success. With many new ways and technologies developing every hour to cater this new age transition, the need for systems with high efficiency, retention and simplicity is spiralling in growth.

To achieve this the electronics and computer science field are dedicate sources, not only are new standards being developed, but also new branches of engineering are being found in this process, control systems, industrial automation, embedded systems, remote access/sensing, data monitoring and acquisition are few of the examples.

The parameters of the equipment like voltage, current, temperature, etc, that are converted into corresponding voltage values, are read through these eight 8-bit analog channels, while the status i.e., ON or OFF will be read through the 8 digital channels.

A provision to control the status of a device (control device) is also provided. The job of data acquisition and control is performed by the micro-controller 89C52, which forms the kernel of the design. To support the job of the kernel, other components like the ADC, Multiplexers, 8255 PPI, EPROM, RAM, Latches, Display, Keyboard, are interfaced.

The communication between the remote site and the central control point is done through telephone line via modem. At central control room, data is displayed on the PC using VB graphics.

In the next section, the main objectives of the system that is going to be designed is presented in a nut-shell.

2. Objectives Achieved

The objectives of the research work is summarized as follows:

- To design an 89C52 micro-controller based system interface to control and read parameters of equipment. The system has a RS232 port.
- To design a 10-bit ADC circuit with 8 channel multiplex facility.
- To assemble/solder circuit boards for 6 digit 7-segment display, 89C52 board, an ADC interface board.
- To assemble interface wires/cables for hooking up the circuits to target system
- To design the software in assembly language to achieve the objectives.
- To design the PC end software in VB6.0 to communicate to remote 89C52 via PSTN (Public Switched Telephone Network) at different locations.
- A-D plug in boards are used at the remote end and using multiplexers to multiplex the data lines and the number of control variables/parameters are increased tremendously.
- At the remote end, dedicated controllers are interfaced with the original system, which increases the functionality of the present system from monitoring to actual control system.
- The implemented design is interfaced with compatible boards to increase the use in accordance with requirement and standards adopted by the industry.
- To make the entire process full automatic.

3. Overall Design of the System

The process begins as follows. Initially a link is established between the remote site and the central control station by dialing appropriate number. After the link is established, the command for reading the analog and digital channels is given subsequently. Then, the values of the channels are displayed on the PC screen, at the central control station. If needed, a change in the state of a device can be made. After the monitoring process is over, the link is disconnected.

The basic block diagram of the process is shown in Fig. 1.

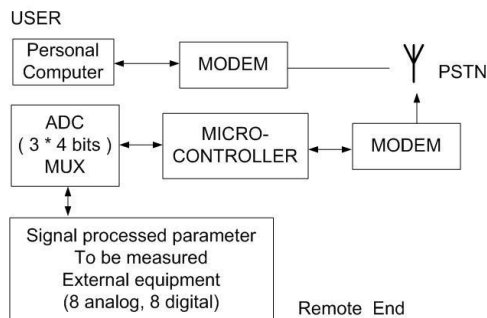


Fig. 1 : Basic block diagram

The algorithm designed in Visual Basic VB6 is shown below in Figs. 2 to 6.

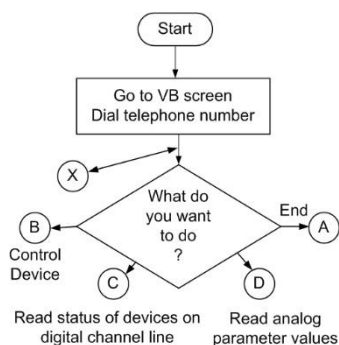


Fig. 2 : Flow chart to read status of devices

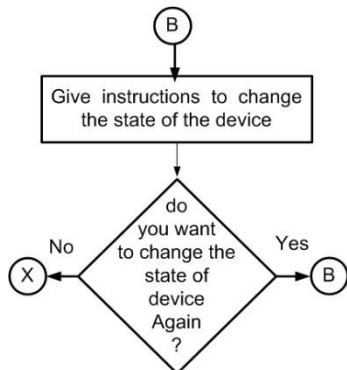


Fig. 3 : Flow chart to change the state of the device

The project targets set can be achieved by implementing the block diagram. The overall view of the block diagram is as follows. We get processed 8 analog and 8 digital channels from the equipment. These 8 analog channels are given to the ADC and analog multiplexer. These are then connected to one of the ports of 8255. The digital channels are connected to the other port of 8255. Microcontroller generates the address and control signal for acquiring data from the equipment or the memory chips. The monitor program will be stored in the EPROM, whereas the data from the equipment will be stored in the RAM. There is a 7-segment display, with 4 fields for address and fields for data. The touch keypad, keyboard is used to send commands or address or data to the microcontroller, which will be displayed on the

display during debugging or diagnosis. The overall design is shown in the Fig. 7.

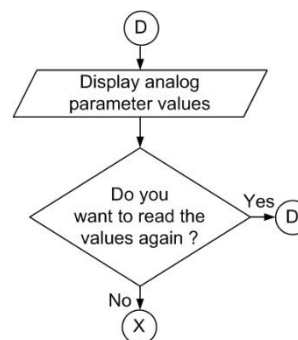


Fig. 4 : Algorithm to display parametric values

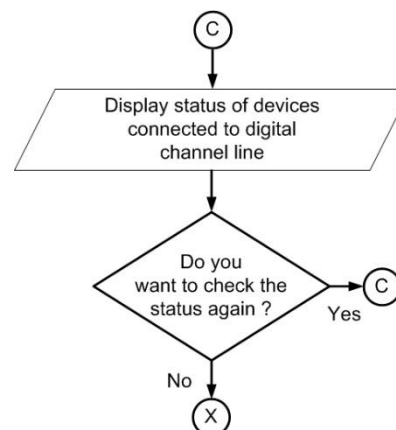


Fig. 5 : Algo to check the status of the device

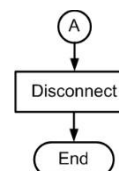


Fig. 6 : Flow chart to disconnect the device

4. Applications

The Data Acquisition and Remote Equipment Control System can be used in applications where process parameters at remote place are to be monitored. The parameters which are continuously changing or which may change discretely. In any case the Data Acquisition and Remote Equipment Control System give the reading which is average of several readings. Thus the readings are taken number of times and then they are averaged to get the value which reflects the true status of the process parameters.

- Commercial applications.
- Industrial applications.
- Security systems.
- General applications.
- Research applications.

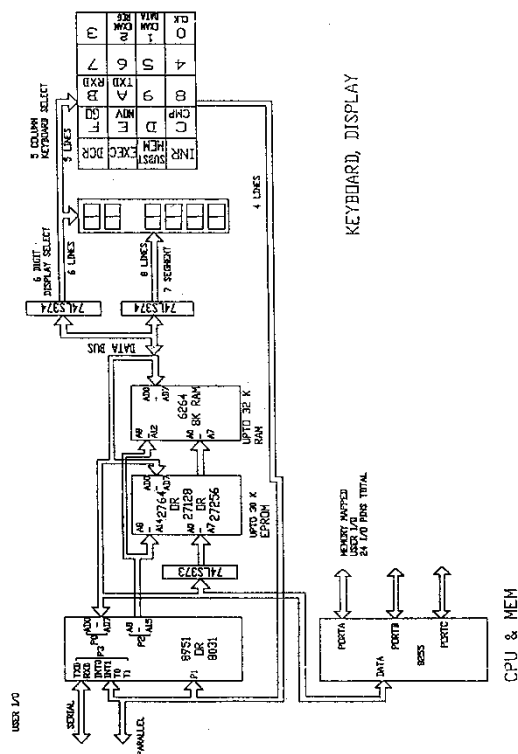


Fig. 7 : Overall microcontroller designed system

5. Conclusions

On varying the potentiometer, which simulates the analog quantities we find a corresponding change in the readings on the computer after giving the command for data acquisition. The digital values were simulated in the program and displayed on the VB screen. LED used, which simulates any on-going process at the remote end had been controlled by initiating appropriate command from the user end. In case of any alerting increase in any of the measured data was also indicated at the user end.

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Design, Analysis, Implementation of a Force base Sensor for Aerospace Engineering

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ABSTRACT

This paper involves recreating the applied force at a desired location. A brief kinematic design of the sensor interface is being carried out. The geometric form of the sensing elements and the synthesis of the leg is also presented. The force torque sensor is interfaced to the internet using the TCP / IP protocol also, instrumentation amplifiers, ACD's, etc..

Keyword : Stewart Platform, Force Sensor, Amplifier.

1. Introduction

A Gough-Stewart platform is a type of parallel robot that has six prismatic actuators, commonly hydraulic jacks or electric actuators, attached in pairs to three positions on the platform's baseplate, crossing over to three mounting points on a top plate. Devices placed on the top plate can be moved in the six degrees of freedom in which it is possible for a freely-suspended body to move. These are the three linear movements x , y , z (lateral, longitudinal and vertical), and the three rotations pitch, roll, & yaw. The terms "six-axis" or "6-DoF" (Degrees of Freedom) platform are also used, also "synergistic".

The Stewart platform structure consists of two plates and six connectors or legs. The top plate is termed as the platform and the bottom plate is known as the base. The legs are the sensing elements of the sensor. The transducer element used is the Strain Gauge. The strain gauges are mounted on each leg. The wrench is applied to the top plate. The wrench is a 6 dimensional vector and consists of 3 component forces and 3 component moments. The legs are so positioned that the applied force gets distributed into the six leg forces.

Consequently each of the leg of the sensor experiences some strain. This strain is sensed by the strain gauges on the leg and they generate a corresponding electrical voltage. In this manner the six leg forces are obtained. The six leg forces obtained are not the actual forces. These leg forces have to be properly resolved to generate the three forces F_x , F_y , F_z , along the x , y , z direction and the three moments M_x , M_y , M_z about the x , y , z directions. The three forces and the moments

are obtained from the leg forces using the force transformation matrix also called as the Jacobean matrix.



Fig. 1 : A view of the Stewart platform

2. Review of the Design Process of the Platform

The analog signals undergo signal conditioning in order to increase their signal to noise ratio (SNR). The analog signals have a very low voltage level. An instrumentation Amplifier is used to amplify them to the desired level. The instrumentation amplifier designed and used here is IC-INA 110. The choice of the instrumentation amplifier is done on the basis of the Common Mode Rejection Ratio, Low gain temperature coefficient; log gain error, low offset and low noise. The data obtained from the instrumentation amplifier is in the analog form. Since the computer is the digital device the conversion of the data is essential.

For that purpose the analog-digital conversion is done with the ADC. The main aim of the research is the communication of the data hence transmission of the force data is done through the LAN network with the Server Client Relationship using the TCP / IP Protocols. The display being a part of the project is done using the Graphics. The acquired digital data is then displayed in real time on the server computer screen. The data acquisition is in the continuous form. The digital data is also displayed simultaneously transmitted to the client computer and displayed there.

At the client side the analog voltages are retrieved from the digital data using DAC. The DAC converted the digital data back into the analog form and thus the force applied also called as the wrench was recreated back. The above system is used to communicate force to remote place. The force given at the sensor side for

the communication from the sensor is recreated back at the client side. The recreated force can be used to drive motor or any other devices. Normally, such sensors are used in Nuclear Reactors where human beings cannot work. The system is implemented by conventional electronics. The need to embed the electronics and the associated software is to make the sensing system alone very compact.

The sensing system is integrated to the robotic system or acts as a standalone system at remote or hazardous places. The Figure below shows the individual blocks of the designed and implemented sensing and force communicating system. The wrench is a 6 dimensional vector consisting of 3 component forces and 3 component moments. TCP / IP is the

Transmission Control Protocol and the Internet Protocol. The 6 axis force torque sensor is used to embed the electronics and the associated software to the sensing system alone very compact. The sensing system is integrated to the robotic system or acts as standalone system at remote or hazardous places. The Fig. 1 shows the individual blocks of the designed and implemented sensing and force communication system.

The basic instrument used for the conversion of the force from one parameter to another is the Stewart Platform. The Stewart platform is a 6 DOF parallel mechanism by Stewart. The form of mechanism is reciprocal to that of a serial mechanism and hence properties of the Stewart Platform are also quite reciprocal to that of serial mechanism. It has a high load capacity since its in-parallel linkages sustain the payload in distributive manner.

Its other characteristic is high positional accuracy, which results from the fact that the joint errors are not cumulative as in serial manipulators. The aspect of compact design with 6 DOF along with the above-mentioned properties prompts one to consider the mechanism for force-sensor.

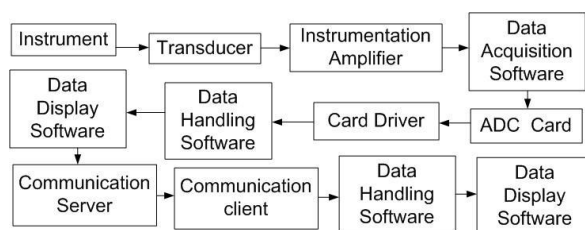


Fig. 2 : Block diagram of the designed system

The design analysis, implementation and experimental results of the Stewart platform based force torque sensor have been made in the following paper. A brief kinematic design of the sensor, geometrical forms of the sensing elements and the instrumentation details is carried out.

3. Design of the instrumentation system

Bonded metallic resistance strain gauge has been used to mount on the legs. Since the gauge responds to surface strain in a structure, the legs acting as elastic structures must be carefully designed as a transducers which must give proper resisting and restoring characteristics when load is applied and withdrawn.

The block diagram shown in Fig. 1 gives interface details of the sensor. Software has been developed to self-calibrate the sensing system and to regulate the sensor. Each time when the software is executed, it keeps the system under wait state until all the strain gauges reach the stable initial value. This is done to ensure against reading any spurious channel values built up during warming up period.

The initial channel values are then set to zero to read the initial reference load to zero. It is found that it requires less than 1 ms in a PC-386 operating at 33 MHz to read channel values and perform a matrix multiplication to compute the force vector. The 6 analog voltage signals obtained from the signal conditioning and instrumentation amplifier stage correspond to the leg forces.

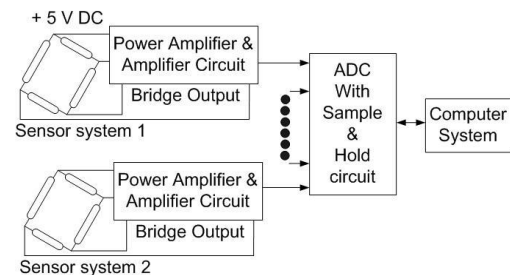


Fig. 3 : Interface details of the sensing system

These analog signals need to be processed in order to compute the force vector and for the display and transmission purposes. ADC is used to achieve this. The conversion of the analog data to the digital form is done using the software. The designed software controls the data flow and the display. The working of the 6 axis stiff force torque sensor is explained as follows.

4. Working of the designed system

- The force applied on the Stewart platform is sensed and converted into the electrical voltage, which is analog in nature.
- The analog force is then converted into the digital form.
- The digital data output of the ADC is then processed by the server computer and transmitted on the internet / intranet using the TCP / IP protocol.
- At the client side, the computer again processes the data and feeds to the DAC.
- DAC converts the digital information back to the analog form which drives the motors.
- Thus, the original force is recreated back called as the wrench.

5. Applications

Stewart platforms have applications in flight simulators, machine tool technology, crane technology, underwater research, air-to-sea rescue, mechanical bulls, satellite dish positioning, telescopes and orthopaedic surgery.

- Defense applications
- Robo surgeons
- Under sea explorations
- Nuclear explorations

6. Software algorithm – Flow chart developed

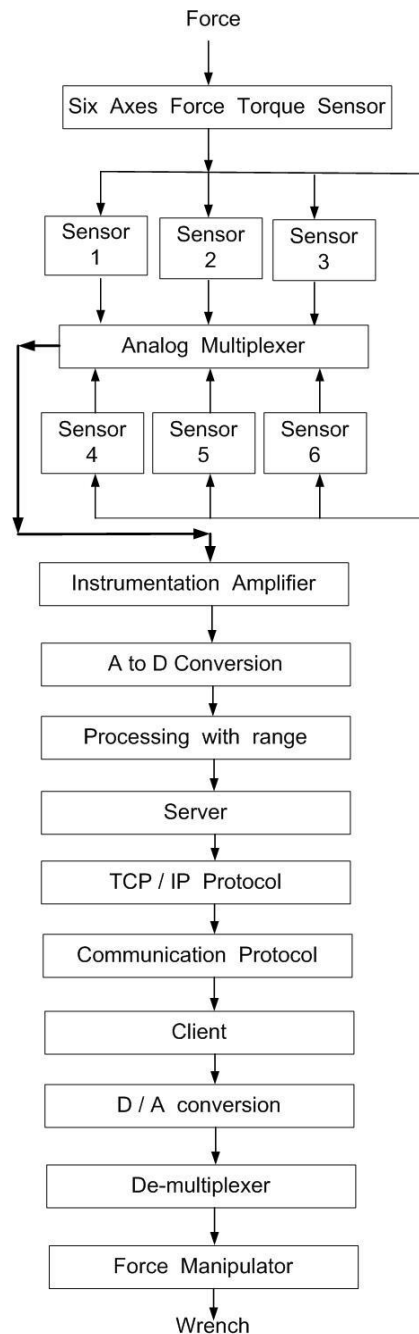


Fig. 4 : Algorithm developed

7. Conclusions

A electronic sensor interface for a Stewart platform was designed and implemented successfully, but in this paper, only the main points are being presented.

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Person Following Smart Shopping Cart

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ABSTRACT

The standard of living for humans has increased drastically because of modern technology. These days, shopping at malls and supermarkets has become part of everyday life. As a result, these places are brimming with people. The most common thing used in malls and marts is a shopping cart. Every time, customers have to push a trolley from rack to rack when shopping for different items. Also, a person has to keep his budget in mind. After completing the shopping, the customer has to stand in a long queue for billing. To avoid the problems of pushing the cart, waiting in queue and thinking about the budget, the idea of "Person Following Smart Shopping Cart" has been proposed.

Keywords : IR transmitter and receiver, RFID scanner, LCD, Microcontroller.

1. Introduction

Modernization aims at making our life easier and more comfortable. All the services, appliances and devices we use have made our day-to-day life easy. Smart cart in shopping malls is another tool that contributes to making the system advanced. This paper will give an overview of the smart cart system in the shopping malls.

In this paper, a smart shopping cart design is proposed using a microcontroller-based system. so that the system is less bulky and requires less power. This makes the system cheaper. Microcontrollers also require less space and can be fitted easily in the system. Customers also need to keep track of their budget when shopping. After completing his shopping, the customer has to wait in a long queue for billing.

The proposed idea eases the shopping experience in a supermarket. This smart cart uses a microcontroller as its brain. It follows the person from rack to rack using an IR transmitter and receiver. It uses an RFID scanner to scan every item put in the cart. It also keeps track of the total cost of items. The cost of each product is displayed on an LCD panel so that the customer can alter the items according to his budget. Also, the billing process is simplified

Our proposed idea eases the customer shopping experience. Customers do not have to push the trolley from rack to rack, because our proposed smart cart follows them wherever they go. The cart also keeps track of the total cost of items in the cart. The cost of items is displayed on an LCD panel so that customers can add or remove items according to their budget. After completing the shopping, the billing process is also simplified.

2. Related Technical Work

An RFID-based wireless manufacturing for walking-worker assembly is designed in [1]. A flexible assembly line is a shop-floor where products are placed at work centers is designed. Workers move from one work center to another, and tools and components are brought to the work center for assembly according to the process and production plan. Such an assembly shop-floor configuration is not only suitable for producing large, bulky, heavy or fragile products, but also offers the necessary flexibility and competitive operational efficiency for products of modest variety and production volumes. However, the shop-floor with a fixed-position assembly island typically suffers from limited spaces at work centers and high dynamics of material and manpower flows, in addition to common shop-floor problems in [1] This project presents a solution to these problems by using wireless manufacturing (WM)—an emerging advanced manufacturing technology (AMT). This paper has presented an affordable WM technology solution. This emerging AMT has relied substantially on wireless devices such as radio frequency identification (RFID) or auto ID sensors and wireless information networks for the collection and synchronization of real-time field data from manufacturing workshops.

A smart trolley with instant billing to ease queues in shopping malls using ARM7 LPC2148 is designed in [2]. In this product, basically, an embedded system is designed that uses the ARM7 LPC2148 microcontroller. To achieve this interfacing, the RFID and ZIGBEE modules, along with the microcontroller, are used and implemented. A project named "Implementation of an efficient shopping technique with automatic billing through-CAST" is made. CAST stands for Context aware shopping trolley, a unique method to make billing through net banking for both the customer and the supermarket. This project contains a touch screen.

It is mounted on a trolley that is divided into two sections, shopping list and the map showing the location of that product [3]. Another project was carried out by Satish Kamble, Sachin Mishra, Rahul,

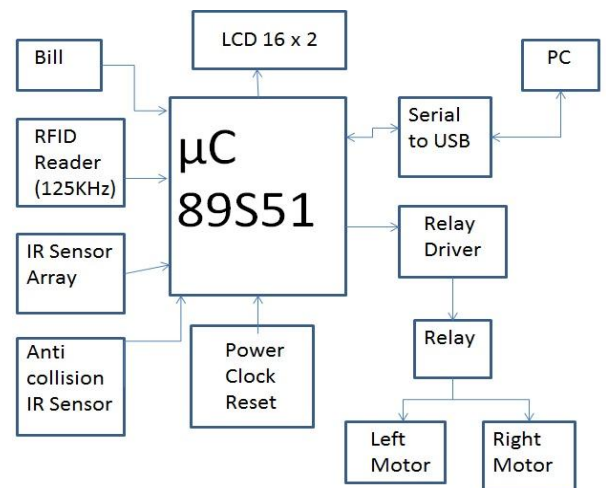
and Roshan Gakhre. They named it “Developing a Multitasking Shopping Trolley Based on RFID Technics.” They used a system that had three components: SCC, UIDC and ABC. The SCC establishes and maintains the connection of the shopping cart with the main screen. The UIDC provides the user interface, and the ABC handles the billing in association with the SCC [4].

A project named "Futuristic trolley for intelligent billing with amalgamation of RFID and ZigBee" uses ATMEL LAT24C04 to store the billing records and a 16 x 2 LCD to display the details of selected items. This project, like the others mentioned above, also focuses on providing easy shopping to costumers and avoiding large queues [5].

Similarly, a project was proposed named “Intelligent shopping cart.” They also used a system that consists of three components, that is, SCC, UIDC and ABC as used earlier). During research related to this field, several projects were seen, and their main objective was to save time, avoid large queues and develop a user-friendly smart shopping machine. Some of them are mentioned above [6]. A Intelligent Shopping Cart is designed and implemented in [7]. In this, they have used EM-18 RFID Reader, LPC2148 Microcontroller, Radio Frequency Identification (RFID) tag, and the ZigBee module. Web shopping is defined in [8]. In this, a cart system is presented as a typical client-server application on the Web. Then, they clarified several problems on the implementation of the Web shopping cart system, which are peculiar to the Web. In order to solve these problems, they proposed a new mechanism that can manage user sessions with high reliability and safety. He compared the Web shopping cart system implemented using the proposed mechanism with the one developed by the conventional methods. A smart shopping cart application has been implemented in [9] using pattern-based software framework. This project proposed an automatic embedded software generation framework that can create and evolve Zigbee applications. The framework consists of two major modules, pattern extraction, and code generation. Pattern extraction and development are designed to provide the Zigbee application with model reuse and modification. Sys ML serves as a medium between pattern development and code generation. State diagrams, class diagrams and sequence diagrams help describe a specific application scenario.

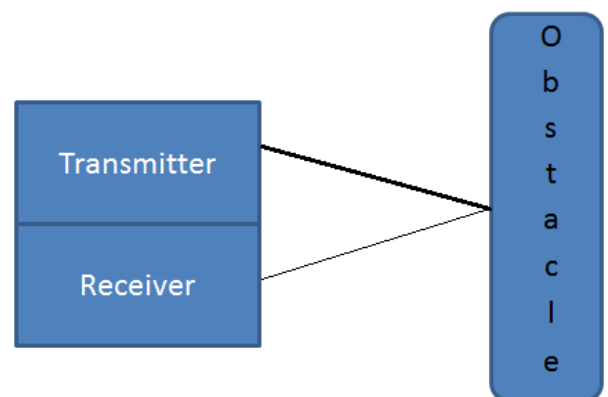
3. Proposed Work

Block Diagram



(I) Cart Mechanism

In this paper, we have adopted the obstacle detection methodology which used an IR trans-receiver. It is used to keep safe distance between the trolley and the customer. The transmitter keeps on transmitting IR signals, if an obstacle is far away then the sensor does not get back the signal since it is not reflected as the obstacle is far away and out of sensors range. If an obstacle is in the range of the sensor, then it will get the reflected signal and the obstacle is detected.



(II) Smart billing mechanism

An array of IR sensors is used to turn the trolley in the direction of the person it is following. A belt having an IR led will emit an IR ray in a particular direction. The cart will turn left or right according to the direction from which the ray is detected. On entering a shopping mall, a customer first takes a trolley. Each trolley is associated with an RFID reader. The functioning of the system is explained below:

When the customer purchases a product, she/he first scans the RF tag of the product using the RFID reader and then places it into the trolley. While the customer is scanning the RF tag of the product, the price of the product is stored in the system's memory. Information stored in the system's memory is compared with the lookup table. If matches are found, then the cost and name of the respective product gets displayed on the LCD screen.

If an unwanted product is removed from the trolley, it decreases the number of products as well as the bill amount. After completion of shopping, a button is pressed, indicating final billing of all the products. Thus, the final information of all products is transmitted to a computer with the help of serial communication, and the final billing is done by VB software on a computer.

IV. RESULT and CONCLUSION

In automatic cart, there is no need to push the cart from rack to rack or worry about the budget. Also, the billing process is simplified. The microcontroller-based smart shopping cart automatically follows the customer. It also maintains a certain distance between the customer and itself. The total cost as well as the number of products in the cart is displayed on an LCD screen. Facilities such as automatic collision detection and directions are provided. So, we could successfully implement the concept of "Person Following Smart Shopping Cart".

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A Survey of Remote Water Level Monitoring and Controlling

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ABSTRACT

Unexpected shortage of water supply is common phenomena observed in densely populated areas. The need for water level monitoring, controlling thus becomes crucial since water wastage is one of the major concerns in day to day life. The paper focuses on exploring the various systems currently implemented for the mentioned scenario. Also, it was observed that the existing systems are incapable of monitoring more than one overhead tank. Major technologies were then surveyed that can be incorporated to implement a multitank system with remote accessibility. The paper discusses the technologies in brief and concludes with the suitable option for the system implementation.

Keywords : Remote, Multi tank, Water Level, Monitor, Control.

1. Introduction

Water Level in a Tank is difficult to assess visually in case of high storage buildings (tower) or big society campus. Water wastage is one of the major concerns in day to day life so the need of water level management is important. Overflow of tank is also a major reason for water wastage. Water Level Management approach will help the society to avoid wastage of the water and track the volume of water consumed in a particular period of time. Monitoring and controlling the tank at any time from any remote location can help in implementing a better system.

2. Literature Survey

Raghavendra R. In his research paper [1] has implemented automatic ON/OFF of the machine when the level of the water in the overhead tank drops below a certain predefined point and switches OFF the motor when the water level rises to the point which indicates that the defined water level is completed. The system has a simple machine which automatically controls the motor and there is no need for operating the machine. The advantage of this system is that it eliminates the need for constantly monitoring the overhead tanks. But the machine cannot be operated from any remote location and there is no method for notifying the person in charge about the status of the overhead tanks.

S. M. KhaledRezain his research [2] has implemented web monitoring through mobile and machine and data acquisition through wired as well as wireless medium. The system has various sensors and indicators for constantly monitoring of the water level. The system

is also capable of establishing data communication and communication from the remote location. The advantage of this system is that the status of water level is stored in server and can be retrieved from server which is available from any remote location having internet connectivity. Though the person in charge can acquire the status of the system but he cannot take any action based on the available information from the remote location.

Ayob Johari in his research [3] has implemented water level monitoring system using GSM network using PIC16F877A pin. The person in charge gets automatically notified about the status of machine through SMS indicating whether the pump motor is switched ON or OFF. The advantage of this system is that the status of water level can be remotely accessed via SMS. The disadvantage is that person in charge can only have knowledge about the status but cannot perform any action from the remote location.

Neena Mani and others in their research[4] have designed a water level indicator using ATmega-32 microcontroller. The microcontroller senses the water level using various water sensors and indicates the water level on the LCD screen. The advantage is that level of the water can be observed from the LCD display. But only indication of the water level is known, automation of the machine is not available. Also, Human effort is required for controlling the machine.

MelatyAmirruddin and others in their research [5] have designed a water level indicator for flood detection using GSM module and visual basic for SMS sending. They have proposed a system in which the water level will be sensed and the level will be notified to the authorized user by the SMS gateway. They have used Visual Basic as a channel to give a pathway between water level sensors and GSM modem to send an alert through SMS.

Ejio for Virginia Eberet all in their research [6] have used comparators for detecting the water level. LM324 comparator was used for detection of the water level and the system was controlled by Atmel 89C52 microcontroller. The comparator senses the water level and send signal to the micro controller and micro controller automatically turns on the motor. The status of the motor is displayed on the LCD screen.

3. System Overview

Existing Systems (Fig.1) consist of microcontroller that only provides indication of the water level of a single tank. Few of the system implementations do not provide automatic control. Some systems cannot be

operated from any remote location and there is no method for notifying the person in charge about the status of the overhead tanks. While few others allow the person in charge only to have knowledge about the status but cannot perform any action based on the information available from the remote location.

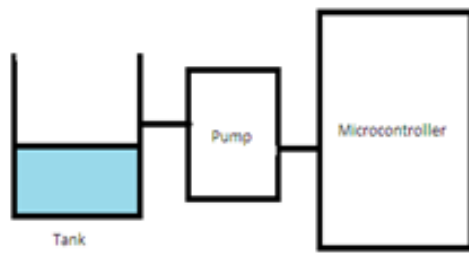


Fig.1 Existing Systems

The observations suggest that for a multiple tank (Fig.2) implementation one of the major hurdle is simultaneous sensing and controlling the water levels. Also for remote accessibility wireless communication has to be established. The communication link should be able to support full duplex communication in order to implement remote control along with sensing. Also, in order to manage the usage, data logging can be incorporated.

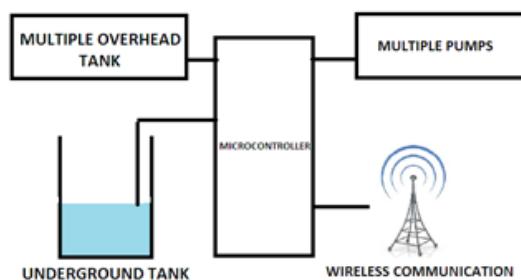


Fig.2 Proposed System

The paper therefore now discusses various recent technologies and standards that can be used to implement the features as listed above.

4. Technologies

Microcontroller is heart of the system. It can be considered as a self-contained system with a processor, memory and peripherals. Microcontroller is programmed using embedded C language. Using microcontroller's serial communication block various wireless communication standards can be interfaced. Microcontroller can be used to control pump motor, LCD display, communication module. Sensor inputs can also be given to microcontroller.

A. Wireless Technologies

Various types of wireless technologies allow devices to communicate with each other and to the web (TCP/IP Networks). Different wireless technologies present can be implemented in hardware systems for the Internet of Things (IOT) and Machine to Machine

(M2M) communication. The wireless standards that can be used for the system implementation are

- i. GSM
- ii. Wi-Fi
- iii. ZigBee

These technologies are reviewed in brief as follows:

i. GSM

Global System for Mobile communication (Fig.3) is used for digital communication system and it is widely used all over the world. From TDMA, GSM, and Code Division Multiple Access (CDMA), GSM is the most widely used. GSM sends data from channel with two streams of user data each having its own time slots, data is sent after it is digitized & compressed. The network type in GSM is SIM specific that is it depends upon the service provider's network. It is dominant standard used worldwide except in US. It uses technologies like GPRS/EDGE/3G/4G/LTE for data transfer. It uses multiple frequency bands like 850 MHz/900MHz/1800 MHz/1900Mhz. It has an estimated 25% of market share. Carriers of GSM are AT&T and T-Mobile's module is used to send and receive SMS using a SIM card. GSM module can be connected to internet for the purpose of sending the message to the SQL server which is then stored in the database.



Fig.3 GSM Module

AT Commands

AT commands (Fig.4) are used for controlling modems. AT is for Attention to indicate the attention from the MODEM. The dial up and wireless MODEMS (devices which involve node to node communication) need AT commands to interact with a system. AT commands are used to provide information and configuration pertaining to mobile device or modem and SIM card. It also provides SMS services' mms services, fax services. It is also responsible for data and voice link over mobile network.

AT Command	The Functions of AT Command
ATD	Dial
AT+CGMS	Send SMS Message
AT+CMSS	Send SMS Message from storage
AT+CMGL	List SMS Messages
AT+CMGR	Read SMS Messages
AT+CSCA?	Service Centre Address
AT+CPMS	To choose storage from ME or SM
AT+HPR=0	To choose auto baud rate
AT+CMGF=	To choose PDU Mode or Text Mode

Fig.4 Functions of AT Commands

ii. ZigBee

ZigBee (Fig.5) is wireless technology which is an open global standard to address the unique needs of low-cost, low-power wireless M2M networks. It operates on the IEEE 802.15.4 physical radio specification and operates in bands 2.4 GHz, 900 MHz and 868 MHz. ZigBee protocol is created to communicate data through Radiofrequency environments that are common in commercial and industrial applications. ZigBee protocols key component is the ability to support mesh networking where, nodes are interconnected with other nodes so that there is multiple pathways to connect each node. These connections are dynamic and are updated and optimized dynamically through built-in mesh routing table. ZigBee supports for multiple network topologies such as point-to-point, Point-to-multipoint and mesh networks. It uses Direct Sequence Spread Spectrum (DSSS) technique. It also includes 128-bit AES encryption for secure data connections, collision avoidance, retries and acknowledgements



Fig.5 Zigbee Module

iii. Wi-Fi

Wi-Fi (Fig.6) is a technology which uses radio waves to create network connectivity. This connection is established using a wireless adapter to create hotspots and it allows users to access services over internet. When it is configured, it provides wireless connectivity to your devices by transmitting frequencies between 2.4GHz - 5GHz, which depends upon the amount of data on the network. Wireless technology is widely used lately and you can connect at home, at work, in libraries, schools, airports, hotels etc. Wireless networking is known as Wi-Fi or 802.11 networking as it covers the IEEE 802.11 technologies. The major advantage of Wi-Fi is that it is compatible most of the operating system, device, and advanced printer.



