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Virtual Instrumentation of Some Characterized Biomaterials

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Abstract :

With improvement in novel bio functionalities of metal for biodegradable implants, it is with a confidence to say that the metals will continue to be used as biomaterials in the future. The methodology for characterization of biomaterial is the source of signal, Biomaterial sample and the response detector. The high frequency ultrasonic signal suitable for biomaterial characterization is made to fall on the biomaterial to be characterized. While passing through the biomaterial, the ultrasonic signals are absorbed, reflected and scattered along different directions. The transmitted and reflected received signals are sense and detect by receiving transducer. The sensor produces proportional current in microamperes. This current will be applied to sensing circuit, which converts current into proportional amplified voltage with the help of an Op-Amp. An Analog to Digital Converter (ADC) circuit converts analog signal into digital signal. This digital signal provides data to a computer. Data acquisition circuit interconnects the PC and driver software to which the input data is provided. Driver software makes NI LabVIEW to interact with hardware. The PC with LabVIEW platform and associated hardware is used for Virtual Instrumentation of characterized biomaterials.

Keywords – Op-Amp, Transducer, Biomaterials, Ultrasonic Velocity, NI LabVIEW, Virtual Instrumentation

introduction

With improvement in novel bio functionalities of metal for biodegradable implants, it is with a confidence to say that the metals will continue to be used as biomaterials in the future. The ultrasonic NDT technique is a versatile tool for the characterization of material. The main objective of this NDT technique is to certify that the sample material being examined is fit for the intended service. Ultrasonic investigation in biomaterials relies mainly on the study of behavior of wave propagation. The presented paper represents, Virtual Instrumentation of some characterized biomaterials. The work described here is carried out to improve accuracy and reliability of ultrasonic velocity and attenuation measurement in solid biomaterials, as well as to fulfill the need of Virtual instrumentation in biomedical industry. The developed system is dedicated for the measurement of ultrasonic velocity and attenuation relative to evaluation of properties for the biomaterials Aluminum, Copper, 316L Stainless steel and Cast Iron.

Ultrasonic velocity and attenuation measurements can be computed in biomaterials by knowing the distance traveled and time of flight of the signal. The ultrasonic velocity is very useful for determining several important material parameters and characterization of secondary

phases in microstructure. In order to study the small, important variations and high-resolution technique the ultrasonic velocity measurements are necessary [1].

Biomaterials

The biomaterials are highly demanded to assist or to replace organ functions and to improve patient's quality of life. Patients with several handicaps require new type biomaterials to improve his quality of life by recovering organs [2]. Materials which are used for structural applications in the field of medicine are known as Biomaterials. These materials are successfully used to replace damaged parts in human or animal bodies. These materials are able to function by remaining in intimate contact with the living tissues, with a minimum adverse reaction to the body. Sometimes, a single material cannot fulfill the complete requirement of specific application; in that case, a combination of more than one material is used. In ancient times, metals were used for orthopedic applications. Pure metals like Silver and Gold were used for different medical applications. In view of requirements of suitable materials for medical applications, the alloys such as 316L Stainless Steel and Ti-6Al-4V have been developed for orthopedic applications [3].

Orthopedic surgeons have been using metallic bone plates for the fixation of humerus bone fractures. Apparently, metallic prosthesis, which are generally made of Stainless Steel and Titanium alloys, cause some problems like metal incompatibility, corrosion, magnetism effect, anode-cathode reactions, including a decrease in bone mass, increase in bone porosity and delay in fracture healing. Implants used in medicine for bone osteosynthesis have to satisfy functional demands defined by the working environment of human body [4].

Type of metal used in biomedical depends on specific implant applications. 316L type stainless steel is still the most used alloy in all implants. The biomaterials which find immense applications in the field of medicine can be classified as, 1) Metals and alloys 2) Glass and glass–ceramics 3) Polymers 4) Composites.

The biomaterials used in our experiment are Aluminium, Copper, 316L Stainless Steel and Cast Iron.

Virtual Instrumentation

Virtual instrumentation uses mainstream computer technology combined with flexible software and high performance hardware technology to create powerful computer based instrumentation system. The objective in Virtual Instrumentation is to use a PC to mimic real instrument with their dedicated controls and displays with the added versatility that come with software. Virtual Instrumentation combines hardware and software with computer technology to create user defined instrumentation system.

Virtual instrument combines processing power of PC with flexible software for numerous measurements. Engineers and scientist can create user defined systems to meet their exact application needs. The virtual instrumentation can be realized using software like LabVIEW, VB, JAVA etc and DAQ card as per the application. LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a graphical programming environment language to design virtual instrument [5].

Manual analog methods used for measurements are tedious and time consuming. Thus without computer automation the necessary measurements for material property evaluation would certainly be impractical where speed, accuracy and economy is required [6]. The ultrasonic velocity measurements using the present PC based system are found to be precise and consistent. The instruments that were used for ultrasonic measurements are replaced by Virtual Instrumentation [7].

NI LabVIEW 2010

LabVIEW is an integral part of Virtual Instrumentation because it provides an easy-to-use application development environment designed specifically for engineer and scientist. LabVIEW offers powerful features that make it easy to connect to wide verity of hardware and software. One of the most powerful features that LabVIEW offers is graphical programming language.

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a graphical programming language written by National Instruments for the development of acquisition software that uses icons instead of lines of text to create programs. Its graphical nature makes it ideal for test and measurement, data acquisition, data analysis and instrument control applications. This results in significant result improvements over conventional programming languages. LabVIEW is an entirely graphical paradigm with the concepts of the block diagram and the front panel. LabVIEW, as a programming language, is a powerful tool that can be used to achieve our goals [8].

Ultrasonic attenuation and velocity in materials

Ultrasonic attenuation, velocity and their related parameters can be used to give insight into materials microstructures and associated physical properties. Behavior of ultrasonic attenuation and velocity as a function of physical parameters related to different physical condition is used to characterize the material during the processing as well as after production [9].

Velocity: To measure the ultrasound velocity in the sample, the formula is given by,

$V = D / T$ Where 'T' is the time elapsed between registering echoes [10]. Some of the non-destructive testing techniques, which have been used to characterize material properties, are ultrasonic testing, radiometry, magnetic methods, eddy current testing, Barkhaussen noise, Mossabuer spectroscopy etc. Ultrasonic Testing is the most preferred NDT technique for characterization of material properties [11].

For the measurement of ultrasonic velocity and attenuation in materials a number of techniques are used. Some of the standard techniques used for the measurement of ultrasonic velocity are: pulse-echo technique, sing-around technique and interferometer technique. The sing-around technique is more accurate for measurement of ultrasonic velocity. This can be described by Soitkar et.al. [2] The ultrasonic pulse-echo overlap technique is widely used for the ultrasonic velocity measurement, as it is accurate and versatile [12].

Basics of the system

In this system procedure is intended for 20 mm thick solid biomaterials. The surface is kept parallel to the direction of energy propagation and has been maintained parallel to at least 10°. Several possible modes of vibration can propagate in solids. This procedure is concerned

with velocity of longitudinal wave. The longitudinal velocity is independent of sample geometry when the dimensions at right angles to the beam are very large compared with beam area and wavelength. The ultrasonic testing system to be used in this work shall include the following apparatus.

Test Instrument—an ultrasonic instrument comprising a transmitter, receiver, and a data acquisition circuit to generate, receive, and display electrical signals related to ultrasonic waves. The equipment allows readings for the positions of 80mm & 180mm.

Search Unit— the search unit containing a transducer that generates and receives ultrasonic waves of an appropriate size, type and frequency, designed for tests by the contact method shall be used. Contact straight beam longitudinal mode shall be used for longitudinal velocity measurements.

Couplant – for longitudinal velocity measurements, the clean light –grade oil can be used as Couplant [13].

instrumentation
Working Principle

The frequency generator circuit generates a signal of 5MHz frequency. This signal is fed to transmitting transducer which is at one end of the measuring cell. At the same time in microcontroller system, controller generates the trigger with specific time & amplitude, this trigger goes on vary with respect to time & amplitude till receiver will not receive the signal. The trigger time & amplitude will be variable for different sample. As soon as the signal is received by the receiving transducer at another end the system measures the peak amplitude of T_X & R_x signal. This process will be carried for multiple attempts. In single attempt, wave count is also measure with respect to transmission, reception and hence also wave drop. Finally controller measure transition time for the wave. All these data will be recorded in DAQ for future use and to transmit to PC.

System Block Diagram
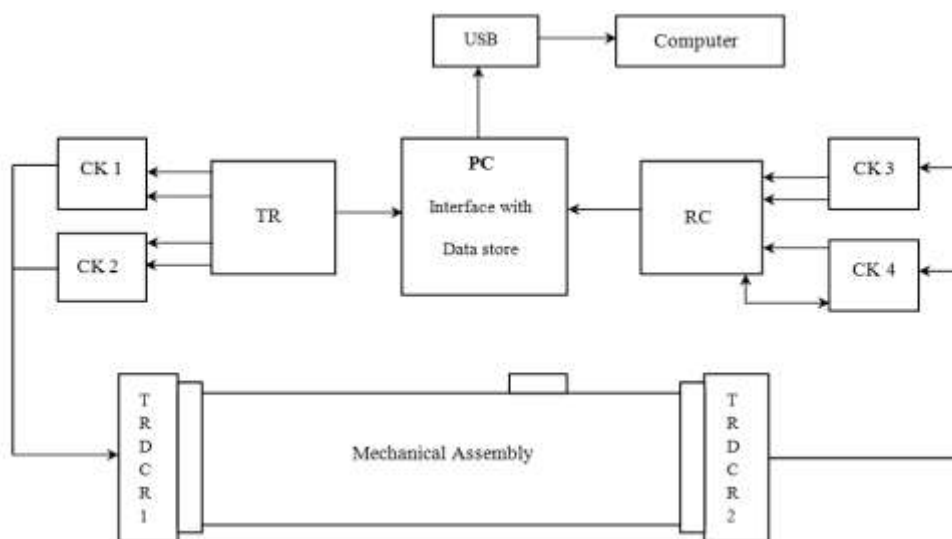
Figure 1: System Block Diagram

Block Diagram Description

The block diagram of the system is shown in Fig.1. The system consists of mechanical assembly embedded with a transducer pair. Receiver-transmitter circuits are also shown in support of two separate circuits each. Circuit 1 and circuit 3 are filter amplifier circuits while circuit 2 and circuit 4 are signal conditioner for the same. Receiver-Transmitter PCB's are interlinked to master PCB. Master controls all the triggering actions and also works for the data collections from the sub-circuits. Finally master interlinks the PC via USB driver as a part of data acquisition for virtual instrumentation for connectivity to LabVIEW.

circuit Diagram

Schematic block diagram of Master controller

Figure 2: Schematic block diagram of Master controller

In the block diagram shown in Fig. 2, TRMT and RCVR are the connections to the transmitter and receiver circuits respectively. ACTTRGR is the connection to active trigger for ultrasonic transducer while VT 123 and VT 456 are the voltage connections to monitor voltage parameters in the circuit. System interlinks to USB via PC connector. J2 is the connector for LCD which is used to display parameters. Other circuitry consists of oscillating and reset circuits for the microcontroller. Circuit consisting of IC U1 is the power regulator circuit for the master board.

At the other end of biomaterial sample the receiver circuit receives, modulates and filters the received ultrasonic signal. First amplification of the signal is performed then two stage filters removes the unwanted transients and finally this signal will be send to data acquisition device.

Measurement Technique :

For the measurement of ultrasonic velocity and attenuation, the transmitting transducer is firmly fixed at one end of the measuring cell while receiving transducer is fixed to movable end. The biomaterial sample is placed between two transducers. The ultrasonic velocity and attenuation measurements can be Computed and displayed on LCD display and on personal computer.

Figure 3 Measuring cell with associated circuit

Block Diagram: The block diagram of graphical programming code in LabVIEW
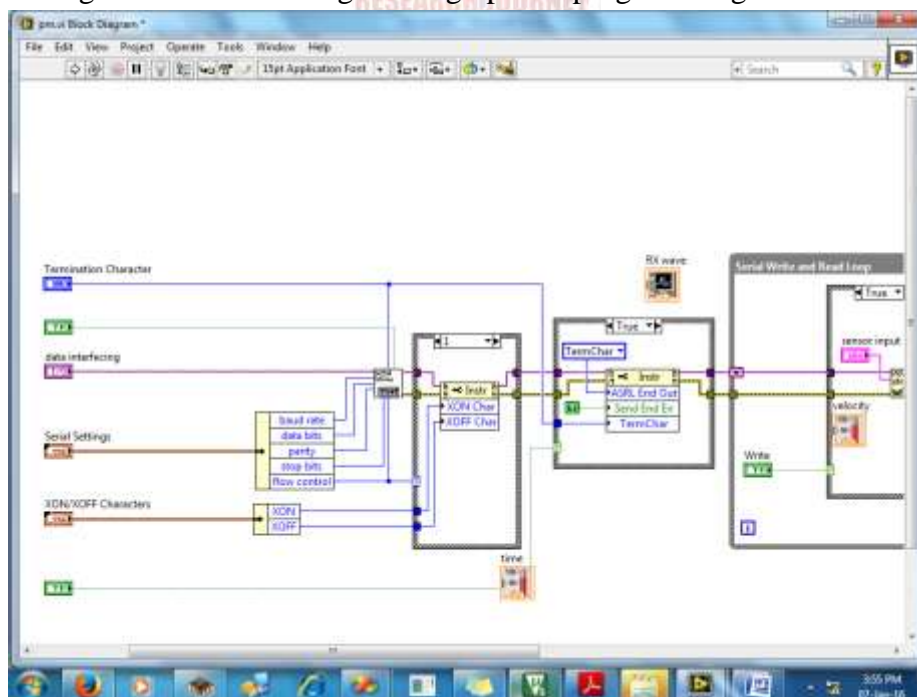
Figure 4: Screenshot showing the block diagram of the LabVIEW Program

Front Panel: All input and output status are available on front panel as shown in following Fig.5.
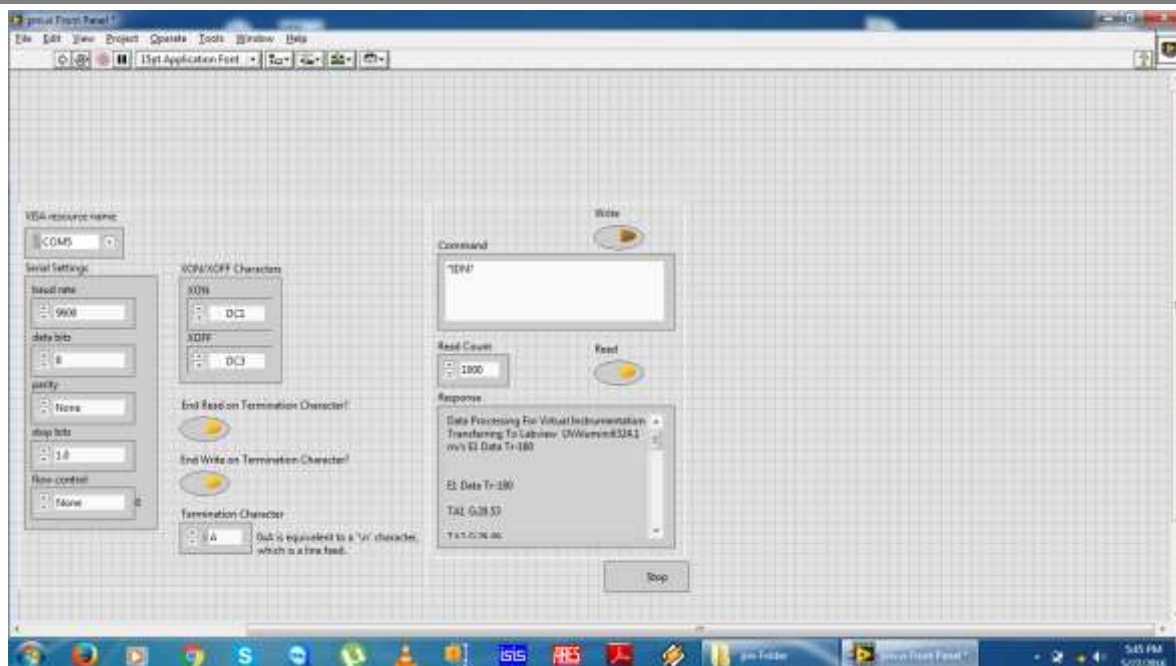
Figure 5: Screenshot showing the Virtual Instrument

Result And Discussions:

The system is checked by measuring the ultrasonic velocity and attenuation in different biomaterial samples at 5 MHz frequency. The distance between transmitting transducer and receiving transducer is kept 80mm and 180mm. Table 2: shows the comparison between the theoretical values and experimentally observed values of ultrasonic velocity in the biomaterial samples.

Table 1: Reference value of ultrasonic velocity in different materials [13]

Material	Longitudinal velocity in m/s
Aluminum	6300
316L Stainless Steel	5900
Copper	4700
Cast Iron	4200

Table 2: Ultrasonic velocity measurement at 5MHz

Element	d=180mm		d=80mm		Velocity(m/S)		Deviation		Average % Deviation
	Avg. time	Velocity (m/S)	Avg. time	Velocity (m/S)	Observed (Avg)	Theorotical	Value	Percentage	
Aluminium	28.51	6312.84	12.65	6324.11	6318.47	6300.00	-18.47	-0.29	0.07
SS316L	30.43	5915.86	13.62	5875.15	5895.51	5900.00	4.49	0.08	
Coppr	38.41	4685.87	17.12	4672.90	4679.39	4700.00	20.61	0.44	
CastIron	42.74	4211.18	19.12	4183.37	4197.28	4200.00	2.72	0.06	

Graphical Representation: The graphs shown below are obtained from observation table.
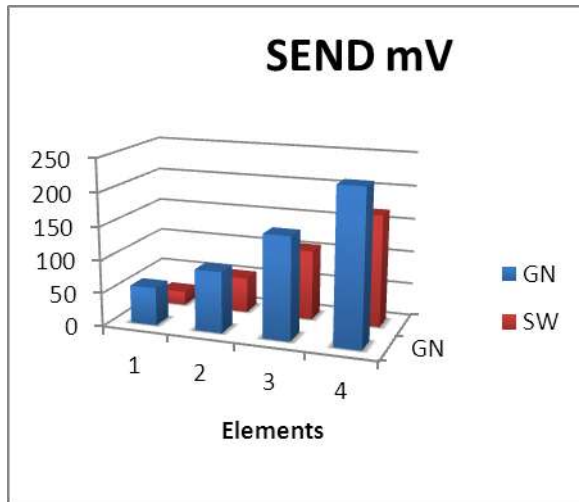
Figure 6: Graph between biomaterial elements and elements and   average sending signal amplitude. amplitude.
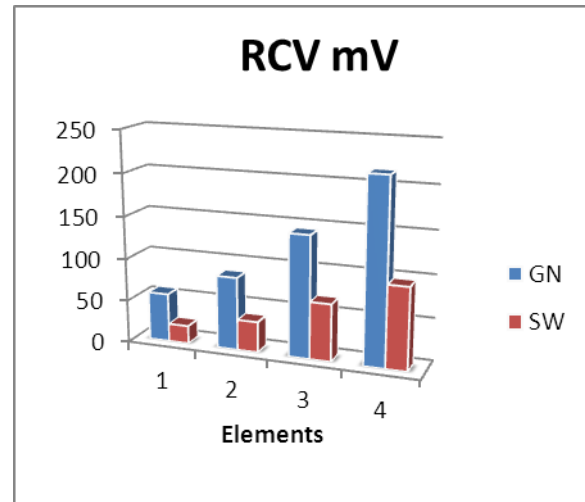
Figure 7: Graph between biomaterial average signal received

Conclusions:

The develop system has gained a lot of importance, as the data acquisition can be done for different biomaterials. Virtual Instrument mimics the traditional way of biomaterial characterization. From the table 2, it is observed that, the experimental observed values of ultrasonic velocity and attenuation at 5MHz frequency are in good agreement with the theoretical values. Moreover, it shows a very small deviation in the observed values with respect to theoretical values, which signify the high accuracy and reliability of the system. Hence it is conclude that the developed system shows good performance and can be used as Virtual Instrument for some characterized biomaterials.

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A High Performance Cmos 1 Bit full Adder

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Abstract:

One bit full adder cell is one of the most commonly used component in applications such as arithmetic logic unit (ALU), DSP architechture it is the essential functional unit of all computational circuit. Lots of researches has been done to improve the performance of full adder circuit design. In this paper,three different configurations of 1-bit full adder cell is compared and simulation has been done in cadence tool at 45nm gpdk CMOS technology.