Fig.6 Wi-Fi

Use of Wi-Fi for communication is limited to a particular range and it can only be used in an organization whose area is defined. ZigBee has a better range compared to Wi-Fi. ZigBee uses radio frequency and the two nodes should be within range for communication (2miles to 40miles depending on ZigBee models used). GSM Module has no particular range for communication it depends on the SIM

service provider and hence it can be used to communicate from any remote location. The only limitation of GSM is the device should be present where network is available

B. Database

Database Server is required to log the data. Most frequently used database server is the SQL server that is discussed below:

i. SQL Server

SQL Server is Microsoft's product. IT IS A relational database management system (RDBMS) which is a full-featured database designed with the intention to compete against competitors like Oracle Database (DB) and MySQL like all other major RDBMS, it supports ANSI SQL which is a standard SQL language. SQL Server also contains T-SQL, its own SQL implementation, and SQL Server Management Studio (SSMS). is SQL Server's main interface tool, WHICH supports 32-bit & 64-bit environment. SQL server is also referred as MSSQL and Microsoft SQL Server. SQL Server is offered in various versions with each having different feature set and pricing options to meet a user needs. SQL Server maintains a database of the messages and generates a report using SQL commands. The SQL server is maintained on website so that the information can be accessed from any remote location.

- a) Enterprise: It is designed for large enterprises with data warehousing, Web-enabled databases AND complex data requirements and its licensed product is the most expensive.
- b) Standard: Targeted toward small and medium organizations WHICH supports e-commerce and data warehousing.
- c) Workgroup: for small organizations where there is no limit for size & user and it can also be used as the backend database for small web servers.
- d) Express: it is free for distribution and it has the fewest number of features & there is a limit on database size and users.

ii. Data Logging

Data logging is the collection of data over a particular period of time, often used for keeping a track of something. Such systems monitor a process using sensors linked to a computer. Most data logging can be done automatically under computer control. Web pages are generally used to display the data logged into the servers. Languages like HTML and ASP.NET are widely used for generation of web pages which are reviewed in the following section.

iii. HTML

Hypertext Markup Language is the collection of markup symbols or codes inserted in a file with the intention to display on a World Wide Web page. This mark-up informs the browser how to display a words and images on a web page. With Cascading Style

Sheets, and JavaScript, it forms technologies for the World Wide Web. Web browsers receive HTML documents from a local storage or web server and transfer them into multimedia web pages. Web page structure is described by HTML semantically.

iv. ASP.NET

Microsoft developed ASP.NET to provide dynamic web pages. Main building block of ASP.Net application development web pages are Web Forms. Methodologies in a Web Form are website format & web application format. Before deployment web app should be compiled & the files are directly copied by the user to the server without prior compilation which is allowed by website structures. Extension of web forms is '.aspx' which contains component markup or static XHTML markup.

5. Conclusion

Water is crucial element for all living beings. But unfortunately consumption and wastage of water is uncontrolled. In this survey, papers based on the water level indicator and controlling were reviewed and a comparative analysis is put forth. After reviewing all the papers and analyzing them based on certain parameters, a water level indicator and controlling with data logging system is suggested for overcoming the above problem.

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A Novel Approach for Low Power, Energy Efficient Automation System

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Abstract :

Automation systems are used to control the appliances remotely. The system proposed here deals with designing of a device known as “KNOCK IT” to control electrical appliances by means of taps. It makes the surface smart on which it is placed. The device is designed using ultra-low power microcontroller and piezoelectric vibration detector which detects the vibration patterns of the taps and controls devices depending on count of taps. Present automation systems deal with making devices smart, however our system is designed to make a switch smart which will make an unintelligent device connected to it smart when plugged into switch. This “SMART SWITCH” is a portable adapter. In addition to “KNOCK IT” and “SMART SWITCH”, the proposed system consists of mechanism for automatic toggling of electrical appliances when a person enters or leaves the room. It also incorporates GSM based home safety.

Keywords: automation; home safety; GSM; KNOCK IT; piezoelectric vibration detector; SMART SWITCH; ultra-low power microcontroller;

1. Introduction

The fundamental of building an automation system for an office or home is increasing day-by-day with numerous benefits. The proposed system is designed for controlling the environment in buildings, schools, offices and museums by using vibration sensor and actuators that control lights, temperature, and humidity. It basically controls electric appliances like tube lights, fans, night lamps, Air Conditioners, water pumps wirelessly. The system is to be implemented in existing environment, without any changes in the infrastructure.

The system consists device named “Knock it” which can snap onto any existing piece of furniture at home or workplace and transform that piece of furniture into a touch surface. If you place” knock it” on table, then the table will respond to knocking patterns and it will turn on/off home appliances depending on the number of knocking patterns. Another component is the portable adapter named “Smart Switch” which aims at making an unintelligent device smart. Any electric appliance when connected to this switch can be controlled by user remotely from any place through different interfaces. With the use of this technology and device, domestic activities

are made more convenient, comfortable, secure and economical as it offers different interfaces for controlling devices.

2. Related Work

The designed system deals with controlling electric appliances like tube lights, fan, night lamps, Air Conditioners, water pumps wirelessly. This is done by using various knock patterns. Patterns are detected using vibration sensor and using wireless module, the information about count of knocks is transferred to the mains where processor is connected. Depending on count of knocks, the devices are toggled ON and OFF. Also with the help of Smart switch, any device can be controlled from anywhere. A website or mobile application can also be used to turn ON/OFF home appliances. User will be provided access to control appliances with traditional method of conventional switches along with the facilities mentioned above [2]. In addition to this, automatic lighting system based on sharp sensors is also employed. This system will toggle the lights with entry and exit of people following a suitable mechanism. GSM based security is the added feature of this system.

A. PROPOSED SYSTEM

Various blocks involved in implementation of this system are shown in figure 1.

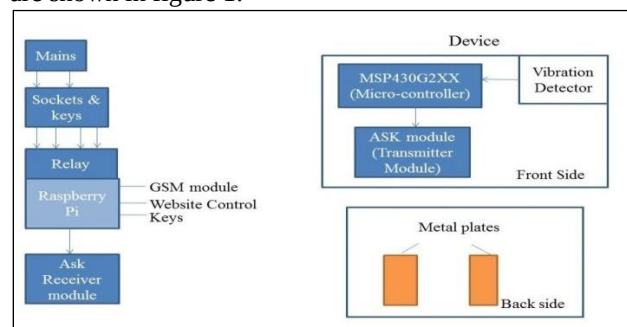


Fig 1. Block diagram of system

B. TRANSMITTER SECTION

The transmitter section consists of 3 major components which includes vibration detector, ultra-low power microcontroller [2] and RF transmitter module as shown in Fig. 2. Vibration detector senses the physical impulse

vibrations depend upon the threshold value and rejects all other continuous vibrations [3]. Then it converts them into equivalent electrical signal. The output of vibration sensor is connected to low power microcontroller. Both the vibration sensor and low power microcontroller are supplied power through mobile battery [4]. Depending upon the program developed for controlling appliances, microcontroller will process the data received from the vibration sensor. This data from microcontroller is given to a wireless module which will transmit it wirelessly over the medium. Wireless transmitter is ASK module which operates at a frequency of 433 MHz [5]. To avoid false detections, the patterns are designed such that they contain more than 1 knock.

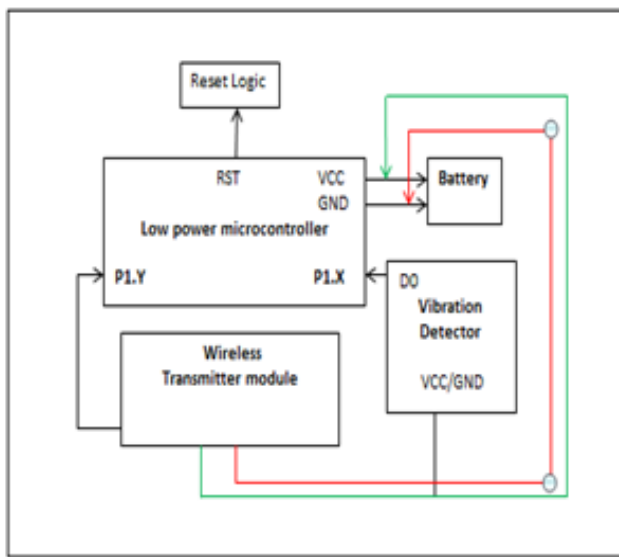


Fig 2. Block diagram of Transmitter Section

The above figure shows the block diagram of transmitter section which consists of “Knock it” device and transmitter module.

C. RECEIVER SECTION

The receiver section consists of RF receiver module, raspberry Pi, relay module, conventional switches and GSM module as shown in fig. 3. The digital data received by RF receiver module is given to processing unit. Raspberry Pi Processor processes the received data and data is transferred to mains through relays. Through the mains, connections are drawn to the appliances that are to be toggled. Solid state relays are used for appliances having power rating greater than 2kW. Raspberry Pi is connected to GSM Module and Keys [6]. A website interface is also provided for toggling devices. This can be developed using PHP programming. Along with the interfaces mentioned above, traditional method of controlling the switches manually is also retained [7]. So manual ON/OFF operation will also toggle devices in addition to the interfaces mentioned above. “Smart

switch” is the extension to this which is a portable adapter. Today’s technology focuses on making individual devices smart, however, here we have proposed to design a switch which can make any dumb device smart when plugged into this switch. Thus device connected to this switch can be toggled from anywhere at any time through suitable interface.

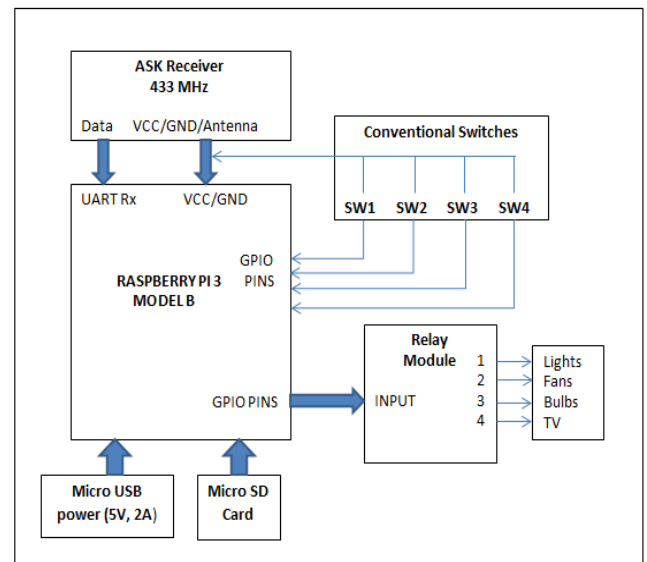


Fig 3. Block diagram of Receiver Section

D. PROCESSING UNIT

Here we have used raspberry pi3 as the main processing unit. Raspberry Pi will toggle the devices whose pins are connected to its General Purpose Input Output Pins. Some pins are programmed as input and other as output. Connections from individual devices are connected to the output pins of processor. Depending upon the transmitted pattern, Raspberry Pi will toggle the device connected to that particular GPIO pin [8]. GSM module is interfaced to provide security. Once the door is locked, it can be unlocked through authentication via website. If it’s opened without any authentication, in case of thefts, then a message will be sent to the user giving security alert. To accomplish this, special arrangement is made behind the door and the device is placed in this arrangement along with the metal plates.

I. Additional Features

Along with the interfaces discussed above, an additional feature is provided by this system which can be used at places where we need automatic toggling of lights, fans and other equipment on entry and exit of people. This system can be implemented in washrooms, conference halls and auditorium where lights can be controlled depending on the number of people inside the room. The system consists of 2 sharp sensors at either ends of the door. Entry will be considered only when a suitable mechanism for entry and exit is followed. For any other cases, count for entry will not be incremented as it's not a valid entry. This mechanism avoids false entries and exits. In addition to this, GSM based security system is incorporated which sends security alert in case of thefts, when door is opened without authentication from website.

Table I : Hardware requirements and specifications

Sr. No.	Component	Specifications
1.	Vibration detector (piezoelectric)- VM14 Digital Vibration sensor	Voltage rating:3.3-5V output current: 15Ma sensitivity: 200mV/g
2.	Raspberry pi 3	voltage rating:5V output current: 2Amp
3.	Relay	VCC: 5V Trigger- 3.3V
4.	Rechargeable Battery	Voltage rating: 7.4V Output current: 7.4mA
5.	Transmitter and Receiver module-ASK module	Operating frequency: 433MHz
6.	Low power Microcontroller- MSP430F2003IN/TN	Voltage rating- 1.8-3.6V current rating-220μA at 1MHz

II. Software Requirements

1. Raspbian Jessie operating system for Rpi3
2. MobaXtermXserver(remote terminal SSH)
3. Python 3.5.2
4. NumPy
5. Code Compressor Studio (CCSv6)
6. Open CV 3.1

1. Advantages

The use of low power microcontroller increases the efficiency of system by lowering its power consumption needs. Using mobile battery for powering devices reduces the size of the device making it more compact, handy and light weight. Piezoelectric sensor detects the impulse vibrations, continuous vibrations are not detected by sensor. Setting threshold for identifying vibration gives an added advantage of selecting values of interest and rejecting all other vibration levels. To avoid false detections of knocks, all the patterns are designed such that they contain more than 1 knock. Automatic toggling of appliances on entry and exit makes use of 2 sharp sensors on either sides of entry and exit to avoid false count.

2. Applications

Knock is a device which makes electrical appliances smart as they are used from anywhere in room and there is no need to change the appliance so as to control it using any device. This device also finds applications in home security. Knock it device will be locked using a website and if someone opens the door without unlocking the device from a mobile application then it will give alert for e.g. by sending a message. GSM module is used to send and receive message through the device. This device can be placed in offices, hospitals, restaurant serving different purposes. This system can be implemented in auditorium. This device can be used to prevent children from using computer, video game, etc. for long duration by setting timers for these appliances. Air conditioner, Washing Machine, Water Pump can be controlled as per need even when the user is far away from his workplace or home.

3. Summary

In this project, various interfaces are provided to control electrical appliances and make them. This is done to provide user an ease to control appliances from anywhere in the room. Unlike other automation projects, which deal with making homes smart, here universal solution is provided to control any electronic appliance by means of Knocks. It deals with making switch smart rather than making device smart. Additional feature of this project throws light on automatic toggling of lights, fans and other appliances depending on the number of people present in the room. It is implemented using a well separated mechanism of sharp sensors.

4. Future Scope

The future work of our project will be enabling “Knock it” device to control more number of electrical appliances with greater efficiency and less delay. A smart switch is a portable device which can snap onto any switch and make the electric appliance connected to it smart. This can be made smarter by providing more number of interfaces to control devices. Also a single switch can be made to control more than one electrical appliance at a time. In this way any electrical appliance connected to that switch can be turned ON/OFF remotely.

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A Novel Technique to Detect Posture

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ABSTRACT

Bad Posture has been a major problem from ages but has been ignored throughout. Most of the people are unaware of their posture since early ages and hence are likely to ignore the ill effects of having an improper posture. This project aims at the detection of posture while sitting. A good sitting posture means, shoulders are relaxed, feet are flat on floor, and back supported to maintain the spinal curvatures properly to sit up straight. Thus the combination of a few sensors-accelerometers, microcontroller with arduino mega and MATLAB software used simultaneously provides us with 2 sets of values which can be compared and the person will know the changes that are to be made for attaining the good posture.

Keyword : Accelerometers, Biomedical equipment, Biomedical imaging, Ergonomics, Feature extraction, MATLAB, Microcontrollers

1. Introduction

Back pain is the second leading cause of absenteeism in industry after the common cold. But then that is the outcome of our total ignorance, people have never been enlightened or educated about how the back functions nor why strong muscles and good posture will help prevent backache. Over time, the stress of poor posture can change the anatomical characteristics of the spine, leading to the possibility of constricted blood vessels and nerves, as well as problems with muscles, discs, and joints. All of these can be major contributors to back and neck pain, as well as headaches, fatigue, and possibly even concerns with major organs and breathing [1].

The second most common reason for visiting a doctor is back pain. 85% of the population suffers from back or neck pain at some point in their lives. The target population for back-ache through a research was found to be 21-40 years of age group of population [2].

Very often neck pain can actually be referring to the shoulder pain. Neck Pain affects 45% of today's workers.

While back pain certainly causes more lost work time than neck pain, the condition of neck pain is serious in nature. Prevalence of neck pain has been found to be 12% of adult females and 9% of adult males. The numbers of people suffering from back pain due to extensive work at a computer or hovering over a mobile device is increasing rapidly. Today lifestyle of people is increasingly sedentary in nature, spending at least 10 – 15 hours a day at work, school, and home in a position of bad posture. Improper positioning while sitting using computers and

phones, performing long hours of repetitive movement, carrying extremely heavy backpacks, purses, and briefcases are reasons for back pain. People when sitting tend to sit in a slouched way or we can simply say that their ear, shoulder and hip joint are not in a straight line (from side view). The above condition is an ideal posture while sitting [3]. Thus, geometrically it can be deduced as; when the ear, shoulder, and hip are aligned perpendicular to ground, it is considered to be an ideal posture. We are referring to this conclusion after referring various healthcare sites, papers, orthopaedist and physiotherapists.

The posture thus can be determined in our project as we detect the person's current sitting posture and compare these values to the ideal sitting posture values which are your angle between ear and shoulder should be perpendicular to the horizontal surface and same is the case with shoulder and hip. The values are obtained by both software and hardware methods. In software we use MATLAB in which with the help of co-ordinate geometry we detect the deviation from ideal posture and in hardware we use accelerometer ADXL335 to measure the deviation, Arduino Mega for processing accelerometer data and few aluminium rods as per our requirement.

The person is made to sit casually on a stool and picture is taken from one side for processing in software whereas the hardware equipment is attached on the other side for simultaneous readings and comparison. Maintaining a correct posture is actually a mental training to realize the importance of good posture and for that knowledge about the incorrect posture and gradual improvement.

Our project provides a means for the test of a posture whether good or bad in an analytical value format. These values will help an individual to get aware of the posture and thus train his/her mind to maintain a good posture and ultimately follow it over the time to achieve a good posture and thus can prevent himself/herself from the problems occurring due to a bad posture.

2. Related Work

Bad posture detection is a field where extensive development has been done. Many devices were developed to detect and correct poor posture such as iPosture, BASN, Lumo Back and also postuino.

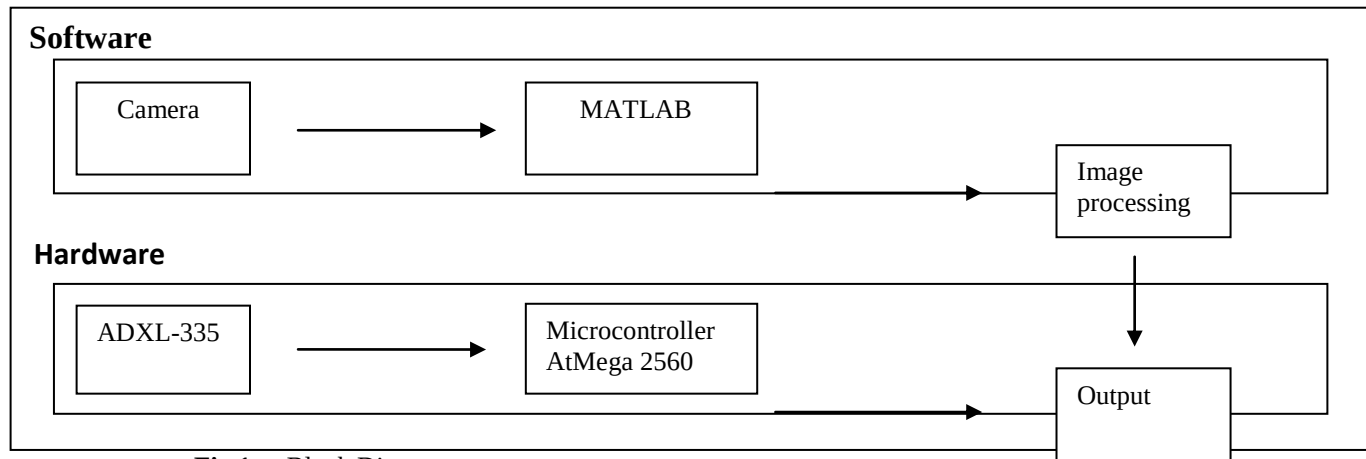


Fig.1. : Block Diagram

iPosture is a small 1-inch round device designed to be worn by the user, detect bad posture, and notify the wearer with a vibration. It warns the user when detecting any deviation greater than three degrees from the chosen posture that lasts longer than one minute. The chosen posture is saved by pushing a button [4]. It is convenient to have such a small posture detection device, though it is uncomfortable to wear all the time. The chosen posture as well might not be the best posture to be kept all the time. This device does not give any feedback to the user about the posture performance during the time where that tool was used.

Body Area Sensor Network (BASN) is a solution for wireless and wearable posture recognition based on a custom-designed wireless body area sensor network, called WiMoCA. Nodes of the network, mounted on different parts of the human body, exploit tri-axial accelerometers to detect body postures[5]. The disadvantages of that solution lie in the impracticality of wearing many sensors and purring daily life activities such as working or studying and the lack of feedback provided for users. On the other hand, one of the challenges this tool faces is power consumption optimization.

Lumo Back is a comprehensive bio-mechanical posture sensor and body movement feedback system that monitors the wearer's posture and coaches to improve throughout the day. It is considered one of the best available solutions, because it is only 8.5 mm thick. The sensor gently vibrates when the user slouches, which is similar to iPosture alert methodology. When synced with a compatible mobile device, Lumo Back keeps track of the user's daily activities; such as steps taken, time spent sitting, calories burned, and sleep habits[6]. The downside of Lumo Back is the lack of a built in adjustor for variations in different users' "correct postures," since each person has a different curvature to their spine, their "correct posture" may be different than someone else's.

Another system designed specifically for monitoring posture while sitting in front of the computer is Postuino: Bad posture detector using arduino[7]. Postuino uses arduino micro and ultrasonic sensors which are placed near the computer facing the person which alerts whenever the person leans towards the screen.

3. Methodology and Device Design

A. Hardware

Acclerometer ADXL335 sensor is used to determine the angles formed between the shoulder and ear as well as between the shoulder and hip. This was possible with the help of an aluminium assembly whose components have been explained below.

Ball Bearings, Guides and Slider, PCB, Velcro Belts, Wooden box, Adjustable strap belt, Wooden Plank, Aluminum Strips are used as a part of hardware. The ball bearing was used for free rotational movement, pcb for placing the accelerometer on the ball bearing. The ball bearing was placed on the shoulder with the help of a wooden plank and adjustable strap belts and on the hip with the help of a wooden box which was balanced on hip with the help of the strap belt which acted like a belt. The aluminium guide slider and strips were used to control the rotational movement of the ball bearing whenever the person is slouched or leaning back. Also a assembly of aluminum strips is placed on head to place a accelerometer to determine the head tilt.

The values obtained from this accelerometer were fetched by the microcontroller in arduino mega thereby displaying the value of angles in its software

The diagrams of few components and the whole of assembly worn by the subject is as shown in fig



Fig.1: Aluminium guide and slider

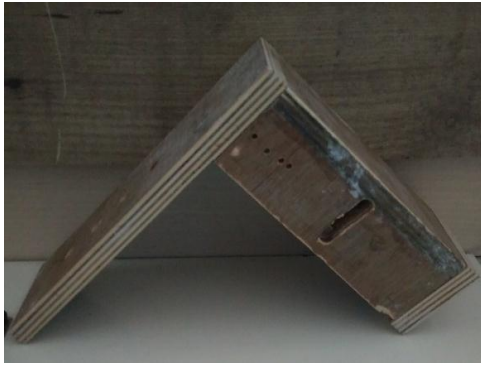


Fig.2. : Wooden box



Fig.3. : Aluminium head assembly



Fig. 4 : Subject wearing the whole assembly

B. Software

The software used to display the values of angles from accelerometer through arduino is Arduino software. In this software the values are calibrated to limit it from 0 to 180 degrees and four values were displayed: angle between ear and shoulder; angle between shoulder and hip; angle of front tilt; angle of back tilt

Along with the hardware technique MATLAB 2015a software was used to determine the above mentioned angles. This was done by capturing the image both front view and side view followed by image acquisition by the software. Multiple images are first trained into MATLAB as per the viola jones algorithm for feature detection such as ear shoulder hip nose collar bone. So the acquired image would automatically detect the feature and center

point is found out. With the centroid of all the detected features, angle between them could be easily found out.

Feature and angle detection diagram along with the angles displayed

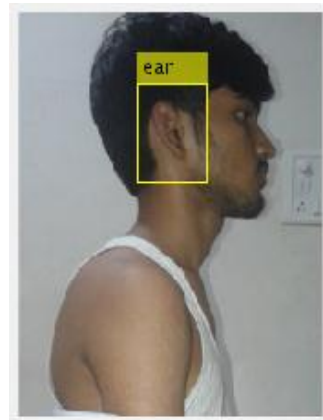


Fig.5. : Feature detection; Ear



Fig.6. : Feature detection; Shoulder

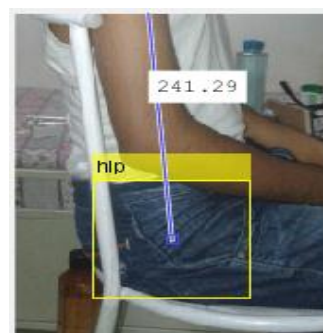


Fig.7. : Feature detection; Hip

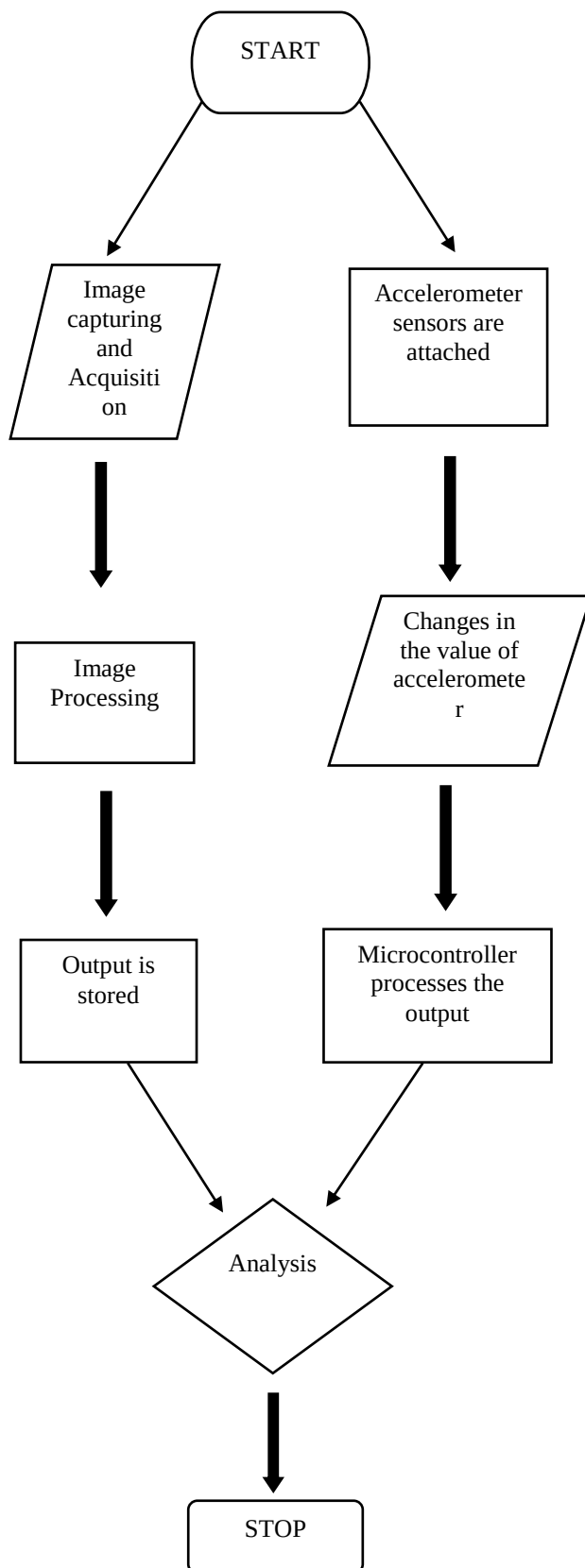


Fig.9.: Flow chart

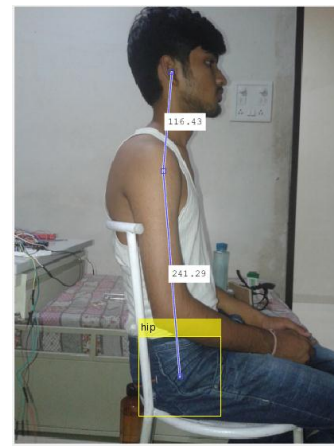


Fig.8. : Feature detection; Hip

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Command Window
New to MATLAB? See resources for Getting Started.

anglebetweenearandshoulder =
    85.0729

anglebetweenshoulderandhip =
    94.6355

fx >>
  
```

Figure.9 : Angle detected by MATLAB

4. Results and Conclusion

Sr. no.	View	Region of angles	Hardware readings	Software readings	Difference
1	Side view	Ear to shoulder	69	56	13
2	Side view	Ear to shoulder	78	83	5
3	Side view	Ear to shoulder	65	70	5
4	Side view	Ear to shoulder	79	88	9
5	Side view	Ear to shoulder	83	71	12
6	Side view	Ear to shoulder	96	94	2
7	Side view	Ear to shoulder	92	98	6
8	Side view	Ear to shoulder	74	78	4
9	Side view	Ear to shoulder	96	94	2
10	Side view	Ear to shoulder	103	112	9
Mean			83.5	84.4	6.7

Table.1.: Table showing angle between ear and shoulder of 10 subjects

Sr. No.	View	Region of angles	Hardware readings	Software readings	difference
1	Side view	Shoulder to hip	92	97	5
2	Side view	Shoulder to hip	86	81	5
3	Side view	Shoulder to hip	94	91	3
4	Side view	Shoulder to hip	89	89	0
5	Side view	Shoulder to hip	110	96	14
6	Side view	Shoulder to hip	70	73	3
7	Side view	Shoulder to hip	102	98	4
8	Side view	Shoulder to hip	101	95	6
9	Side view	Shoulder to hip	106	99	7
10	Side view	Shoulder to hip	103	97	6
Mean			95.3	91.6	5.3

Table.2.: Table showing angle between ear and of 10 subjects

10 subjects voluntarily participated in examining the system the output. It was observed that their existed a difference of 5°approximately between the hardware and software values. Inspite of the subject being aware of the posture test being carried out he/she could not maintain an upright posture for more than few minutes as the muscles are toned to gain their normal posture. From the results it was observed that 80% of the people tend to slouch having a bad posture.

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Design Considerations for a Quadcopter(Small Scale Applications).

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Abstract :

Surveillance and monitoring are important aspects for both indoor and outdoor security purposes. Most of the times stationary monitoring systems limit us in range and this compels us to use multiple scanning devices. Thus an immediate solution is to have a mobile surveillance system which could analyze and monitor areas dynamically reducing the required number of scanning devices and at the same time be beneficial for monitoring places where human presence without previous information might be risky.

The main component of such a system is an aerial robot (quadcopter) with varied sensors. Also, a camera for live video of its front person view (FPV) can be used. The video could be directly streamed to a smartphone/desktop for video feedback to controller for monitoring purposes and also help in navigation.

Keyword: Quadcopter, monitoring system, aerial robot, sensors, controller.

1. Introduction

Quadcopter - a part of Unmanned Aerial Vehicle (UAV) family is one of the best choices in order to achieve surveillance and monitoring for security purposes with low cost and high efficiency. This aerial system could be easily implemented for spaces beyond human reach to perform tasks which were otherwise risky. Quadcopters have gained great popularity in recent times due to a boon in microcontroller and semiconductor technology that makes the system compact, yet impressively powerful and capable to perform complex operations with ease. Based on the required specifications appropriate components should be selected. Ref. [1] highlights that designing steps of quadcopter comprises of selection of following components:

1. Frames (size, material, design).
2. Flight controller.
3. ESCs.
4. Battery (voltage, capacity).
5. Ground station software.
6. Radio Control (Transmitter and Receiver).
7. Motors (Depending on RPM values).

2. Components of a Quadcopter Frames

A) Type of Frames : The major two types of frames are :

- X Frame.
- + (plus) Frame.

Fig.1 shows the X frame configuration while Fig.2 shows a + (plus) frame configuration.

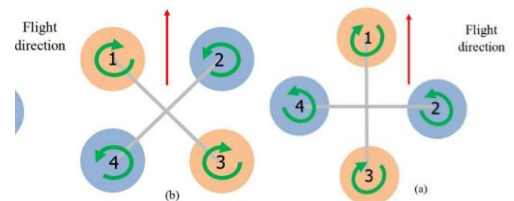


Fig 1: "X Frame"

Fig 2: "Plus Frame"

Ref. [2] points to the several key differences between a plus "+" and cross "x" configuration:

a) Physics:

If you have a "+" configuration, then the thrust forces are applied at a distance ' r '. If you have an "x" configuration, then the thrust forces are applied at distance of " $r \cdot \cos(\pi/4)$ ". Thus, about 41% more rotational acceleration is obtained from an "x" than a "+".

b) Visibility of yaw:

A "+" will have one marked front arm. An "x" will have two. Frequently the operator can only see two arms on a quadcopter. If you have one uniquely colored arm and can only see two arms that leaves an ambiguity over the direction of the vehicle. Recovering situational awareness during flight is a very safety critical process.

c) Camera Arc Clearance:

An "x" can have a camera pointed forward without obstruction from the frame more easily than a "+". Some designs remove this concern, either by mounting the camera on a standoff or with moving landing gear.

1) Type of material: Many different types of materials are used to build the modern day drone. Some of the more popular options include carbon fibre, fiberglass, and various types of plastic, metal or wood. Fig.3 shows the various materials and their properties.

Material	Density (lb/cuin)	Young's Modulus (Msi)	Tensile Strength (Ksi)
Carbon Fiber	0.05	9.3	120
Titanium	0.16	16.82	130
Aluminum	0.1	10.3	15-75
Fiberglass	0.07	2.7	15-50
Steel	0.29	29	30-290
Polycarbonate	0.05	0.75	8.0-16.0
Acrylic	0.04	0.38	8.0-11.0
Balsa	0.0027-0.0081	0.16-0.9	1-4.6

Fig 3: “Properties of different frame materials.”

While materials like carbon fibre may have a very high weight-to-strength ratio, ref. [3] states that they can be very expensive to work with. For this reason, many people begin by making their designs from wood, or even 3D-printed acrylonitrile butadiene styrene (ABS) plastic. On the other hand, many composite fibres and glass fibres provide good strength and durability for a little lower cost and thus are great choices for small applications.

2) *Size of Frame* : The size of frame is an important parameter to determine the category of a quadcopter. This is measured in terms of diagonal motor to motor distance. Fig.4 shows the concept graphically.

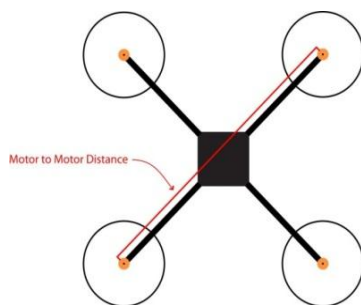


Fig.4 : “Motor to Motor Distance”(Image courtesy: www.aeroquad.com)

As per [4] Some well-known categories of quadcopter are: 150mm, 250mm, 300mm, 450mm and 650mm. All these are motor to motor distances. A smaller size means smaller blades which generate less kinetic energy. Thus smaller quadcopters are more reliable and safe. They are also cost effective. A larger quadcopter provides more efficiency. But, as blade size increase, there is an increase in their momentum which hampers the control. Larger quadcopters can carry heavier payloads and can achieve higher altitudes.

B) Flight Controller

The flight controller is the brain of the quadcopter. It is a microcontroller board that is equipped with sensors like accelerometer, gyroscope, barometer etc. It helps in stabilizing the quadcopter and at the same time takes care of all other aspects of flight and radio telemetry. As per [5] various components of flight controller are:

- Processor
- IMU
- GPIO pins
- Telemetry ports

The Inertial Measurement Unit (IMU) is a board which contains sensors like magnetometer, Accelerometer and gyroscope. These help in controlling flight dynamics and keep the aircraft stable in air. The Telemetry and GPIO ports are used to interface all other components like motors, radio receivers, etc etc.

1) *Choice of controller*: The use of optimal flight controller gives the required performance for an optimal price. For small scale and low altitude applications, moderate performance controllers are best fitted for a decent price. As mentioned in [6], some of the popular mid-priced moderate performance flight controllers are:

- CC3D
- Naze 32
- kk2
- ardupilot
- Multi Wii

All these controllers vary in performance in terms of hardware and software. Naze 32 and CC3D are 32 bit controllers whereas ardupilot is an 8 bit controller.

C) Motors

Motors provide the torque to rotate the propeller that in turn provides thrust to the aircraft. Ref. [7] suggests that in order to make the operation more reliable, more efficient and less noisy the recent trend has been to use brushless D.C (BLDC) motors. They are also lighter compared to brushed motors with the same power output. The conventional D.C motors require occasional maintenance. Thus, the brushed D.C motor should never be used for operations that demand long life and reliability. For this reason BLDC motors are used in most of the modern devices. Efficiency of a BLDC motor is typically around 85-90%, whereas the conventional brushed motors are only 75-80% efficient. Fig.5 below shows structure of a BLDC motor.

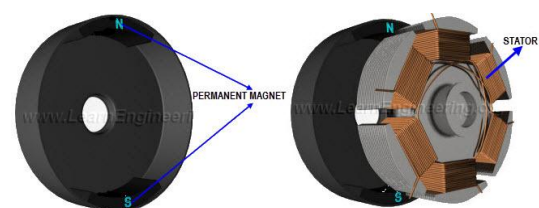


Fig.5 : “Structure of a BLDC motor”(Image courtesy: www.learnengineering.com)

Some of the main categories of BLDC motors are:

- Out runners
- In runners

Both the types vary only over the placement of runner inside the motor body. The motors are selected in terms of rpm and Kv ratings. These factors decide the power and speed motor can provide.

D. Electronic Speed Control (ESC)

As defined by [8] ESCs are controllers for brushless DC motors. It is an optoelectronic device that controls the current flowing into the coils of BLDC motors thus controlling their rotational speed. There are two types of ESCs: opto ESCs and BEC ESCs. The type of ESC you use for a multi-rotor project is very important because you will need to use a completely different power system for each type. The esc is characterized by its current rating. Fig.6 shows a typical BEC ESC.

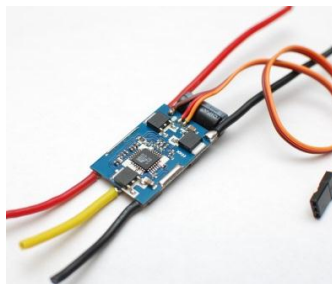


Fig.6: "Electronic Speed Controller"
(Image courtesy: en.wikipedia.org)

The two major types of ESC as per [9] are BEC (battery elimination circuit) ESC and Opto-SC. A BEC ESC, which is sometimes called an UBEC ESC, is basically two electronic circuits in one package. First you have the ESC circuitry. And the second part of the package is a BEC which takes the high voltage from the battery and reduces the voltage down to a level that can be fed into the flight controller.

An Opto-ESC has only the ESC circuitry in the package and lacks a battery eliminator circuit. So, they cannot be used to supply power to the flight controller.

E. Battery

The power required to keep the system in air is provided by the DC batteries. The batteries essentially power the whole device through a Power Distribution Board (PDB) as all components do not work on the same voltage and current levels. There are various types of batteries like rechargeable li-ion LiPo and various non-rechargeable batteries. LiPo batteries (Lithium Polymer) are a type of rechargeable battery that have become very popular because of their power to rate ratio. thus by [12] in other words, it provides more electricity in a lighter package. Obviously, this is ideal for anything small to be able to go airborne. Another advantage is that LiPos have a high discharge rate – which means they can deliver

large amounts of power at once. The batteries are rated in terms of capacity in Ah(Ampere*hours). The C rating of a battery is measure of its discharge capacity.

F. Radio Control (Telemetry)

The telemetry is a very important part of the system as it is user controlled to maintain flight characteristics according to need of the user. According to [11] the conventional quadcopters need a minimum of 4 channel transmission. Dedicated channels for yaw, pitch, roll control and Throttle control channel. More channels can be used to acquire or send additional real time data like battery power, range limit and other time critical parameters. Fig.7 shows a channel Radio transmitter.

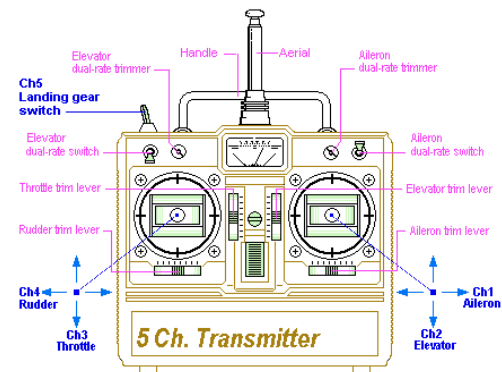


Fig.7: Channel Radio Transmitter(Image courtesy:
www.oscarling.com)

Wireless radio is a great option as wired media limits range and could interfere with propellers. Also, they are cheaper than other media and have good range capabilities for a low power technology.

The Proposed System

The proposed system aims at a modular and optimal configuration that can be interfaced to varied sensors for different applications. The focus is on moderate scaled applications that require good flying speed, moderate flight time and a considerably good payload still keeping the cost of the system low. The proposed system considers the optimal choices and the reasons for the choices to uphold the system efficiency and reliability. These are of further advantage as they determine the stability of the system when air borne. The proposed components form a cost effective yet powerful system providing good balance and strength.

Proposed Frame

Outdoor monitoring applications require moderate speed and not very high altitudes with considerable payload for sensors and camera thus the choice of size considering all these factors is 250mm mini quadcopters. The popular frame designs in this category are QAV250 (Fig.8.1) and ZMR250 (Fig.8.2).

**Fig.8.1:** ZMR 250**Fig.8.2:** QAV250

(Image Courtesy: www.cheapdrone.uk)

The main difference is that ZMR250 is built using G-10 glass fibre whereas QAV250 is a carbon fibre build. Also, QAV250 is a uni body build which means that any damages needs the whole frame to be replaced. Here, the ZMR250 has detachable and foldable arms that can be replaced in crash a scenario without need of replacing the whole frame. Thus, Qav250 gives more strength to weight ratio and zmr250 gives better flexibility. Thus zmr250 frame is a good option for the targeted application.

Flight Controller

Flight controllers suitable for medium applications have more or less same features varying in processing powers and brand names that add up to the cost. Out of the popular controllers mentioned above, The 32 bit controllers provide a good processing power and speed than the 8 bit controllers narrowing the choice to NAZE32 and CC3D atom.

Table 1 : Comparison of naze32 AND CC3D ATOM

NAZE 32 Acro	CC3D
Naze32 uses a MPU6050 (more accurate) IMU	CC3D uses the MPU6000
Naze32 has Micro USB	CC3D has Mini USB.
Naze32 has an on-board USB to UART adapter which connect to the processor's serial port.	The CC3D board has a USB port that is directly connected to the processor.
Naze32 uses Base-flight configurator (easier to configure).	CC3D uses Open-Pilot GCS (finer tuning than NAZE 32)
Cost : Rs. 2.0k(Approx.)	Cost : Rs. 1.5k(Approx.)

Thus as both choices have comparable features and CC3D being lower in cost, CC3D is a great choice for the proposed system.

Motors

The need for stability and reliability with good thrust leads to choice of BLDC motors. For selecting required motor, the important parameters as per [12] are:

1) **Thrust** : the total thrust required to keep the quadcopter in air is double to its total weight in kg. The thrust required per motor is represented by (1).

Required Thrust per motor = $(\text{Weight} \times 2) / 4$ (1) The thrust also depends upon the size of propellers. Fig.9 shows a 2200Kv BLDC motor.

**Fig.9 :** 2200kv BLDC motor.

(Image courtesy: www.banggood.com)

The motor rpm is calculated as product of motor thrust and battery voltage. Thus, assuming a 11.1v battery (3S), owing to these conditions, the selection of motors gets us down to a configuration of **2300kv bldc** motors which shaft size depending upon compatibility with the frame.

ESC

Atypical 2300kv motor draws around 10Ampere current at max speed as per [13]. Thus to comply with this current requirement a 12Ampere ESC should be sufficient enough to fulfill the current requirements. The BEC ESC are useful at it saves us from additional hardware to regulate battery voltage from flight controller. Thus, the proposed component is a BEC ESC(12 amperes) with simonk for current linearity.

Battery

Reference[14] implies that The battery capacity and discharge rate are important parameter which determines the time of flight. Thus, as maximum required voltage of 3S (11.1V) battery with a battery capacity of 3 Ampere hours (3000 mAh) gives an optimal time of flight of around 7 minutes and a C rating of 16C.

Conclusion

For a medium payload capacity and high speed quadcopter with moderate complexity applications, the optimal system with a low propeller pitch and diameter is best suited. By varying the selection parameters as required, the performance of system can be further enhanced. Table.2. sums up all the proposed components for the system.

TABLE – 2 : Comparision of naze32 AND CC3D ATOM

Component type	Proposed Component	Cost(Approx.)
Frame	ZMR250mm(G10 fiberglass)	1200
Flight controller	CC3D Atom	1300
Motors	2300kv (2204) Brushless DC (compatible with zmr250mm)	550*4= 2200
ESC	12A simonk ESC(one shot)	550*4= 2200
Propellers	Gefman 5030 (carbon fibre)	150*4= 600
Battery	3000mAh LiPo (12C) battery	1000*2= 2000
Radio Transmitter	FlySkyFs T-6 (Compatible with CC3D)	800
Radio Receiver	FlySky R-6B (Compatible with CC3D)	700
Total		11000

The system further requires control telemetry which are available in market as compatible transmitter receiver pair and thus do not require very close consideration. The above proposed system can be a viable solution for indoor and outdoor monitoring and surveillance applications and can have a very wide range of application including small scale cargo delivery to traffic monitoring or disaster mitigation. These systems due to such utility and cost effectiveness are bound to gain huge popularity in near future.

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Two-Dimensional MoS₂ : A Novel Material for Next Generation Semiconductor Technology

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ABSTRACT

In order to overcome problems faced by silicon based devices when scaled below 14nm researchers are looking at 2-D materials as a replacement for silicon. Graphene was the first two-dimensional (2-D) material. Its interesting properties has caused major focus on other layered and crystalline materials which also have unique electronic and optical properties like graphene. One of the major group which is drawing a wide range of attraction is transition metal dichalcogenides (TMDCs). Their properties like direct band gap, optical transparency, electrostatic control and mechanical strength have made these materials fascinating inorganic nanosystems for a variety of applications. This paper discusses electronic and optical properties, various methods of synthesis and applications of these 2-D TMDCs especially Molybdenum disulphide (MoS₂), which is widely studied material and exemplar of the transition metal dichalcogenides (TMDCs).

Keyword : Two-dimensional; Transition metal dichalcogenides; molybdenum disulfide; chemical vapour deposition; van der Waals force; liquid exfoliation

1. Introduction

Silicon has dominated semiconductor industry for decades, with need to accommodate more transistor on a chip in order to satisfy Moore's law it is important to scale down transistors. Scaling transistors below 14nm cannot be done without causing short channel effects like velocity saturation, implant ionization, drain induced barrier lowering etc. These short channel effects degrade the performance of the device. So scaling of silicon based devices below 14nm is done at the cost of performance degradation. Hence finding an alternative to silicon which can be scaled below 14nm without performance degradation due to short channel effects is essential. Researchers found that some materials when stripped to single or very few layers, showed change in electronic and optical properties. These single layer materials are called 2-D materials. Graphene was the first 2-D material which showed some positive indication as a replacement of silicon.

Graphene, a two dimensional layered material, initially developed from mechanical exfoliation of three dimensional graphite has encountered its splendid age since the year 2004 [1]. Underlined properties such as high thermal conductivity at room

temperature (3×10^3 W/m K), high specific surface area ($2630 \text{ m}^2/\text{g}$), high transparency (97.7% transmittance in the visible spectrum), high Young's modulus (1.1 TPa) and high electrical conductivity ($\sim 10^4 \Omega^{-1} \text{ cm}^{-1}$) have been detected [2,3]. Graphene has found its applications in solar cells [4], transparent electrodes [5], wearable devices [6], energy storage [7] and catalysis [8] due to these remarkable characteristics. However, graphene does not have a band gap which restricts its applications in logical circuits for low-power electronic switching. In order to overcome the shortcomings of graphene, many researchers have shifted their focus to non-graphene 2D materials such as transition metal dichalcogenides (TMDCs) [9,10] especially in regards with low-friction coatings and catalysis. The understanding that single layer materials have distinct electronic and optical properties [11], led to a large interest in this new field of study.

Due to its abundance in nature in the form of molybdenite, MoS₂ is the majorly studied TMDC. Monolayer MoS₂ is a semiconductor that exhibits a direct bandgap of 1.8 eV [9]. This promising property of MoS₂ will help in overcoming the shortcoming of graphene in terms of band gap [12] thereby allowing use of 2D materials in next generation switching and optoelectronic devices.

In this paper, we will be focussing on structural and electrical properties, preparation methods like chemical vapour transport, mechanical cleavage, liquid exfoliation and chemical vapour deposition (CVD) growth of MoS₂. Some of the major applications developed using MoS₂ are also discussed.

2. Properties of MOS₂

TMDCs which have generalized formula MX_2 (M = Transition metal (Ta, Zr, Hf, V, Nb, Ti, Mo, W, Tc, Re, Co, Rh, Ir, Ni, Pt, Pd), X = Chalcogen (S, Te, Se)) [12], include a large family of materials and semiconducting, metallic and superconducting electronic characters [13]. As shown in Figure 1 vertical stacks of two dimensional layers separated by $6.5 \text{ \AA}$, form bulk TMD crystals. In a single layer of MoS₂, Mo and S form a sandwiched structure by virtue of covalent bonds arranged in a sequence of S-Mo-S [14]. Relatively weak van der Waals forces act between the sandwiched layers. Monolayer MoS₂ with trigonal prismatic polytype is semiconducting while that with octahedral crystal symmetry configuration is metallic (Figure 2) [15].

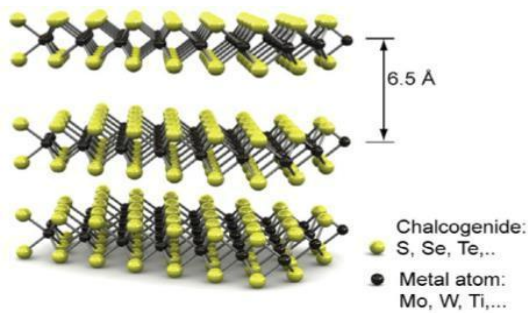


Figure 1: Schematic representation of the structure of a TMD material [18]

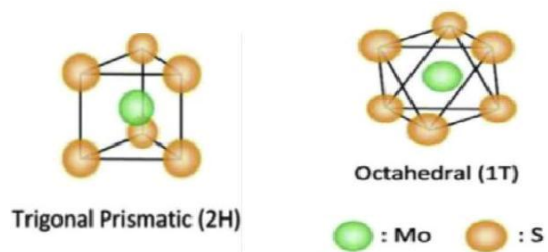


Figure 2 : T wopolytypes of single layer MoS₂: trigonal prismatic (1H) and octahedral (1T) [12]

Whenever there is band gap present in a 2-D semiconductor it is a clear indication that it has application in electronics and logic circuits that are based on field-effect transistors. Switching between On and Off state using control voltage at gate terminal, is one of the most important feature while making transistors. MoS₂ has band gap equal to 1.8eV. Material get depleted of charge carriers due to presence of band gap hence 2-D materials like MoS₂ are suitable for making logical circuits using FETs. Another advantage of MoS₂ is their low thickness, they have atomic scale thickness i.e single or few layers of atoms. Such atomic scale thickness gives MoS₂ advantage over 3-D materials like silicon because it lowers the short channel effects. These short channel effects observed majorly in silicon based devices degrades the performance of nanometer sized transistors. Penetration of electric field in semiconducting channels is what causes short channel effects. This penetration length is described by natural length which is directly proportional to thickness of the semiconducting channel. To avoid short channel effects the channel length should be at least 3-4 times natural length. As the thickness of MoS₂ material can be brought down to single or few layers of atoms, penetration electric field in semiconducting channel is very low in case of MoS₂. Hence transistor made from MoS₂ can be scaled to very small size without causing performance degradation due to short channel effects. Tests conducted on MoS₂ layers with thickness in the sub-100nm range have proved the absence of short channel effects. Hence MoS₂ device can be scaled to very low thickness without causing short channel effects. By using scandium contacts further scaling can be achieved as it reduces contact resistance.

In 2011 Radisavljevic et al [16] demonstrated transistor made from monolayer MoS₂ with on/off ratio of approximately 10^8 at room temperature. Also the device showed negligible off-state current and n-type transport [12]. Monolayer MoS₂ FETs developed afterwards showed saturation and Maximal current densities equal to 170mA/mm [42,12] which exceeded current carrying capacity of copper by at least the factor of 50. Bulk MoS₂ showed the mobility greater than $100 \text{ cm}^2/\text{Vs}$, but when monolayer MoS₂ is embedded with high K dielectric like hafnium oxide (HfO₂), mobility can be increased upto $200 \text{ cm}^2/\text{Vs}$.

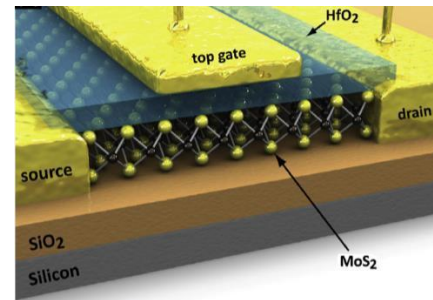


Figure 3: Schematic representation of field-effect transistor based on top Gated MoS₂ [18]

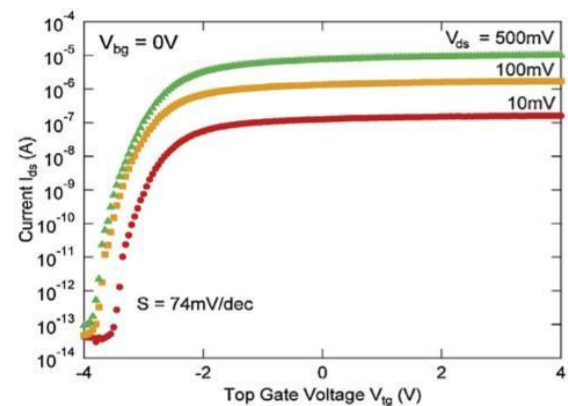


Figure 4: The device current vs gate voltage. The device turns off for gate voltages $< -2 \text{ V}$. The $I_{\text{on}}/I_{\text{off}}$ ratio $> 1 \times 10^8$ [12].

3. Preparation Methods

A. Chemical Vapour Transport

Chemical vapour transport method is used to grow bulk MoS₂ crystal. In this method purified dichalcogenide in the powdered form is mixed with elements such as bromine or iodine, which act as transport agent and is sealed in quartz ampoule. This quartz ampoule is then placed in zone electric furnace. The temperature gradient is maintained along the tube [18].

B. Micromechanical Cleavage

This method is similar to the method by which first 2-D graphene was extracted from bulk. Mono as well as few layered 2-D MoS₂ can be easily generated using this method. The bulk crystal MoS₂ produced using chemical vapour transport in the first method can be used in this method to

generate mono layered MoS_2 . Also MoS_2 crystal in the form of mineral molybdenite can be used. The main reason why MoS_2 is widely studied among all the other TMDs is because of easy availability of minerals and crystals from which single layer MoS_2 could be extracted.

In mechanical cleavage, adhesive tape is applied on the surface of the MoS_2 mineral or bulk crystal, taken off from the surface and then stuck back on the substrate which is free of any organic residue. After this, 2-D layer of MoS_2 is formed on the substrate which can be easily verified by testing its light interference pattern [19,20]. This method produces highly crystalline MoS_2 flakes with sizes ranging in tens of microns. Also the quantity which is produced is sufficient for electronic devices and also for small circuits. This method does not require any kind of expensive instruments other than optical microscope for testing interference pattern. This simplicity is what makes rapid spreading of this method. But this method has some major drawbacks like lack of scalability and manual testing of MoS_2 flakes to check whether they are suitable as a 2-D material. Hence it is necessary to find some other method, which can be used for producing large quantities of nanosheets.

C. Liquid Exfoliation

Liquid exfoliation is one of the most promising methods for producing large quantities of mono layer nanosheets. In this method, sheets with relatively large separation between layers are produced which allow inclusion or insertion of a molecule or ion into compound with layered structure (intercalation) of variety of compounds like alkali metals. In liquid exfoliation, powder or crystal of MoS_2 is soaked in solution of butyl lithium in hexane. This forms MoS_2 intercalation with Li. Later, this solution is added to water which results in release of hydrogen in gaseous form, which pushes layers apart. This method produces grams of exfoliated monolayers but these monolayers are in 1T metallic phase and are required to be heated to 300°C to bring it back to semiconducting 2H polytype [22,23]. Performing this process in inert environment is essential due to use of lithium.

An alternate method which can be used to perform exfoliation is by using ultrasonication in organic solvents or surfactant solutions [24,25] such that, surface tension of the solvent is almost equal to the surface energy of the solid which is under exfoliation. Relatively larger quantities of monolayer dispersion are the major advantage of liquid exfoliation. These monolayers, then can be used in composite fabrication or deposition of monolayer material using inkjet printing, spin coating or spraying [18]. Films formed by this method result in relatively small flakes which restrict the use of this method in electronics or photonics applications as they require large and continuous films having very less defect concentration.

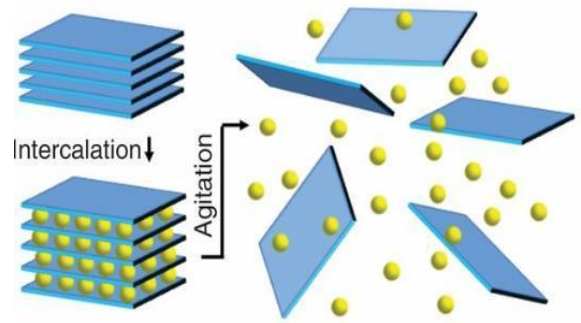


Figure 5: Mono layer MoS_2 synthesis using butyl Lithium [43]

D. CVD Growth

Due to need for larger and continuous films, lot of research was done which resulted in some ground breaking results from scientists like Zhan et al [26] and Liu et al [27]. The method consists of solid materials like Mo [26] or MoO_3 [28]. These materials in the form of thin films are deposited on the substrate which then react with sulphur at high temperatures. Liu et al developed a different method which involved thermal decomposition of ammonium-tetrathiolymdate ($(\text{NH}_4)_2\text{MoS}_4$) [27] heated in presence of sulphur. Even though these initial methods were promising they were restricted by difficulty of producing monolayer growth over large area.

The method which allowed control over thickness was proposed by Liu [29], Lou [30] and Hone groups [31]. This method involved use of MoO_3 and sulphur powder. MoO_3 and S were placed in a furnace which was then heated under inert environment at atmospheric pressure. This method resulted in monolayer MoS_2 films with thickness approximately equal to 100nm with electrical and optical properties similar to layers produced using exfoliation method. Even though this method is a significant improvement over other methods in terms of thickness control of the film, more research is required to find methods which allow uniform thickness over larger area so as to introduce n and p - type impurities during growth [18].

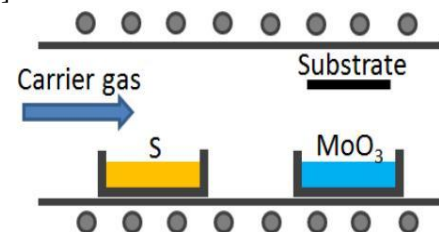


Figure 6 : Synthesis of mono layer MoS_2 using CVD growth [44]

4. Applications

Even though MoS_2 was studied since 1960's it was not used in electronics until unique properties of 2-D materials have showed promising applications in field

of electronics. After finding usefulness of MoS_2 , lot of research has been done on development of devices using MoS_2 . Even though MoS_2 is not used for commercial production in semiconductor industry, devices developed shows bright future for the material.

Wang et al [34] demonstrated ring oscillators and random access memory based on bilayer MoS_2 which can also be also be operated as an analog amplifier. The floating gate transistor is a characteristic feature of flash memory circuit. Floating gate transistor is a device which consists of electrically disconnected gate electrode placed between the conductive channel and the control gate electrode in addition to a standard FET. Voltage on the different electrodes determine whether charges can be stored or transferred between floating gate and the channel. To function as a memory cell, the charges stored on the floating gate screen the charge from the control gate and modify the response of the transistor. One of the issues restricting the scaling of current flash memory devices is the reduction in the amount of stored charge on the floating gate with a decrease in its size. Another problem is the crosstalk between the neighbouring memory cells which increases with a decrease in the distance between the cells. Both of these issues could be solved by utilizing 2D materials. The large degree of electrostatic control over conductivity allows for higher sensitivity to a small amount of charge stored on the floating gate. There is a decrease in the capacitive coupling between the neighbouring cells due to reduced thickness thereby enabling higher packing densities [18].

Bertolazzi et al [41] developed such a device using 2D materials. Monolayer MoS_2 formed the transistor channel which was contacted with graphene electrodes (Figure 4). These electrodes acted as ohmic contacts with effective charge injection into MoS_2 . Due to its capacity of high charge storage, the floating gate was made out of four-layer graphene. As a result of its 2D nature, monolayer MoS_2 is extremely susceptible to the presence of charges in the charge trapping layer resulting in a factor of 104 difference in currents between states in which the memory is stored and erased [18].

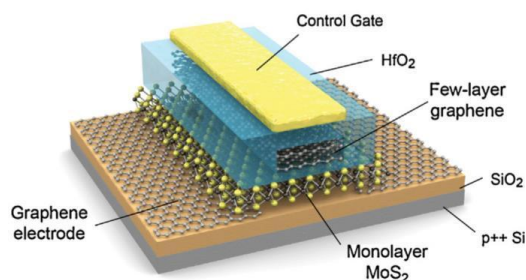


Figure 7 : 3-D representation of device based on MoS_2 with graphene contacts and few layer graphene floating gate [18]

The properties of the material change as it is striped from bulk to mono layer. The band gap of bulk MoS_2 is 1.2eV [36] and it increases to 1.8eV [37] as the thickness of the MoS_2 bulk is decreased down to single layer. When this change in a band gap takes place it is indicated by powerful photoluminescence [18] from the monolayers [11,37]. This characteristics of the single layer MoS_2 can be useful for many optoelectronics applications like Photodetectors, displays, modulators, LEDs, optical switches, lasers etc. In first monolayer MoS_2 based phototransistor, photoresponsivity of the order 7.5 mA/W [38] was observed, which was similar to the photoresponsivity of devices based on graphene. By changing the thickness of the MoS_2 layer different light wavelength can be detected. As the number of layers changed, colour of the light that could be detected using that phototransistor changed, like single or double layered MoS_2 with band gap equal to 1.8 and 1.65 respectively could be used to detect green light, similarly MoS_2 with 3 layers and band gap of 1.35 could detect Red light [39], as demonstrated by Lee et al. Lopez-Sanchez et al reported single layer phototransistor having photoresponsivity as high as 880 A/W [40] (fig). As MoS_2 was 2-D in nature, it provided high degree of electrostatic control hence allowing very low dark current when device was in off state. Due to all this very low Dark current noise was created which is one of the major factor affecting the detection limit of photodetectors [18].

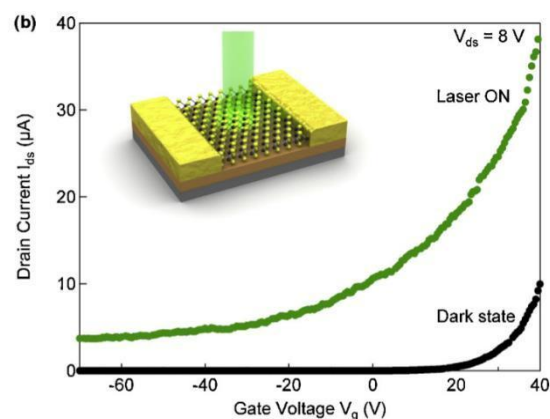


Figure 8 : Drain current vs Gate voltage response of highly sensitive photodetector with photoresponsivity of 880 A/W [18].

5. Summary And Prospects

In this paper, research in the field of 2-D TMD materials is reviewed with main focus on MoS_2 . MoS_2 is most widely studied of all the TMD materials due to its wide abundance in the nature. The research related to electronic and optical properties, methods of synthesis of MoS_2 and few applications in the field of electronics and optics were reviewed. It can be concluded that this research is very promising for field of semiconductor technology. MoS_2 was one of the major graphene-like material with direct band gap of 1.8eV. This band gap as well as other unique electrical and optical properties allowed practical applications of MoS_2 which consumes 10000 less

energy that traditional silicon devices. In order to keep up with moore's law scaling of transistor is essential. Study of MoS₂ showed that very thin layers can be made without causing degradation in the performance of the device due to short channel effects. Hence more MoS₂ transistors can be accommodated on single chip compared to silicon which will satisfy moore's law.