Keywords-Low power, low delay10Tadder,11T adder,16T adder, Full Adder.

Introduction:

Recently electrical circuits call for low energy, excessive performance with decrease in area. The battery charge of the device dominates the entire value of the product. The product value may be minimized by means of extending the battery life through decrease in consumption of power without affecting performance.

Arithmetic operations are considerably used in every branch of VLSI like video processing, microprocessors, digital signal processing. The most commonly used arithmetic operations are addition, subtraction ,multiplication, division of two numbers. The 1-bit full-adder cell is the crucial and essential constructing block of the increasing the major performance parameters like speed and power consumption.

Methodology:

Design of full adder:

A and B are the inputs and Cin is the carry input, and Sum is total output and Cout is the carry output as shown in fig. 1.Equation 1 and 2 present input and output relation. Full adder is the combination of and, xor and or gates.

Sum $= A \oplus B \oplus Cin$……….(1)

Cout $= (A \oplus B)Cin+AB$…...(2)

Power consumption in VLSI Circuits:

The two types of power consumption in CMOS circuits are static and dynamic power consumption.

Static power consumption: Power consumed when the transistor is in stable level, it is due to leakage currents.

$$I_{leakage} = i_s(e^{\frac{qV}{kT}} - 1) \qquad \text{…(3)}$$

$$Static\ Power = \sum(I_{leakage} * Supply\ voltage) \qquad \text{…(4)}$$

Dynamic power consumption:

Power consumed due to charging and discharging of capacitors (both load and internal) during switching of states. At high frequency switching the dynamic power consumption will contribute the majority of power.

Transient power consumption can be calculated by the following equation.

$$P_T = C_{pd} * V_{cc}^2 * f_i * N_{sw} \qquad \dots(5)$$

Capacitive load power consumption

$$P_l = C_l * V_{cc}^2 * f_o * N_{sw} \qquad \dots(6)$$

C_l is the load capacitance per output

Total dynamic power

$$P_d = P_T + P_l \qquad \dots(7)$$
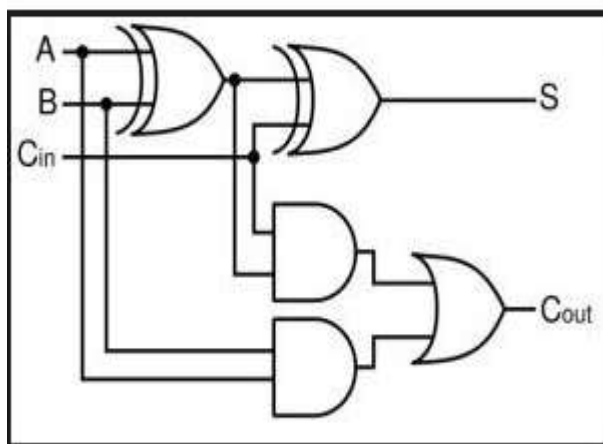
Fig.1 General form of XOR based full adder.

Two 1-bit Adder Cells

10T : Fig.2 shows the schematic of 10T 1 bit full adder circuit. It is realized using nmos and pmos.In this it contains and, or and xor gates. In this three Vpulse input is given for A, B and Cin inputs with some fall time and rise time. Supply is dc voltage source. In this the circuit consists of simple full adder design from half adder. The output transient response of sum and carry output is shown in fig.3.The leakage power can be taken from direct plot and average power consumption and delay can be calculated using calculator in Cadence.

11T : Fig.4 shows the schematic of 11T 1 bit full adder cell. In this it contains an extra nmos that is used to pull down the transistor to zero preventing it from getting on unnecessarily. This contains three Vpulse inputs for A, B and Cin .Supply voltage is given 1.8V dc supply. The output transient response is taken from sum and carry outputs which is confirmed with the truth table of full adder.
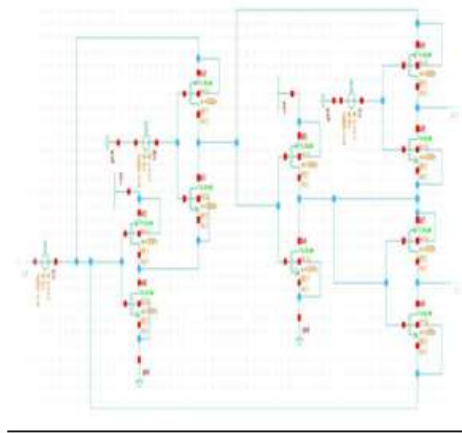
Fig 2. Schematic of 10T 1 bit full adder cell. full adder
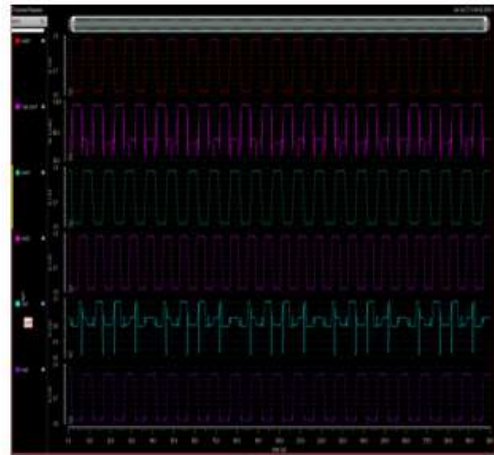
Fig 3. Transient analysis of 10T 1bit
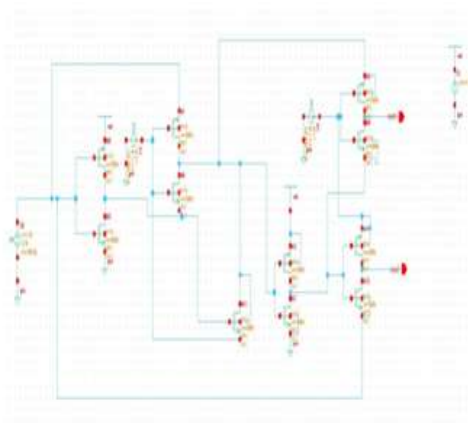
Fig 4. Schematic of 11T 1 bit full adder cell.
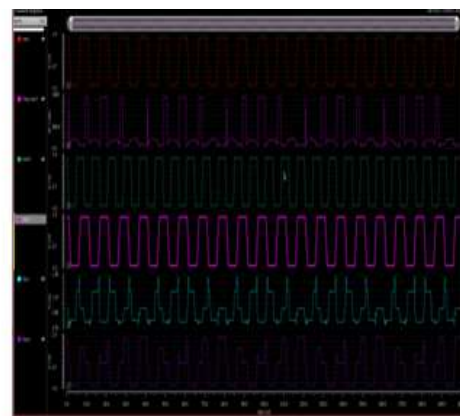
Fig 5. Transient analysis of 11T 1bit full adder

Results and Discussion:

Table 1. Comparison of delay, average power and leakage power between different number transistors

Transistors	Delay (ps)	Average Power(uw)	Leakage Power(uw)
10T	975	74.02	28.62
11T	983	259.7	31.34

Manoharan K et all[1] said that the stability of the circuit can be influenced by the low noise margin directly. A novel 4T XOR gate design has been proposed to overcome the problem. Dan Wang, Maofeng Yang [2] have proposed a futuristic design of four different low power adder cells. For this implementation they have used different XOR and XNOR gate architectures.

Amit Dubey et all [3] have concluded a design of very low complexity full adder design which needs lower voltages to operate and efficient in energy consumption.

Umashankar Dhepra et all[4] proposed the comparision of four full adder designs made up of different number of transistors 10T 11T 14T and 16T. Each of them are compared and various techniques are used to reduce the leakage power.

Conclusion:

The implemented 1-bit full-adder cells use the XOR and AND function, transmission gates, and pass transistors in the design. Low power consumption is the main aim at design level. We compared delay,average power and leakage power of 10T,11T,16T transistors. It is observed that 10T consumes low power than 11T and 16T. Delay of 16T is less than 10T and 11T.

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Efficient Smart Waste Management System With Multifunction Embedded Controller

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Abstract:

In these days of e-Waste management, for convenient monitoring of real time parameters, the wireless communication technique is necessary. There are some standard techniques such as Bluetooth, wireless LAN, Zigbee etc. used in the recording of data details. We have tested these techniques for dustbin level details networking and summarize the advantages and the disadvantages. As a result we decided the GSM-GPRS radio as sensor network of dustbin in the corporation locality. We developed this dustbin monitoring system which has several level parameters. Especially, this system has ability of dustbin parameter monitoring in the remote areas. In this project in order to record dustbin details repeatedly we using RFID tags which shows complete profile of the dustbin sensing parameters. Whenever dustbin expose, their cards in a RFID field, complete details are measured by embedded system and will transfer to centralized health administrator of corporation to analyzed dustbin level scenario.

Introduction

Waste management is an important requirement for ecologically sustainable development in many countries. Efficient sorting of waste is a major issue in today's society. In Europe, the consumer society has led to an ever increasing production of waste [1]. This is a consequence of the consumer's behavior, and worsened by packaging. In [2], it is shown, that the production of waste reaches almost 1.2 kg/day/inhabitant in Western Europe. Paradoxically, the same consumers in India who are very sensitive to environmental protection are often reluctant when it comes to have more land-filing or more incinerators.

Therefore, waste should be disposed and treated properly to reduce environmental impact. Waste management services are becoming an important market, for which the waste collection process is a critical aspect for the service providers [3], [4]. The main goals are the following:
1) Reducing waste production
2) Ensuring that wastes are properly disposed
3) Recycling and re-using disposed products

To achieve these goals, regulations and taxes are being implemented to favor virtuous behaviors. In particular, to reduce the production of waste, there is an increasing trend towards individual billing, where people are charged depending on waste quantity disposed. Selective sorting is another approach, which is often implemented to improve recycling and reduce the environment impact. The importance of resources and energy saving is another argument to manufacture recyclable materials.

The sorting of wastes must be implemented as early as possible in the chain to increase the quantity of valuable recyclable materials. The use of pervasive computing technology such as Radio Frequency Identification (RFID), and sensor networks offer a new way to optimize the waste management systems.

In recent years, we have seen increasing adoption of the radio-frequency identification (RFID) technology in many application domains, such as logistic, inventory, public transportation and security. Essentially, RFID makes it possible to read digital information from one or several objects using a reader at proximity of the objects, enabling automatic identification, tracking, checking of properties, etc. It is predicated that RFID could replace barcode and attached to most products by manufacturers and/or retailers. In this perspective, RFID would be an important opportunity for waste management, as RFID tags could be used to improve current waste management processes.

This paper proposes a method to improve the quality of selective sorting. This approach is based on local interactions to track the waste flow of a city. Each waste is detected by information properties stored in a RFID tag associated to it. At each step where wastes are to be processed the RFID tags are read in order to provide the relevant information. This process improves the sorting quality of recyclable products. We assume organic wastes products are not recycled and hence RFID tags are not attached to it.

Without using an external information system, RFID can improve the selective sorting quality. The information stored in each tag associated to a waste can be used to help the user in the sorting process, and to analyze the content of a bin.

Methodology

In our city many times we see that the garbage bins or dustbins placed at public places are overflowing. It creates unhygienic conditions for people. Also it creates ugliness to that place. At the same time bad smell is also spread.
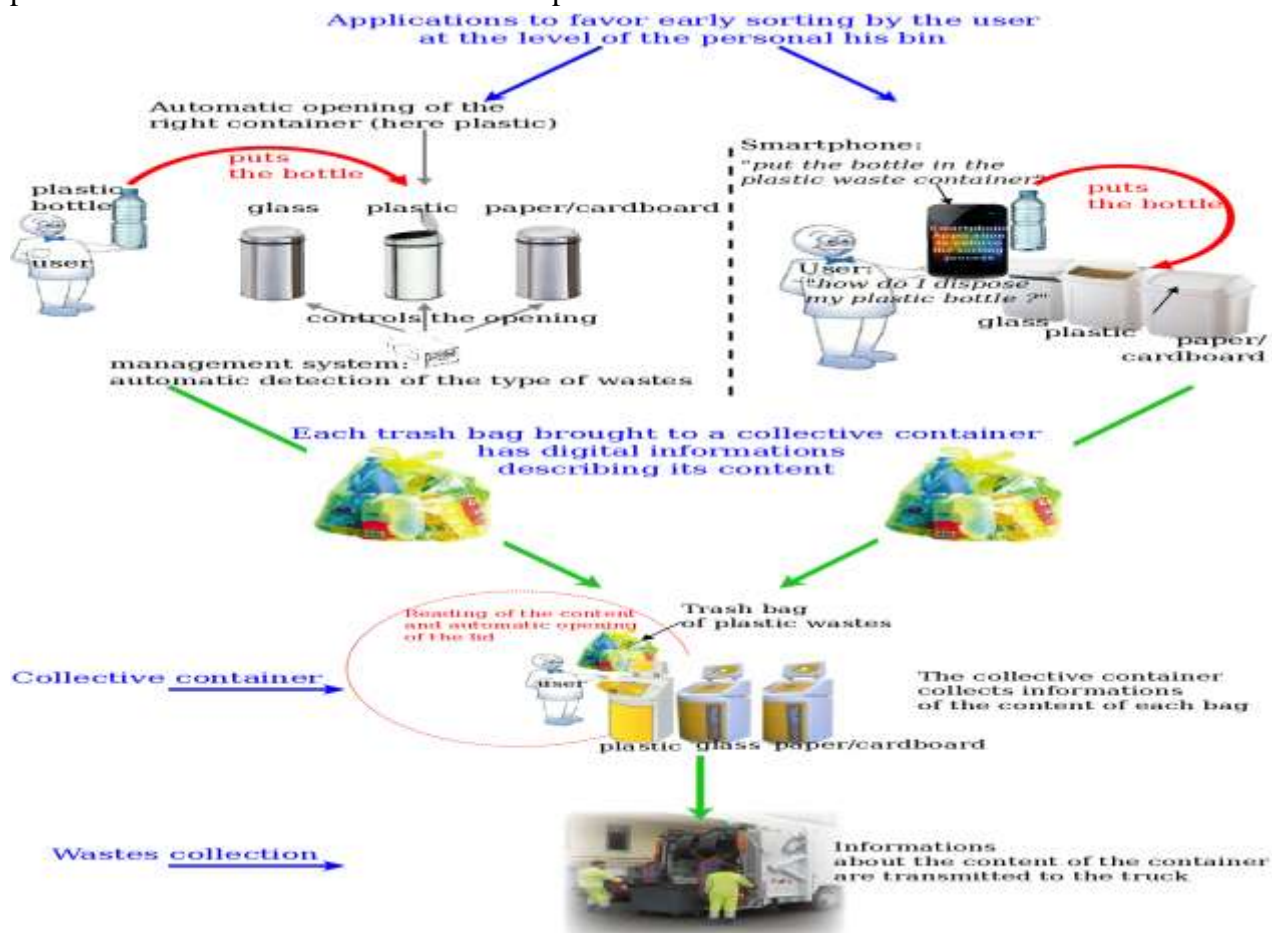
To avoid all such situations we are going to implement a project called Garbage collection bin overflow indicator using GSM technology. In this project we are going to place ultrasonic sensors at the top as well as bottom of the dustbin. When the garbage in the dustbin reaches to the top level, it will be detected by ultrasonic sensor and a sms will be sent to the respective Municipal / Government authority person. Then that person can send the collection vehicle to collect the full garbage bins or dustbins.

We have observed that the municipal officer or the government authorized person will monitor the status of dustbin. Or generally we see that they have a regular schedule of picking up these garbage bins or dustbins. This schedule varies as per the population of that place. It can be once in a day or twice in a day or in some cases once in two days. However we see that in case there is some festival or some function, lots of garbage material is generated by people in that particular area. In such cases the garbage dustbin gets immediately full and then it overflows which creates many problems. So in situations, with help of our project the government authority person can get SMS immediately. So they will get SMS before their periodic interval visit of picking up the dustbin. Then they can go and pick up the dustbins.

A Embedded Hardware Approach:
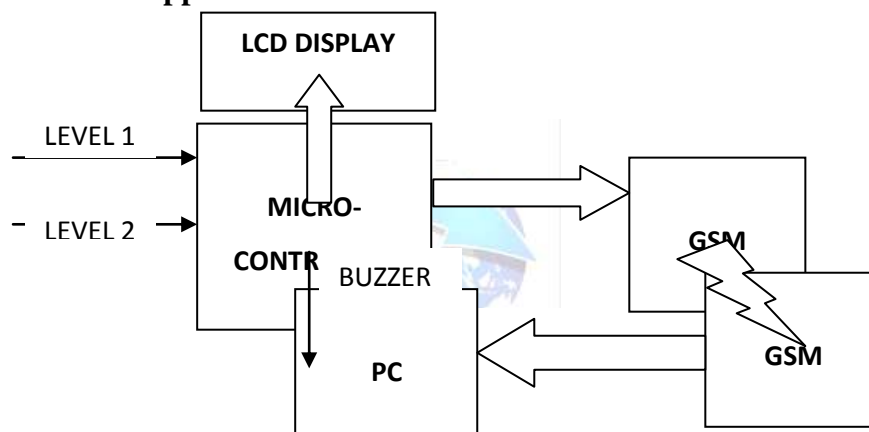
Fig: Block diagram of the System

Working In Detail:
Following are the important blocks of this system
1) Ultrasonic sensor: We have used ultrasonic sensors as a level Sensors. The detected output data is transformed into equivalent electrical signal.
2) Microcontroller: This is the CPU (central processing unit) of our project. We are going to use a microcontroller of PIC family. The various functions of microcontroller are like:
I. Reading input signals from weight sensor
II. Sending this data to LCD so that the person operating this project should understand the status.
III. When ultrasonic sensor detects maximum garbage level, sends the data to GSM modem using serial port.
3) LCD: We have used 16×2 alphanumeric Liquid Crystal Display (LCD) which means it can display alphabets along with numbers on 2 lines each containing 16 characters.
4) Buzzer: We are going to use a buzzer to indicate the over limit condition.

General Hardware Blocks:-
This project contains the key component like

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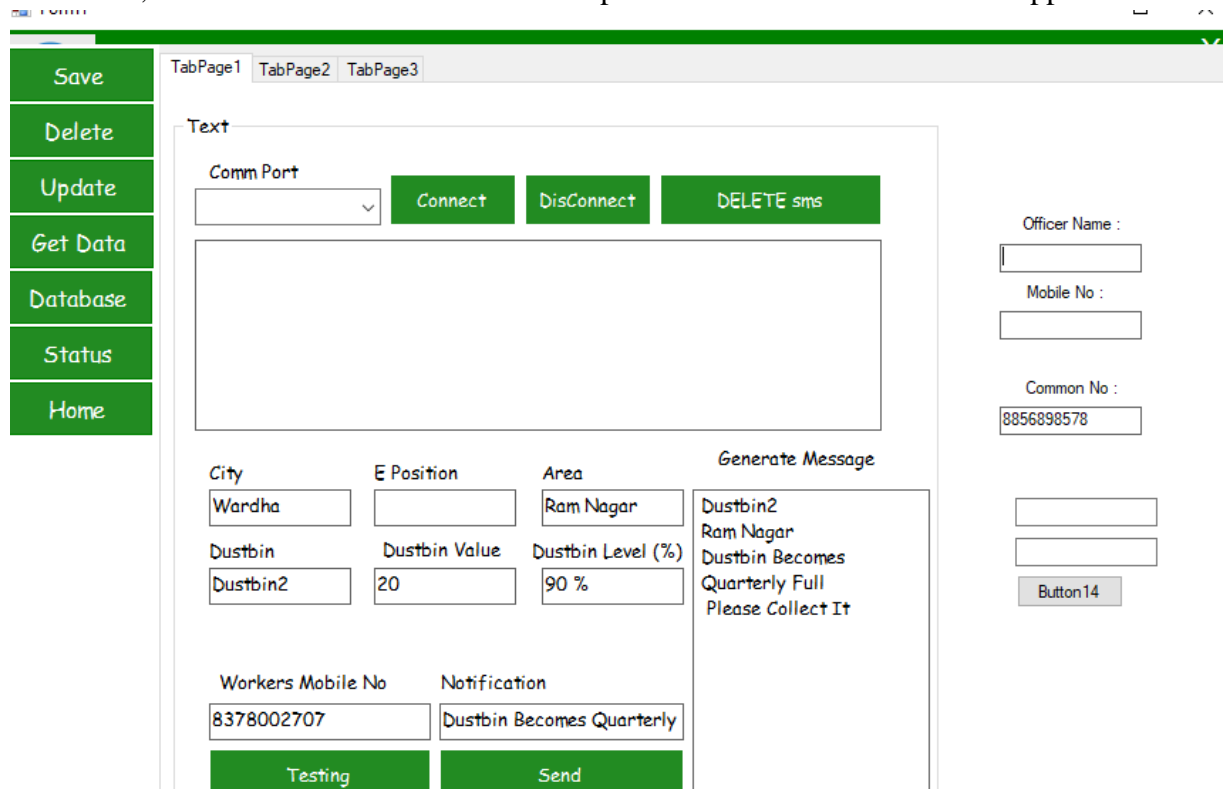
1. Power supply unit
2. ultrasonic Sensor
3. GSM
4. LCD
5. Microcontroller
6. Transistor
7. Resistor
8. Capacitor
9. Crystal Oscillator

Software System Designs:

One of the transmitter units is dustbin unit. Receiver unit includes GSM transreceiver and computer with V.B software installed.

In this setup, GSM is used as source of information to admin from dustbin. GSM is duplex unit and capable of transferring data as well as voice. Parameters of dustbin measured in location are received by GSM receiver with delay of 60 sec. These parameters should be displayed on screen, so GSM has accompanied with computer having V.B. program, which is compatible for storing and displaying received data in appropriate form which is very user friendly. In this, we are using stack for storing received data. After every 60sec interval, data get updated and displayed on monitor. According to displayed data, appropriate action required can be suggested via message or call. As process of typing a message and sending it, is very time consumable, call back is preferred. So we are using GSM unit in simplex mode, so as to avoid its time restrictions.

So, at health office unit GSM and computer fulfill the need of receiver application.

Future Development For The Project:

We can add GPS modem to this project. This will help to track the position in case there are more dustbins.In this project, we propose a new solution to enhance waste collection efficiency using the RFID technology. Fully relying on digital information attached to waste items, this approach does not require any sensor, nor external information system support, enabling high scalability and availability. The presented system helps the user in correctly sorting and disposing wastes.

Regarding the waste sorting support, the user is oriented to the correct container to dispose the waste, and is helped in case of errors. Another contribution of this system is to be able to report the content of a bin. This information is useful to waste processing operators, for example to optimize waste collection scheduling, or to set up a special handling when an undesirable product is detected somewhere.

The reported information about the content of each bin is also a way to compute statistics of each type of waste in the recycling process. The smart bins can precisely determine the quantity of each type of waste produces by a household. It should help people to contribute to a more efficient sorting of waste, and reuse valuable materials. By considering the value of wastes produced by each household, it becomes possible to make a retributive incentive system to encourage each user to make the selective sorting of its wastes.

This approach can also help to better plan waste collection and special intervention by operators in case of a normal condition. The latter feature is based on an ambient communication infrastructure, which we do not describe here.

Conclusion:

In This research we have focused to develop an optimized microcontroller-based architecture for REAL TIME multi-purpose wireless dustbin system based on GPRS wireless data transceiver. It has the capability to monitor dustbin signals from multiple level sensors by means of different communication standards. Its capability has been tested through standard with enhanced user graphical interface to visualize and monitor the progress of multi-sensors' curves concurrency in real-time. In addition, we have developed a GPRS ready compliant wireless system that offer low power consumption, low cost and advanced network configuration possibilities. Its reliability has been measured and proved through experimental results related to the bit error rate measurement. Hence, an affordable transmitting power level has been chosen in order to reduce the power consumption and save the energy. This work can further shows the success of our proof-of-concept study for real-time efficient public utility evaluation prototype. For this purpose, and in addition to the use of higher transmission frequency for the real implantable system, our future work can be concentrated on a comparative study between UHF, GPS and WiFi wireless data link system to evaluate the most adequate wireless link to be compliant with such a biomedical care systems.

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Characterists of Electronic Transducer in Biomedical Instruments

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Abstract:

l instruments various transducers are used for measurements of various physiological parameters. The biomedical system cannot be designed until and unless proper transducer is selected for measuring physiological parameters. The present scenario of transducers in biomedical instruments is discussed in this paper. The various researchers had used different methods of measurements of body temperature. Some of these methods are discussed in this paper. The researcher has designed body temperature measuring transducer using UJT time base circuit, thermister and LDR. The designing technique of the transducer is discussed in this paper. The F-T characteristic of this transducer is[1] plotted and the performance of transducer is compared with existing transducers used in the instruments for the purpose.

Introduction:

Biomedical instruments have been developed in various stages. Old biomedical instruments, constructed by transducer/sensor worked on the principle of analog type (resistive, capacitive, and inductive). The ac or dc amplifiers constructed by the transistors was used to manipulate the output of the sensors/transducers. The analog meter (D'Arsonal movement), graph plotter, indicator were used to display or record of physical signal.

Research in the electronics field has developed biomedical instruments, stage-wise. The ac or dc amplifier has been replaced by operational amplifier, which is found suitable to detect even weak signals from the body. The advanced display system like Cathode Ray Oscilloscope (CRO), digital display, LED, LCD etc. have been used to display or record.

data either in form of waveform or digital display. The microprocessor, microcontroller and personal computer provide intelligence to biomedical instruments. Advanced biomedical instruments with their functional blocks are shown in Fig. 1.
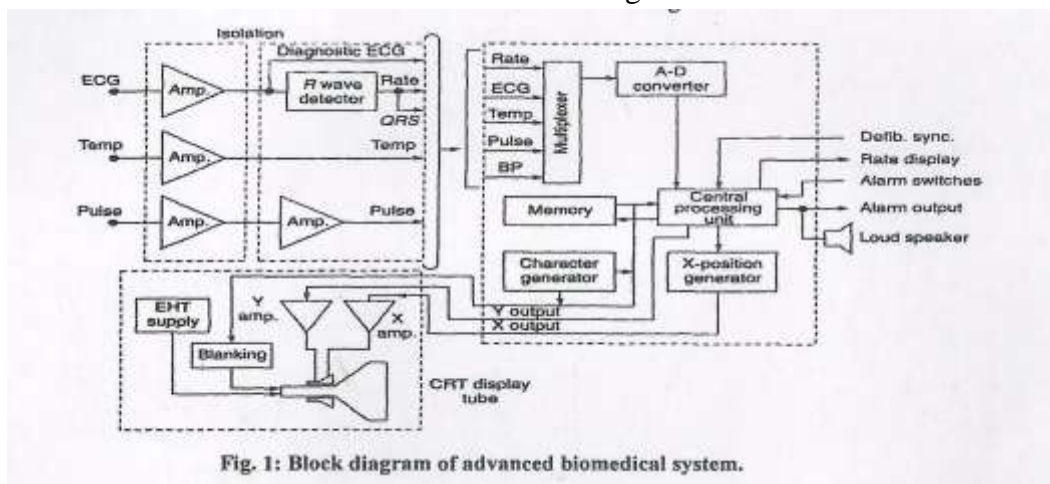
Fig. 1: Block diagram of advanced biomedical system.

Sensors/Transducers In Biomedical Instruments-Present Scenario;

Advanced biomedical instruments function better than old ones only when new technology has been employed in the sensing part of biomedical instruments. This requirement has been fulfilled by reviewing the various technologies of sensors/transducers used in biomedical instruments for sensing physical activities of the body. Various physiological parameters have to be measured as such as body temperature, blood pressure by direct and indirect method, blood flow, cardiac output, heart rate, phonocardiogram, impedance cardiogram, respiration rate, tidal volume, and gases in expired air, diffusion of inspired gases during the treatment of patient in clinics or hospitals. The researcher has attempted to develop the biomedical instruments for body temperature measurement. Therefore, it was important to know the various methods for body temperature measurement. The biomedical system cannot be developed until and unless the proper sensors/transducers cannot be selected to measure the physiological parameter in biomedical system, which has been developed by the researcher.

Methods of Measurement for Body Temperature in Biomedical Instruments;
Temperature of human body:-

Thermal behavior of biological material, particularly living tissue depends on passive or intrinsic property and active response of the biological system to thermal stimuli. The intrinsic thermal physical properties influencing heat transfer in biological material are the same as those in any other material, thermal conductivity, diffusivity, and specific heat. The magnitude of these properties tends to be quite variable not only in the body but also within the same tissue. These properties are directly dependent upon the inherent inaccuracies in the thermal calculation of living tissue. The physical parameters observed from tissue of human body are temperature, heat, fat and movement. Temperature of living tissue is a measure of tendency of the body to transfer heat from one body part to other. The average normal body temperature is in the range of 37°C to 41 °C and it remains almost constant with ±0.6°C for healthy person. In normal condition, it is generally considered to be 37°C.

Existing temperature measuring system for human body:-!.

The body temperature is measured by expansion of mercury (Hg) in a glass capillary. Calibration and conversion was required for measurement of temperature, which is a difficult task.

Thermocouple is a junction of two different material wires, which is formed by two or more junctions. One junction is cold or reference junction (kept at 0°C) and other junction is hot or measuring junction. Thermo electromotive force (emf) generated across wire is developed current in the circuit. The emf generation range is in mill volt with resrjeet to temperature Copper-constant. A combination of thermocouples is preferred for medical application. In this construction, a one junction is kept at 0°C while other is kept at 37°C. An ice bath is used to maintain constant temperature, which is a major drawback in measuring system.

The temperature dependence of resistance of certain metals (platinum or nickel) makes it convenient to construct temperature transducer for biomedical instruments. Most of the metal resistance depends on temperature. Thermometer constructed from coil of the metals is used for skin, rectal and oesophageal temperature measurement. The coefficient of receptivity of platinum is 0.004 ohm/°C. Practically the measurement of resistance with respect to temperature is quite

difficult because circuit resistance and electrochemical changes affect the resistance of metal during measurement. The temperature coefficient is very small.

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4. Thermistors: -

Thermistors are the oxides of certain metals like manganese, cobalt, nickel which have large negative temperature coefficient (NTC) of resistance. The sensitivity is about 4% change In resistance per degree. This device Is a better solution for the measurement of temperature in medical applications. However a major disadvantage observed here is that, the resistance of thermistor are exponentially changes with respect to temperature. In a temperature-measuring instrument, resistance should change linearly with respect to temperature. The thermistor is a better solution for sensing of temperature, but its characteristic has to linearized by some technique. The researcher has proposed the technique for linearization of characteristic of thermistor.

Study orrime-based oscillating circuit in quick recoverv sensors^

The pulses are developed across capacitor C_E, RBI and Rg2- The voltage-time signals across RBI, RBI and C_E during the continued time interval, are shown in (Fig. 2) during charging and discharging action of C_E.
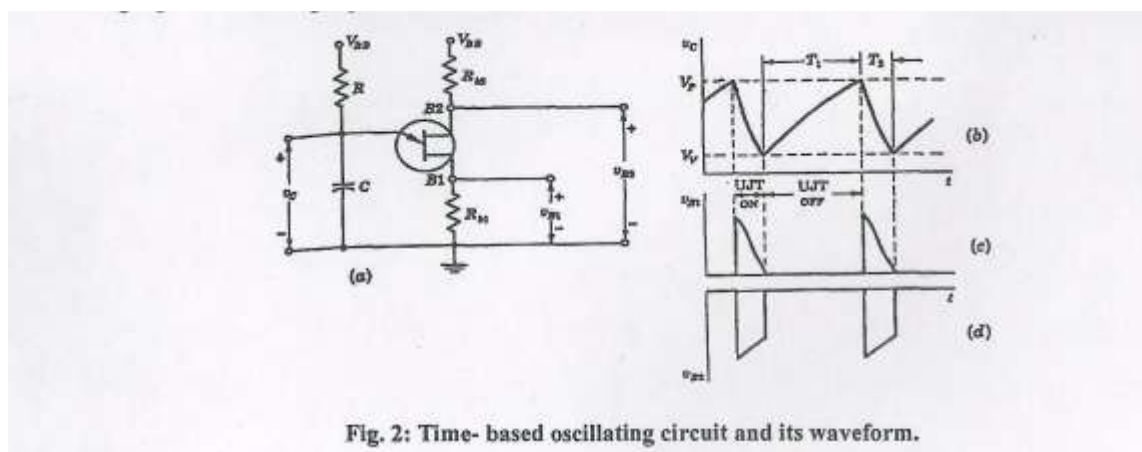
Fig. 2: Time- based oscillating circuit and its waveform.

The pulses at the base BI is an abrupt leading edge, but the anticipated drop at the trailing edge may not be easily apparent charging the holding current, which is small in comparison with the current at the moment of breakdown. The Ie2 current is smaller because the Base current IBI is equals the emitter current. lea is nearly constant during the capacitor discharge. The linearity of the waveform may be obtained by feedback methods.

Studies of Thermistor Characteristics:

Another type of thermal resistor (the thermistor) is made of evaporated films, carbon or carbon compositions, or eeramic-like semiconductors formed of oxides of copper, cobalt, manganese, magnesium, nickel, titanium or uranium. Unlike the basic RTD device, thermistors can be molded or compressed into a variety of clever shapes to fit a wide range of applications. These devices have a resistance change characteristic of 4 to 6%/°C with generally a negative temperature coefficient. Special classes of thermistor, called posistors, which are made of barium

titanate or strontium titanate ceramics, have a positive temperature coefficient. Positive temperature coefficients are also found in silicon thermistors in which the Si semiconductor is doped to a density of about $10^{16}/cm^3$. The resistance vs. temperature characteristic of thermister is non linear in certain part of its range.

Studies of Light Dependent Resistor (LDR) Characteristics:

Optoelectronic devices generate electric current when they are subjected by light energy. The optoelectronic devices include photoconductive device, photodiodes, phototransistors, LEDs and injection laser diodes etc. These devices operate when they are subjected to optical irradiation. The semiconductor material such as silicon and germanium cannot be used to construct a photoconductive cell. The most commonly used compounds are cadmium sulphide (CdS), cadmium selenide and cadmium telluride. CdS is mostly used photoconductive material. Photoconductive cell is bulk device rather than junction device and it does not have any semiconductor junction. Photoconductor is commercially known as light dependent resistor (LDR). The photoconductive material CdS is deposited on a cylindrical ceramic base in a zigzag fashion. This construction adopted to increase the area of the CdS so that its resistance value can be controlled with light exposed on the surface. Metal contacts are formed at the end points of the zigzag structure from, which external leads are taken out. L-R characteristics of photoconductive cell show exponential decay in the resistance with respect to light intensity (light flux in lumens).

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Design Techniques Of Quick Recovery Temperature **Transducers**

Time based oscillating circuit; thermister, LED, and LDR may be used in designing the quick recovery temperature sensors. In the present study QRTS is designed by time based oscillating circuit and temperature sensing components as thermister. The thermister has been selected in a probe shape to measure surface temperature of the body easily. In time base oscillating circuit, the emitter resistance RE is replaced by thermister resistance RT. Before replacing emitter resistance by thermister resistance, it has been observed that output of sweep signals of the time base oscillating circuit depends on RE. The capacitor Cehas been chosen with fixed value to produce constant frequency of sweep signal. The resistor RE has been chosen to get the frequency of output signal in the frequency range of 200Hz to 300 Hz. It has been observed that the R-T (resistance-temperature) curve of thermister is mostly nonlinear in the range of medical temperature measurements. The graphs have been plotted between temperature sensed by thermister and the frequency of output sweep signal. F-T characteristics of QRTS are shown in figure-3. This characteristic has been plotted with rise (24 to 48 degree centigrade) and decay (48 to 24 degree centigrade) of temperatures. Accuracy has been achieved in the measurement of temperature with rise and decay of temperature and by repeating the experiment for four times.
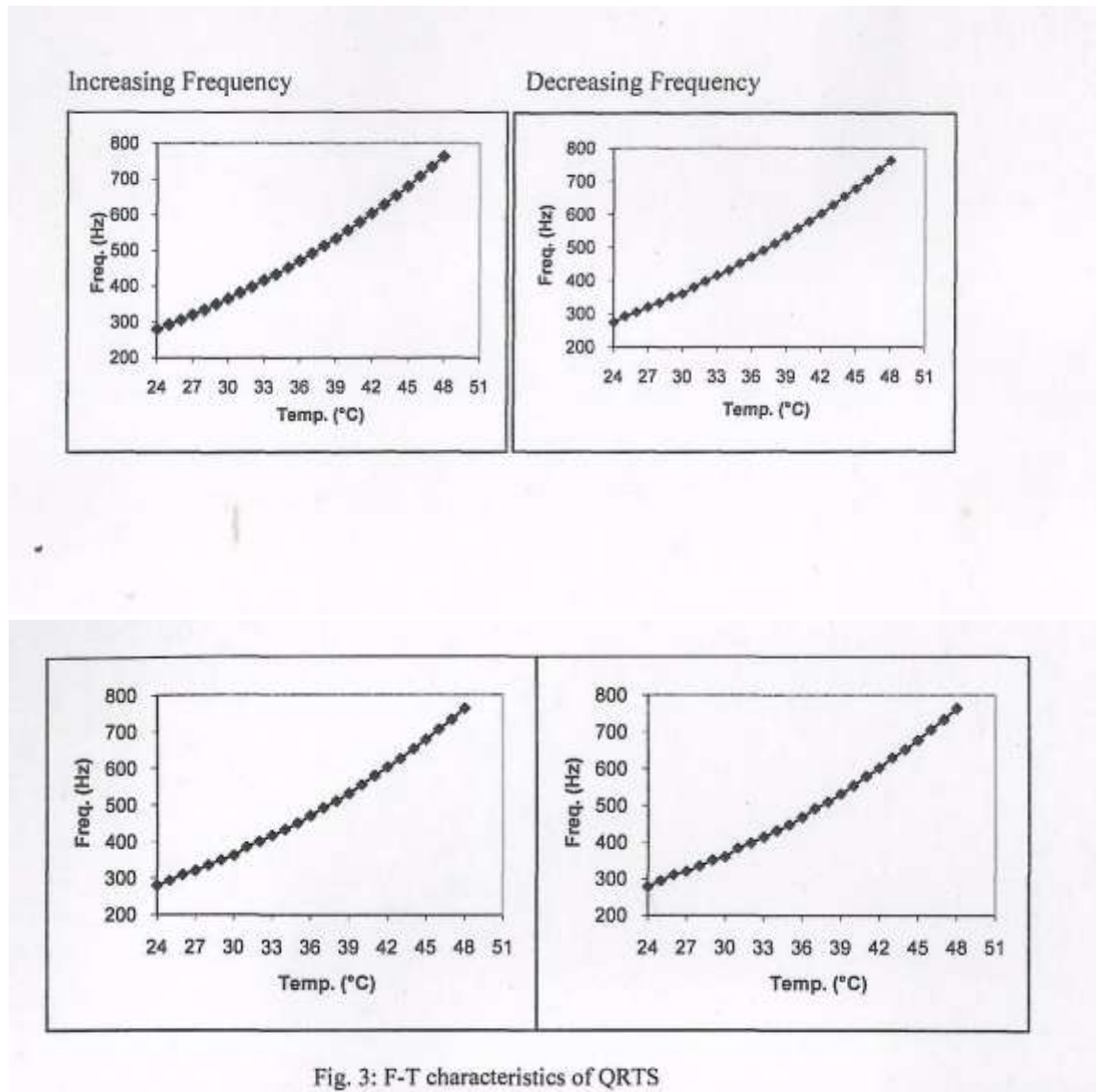
Fig. 3: F-T characteristics of QRTS

Analysis & Results:

The QRTS transducer is designed by researcher for body temperature measurements by producing frequency output in the range of 200 Hz to 800 Hz which changes linearly with respect to change in temperature. The frequency output of QRTS is easily digitalized as compared to existing senor output.

The variation of output sweep signal frequency is linear in the body temperature range and QRTS is most useful for body temperature measurements in comparison to existing sensors studied by researcher.

The sensitivity is measured about 12 Hz per degree centigrade. The sensitivity is very good as compared to existing sensors studied by researcher.

QRTS is constructed by semiconductor components. It could be fabricated as a compact sensor by integrated technology. The smart sensor technique is popular now a day in designing of sensors/transducers to measure physiological parameters in biomedical instruments. QRTS could also constructed by SST for embedded biomedical instruments to measure body temperature.

QRTS is low cost, simple in construction and easy to operate with low power.

Researcher has found the response of QRTS is similar when compared with existing sensors used in body temperature measurements.