Even though MoS₂ is widely studied TMD, some research is required before it can be used as a replacement for silicon commercially. Currently there is no control over intrinsic impurity concentration in MoS₂, so it is important to find a method for introduction of dopants into MoS₂. Even if MoS₂ offers superior performance, it is of no use if contact resistant of the material used for contact is high. Hence finding a material which is compatible with MoS₂ and offers very low contact resistance is necessary. And finally it is very important that researchers from different fields like physics, chemistry, material science and electrical engineering, to study 2-D materials in order to find some advance properties in the near future.

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Factors Affecting the Impact of Professional Management on Family Managed businesses

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ABSTRACT

This paper is an attempt to study the impact of professional management on Family Managed businesses and the environmental factors affecting it. While the overall global businesses have rapidly gone professional from having started out as Family Managed Businesses (Referred to as FMB's), a vast chunk of Indian Businesses mainly the SME's and MSME's are still family run. As per the findings of the research, these organizations are in dire needs of changing over to a professional environment. This revolution is very much needed because these very organizations have formed the backbone of the Indian economy and these very organizations employ and train the semi-educated labor which would otherwise have to either remain stuck as agricultural hands or resort to menial jobs.

Object of Research

The areas under research here are the SME's which are run by business families. The patriarch typically grooms his brothers, sons, nephews and inducts them into expanding the business. The larger business houses are beyond the scope of research.

Background Research

FMB's typically in India are a complex web woven intricately between balancing of the relations and the profitability. The blending of these two inherently different galaxies comprising of the cold hard world of business and the emotionally volcanic domain of the family tends to create a system fraught with confusions and interfamily conflicts. Typically this is what is said about the FMB's" The first generation makes the money, the second spends it and the third generation loses it". Barring a few exceptions; very few of the joint FMB's have made it beyond the third generation. While most of them survived the "siblings as business partners" with some going up to 1st cousins; very few could make it to the "second cousin" syndrome.

An oral survey of a few FMB's has brought to light the fact that FMB's are culture specific and professional management is usually neglected. Another important point that has been taken into cognizance is that the culture of a family managed business is different from other private economic enterprises is that the affairs of the families and the personal finances, company finances are closely intertwined.

Another fact which was also brought to light was that a persistent source of inter personnel conflicts and difference in the thought processes of the two generations (since both the generation would still be co-managing it) tended to a large number of missed opportunities which an organization can ill afford to miss given the current competitive environment.

Induction of Professional management into the FMB :

While the above discussion clearly indicates the importance of inducting professional management into the FMB, the same would be easier said than done. Professional management cannot be generalized and ethnic and cultural differences would have to be borne in mind. It would be important and fruitful to study the relationship between the cultural influence in family businesses and its impact on professional management. The points to be borne in mind would be 1) planning 2) Family harmony and 3) Culture related variables.

In the culture of FMB's, ethnocentricity presents one of the biggest hurdles in the implementation of cross cultural management. While inclusion of cross cultural diversity in FMB will definitely be a high value adder, it is somehow missing in the traditional FMB as an employee's cultural background is linked to his social and commercial behavior which prevents the emergence of a cross cultural diversity in the FMB. In order to successfully implement a long lasting good governance model, it would be wise to construct a theoretical model that will describe the relationship between cultural related variables and the perceived good governance. In the theoretical model, the characteristics of good governance would be the dependent variable and the cultural values would be the independent variable. In the business context, shared values of the stake holders will refer to their common beliefs about mission, vision and values. An oral survey of the same revealed that the bottom line for most of the FMB's was sustainability, growth and profitability.

While change management is an inseparable part of good governance, most of the FMB's are averse to any kind of a critical examination of their prevailing business practices as "emotional Attachment" plays an important role in shaping the values of these organizations.

Governance in the FMB's is largely influenced by family personal needs while emotional considerations seldom find their way in the governance of professionally managed businesses.

Identifying the long term vision

Considerations of efficiency improvement, process improvement should pre-dominate the vision shaping values rather than the influences of the founder which have been developed over the generations. It would also help to take note that no vision is cast in stone and vision values will have to be revisited time and again. Strategic planning would be made easier after a clear

identification of the vision. Typically, FMB's are fraught with conflict of interest and personal egos making strategic decision making extremely complex.

Needs Alignment

While it is definitely exciting, challenging and more rewarding to work in the family business, Individual career needs and professional interest need to be mapped to the long term mission of the FMB to help nurture the interest of the succeeding generations in joining the enterprise and take it forward. The cultural values also need to be aligned with the same in order to preserve them.

Global comparatives

A similar such study conducted in of the ethnic Chinese FMB's based in Singapore revealed that 80% of the market capitalization share of the Singaporean economy is dominated by ethnic Chinese FMB's.. A large number of FMB's had got devastated after the Asian economic crisis. Due to the presence of professionally trained managers, these enterprises were able to harness western funds and professionally trained managers were brought in to manage the day to day affairs of the company. The family though continues to call the roost.. Chinese family businesses follow an ethical order in which people are not born with rights but with obligations to an hierarchically arranged centralized command. However heavy investment in acquiring international education from western universities for the off springs naturally paved the way for globalization of the ethnic thought process.

Governmental intervention

Similar to India, Singapore had also nurtured state owned enterprises as a measure of curtailing unemployment. However unlike India, Singapore had also simultaneously paved the way for enticing multinationals to invest in Singapore. Banking industry was predominantly Chinese owned thus allowing the Chinese to dominate the entire finance. As a remedy, the Singaporean government made it mandatory for the Chinese controlled banks to obtain an approval from the **Monetary Authority of Singapore** before appointing any chairman. Westernized education also paved the way for globalization in the finance system.

It was also emphasized that the FMB's were going downhill due the lack of global talent which was not found locally.

“World class companies needed the best man for the job and a funding family may not always have it” This emphasis on western education not only helped the local companies globalize but also the Singaporean economy attracted the world's best talent.

Conclusion: While SME FMB's in India have contributed significantly to the growth in the Indian economy in many ways, there is still much left to be worked upon. The journey from a protected economy to a liberalized one saw the sudden decline of the manufacturing sector which was largely controlled by the FMB's as they did not know the path to be taken in the newly globalized era. While modern education in technology and management would definitely help the offspring understand the new business world better, it would be important to take into account the Singaporean experience of the Chinese FMB's wherein professional managers were inducted for the day to day management while the families could continue to focus on the holistic development and the long term visionary approach. A fair bit of help from the government in the form of making the families accountable as in the Singaporean style will also be of help.

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PC based Monitoring and Speed Control of Closed Loop Bidirectional DC Motor using Dual Converters and DSP

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ABSTRACT

This paper describes proposed work for cascade control system that is dual converter based reversible DC drive. Adaptable speed drive describes equipment used to control speed of machinery which has many applications in industrial process such as assembly lines. Cascade control offers applications in such equipment because of better stability and faster control operation. It has numerous applications in DC drive system which is an integral part of renewable energy system based on wind source. In this mode of operation, both the converters of dual converter will be operated separately. Firing pulses will be obtain using PID controller algorithm and cascade control which is proposed by using current sensor in inner loop and speed sensor in outer loop and DSPIC30F6012A for non-circulating current control mode. The measured speed and current will be serially transmitted to pc using UART. Measured speed, and expected speed will be displayed on PC

Keywords : Cascade control, dual converter, non-circulating current, UART, serial transmission.

1. Introduction

Permanent magnet DC Motors and their control drive are playing very important role in industrial applications such as electrical vehicles, steel rolling mills, electric crane, robotic manipulators and also for commercial applications like home appliances, washers, driers and compressors. Apart from these, DC motor drives are also used in wind energy which is most important source of renewable energy. For all the above applications, speed control of dc motor is required with respect to change in load and disturbances. A cascade controller design procedure with PID tuning using Ziegler Nichols method and its implementation is discussed in [1] With the advent of power electronics, converter based motor control systems have become popular. In [2] an induction motor control system based on vector control loop and torque control loop using Digital Signal Processor (DSP) is discussed. To realize the speed controller, the torque reference is calculated as the output of speed controller. The inner current control loops are realized

with Proportional and Integral controllers while for the outer loop, an adaptive controller based on a class of Model Reference Adaptive Controller (MRAC) is chosen. The reference model considered is a first order system.

In [3] author has proposed a speed control strategy for thyristor driven DC Motor subjected to parameter variation. The inner current loop is dual mode adaptive controller which is cascaded with a model referenced adaptive speed control loop. The system is implemented using microcontroller. In [4] authors have presented MATLAB aided Cascade designed controller to control and monitor DC Motor speed using microcontroller PIC16F877A which is operated by PWM signal. [5] Presents a new speed control strategy of Brush Less DC Motor, a cascade DC-DC to reduce the low precision of speed feedback is proposed. This uses a Full Bridge circuit and motor close-loop speed control is achieved by control of output voltage of buck circuit and with motor phase current positive feedback compensation with use of predictive control. Authors have shown experiment results to prove that using output voltage feedback and phase current positive feedback for close-loop speed control of BLDCM, the ripple of output voltage can be eliminated by phase current predictive control technique during commutation interval. In [6] Authors presented the implementation of real time control algorithm for digital motor control. The steps required for The implementation of the control algorithm on an embedded computing system are described in detail and a cascade control topology is proposed in order to control the speed of the DC motor. Author has proposed three-level cascade structure for robust velocity-tracking control of electrical motor drive in [7]. They showed that with a cascade control structure, adaption of controller of different motors can be easily accomplished and the robustness problems can be solved with the most suitable technique at each control level. In [8] a novel scheme for the speed position control of PMDC drives is presented. A cascade-control scheme, based on multiple instances of a second-order sliding mode control algorithm is suggested, which provides accurate tracking

performances under large uncertainty about the motor and load parameters. All the above methods either demonstrate simulation results or real time implementation using microcontrollers for unidirectional DC drives. As DSP provides easy implementation of complex control with greater accuracy and speed of response, it is becoming popular in industrial drive systems. In [9] a DSP based PID controller has been developed to control speed of PMDC motor. It is found to improve accuracy of the speed control system to a great extent. To implement bidirectional speed control, Dual converter has been used.

The design of speed and position controllers for permanent magnet brushless DC motor (PMBLDC) is discussed in [10]. Authors feel a precise speed control of PMBLDC motor is complex due to nonlinear coupling between winding currents and rotor speed. There is also nonlinearity in torque due to magnetic saturation of the rotor. A novel control scheme to the PMBLDC motor drive, which can improve robustness by complete decoupling of the design, is detailed in the paper. Authors claim that this robust control scheme is suitable for both static and dynamic aspects. [11] Explains a modification to the existing system in [10], by implementing cascade control to further improve the system response and precision. Here a DSP based system as in [9] is modified using cascade controller. The outer speed loop is implemented using DSP and the inner current loop (PI) is implemented using analog discrete components. The system explains bidirectional control of permanent magnet DC motor using DSP. In this paper, we are proposing a modification to [11] by implementing the inner control loop by DSP. The advantage of this system will be to avoid the extra analog controller for inner current loop and removal of analog switch used for the direction change.

Section II describes the DC motor speed torque characteristics and its model. In section III closed loop cascade speed control algorithm is discussed. Section IV discusses the block diagram and components. Section V describes the proposed flow chart and working of the system and VI gives the expected results and conclusions.

2. DC Motor Characteristics

For a permanent magnet DC motor the differential equations describing the operation of electrical circuit are given by [12] as

$$V_a(t) = R i_a(t) + L \frac{di_a}{dt} + E_a \text{ --- (1)}$$

R-Armature Resistance in Ω

L-Armature Inductance in H

$V_a(t)$ -Armature terminal voltage

E_a -Armature back EMF

$I_a(t)$ -Armature current

and for mechanical circuit are

$$T_e = Bw(t) + J \frac{dw}{dt} \text{ --- (2)}$$

T_e = Electromagnetic Torque in N-m

B = friction coefficient of motor and load

J = Moment of inertial of motor and load

The electrical time constant (L/R) for armature circuit is much smaller (i.e. faster) than the mechanical one J/B. So the system can be broken in to two parts :

1. The electrical and
2. The mechanical part two PID controllers.

If the current is controlled, then the transient response of the speed control system can be improved as compared to a single PID controller as the changes in the load torque have a direct effect on the armature current. This technique is called as Cascade control. It is one of the most popular complex control structures. It is implemented to improve the disturbance rejection properties of a controlled system. In this cascade structure, each loop has its corresponding PID controller. The controller of the inner loop is called secondary controller whereas controller of outer loop as the primary controller. The structure is shown in Fig. 1. Usually, conventional cascaded speed and current controllers are designed to ensure a definite separation of speed and current loop in frequency domain. This separation allows independent design of speed and current controllers and minimum interaction among these loops. However, there are number of practical cases, where the conventional configuration cannot deal adequately with robustness issues. When current loop is subjected to parameter variations, the conventional cascade control does not guarantee for maintaining the outer loop in an acceptable performance.

3. Closed Loop Cascade Speed Control

Fig 1. shows a closed-loop Cascade speed control scheme which is widely accepted in electrical drives. It consists of an inner current control loop and outer speed loop. Inner current control loop is provided to limit the converter and motor current or motor torque below a safe limit. Inner current loop also helps in reducing the effect of non-linearity present in convertor-motor system on drive performance. An increase in reference speed ω^*m produce a positive error $\Delta\omega m$. Speed error is processed through a speed controller and applied to a current limiter which saturates even for a small speed error. Consequently, limiter sets current reference for inner current control loop at a value corresponding to the maximum allowable current. Drive accelerates at the maximum allowable current.

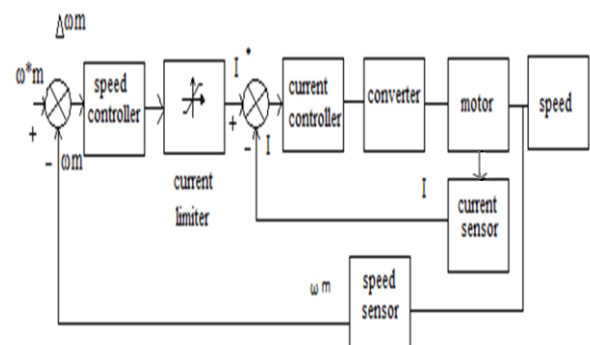


Fig 1: Closed loop cascade speed control

4. Block Diagram

The system used in [11] as shown in Fig 2.

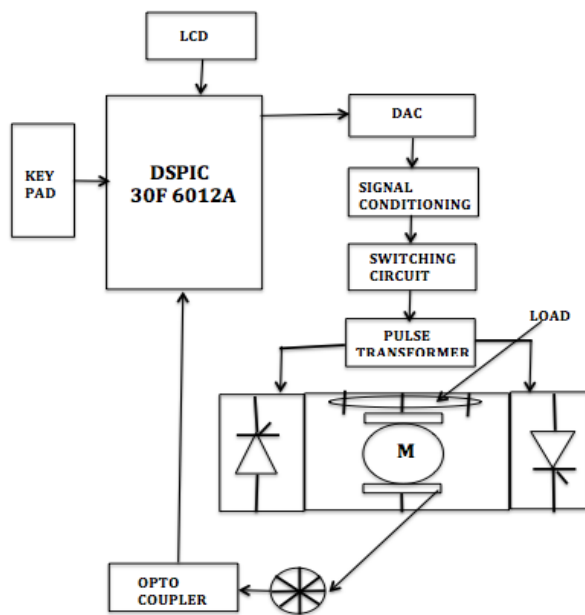


Fig 2: Block Diagram

In this method output is increased by proportional to the error and try to restore the speed. However, as the expected motor speed is achieved, the error reduces and motor speed is maintained. In this closed loop system, speed of motor is controlled using a PID controller implemented using DSP processor.

PID controller is a simple three-term controller. That the letters P, I and D stand for proportional, integral and derivative respectively. The discrete PID control algorithm is used to generate control signals. The equation for PID controller in discrete form is given below :

$$u_k = \bar{u} + K_c e_k + K_i \sum_{i=0}^k e_i + K_d \left(\frac{e_k - e_{k-1}}{T} \right) \quad \dots (3)$$

where, K_c = Proportional gain

K_i = (K_c/T_i) : integral gain

K_d = $(K_c * T_d)$: derivative gain and

T = Sampling time

e_k = Current instant

e_{k-1} = Previous instant

e_i = Error at i^{th} instant

This project implements cascade controller using PID parameters as listed below. The parameters are selected by assumptions:

$$K_c = 1$$

$$K_d = 0.01 \text{ sec}$$

$$K_i = 0.1/\text{sec}$$

$$T = 0.001 \text{ sec}$$

$$F_{\text{sampling}} = 1 \text{ KHz}$$

The system has two major parts. The drive motor and DSP controller.

i) DC Motor

DC Motor used is permanent magnet 12V DC Motor. The specification of this Motor is shown below. Power of this Motor is 1/4 hp.

Manufacturer	Tohoku Ricoh Co Ltd
Voltage Rated	12V
Speed	1500rpm
Current	2.1amps
Type	CA1215

ii) DSP (DSPIC 30F 6012A)

DSP processor (DSPIC 30F 6012A) is used which consists of 40-bit wide accumulator with CPU speed 30 MIPS. Inter integrated circuit (I^2C) to provide complete hardware support for both slave and master modes and it also allows bidirectional transfer between these two. Universal Asynchronous Receiver Transmitter module (UART) is used for full duplex transmission, in which the data format and transmission speeds are configurable. The electric signaling levels are handled by a driver circuit external to the UART. Controller Area Network (CAN) module is a serial interface useful for communicating with other microcontroller device, A to D converter allows conversion of an analog input to 12 bit digital data.

5. Flow chart and proposed sytem of speed control

The implementation of the system in [11] is based on the flow chart shown in Fig 3. this uses DSP processor for outer loop which is PID controller, However the inner speed loop is by using analog controller of discrete components. This also uses an analog switch to control the direction. This creates inconvenient.

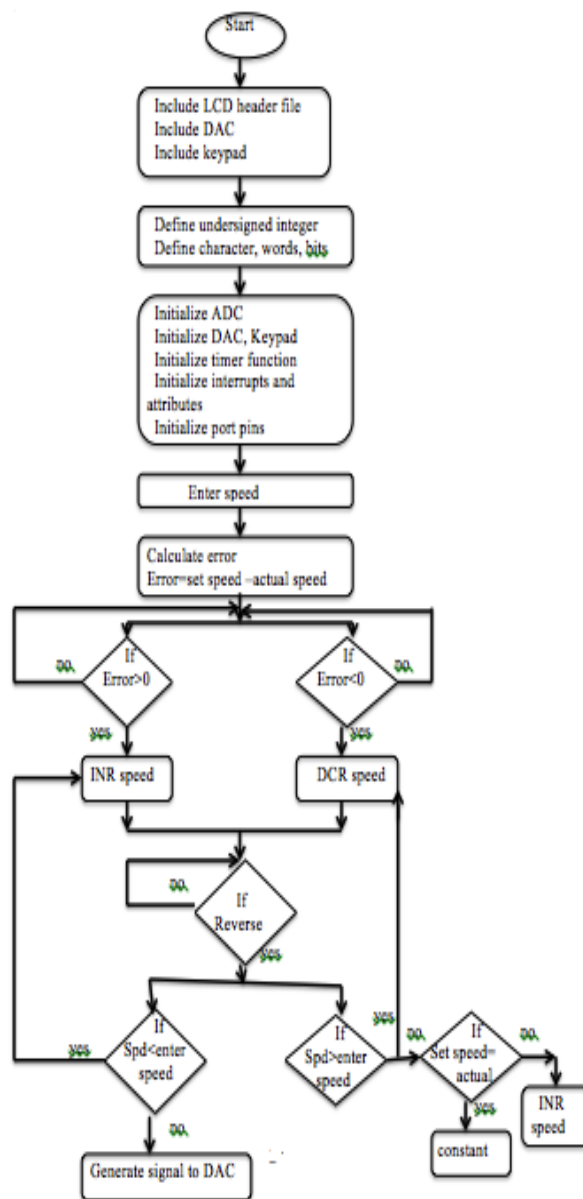


Fig 3: Flow chart of speed control system

Fig 2 shows Block Diagram of Cascade Control Discontinuous mode of DC motor.

In the proposed improvement a user interface is placed so that user can enter desired speed of motor through a keypad and actual speed of the motor can be measured by Optical encoder and given to the Interrupt of DSP. Current sensor which is connected in series with motor will sense motor current and the value will be processed by the algorithm and provide the maximum current of motor to maintain the output of PID. DSP can take input from both current loop and speed loop. DSP will produce control signals based on inner loop and this will be given to outer loop. Controller inside DSP will compare desired

speed and actual speed and generates the error signal which is given to DAC to get analog error. This error given to RAMP generator which will produce saw tooth waveform whose frequency is proportional to error signal. This saw tooth waveform is given to 555 timer in monostable mode, then pulse position modulation will produce pulses proportional to the error voltage. These pulses are given to trigger the SCR's via pulse transformer and eventually motor will be controlled.

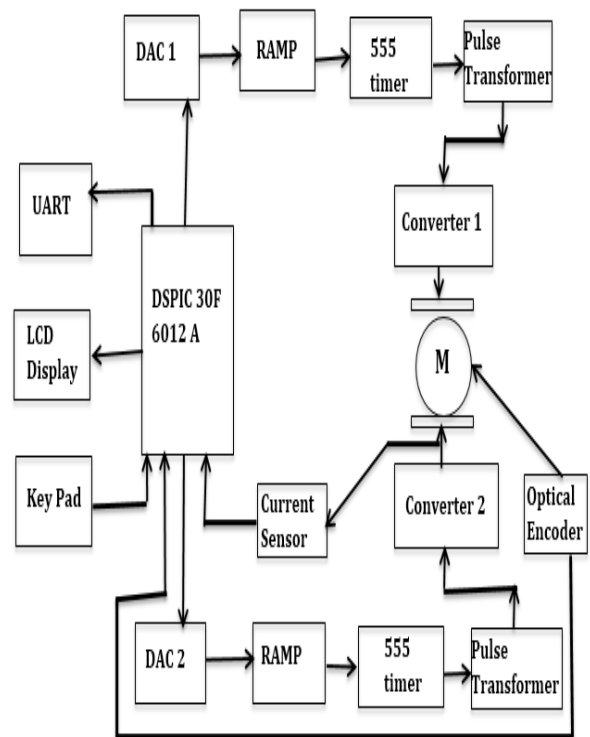


Fig 4: Block diagram of proposed system

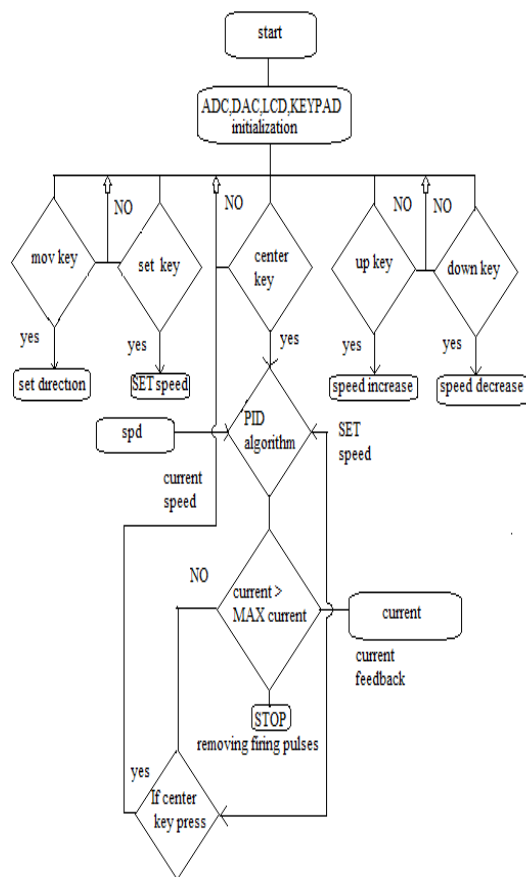


Fig 5 : Flow chart of proposed system

5. Expected Results of Proposed Work

In DSP based PID controller to control speed of PMDC motor it is found that the speed of the motor is controlled to a great extent with considerable accuracy. The controller performance was slightly sluggish and it takes about 2 to 3 secs to react properly. At lower speeds when there is disturbance, performance of the controller needs to be improved in order to achieve quick control of motor speed smoothly and to implement bidirectional speed control.

To improve the system performance a bidirectional speed control system that uses dual converter has been suggested with closed-loop cascade speed control scheme which is widely accepted in electrical drives. Using this system more speed control is expected more accurately and time response is also expected to improve.

6. Conclusion

In DSP based automatic closed loop bidirectional dc motor speed control and monitoring system using dual converter can be implemented for speed control of PMDC motor. It would help to trace speed of DC motor more accurately both at high speed and at low speed. Time to reach the desired speed can also be observed to see any improvements. The performance can also be checked for any improvements because of use of automatic control.

In this project we are using non circulating mode of operation to control the speed of motor. In future we can implement circulating mode of operation will be able to control speed of motor more precisely.

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Leveraging PLCC for Digital and Smart India

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ABSTRACT

The present focus of the government and the industry on digitalizing India and creation of smart cities puts an unprecedented demand on communication infrastructure. The technologies currently deployed primarily are adapted from the western world and pose distinct limitations. The research effort involved exploring alternate technological possibilities. The technology of Powerline carrier communication presented a lot of promise. This research paper documents an effort to compare PLCC with existing technology in isolation or in combination from its suitability for the above mentioned purpose. The research methodology involved the testing, benchmarking, conceptualizing and reading various references to understand the SWOT of this technology. An attempt has been made to conceptualize a few applications that would promote digitalization and smart communication.

Keywords : PLCC; powerline; carrier; communication; data; distribution; bpl.

1. Introduction

As of now, there are three main media which are used for data transmission viz., copper wires, optical fibers and wireless radio communication. Data transmission done using wires and optical fibers has a large range. But these are expensive, messy, they occupy space and the final received signal may be attenuated to a large extent after a certain distance. Wireless communication is neat and requires lesser infrastructure than wired transmission. But it can prove to be a problem if there are disturbances of a similar frequency or obstructions in the path between the receiver and transmitter. Obstructions like metal sheets, lead casings, magnetic fields or even simply, walls, can attenuate the signal to a large extent. Using transceivers and repeaters or boosters for rectifying the same would prove to be very expensive for a local network.[1]

PLCC utilizes the power line to form a network grid. Data to be transmitted is modulated onto the power line. This makes the data available throughout the power line and can be received at any power outlet. [2]

An n-port serial data stream is given to a PLCC device which modulates the serial data using either ASK, FSK or PSK depending on the requirement. Every PLCC device is a transceiver and is capable of full duplex communication. The harmonics present on the power line as a result of the modulation have maximum peak to peak amplitudes of under 1.5V, which is less than 1% of the

power line voltage. Harmonics of this amplitude do not have any effect on the working of other appliances deriving power from the power line.

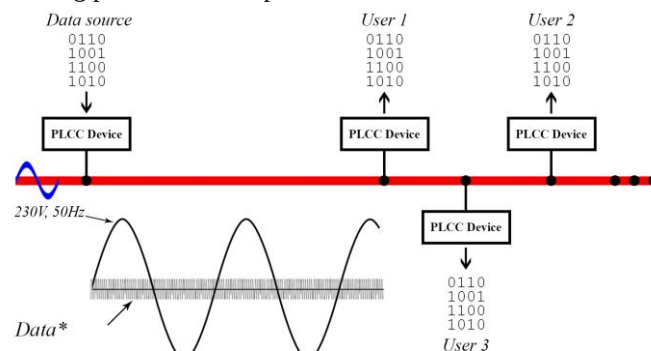


Figure 1 : Concept of PLCC Technology

* Waveform shown is for illustrative purpose and not the actual waveform.

PLCC technology provides combined advantages of the currently existing wired and wireless technologies. As no additional network infrastructure is needed for PLCC, the setup is uncluttered, organized and less expensive. The concept of PLCC being modular, the time required to install or modify the network is minimal. Easy availability of power outlets lifts the restrictions on the locations of usage. As the power lines are robust, the probability of any damage is low. This makes the PLCC network reliable. Even in case of any damage, tracking and troubleshooting is easy as availability of data is directly related to the availability of power. As PLCC uses power lines (cables) for transmission, the attenuation is less and thus the signal to noise ratio (SNR) remains high.

Modern day PLCC transceivers are capable of communicating at Gb/s rates. They use OFDM, QAM, QPSK, and BPSK to achieve these speeds depending on the application.[3]

PLCC technology is currently implemented and in use mainly in two areas viz., in high voltage distribution networks (communication and telemetry applications) and in low voltage distribution network (Broadband over Power line (BPL)).

A. High voltage distribution network

PLCC technology is used in high voltage networks for two main functions- communication between power sub stations and carrier telemetry.

1. Communication between power sub stations

Power sub-stations are generally located at places which are hundreds of kilometers apart. Some sub-stations are also located at remote places e.g., forests, deserts, or remote villages which have not yet been included in the network grid. Instead of setting up network connections between the power sub-stations for the personnel to communicate, PLCC can be used for data transmission. The high voltage levels between power sub-stations are generally above 33kV which ensure that the PLCC modulated data can traverse a long distance before it attenuates to a minimum acceptable level. [4]

2. Carrier telemetry

Power sub-stations located at remote places are often inaccessible to humans. The electrical quantities sent out by the metering devices need to be sent to locations which are accessible to humans for monitoring. In many places, electrical quantities in kW, kVA, V, A, kVAR etc. are sent using PLCC for remote monitoring. By using full duplex PLCC, communication with the plant controllers can be achieved. [5]

B. Low voltage distribution network

In low voltage distribution network, PLCC is primarily used for Broadband over Power Line (BPL). Using BPL, the broadband network is made available throughout the power line. This helps to reduce the expenditure for the initial setup while retaining the quality of communication.[6]

2. Overview of technologies

Both wired and wireless networks have their own merits and demerits over each other. Due to these limitations, one kind of network has to be used in an environment where it is suitable.

A. Wired networks

Wired networks consist of physical cables which inherently make them suitable for long distance transmission. Even after traversing a long distance, the SNR remains high. As a result of this, wired networks are used in local applications which require long distance communication e.g., intercom systems and local internet distribution.

The setup cost of wired network is high. Installation or modifications of these networks also need a lot of time to be invested.

Since wall sockets are necessary for communicating using wired networks, they impose restrictions on the location of usage points.

Due to presence of physical cables, wired networks are more reliable as compared to wireless networks. But for them to remain reliable, high maintenance is essential which adds to the overall expense. Also due to all these cables, the setup becomes messy, bulky and occupies a lot of space making wired networks very difficult to troubleshoot. [7]

B. Wireless networks

Wireless networks exchange information using radio waves. For this purpose, generally, routers are used which makes data exchange possible while moving around freely within the stipulated range. Due to absence of cables, the entire setup is neat and less bulky.

The connectivity of such networks can be very unreliable due to presence of obstructions as seen earlier. The maximum range of local wireless networks comprising of one router is generally not more than 46m.

The data rate received from wireless networks is lesser than that of a wired network having the same speed e.g., the internet speed received by a mobile device 10m away from the router may be 80% of the maximum data rate (available at the inlet port of the router) whereas that received from the wired network may be 95-100%. [7]

C. Powerline networks

Powerline networks use the power cables and provide a strong connectivity even over long distances. They provide performance equal to or sometimes even better than wired networks (in case of larger distances). This makes powerline networks very reliable as compared to other networks.

Power line networks do not require an additional setup which makes them less bulky, uncluttered and organized, thus making it cheaper than wired and wireless networks. This also makes them easy to maintain and troubleshoot. As the infrastructure needed for powerline networks is already present, these networks are modular and can be easily modified without investing too much time.

D. Case study

In this section we present case studies for various aspects related to data transmission like cost, performance and comparison of PLCC with the other techniques. For simplicity of comparison, data transmission media have been classified into wired (copper wires and optical fibers) and wireless. For the cost analysis, it is better to choose copper wires over optical fibers considering the fact that the latter media is expensive.

E. Cost Analysis

[†](The calculations for a building and an apartment have been performed assuming the building to be 10 floored with 4 apartments on each floor and every apartment having an average of 4 rooms.)

[‡] (The calculations for a commercial campus have been performed assuming the campus to consist of 500 rooms in total along with an open area of 800m². The average router range for an open area is taken as 90m.)

3. Wired Network Setup

(a) For one apartment

From the study conducted, one apartment requires 30m of CAT5e cable, RJ45 connectors, Ethernet wall sockets, a modem, a router and some peripheral components.

Table 1 : Cost estimation of one apartment[†] (wired)

Sr. No.	Component	Price*(in INR)
1	Cables	750
2	Wall sockets	2,500
3	Router	2,000
4	Modem	1,000
5	Peripherals	500

*The prices considered are average prices.

The above table implies that the expense of setting up a wired network for an apartment totals to around INR.6,750.

a. For one building

From the study conducted, a building requires a switch, hubs, 200m external CAT5e cable and RJ45 connectors in addition to the internal requirements of each apartment.

Table 2 : Cost Estimation of one building[†] (wired)

Sr. No.	Component	Price*(in INR)
1	Apartment setup	270,000
2	Switch	25,000
3	Hubs	10,000
4	Cables	5,000
5	Peripherals	3,000

*The prices considered are average prices.

The above table implies that the expense of setting up a wired network for a building totals to around INR. 313,000.

4. Wireless Network Setup

(a) For one apartment

From the study conducted, one apartment requires a router, Cat 5e cables, a modem, extenders and RJ45 connectors.

Table 3 : Cost Estimation of One Apartment (Wireless)

Sr. No.	Component	Price*(in INR)
1	Router	2,000
2	Extenders	4,000
3	Cables	250
4	Modem	1,000
5	Peripherals	500

*The prices considered are average prices.

The above table implies that the expense of setting up a wireless network for an apartment totals to around INR.7,750.

(b) For a commercial campus

From the study conducted, a commercial campus requires multiple quantities of routers, switches and large lengths of cables.

Table 4 : Cost Estimation of a Commercial Campus[†] (wireless)

Sr. No.	Component	Price*(in INR)
1	Routers	300,000
2	Extenders	300,000
3	Cables	250,000
4	Hubs	60,000
5	Switches	250,000
6	Peripherals	30,000

*The prices considered are average prices.

The above table implies that the expense of setting up a wireless network for a commercial campus totals to around INR.1,190,000.