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Use of AINN Filters for Reduction of Noise from ECG Signals

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Abstract—
The leading cause of death in the world is the heart attack. Therefore it is very important to know the facts about heart. ECG is the collection of electrical signal acquired from the heart of human body. But these signals are affected due to noise and artifacts. The noise included inherent noise in Electronic equipments, ambient noise, motion artifacts, power line interference, base line drift, electrosurgical noise and inherent instability of signal. By using conventional methods, it is very difficult to reduce the noise from biomedical signal. Therefore different methodologies are used to remove noise and artifacts. This paper describes the AI filters which are used to reduce noise from ECG signals.

Keywords- Adaptive filter, Ainn, Ecg, Lms, Nlms, Nslms

Introduction:

ECG is an instrument which is used to observe and analyze the electrical activity of heart. This signal is normally a function of time and is described in terms of its amplitude, frequency, and phase. The analysis of ECG signal is very important for researchers as well as medical practitioners for careful and proper treatment of the patient. If the signals are not properly diagnosed and analyzed, it will lead to wrong diagnosis and can be dangerous for human beings.

While recording of ECG signal, the original signal is corrupted due to noise. The noise included inherent noise in Electronic equipments, ambient noise, motion artifacts, power line interference, base line drift, electrosurgical noise and inherent instability of signal and this reduces the performance of desired signal. Therefore for the proper treatment of a patient, it should be removed from the desired signal. Using an amplifier with high gain, high input impedance and differential input with good common mode rejection and various filter circuits could reduce the noise from ECG signal. But conventional methods are not sufficient to reduce noise from ECG signal. Therefore intelligent solutions are required.

Most recent years, various mathematical techniques and Artificial Intelligence approaches are being used for noise reduction. Literature reviews shows that mathematical models such as Wavelet Transform, Time Frequency Approaches, Fourier Transforms, Wegner-Villie Distribution, Statistical Measures and Higher Order Statistics are used in nonlinear system identification. Artificial Intelligence (AI) includes artificial neural network, dynamic recurrent neural network, Fuzzy logic system and genetic algorithm are used.

The researchers are especially interested to design the techniques which provide noiseless biomedical signals. R. Sehamby and Buta Singh (2016) [11] have designed the adaptive

electrocardiogram filter to reduce noise caused by external systems & body artifacts. R. J. George (2015) [9] reveals in his study that the pipelined DLMS adaptive FIR filter is faster than non-pipelined LMS adaptive FIR filter. H. K. Gupta, R. Vijay and N. Gupta (2013) [5] have observed that the accuracy has been increased by increasing filter order as well as with increased in step size, convergence rate took place fast. B. Chandrakar, O. P. Yadav and V. K. Chandra (2013) [8] have studied Finite Impulse Response (FIR) filter based on various windows and Infinite Impulse Response (IIR) filters for noise removal of ECG signal. The researcher D. C. Dhubkarya and A. Katara [10] have studied the comparison of MATLAB Simulation and DSP Processor implementation of an adaptive filter on Least Mean Squared (LMS) and Normalized Least Mean Squared (NLMS) Algorithms. They suggested NLMS algorithm is superior in hardware implementation.

Software Specification Requirement And Implementation Details;

In real time situations, the accuracy of the measurement is required. As we know that ECG signal is error prone due to complicated situations. AI can be used to obtain reasonably good accuracy and intelligently reduce the noise. In this section, we have simulated the MATLAB codes for the data conversion, adaptive filter algorithm, artificial intelligent training and its testing.

Database collection:

To design AINN Model, a sufficiently large amount of data is required for training and testing. We have collected standard data bases for biomedical signal from the following websites.

https://physionet.org

http://www.emglab.net

https://drive.google.com/file/d/0B3NaVR72FYQcaHAybXVCZ0ViVVk/view.

We have used 500 samples for the training and testing of Adaptive filters and AINN based filters.

Software specification:

matlab (matrix laboratory), 2014b is used for simulation. it is a numerical computing environment and fourth-generation programming language developed by math-works. matlab allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including c, c++, java, and fortran.

implementation details:

the gui is constructed by using matlab codes. other set of codes have been used to run the various algorithms for noise removal in matlab simulator.

the main gui contains four parts-

1] file input and its conversion

2] adaptive filter algorithm and its input parameter section

3] output parameters section

4] artificial intelligent noise removal section.

file input and its conversion:

Most of the data bases are available in .dat or .xls format. To read this in Matlab, we have designed a code which will convert and save the .dat file or .xls file in .mat file format.
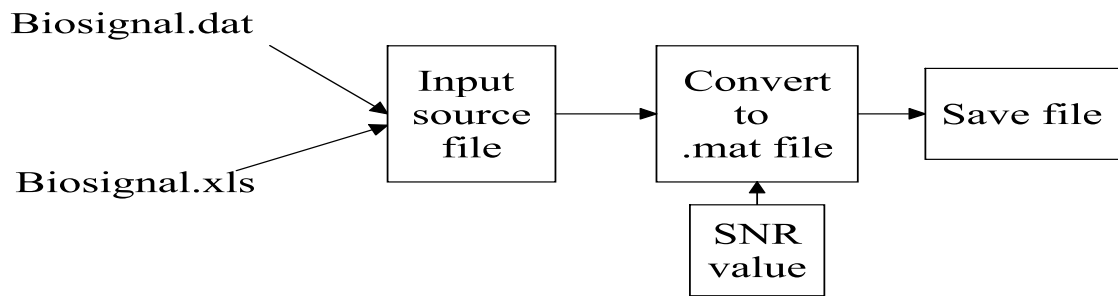
Figure 1: Block diagram of conversion of .dat and .xls files into .m files.

Adaptive filter section and its Input parameter section:

There are numerous Adaptive filter algorithms [22], out of which 3 algorithms were used. These are

1] Adaptive Least Mean Square (LMS) Algorithm:

If w (n) is the filter coefficient vector at step n (time), then its' updated value w (n +1) is given by

$$w (n + 1) = w (n) + 2 \mu e(n) x(n)$$

Where, Filter output $y(n) = w^T(n) x (n)$

Error $e(n) = d (n) – x (n)$

Filter taps at time n, $w(n) = [w_0(n) w_1(n)\ldots\ldots.. w_{M-1}(n)]$ and

Input data, $x (n) = [x(n) x(n-1) \ldots\ldots\ldots x(n – (M+1))]^T$

2] Adaptive Normalized LMS Algorithm:

The updated value w (n +1) is given by

$$w (n + 1) = w (n) + \frac{1}{x^T(n) x (n)} e(n) x (n)$$

with

$$\mu (n) = \frac{1}{2 x^T(n) x(n)}$$

3] Adaptive Normalized Sign LMS Algorithm:

The updated value w (n +1) is given by

$$w (n + 1) = w (n) + 2 \mu \frac{Sign (e(n) x(n))}{\left\| x(n) \right\|^2}$$

Output parameter section:

The performance of ANN is assessed on the basis of performance parameters Signal to Noise Ratio (SNR_out).

The output SNR (SNR_out), is calculated from the power of input signal x (n) and noise signal e (n) and is given by,

$$SNR\_out = 10 \ Log_{10} \left[\frac{Signal \ Power}{Noise \ Power} \right]$$

Or SNR_out= $P_{signal}/P_{noise.}$

Where the power is expressed in decibel.

Artificial intelligent noise removal algorithm:

We have designed an artificial intelligent model for removal of noise from ECG signal by using Matlab coding. The fig. 2 shows the block diagram of proposed artificial intelligent neural network model.
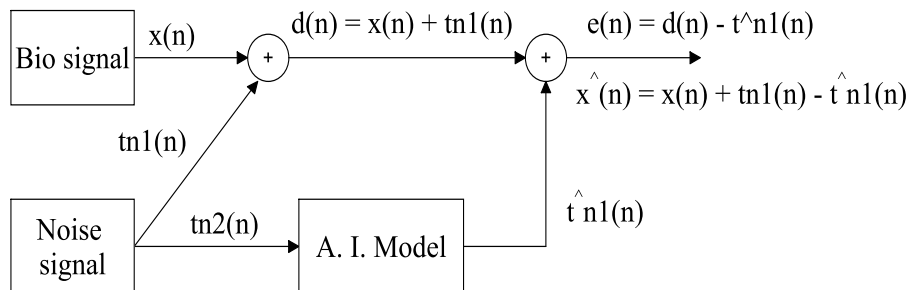
Figure 2: Block diagram of proposed AINN Model

For the design of model, we used layer recurrent neural network (Figure 3). The values of parameters selected to design of LRN are given below.

a) Number of neurons: 15
b) Training method: Layer recurrent neural networks
c) Epoch number: 30
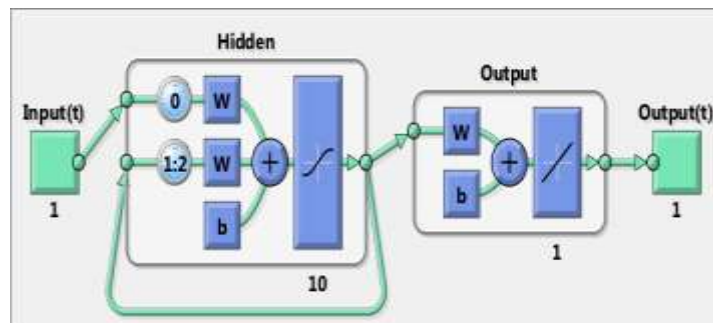
Figure 3: Layer recurrent neural network

Simulation Results

The major objective of this study was to investigate a noise removal filters. For this, simulations are carried out on ECG signals. The results are obtained on output parameter section of Matlab based GUI for removal of noise from biomedical signal. The Table 1 shows the signal to noise ratio of adaptive Filter using algorithms LMS, NLMS and NSLMS, for various step sizes on ECG signal 1.

Table 1: SNR_out Vs Step size for adaptive filter using various algorithms

No. of taps= 2 and SNR_in= 0

Step Size	SNR_out		
	LMS	NLMS	NSLMS
1e-7	-0.19906	26.7339	26.7339
1e-8	0.21109	26.7339	26.7339
1e-9	1.23573	26.7339	26.7339
1e-10	10.2783	26.7339	26.7339
1e-11	24.5255	26.7339	26.7339
1e-12	26.7039	26.7339	26.7339

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1e-13	26.7336	26.7339	26.7339
1e-14	26.7339	26.7339	26.7339
1e-15	26.7339	26.7339	26.7339

Table 1 shows that Normalized LMS and Normalized Sign LMS algorithm performed better at a small step size also. But overall, all algorithms have good performance on step size 1e-10, which governs the rate of convergence, speed of tracking ability.

For this study, the AINN based filters are examined on various ECG Signals. The SNR_out of AINN based filters are compared with the adaptive filters for the selected parameters; No. of Taps= 02, SNR_in= 0 and Step size= 1e-10. The Table 2 shows the comparison of SNR_out of Adaptive and AINN based filters.

Table 2 (i) and (ii): Comparison of SNR_out of Adaptive and AINN based filters for various ECG Signals.**(i)**

Algorithm	AINN based Filter SNR_out	Adaptive Filter SNR_out
	ECG Signal 1	
LMS	36.7437	10.2783
NLMS	36.7437	26.7339
NSLMS	36.7567	26.7339

(ii) Algorithm	AINN based Filter SNR_out	Adaptive Filter SNR_out
	ECG Signal 2	
LMS	27.0429	10.2783
NLMS	27.0429	26.7339
NSLMS	27.0424	26.7339

From the Table 2, it is inferred that SNR_out for all selected algorithms show excellent signal to noise ratio as compared to Adaptive filters. Thus all algorithms are excellently filtered out noise signal from ECG signals.

Discussion:

The typical amplitude of ECG signal is obtained in mV. Thus the signals are easily affected by various noise sources resulting degradation of the signal. The researchers are doing hard work in designing filters for noise removal. We are designed AINN based filtering algorithms. This has only two processes- training and testing. Training process based on subset outcomes of adaptive filtering algorithm in initial stages, which may not require in later time even on change of source input as well, called trained filter / smart filter. Such intelligent filters give the freedom of selection of signal with different SNR values; also not bother about number of parameter settings which lead one more step towards the auto filter concept.

We have used different ECG signals for the simulation. The simulation results are carried out by measuring the performance parameters SNR_out and these results are summarized in

tabular form in the Tables 1 and 2. The comparison of these two filters reveals that the AINN based algorithms give better results than the adaptive filter algorithms.

Conclusion:

Artificial Intelligent Neural Network filters are designed to reduce the noise from the ECG signals. The implementations of ECG signals on various adaptive algorithms (LMS, NLMS, NSLMS, SLMS and SSLMS) are successfully performed. The result shows that the AINN gives better results than the adaptive filter algorithms. Thus AINN is an excellent system to filter out the noise signal from the ECG signal.

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Study of Open Source Tools and Technologies for Data Mining and Data Visualization

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Abstract:

Data science is becoming a hugely popular and emerging field in the recent times. It is not only a topic which attracted the researchers and academicians but also a very big option for career aspiring persons in the field of data analytics. Data mining is a major aspect of data science which relates to algorithms and procedures used in data analysis. Data mining also refers to analyzing data and identify relationship between the entities. The knowledge discovered from the data analysis can be used to formulate decision support systems to improve the business efficiency, profitability and further helps in business intelligence. The next level of data analytics is the machine learning and deep learning which employs artificial intelligence that brings an ability in the program to automatically learn by itself and improve system from the past experiences without being explicitly programmed. There are a large number of tools and programming languages available for data mining and machine learning. The current paper makes a comprehensive study of Open Source software tools and languages available with their features and use.

Keywords: Open Source, Data Mining, Machine Learning, Visualization

Introduction to Data Mining

Data has become one of the most important commodity in the modern age. Since the great popularity and huge usage of internet and millions of web applications, data is generated in enormous amounts each day. Every day hundreds of petabytes and exabytes of data is generated by the applications and the users. Such data in very large volumes is termed as BigData[1]. There are there V's generally referred to define BigData, Volume refers to large quantities of data generated and stored, Velocity is the great speed at which the data is generated across the globe by users and applications, and Variety specifies the different types of data generated like structured data and the unstructured data. BigData is always associated with Hadoop, an open source software tool to store and process data on commodity hardware and clusters.

Numerous techniques for data mining have been devised for data mining like classification, clustering, and association rule mining, each have their own characteristics and limitations. The classification algorithms aids in classifying data into different classes. There are many classification algorithms like decision tree [3], Naive Bayes[4], various types of regression model like linear, non-linear and logistic regression and support vector machine. The classification is performed mainly on the basis of parameters i.e. accuracy and confusion matrix. This technique provide various applications in the field of customer interest, social network, medical and health care and many more. Regression is used to map the relationship between two variables. This is also represented in the map form and can be used to check the result by comparing the distance of data points from regression line. Profit, square footage, temperature, sales and distance are predicted through regression.

Open Source Data Mining Tools

There are many off the shelf software tools available for data mining and data visualization. Many of them are free and open source tools. These tools provide all the

1.Tanagra

Tanagra is a DATA MINING software for academic and research purposes. It proposes several data mining methods from exploratory data analysis, statistical learning, machine learning and databases area. It is more powerful, it contains some supervised learning but also other paradigms such as clustering, factorial analysis, parametric and nonparametric statistics, association rule, feature selection and construction algorithms. TANAGRA is an "open source project" as every researcher can access to the source code, and add his own algorithms, as far as he agrees and conforms to the software distribution license. The main purpose of Tanagra project is to give researchers and students an easy-to-use data mining software, allowing them to easily add their own data mining methods, to compare their performances and in direction of novice developers, consists in diffusing a possible methodology for building this kind of software. They should take advantage of free access to source code, to look how this sort of software is built, the problems to avoid, the main steps of the project, and which tools and code libraries to use for. In this way, Tanagra can be considered as a pedagogical tool for learning programming techniques.

2.RapidMiner

Yet another popular tool for data mining, the Rapidminer is unquestionably the world-leading open source system for data mining. It is available as a standalone application for data analysis and as a data mining engine for the integration into own products. Thousands of applications of RapidMiner in more than 40 countries give their users a competitive edge. RapidMiner as a powerful engine for analytical ETL, data analysis, and predictive reporting, the new business analytics server. RapidAnalytics is the key product for all business critical data analysis tasks and a milestone for business analytics.

4.Weka

One of the most preferred tools by academicians and resaerchers, Weka is a collection of machine learning algorithms for data mining tasks. The algorithms can either be applied directly to a dataset or called from your own Java code. Weka contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization. It is also well-suited for developing new machine learning schemes.

6.KNIME

Kmine is an Open Source and user-friendly graphical workbench for the entire analysis process: data access, data transformation, initial investigation, powerful predictive analytics, visualisation and reporting. The open integration platform provides over 1000 modules (nodes) 7.Orange is an Open source data visualization and analysis for novice and experts. Data mining through visual programming or Python scripting. Components for machine learning. Add-ons for bioinformatics and text mining. Packed with features for data analytics.

8.Apache Mahout

One of the popular components of Hadoop ecosystem, Apache project produces free implementations of distributed or otherwise scalable machine learning algorithms on the Hadoop platform. Currently Mahout supports mainly four use cases: Recommendation mining takes users' behavior and from that tries to find items users might like. Clustering takes e.g. text documents and groups them into groups of topically related documents. Classification learns

from existing categorized documents what documents of a specific category look like and is able to assign unlabeled documents to the correct category. Frequent item set mining takes a set of item groups (terms in a query session, shopping cart content) and identifies, which individual items usually appear together.

Programming Languages for Data Analysis

Although there are many ready to use software tools available for data mining, analysis and data visualization, the hard core programmers prefer to develop applications for data mining using programming languages. These languages give you freedom to device your own algorithms or modify the existing ones to suit the requirements for a specific data mining task. Most of these languages also contain built-in or third party libraries and API (Application Programming Interface) for data mining and visualization.

A. R programming language

R is very widely used language in the field of data science and data mining. It is a very popular language amongst statisticians. R provides many statistical methods used in data analytics and also offers object oriented programming features that gives an upper hand over many object oriented programming. R mainly works on arrays, vectors, matrices and data frames. R also delivers an easy way to generate various types of graphs to visualize the results generated. R is a better alternative to tools like MatLab and SAS.

B. Python

An easy to learn and use, Python is another popular open source language of modern age. It is an interpreter based, interactive, object oriented, multi-paradigm language and ideal for data analysis and mining. The greatest feature of python is its huge collection of libraries for various data mining tasks.

C. Julia

Julia is another popular language and getting attention amongst the data scientist worldwide. It is a multi-paradigm, dynamic programming high level language. It is a high performance language for numerical analysis and computational science. It is ideal for floating point calculations and include libraries for linear algebra, random number generation and regular expression matching.

D. Scala

A derivative of Java, Scala is a user friendly high level programming language that runs on any platform like Java. A scala program is compiled into byte code like that of java and runs on the Java Virtual Machine. The main features of scala is the functional programming like lazy evaluation, immutability, and pattern matching. It also has advanced data types like algebraic data types, covariance, contra-variance etc.

Conclusion:

Data mining is one of the most prominent and promising field of the modern age. The knowledge discovered from the data using various data mining techniques help the organization in taking correct decisions to improve the efficiency and profitability of the business. The current paper has briefly discussed various methods used in data mining and also the popular tools and languages that are used in data science.

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Design and Development of Microcontroller Based Low Cost System for CO₂ Trapping In Greenhouse

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Abstract –

The scope of this paper includes the design and development of a low cost system for CO₂ trapping in greenhouse using microcontroller. The hardware of the system consists of interactive user interface, which allows the user to enable or disable the trapping system. The system also supports digital clock designed using IC PCF8583 clock/calendar catering the need of a clock for the system. The software was developed for the system for user interface which includes the keyboard, display and processing the settings made by the gardener and generating the output accordingly at different port lines.

Keywords: - Greenhouse, Microcontroller, RTC, SSR.

Introduction:

The classical definition of greenhouse is a structure that is covered with a material that is transparent to the visible portion of the electromagnetic spectrum, which is utilized in the growth of plant Automation in greenhouse is very important for successful management of the greenhouse crops [1]-[3]. Carbon Dioxide (CO₂) is essential for photosynthesis. The CO₂ released by the plants and soil during night could be trapped and hence CO₂ level could be increased by 6-7 times and photosynthetic activity by 3-4 times [4]. Normally air contains about 300ppm of CO₂. Studies have shown that levels of 1000 to 1500 ppm are very beneficial for good yields [5]. Therefore, the economical method to achieve this is designed to close all openings of the greenhouse in the late afternoon and open them in the morning automatically.

1. **System Block Diagram**
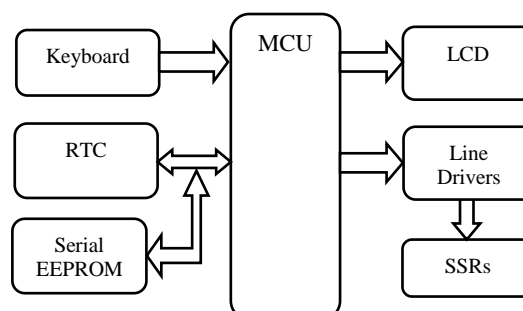
2. **Hardware**

3.1. The MCU

Atmel's 89C52 IC was used to design the system hardware to which 12MHz crystal was connected for generation of system clock. The port 2 pins were connected to the line driver IC ULN2803, which was used to drive the Solid State Relays (SSRs) to which mechanical system may be connected to drive doors and vents of greenhouse. The port1 pins P1.0, P1.1 and P1.2 were used for the keyboard design. Audible alerts were generated using buzzer connected to port 1 pin P1.3. Port pins P1.4 and P1.5 were used to interface the serial devices. P1.4 was defined as the serial Data line and P1.5 was used as the clock signal to the serial devices.

3.2. Keyboard and Display

A simple keyboard consisting of three keys was designed for the system which could be used to set clock and to start or stop trapping mechanism. The limited number of keys reduces the complexity in the operation. A 20x4 LCD display module was used to display the current time and also to show interactive messages for the user during the settings. This module has four rows of twenty characters in each row.

3.3. Real Time Clock and EEPROM

The system uses I^2C bus for integrated clock/calendar IC PCF 8583P by Philips semiconductor and serial EEPROM. The clock/calendar IC was very helpful in the current system which was used to control the mechanical system at proper time for trapping CO_2. The minutes and hours were used in the system, which may be modified as per the local time. The EEPROM IC24C02 was used in the design to store the settings made by the user. This facility avoids the need of making frequent settings in case of power failure and system resumes its functioning as per the previous settings when power is turned on. Both, RTC and EEPROM are serial devices which reduces the hardware and ultimately the power consumption [6].

3.4. Line drivers and SSRs

To control the mechanical system used for doors and vents of greenhouse as per the software, The single phase solid state relays (SSR) 006 JDA 330705 by ERI having rms on state current of 7 Amperes were used. The output port lines were first connected to the line driver IC ULN2803, which is designed to be compatible with standard TTL families, which drives the solid state relays (SSRs).

4. **Software**

Three main software modules were developed for the system. The modular programming approach was used so that individual modules could be upgraded as and when needed [6]. These modules are:

  i. The initialization Module,
  ii. The Keyboard and Display Module, and
  iii. CO_2 Trapping Module

The initialization module, prepares the system for the normal operation. This module first defines the variables and initiates them to their default values. Reads the settings from the serial EEPROM and stores them to corresponding location. It also initiates the LCD display by sending the commands and displays the welcome message on it then displays the current time. The keyboard and display module scans the keyboard and detects the key pressed by the user and the display the related message on the LCD. If user wishes to change the current time, it could be done with the help of proper keys on the keyboard. Intelligence was developed in the system

such that if user does not press any key, the system remains unaffected and the current information from the RTC was used. But, in case the user modifies the minutes or the hour values, it will be immediately loaded to the corresponding locations in the RTC, which proceeds with the new values. The CO_2 module, if activated, generates the signal at 5 p.m., which may be used to drive a mechanical system which close all the doors and vents of the greenhouse so that CO_2 can be trapped and accumulated and in the morning, the system deactivates the signal at 8 a.m. so that the mechanical system can now open all the doors and vents of the greenhouse. This will enhance the CO_2 level. The signal generated by the controller remains activated between 5 p.m. to 8 a.m. and during this period complete vents of greenhouse will be closed. Here, the signal was kept continuously alive for the required duration so that in case of power failure, if trapping mechanism was activated, then system could take the action when the power resumes. The Control signals generated by microcontroller were used to drive the solid state relays through line drives. The mechanical system, to open and close greenhouse vents, needs to be designed and would be driven by these solid state relays.

Result And Discussion:

Respiration by the plant at night causes the Carbon dioxide levels to increase to around 500 ppm by early morning. The plant uses this high level in the first two or three hours after sunrise causing the levels to drop to around 150 ppm. At this stage the doors and vents could be opened to allow outside fresh air and the levels then rise back to around 300 ppm [4]. The actual test of this system was conducted by simulation, where the system clock time was changed and system actions were verified for the signal generation for the mechanical system. The controller generated the signals only when the CO_2 trapping was started. If user stops the CO_2 trapping, the system immediately deactivates the signal generated for the mechanical system. The functioning of this mechanism was tested by having different setting pertaining to clock and CO_2 trapping mode.

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Alternative Miracle Vehicle

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Abstract:--

This research paper relates to the functioning of an electric car with self charging from the alternator, solar plate, wind turbines to the battery and also have microprocessor to control and perform all task with its artificial intelligent(AI) system. The alternator produces the electricity while the wheel is moving, allowing the alternator to move with the wheel friction and also have solar plates and wind turbines as a secondary source to produce the electricity. we take all the components of alternators that include a DC-DC converter, motor, battery, controller, Bluetooth module, IR sensors, relay, solar plate, wind turbines and aurdino MEGA. We are trying to create this technology for controlling the pollution rate in world also to control the environmental effect and for humanity.

Keywords — Alternator, Controller, Bluetooth module, aurdino MEGA, Relay and DC-DC Convertor, Motor, solar plate, wind turbines.

Introduction:

In the electric vehicle, we mainly use an electric power and their supply is indicated from the battery and we have two LCDs to show how much amount of electricity is produce in LCD1 and how much amount of battery is available in battery in LCD2. Battery is installed in an electric car and also to be mounted with the vehicle. The performance of an electric vehicle is more as compared to another type of vehicle. It also has a maximum output efficiency rather than to that of internal combustion engine. Whenever the electricity is used in the vehicle, it produces a zero percentage of emission while it is running or in the initial condition. This process is totally emission-less. It has power to carry the vehicle at minimum time. An electric car has totally different work from that of internal combustion engine. In an electric vehicle, all the circuit and switch are controlled by the controller and Aurdino MEGA. Controller and Aurdino MEGA is directly connected to the motor, battery and another lighting system. The motor drives to the accelerator pedal that is controlled through the controller and Aurdino MEGA. In the electric vehicle, re-chargeable batteries are mostly used. The battery is charged with the charging system. In the electric vehicle the main component that we use is battery, controller, Aurdino MEGA, motor and another more components. Electric car can be changed to kinetic energy; electricity can be converted from kinetic energy to electric energy. It has a minimum power loss and maximum output efficiency rather than the internal combustion engine which has less output efficiency. The motor is installed at the rear differential between the rear wheels. Alternator works on the principle of electromagnetic induction and it also moves around its axis to produce electricity. With the installation of the alternator it increases the range of battery and it provides the battery charging while the electric car is in running condition than the alternator produces electricity.

Block diagram:-
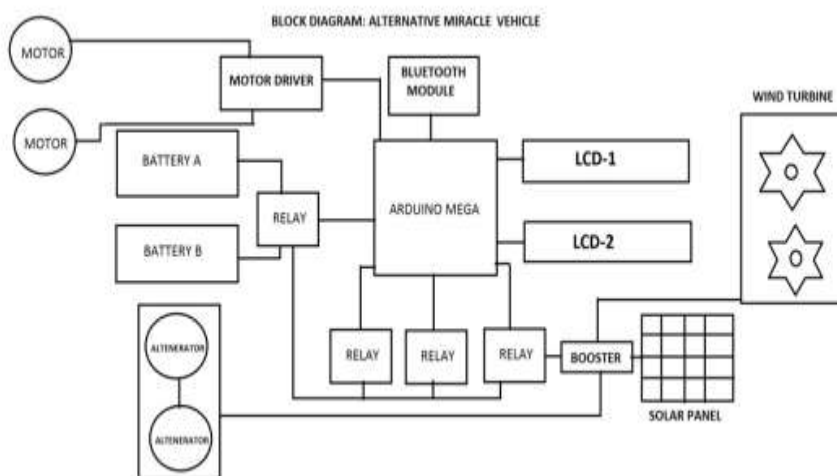
Batteries:-

Selected batteries are the KEYKO batteries, rechargeable batteries.

Specification:-

2 Batteries each are connected in series with 12V voltage.

a)Prototype use: 5V-10V

b)All battery voltage: 24V

c)Single battery voltage: 12V

d)Weight of battery: 2.5*2 = 5KG (with acid)

e)Battery capacity: 0.2Ah

f)The battery takes 7-9 hour to get fully charged.

Aurdino Mega:-

We uses aurdino mega to control and perform all type of functions in our vehicle. we coded and create a software to handle our vehicle and sense the battery percentile. It helps the vehicle to enter-change the batteries automatically with the help of AI and relays. It also help to sense which type of charging source is currently use manage it according to the need of vehicle. Its shows the production of electricity with the help of 16-seg LCDs which mounted on the proto type.

Prototype:-Amv

Conclusion:-

It reduces the pollution from the cities. The city has been defined to develop a battery power vehicle for daily use and to change eco-friendly methods for daily short-term basis within the cities. In conventional work, the future concept of self charging has been found in conventional battery power vehicles, which was the goal of changing the concept of plug-in charging.

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Advanced Sit and Reach Flexibility Measurement Test Box Using Arduino

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Abstract:

In this paper presents the check the flexibleness of the lower back and hamstring muscles. This check can be modified for elders with the utilization of a chair and having them raise one leg and reach towards it. This box uses Arduino and Ultrasonic sensing element for activity. It is quick, automatic and show exact measurement. It can place in the space from their toes to their fingertips to record. If their fingers passed beyond their toes, the results will positive, if the fingers are behind the toes, the results will negative. This result's will show on liquid crystal display. It is applicable in sports, health monitoring, medical, yoga and naturopathy treatment .If result's negative then buzzer activated and user suggested improves flexibility by doing exercise.

Keywords: Arduino UNO, Buzzer, LCD, Sit and reach wooden box

Introduction

The sit and reach test is a common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles. This test is vital because tightness in this area is implicated in lumbar lordosis, forward pelvic tilt and lower back pain. Ultrasonic sensing elements are great tools to measure distance without actual contact and used at several places like distance measurement. This is an efficient way to measure small distances precisely. In this paper we will use an Ultrasonic Sensor to determine the distance of fingertip from the sensor. Basic principal of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment then waves are return back to origin as ECHO after striking on the fingertip. So we only need to calculate the travelling time of both sounds means outgoing time and returning time to origin after striking on the fingertip. As speed of the sound is known to us, after some calculation we can calculate the distance. This system uses Arduino UNO to control overall process. The UNO is the most robust board.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. This paper introduces Advanced Sit and Reach Flexibility Measurement Test Box Using Arduino. It mainly focuses on automatic flexibility detection.

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Literature Review:

Comparison of three different sit and reach tests for measurement of hamstring flexibility in female university students (G Baltaci, N Un, V Tunay, A Besler, S Gerçeke):

This paper mainly focused on the sit and reach test is the most common flexibility test used in health related fitness test batteries. To examine and compare three different sit and reach tests as a measure of hamstring flexibility

Proposed System:

In this proposed system, we will ultrasonic sensor, Arduino UNO, LCD and Buzzer. These sensors will be responsible for sensing the distance from the fingertip or user. The data sensed by sensors will get converted into an electrical signal. The devices which generate output are generally called as transducer. The electrical signal will get transmitted to the Arduino

Microcontroller.

Arduino Uno is microcontroller boards based on the ATmega328P .This is main control unit which senses the signal from sensor and calculate the distance displays on LCD.If result of flexibility measurement is negative it beep the buzzer

Fig. 1. Arduino Microcontroller

A Liquid Crystal Display commonly abbreviated as **LCD** is basically a display unit built using Liquid Crystal technology. When we build real life/real world electronics based projects, we need a medium/device to display output values and messages.

Fig. 2. Wi-Fi Module

A piezo buzzer is a sound producing device. The main working principle is based on the theory that, whenever an electric potential is applied across a piezoelectric material, a pressure variation is generated. A piezo buzzer consists of piezo crystals in between two conductors. It used to produces sound Beep

.

Fig. 3. Buzzer

The proposed system uses Arduino UNO, 16X2 LCD, ultrasonic transreceiver module, buzzer and power supply. When fingertip approaches near the ultrasonic region then signal is sent back to receiver and signal is given to Arduino UNO which calculates the distance between fingertip and sensor and displays result on LCD.The program inside Arduino analyze the data and indicates the result. If result is negative buzzer beeped

Fig 4 Proposed System
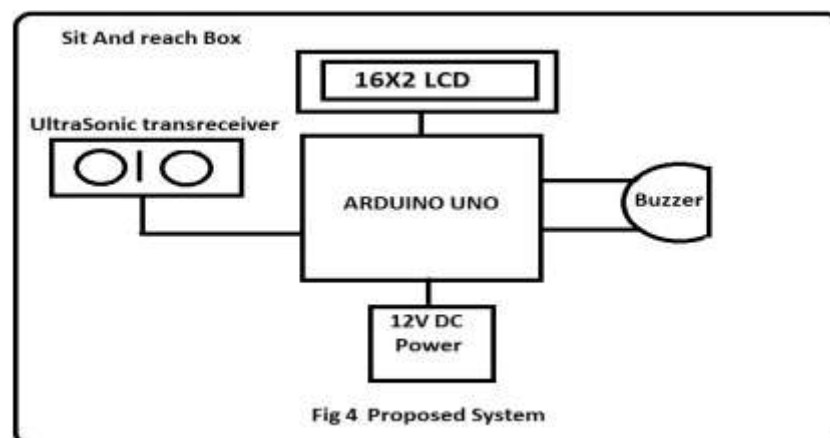
Procedure

1. Power ON the system.
2. This test is best completed after a substantial amount of warm up is completed in order to ensure the best results as well as being a safety precaution. When a warm up is involved it is critical that the same warm up is completed each time the test is conducted.
3. To begin this test, have the client sit on the floor with both feet straight out against a box for them to press their feet against.
4. Make sure their feet are bare, both knees are pressed down to the floor, and their palms are facing downward.
5. Have them reach as far as they can towards their toes, or if they are really flexible, over the box.
6. With the help of ultrasonic sensor and Arduino note the length displays on LCD of which the client can reach from their toes to their finger tips.
7. Make sure that both hands are even and one is not reaching further than the other.

8. The client is allowed some practice reaches before you record their final hold.
9. The client should not be making any quick movements while recording.

Result Analysis

Measure the distance from their toes to their fingertips, and record. If their fingers are passed their toes, the results are positive, if the fingers are behind the toes, the results are negative. Use the chart below to gauge their ability. The measurements are in cm.

	Very Poor	Poor	Fair	Average	Good	Excellent	Super
Female	< -15	-15 to -8	-7 to 0	+1 to +10	+11 to +20	+21 to +30	> +30
Male	< -20	-20 to -9	-8 to -1	0 to +5	+6 to +16	+17 to +27	> +27

Table.1 Result diagnosis chart

Advantages

- It is easy to use.
- Automatic and thus no calculation required.
- Time saving.
- Low cost.

Applications

- To Measure the flexibility.
- It is useful in yoga and naturopathy field.
- It can used in Physical and sports activities.
- It is used in medical field.

Conclusion

Advanced Sit And Reach Flexibility Measurement Test Box Using Arduino is accurate measurement system for flexibility and useful to maintain physical fitness. This system will help to reduce cost and time in future. This system can save the lives of many people.

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Selection of Transfer Function for The Hidden Layer and Output Layer of MLP Network

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Abstract—

Voice which is the most frequently used for the communication in humans also now a days for human- machine interaction. It is one of the natural methods of interaction. Thus the development of a system that can recognize human voice for the action of machine is one of the big issues in machine learning. In the design and development of system like biometric, it takes the inputs features from the physical characteristics. The Multilayer Perceptron and Support Vector Machine classifiers are used to classify and recognition of voice samples. From the result of the experiment, it is found that Sigmoid Axon is best suited for output layer because value of Mean Square Errors (MSE) for training and for Cross-Validation of dataset, are the lowest among all combinations also Support Vector Machine network having the best classification accuracy and the network becomes the more suitable.

Keywords- Artificial Neural Network, MLP, SVM.

Introduction

The person can automatically identify using a system which based on his/her voice features. Also using the voice instructions, the person can easily interact with the machine. By adapting some method of human communication, it is expected that human interaction with machines is also becoming more natural and can even facilitate the people with special needs such as persons with disabilities [1]. Some of the interaction method includes eye, pronunciation, touch of the hand etc.[2]. Interaction between the user and the devices usually takes place via advanced 'natural' user interaction techniques involving human-speech [3].Voice recognition have very wide range of applications in security systems and Robotics. Voice Recognition system [4] is used to recognize a person by using his or her vowel. Voice recognition is a more personalized form of control, since it can be adapted and customized to a particular speaker's voice [5].

Review Of Literature

In voice recognition the vowels have to be recognized and this is quite difficult pattern recognition problem in the Voice recognition system. During some past years, much research has been done using Multi-Layer Perceptrons (MLP) and Decision Trees for this task. Voice recognition experiments on monosyllabic vowels and vowels in words In that they presented a vowel recognition technique that deals with input vowels as one sequence and recognizes them using binary relationships between data is investigated. Voice recognition experiments on monosyllabic vowels and vowels in words showed that recognition rates are 99.1% and 93.2%,

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respectively. These results are about 2% better than those obtained using a statistical matching method.

Details Of Experiment

The voice recognition system consisting of neural network is a well trained network having sufficient amount of data for training, cross- validation and testing. The benchmark data sets is get available from Principie. The data is stored in the column vectors of excel-sheet and then it is supplied to neural-network. The accompanying data file, "vowelcontext.data", consists of a three dimensional array: voweldata [speaker, vowel, input]. There are fifteen individual speakers. These speakers are assigned with a code number. Each individual speaker repeats each vowel six times.

Each person utters each vowel six times, so total 66 rows (11×6) of data for each person. For each utterance, there are ten features extracted from these input values i.e. Feature 1, Feature 2,….Feature 10.These features are floating-point values. Also there is, Sex column to give one additional feature to the network. The speech signals were low pass filtered at 4.7 kHz and then digitized to 12 bits with a 10 kHz sampling rate. As the "vowel-context .data" data file consists of space separated values, the file can directly import in NeuroSolution. After saving the data file, tagging must be done on input and desired output column and select the percentage of data for training, cross validation and testing are as given in Table 1.

Table 1   Percentage Of Data For Experiment

Total Dataset=1200	Data Partition	Number of Data samples
Training	60%	720
Cross Validation	20%	240
Testing	20%	240

The parameters such as MSE, Final MSE and visual inspection of desired output are to be taken to assess the performance of NN. The Network has been trained at least 3 times, starting from different random initial weights so as to avoid local minima. Neurosolution is specially used for obtaining results. The comparative study for the voice recognition using MLP and SVM has been carried out. The rapid development and improvement of SVM has many advantages in solving small sample, nonlinear and high dimensional pattern recognition problems[6]. In addition to the normal voice, an abnormal sound, such as screaming and glass broken, were discriminated from normal sounds where Gaussian Mixture Model (GMM) and Support Vector Machine (SVM) were commonly used for recognitions [7]-[9].

Experiment Results

The extracted features from voice samples are taken as input and a particular person having its voice is the targeted output. The Neurosolution software require these features as input and gives the desired output. The parameters such as Processing elements, transfer function, learning rule, step size and momentum of hidden layer and output layer of MLPs were tested with maximum epoch 5000 and for the 3 runs.

A.   Selection of Transfer Function and Learning Rule for Hidden Layer:

Various learning rules such as step, momentum, CG, LM, QP and DBD are used for training and best performance parameters are observed. Results are observed for various Transfer Functions like TanhAxon, SigmoidAxon, Linear TanhAxon, Linear SigmoidAxon, SoftMaxAxon, BiasAxon, LinearAxon and Axon only as shown in the Table 2.

Table 2   Transfer Functions And Learning Rules In Hidden Layer

Transfer function	Learning rule	MSE
TanhAxon	Step	0.020361704
TanhAxon	Mom	0.013935919
SigmoidAxon	CG	0.002886206
SigmoidAxon	**DBD**	**0.002474252**
Linear Axon	Step	0.1008
Linear Axon	Mom	0.076990809

From Table 2, it is inferred that the optimal values are obtained for Transfer function – SigmoidAxon and Learning Rule – DBD in the hidden layer. The values of MSE= 0.002474252 which is optimal value as compared to the results obtained for other transfer function.