5. PLCC Network Setup

(a) For one apartment

Table 5 : Cost Estimation of an Apartment (Powerline)

Sr. No.	Component	Price*(in INR)
1	Modem	2,000
2	PLCC Devices	4,000
3	Peripherals	500

*The prices considered are average prices.

The above table implies that the expense of setting up a powerline network for an apartment totals to around INR.6,500.

(b) For one building

Table 6 : Cost Estimation of a Building (Powerline)

Sr. No.	Component	Price*(in INR)
1	Apartment setup*	200,000
2	N port Router	25,000
3	PLCC interim devices	55,000
4	Peripherals	3,000

*As the entire building would be set up using PLCC, individual apartments won't need modems

The above table implies that the expense of setting up a powerline network for a building totals to around INR.283,000.

(c) For a commercial campus

Table 7 : Cost Estimation of a Commercial Campus (powerline)

Sr. No.	Component	Price*(in INR)
1	Routers	250,000
2	PLCC interim devices	100,000
3	PLCC devices	500,000
4	Peripherals	10,000

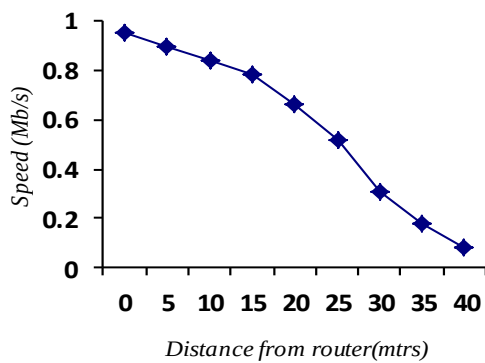
The above table implies that the expense of setting up a powerline network for a commercial campus totals to around INR.860,000.

As seen in Tables 1 to 7, setting up a wired or wireless network is expensive. Apart from these setup costs, the maintenance cost is also high. On the other hand, setting up a powerline network is much less expensive and gives a better performance than wireless without a cluttered environment.

(d) Performance Analysis

Apart from setup cost, one other factor that needs to be analyzed is the performance (speed and reliability) delivered by any communication technology. Following is a detailed analysis for a wireless network.

(The following test was conducted on a router having a specified range of 40m. The incoming internet data rate for the used router was 1Mb/s. The observations from the test are shown below. Mentioned speeds were obtained using speedtest.net. The above test was conducted with the router placed in an open area.)



Graph 1 : Speed vs Distance plot of the connectivity (without obstructions/open area)

(The above test was conducted with the router placed in an open area.)

Graph 1 shows that the speed received by a device decreases by a significant value in a distance of 40m in an open area without any obstructions.

In practical applications, obstructions are present between the receiving device and the router which affects the connectivity. To test the router connectivity with obstructions present, the following test was conducted.

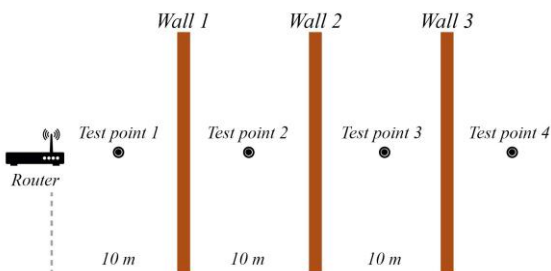
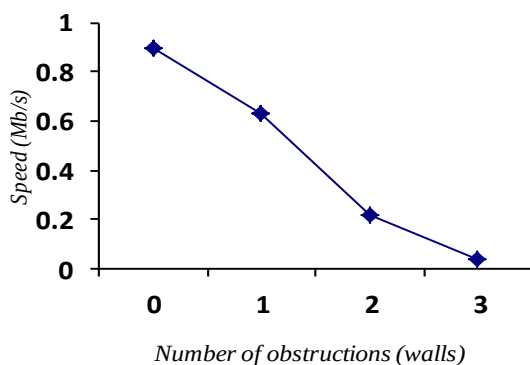


Figure 2 : Test Area Layout

Figure 2 shows the locations of the test points and obstructions.

Test points are located at a distance of 5m, 15m, 25m and 35m from the router with the number of obstructions increasing by one with each test point.



Graph 2 : Speed vs Number of Obstructions Plot of a Router (for the setup shown in Fig. 1)

(The above test was conducted with the router placed as in Fig. 2.)

Based on these tests, it is imperative that the connectivity of wireless radio network decreases exponentially with increase in the number of obstructions in its path. In a practical environment, the connectivity of a wireless network is limited due to this.

Apart from physical obstructions like walls, interference caused due to the presence of stray radio waves also hampers the signal strength to a significant level. The connectivity strength maps have been developed based on the above case study.

(The connectivity strength maps in the FIGURES III-V were created for an average sized apartment.)

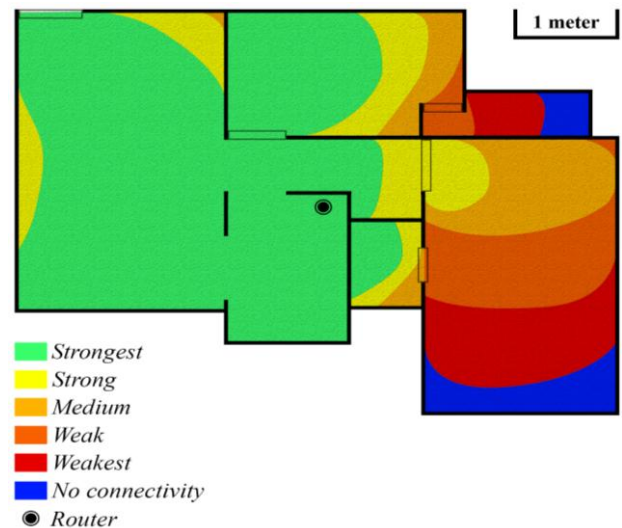


Figure 3 : Wireless Network Connectivity Strength Map

A home wireless network has a decent connectivity within a range of few meters and is very easy to use. But, the strength reduces exponentially with increasing distance and with increasing number of obstructions. As seen in Figure 3, no signal is received in far corners of an apartment which makes wireless network unreliable.

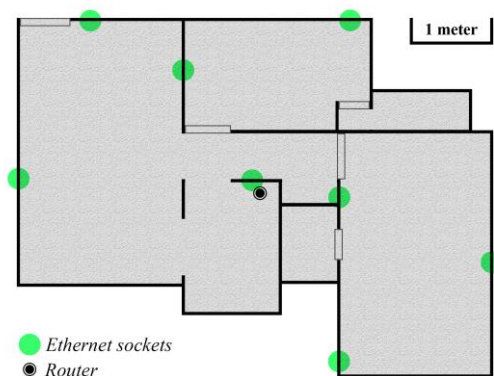


Figure 4 : Wired Network Connectivity Strength Map

Wired network gives an excellent performance in terms of speed and connectivity throughout an apartment (refer FIGURE IV). Since wired network depends entirely on physical connections, a lot of wires have to be laid down thereby making the entire setup cluttered and messy.

The average number of Ethernet wall sockets provided in an apartment is limited which restricts the freedom of movement of the user.

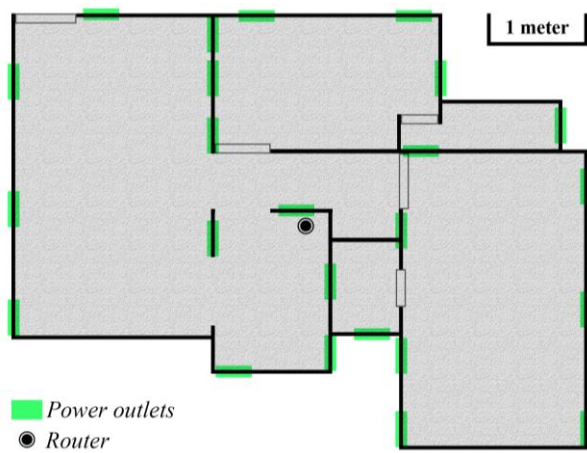


Figure 5 : Powerline Network Connectivity Strength Map

A powerline network gives high speed connectivity throughout the network grid with the reliability same as that of a wired network (refer FIGURE V). Apart from this, the overall network is neat and uncluttered. Sufficient power outlets are available throughout an apartment which increases the ease of access.

Thus it is clear that a powerline network has distinct advantages over other networks when implemented at a home level or a larger level. As the overall length of cable to be traversed in an apartment is not much, the wired network provides the same quality of signal as that of a powerline network. But when the length of cable increases substantially, a higher amount of attenuation is seen in the wired setup as compared to the powerline network.

6. Recommended Applications

In a country like India where network penetration is extremely low and the costs of laying down network cables or providing short haul networking satellites are very high, PLCC could prove to be the breakthrough solution. Implementing PLCC networks in LV distribution networks and MV distribution networks would also prove to be very beneficial.

(A) *Incorporating rural areas into the network grid*

There is a great disparity between rural and urban areas in terms of access to information and communication technologies due to lack of availability of good quality internet in such remote areas. The major reason behind this disparity is the cost of setting up the required infrastructure using currently used technologies. PLCC offers an interim solution to this problem with minimum additional infrastructure. Since low voltage distribution network covers majority of the remote areas, it becomes an easier way to reach out to maximum number of houses with electricity as well as data. Since government programs for rural electrification are already in action, PLCC can be implemented at a minor incremental expense than the allocated budgets.

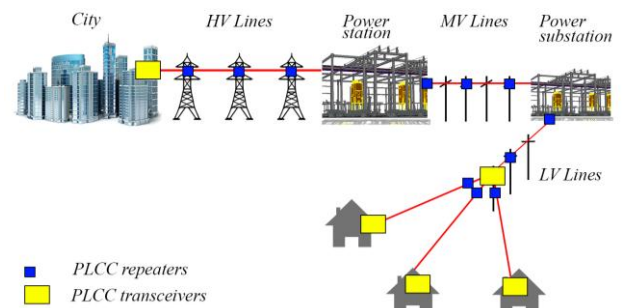


Figure 6 : Illustration of PLCC Network Grid Expansion

Power generated in a power plant is transferred through high voltage cables to a medium voltage substation. The requirements of PLCC are met by high voltage and medium voltage power lines which extend to tens or hundreds of kilometers and can reach remote and rural areas. The voltage is stepped down to a lower voltage and is distributed to a large number of low voltage grids [8]. As shown in FIGURE VI, PLCC repeaters are installed at regular intervals in the network in order to avoid signal attenuation and thereby maintain good SNR throughout the network grid. This ensures high quality data to the end users. Using appropriate arrangement of line traps, wave traps, line tuners and other filters along the path, high quality data transmission can be made possible for large distances wherever required.

PLCC technology, if implemented at a large scale, can incorporate every village into the network grid where low voltage distribution network has reached by providing good quality internet facility. PLCC is a potential means of empowering the people residing in remote location by provision of a reliable communication facility.

(B) *Promoting Smart City initiative*

In the approach of the Smart Cities initiative by the Government of India, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. Efficient urban mobility and public transport, and robust IT connectivity and digitalization are among the core infrastructure elements in a smart city.

7. IT Connectivity & digitalization

To achieve the Smart City Mission, expanding and improving the IT infrastructure of the city is a must. Expanding the IT infrastructure facilitates more and more intelligence in the individual systems in a city. This would mean that the individual systems/services become more user-friendly and convenient. Also due to the creation of a common network grid between these systems, information exchange becomes possible which facilitates a richer database. Using this enriched IT infrastructure, applications can be built which could benefit the citizens of the city and could promote a better lifestyle and standard of living. The common factor which already is needed by all the systems/services is power. Using PLCC, this common network could be utilized to bring every system/service onto the IT network. The applications possible after the creation of such an IT grid are many.

8. Efficient Urban Mobility & Public Transport

The public transport systems in a city in India include the train, tram, bus, taxi systems. Train and tram systems use overhead power lines for power. Bus stops have lights and advertisement boards which need power. Taxi agencies have their offices and stops which also require power. Similarly, all other public transport and urban mobility services and systems need power. This power network can be put to use for creating an IT network using PLCC.

Using the overhead power lines, communication between trains/trams & the stations and between two or more trains/trams can be set up. Bus stops could have digital boards which read out the estimated time of arrival and the details of the buses to come by using power lines as the media for communication. Using a combination of PLCC and RFID/optical systems, a very data-rich and intelligent system could be devised. Due to this, creation of a real time database becomes easily possible. Using intelligent software this data can be made accessible in a beneficial form which could save time and efforts of the citizens using these services.

9. Smart Metering Using PLCC

In India, electrical meter readings are collected by an individual sent by the power distributors. The data about the power consumption of a user is available to the user and the distributor only at the end of the month's billing cycle. Various communication concepts like GSM or GPRS modems/tele-control modems are being tried for smart metering. PLCC unquestionably offers a robust and techno-commercially optimal alternative. Using this concept of smart metering using PLCC, data collection could be made more dynamic and users could track their power consumption on a real time basis.

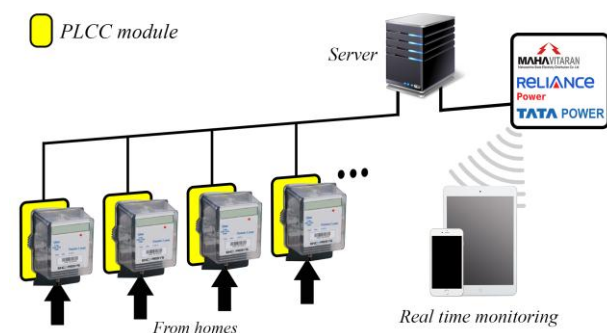


Figure 7 : Smart Metering Using PLCC

Smart Metering systems provide two-way communications that enable utilities to interact with meters and allow customer awareness of electricity pricing on a real-time basis. Smart meters are important tools for the utilities for reducing operational costs and losses because, in addition to meter reading, they also provide capabilities such as remote connect/disconnect and reduction of non-technical losses, e.g., losses due to energy theft or errors in manually collecting the readings. [9]

(A) PLCC Embedded product manufacturing

We're entering a new era of computing technology- the Internet of Things (IoT). The Internet of Things (IoT) is the network of physical devices, home appliances, gadgets and other items—embedded with electronics,

software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. When more devices become IoT capable, monitoring and controlling them can be done remotely over the internet.

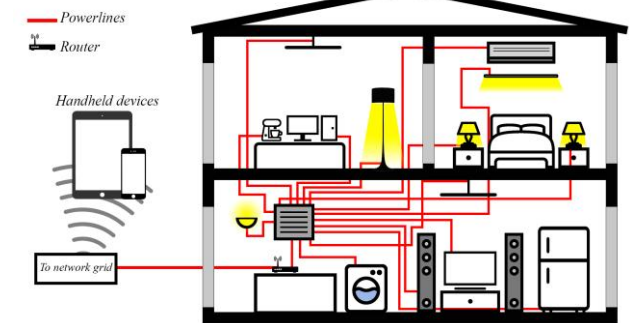


Figure 8 : Illustration of PLCC Network Grid Expansion

Product and appliance manufacturers, while manufacturing, could embed their products with PLCC transceivers which would make these products capable of network communication once they are powered. If all the home appliances are manufactured accordingly, they can transmit digital information about their current statuses on a real-time basis over the internet. Any internet capable device, through appropriate software, can be used to control and monitor these appliances irrespective of the time and place. An example of all the home appliances embedded with PLCC transceivers, forming a network, is shown in Figure 7.

PLCC can also be implemented at a local level to distribute internet signals over an apartment, building or a campus as mentioned in the section on statistical analysis.

10. Future scope

PLCC, as seen earlier, has some obvious advantages over the other media of communication. But wireless media, in specific, has an important benefit. Wireless communication is convenient for the user and it allows a total freedom of movement. This makes wireless communication irreplaceable. Nevertheless, the current wireless radio communication has spectrum limitations and most of the available spectrum is already in use. This problem of spectrum crunch has to be solved. Enhancing the spectrum reuse by using smaller cells and/or identifying a new spectrum are the two solutions. [10]



Figure 9 : Example of A LI-FI Environment

Source: Boston University[11]

The new upcoming Li-Fi technology uses the visible light spectrum which is thousand times greater than the radio wave spectrum currently in use. It uses the standard off-the-shelf LED light bulbs for communication and has many distinct advantages over the present day Wi-Fi technology. The PLCC technology forms the base of this new Li-Fi technology as communication with lights can be easily achieved using the power lines on which they are connected. [12]

In the future, PLCC if used in tandem with Li-Fi, could possibly replace the present day wired-Wi-Fi duo. This would be highly advantageous as the parallel consequences of this would be:

- i) Power saved is high
- ii) Gb/s speeds are easily achievable
- iii) Lesser raw material and resources are required
- iv) Setup costs are reduced
- v) Time and efforts are saved

A sample setup for the use of this Li-Fi technology along with PLCC could be seen in FIGURE X wherein, LED lights connected onto the powerline are being used for data communication with a handheld device.



Figure 10 : LI-FI along with plcc

11. Areas of Concern

PLCC is very beneficial in almost all aspects. But nonetheless, it has some points of concern as of now. Some of these areas of concern are:

- i) An absence of international standards and regulations for PLCC prove to be a difficulty to make PLCC a repeatable and standard process
- ii) PLCC communication has a lesser bandwidth as compared to wired and wireless.
- iii) As many power lines aren't shielded, sometimes, interference with stray radio signals may induce noise. Care needs to be taken to avoid this interference.
- iv) Switching on and off of electronic devices connected to the power lines induce interference.
- v) The LV transformers may act as low pass filters if the system isn't designed properly having considered PLCC.

- vi) Precision filtering is necessary in places where data shouldn't reach.
- vii) Compatibility issues with other users of the radio spectrum.

Further extensive research needs to be carried out in PLCC to overcome these concerns. [13]

12. Conclusion

Looking at the all the distinct and unquestionable strengths that powerline communication has over wired and wireless communication, PLCC must be implemented in many applications, especially in the Low Voltage and Medium Voltage distribution networks. If implemented optimally, PLCC would prove to be a huge success in a mission like outreach of internet to remote areas, in initiatives like the Smart City initiative by the Government of India, or for taking definitive big steps towards the third industrial revolution led by the Internet of Things.

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Techniques for Localization Applications

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ABSTRACT

Nowadays the interest for developing localization or position tracking system has increased considerably. Precise and accurate localization is basic requirement of any localization applications, such as searching and rescuing in emergencies, guiding visitors in navigating complex environments, security purposes, etc. This paper presents a broad view of various techniques for localization and tracking. We will see different methods of tracking using RFID and Inertial Measurement Unit (IMU) and will discuss on the practical implementation of it.

Keywords : RFID; Inertial Measurement Unit; MEMS

I. Introduction

In large scale industries, in government sectors, etc., having huge campus with different entrance and sections, often requires high security when dealing with sensitive information. Deploying a highly secure visitor path guidance and tracking system is vital for the organizations. Tracking a person or an object is done with various techniques such as:

1. **Video** : In the computer vision area, video-based algorithms are applied on sequences of images from a camera, for tracking. [7]
2. **RFID** : An object consist of an RFID tag & whenever it comes in range of a RFID reader the object is detected. By properly placing the readers in known locations, the moving object can be tracked.
3. **UWB** : Ultra narrow band adaptive tomographic radar is also a good technology able to detect transceiver-free object. However, since the communication range is limited for such technology, the cost is high in deployment. [7]
4. **Bluetooth** : Many positional systems leverage Bluetooth technology in localization. It requires a Bluetooth-capable hand- held device carried by the target. [7]
5. **Accelerometer** : The double integration of accelerometer data give the position of object i.e. location of the object.
6. **Global Positioning System (GPS)** : A GPS receiver, carried by an object can locate four or more satellites, figure out the distance to each, and find the location. GPS is widely used to track outdoor moving object.

Different localization technologies have different challenges depending on their application and environment. Some techniques are good for indoor applications such as laser, RFID, etc whereas some are good for outdoor applications such as GPS, IMU, etc. But some techniques can be used for both indoor and outdoor applications such as Video, inertial sensors, etc.

Currently RFID and Inertial Sensors are the most upcoming technologies to design systems with better and accurate localization and tracking human in the environment. The RFID technology has good resolution of position estimation and less cost of system installation to be used in localization applications. The Inertial Sensor i.e. Inertial Measurement Unit (IMU) with MEMS (Micro Eletro-Mechanical Systems) technology enables quartz and silicon sensors to be small, light, and less costly to be used in localization applications.

In section II, we will see the RFID technology, different methods of tracking using RFID. In section III, we will see the IMU technology, different methods of mitigating error in IMU system and different Filter methods for tracking using IMU IMU. In the end we will draw a conclusion based on the content discussed in this paper.

II. RFID as a Tracking System

The RFID system consist of Tag, Reader and a Server as shown in figure 1. The RFID tag communicate with RFID reader using Radio Frequency . There are two types of tags - Active tag and passive tag. Active tags have an internal battery, larger in size, long range for communication but are costlier. Whereas, Passive tags have no internal power supply, are smaller in size, short range and less costlier. The RFID reader retrieves the tags identity and communicates the information with the server. The reader consists of memory and an antenna for communication. The server then executes the localization method on the data collected from the reader. [3]

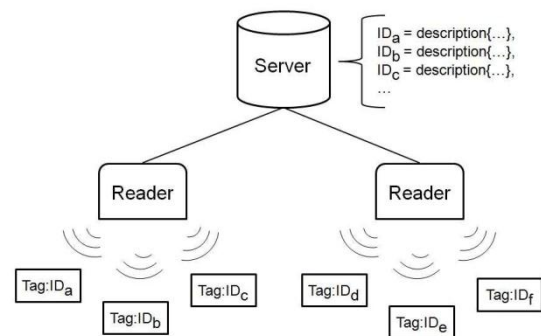


Figure 1 : RFID System

The tag tracking and reader tracking are the two types of RFID tracking methods used in RFID based location tracking system. In tag tracking (shown in Fig. 2a), the readers are placed in the environment, and the object to be localized is attached with a tag. As the object is moving in the environment, the reader deliver the collected data to a server that calculates the position. In reader tracking (as shown in Fig. 2b), the RFID reader is carried by the object and tags are

deployed in the environment. The reader obtains nearby tags identity and transmit the RFID reading to the server for position estimation.

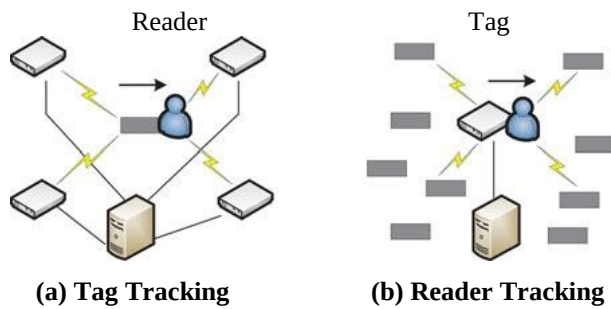


Figure 2 : RFID Tracking methods

The RFID readings are often noisy. Existing methods for tracking with noisy RFID readings are- Kalman Filter, Particle Filter (PF), Weighted Centroid Localization (WCL), etc .

1. **Kalman Filter** : Kalman Filter is more commonly used method which is applied on series of observations i.e. the present input measurements and the previously calculated state and its uncertainty matrix to find the current location. The Kalman filter is suitable for linear system with Gaussian noise, and for non-linear system computational complexity increases.
2. **Particle Filter** : It is an implementation of the Bayesian filter using repeated random sampling (Monte Carlo methods) to obtain numerical results represented by a set of weighted samples (called particles).. The two procedures, sampling where the particles are sampled randomly, and the filtering, where each particle is first assigned a weight according to the sensors. The particles with low weight are then filtered out. This procedure is executed repeatedly. The particle filter is very simple, but computationally complexity may increase with increase in speed of moving object. [3][5]
3. **Weighted Centroid Localization** : The position is calculated using centroid determination, i.e. it calculates the position of object by averaging the coordinates of known reference points. WCL uses weights to attract the estimated position, more weight for shorter distance and less weight for larger distance. WCL algorithm has advantages such as fast, easy and cheap in computational cost, but when the object is moving with a high speed, accuracy is decreased.
4. A hybrid method is the combination of the two localization algorithms (PF+WCL) proposed for tracking mobile object with high accuracy and low computational cost. It uses reader tracking method where mobile object carries a reader along with it and tags are deployed in the environment. Whenever the reader detects a tag, the location is accessed through the tag ID and communicate it with the server through wireless networks for location estimation. The selection of method is done based on the estimated speed of the object. If the estimated speed of the moving object is high then Particle filter is used, whereas, if the speed is low then Weighted Centroid Localization Algorithm is used. As the WCL method has less computational cost and requires less memory, the algorithm can be executed within the RFID reader, but the PF has complex computational cost and requires huge memory and so need to be executed at the server.[4]

There are various indoor applications such as- Access management, Tracking of persons and animals, Airport baggage tracking, Tracking of goods, etc. which uses RFID for Location Tracking.

III. IMU as a Tracking System

Inertial sensors consist of accelerometers and gyroscopes. An inertial measurement unit (IMU) combines multiple accelerometers and gyroscope, sometimes magnetometers also. An accelerometer measures specific force and a gyroscope measures angular rate and magnetometer measures magnetic field surrounding the object.

Accelerometers measure linear acceleration i.e. acceleration due to the device's linear movement and acceleration due to earth's gravity. Since it cannot distinguish between these two accelerations, gyroscope helps to separate gravity and motion acceleration. When the gravity is removed from accelerometer data then the linear movement is left, this is called gravity compensation. The single integration of this linear movement gives velocity and the double integration of linear movement determines the position of the object. But linear drift in orientation is observed and there are several techniques to overcome this drift, such as-

1. **Magnetometer** : To calibrate orientation drift, the system uses a magnetometer sensor to compute a yaw measurement that is used as an input measurement to an Extended Kalman Filter (EKF) to estimate position.
2. **Sensor Fusion** : Here two or more systems using different sensors are combined together to mitigate the drift error and help to estimate the accurate position of the object. For example, along with the IMU sensor output, Global Positioning System output combined together helps to mitigate the error.
3. **Zero Velocity Updating (ZVU)** : In this method, the initially tracked velocity is periodically updated to zero by stopping, the position will remain precise for a much longer time. Thus Zero Velocity Updating (ZVU). helps in mitigating the error.

Further an Extended Kalman Filter or Complementary Filter is used for position estimation after mitigation the error.

1. **Extended Kalman Filter** : The extended Kalman filter (EKF) is the nonlinear version of the Kalman filter which linearizes about an estimate of the current mean and covariance.
2. **Complementary Filter** : Complementary filters are the filters which manages both high-pass and low-pass filters simultaneously. The low pass filter, filters high frequency signals (such as the accelerometer in the case of vibration) and High pass filters that filter low frequency signals (such as the drift of the gyroscope). By combining these filters, you get a good signal, without the complications of the Kalman filter.

Applications such as in military, surgical aid, navigation systems, mobile robots, gaming, virtual reality and gesture recognition, animation production, ergonomics, rehabilitation and biomedical analysis, etc. uses Location tracking system developed using IMU.

IV. Conclusions

The choice of technique and technology depends on the application which significantly affects not only the accuracy of the location information but also the whole cost and the efficiency of the system.

The RFID technology is mostly used for object tracking in indoor environment due to their low cost and convenience for deployment. But RFID based tracking system face problems like shadows, light interruptions, distance limitations and interference in RSSI signal, which limit their use in outdoor environment.

The IMU based tracking system are less costly then RFID system as there is no initial infrastructure investment required. The IMUs i.e. the Inertial sensors overcome the other technology problems, like jitter, latency interference, line-of-sight obscurations, etc.

This IMU based tracking system can be used for indoor as well as for outdoor applications. However, the inertial MEMS sensors currently offer relatively poor performance.

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Non Invasive Approach for the Measurement of Cerebral Oxygenation

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ABSTRACT

Oxygen forms the basis of the human survival. Oxygen from the atmosphere enters human body and diffuses to different cells, tissue and organs. This is utilized for the routine functioning of the system. Reduced concentration and perfusion of oxygen creates a hypoxic situation. Monitoring of the oxygen saturation is an important procedure adopted during most surgical procedures and for continuous monitoring in ICU. Some traditional techniques used to measure the concentration of oxygen are transcutaneous oximetry, Doppler flowmeter. The normal way involves measurement of arterial saturation at pulsatile locations like ear lobe, finger or the forehead. Pulse oximetry and NIR Spectroscopy has offered a new avenue for noninvasive measurement of regional oxygen saturation.

Complex surgical procedures like cardiac bypass surgery involve additional measurement of cerebral oxygenation since perfusion level to extremities is greatly reduced and brain receives the maximum amount of Cardiac Output. Newborns with critical health conditions are born in neonatal intensive care unit (NICU), monitoring of their cerebral oxygenation becomes essential since they are more prone to brain injury.

NIRS (Near Infrared Spectroscopy) offers a safe and reliable way to measure cerebral oxygenation noninvasively. This system employs use of optical sources like LED's and Laser diodes which gives an output power of 20mW (maximum), which is safe as the maximum allowed output power on the body to avoid damage of any kind (ANSI standards) is 0.2 W/cm^2 .

This work describes the use of NIRS for monitoring cerebral oxygenation by developing a system for measurement of regional oxygen saturation of brain and use LabVIEW® for processing and display of the results.

Keyword: Brain oximeter; regional oxygen saturation, NIRS; cerebral perfusion.

1. Introduction

Oxygen plays a critical role in energy metabolism in mammalian skeletal muscle. The delivery of oxygen and the potential role of insufficient oxygen delivery have been well studied areas for a long time. It would be difficult to argue against the percept that almost any experiment that involves exercising muscle would be well served by measuring oxygen delivery and oxidative metabolism.

One of the important difficulties in measuring oxygen delivery is methodological. This is particularly true of human studies in which there is emphasis on non-invasive experiments. Two common methods of measuring blood flow are Plethysmography and Doppler Imaging. These provide a global measure of flow, with plethysmography measuring changes in limb volume corresponding to total arterial inflow and Doppler Imaging corresponding to the volume flow in the large artery. As useful as these measures are, they do not reflect the actual delivery and utilization of oxygen in skeletal muscle. Magnetic resonance spectroscopy (MRS) of high energy phosphorus compound can provide an accurate picture of energy metabolism, but this method cannot differentiate between limitations caused by oxygen delivery and oxygen utilization. MRS of muscle myoglobin has the potential to measure intracellular oxygen saturation. However, this methodological capability is still rare and all MRS experiments require large and expensive equipment.

In contrast, near-infrared spectroscopy (NIRS) has a number of significant advantages. It can be portable, and in its simplest forms, NIRS is relatively inexpensive. Signal detection is based on non-harmful levels of light, which are directed into subject through the overlying skin. The resulting signal comes from the hemoglobin (Hb) located in small vessels and thus indicates the balance between local oxygen delivery and oxygen utilization. Indeed, these very characteristics have stimulated a fairly rapid growth in the number of experimental studies that have used this technique. [1]

2. Near Infrared Spectroscopy (NIRS)

A. Principle of NIRS

The work described so far does not have an application in measuring brain oxygenation non-invasively because visible and ultraviolet light does not adequately penetrate through the skull and into the brain tissue. The relatively high penetration of near infrared light had however been used to a limited extent in ear oximeters, and the near infrared absorption bands of haemoglobin had been accurately measured. It was Jobsis, working at Duke University, North Carolina who put this information together with a sensitive spectrophotometer and showed that it was possible to measure the attenuation spectrum across a cat's head and hence initiated the field of NIRS. Thus it now appeared possible to both blood oxygenation in the brain through the haemoglobin absorption.

Most of the Jobsis group's publications on NIRS have been on the application of the technique to basic physiological studies in laboratory animals and are too numerous to mention. The validity of the technique itself and the instrumentation requirements have sadly received minimal attention in the scientific press.

The first clinical publications on NIRS arrived in 1984 from Ferrari and Giannini and in 1985 from Brazy and Jobsis. These clinical data were in the form of traces of changes in the concentrations of oxygenated and deoxygenated haemoglobin. Comparisons were made between cerebral oxygenation changes, clinical observations and data from other monitored parameters e.g. transcutaneous arterial oxygen and carbon dioxide levels, heart rate, blood pressure etc. The direct effect of clinical procedures on the oxygenation of the brain could be seen.

The same data also illustrated the major drawbacks of the technique: firstly, the concentration measurements were relative and not absolute (i.e. they are concentration changes from one point in time relative to another); secondly, the measurements of hemoglobin were also in arbitrary units. The reason for the chromophore concentrations being quoted in this manner are two fold and relate to the multiple scattering of light within the brain tissue. The first reason is that there is no simple reference cuvette against which brain transmission measurements can be compared and secondly the optical path Length in the tissue is unknown. The optical path length is necessary in order to calculate concentrations in non-arbitrary units.

The radiation used in NIRS is safe as long as the intensity employed is below that which would cause tissue damage due to thermal heating. The average optical power reported in these early clinical measurements was of the order of 10 mW at the skin surface at an irradiance of approximately 50 mW/cm². This is below the safety levels set by the British Standards Institute for skin exposure to laser radiation, and are similar to the intensity of the sun on a sunny day. [2]

B. Behavior of Light Inside Tissue

When light enters a tissue, its propagation is mainly governed by two physical phenomena, i.e., light absorption and scattering. There are certain substances in human tissues for which the spectra within the NIR wavelengths are well defined. Some of these absorbers such as water, melanin, and bilirubin do not change in concentration with time. But concentrations of some other absorbers such as oxygenated hemoglobin (HbO₂) and deoxygenated haemoglobin (Hb) are strongly related to the tissue oxygenation and metabolism. Thus the absorption changes can provide clinically useful physiological information.

Figure 1 shows absorption spectra of water, and Figure 2 shows absorption spectra of Hb and HbO₂. As can be seen from these two spectra, water absorption dominates at wavelengths above 1000 nm, and below 650 nm, there is a dominant absorption by Hb.

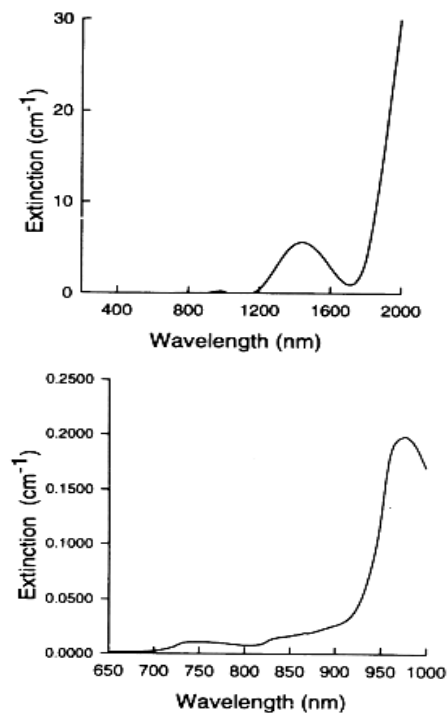


Figure 1: Absorption Spectra of pure water [3]

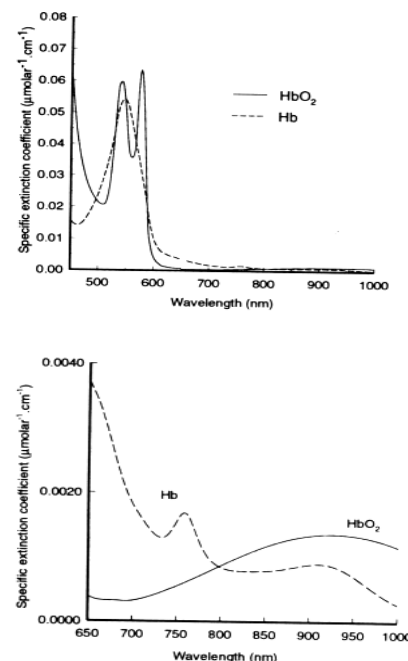


Figure 2: Absorption Spectra of Hb and HbO₂ [3]

3. System Hardware Implementation

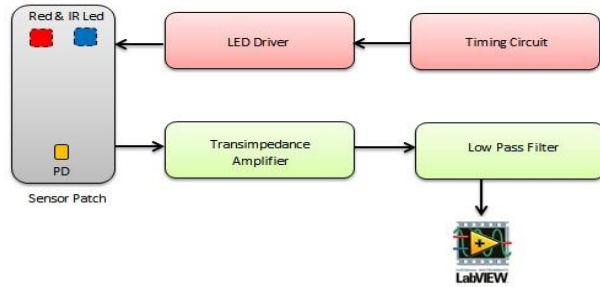


Figure 3: Conceptual System Block Diagram

Figure 3 shows the conceptual diagram of the sensor. The sensor includes two LED (660, 940 nm)[4] and two photodiodes at 1.5cm from the light sources. Traditionally NIR Oximetry makes use of NIR Wavelength (660,940) to measure oxygen levels in the blood. These two wavelengths are chosen because, at 660 nm, deoxygenated blood has a higher absorption, whereas at 940 nm, oxygenated blood has a higher absorption.