Table 3-Min. MSE for all transfer function with step

Transfer Function	Min. MSE
TanhAxon	**0.020361704**
SigmoidAxon	0.022891146
LinearTanhAxon	0.029853438
LinearSigmoidAxon	0.024263437
SoftMaxAxon	0.025861404
BiasAxon	0.1008
LinearAxon	0.1008
Axon	0.293025385

By observing the above reading, for LR- Step, TanhAxon gives the Minimum MSE value among all transfer function.
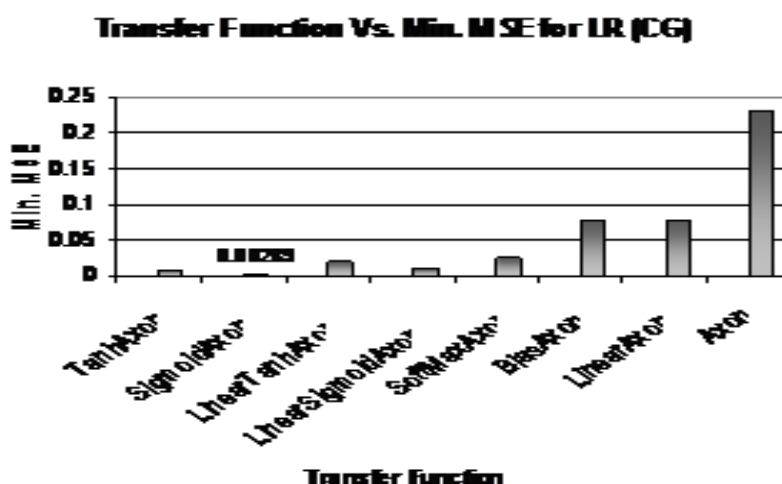
Chart- I

The report generated after the training for this SigmoidAxon-CG shows that, it gives better Minimum MSE value than the previous any combination.

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Table 4

Transfer function - LR	Min. MSE
TanhAxon - Step	0.020361704
TanhAxon-Mom.	0.013935919
SigmoidAxon - CG	0.002886206
SigmoidAxon - LM	0.009628448
TanhAxon - QuickProp	0.018532166
SigmoidAxon - DBD	**0.002474252**

B.   Fixing of Transfer Function and LR Combination (Output Layer):

Just like fixing the TF-LR for hidden layer, setting of TF for output layer is also essential, for better performance of the network. same LR of the hidden layer worked for the output layer. So DBD is fixed for the output layer also. Now, only best TF has to be found out for this layer.
The Summary of all these training report is given in Table 5.

Transfer Function	Training	CV
TanhAxon	0.0608	0.060778
SigmoidAxon	**0.0033**	**0.008042**
LinearTamhAxon	0.103181	0.101961
LinearSigmoidAxon	0.010865	0.013875
SoftmaxAxon	0.025037	0.0251
BiasAxon	0.085017	0.082361
LinearAxon	0.088034	0.086343
Axon	0.085034	0.084046

Table 5 - Setting of TF for Output layer
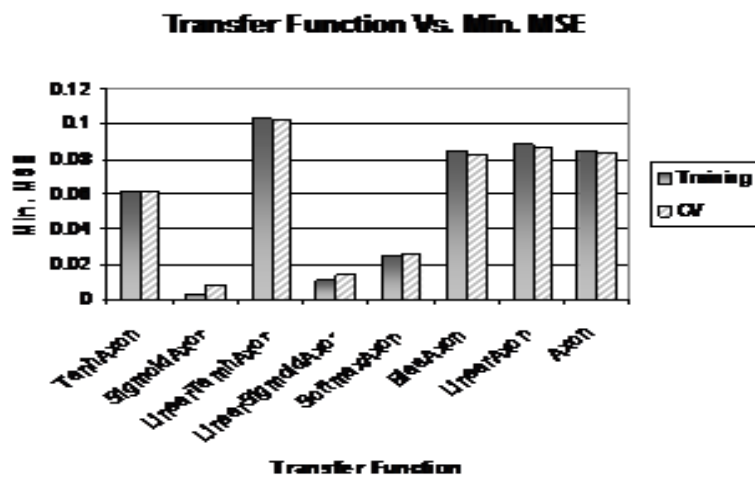
Chart - 2

Conclusions-

From the above all findings of transfer function and learning rule of MLP, one can say that the Sigmoid Axon is best suited for output layer because value of MSE's are 0.0032995 for training and 0.0080421 for CV dataset, are the lowest among all combinations. The transfer

function which having the minimum MSE at hidden layer, the same is appearing for the output layer also.

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U-Slotted Reconfigurable Multiband Micro Strip Antenna for Wireless Networks and SDR

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Abstract—

A scaled down size slotted multi frequency Microstrip antenna for wireless applications is simulated and designed and its characteristics have been studied. The proposed antenna consists of a FR4 substrate consisting on one side a radiating patch containing U-shaped slots and other side is having a partial ground. The number, length/width, and positions of the U-shaped slots have been selected suitably so as to achieve desired results for return loss, VSWR in frequency bands of interest. The proposed antenna characterizes four bands at resonant frequencies of 3.8, 5.87and 2.72,6.1,3.7,4.46,3.4 GHz with return loss values less than 10 dB and VSWR values less than 1.5. The designed antenna can operate in IEEE 802.11a radio WLAN applications in frequency band 5.180–5.825 GHz, IEEE 802.16-2004 fixed WiMAX applications in frequency band 2–11 GHz, and IEEE 802.16e mobile WiMAX applications in frequency band 2–6 GHz. The proposed antenna has almost near omnidirectional radiation pattern exhibiting reasonable gains across the desired frequency bands

Keywords- SDR, Multiband, Slot, VSWR, Return Loss

Introduction :

Recent developments in short-range radio links for pico-cells for 5G such as worldwide interoperability for microwave access (WiMAX) and wireless local area network (WLAN) have led to massive advancements in miniaturized antenna structures. Antennas are required in applications involving transmitters and receivers, however in some cases antennas are hidden inside laptop computers and radios providing Wi-Fi facility. Antennas are required by radio receiver or transmitter in order to provide coupling between electrical connections and the electromagnetic field. Radio transmitters and receivers are utilized to convey signals in broadcast radio, Wi-Fi, point-to-point communication links and many remote controlled devices[1-2]. Nowadays, antennas are required to be compact in size and should be capable of providing multiband operation [3].

Several Micro strip antenna designs have been reported in the literature, however, in many cases they are relatively large in size and mostly incapable of multiband operation. A small

printed antenna is presented for providing triple band operation with horizontal strips attached to radiation element . A novel coplanar waveguide (CPW)-fed antenna is reported.

Software Defined Radio:

The Federal Communication Commission (FCC) allocated some part of radio frequency spectrum intended for telephones which are mobile during the year 1969. In year of 1987, SDR design has started with the development of a programmable modem which was funded by Air Force Rome Labs (AFRT). This was the step which paved way for the development of the structural design of the integrated communication, identification structure design (ICNIA) as well navigation. ICNIA was designed by the merging of multiple radios having single box with the compilation of numerous single purpose radios. The software can define the frequency band as well bandwidth of radio channel, user application, and modulation method, coding method, resource management protocols and mobility management protocols of transceiver. On the basis of defined features, SDR is defined as "Software radio is an emerging technology, thought to build flexible radio systems, multiservice, multi-standard, multiband, reconfigurable and reprogrammable by software [4,5].

Fig 1: Generic block diagram of SDR

Design of antenna

An antenna small in size with capabilities of operating at all frequencies for suitable applications is desired. The proposed slotted Micro strip antenna designed to operate in quad band is shown in Fig. 2
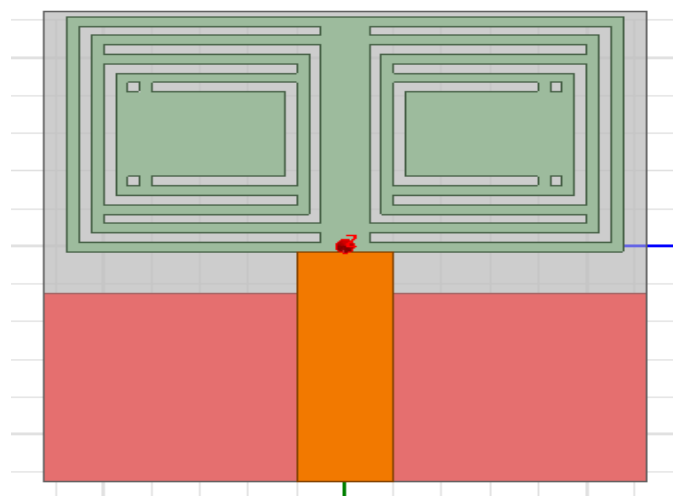
Fig 2: Top view of the proposed antenna geometry
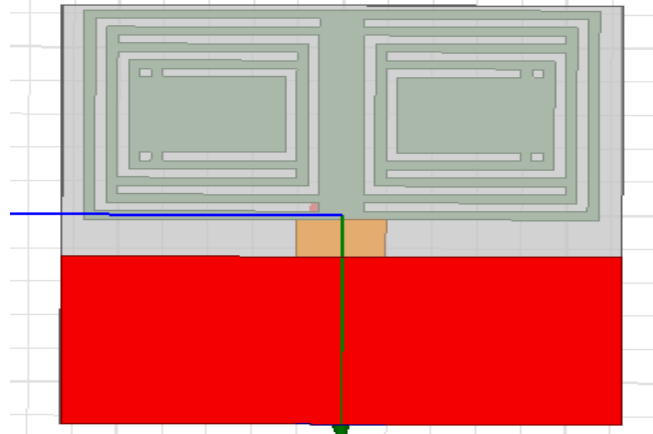
Fig 3: Bottom view of the proposed antenna geometry

An edge connected feed line is used to feed the antenna. The dimensions of the proposed antenna including the size of the substrate, length of the slots and the ground plane are optimized. Simulations showing reflection coefficient (S11),gain, voltage standing wave ratio (VSWR) and radiation patterns were carried out using EM field solver tool (HFSS). FR4 substrate having permittivity of 4.4 and a thickness of 1.6 mm is used for imprinting the proposed antenna. The dimensions of the proposed antenna are Lg*Wg*h mm^3.

Table I: Dimensions of the proposed antenna

Parameter	Size in mm
Lg	25
Wg	25
Lp	13mm
Wp	23.5
h	1.6 mm

Results

The antenna is fed through a 50 ohm coaxial probe with an SMA.. The measurement set up for testing the performance of designed antenna is shown in Fig. 4.

Fig 4: Measurement set up of the Micro strip antenna

The proposed Micro strip antenna geometry is designed & simulated using HFSS software to obtain various parameters like return loss, voltage standing wave ratio (VSWR), bandwidth, gain and radiation pattern. The designed antenna is tested using VNA ZVK(10 MHz-10 GHz) tool.

Fig 5: Measurement set up of the Micro strip antenna(ON)
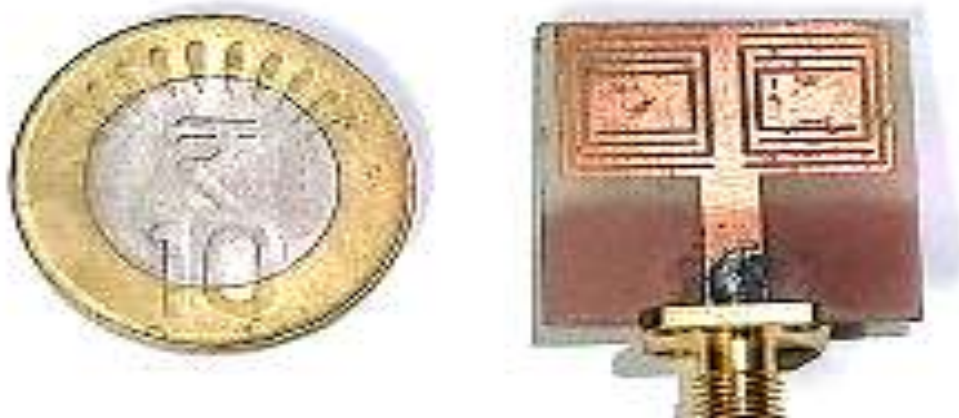
Fig 5: Measurement set up of the Micro strip antenna (OFF)
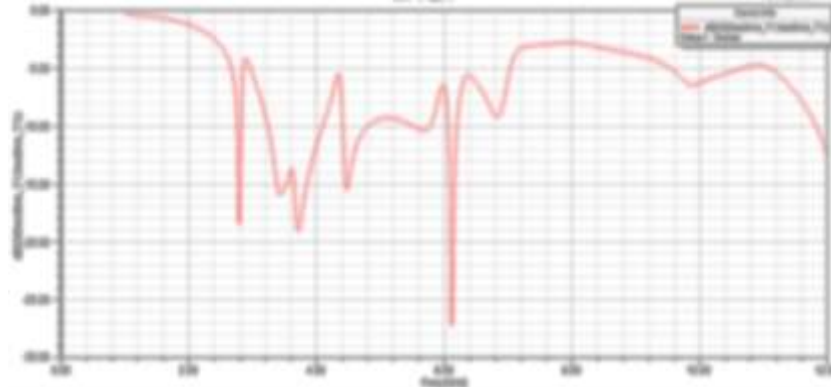
Fig6: Simulation results of the multiband antenna when ON.
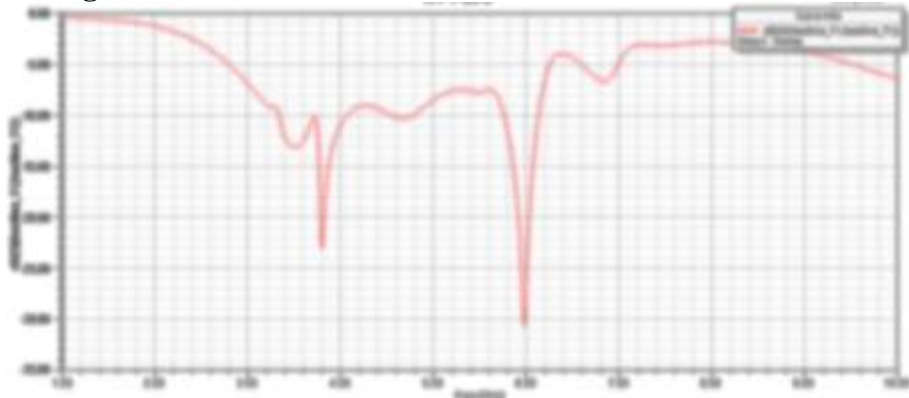
Fig7: Simulation results of the multiband antenna when OFF.
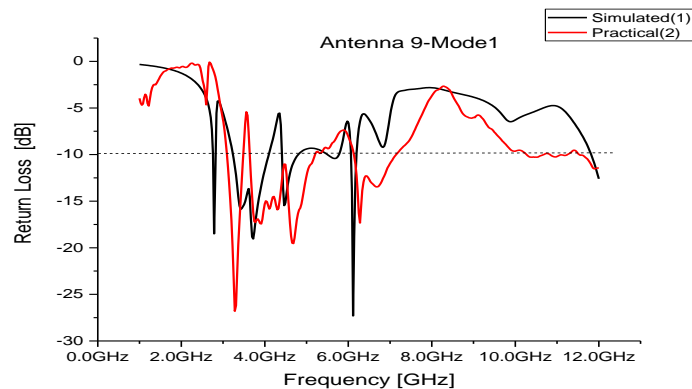
Fig 8: Comparison results of the multiband antenna when ON.
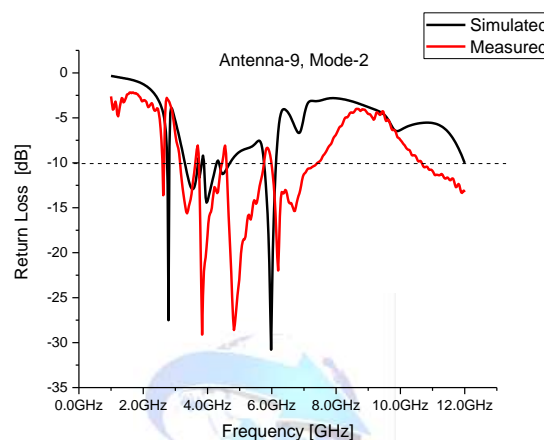
Fig 9: Comparison results of the multiband antenna when ON.

The return loss measurements were simulated and tabulated. The variations in the return loss was due to the parasitic inductance and capacitance of the PIN diode switches modelled during the simulation.The fabrication variations also contributed to the variations of the simulation results with the practical results.

Acknowledgment:

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Integrated High-Tech Intelligent Security System

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Abstract—

This research article presents the development of Integrated High-Tech Intelligent Security System. In recent years, the scale of security with smart technology has become larger and larger, however, the traditional security system slightly decreased. The proposed integrated automated smart security system is comprised of Arduino Mega(2560), Voice recognition module, RFID transreciever, Bluetooth HC-05 based smart phone contolled mechanism, etc. The noteworthy feature of such system is that it can be used not only for authorised user but also the unauthorised one in specific condition.

Keywords— Arduino, Transreciever, Voice Recognition.

Introduction

In twenty-first century security system, the more and more home and business are looking for their security systems to make sure their families, staff, or possessions are protected. Rapid and continuing advances in technology have made traditional security systems monitored by central stations for monthly fees outdated and ineffective at properly protecting your property and assets. One of the ways technology has transformed security is through smart security systems. A smart security system uses the wireless technology, home networks, and the prevalence of mobile phones to integrate your security with day-to-day life. From door sensors to wireless CCTV footage, a smart security system means you can customise, monitor, and manage your security systems anywhere, at any time, from your mobile phone. Essentially, it gives control of your security back to you and makes it convenient and accessible to you, whenever you want to check in. In addition to the security benefits of smart systems, there are several other benefits for the home or business who chooses a smart system. Install only the sensors and security systems you want to use, where you want to use them. This reduces unnecessary and unwanted costs, giving you much more control over the price of your property defences. Because you don't need to pay someone else to install your systems, you can set your security up easily and quickly. Everything syncs with your phone, so it couldn't be simpler to use and review. No matter where you are in the world, you'll have the ability to monitor your home security systems from your smart phone. In this paper, application software, RFID and Voice control mechanism are designed for automatic Gate control system and recognition. This system will be able to use in all the places, and able to works automatically without need of human being. This process is controlled by Arduino MEGA microcontroller. Arduino receives the signal from the transmitter of RFID or Smart phone or voice controller, decode it and switch ON the relay that control the motor which controls lock and unlock of gate. When the wrong password is used then the gate will not open.

The rest of the research has been organized into three different sections, namely Literature survey, implementation of hardware and conclusion.

LITERATURE SURVEY

In the existing gate security systems, biometrics is frequently exploited for identification and authorization. Biometrics based gate security system is widely adopted, Biometrics based gate security system has no weakness of replication and modification, but it requires high complexity and shows the high false identification ratio.[1] The other type of system that can be described as attempt to construct a small and simple model of an Automatic Gate is System, which uses a power window motor which uses for car power window and circuitry to move the gate.[1] Other one is automatic gate system, in this system the sensor senses the vehicle automatically and opens the gate for any vehicle. In this system we don't need security guard. In this system security level is the lowest of all the system, as the gate is opened for every vehicle. It is mainly used in malls or hotels where the number of guest incoming/outgoing is high. Other system similar is the gate system with a remote given to the security guard. He will then check the vehicle number and press the button on the remote and then the gate opened. In this system the gate will not be opened for every vehicle entering as the remote is in the hands of guard, only the vehicles which are allowed by guard will be able to enter. In this system the security level is moderate. These types of systems are mainly used in toll booth systems or parking lot.[2] The device connected to this gate is working through the process from microcontroller that has been programmed with assembled language and logic circuit. this process is controlled by 8-bit microcontroller at89c2051, the microcontroller receives the infrared signal from the transmitter which remote control through IR sensor, decode it and switch on the relay that control the dc motor which incorporate with gear that control the movement of the gate forward and backward, when the wrong password enters through ir remote control designed for the circuit and open button is press the gate will not open, the security alarm will sound for security purpose. this alarm system is incorporated with design in order to impede intruders from gaining entrance to the opening of the gate. [4] To increase safety in access automation systems, these systems include automatic swing and sliding gates, bollards and barriers to prevent unwanted access. In current installations the anti-crushing protection is ensured by an electronic device installed on the control boards, which directly controls drive torque, and a couple of infrared photo detectors: when an obstacle is touched by the gate leafs or barriers, or cuts the infrared beam, the control board stops the gate movement. The new device returns a stop signal when an obstacle is present in a predefined area. The algorithm has been integrated in a real access system to test its performance.[6] A 2.45-GHz wireless IC card system has been developed for a noncontact-type train station automatic gate system. This system consists of compact transmitter-receiver equipment and noncontact wireless IC cards. [5] And the next one is the gate systems open for authorized users only. The sensors sense the presence of authorized user and command the system to open the gate whereas the difficulty that falls in this system is that no provision is being made for unauthorized user. So here comes the manual job for the guards to open the gate. And if, manual work is brought then the main feature that is security can be compromised with the human made mistakes/errors. So this system also doesn't include full basic features required. In present paper, application software, RFID and Voice control mechanism are designed for automatic Gate control system and recognition. This system will be able to use in all the places,

and able to works automatically without need of human being. This process is controlled by Arduino MEGA microcontroller. Arduino receives the signal from the transmitter of RFID or Smart phone or voice controller, decode it and switch ON the relay that control the actuator which controls lock and unlock of gate. When the wrong password is used then the gate will not open.