The sensor utilizes two NIRS wavelengths 660 and 940nm. These wavelengths monitor the absorption spectra of deoxygenated hemoglobin and total hemoglobin respectively. [4]

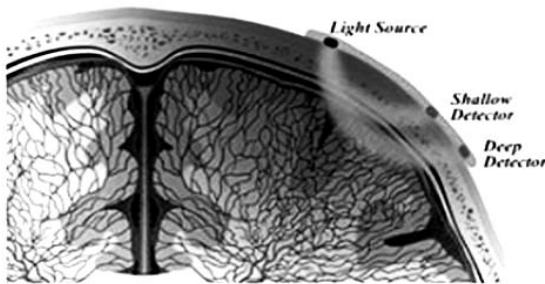


Figure 4: The mean photon path is shaped like a banana or canoe with ends located at the light-emitting source and the corresponding detector [5]

Two NIR wavelength laser diode of 660 nm 940nm are driven by 250 Hz modulation frequency generated by timer circuit. The LED's are driven by a Driver circuit to provide a constant current to drive the LED's. The light emitting from the IR Led was transmitted through the scalp and change in light intensity is detected by photodiode. The raw signal detected by the photodiodes is processed by a Trans-impedance amplifier to amplify the signals resulting from the photons impinging on the detectors to a useful level, since photodiodes produce a very little current from their exposure to light. A low pass filter with an upper cut-off frequency of 20Hz was used to smooth the signal and eliminate the noise. Finally, the signal is captured, processed and displayed in LabVIEW®.

4. Calculating the oxygen Saturation

Haemoglobin's reflection of Red light increases as the number of oxygen molecules bound to it increases. Intuitively, this is a sensible trend as it is common to relate blood that is bright red with oxygenated blood, and blood that is paler in color to deoxygenated blood. Theoretically,

this trend takes its roots in the extinction coefficients of oxygenated and deoxygenated haemoglobin molecules. Extinction coefficient is a measure of the strength of absorbance for a molecule at a given light wavelength. The lower this value is, the better the molecule reflects the given wavelength. It is because this value is significantly different for oxyhaemoglobin and deoxyhaemoglobin at Red and Infrared wavelengths that calculation of blood oxygen saturation is possible. The extinction coefficients for them were found through research to be as follows.

Extinction coefficient (ϵ)	Oxyhaemoglobin (HbO ₂)	Deoxyhaemoglobin (Hb)
Red	0.000077025	0.00079207
Infrared	0.00031123	0.00018126

Table 1: Extinction coefficient (ϵ) of haemoglobin and oxyhaemoglobin [6]

Extinction coefficient thus governs the amount of light that is reflected back depending on the concentration of an analyte in the tissue. The relationship between the concentration of an analyte and the light intensity absorbed is called the Beer Lambert Law.

$$I_{out} = I_{in} e^{-cds(\lambda)} \quad (1)$$

where I_{in} is the intensity of light originally shone at the tissue, c is the concentration of the analyte in the tissue, d is the path length of the light, and $\epsilon(\lambda)$ is the extinction coefficient of the analyte at the wavelength of light shining through. Since there are two absorbers of light in this case, HbO₂ and Hb, the Beer-Lambert Law can be rewritten as follows:

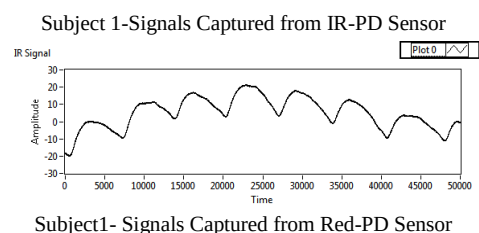
$$I_{out} = I_{in} e^{-cd(S\epsilon_{Hb}(\lambda) + (1-S)\epsilon_{HbO_2}(\lambda))} \quad (2)$$

where S is the oxygen saturation.

5. Results Obtained

Data was collected from different individuals to analyze the regional oxygen saturation. The standard hardware could give two set of signals one corresponding to IR LED and other corresponding to RED LED. The individual signals were captured and offline processed in LabVIEW.

The signal captured was processed using Modified Beer Lambert's Law for calculation of the regional oxygen saturation. The below data represents the regional oxygen saturation for Healthy Individuals. Regional Oxygen Saturation between 55% to 75% represents normal physiological state and Regional Oxygen Saturation below 55% for long period represents neurological disorders. [7]



Subject1- Signals Captured from Red-PD Sensor

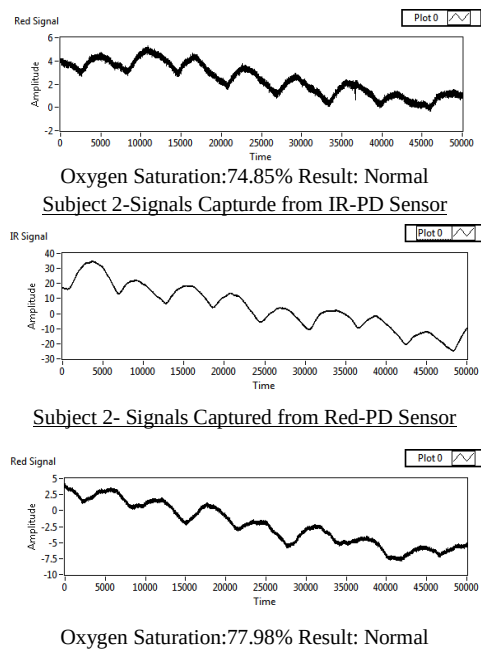


Figure 5: Signals obtained from different subjects from IR and R Sensors

Acknowledgement

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Selection of Optimal Mother Wavelet for EEG Signal Preprocessing

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ABSTRACT

The main objective of this paper is prominent feature extraction from the EEG Signal using different wavelets and select the best suitable wavelet which gives excellent result and with the help of these features the EEG signal can be classified into normal and abnormal category using Neural Networks. The EEG signal data is collected from the database available online (<https://www.physionet.org/physiobank/database/>).

The signals are pre-processed by passing through low and high pass filters to retain signals generally in the 1-50Hz range and then sampled at 128Hz or 512Hz. Each second, the signal is analyzed in the time domain to detect and correct noise artifacts as much as possible, while retaining as much of the original signal as possible. The filtering methodology is applied to eliminate the unwanted noise or interferences presented into the signal. The wavelet transformation is performed on EEG signal for every channel, it is then broken down into sections or epochs for the purpose of wavelet transform as well as numerous parent wavelets are used for pre-processing. The Biorthogonal family of mother wavelets found suitable for pre-processing of EEG signals.

Keywords : EEG, Discrete Wavelet Transform, Biorthogonal wavelet.

Introduction

Electroencephalogram or EEG signals are an important source of information for the study of underlying brain processes. Such studies now provide a framework for the development of a new modality of human computer interaction based on EEG[1]. Till date, researcher succeeded to detects a small number of mental states.

Basically, EEG records are complex, Pure and Simple oscillations are rarely observed. It has been noticed that these signals are not carefully studied due to the unreliable interpretation by analysts. Hence, EEG signal analysis requires the algorithm for the accurate measurement. The researchers have adopted wavelet transform in order to processes the raw EEG signal[4]. The optimal implementation of wavelet overcomes; Masking, Beats, Waveform distortion and Modulation. It increases yield of information and reduces tedium of extracting. Wavelet transform enables to transform and analyze primary records to disclose and emphasis certain features which are otherwise obscure and ambiguous[6]. Considering the significant improvement in the area of EEG signal processing by

researchers, present work focused on critical analysis of different wavelets from Daubechies, Symlets, Coiflets, Biorthogonal families. The proposed work investigates the feasibility of using wavelet transform and select the best mother wavelet as a preprocessor for an Artificial Neural Network (ANN) based EEG spikes detection system.

In this study, different wavelets were tested and found that bior 6.8 gives excellent results. Biorthogonal wavelets were found suitable for analysis due to the compact support and their similarity with the SSW Wave. EEG dataset is analyzed completely by using wavelet transformation and to extract all the fundamental frequency components of EEG signal that is Alpha, Beta, Gamma, Delta and Theta. The complete analysis of EEG frequency bands which relate to various brain states are completed successfully.

I. DATA COLLECTION AND WAVELET TRANSFORM

The EEG signals data is collected from the database available online (<https://www.physionet.org/physiobank/database/>).

The different wavelets are then tried and tested for pre processing these EEG signals.

A. Why bior 6.8

Amongst the different wavelets verified bior 6.8 gives excellent results. To justify this, the Table I- Table IV below gives the error in the coefficients of the reconstructed feature components due to different wavelets. The tables indicate the reconstruction error generated by different wavelets, minimum error in the reconstruction means better wavelet for processing. Observing the results and tables below we have concluded that bior 6.8 is the best for processing EEG signals.

Table I Daubechies Wavelets and Reconstruction error

	Features(Gamma, Beta, Alpha, Theta, Delta) with reconstruction error	Reconstruction Error
DB2	Gamma: Maximum occurs at 12.25 Hz. Beta: Maximum occurs at 7.35 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 1.225131 Hz. Delta: Maximum occurs at 1.050112 Hz.	7.8968e-12
DB4	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.700075 Hz. Delta: Maximum occurs at 0.350037 Hz.	1.4922e-11
DB8	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.350037 Hz.	8.3535e-12

Table II Symlets Wavelets and Reconstruction Error

	Features(Gamma, Beta, Alpha, Theta, Delta) with reconstruction error	Reconstruction Error
Sym2	Gamma: Maximum occurs at 12.25 Hz. Beta: Maximum occurs at 7.35 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 1.225131 Hz. Delta: Maximum occurs at 1.050112 Hz.	7.8968e-12
Sym3	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.875093 Hz.	2.8388e-11
Sym4	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.700075 Hz.	2.9141e-12
Sym5	Gamma: Maximum occurs at 12.25 Hz. Beta: Maximum occurs at 7.35 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 1.225131 Hz. Delta: Maximum occurs at 1.050112 Hz.	2.4540e-12

Table III Coiflets Wavelets and Reconstruction error

	Features(Gamma, Beta, Alpha, Theta, Delta) with reconstruction error	Reconstruction Error
Coif1	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.875093 Hz.	4.4902e-12
Coif2	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.350037 Hz.	3.3009e-12
Coif5	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.350037 Hz.	3.6811e-08

Table IV Biorthogonal Wavelets & Reconstruction error

	Features(Gamma, Beta, Alpha, Theta, Delta) with reconstruction error	Reconstruction Error
Bior4.4	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.875093 Hz.	1.0727e-11
Bior5.5	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.875093 Hz.	2.5559e-12
Bior6.8	Gamma: Maximum occurs at 9.80 Hz. Beta: Maximum occurs at 4.90 Hz. Alpha: Maximum occurs at 2.450262 Hz. Theta: Maximum occurs at 0.875093 Hz. Delta: Maximum occurs at 0.875093 Hz.	2.4176e-12 Minimum Reconstruction Error

B. Biorthogonal 6.8 wavelet

A Biorthogonal wavelet is a wavelet where the associated wavelet transform is invertible but not necessarily orthogonal. Among the different wavelets bior6.8 has been chosen for the EEG feature extraction[2]. The properties of Bior wavelet are discussed below Let f_k and g_k belongs to H then f_k and g_k are said to be biorthogonal if [2][3]

$$(f_j, g_k) = \delta_{jk}$$

In order to construct two sets of wavelets that is

$$\varphi_{j,k} = 2^{\frac{j}{2}} \varphi(2^j x - k) \text{-----(1)} \quad \tilde{\varphi}_{j,k} = 2^{\frac{j}{2}} \tilde{\varphi}(2^j x - k) \text{-----(2)}$$

To construct (1) and (2) $g, h, \bar{g}, \bar{h}$ filters are needed. The two decomposition sequences are g_n and h_n and two sequences to act as a reconstruction sequences If C_{1n} is a data set, then it can be decomposed as

$$c_n^0 = \sum_k g_{2n-k} c_k^1 \text{-----(3)}$$

$$d_n^0 = \sum_k h_{2n-k} c_k^1 \text{-----(4)}$$

For reconstruction

$$c_l^1 = \sum_n h_{2n-1}^0 c_n^0 + g_{2n-1}^0 d_n^0 \text{-----(5)}$$

The condition for the perfect reconstruction is

$$g_n = (-1)^{n+1} \tilde{h}_{-n} \text{ and } \tilde{g}_n = (-1)^{n+1} h_{-n}$$

The scaling function is defines as

$$\varphi(x) = \sum_n \sqrt{2} \sum_n h_n(2x - n) \text{ And}$$

$$\tilde{\varphi}(x) = \sqrt{2} \sum_n \tilde{h}_n(2x - n) \text{-----(6)}$$

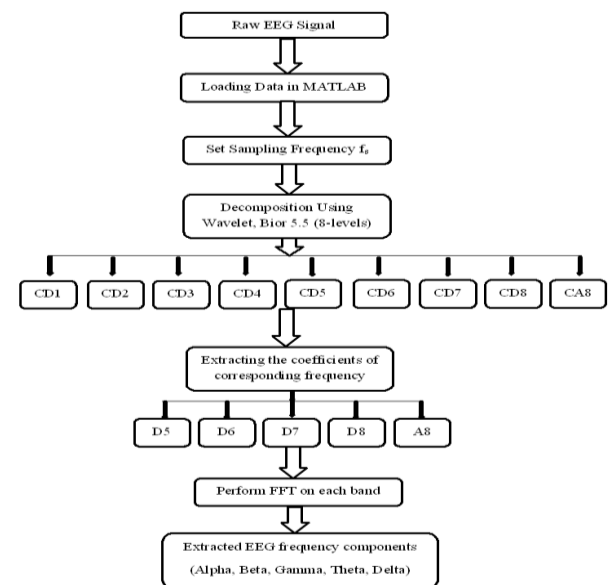
C. Analysis Using bior 6.8

The different bands of raw EEG signal are extracted by using bior 6.8 wavelet functions. The flowchart of the DWT algorithm is as shown in the Figure 1. The algorithm flow chart for EEG feature extraction contains the following steps:

- Collecting the Raw EEG signal from the EEG acquisition set up.
- Raw EEG signal is converted into CSV format that is comma separated values in the Excel sheet.
- Load the signal into the MATLAB platform.
- Set the sampling frequency (fs)
- Use bior6.8 wavelet for decomposition and reconstruction of a signal.

To extract the frequency components bior 6.8 at 8-levels is used for the decomposition.

After 8 level decomposition the coefficients which lies in the suitable frequency bands off EEG only those coefficients are selected and they represents the different frequency bands of EEG.

**Figure 1 : DWT Algorithm for Feature Extraction**

Experimental Results

Here the experimental observations in the form of results of the implemented techniques are presented along with the assessment methodology and analysis. The thorough analysis

of the experiments conducted on the data base shows that some of the specific types along with some specific features offer more accurate results. The results of the study is that the use of the WT drastically decrease the input size of the ANN, without much compromise in performance. The most important factor in performance, however, was the proper selection of optimal mother wavelet. Out of different wavelets analyzed, it was found that bior6.8 gives excellent results. ANN is then trained and tested with features extracted from EEG signal for classification into Normal and Epileptic category. The ANN gives correct indication of Normal or Epileptic EEG for any unknown EEG input.

D. Algorithm Flow Model

Signal reading from .XML file

- Framing of samples with 14 subdivisions
- Filtering of frames with high pass filter coefficients
- Windowing is done using hamming window function
- Fast Fourier transform, logarithmic conversion, IFFT was carried out
- Signal normalization
- Wavelet filter bior 6.8 is applied to make low and high pass filter coefficients.
- Wavelet decomposition to 8-levels
- cD1,cD2,cD3,cD4,cD5,cD6,cD7,cD8 detailed coefficients splitting
- Approximate coefficient cA8
- D5-Gamma frequency wave
D6- Beta frequency wave
D7- Alpha frequency wave
D8- Theta frequency wave
A8- Delta frequency wave
- Computing FFT to get frequency of feature
- Feature vector of Trained Data

E. Result analysis and graphs

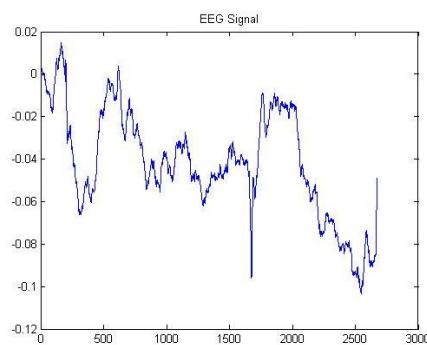


Figure 2 : EEG Signal

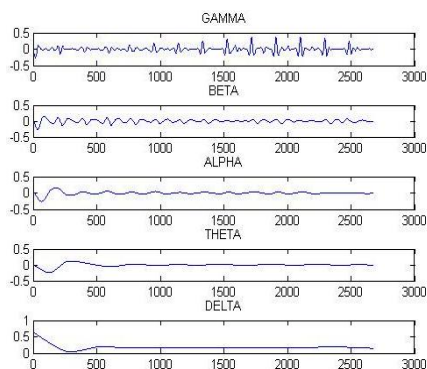


Figure 3 Gamma, Beta, Alpha, Theta, Delta waves.

Figure 2 above shows the acquired input sample to test whether it is normal or epileptic, X-axis represents the

number of samples in the signal and Y-axis represents the signal amplitude.

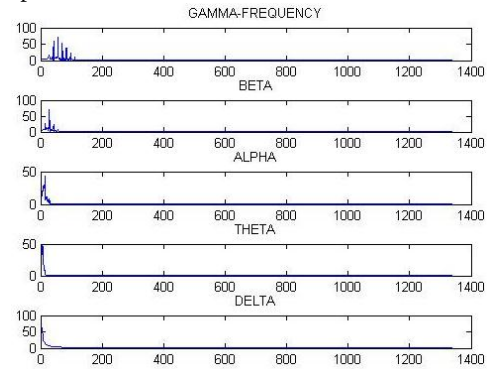


Figure 4:Gamma, Beta, Alpha, Theta, Delta Frequencies.

Figure 3&4 above show the DWT decomposed signal of each waves of gamma, beta, alpha, theta and delta. After decomposition and reconstruction of the individual waves, we need to predict their corresponding frequencies by using FFT function.

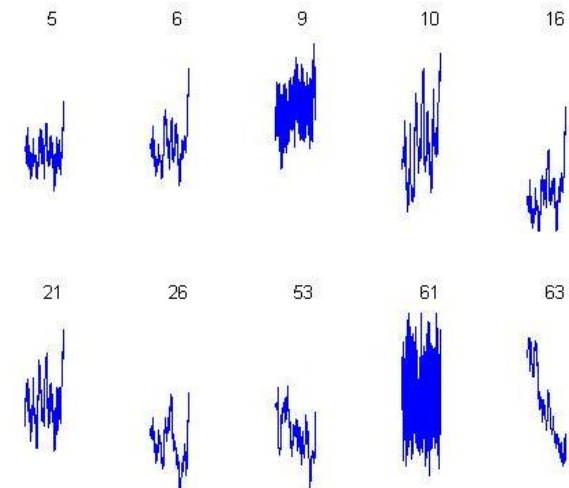


Figure 5 Retrieved matching samples from dataset

Figure 5 above shows that similarity measures are calculated in two stages of analysis (normal and epileptic), against the signals in database and the query sample for adept matching. By the first stage of experimental analysis with large database of EEG signals according to the trigonometric distance function, ten relevant signals for the given query is obtained. Figure shows only the sample of signals that are retrieved from the database for trigonometric distance (not all samples that are normal).

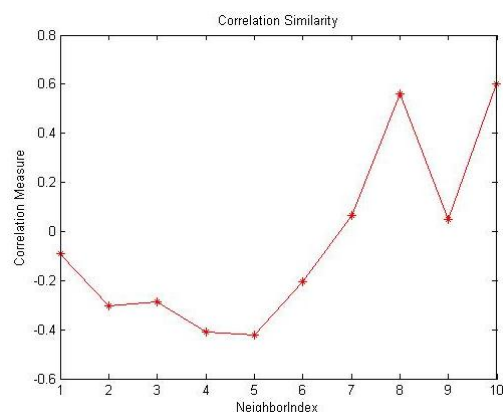


Figure 6 Correlation similarity

Figure 6 above exemplifies the correlation similarity graph that is plotted against the values of neighbour index (index of relevant signal) and correlation measures. This approach mainly concentrates on the similarity measurements on both features and visual correlation of signals. Feature similarity is obtained using trigonometric function distance, whereas visual similarity is measured with correlation coefficient factors.

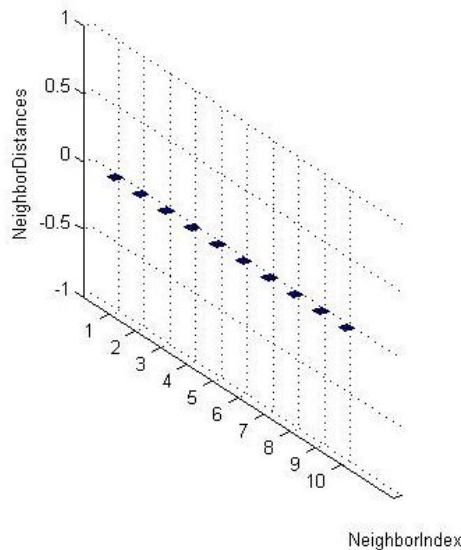


Figure 7 Neighborhood Distances

Figure 7 above shows the relationship between the values of neighbor index (relevant sample ID) and neighbor distance (relevant signal distance). The graph is plotted for the relevant sample indexes obtained after the retrieval analysis with trigonometric function distance and correlation similarity. It is obvious from the graph that the retrieved samples with less similarity have larger neighbor distance.

II. CONCLUSION

Biorthogonal Wavelets found to be more suitable for EEG signal pre-processing. Bior4.4, Bior5.5 and Bior6.8 were analyzed. The analysis showed better result of Bior6.8 with minimum reconstruction error of 2.4176×10^{-12} . Bior4.4 and Bior5.5 has showed reconstruction error of 1.0727×10^{-11} and 2.5559×10^{-12} respectively.

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SIM card Authentication Using Biometrics

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ABSTRACT

With the increasing prevalence of mobile devices, there is an increasing risk that the mobile networks may be targeted by information warfare attacks. This paper presents a system to use biometric finger-print identifier for authentication of mobile station. If a person wants to buy a SIM card; he or she provides his or her finger-print to service provider. The finger print is collected with the help of optical sensor. The service provider will store the digitized finger-print image of the user in SIM card and Home Location Register (HLR). Before availing network to mobile station, the authentication centre (AuC) will first verify the finger- print of the user. If it matches, then only the user will be allowed to use network otherwise not. This results into a highly secure mobile communication system.

Keyword : biometric identification; Mobile communication; authentication process etc.

1. Introduction

Biometrics refers to the identification of humans by their characteristics. It is used to identify individuals in groups that are under surveillance. "Finger print recognition system" is a smarter way to provide security in our daily appliances so we have decided to add this feature to improve security in mobile communication. Considering the process of SIM card authentication, which follows A3 algorithm, 128 bit RAND signal with 128 bit private key generates SRES signed response which is then followed by A8 and A5 algorithm. So in this case, security depends on 128 bit private key sequence. This means probability of getting SIM hacked is high. In this paper we are proposing an idea to utilize the memory span in SIM to store the biometric data such as finger print impression, which is then used for authentication process.

To buy the SIM card we require only few documents like photograph, identity-proof, signature of the subscriber. On the fulfillment of these documents, the Service provider activates or issues the SIM. Thus, because of this security is less for a subscriber since by providing faulty documents some people misuses the SIM card by using it for unauthorized or illegal activities. With the ever increasing demand for mobile communication there is increase in civil and criminal cases due to misuse of SIM. So if we provide more security at first level i.e. at the authentication stage, by adding biometric data in available memory span of SIM card, then the probability of SIM card getting hacked will be minimized.

2. Related Work

Biometric recognition, or simply biometrics, refers to the automatic recognition of individuals based on their physiological and/or behavioral characteristics. By using biometrics it is possible to confirm or establish an individual's identity based on "who she is", rather than by "what she possesses" so biometric is a better option to improve security is concluded from paper [1]. It can be concluded from the above, that a reliable, secure, fast and an efficient system is developed using biometric data. Thus, a reliable service fingerprint authentication is a better option over the traditional authentication technique [2,3].

The term mobile communication is very important and widely used system nowadays .The architecture and all important processes of mobile telephony were analyzed from [4] and concluded that even if mobile communication is very widely used system the security level is very poor. It is based on certain authentication algorithm [5] and private keys which are probably easy to get hacked.

Considering this scenario, a new authentication system is proposed that is able to improve the security in mobile communication. The idea is to utilize the unused memory in SIM card to store the biometric data (fingerprint) and use it for authentication purpose. But officially we cannot read or write data in SIM card for that reason we have used virtual SIM and base station with proper algorithm to develop the prototype. This demonstration is carried out using Atmel controller and software programming based accordingly in [6] to [9].

3. Proposed System

We have proposed a system which takes into account the above stated problem and provides solution for the said problem statement. So, for the security purpose we can add the biometric fingerprint scanning during the issuing of the SIM card. This biometric information, which is the unique feature of every individual will be linked with SIM card and maintained in the database. This information will be checked always before using the SIM card. This will prevent the misuse of SIM card and only valid subscribers can use the SIM.

4. Methodology

In this paper, we have proposed a system to use biometric identifier fingerprint for authentication of mobile station. In our system, we are using two microcontroller kit, i.e., ATmega 168 and ATmega 8. One microcontroller kit will act as virtual SIM Card (i.e. mobile station) and the other microcontroller kit will act as authentication centre that is mobile switching centre. In first stage, the user's data that is fingerprint and the name of the person is collected. The fingerprint will be scanned by the optical sensor i.e. SM630. The captured fingerprint is stored in the scanner. This captured fingerprint is converted in digitized form and sent to microcontroller kit i.e. virtual SIM through RS232 interface. The captured data from microcontroller kit 1 is transferred to microcontroller kit 2 i.e. authentication center.

In this controller kit, there will be fingerprint of two different people. This data will be stored in this microcontroller kit at two different memory locations. At the time of authentication, the comparison will take place, if the data matches then only the user will be allowed to access the network otherwise if the fingerprint does not match then the user will not be considered as a authenticated user.

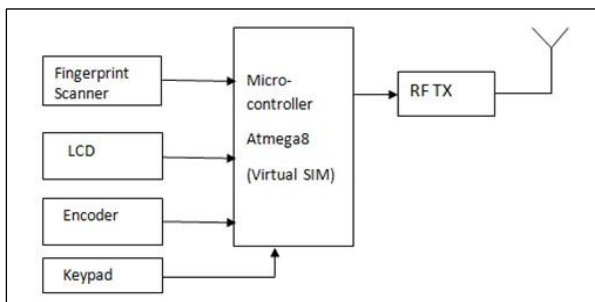


Figure 1: Block diagram of module to enroll the user (Virtual SIM)

As shown in the block diagram, the entire processing will be done by the microcontroller. The communication between microcontroller unit (MCU ATmega8) will take place serially. The procedure will take place accordingly, user will have to keep their finger (thumb) on the SM630 for the specified time to get their IDs loaded into the system. They will have to keep their fingers and press the corresponding switch until the system acknowledges them of the successful entry of their fingerprint. The fingerprint will be scanned by the optical sensor i.e. SM630. The captured fingerprint is stored in the sensor. This captured fingerprint is converted in digitized form and send it to microcontroller kit i.e. virtual SIM. If fingerprint is not captured within a specified time or if quality of finger is poor then module will respond and corresponding message like parameter error, time out, fingerprint process failure will be displayed on LCD. In microcontroller, the fingerprint data is stored into register. The fingerprint data from microcontroller is transferred to encoder that converts serial data to parallel and gives to RF module transmitter. The data from transmitting side is transferred to authentication centre using transmitting antenna.

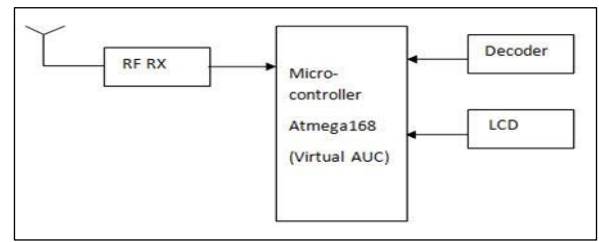
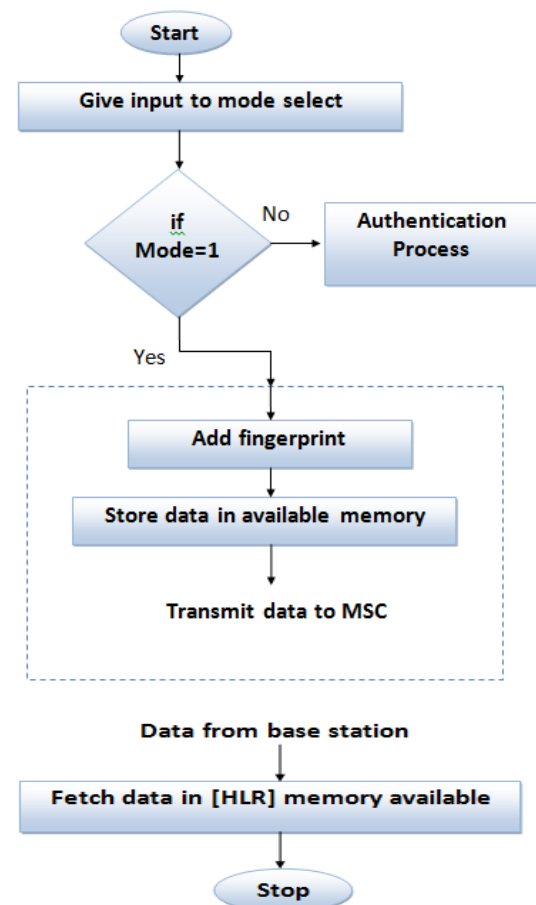


Figure 2: Block diagram of module to authenticate the user

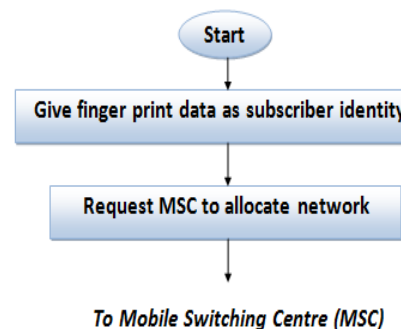
The receiving antenna will capture the data from the transmitting antenna. The data is given to decoder which will decode the data and compare between the stored data and the received data. If match occurs then AuC will avail the network otherwise not.

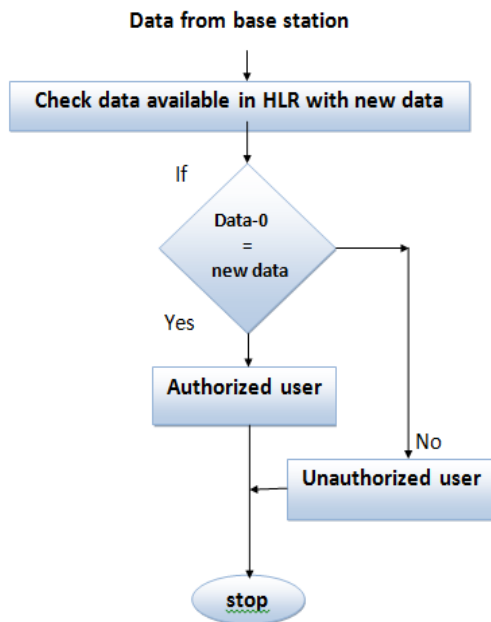
Flowchart

1] Initial Stage



2] Authentication process





5. Implementation Details

The most important requirements for the implementation of the prototype are listed below:

Hardware Components

1. Micro- controller Atmega168
2. Micro- controller Atmega8
3. Fingerprint Scanner (SM 630)
4. LCD Display
5. RF transmitter and RF receiver
6. Encoder HT-12E and Decoder HT-12D

Software Requirements

1. Operating system: Windows XP or later
2. Keil μ Vision5
3. Programming Language: Embedded C

6. Results

Figure 3 shows the module for Mobile station whereas figure 4 shows the module for Authentication Centre.



Figure 3: Module to enroll the user (Virtual SIM)

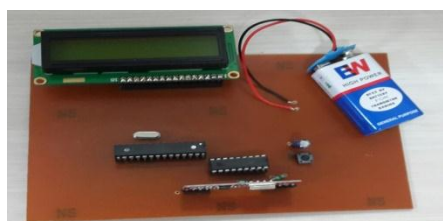


Figure 4: Module to authenticate the user (VirtualAuC)

Figure 5 to figure 7 shows the LCD display while registering and authenticating the user.



Figure 5: Display while registering the user for first time



Figure 6: Display if the fingerprint is not matched



Figure 7: Display if the fingerprint is matched

7. Conclusion and Future Work

This advance feature technology will provide better security for SIM card users. Considering the security level, Fingerprint recognition is becoming more and more important in the modern world. It helps to avoid getting SIM card by providing fake documents or the dead person document. Thus, with the old mobile Authentication Algorithm, if we add finger-print matching and then it will be difficult for anybody to make a duplicate SIM card. A compulsion of finger-print at the time of issuing a SIM card, will not allow anybody to purchase a SIM card in the name of a person who is not genuine.

If we want to make this authentication still more promising, efficient and secured, then with finger-print, we can make use of another biometric identifier like Iris and DNA.

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Evaluation of Skin Disease Using image processing: a Review

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ABSTRACT

Human skin is found to have different colors and coarseness. Digital processing of these different skin images will help in qualitative analysis of the present features. In this paper, we discuss evaluation of skin diseases based on histogram analysis and GLCM technique. The effects, level/stage of the disease is also analyzed and discussed.

Keywords : Image texture analysis, image enhancement, Image texture.

I. Literature Survey

Skin being the outer most layer of the body, is the first body organ which comes in contact with any foreign bodies present in the atmosphere. Hence it is prone to many infections and diseases. Some of the different skin abnormalities can be stated as:

Rash: Nearly any change in the skin's appearance can be called as a rash. Most rashes are from simple skin irritation, others result from medical conditions. [1]

Dermatitis: It is a general term used for inflammation of the skin. Atopic dermatitis is the most common form.

Eczema: It is skin inflammation (dermatitis) causing an itchy rash. Most often, it is due to an overactive immune system.

Psoriasis: It is an autoimmune condition that can cause a variety of skin rashes. Silver, scaly plaques on the skin are the most common form.

Dandruff: It is a scaly condition of the scalp may be caused by seborrheic dermatitis, psoriasis, or eczema.

Acne: It is the most common skin condition; acne affects over 85% of people at some time in life.

Herpes: It is caused by the herpes viruses HSV-1 and HSV-2 developing periodic blisters or skin irritation around the lips or the genitals.

Ringworm: It is a fungal skin infection (also called tinea). The characteristic rings it creates are not due to worms. A Dermatologist can easily identify some of the disease by simply looking at the skin. For the assurance of a particular disease different methodologies are used for the testing of skin. The various ways used for testing the skin are:

- (a) Skin Biopsy
- (b) Allergy Testing
- (c) Tuberculosis Skin test
- (d) Scraping of skin
- (e) Tzanck Testing
- (f) Wood light
- (g) Diascopy

II. Methodology

Conventional methods are performed manually, with the increase in technology and advancements in science it has been found that processing the image of an infected skin digitally we can make analysis for the present infection.

There are different image processing techniques involved in human skin texture analysis. Some of them are as follows:

Histogram Analysis:

Histograms are one of the most common graphs used to display numeric data. The Histogram analysis is purely based on that numeric data. Histogram gives the information about the shape, span etc. The histogram-based measurements do not carry the information regarding the relative spatial arrangement of pixels with each other. [2]

DWT: Discrete Wavelet Transform:

To analyze a time dependent signal at different resolution there is mathematical function called as wavelet. [3] The wavelet transform has a good time and poor frequency resolution at high frequencies, whereas good frequency and poor time resolution at low frequencies. [4] Signals having different resolutions are decomposed for approximation. Haar wavelet is used which is the simplest possible wavelet. In MATLAB there are different functions for Single-level discrete 1-D wavelet transforms (dwt) and Single-level discrete 2-D wavelet transforms (dwt2). [5] The first dwt was introduced by mathematician Alfred Haar. The DWT analyzes the signal at different frequency bands with different resolutions by decomposing the signal into coarse approximation and detail information. DWT employs two sets of functions, called scaling functions and wavelet functions, which are associated with low pass and high pass filters, respectively. Even after image is rotated the accuracy remains same will result into proper classification. [14] Haar wavelet is a faster method but major drawback of the Haar wavelet is that it is not continuous, and therefore not differentiable.

Analysis and extraction of features is an essential step for automated methods. The main aim is to obtain important characteristics from the input image. Because of the drawbacks in Histogram analysis and DWT, it is preferred to use the Grey level texture analysis methods. Grey level texture analysis is performed by different methods based on the statistical approach. They are as follows:

GLDM: Grey Level Difference Matrix

GLDM collects the absolute difference between pair of pixel values. From the obtained matrix it is possible to easily compute nine descriptors that are :-

1. Mean
2. Angular second moment
3. Contrast
4. Variance
5. Inverse difference moment
6. Entropy
7. Product moment
8. Cluster shade
9. Cluster prominence

GLRLM : Grey Level Run Length Matrix

The GLRLM based on information of higher order statistics. It contain information on a particular number of equal grey levels (run) is given direction. So a run length matrix is defined as a set of consecutive pixels having the same grey level. The element (i,j) of run length matrix specifies the number of times that the image contains run length I composed by all pixel with grey level i. The GLRLMs are calculated by considering the four main orientations and for each matrix eleven descriptors can be extracted that are:-

1. Short Run Emphasis
2. Long Run Emphasis
3. Grey Level Non-uniformity
4. Run Length Non-uniformity
5. Run Percentage
6. Low Grey Level Run Emphasis
7. High Level Run Emphasis
8. Short Run Low Grey Level Emphasis
9. Short run emphasis
10. Long Run Low Grey Level Emphasis
11. Long Run High Grey Level Emphasis.

GLCM: Grey Level Co-occurrence Matrix

GLCM was first introduced by Haralick et al. It provides various features of texture. GLCM is also known as Grey level spatial Dependency Matrix. Grey levels mean the brightness of the pixel. [6] It is most important and popular statistical method for texture analysis. GLCM is a spatial domain technique. [5] A GLCM is a matrix where the number of rows and columns is equal to the number of grey levels, G, in the image. [7] It is primarily used to discriminate texture images. GLCM indicates the probability of occurring particular grey level in neighborhood of grey level at some distance and direction/degree. [8] The most used are $d=1$ and $\theta=(0^\circ, 45^\circ, 90^\circ, 135^\circ)$. It is a 2D array of grey levels for pixels separated by fixed spatial relationship which helps to calculate and to understand the various parameters.

The following figure shows how gray co-matrix calculates several values in the GLCM of the 4x5 image I. Element (1,1) in the GLCM contains the value 1 because there is only one instance in the image where two, horizontally adjacent pixels have the values 1 and 1. Element (1, 2) in the GLCM contains the value 2 because there are two instances in the image where two, horizontally adjacent pixels have the values 1 and 2. Greycomatrix continues this processing to fill in all the values in the GLCM [9]

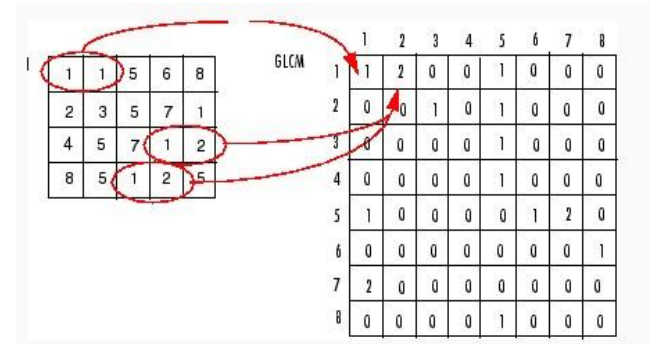


Figure1. GLCM of 4x5

Features are obtained from characteristics of GLCM. A feature is defined as function of one or more measurements, specifying some quantifiable property (i.e., color, texture, or shape) of the whole image or sub image of the single object. GLCM characteristics particularly used for skin texture analysis are Contrast, Energy, Entropy, Mean, Variance, Homogeneity, and Correlation. [10] The only shortcoming of the GLCM is its computational cost. Since Co occurrence matrix is spatial dependent means the matrix is fully dependent on neighboring pixel values. Rotate operation disturbs the pixel values. Hence when image is rotated GLCM will provide different result which may cause inaccurate classification of disease. [14]

III. Proposed System

Image of patient's skin is taken by camera as test image or new image and then processed through MATLAB software. Here we have already stored several images of different types of skin disease as reference images or stored data.

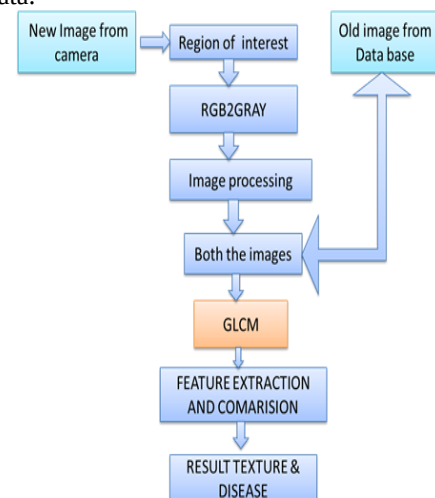


Figure 2 : Proposed system block diagram

Region of interest (ROI) is selected from new image so that only skin area is focused for processing. Colored image that is RGB image is then converted into the grey scale image using RGB2GRAY function. [10] Damaged or affected part of skin will contain many discontinuities in properties of image and show difference in grey values.

Different image processing techniques are used to detect these discontinuities such as Image enhancement to enhance the image by reducing the lowest grey values to black and the highest to white, Histogram processing to adjust the contrast and thresholding for image segmentation.

Software uses the GLCM method for further processing. There are some functions such as greycomatrix [12] [13] and greycoprops. [9] To compute characteristics of digital image feature extraction are used which involves reducing the amount of references required to describe a large set of data. Feature extraction is the process for obtaining the specific information which is required for performing the computational task for certain applications This helps to provide related data images. Result image is derived after comparing them and the difference between them if any present will give the percentage or level/stage of disease.

IV. Conclusion