IMPLEMENTATION OF HARDWARE

The foremost working consists of the front end components i.e. the RFID tags and receiver comes under progress. Here the RFID tags have a unique id which is used to detect the authorized user and the receiver detects these authorized users. If it authorizes the user then the control is shifted to the motor with the help the Arduino IDE. The IDE consists of the embedded C Programming which takes the control of what component should be used. The one more application is added for the authorised user is voice control mechanism. The working of voice control mechanism is similar as that of RFID. If the user is unauthorized then procedure interrupts and the gate will not open. So the other option used here for unauthorized users like guests is the mobile application. This mobile application is connected to IDE with the help of the Bluetooth Module HC-05. This application works as a manual alternative for the automatic system. There are two buttons present in the application one for the opening of door and closing the door.

Architecture

Smartphone is used for commonly authorised as well as unauthorised person. Its operation depends on the validation of password entered by the person. RFID card uses a unique password which is accessible by that program. It consists of an antenna which transmits the signal that is used by RFID receiver to process data and evaluate if the signal is valid or not. Arduino decides whether to open the system using motor and when to close the gate depending on the instructions of the Arduino.
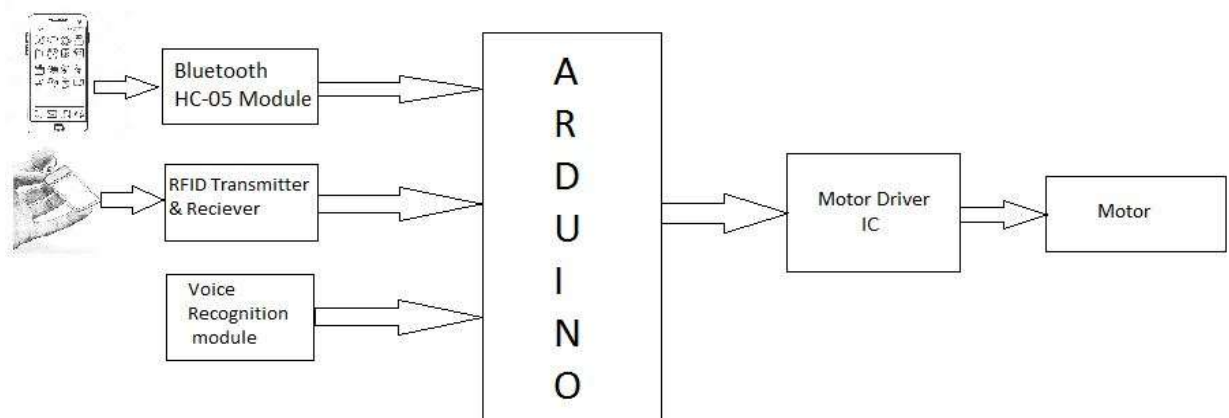
Module :

Any system can be divided into modules for better understanding. Different modules used in the current system are mentioned below. For Authorized User: This module consists of RFID tags and receiver, Arduino, Motor. If RFID tag is validated by the RFID receiver then signal to open or close the gate is sent to Arduino, Arduino further sends the signal to the DC motor to open or close the gate. And voice recognition module is added to validate the voice of

authorised person. For Unauthorized User: This module consists of similar components as above only an android application is added and instead of RFID the Bluetooth module is used. Mobile application connects with the Bluetooth module and sends signal to Arduino to open or close the gate with the help of the application.

Components used:

Arduino:

Arduino is a prototype platform (open-source) based on an easy to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and the software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

Fig.2. Arduino MEGA(2560).

RFID:

Radio-frequency identification (RFID) is a technology to record the presence of an object using radio signals. It is used for inventory control or timings sporting events. RFID is not a re-placement for the bar-coding, but a complement for distant reading of codes. The technology is used for automatically identifying a person, a package or an item. To do this, it relies on RFID tags. These are small transponders (combined radio receiver and transmitter) that will transmit identity information over a short distance, when asked. The other piece to make use of RFID tags is an RFID tag reader. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and de-modulating a radio frequency (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal.

Bluetooth:

Bluetooth is a wireless technology standard for exchanging data over short distances. The HC-05 is an expensive module that is compatible with wide range of devices including smart phone, laptops and tablets. Adding a Bluetooth to Arduino can take your project to the next level. It opens up lots of possibilities for user interface (UI) and communication. The phone/tablet etc. can act as an UI element or data logger .HC-05 module is an easy to use Bluetooth SPP(Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05

Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication.

Fig.4. Bluetooth module.
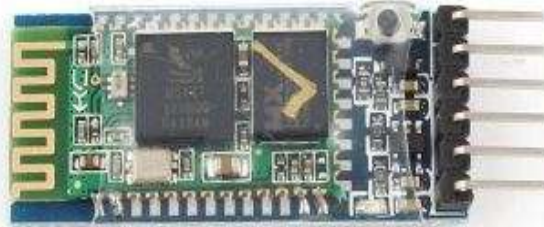
Voice Recognition Module:

Voice Recognition Module could recognize your voice. It receives configuration commands or responds through serial port interface. With this module, we can control cars or other electrical devices by voice. It can store 15 pieces of voice instruction. Those 15 pieces are divided into 3 groups, with 5 in one group. First we should record the voice instructions group by group. After that, we should import one group by serial command before it could recognize the 5 voice instructions within that group. If we need to implement instructions in other groups, we should import the group first. This module is speaker independent. If your friend speaks the voice instruction instead of you, it may not identify the instruction.

CONCLUSION

The result contain the working of the smartphone connected Bluetooth module, RFID device and the Voice recognition module works properly and unlock the door. The security of system proposed in this paper is high and will be stronger as per the human requirements.

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Methods of Non-Invasive Blood Glucose Monitoring Using Nir Spectroscopy: A Review

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Abstract:

Diabetes has emerged as a major healthcare problem in India. India is one of the most diabetic populated countries in the world. Regular monitoring of blood glucose is important to avoid complication of diabetes, as it is becoming a serious and alarming illness. In recent medical practice, the concentration of glucose in blood is measured using an invasive techniques which generally involves finger puncturing. Continuous blood glucose monitoring with Invasive method is inconvenient and dangerous. Non-invasive method is a pain free technology which helps patient's regular blood glucose monitoring. This review describes different methods of Non-invasive blood glucose monitoring using NIR spectroscopy.

Keywords: Diabetes Mellitus, Blood Glucose, Non-invasive, NIR Spectroscopy

Introduction:

Diabetes is a widely spreading disease which is known as one of the life threatening disease in the world. It occurs not only among adults and elderly, but also among infants and children. In 2017, there was around 451 million people had diabetes world-wide, the number is expected to increase 693 million by 2045. It was observed that almost half of all people i.e. 49.7% living with diabetes are undiagnosed and in 2017, approximately 5 million death occurred worldwide because of diabetes[1]. There are three main types of Diabetes.

1) Type- I Diabetes

2) Type- II Diabetes

3) Gestational Diabetes.

In Type I body does not produce insulin. People usually had type I diabetes before their 40th year, often in early adulthood or teenage years. Type II occurs in childhood or occurs later in life perhaps after 40 years of age. The pancreas does not produce sufficient insulin or cells do not respond to insulin properly. Hence, requires insulin doses to maintain life. In addition healthy eating & exercise needed. Gestational Diabetes affects females during pregnancy. The majority of gestational diabetes patients can control their diabetes with exercise and diet [2, 9]. The acceptable range of glucose concentration is from 70 mg/dL to110 mg/dL. But soon after eating, glucose concentration of a person may rise to a level up to 140 mg/dL[2]. Diabetes can lead to very serious and severe complications including heart failure, blindness, obesity, kidney disease and nerve disease. Currently, Blood glucose can only be monitored through the use of invasive techniques. This method involve finger puncturing, which is painful. There is a risk of infection and bruising with all of the invasive techniques.

Non-invasive method is excellent alternative to existing invasive method [4,9,12]. Non-invasive glucose monitoring refers to the measurement of blood glucose levels without drawing

blood, puncturing the skin, or causing pain or trauma. Advancing technology improves diagnostic techniques and needed equipments. There are many technologies to measure blood glucose. Near infrared spectroscopy has become a promising technology among others for blood glucose monitoring.

Spectroscopy is the branch of science concerned with the investigation and measurement of spectra produced when matter interacts with or emits electromagnetic radiation. Spectroscopic techniques are used to determine the presence or concentration of a substance by measuring how it interacts with light. This spectrum contains information about the optical properties and structure of the medium being measured. Near Infrared spectroscopy is a well established and constantly developing analytical technique which allows for the rapid, high-throughput, non-destructive analysis of a wide range of sample types [6]. It allows blood glucose measurement in tissues by variations of light intensity, based on transmittance and reflectance. The light focused on the body is partially absorbed and scattered, due to its interaction with the chemical components within the tissue [2]. In NIR spectroscopy, the absorption spectrum range of glucose is from 700 to 2500nm. Molecular formula for glucose molecule is $C6H12O6$. There is bonds C-H, O-H and C=O which causes absorption of NIR light in blood or other human bodily fluid. Glucose concentration could be estimated by variations of light intensity both transmitted through a glucose containing tissue and reflected by the tissue itself [11]. NIR spectra are made up of broad bands corresponding to overlapping peaks: the overtones (i.e, first, second, third, and combination overtones), formed by molecular vibrations [5].
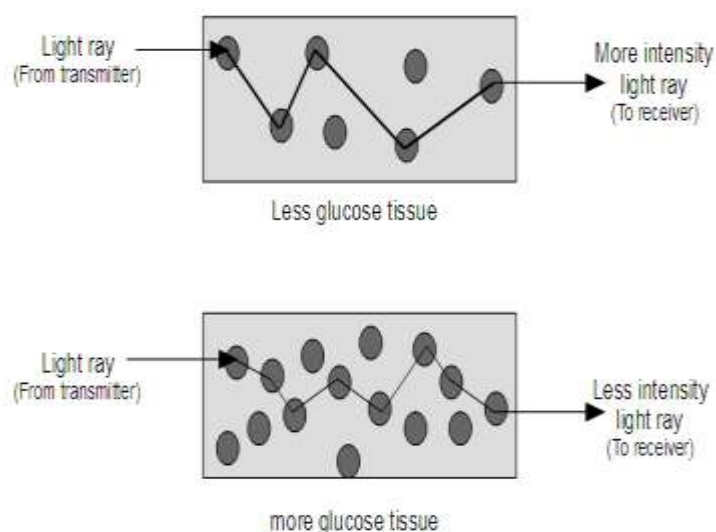
Figure 1 Schematic description of affect of glucose on light path [10].

Metheod And Material

Akesh Govada, et al[2] in 2014 have reported about the problems and side effects of invasive method such as risk of infection, costly and discomfort for the patients and gives the innovative idea about the continuous monitoring blood glucose by developing non-invasive blood sugar measurement technique. Here NIR spectroscopy is used to develop a Non-invasive blood glucose concentration monitoring system. NIR has greater penetration depths and less background interference due to water absorption. The proposed system has been equipped optical sensor, signal conditioning, ADC, microcontroller and LCD display. NIR signals are passed through the fingertip with and without blocking the blood flow. The received reflected

signal is amplified and filtered, using a precision amplifier and a low pass filter. So for this Signal conditioning section is used which consists of a preamplifier and a low pass filter. An ADC buffer is used to perform the ADC conversion of the received signal

from signal conditioning section. The microcontroller unit used to convert the values into corresponding blood glucose value, which is then displayed on LCD. The technology is based on the direct effect of glucose on the scattering properties of the organ.

Jui-Lin Lai, et al[3] in 2016 proposed the non-invasive bio-sensor to sensing the blood glucose using NIR LED of 960 nm optical spectrum which is measured by the spectrometer system.. The optical bio-sensor is consist of NIR LED, photo diode and transducer. The instrumentation amplifier is used in the transducer to sensing the concentration of glucose in the blood from the photo diode which generally avoids finger puncturing. It base on the absorbance rate of the NIR LED emitted into the finger. The NIR source element is suitable to detect the absorbance energy from the skin tissue corresponding to the concentration of glucose. Jyoti Yadav, et al[4] in 2014 described the need to develop a non-invasive monitoring system which can measure blood glucose continuously without finger puncturing. The present work is focused on development of non-invasive blood glucose measurement sensor system using Near-infrared (NIR) technique. Here NIR LED at 940nm wavelength is used. Initially in-vitro glucose measurement prototype is developed using continuous wave (CW) from NIR LED (940 nm) to check the sensitivity of the system for different glucose concentrations. Later a Sensor patch was designed using LED and a photodiode to observe diffused reflectance spectra of blood from the human forearm. Diffused reflectance spectra of the subjects obtained with this technique was also compared with commercially available invasive finger tip gluco-meter. The results are promising and shows the potential of using NIR for glucose measurement. NIR is widely used optical technique because of its high penetration in skin. It can be applied on various body parts such as finger, palm, arm, earlobe,etc.

Chi-Fuk So et al[5] in 2012 have reported about the main technologies currently being explored for non-invasive glucose monitoring. In their report the principle of each technology is mentioned with its advantages and limitations. As per report relatively low cost and the high sensitivity of the photoconductive detectors is the main advantage of NIR spectroscopy. NIR spectroscopy is located in the wavelength region of 730–2500 nm. NIR spectroscopy has become a promising technology, among others for blood glucose monitoring. T. R. Jaya Chandra Lekha, et al [6] in 2015 have reported that diabetes and its complications have been a heavy burden on the society. The continuous blood glucose measurement and monitoring requires to control of blood glucose levels. The existing method is invasive for blood glucose measurement which requires extraction of blood through a lancing device. This method is painful, potentiality dangerous and expensive to operate. Non invasive glucose measurement eliminates the painful pricking, expensive, risk of infection and damage to finger tissue. Optical methods have been developed as the most powerful technique for non-invasive glucose measurement. The NIR spectroscopy method is one of the most promising optical approaches. Near Infrared Spectroscopy is simple, quick, non-destructive technique for non-invasive blood glucose measurement. Rolamjaya Hotmartuaa, et al [7] in 2015 have reported that invasive method is costly and uncomfortable. The development of non-invasive blood glucose detector is desired to replace the existing Invasive method. NIR spectroscopy is used to detect blood glucose noninvasively. Glucose has specific absorbance spectrum in NIR range, 850nm –

2500nm. LED is utilized as incoherent infrared source to irradiate body surface in wavelength 1550 nm. Penetrated light is then detected by InGaAs photodiode, sensitive for wavelength 850 – 1700 nm. Photodiode's current is converted into voltage using trans-impedance amplifier circuit. In order to minimize high frequency noise, low pass filter is applied consecutively. Earlobe is chosen as the measurement sites, since it is thin. This paper shows NIR spectroscopy has potential as a window to look at the concentration of blood sugar in vitro. Xiaoli Li, et al [11] in 2015 shows that, non-invasive glucose monitoring setup was developed using near infrared by detecting the transmission laser power. The detecting system included the semiconductor laser diode as light source, the S302C light power probe which detected the incident light and, the PM100USB transmit data to the computer. The specific infrared spectrum (1310 nm) was used as the incident beam. A proportional relationship between the laser power and the glucose concentration was proved by comparing the resulting laser power for a few of glucose aqueous solution samples with glucose concentration estimated value at the same circumstances. This research suggested the relationship that the output power value decrease indirect proportion with increase of glucose concentration.

Result And Discussion :

Regular blood glucose monitoring is very important to avoid diabetes complications. From the study using Invasive method, regular blood glucose monitoring is not possible. It is the necessity of time to use Non-Invasive methodology. This paper overview Non-Invasive blood glucose monitoring using NIR spectroscopy. The NIR spectroscopy is one of the most promising optical method.

Conclusion :

NIR spectroscopy is very useful in Non- Invasive blood glucose monitoring. It is safe, simple and painless technique. Non-Invasive blood glucose monitoring system is needs to improve for continuous monitoring in healthcare centres and Homes, hence diabetic patient will monitor their blood sugar regularly.

Acknowledgements :

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Microcontroller Based Techeye System for Obstacle Detection & Ranging To Assist Blind Person

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Abstract:

Science is such a field of research which tends to make life of a human comfortable and less complicated, it makes our life easy. But what about these physically impaired people?

I particularly came up with this project because this makes life of a blind person more efficient. My device TechEye which stands for Technology Eye, enables the blind person to get known to his/her surroundings. And he/she can act accordingly. TechEye will prove to be the best artificial assistant to that blind person.

Introduction:

Currently blind people are facing a huge problem when they are in a public place. They have stick in their hand which helps them a bit. But I modified that stick and installed ultrasonic sensors along with necessary hardware in it. Which helps the blind person more efficiently and lets him sense the surrounding up to a radius of 2 meters (which can be extended as per the need) and the device has proven as the best assistant for the blind person as per the real time survey in blind schools.

The TechEye enables the blind person the sense the surrounding and act accordingly. Ones he/she starts using it, they feel no need of human assistance.

My first objective is to provide an easy way of detecting obstacles to blind people, while walking. Secondly I had to design a low cost i.e. economical instrument for the blind people, which they could afford. The design of the instrument should be simple to operate and easy to use for the blind people. The instrument must give fairly accurate results while detecting the obstacles. The instrument must work for a long time on the portable and rechargeable battery. And lastly, the instrument must work long life and to the fullest possible utility.

Block Diagram
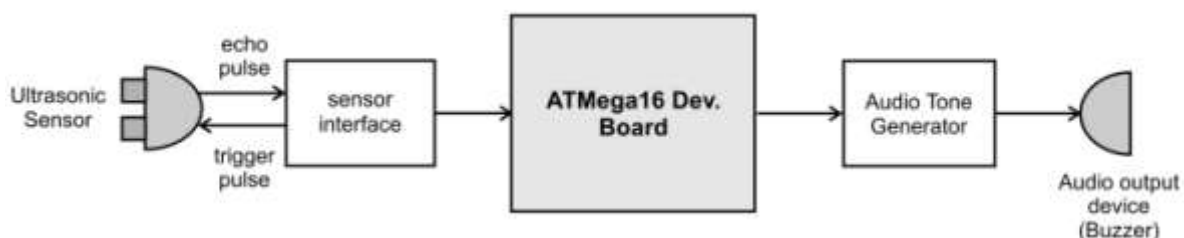
Block diagram of TechEye System for Obstacle Detection & Ranging to Assist Blind Person

1) - dedicat Working of the System
2) The system works as given below:
3) So to help socially I designed a microcontroller based system. The system uses Ultrasonic Waves to detect obstacles around the blind person.

4) When there is any kind of obstacle in front of the blind person holding the TechEye, the Ultrasonic Sensor will detect the presence of the obstacle or any object. Then it calculates the relative distance with the help of internal coding and will produce different types of audio tones to give audible alarm to the blind person.

5) In this way a blind person can use this system very accurately and effectively.

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Controlling Home Appliances Using Advanced Microcontroller: A Novel Approach

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Abstract:

Technology in 21st centuryy has been a never ending process. Instrumentation, control and automation playing a vital role in human life. The main objective of this article is to present the design and implementation of low cost, efficient and reliable arduino based control of home appliances such as light, fan, bulb refrigerator for household use. Any Android based smart-phone with built-in support for Bluetooth can be used to access and control these home equipments. Most common problem in the residential apartments is the depletion of electric energy due to unplugging of home appliances when they are not in use. Such type of energy diminution has been identified as an important energy wastage requiring urgent attention in the context of developing countries such as India, leading to electric energy crises. To avoid this situation, approach of easily controlling devices in home appliances through the use of wireless technology should be adopted. The author has proposed a low-cost, flexible system through smart-phone which helps to control the home appliances within certain distance from them.

Keywords— Arduino UNO, Bluetooth, Relay, Smart Phone.