On the basis of study and analysis it is been found that GLCM technique is the most precise way for the detection of skin abnormalities and diseases. GLCM gives a better performance when compared with other techniques.

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Virtual Interactive Tour

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ABSTRACT

The virtual tour is an integral part in digital travel revolution. Not everyone can visit each and every college campus before making college decision - time, distance, working commitments or finances might get in the way. In recent years many universities and colleges have become adroit at offering virtual visits. In this paper we propose implementation and development of virtual tour using photo-stitching technique. We also show implementation of walkthrough on Google of VIT campus using Google Maps JavaScript APIs. We show the implementation of embedding pop-ups with prominent locations in virtual tour to make it more persuasive for new users. The completed prototype is proposed to be released on Vidyalankar Institute of Technology's website.

Keywords : Virtual Tour, Panoramic view, Photo-Stitching technique

I. Introduction

Virtual Tour is a series of 360 degree panoramas created to display interactively on a screen, where the viewer feels he/she are in the photograph itself and can navigate around it, experience the locations as if they're actually there. The word "Panorama" suggests a view that is unbroken, since a panorama can be series of images or panning video footage. Every day people are bombarded with lots of images and ideas as we live in a society that is increasingly visual. Gone are those days when planning a trip to somewhere meant visiting a travel agency or calling some travel agent. By far, the most favorite way to explore any place is going on a virtual tour. Today's technology has advanced so much. Virtual tour gives the most vivid experience possible of a location without needing to be physically present on site[162].

The virtual tour is an integral part in the digital revolution. Progress in 3D camera technology enables 360 virtual tours to mirror closely the way humans see and experience the world. And this is just the beginning. The medium is evolving very rapidly thanks to new advancements in technology. One such development is Google's streaming 360 service on YouTube which lets an online visitor experience a video in any direction[1]. A key driver in making virtual tours is significant cost reduction and availability of various technologies, tools. Moreover, quality and usability of virtual tours has improved significantly with some websites allowing users to navigate through navigation buttons or clicking on maps or floor plans.

In recent years, virtual tours have benefited colleges, universities, hotels and restaurants as through virtual tours they are able to visually demonstrate their facilities in much better way. A study shows that, websites which provide experience of virtual tours received as much as 40% more views than those without virtual tours. Experts recommend that, before making any definitive college decision student must visit campuses first. Stepping foot on the physical campus can help prospective students to understand the environment, academic opportunities, and many other factors. Stepping foot on a campus may be the best way to get a true feel of a college, but virtual tour gives the student the next best option from the convenience of the couch. It provides 360-degree virtual tour of college campus and surrounding areas for the user to explore—at no cost.

In this paper, we propose a virtual interactive tour of prominent, distinct areas of Vidyalankar Institute of Technology. There are several advantages of our virtual tour: 1) The entire process of accessing virtual tour, what all areas will be seen, how will be the overall experience of the viewer is explained by interactive animated instructor at the start of virtual tour. 2) Each and every distinct areas of campus is described by a small pop-up showing information about that area. 3) The viewer can view the virtual scene at all directions.

The rest of this paper is organized as follows. Section II discusses related work. Section III discusses actual implementation of virtual tour. Section IV discusses implementation of instructor and Section V concludes the paper.

II. Related Work

Most of the previous research on virtual tours has focused on adding more and more contents than focusing on quality and expressiveness of virtual tours. Very few institutes in India have actually implemented virtual tours. Flash player from Adobe has become the most popular way to view virtual tours. Because of good quality of panoramas playbacks and almost unlimited capabilities, Flash developers quickly replaced their competitors in market. QuickTime, Deval VR, Java and other formats which had been popular earlier, became a history. Amity University in India has implemented virtual tour which allows viewers to explore locations like libraries, classrooms, courtyards, labs, studios, sport complex and other facilities[2]. This Virtual tour is implemented using Flash. With the fast development in technology, Flash format have begun to lose its position, in favor of HTML5 format. Mobile devices as well as all modern browsers support HTML5

format now. However, Flash panoramas are not able to be quickly replaced in the market of virtual tours viewing formats. Not all browsers are able to display HTML5 panoramas correctly. So, the best way to reach out to maximum viewers is using both the formats simultaneously.

Using Apple VR software and Flash, Oxford University has developed their virtual tour. It contains hundreds of interactive panoramas of the campus and town[3]. Many virtual tours are implemented around the globe – Virtual tour of White House, Sydney Opera House, Pyramids, South Pole to name a few.

To study the development of virtual tours using image-stitching technique a research was conducted. Campus virtual tour of UiTM Perlis was developed to conduct this research[4]. Adobe Photoshop CS3 was used for stitching images. Implementation of virtual tour was done using Tourweaver 4.00 professional edition.

The significance of proposed system is 1) It will assist the user to view the panorama in real-time, feeling like actually being there. 2) This will enhance the user's journey on the internet by showing close images of the campus environment in a better, clearer & more interactive way. 3) The observer will be able to view the virtual scene in all directions.

III. SYSTEM MODEL

In this section, we first explain virtual tour system model. Later we discuss actual implementation of virtual tour along with softwares that will be used for its creation.

A. The Virtual Tour System Model

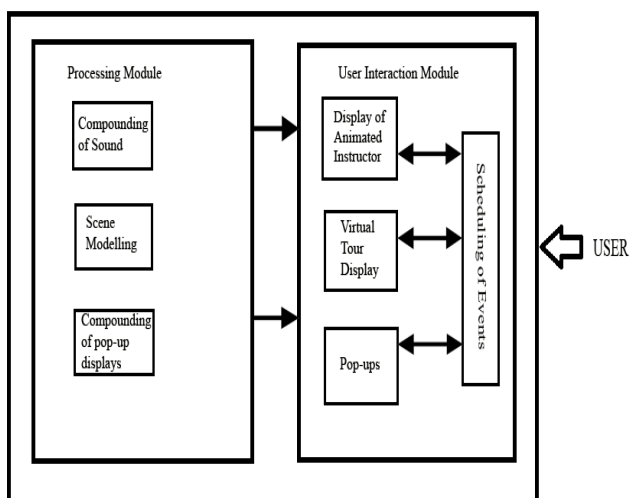


Fig. 1: Functional Structure of System

Once user starts with virtual tour, an animated instructor appears which gives thorough information about the tour. The user has different navigation options. To go left, right, forward or backward, the user can scroll, swipe or use arrow keys accordingly. When any action is performed popups are displayed in the visible range. For example, when user starts with virtual tour, the first visible region includes principal's office and hence a popup for the same appears. As user moves about the tour the popups of

various prominent places are displayed. Once user chooses to enter into any particular location, information about that location is provided via voice and text. Virtual tour is particularly designed for users who are new to this place and have no information about what is located where.

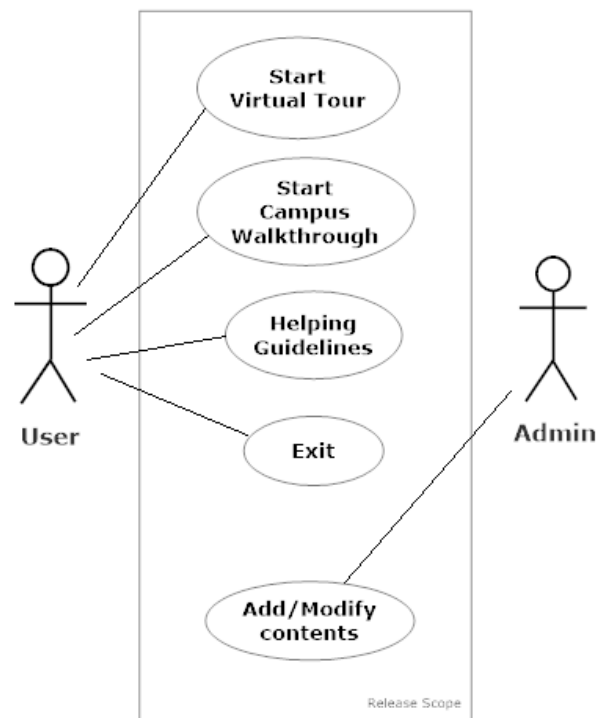


Fig. 2: Use case diagram of campus virtual tour

B. Virtual Tour Creation

A virtual tour is composed of many still photos or video frames to present an overall view for each angles of the subjects, usually a building having different parts, or beautiful landscapes with dissimilar view-angles. How to combine all of these 360 panoramas together and make viewers feeling like being in person? That's 360 virtual tours.

a. Equipment Analysis and data collection phase:

Using high-resolution digital photography to capture the panoramic scenes in virtual tour is mandatory. Typically, we'll scout our location and work with to determine the best locations for the camera, best time of day for each shot, whether we need people (or in some cases – animals) in the shot.

When we try to stitch photos together the worst parts of the images: their edges! It is the basic principle of panorama by stitching, but it's indeed where all the defects of a lens are gathered. A fisheye lens is an ultra wide-angle lens that produces strong visual distortion intended to create a wide panoramic or hemispherical image like Sigma currently makes a 4.5mm fisheye lens that captures a 180 degree field of view.

b. Preparing Images for Panorama:

The photos will be shot in RAW format and they thus have to be developed before stitching. All the images must have the same size in pixels or the stitching software won't want them. Once we decide what size our final image will have, at least in height and thus depending on what we want to do with it (full screen virtual tour or in a window), we'll have to redefine their size. In Photoshop, it can be done via the image menu/image size.

The format of our images play important role because even if each stitching software accepts JPG images, it's not the case of the format TIFF, 8 or 16 bits, PSD and even less of the RAW format - raw format, often proprietary -. The images should indeed maybe be converted before stitching.

Software that will be used for this step is Autopano. It takes a folder and searches it for image files. By analyzing the pictures, it attempts to divide them into panorama by analyzing sets.

c. Measuring Light Exposure and Correction of Distortion:

Once we've got our panorama, it is the time to solve and modify all distortion and natural effects of light to give a smooth transition effect to final tour. Some photo edits or corrections must be performed before stitching the photos when we're trying to achieve the best final quality[5].

i) Color Balance: One of the main assets of digital cameras is their setting of color balance. It is then very easy to harmonize a panoramic serial because all the photos can synchronize on the reference photo.

ii) Light Exposure: In virtual tour creation as photos of ceiling and floors are captured, maintaining light exposure is essential.

iii) Color temperature and white balance: Always an issue in film-based photography, the management of the color temperature of the photos is eased dramatically by the white balance.

iv) Halo effect: The flare effect - halos generated by the sun or any other very intense luminous source - strongly reduces the contrast in the photos and is, of course, very ungracious. The new stamp tool of Photoshop is impressively efficient for this step.

Software that will be used for this step is Adobe Photoshop Lightroom. Lightroom editing tools are intuitive and powerful. So making basic adjustments to color and brightness are a snap. Retouching, local adjustments, and perspective corrections are quick and simple.

d. Image Matching & Stitching:

Once we take the photography, it's time to get in front of the computer and "stitch" the images together. This means we use special software to find identical locations that appear in multiple photographs[6]. Once we connect all these "control points" together, the software can begin to re-shape all the images into one flat image.

For stitching Panorama manually:

- 1) Consider 2 images at a time.
- 2) Keep one image fixed, find the best homography for the other image so that they should overlap with best possibility.
- 3) To compute the homography, pick four points in each image i.e. manually picking 8 correspondence points.
- 4) After giving the correspondence, the first image can be transformed so that it overlaps with the second image.

Algorithm for Automated Panorama Stitching:

- 1) Consider 2 images at a time.
- 2) Use Harris Corner Detection to generate interest points.
- 3) Filter them down to 400 points. To get 400 points use Adaptive Non-Maximal Suppression (ANMS).
- 4) Find pairs of features, one in each image to recover homography between them.
- 5) To find pairs of features compare each feature point in left image to each feature point in right image and take the one with the lowest sum of squared differences. If the ratio between the first and second lowest SSD scores is more than a certain threshold then reject features.
- 6) To discard incorrect feature pairs and to solve for the homography between two images use RANSAC (RANdom Sample Consensus) algorithm.

d. Turning Panoramic Images into Virtual Tour:

After getting beautified panoramas ready, next step is to take those images and create the Flash or HTML5 virtual tour that will be seen by millions. Virtual tour software that will be used is Pano2VR[7].

IV. ADDITIONAL FEATURES

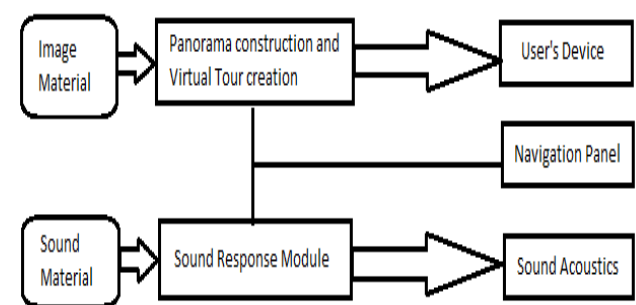


Fig. 3: System Framework

A completed campus virtual tour system is the composition of various technologies. In our design, a typical virtual tour experience is like this: the user starts off from somewhere in the campus, roams in some areas, and the surroundings are displayed. The user may also hear same background sound along with the scene changing (like the sound of cool breeze passing when he is getting closed to a playground). Any media authoring tool will be used to implement animated speaking instructor in our virtual tour[8]. These characters are available in head, bust and body formats and are capable of speech, emotions and gestures. They can be customized using logos and

swappable clothing. We can even use our own voice or that of a voice talent. The optional character server software generates streaming media from arbitrary text and connects to AI software such as ChatScript to power learning agents and conversational virtual assistants.

For creation of VIT campus walkthrough on Google "Google Maps JavaScript API" will be used which supports display of custom panoramas within StreetViewPanorama object.

To create pop-ups for prominent entities in our flash virtual tour, we will define JavaScript function "popupwindow" in HTML page in head section. This JavaScript function will be called in Flash using OnClick action. Now the next step is exporting Flash file to the same folder where HTML page is placed and embed Flash animation in HTML using OBJECT and EMBED tags.

V. Conclusion

In this paper, we presented the development of virtual tour of Vidyalankar Institute of Technology using image-stitching techniques. The significance of using this technique is to get the panoramic view of the VIT campus area which will enable viewers to experience prominent entities of VIT campus on the Internet as if they were really there. We proposed to show implementation of interactive instructor to guide and advice user in online

virtual environment. The interactive instructor attempts to provide adaptive guidance, to perform engaging storytelling & to promote user's participation through virtual tour. The completed prototype is proposed to be released on VIT's website.

Acknowledgment

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Image Description Using Deep Neural Networks

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ABSTRACT

Machine vision using GPU is an evolving concept which is responsible for numerous applications in the fields of medical imaging, autonomous cars, surveillance, optical character recognition and many more. Our application is based on the image description which serves in online automatic picture segregation and surveillance purposes. We used 'back propagation' algorithm and compared its results with previously used methods such as logistic regression. We built a four layered deep neural network and trained it with the pre-labelled dataset in order to correctly classify a set of 10 objects. After spotting the correct objects it was then possible to correctly recognize a particular image on the basis of confidence provided by the architecture.

Keyword: *Computer Vision, Image Processing, Scene Recognition, Object Recognition, Deep Neural Networks*

1. Introduction

In this research Paper we are focusing on how deep neural networks can be used in order to increase the efficiency of the machine vision applications. Neural networks came into existence from the early '1940s' but there was limitations due to computational ability of the machines available in that generation, neural networks was not able to make sufficiently visible impact. After the late '1980s' machines finally began to show some progressive computing ability. The scope of deep learning in the late 2000s once again created new possibilities. Deep Neural Networks found its applications in Robotics, Data processing, medical analysis, machine vision etc. Later in 2012 using Graphic Processing Units based implementations it was then possible to train as well as process huge amounts of data in real time which increased the overall efficiency.

One not only needs to correctly recognize what appears in images but also establish the understanding of spatial relationships and interactions between various objects in a particular image. In the future, machines with artificial intelligence should communicate with humans in a more sophisticated and a natural way. Machine vision will enable the robots to see and convey the meaning of the image in human language. It can be accomplished with the help of Computer Vision using GPUs and Image Processing. We will recognize various scenes with the help of related object detection. For example, objects such as desks, blackboards, humans and doors may signify a

classroom setting. We will then judge our object detection algorithm on various papers as this as a whole project has not been implemented. We fed a data set comprising of more than 5000 labelled training examples to our architecture. There are various algorithms which are used for finding the correct training parameters like BFGS, L-BFGS etc. Our architecture is based on the back-propagation algorithm. The architecture consists of one input layer, one output layer and two hidden layers. After training the data set have a 97% accuracy on classifying the objects which are included in the training examples. Using the predefined labels we can now give an appropriate description to the sample image. Collecting the objects from the image it is now possible to detect a particular scene.

2. Literature Survey

With the help of high-performance systems, and abundant public-contributed repositories, there has been accelerated growth in the domain of classification and identification of objects in images as well as videos. Large scale object classification and detection has been achieved with the help of various algorithms and techniques like Convolutional Neural Networks (CNN) [1], Recursive Neural Networks.

(RNN) [2] Etc. The framework of the neural network based techniques is the back-propagation [4] algorithm which made it feasible to include hidden layers in the computation process in order to train, virtually, any regression or classification task. The basic functioning and approach of a neural network, is referred in [5]. Neural networks allows us to perform a wide variety of tasks[6] like data reduction and feature extraction, image restoration, image segmentation, image understanding and object recognition. But, training the neural network is a computationally expensive task and latency in high-data transfer prevents multi-core and multi-threading approach from providing substantial reduction in time taken to train the neural network. On the other hand, [10],[11] have shown results that overcome this by using parallel processing through Graphic Processing Units (GPUs). Hence, there is a two-fold reduction in training time taken to train the network as shown in [8],[9]. In 3d object detection and recognition, depth of the object in the frame

is available, which has been performed successfully in [13]. Our model will try to detect, classify and localize a two-dimensional object in an image to provide its description, in a computationally cheaper and efficient method. As the number of classifiers increase, more training time is required for the network and therefore, proper parallelization as well as parameterization of GPU, is essential in cutting down computation time.

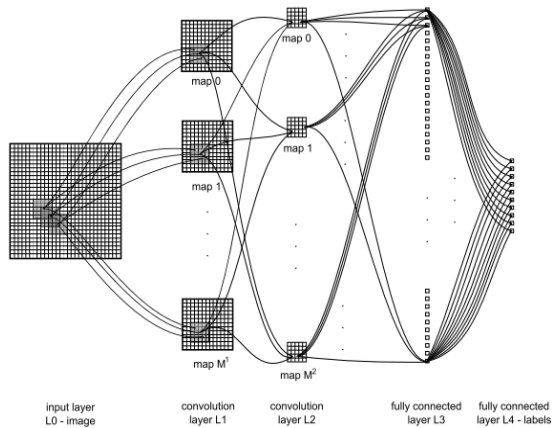


Fig.1. Convolutional neural network depicting a 5 layer network.

3. Proposed System

The neural network structures, in general, have developed rapidly in recent years, in in fields of natural language processing and computer vision. Currently, the algorithms tend to have less confidence in identifying the small objects. Objects like pen, mobiles, and similar objects are hard to predict. Krizhevskiy et al [18] proposed a CNN (Convolutional Neural Network) with 8 layers, for image classification tasks on which we are trying to improve the efficiency. Also, to give a meaningful and grammatically appropriate caption to an image after detecting various objects is a difficult task. In 2014, Girshick et al [16] proposed an object detection framework using CNN as they show great potential in speech recognition and word embedding [20]. Task to describe images is formulated as a ranking or embedding learning problem [17]. First word features and references are extracted [22] uses Recursive Neural network to extract sentence features as well as the image features. Later an embedding model maps both language and image feature. Hence, distance between images and sentences can be easily calculated.

Novel sentences can be generated in two ways:

1. Rules of language grammar should be followed. Sentence is divided into several parts depending on various extracted parts [21]. These extracted parts are then matched [19]. This method generates sentences that are correct, syntactically.
2. Network learns a probability density over the space of multimodal inputs [23]. Here, richer as well as more flexible sentences are generated here.

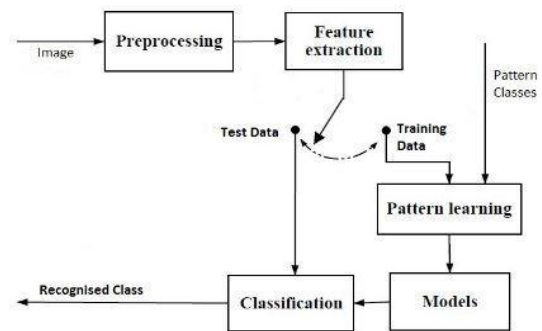


Fig.2. Diagram describing logic of working of neural network.

4. Block Diagram

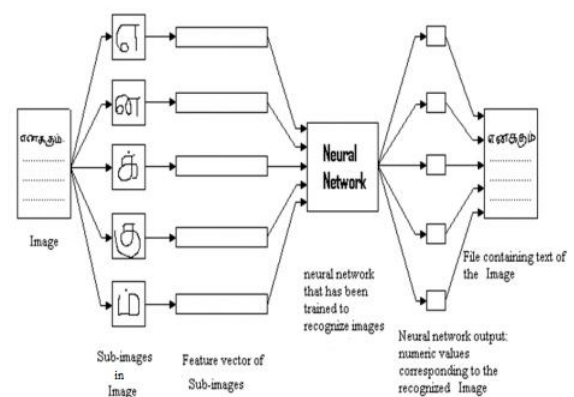


Fig.3. Flow of the object detection technique adopted.

The Block Diagram can be divided into three main sections. Data feeding, Processing and Pattern recognition, classification and Display. In the first part, huge data of pre labeled images are fed to the neural network.

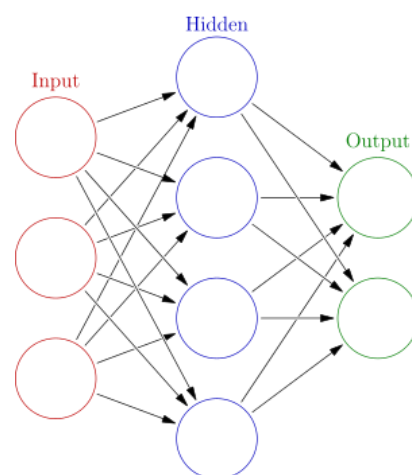


Fig.4. Example of feature extraction and classification using neural network.

The Neural network partitions the acquired data into training data and test data. It uses the training data to teach itself the pattern for recognizing images belonging to a particular set whereas test data is used to measure the efficiency of its developed algorithm. In the last block it successfully classifies the Images into various categories and then displays the identified object in the image.

5. Conclusion

The proposed system of performing visual recognition will enhance the current application of artificial intelligence[5]. In future, it is possible to implement a captioning system, which recognizes all the objects in a given frame and by utilizing algorithms of Natural Language Processing it will successfully, predict captions for the image/ frame.

6. Future scope

Computer vision will eventually impact everything from monitoring, ensure a more sophisticated interactions between machine and humans. Computer vision has the potential to be used for many purposes, starting with, and highly intrusive visual surveillance. Tasks like identifying people, manipulate 3D geometry of things, understanding relations, emotions, actions and intentions can be achieved with the conglomeration of 'NLP', deep learning and computer vision to build a improved problem solving Artificial intelligence system.

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Novel Method of Noise Elimination of Digital Signals

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ABSTRACT

The primary purpose of this paper is to develop a speech recognition system, which will be capable of recognizing and interpreting an individual's voice. This will thus obviate the use of keyboards and other such input devices to output the data.

Keyword: Signal, Processing, ADC, Microphone.

1. Introduction

The primary purpose of this research work is to develop a speech recognition system, which will be capable of recognizing and interpreting an individual's voice. This will thus obviate the use of keyboards and other such input devices to output the data. The scope of this work is limited to the recognition of digits. The subject of our work is an isolated word, speaker independent 0 to 9 digit recognition system that can achieve a higher level of accuracy. We have chosen speaker independent approach because for a small vocabulary systems (e.g., digit recognizers) with large amount of users it is not feasible to store training data for every individual user. Furthermore, most systems cannot train themselves to a new speaker very rapidly. Hence, we aim to make research in the field of speaker independent isolated work 0 to 9 digit recognition. Digitization of the analog speech signal and then elimination of the unwanted noise signal. The purpose of digitization is to produce sampled data representation of the speech signal with high Signal to Noise Ratio (SNR).

2. Digitization Process

Digitization is a process of converting the speech signal from sound pressure wave to a digital signal and emphasizing the important frequency components in the signal. It involves digitization of the analog speech signal and then elimination of the unwanted noise signal. The purpose of digitization is to produce sampled data representation of the speech signal with high Signal to Noise Ratio (SNR). The block diagram of the system is shown in Fig. 1. We know that speech is a continuously varying analog signal. The first step in any system is to capture the speech and a general purpose high sensitivity low noise microphone is well suited for such an application. Audio is inherently an analog phenomenon.

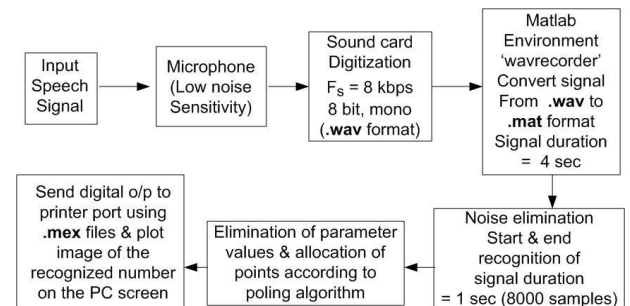


Fig. 1 : Block diagram of the implement speech

3. Software Tool Used

In order to recognize the digit spoken we need to process the sampled speech signal. Hence, we require a versatile software tool for high performance numerical computation and visualization. "Matlab" is used as the tool. Mex files are written for the software design.

4. Different Methodologies Employed

We aim to develop methods and techniques that enable computer systems to accept speech input and to transcribe the recognized utterances into normal orthographic writing. 4 basic approaches to attain this goal have been implemented.

- Template based approaches, where the incoming speech is compared with stored units in an effort to find the best match.
- Knowledge based approaches that attempts to emulate the human expert ability to recognize the speech.
- Stochastic approaches, which exploit the inherent statistical properties of the occurrence and co-occurrence of individual speech sounds.
- Connectionist approaches which use networks of a large number of simple, interconnected nodes which are trained to recognize speech.

We, in our project work, have selected speaker independent approach; hence out of the 4 above mentioned methods, stochastic approach best suits our work. The 10 digits under study can be ground into 2 classes according to the associated values of the parameters. The stochastic approach involves finding robust parameters which are sufficient enough to distinguish between 2 classes (digits in our case).

In the search for a sound feature that would be relevant in respect to our classification purpose, we developed signal processing algorithms to extract several physical parameters. Parameters are those features which are unique for a particular digit. Thus, we have to derive some parameters out of the input speech signal which should have the following characteristics :

- Values of parameters should vary widely from digit to digit.
- For a particular digit, they should be insensitive to the change in speaker.
- Parameters should be stable over a period of time.
- Such parameters should be easy to derive.

5. Observation of the outputs of the system

The basic aim behind the recognition of digits is to control a process or a machine or a robot using speech. Also, many software applications can be built using the digit recognizer.

Software codes designed and implemented :

- Code for speech recognition for males
- Code for speech recognition for females

Different functions used are

- Energy consumption.
- Computing the threshold ratio.
- Computing the pitch of the signal.
- Calculation of 2nd max. frequency after pitch frequency and deviation.
- Computing threshold crossing in frequency domain.
- Computing the maximum probable digit.
- To check whether the recognized digit is correct or not.
- To plot the image of the recognized.
- To generate the output at the printer port.

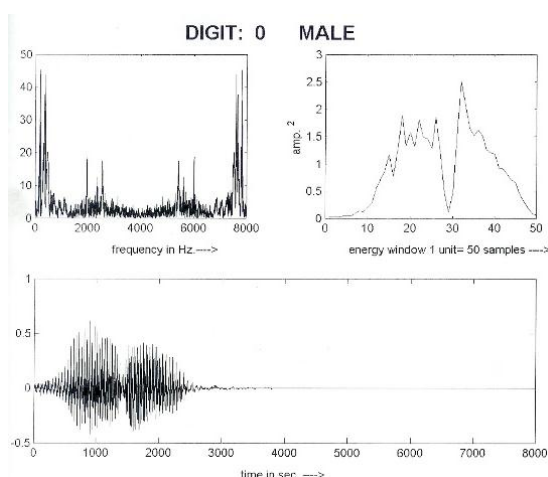


Fig. 2 : Response of digit 0 of Male

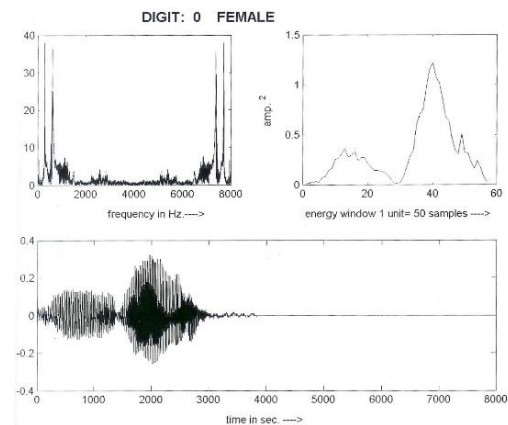


Fig. 3 : Response of digit 0 of Female

6. Conclusions

A speaker independent isolated (0-9) recognition system has been successfully implemented in this paper & only the main objectives & the block diagrammatic representation is shown here for the sake of convenience. The system under best conditions showed accuracy more than 90 %. In implementation of the system, a low noise high sensitivity microphone is used as the transducer element for receiving the digit input.

This analog signal is sampled, quantized and then converted into digital signal by the soundcard present in every PC. Matlab, a versatile software tool is used for further signal processing.

An interface between Matlab and MS-paint has been established. In our program, we have given an option of re-recording the digit if digit is wrongly recognized. All the interfaces made with the user are either visual or audio and hence require no expert knowledge of the system.

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Analysis and Implementation of Pan Tompkin's Algorithm

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ABSTRACT

Heart rate is the measurement of heart beat per minute. Electrocardiogram [ECG] is one of the parameters which provide heart rate. ECG is the measure of electrical activity of heart which provides much useful information related to heart. The detection of R peak in ECG provides information of heart rate. In this paper analysis and implementation of Pan Tompkin's algorithm is done with the help of MATLAB. Digital signal processing is used to minimize the time required for analysis and to get accurate results. The data is actually recorded in laboratory from a healthy subject.

Keywords: ECG, Pan Tompkin's algorithm, filter, differentiator, moving window integration.

Introduction

In many biomedical signal analysis since the biological signals are too small to study they need further processing such as amplification. While recording biological signals and processing it, noise get introduced in it either by external source or internal components of processing circuits. Noise cannot be eliminated completely from the signal but can be sufficiently reduced so that the biological signal can be used for diagnostic purpose. This can be done by using digital signal processing. ECG is measured with the help of electrodes. ECG consists of P wave, QRS complex, T wave. For heart rate measurement R peak detection is done. Heart rate is the measure of number of heart beat per minute which gives the information of pumping action of heart. Normal heart beat ranges from 70 to 100 beats per minute. Pan Tompkin's algorithm gives the R peak detection using which the heart beat can be calculated.

I. Electrocardiogram

ECG is the measurement of electrical activity of heart during contraction and relaxation of heart. ECG is measured with the help of surface electrodes. Frequency of ECG ranges from 10Hz to 100Hz. Normal ECG waveform is as shown as follows:

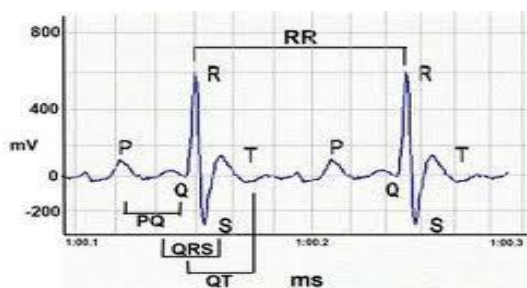


Fig.1. Normal ECG Signal

It consists of P wave, QRS complex, T wave. Significance of each wave is as follows:

P wave:

It is the recording obtained due to the contraction of atria.

QRS Complex:

It is the recording obtained due to the contraction of ventricles.

T wave:

It is the recording obtained due to the relaxation of both atria and ventricles.

II. PAN TOMPKIN'S ALGORITHM

Pan Tompkin's Algorithm is used here to detect R peaks in ECG. Steps involved in Pan Tompkin's algorithm are filtering, derivative, squaring, moving integrator, threshold and peak detection. Block diagram of steps involved in Pan Tompkin's algorithm is as shown in figure 2:

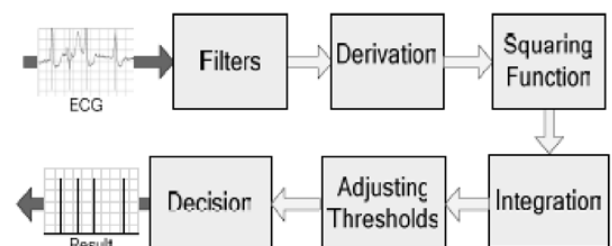


Fig.2. Block Diagram of Pan Tompkin's Algorithm

A. Filtering

The ECG signal obtained by recording is first filtered to eliminate noise and unwanted signals which are not in the frequency range of ECG. Band pass filter is formed by low pass filter with cut off frequency of 30 Hz and high pass filter with cutoff frequency of 100 Hz. Band pass filtering helps to remove unwanted components having frequency less than 30 Hz and greater than 100 Hz.

B. Derivative

The filtered signal is then differentiated to get slope of the signal. Since slope of the QRS complex in ECG signal is more, peak of QRS complex obtained by differentiation is high.

C. Squaring

Squaring is done to remove negative peaks in the differentiated signal. It amplifies the positive peaks in the differentiated signal thereby performing nonlinear amplification of the differentiated signal.

D. Moving window integration

The differentiated signal is then integrated so as to retain only QRS peak. Here since the signal is discrete, moving window integration is used instead of normal integration. This is done by selecting the appropriate window length so as to retain only QRS complex peaks.

E. Thresholding

Thresholding is done to remove any small peaks which does not represent QRS complex. In this process a certain predetermined value is taken as threshold value. The integrated signal above this threshold is retained and below it gets eliminated, thus providing only the peaks of QRS complexes.

F. Peak detection

After thresholding the peaks of QRS complex are determined with the help of peak detection algorithm. This peak detected is the R peak having maximum slope in the ECG signal. It also provides the information of heart rate.

III. RESULTS

The original ECG signal recorded is as shown:

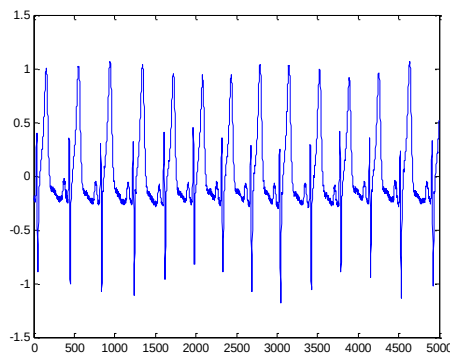


Fig.3.Original ECG Signal

This original ECG signal is then passed through a band pass filter by first applying low pass filter and then applying high pass filter. The low pass filter of cutoff frequency 10 Hz is applied and a high pass filter with cutoff frequency of 100 Hz is applied. The filtered signal is then differentiated to get the slopes. The differentiated signal is then squared to make the negative peaks positive and to nonlinearly amplify the positive peaks. After squaring, integration of the signal is done with the help of moving window integration. In this example the optimum length of the window is 20 samples wide. If the window is too narrow it will result in several small peaks and if the window is too wide it will result in merging of QRS complex and T waves. Therefore window length optimization becomes necessary. After integration, thresholding is done so as to retain only QRS complexes. Thresholding removes all the small peaks in the signal. Steps involved are as shown in figure 4:

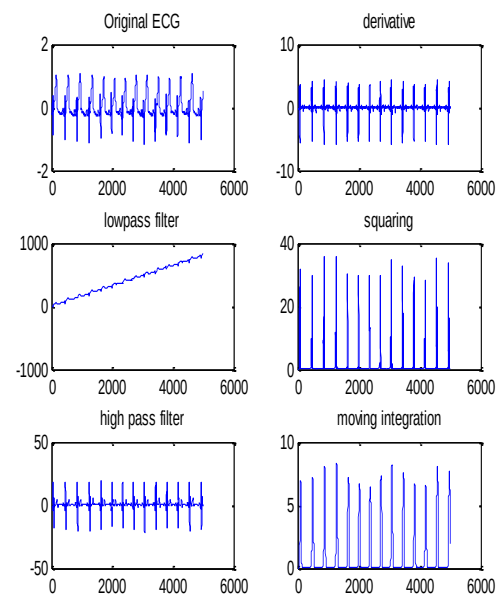


Fig.4.Steps involved in Pan Tompkin's Algorithm

Finally, peak detection algorithm is applied to detect the peaks of QRS complexes. The detected peak along with the original signal is as shown as follows:

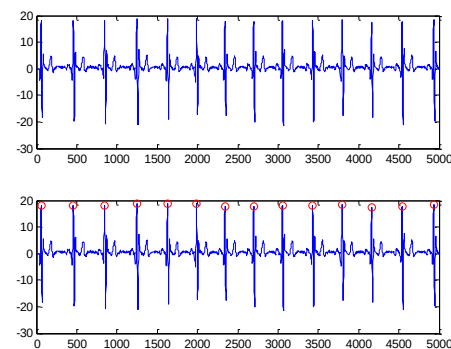


Fig.5.original signal and peak detected signal

IV. Conclusion

Pantompkin's algorithm can be thus effectively used to detect QRS complex in ECG signal which can provide information such as heart rate. Moreover, the method is more reliable compared to conventional methods as it selectively detects r peaks and prevents smaller peaks from being detected, thus increasing the accuracy of the system. Filtration becomes necessary so as to eliminate the unwanted external noise. This algorithm can also be used to detect other peaks such as P wave and T wave by adjusting the window of moving window integration and adjusting the threshold value.

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Overview of Cloud Detection and Removal Techniques in Satellite Images

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ABSTRACT

Satellite imaging has various approaches in weather forecasting, geographical area studies, remote sensing and so on. However the satellites being placed far from the earth, the imaging through them gets hampered many times by the clouds. Cloud free optical satellite imaging simplifies the study of the areas for further applications. This paper gives an overview of various techniques that can be used for the cloud detection and removal from the satellite images. The approaches that can be used are mainly multitemporal or multispectral.

Keywords : *Satellite; remote sensing; multitemporal; multispectral, MODIS, MAP-MRF.*

1. Introduction

The past two to three decades has seen a turnaround in our capacity to survey and map our global environment through use of satellite remote sensing technology. Remote sensing is closely related with satellite imaging. Optical satellite images are important tools for remote sensing, and suitable analytics applied to satellite images can often benefit applications such as land monitoring, mineral exploration, crop identification, etc. Images can be acquired by using different satellites such as ikonos, landsat, Quickbird and each satellite is used for different purposes like defence (change detection in regions), agriculture (for analysis of agriculture) etc . Every object in a satellite image is essential for accurate processing, so image quality is one of the most important factors in satellite images. However the presence of clouds in satellite images affects the quality of image to a great extent. The usefulness of satellite images is largely limited by cloud contamination [1], thus a cloud removal and reconstruction system is highly desirable.

In this paper, we have discussed various approaches for cloud detection and removal in temporal satellite image sequences.

This paper is composed by 6 chapters. The rest of the report is organized as follows. Chapter 2 presents problem regarding cloud detection. Chapter 3 presents general steps include in cloud detection & removing algorithm. Chapter 4 presents overview of related work done yet in cloud detection and removal area. Finally conclusion is presented in Chapter 5

2. Problems Regarding Cloud Detection

Physically, we are able to discriminate between the clear and cloudy sky conditions. Such a procedure is very consolidated and robust, especially when the type of

clouds present in the atmosphere matches the clouds that were simulated in the radiative models. Physical methodologies suffer from three main drawbacks: The variability of clouds in the sky is much larger than that resulting from simulations by radiative transfer models; The dependence of radiance on the emissivity of the surface, which is very difficult to estimate accurately over land; The increase of the number of spectral channels of sensors, that makes more difficult the choice of suitable bands for the decision rules [2]. The identification of clouds in visible satellite images is relatively straight forward for a trained scientist during the day, but this process is substantially more difficult at night when only thermal channels are available [3]. The automatically detection of clouds in GOES satellite imagery is not a simple task. Poor spatial resolution, changing solar incidence and instrument viewing angles, limited spectral channels, instrument noise and varying surface properties often limit the success of traditional cloud detection schemes [3].

Polar nocturnal clouds are often warmer or at the same temperature as the background snow surface, complicating cloud detection. Also, there clouds tend to be thin, with lower emittances than clouds occurring during the summer [4]. Sun glitter may interfere with cloud detection in the tropics due to spatially unresolved water bodies or recent rainfall. Over volcanic areas clouds and volcanic ash may appear similar in the visible wavelength. Over the desert, clouds and dust may appear similar. Over forests, clouds and fire may appear similar, Terrain shadows may also interfere with cloud detection in the tropics [5].

3. Cloud Detection & Removing Algorithm

Clouds are one of the significant obstacles in extracting information from tea lands using remote sensing imagery. Different approaches have been attempted to solve this problem with varying levels of success. The common algorithm or techniques in general include:

1. The information cloning algorithm
2. Cloud Distortion Model and Filtering Procedure
3. Semi-automated Cloud/Shadow, Haze Identification and Removal
4. Mean
5. Second Highest Value
6. Modified Maximum Averaging

4. Related Works

- A. *Cloud Detection and Removal Algorithm for Moderate Resolution Imaging Spectrum-radiometer (MODIS) Remote Sensing Imagery*

Firstly, several preprocessing works need to be done for MODIS L1B data, including geometric precision correction, bowtie effect elimination and stripe noise removal [10]. Furthermore, through analyzing the cloud spectral characters derived from the thirty-six bands of MODIS data, it can be found spectral reflections of ground and cloud are different in various MODIS bands. Therefore, cloud and ground area can be respectively identified based on the analysis of multispectral characters derived from MODIS imagery. Most cloud regions including both thin and thick types can be detected by this method. Clouds removal processing mainly aims at cloud regions rather than whole image, which can improve processing efficiency. As for thin clouds and thick clouds removal, different removal algorithms are used in this method. This proposed method can effectively detect and remove cloud from MODIS image, which can meet the demands of post processing for remote sensing imagery applications. But this method lead higher misclassification rate of cloud pixels and it also a high time consuming process.

B. *Cloud Detection Algorithms Based on a MAPMRF Approach in Space and Time*

A recurrent concern in cloud detection approaches is the high misclassification rate for pixels close to cloud edges. Solving this problem by introducing a novel penalty term within the classical maximum a posteriori probability–Markov random field (MAP-MRF) [10] approach. To improve the classification rate, such term, for which suggest two different functional forms, accounts for the predictable motion of cloud volumes across images. Two mass tracking techniques are proposed. The first one is an effective and efficient implementation of the probability hypothesis density (PHD) filter, which is based on Gaussian mixtures (GMs) and relies on finite set statistics (FISST). The second one is region matching procedure based on a maximum cross-correlation (MCC) that is characterized by low computational load. Classical MRF methods account only for spatial dependence relations, thus neglecting the temporal information often available in image sequences. In this method, apply a spatio-temporal MRF methods to the cloud masking problem that is complicated by the non-rigid nature of the masses. This approach turns out to be especially valuable in mitigating the problem of misclassification rate at the cloud edges, which typically stems from low contrast against sea and land background [8] by exploiting the cloud motion as an additional discriminant feature against the static background. Cloud detection by using MAP-MRF approach is more efficient and good method than other cloud classification algorithm.

C. *Cloud Detection and Removal Algorithm (ECDR)*

The proposed method is Efficient Cloud Detection and Removal Algorithm (ECDR) which helps to improves the accuracy of the cloud restoration area than the NSPI method. The proposed algorithm is based on the multi-temporal approach. The time series images are

taken as a reference image. The reference image must be more than three to get the accuracy in the result. Consider the reference images as R1, R2, R3, etc., and the cloud contaminated images as C1 and it is considered as the original images.

The cloud detection is the very important step without cloud detection the cloud removal and reconstruction is a complex problem. The clouds can be detected by the calculation of the pixel value. The clouds are brighter in visible bands and lighter in thermal bands. The cloud pixel values are ranges from 200 to 255 in thermal band and 255 in visible band. Based on this calculation the cloud values are detected. After cloud detection, consider the reference image R1, R2 and R3 and find the difference between them. Then find the difference between them. Compare the pixel values from the image difference and find the average. Calculate the R13 variations using R13 and R13 with average of image difference. Find the difference between the D1 and D2, based on the positive and negative values in the difference; replace the cloud pixel by R13 with variance. If the difference value is positive then add the value with R13 otherwise subtract the value and replace for the cloudy region. The filtering is used to enhance the contrast of the image. The quality of the image is improved. The discrete wavelet transform is used for filtering the image i.e., denoising. The images are divided into the sub bands and the wavelet threshold (WThresh) is applied to the sub-bands except the original images. The WThresh helps to de-noise the image.

So, the quality of the image is improved. Image can be de-noised at different levels of resolution and can be sequentially processed from low resolution to high resolution. Sub-band level analysis results in high accuracy. Gain accuracy in cloud removal. Applicable for all sizes of the clouds. Produce efficient results even frequent clouds are appearing. The proposed system is designed to detect and remove clouds from the satellite images. In the coastal regions and during the winter season the tropical regions are fully covered with clouds. The cloudy regions are not monitored because the clouds will cover the areas. Thus, lots of existing methods are available for cloud detection and removing. The existing system has lot of problems when the images are applied to the real time applications. The existing system modified NSPI approaches has face problems such as lack of accuracy, similar to the other existing methods etc. The major disadvantages in the existing method is that, if the frequent clouds are appeared then the existing method cannot produce the accurate result because in the existing method where the similar pixels can be find by calculating based on the distance between the target pixels. Thus, it is possible to replace the cloud pixel has the similar pixel. If the cloud pixel is replaced then the method lacks its accuracy. In the proposed ECDR algorithm [9] there is no chance of replacing the cloud pixel because all the information's are gathered from the reference images. Thus, there is no chance of replacing the cloud pixel.

Generally there are three types of cloud removal methods are present but each has its own algorithm, methods and techniques.

The three types of cloud removal methods are:

1. In-painting method
2. Multi-spectral method
3. Multi-temporal method

1. In-Painting Method:

The in-painting method is the earliest method that helps to remove clouds from the satellite images. In the in-painting technique, the data's are gathered from its neighboring regions either its mean value or the similar pixel value. But the biggest problem is that the data which reconstruct on the cloudy region is not accurate. The major problem in this method is that the boundary of the cloud is not fixed.

2. Multi-Spectral Method

In multispectral-based approaches, multispectral data are utilized in cloud detection and removal. The different band images are taken and reconstruct the cloudy region of the image. The different satellite images have different spectral bands such as band 1,2,3,4 and so on. But the different spectral band images have different color combinations thus the accuracy of the image is not up to the level. But when compared to the In-painting technique the result accuracy was level increased.

3. Multi-Temporal Method

The Multi-temporal based method is somewhat better method when compared to the Multi-temporal and in painting method, which rely on both temporal coherence and spatial coherence have a better ability to cope with large clouds. The spectro temporal relationships are inferred from cloud-free areas in the neighbourhood of cloud-contaminated regions over the available temporal images. A thresholding-based approach is used to identify the best cloud-free and non-shadow pixels region is given and then generated by stitching or mosaic king the selected cloud free pixels.

The multi-temporal based method produced result is more accurate when compared to the above two method because in this method where the information are gathered from the previous year image of the same location.

Conclusion

Automatic and accurate classification of clouds to enhance weather forecasting is one of the important applications studied in meteorology. Many different approaches have been used to automatically detect clouds in satellite imagery. Satellite imagery is very important field especially for cloud detection and weather forecasting. But no cloud detection and removal technique is absolutely perfect and without errors. This paper concludes that, MAP-MRF approach for cloud detection gives improved classification of cloud edges than other methods and with the help of image processing we can enhance the satellite images and make easy the analysis of satellite images.

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The Need of Accreditation in Promoting Quality Assurance of Polytechnics

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ABSTRACT

This paper examines the nature and scope of quality, and the different perceptions about quality, accreditation skill development in Polytechnic education. The factors promoting quality and skill development in Polytechnics are briefly reviewed, and the requirements of and expectations from Polytechnic students and Polytechnic administrators in order to face the challenges of the next millennium are enumerated. Beginning with the pioneering efforts of NBA, INDIA, accreditation has established itself worldwide as the principal mechanism for quality assurance and skill development in technical education, and more and more Institutions are coming under the umbrella. Accreditation is a process of self-study and external quality review used in higher education to scrutinize colleges, universities and higher education programs for quality assurance and quality improvement. Accreditation is a "hard power", able to stop programs that perform below a certain quality threshold. In fact, accreditation has been effective in eradicating those programs at the very bottom of the quality spectrum. It refers to a process of assessment and review which enables a higher education course or institution to be recognized or certified as meeting appropriate standards. The effectiveness of accreditation resides in the fact that it ensures that programs that do not meet a certain quality threshold will cease to exist. [1] This paper emphasizes the significance and impact of accreditation in enhancing quality of technical education and develop skills ensures that the skills and attributes become a part of the students' nature, making them more self-assured and confident.

Keywords : Accreditation, Quality, Polytechnics

I. Introduction

Technical Education plays a vital role in human resource development of the country by creating skilled manpower, enhancing industrial productivity and the quality of life. Technical Education covers courses and programs in Engineering, Technology, Management, Architecture etc. Today's Technical Education system is in direct need of reform. The development and utilization of effective mechanisms for quality assurance and developing sound technical knowledge and skills to do his or her job at a high level of accomplishment, demonstrate active interest and ability to enhance and apply new functional skills is the need in the present era of global competitiveness. Quality assurance is a planned and systematic review process of an institution or program to determine whether or not acceptable standards of education and infrastructure are being met, maintained and enhanced. Globalization, knowledge and competition have intensified the need for highly skilled workforce in both the developing and developed nations as it enables them to accelerate their growth rate towards higher trajectory. India has taken crucial steps to pursue quality in technical education in

order to achieve planned growth. Special efforts are being undertaken to inculcate competitiveness and quality in technically qualified human resources to make it globally acceptable. To achieve accreditation an institution must comply with rigorous standards, develop and implement an Institutional Effectiveness Plan, undergo an annual review of its financial stability, retention and placement rates and undergo announced and unannounced site visits.[2] National Board of Accreditation is an independent organization from the regulatory body AICTE, launch of mission teacher and training, sub-mission on polytechnics under coordinated action for skill development, provides impetus to National Mission on Education through ICT etc. to improve the quality of higher and technical education in the country.[3]

II. The Pioneering Work of Nba

To stimulate the quality of teaching, self-evaluation and accountability in higher education and facilitate the Institutions in realizing their academic objectives, adopt teaching practices that enable them to produce high quality professionals and to assist them in continuously contributing to the domain of knowledge through innovations & research is the mission of NBA, National Board of accreditation.[4]

The accredited institute benefits from the process of continuous quality improvement that is encouraged by the NBA's developmental approach to promote excellence in technical education.

All the challenges, which students face locally and internationally, are due to lack of proper governance and management practice. The ultimate goal of any educational research is to make education fit to the recipients. The NBA was originally constituted in September 1994 to assess the qualitative competence of the educational institutions from diploma level to postgraduate level in engineering and technology, management, pharmacy, architecture, and related disciplines. The National Board of Accreditation (NBA) has announced a New Self Assessment Report (SAR) format for the Diploma Engineering Programs, applicable with effect from October 1, 2015.[5] The NBA works very closely with stakeholders (faculty, educational institutions, government, industries, regulators, management, recruiters, alumni, students and their parents) to ensure that the programs serve to prepare their graduates with sound knowledge of fundamentals and to develop in them an adequate level of professional competence, such as would meet the needs of the engineering profession locally as well as globally. The objective of the NBA is to assess and accredit professional programs offered at various levels by the technical

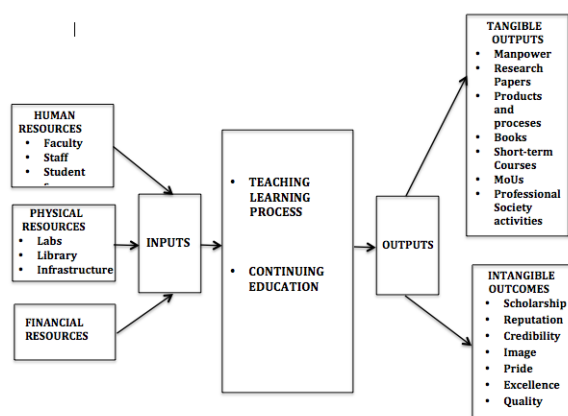
institutions on the basis of norms prescribed by the NBA. The General Council is the principal authority of the NBA, and is responsible for its overall activities and affairs. It gives policy directions/guidelines to the Executive Committee, which takes steps for managing the activities and affairs of the NBA. The affairs of the NBA are managed, administered, directed and controlled as per Rules and Bye-laws approved by the Executive Committee (EC) and ratified by the General Council (GC).[6]

III. Process of Accreditation

A step wise accreditation process is detailed below:

- **Standards:** The institution must ensure that the accreditation standards are understood and implemented across all departments and functions.
- **Self-study:** The institution or program seeking accreditation prepares an in-depth self-evaluation study that measures its performance against the standards established by the accrediting agency. It provides the institution with the opportunity to engage in a comprehensive analysis of all aspects of its operation.
- **On-site Evaluation:** A team selected by the accrediting agency visits the institution or program to determine first-hand if the applicant meets the established standards. The on-site team visit is the focal point of the accreditation process. It provides an objective “snapshot” of the institution represented in a written report.
- **Grant of Accreditation:** Upon being satisfied that the applicant meets its standards, the accrediting agency grants accreditation status and lists the institution or program in an official publication with other similarly accredited institutions or programs.
- **Monitoring:** The accrediting agency monitors each accredited institution or program throughout the period of accreditation granted to verify that it continues to meet the agency's standards.
- **Re-evaluation:** The accrediting agency periodically reevaluates each institution or program that it lists to ascertain whether continuation of its accredited status is warranted.[2]

IV. Anatomy of a Typical Polytechnic



Polytechnic courses approved by the All India Council of Technical Education (AICTE) have always been popular even with high-scoring students. Core branches like mechanical, electrical, civil and electronics engineering are most preferred as they give strong foundation in engineering courses if taken through lateral entry.

It is instructive to adopt the systems approach to describe the anatomy of a typical technical institution (The VP system, for example). Figure 1 shows the processes that constitute the core activities of such a system, the three major classes of inputs, and the two major classes of outcomes. Vidyalankar Polytechnic (VP) is a Diploma College, approved by AICTE and affiliated to the Maharashtra State Board of Technical Education. MSBTE is an autonomous Board of Government of Maharashtra. Faculty development, students' development, curriculum development, Industry-Institute-Interaction, Domestic & Foreign Collaborations, National level Conventions, Academic Monitoring, Preparation of Perspective Plan, Preparation of Vision for MSBTE etc. are the parameters to enhance the quality of Technical Education in Maharashtra.[8]

Academic monitoring is an important activity of MSBTE to ensure uniform curriculum implementation throughout the state. MSBTE uses its own specially designed instrument [KPI-Norms-Key Performance Indicators Norms] for conducting academic monitoring of all affiliated institutions. These KPI norms are now revised based on the NBA criterion and the academic monitoring of all institutions is carried out using revised KPI norms. This is an important initiative from MSBTE for preparing its affiliated institutions to step ahead for NBA accreditation.

NBA's key objective is to contribute to the significant improvement of the Institutions involved in the accreditation process. Accreditation process quantifies the strengths, weaknesses in the processes adopted by the Institution and provides directions and opportunities for future growth. . It also helps students determine acceptable institutions for enrolment.

V. Self-Assessment of Polytechnic

Self-assessment is often performed through a SWOT analysis. SWOT is an acronym for Strengths, Weaknesses, Opportunities and Threats; it refers to the internal strengths and weaknesses of an organization or institution, and the environmental opportunities and threats facing the organization. Ideally, an institution should build on its strengths, dilute its weaknesses, exploit the opportunities, and avoid the threats. [8]

After Std X, there are students who prefer to take a route which is more focused on their future academic goals. Students who are clear that they want to make a career in the engineering field start off early by enrolling in a polytechnic diploma right after STD X. The three-year diploma not only gives students a heads up in basics of engineering, but also makes them eligible for direct admission into second year of any engineering degree course. The status and quality of the polytechnics is a reflection of this state of affairs. Polytechnics began with a mandate to provide skilled workforce to a nation. However outdated curriculum, obsolete equipment, lack of practice based learning exposure, detached industry interaction have denied the polytechnics the status they should have enjoyed. SWOT analysis of a typical polytechnic student is done below:

VI. Swot Analysis of Polytechnic Student

A major challenge in using SWOT analysis is in identifying the position the institution actually is in. The value of the analysis does not rest solely on careful placement of an Institution in one particular cell. The SWOT analysis helps resolve one fundamental concern in selecting a strategy: What will be the principal purpose of the grand strategy? Is it to take advantage of a strong position or to overcome a weak one?

Strength Strong foundation for engineering courses Practical orientation (academics) Exposure to industry oriented projects. Trouble shooting capabilities. Graphical communication skills Field of specialization is decided at their tender age.	Opportunities Entrepreneurship Scope for Higher studies Easily employable Jobs in all industrial sectors Practical hands on experience.
Weakness Exposure to engineering mathematics is inadequate. Oral and written communication skills. Lack of analytical and quantitative skills Obsolescence Design capabilities Restricted only to certain domains.	Threats Without further skill development and higher education unable to move up the ladder in management. Quantitative expansion in technical education without simultaneous quality assurance. The inherent biases in Indian education system for degree courses.

VII. Role of Accreditation in Enhancing Quality and Skill Development in Students

The purpose of the accreditation by NBA is to promote and recognize excellence in technical education in colleges and universities—at both the undergraduate and post graduate levels. Institutions, students, employers, and the public at large all benefit from the external verification of quality provided through the NBA accreditation process. They also benefit from the process of continuous quality improvement that is encouraged by the NBA's developmental approach to promote excellence in technical education. [4] Earlier NBA was for input – output based accreditation, now it has switched over to outcome based accreditation. Outcome based education is student centered learning method that focus on measuring student performance i.e. outcomes. Outcomes may include a range of skills and knowledge.

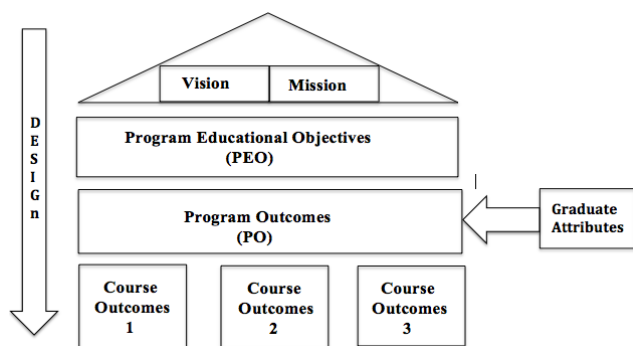


Fig 2: Key Constitutes of Outcome based Education

Vision is a futuristic statement that the institution /department would like to achieve over a long period of time. Mission statements are essentially the means to achieve the vision. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. Course outcomes identify what the learner will know and be able to do by the end of a course or program.

VIII. How it is Implemented

The NBA has evolved a framework of quality assurance containing a robust process ensuring highest degree of transparency and credibility - with little scope of discretion and subjectivity. [5]

Accreditation Criteria:

The criteria that are considered by NBA during the process of accreditation of a programme are determined by the NBA's definition of quality of programmes and its relevance to the profession concerned. These criteria are:

1. Institutional Mission, Vision and Programme, Educational Objectives
2. Programme Outcome
3. Programme Curriculum
4. Students' Performance
5. Faculty Contributions
6. Facilities and Technical Support
7. Academic Support Units and Teaching-Learning Process
8. Governance, Institutional Support and Financial Resources
9. Continuous Improvement in Attainment of Outcomes.

Accreditation Parameters :

The parameters adopted by NBA for accreditation of programmes are based on initial capabilities, competence, skills, etc. keeping in mind the outcomes desired by the profession concerned. These parameters are called Graduates Attributes and they vary from discipline to discipline and level to level. As an illustration, following are the Graduate Attributes for UG Engineering Programme:[5]

- a. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
- b. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- d. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- e. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- f. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
- g. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- h. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
 - i. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
 - j. Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
 - k. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- SAR:** Self-Assessment Report is the key element in accreditation. SAR allows:
1. Institution to evaluate itself and improve.
 2. Evaluators to proceed systematically.

IX. Case Study

A case study of Vidyalankar polytechnic, Wadala, Electronics & Telecommunication department is illustrated below. Vidyalankar was established in 1960 by Prof. Chandrashekhar S. Deshpande, a person blessed with extraordinary academic talent and immaculate engineering skills. Vidyalankar Polytechnic' mission is to provide an educational environment where students can reach their full potential in their chosen discipline and become responsible citizens without compromising in ethics and a scholarly environment where the talents of both, the faculty members and students are nurtured. The Vision of the institute is to establish a leading centre of imparting Quality Education in the field of Science, Technology and Management with emphasis on ensuring that students learn the fundamental concepts in various disciplines.[5]

Curriculum, assessment and evaluation are the major tools by which program outcomes are attained. Some of the measures and processes that have been implemented are detailed below.

- a. At the end of the semester, student feedback is taken for the quality of the course contents. This enables the Department to make proactive changes to successive courses.
- b. Preview meeting is conducted at the start of the semester to identify the gaps in the curriculum with H.O.D., Cluster head and Subject teachers. This curriculum gap is bypassed by taking content topics beyond syllabus and by arranging expert session for the students.[refer Table 1]
- c. The process to find gap and take action is done in accordance with the subject teachers, cluster head and HOD.

The department strives to achieve the set attainment. The target attainment for first year and second year students is set 2 and for final year is set 3.

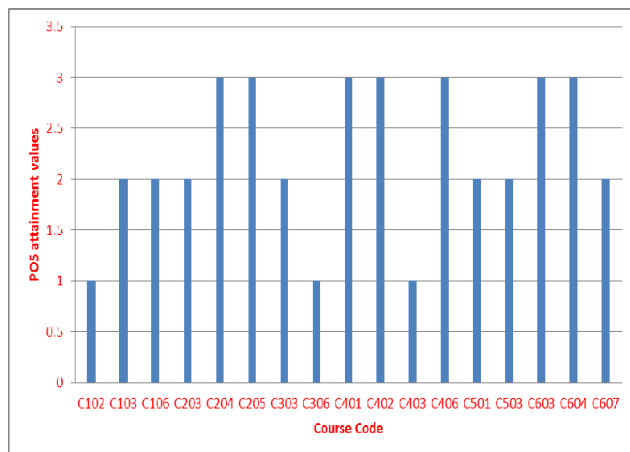
A sample bar graph for the year 2015-16 is selected. [Fig 3]. A review is done for the subjects having less set attainment. The following corrective action is taken for the academic year 2016-17. (The course code is defined with respect to MSBTE G-Scheme curriculum for Electronics & Telecommunication branch). [8]

1. The subjects are allocated well in time so that the faculty can prepare the course plan consisting of course delivery methods, assessment plan, assignment frequency. Regular monitoring is done by the HOD before commencement of the class. Weekly progress is monitored and reported to the principal.

Table 1

Sno.	Semester	Subject	Action taken
1.	III	Electronics Instruments and Measurements	Basic knowledge of OPAMP is required.
2.	V	Microcontroller	Basic knowledge of Microprocessor.
3.	V	Control System & PLC	Basic knowledge of Laplace Transform.
4.	V	Behavioral science	Basic knowledge of Communication skills.

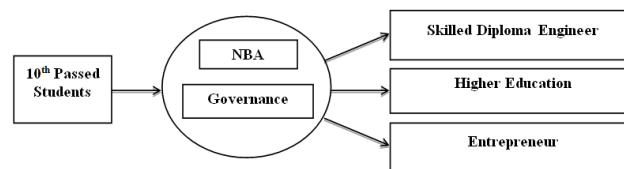
2. Examinations are planned and announced before the commencement of the semester classes. Question papers are set according to bloom's taxonomy and CO mapping is done. Evaluated answer scripts are returned within five days and weak students are monitored and mentored. The same is informed to the parents. By this process the course outcome attainment is monitored and simultaneously PO attainment is recorded.
3. Assignments are distributed evenly throughout the semester. They are given in different forms to develop in students their interpersonal skill, communication skill and presentation skills. It also develops their self-learning capability.
4. Micro projects and mini projects are made compulsory as part of the course delivery by which skill development is achieved.
5. Subject wise quiz is organized and conducted among the students of the class to develop the technical knowledge of the students & initiate healthy participation.
6. Assignments, quizzes and examinations contribute to assessing the students' ability to use fundamental concepts, quantitative, numerical and analytical skills.
7. Laboratory exams, mini projects and main projects contribute to the assessment of practical skills which reflect the ability of students to implement ideas and techniques.
8. Project reports, oral presentation and viva-voce contribute to the assessment of overall communication skills and dissemination of ideas.
9. These assessments are carried out periodically and hence allow the faculty members to monitor and provide attention to the students who may not be attaining the PO's to the required level.
10. This ensures that all students attain the minimum level of each program outcomes.



Graph : CO – PO attainment graph

X. Conclusion

Every engineering college and polytechnic should define their quality policy and articulate their commitment to achieve quality in all their activities and implement the policies energetically. Assessment reports offer important insights about the ways that accredited colleges and higher educational institutions benefit from accreditation and use the process to guide their future objectives. It might mean the difference between survival, and success and failure. The vision of the department is to provide valuable resources for industry and society through excellence in technical education and research. Keeping the trend of the institute's vision, mission and excellence with academics the department of electronics & telecommunication, VP aims at building the holistic life of students at large.



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