Introduction:

In today's era, computers have eased the human life with the help of automation in almost all walks of life. Use of smart phones has increasingly become essential for people. The applications that people have downloaded and are available for download have no end in terms of their usage and purposes. In 21 century, theandroid based smart-phone has become basic requirement, which can be used for controlling the home appliances. In present scenario, electricity insufficiency is one of the major problem in our society that people are facing in everyday life. We need to conserve energy.To overcome this situation, a system is to be proposed such that home appliances should be turned OFF whenever they are notneeded to be used.

It is also very difficult for the old age and physically disabled people to operate the switches to switching the devices ON or OFF, especially if the switches are placed at far distance and higher places. It would be beneficial if these home appliances like fans and lights, etc. could be operated easily from a distance that is convenient to them. Smart phones have already proven their perfection in communication with other devices through an ad-hoc network viawireless connectivity like Bluetooth. Here the authors have demonstrated a mechanism for controlling the home appliances through a smart phone having android platform via 8-bit Bluetooth interface. Arduino is used for controlling a number of home appliances such as light, Fan, Bulbs and many more using ON/OFF relay.

This paper presents the arduino based control for household devices that use traditional method of the switch for operation. The short range wireless communication is used to control the home appliances through smart phone.

Design And Implementation

Nowadays smart phones are widely being used as a basic necessity. Considering its popularity and common usage, this paper has tried to exploit the usage of the same smart phones to control the home electrical equipments such as lights and fans. The feature of this mechanism is that it makes it possible to operatethe devices from a reasonably long distance with the help of wireless system through smart-phones. This mechanism is certainly beneficial for the elderly people and physically disabled people to comfortably switch the devices ON/OFF in a very short time using smart-phone from a distance. Also the smart phone can be use in system to improve the standard of living at home. The main objective of this paper is to implement low cost and wireless assistant for these people to control the home appliances as well as creating alerts in critical situations. The basic block diagram of arduino based control system for home appliances through smart-phone is depicted in following figure. The smart phone is connected to the arduino-uno (Microcontroller) through the Bluetooth module which interfaces with arduino board and allows the android smart-phone to communicate with it efficiently. The arduino microcontroller is the heart of this system that is capable of functioning as an interface for all hardware modules. The relay channel send control signals from the controller to electronics device like Fan and Light to accomplish the actions of switching the device ON / OFF from suitable distance. The arduino controller is programmed to control home equipments based on data sentby the mobile phone to arduino through the wireless interfacing module i.e. Bluetooth. The wireless communication between the smart-phone and Arduino Bluetooth module was found to be limited to 50m in a concreted building and maximum of 100m range was reported to be applicable in an open area.It is implemented using a smart-phone that can be connected to the hardware modules through Bluetooth and it receives status updates from them and also send control information to the arduino(microcontroller).The Bluetooth module (HC-05) is easy to use for Bluetooth serial port protocol module. It's approach give comfort in their home. There are many benefits and features related to the home automation system. One of the benefits associated with user, when the switch is too far from them is that the user does need to turn ON / OFF the electrical equipment.
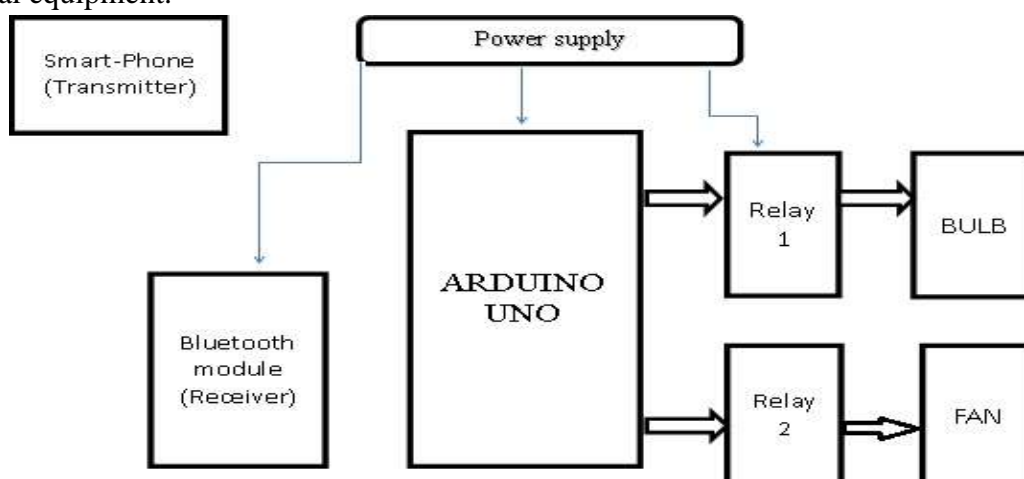
Fig. 1: Smart phone is connected to arduino-unothrough the Bluetoothmodule.

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Fig. 1: Smart phone is connected to arduino-uno through the Bluetooth module**.**

Hardware Implementation:
Arduino-Uno:

The heart of this system is arduino microcontroller that is capable of functioning as a interface for all hardware modules as shown in fig-2 a). All communication & control in this system are transmitted by the arduino microcontroller. The arduino is open source platform used to designa project. The arduino consists of both the programmable circuit board &the software that run on computer, to write and upload computer code to the physical board. The arduino does not require separate pieces of hardware, simply USB cable like a serial device. They are directly plugged into to computer and comfortably used to interface with computer. In addition arduino uses simplified version of C++, which makes it easier to develop the programs.
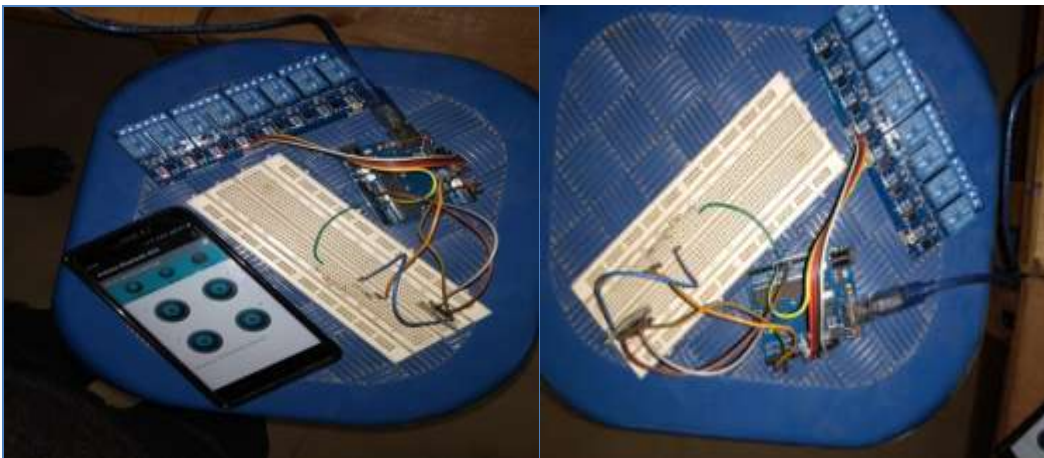
Fig-2-Hardware implementation

Bluetooth Module:

Bluetooth module (HC-05) is easy to use for Bluetooth serial port protocol module as shown in fig-2 b). The module can work on two operations, where it transmit and receives the data to another Bluetooth module. Using this feature, they communicate with other Bluetooth enabled device like Mobile, Tablet, Laptop etc. The (HC-05) module can be operating on 3.3v to 5 v power supply.

Relay:

A relay is an electromagnetic switch as shown in fig-2 c). The basic function of relay is to allow low power control voltage to operate a high power switch. Relays are switch that open and close circuits either electromechanically or electronically. Although it takes relatively small amount of power to turn ON, the relays can control much more power device. They are available in different configurations of operating voltage like 6v, 9v, 12v & 24v etc. Basically relay can work on three contactors namely normally open (NO), normally close (NC), Common (COM). When voltage is applied, the relay coils get energized & change COM to NO contact. Using the proper combination of contact, the electrical circuits can be turned ON & OFF.

a) Arduino-uno   b) Bluetooth module   c) Relay
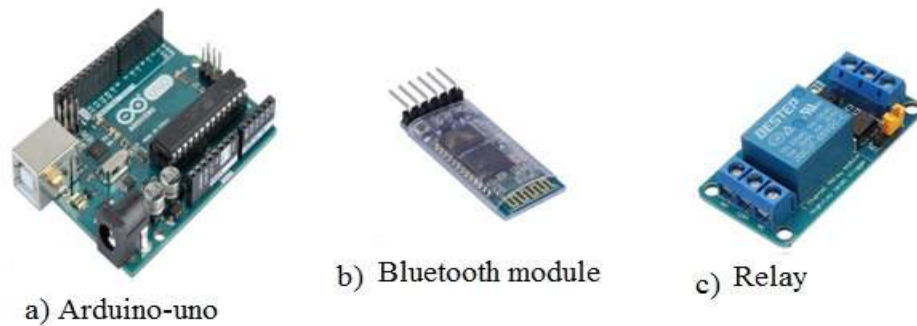
Fig-3-Hardware images of a) Arduino-uno b) Bluetooth module c) Relay

Conclusions:

Considering the features, usages and technology; the smart phones have become an integral part as well as the basic necessity in today's modern life.

In this paper, author has designed a model of android based smart-phone to control the household appliances. This novel architecture has been proposed and implemented for low cost and flexible method which can be extremely handy for old aged and disabled persons. It will enable them to control home appliances whenever they want through their smart phone, even though the devices are somewhat away from them. Finally it is realized that there is no need of superfluous training tothe technically aware people who are aware of android phone. Any Android based Smart phone with built in support with Bluetooth can be used to access and control the devices at home. Author further states that, in future it may be possible to use Wi-Fi facility or mobile cellular networks such as 3G or 4G to access the system. Prospective future works include incorporating SMS, Bluetooth module replaced by GSM modem and reducing wiring changes for installing the proposed system in pre-existing house by creating wireless network within the home for controlling home equipment.

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Arduino Uno Based Accident Avoiding System IN Mountainous Area ACROSS U-Turn

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Abstract:

Where there is a U-turn either on a ground level road or in mountainous area, the place becomes prone to accidents, particularly if the speed of vehicles is more, banking of the road is more or non-signalling of horn and/light while taking the U-turn on such places.

However, the road accidents on such places can be avoided using "Accident Avoiding System in Mountainous Area Across U-Turn". The suggested system use the typical use of Arduino UNO dev. board along with two ultrasonic sensors, sensor interfacing circuits, lamp driver circuits and two read lamp posts on opposite sides of the U-turn area on such places.

Introduction:

The setup of this system can be understood with the help of following diagram. Here consider one U-turn in a mountainous area. The traffic may be from both sides of the road and there is no disciplined system of traffic like one-way traffic.
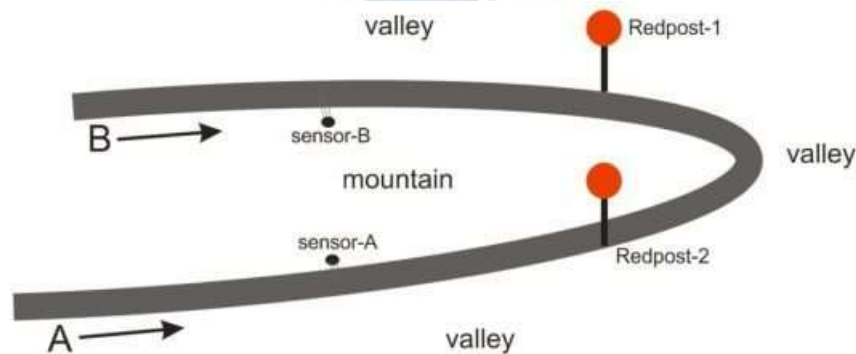
Suppose one vehicle (A) is approaching from bottom road towards the U-turn and another vehicle (B) is approaching from top road towards the U-turn simultaneously.

There are two RED lamp posts fixed at the starting points of U-turn, as shown above. Redpost-1 is controlled by sensor-A and the Redpost-2 is controlled by sensor-B.

Whenever the vehicles will pass in-front of the sensors, the sensor system will switch ON the respective Redpost-1 or Redpost-2.

For example, suppose vehicle-A is detected by sensor-A, then it will switch on the Redpost-1, i.e. the lamppost on opposite side of U-turn. This will give a visual alarm to the vehicle-B coming from other side of the mountain.

In the same way, vehicle-B will be detected by sensor-B and it will switch on the Redpost-2 i.e. the lamppost on opposite side of the U-turn. This will give a visual alarm to the vehicle-A coming from other side of the mountain.

Block Diagram
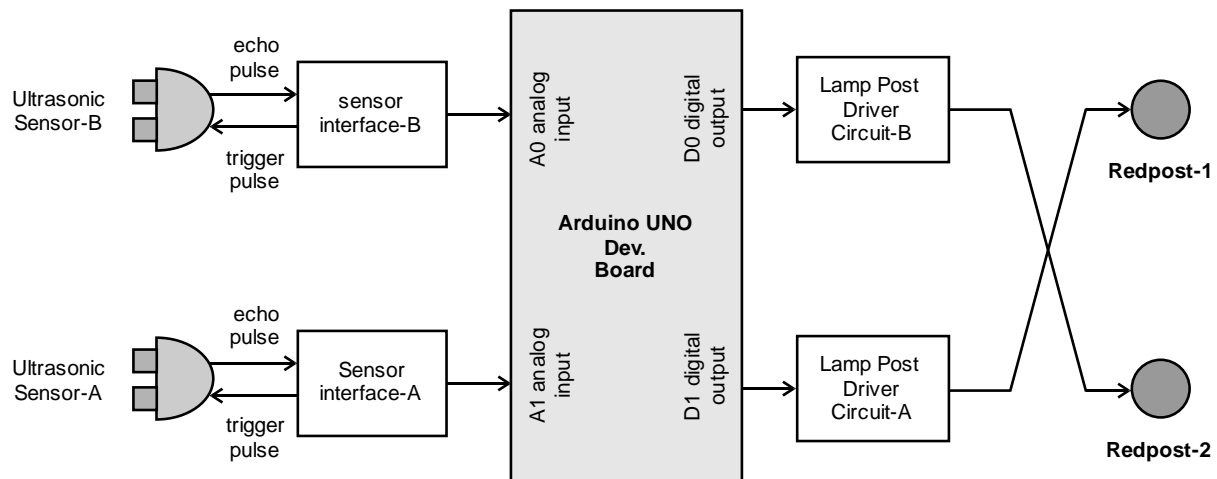
Block diagram of Arduino UNO Based Accident Avoiding System in Mountainous Area across U-Turn

Brief Working of the System

The working of the system can be understood by considering two possible conditions:

1)   Only vehicle-A is approaching: In this case, the US sensor-A will detect the presence of the vehicle. It will send an echo pulse to the sensor interface circuit-A. Then the detected signal will be processed inside the Arduino UNO dev. board as per the stored code of the system and will trigger the Lamp Post Driver Circuit-A. This will switch on the Redpost-1 to give a visual alarm on the other side of the mountain.

2)   Only vehicle-B is approaching: In this case, the US sensor-B will detect the presence of the vehicle. It will send an echo pulse to the sensor interface circuit-B. Then the detected signal will be processed inside the Arduino as per the stored code of the system and it will trigger the Lamp Post Driver Circuit-B. So the Redpost-1 will be switched on to give a visual alarm on the other side of the mountain.

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Green Electricity Response of Silver and Magnesium Electrode Pair

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Abstract:

Producing the electricity from tree's or plant's leaf as well as stem is possible. A leaf contains approximately more than trillions of cells. During the process of photosynthesis, each cell of the leaf emits electrons. By the movement of these trillions of electrons, we can produce electricity. In another method, we can get current from leafs by means of flow of electron between two types of different plants using different metal sensors and conductors. If we produce electricity from plants or trees, everyone wants to be planting the trees in ones garden. Government also motivated the process of plantation. As a result, the number of trees in the world will also increase; which can save our earth from global warming too.

Electric energy is playing a major and indispensable role in day-to-day life of human being. Most all the fields are encompassed with electricity and related appliances. There are number of ways by which electricity is being generated. To surmount the demand of electrical energy is ever growing problem and is creating several threats to the environment. To deal with the situation, various types of non-conventional and renewable energy sources are being invented and developed throughout the world.

In the presented research paper, an impact is given to generate DC voltage, from living plants like xerophytes as well as mesophytes. Such kind of energy source is non-conventional as well as renewable type of energy source and is very useful. It is eco-friendly technique of low voltage generation. Though the current research work of electricity generation from living plants is in infancy, but has wide scope in future for the development and evolution of renewable and non-conventional energy resources. The undertaken research work describes the design aspect of low power energy source wherein various plants are used as natural electrolytes along with various electrodes and cells.

Keywords: Green electricity, xerophytes plant, eco-friendly and renewable energy source, Silver and Magnesium electrode pair

Introduction:

Due to an scarcity of electricity, human being is facing the problem of load shading. There are number of ways by which electricity is being generated. The conventional as well as non-conventional methods are being research and developed used by different agencies, boards, institutes & companies. On some extend, every scientific team is contributing its share in the field of electricity generation.

The researchers are trying to use nonconventional method of generation of electricity by using living plants like xerophytic types. After generation of the electricity it will be utilized as a new kind of power source for small electronic circuits, devices & gadgets. This may stand as one of the renewable emerging source of energy. Such type of low voltage can be generated without creating waste materials, and also without polluting any environmental parameters.

If we become able to produce electricity from living plants or trees, everyone wants to be planting the trees in ones surroundings. Governments of many countries are also motivating such a process of plantation of trees and plants. As a result, the number of trees in the globe will also increase, which indirectly will save our planet from the serious issue of global warming. Though, the plant & tree power is improbable to replace the power sources for the most of applications. But this kind of system could provide low cost, continuous, pollution free & more natural option of the electricity or power source. On the primary level, the researchers tried to introduced such kind of low power source from the living plants. In near future, it might be used for different applications. In this paper, Silver and Magnesium materials are considered for preparation of electrodes and cells [1].

Preparation of electrodes and cells:

By using different xerophytic type of plants, various shape and size of the electrodes were tested practically for optimum values of output voltage, current and power [2]. Overall, twelve different materials like Copper, Aluminum, Zinc, Platinum, Iron, Silver, Gold, Carbon, Iron, Magnesium and Stainless Steel were used to design and developed the electrodes and cells. Despite the fact of designing the various kinds of electrodes and cells, following parameters has been taken into deliberation.

- ❖ Maximum electrode area should come in contact with the available sap flow
- ❖ Shape of electrode should be suitable to accommodate it into the plant
- ❖ Sap flow of the plant should reach to both the sides of electrodes [3]
- ❖ Square, rectangular, elliptical and circular shaped electrode has less contact area of sap flow
- ❖ Corrugated shaped electrodes has more contact area of sap flow comparatively and are most suitable for optimum output values
- ❖ Small sized electrodes has less contact area of sap flow which results in less output values
- ❖ Big sized electrodes may damage the leaf or plant which may reduce the remaining life span of the plant or tree

Response of Silver and Magnesium electrode pair:

Assorted xerophytic plants such as Aloe vera, Opuntia dillennii, Euphorbia neriifolia, Cereus hildmannianus, Euphorbia antiquorem, Agave vivipara, Opuntia stricta and Euphorbia lactea were studied practically for output voltage, current and power. In overall, 45 different plants were tested with the help of various types of electrodes. But the only plants with good potential difference (or voltage) and output current are considered in this presented paper. Following five plants viz. Aloe vera, Opuntia dillennii, Euphorbia neriifolia, Cereus hildmannianus and Agave vivipara provided better response for Silver and Magnesium electrode pair [4].

Just as abovementioned, five xerophytic plants were studied using Silver and Magnesium (Ag-Mg) electrode pair. The readings for output voltage and output current are recorded in

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following table (1). Also, the measurements of Specific conductivity and pH value of plant extract are noted in the same table.

Table (1): Response of various Xerophytes for Silver and Magnesium electrode pair

S. N.	Name of the Xerophytes used	Specific conductivity in m℧	pH value of plant extract	Output voltage in Volts	Output current in mA
1)	Aloe vera	3.62	6.4	1.068	0.85
2)	Opuntia dillennii	7.44	6.2	1.641	1.12
3)	Euphorbia neriifolia	5.32	5.7	1.586	0.84
4)	Cereus hildmannianus	5.40	5.3	1.621	0.71
5)	Agave vivipara	4.16	5.1	1.198	0.37

From above table it is found that Opuntia dillennii produces maximum voltage as well as maximum current using Silver-Magnesium electrode pair. Figure (1) below, shows the graphical representation and analysis of output voltage and output current obtained for these plants.
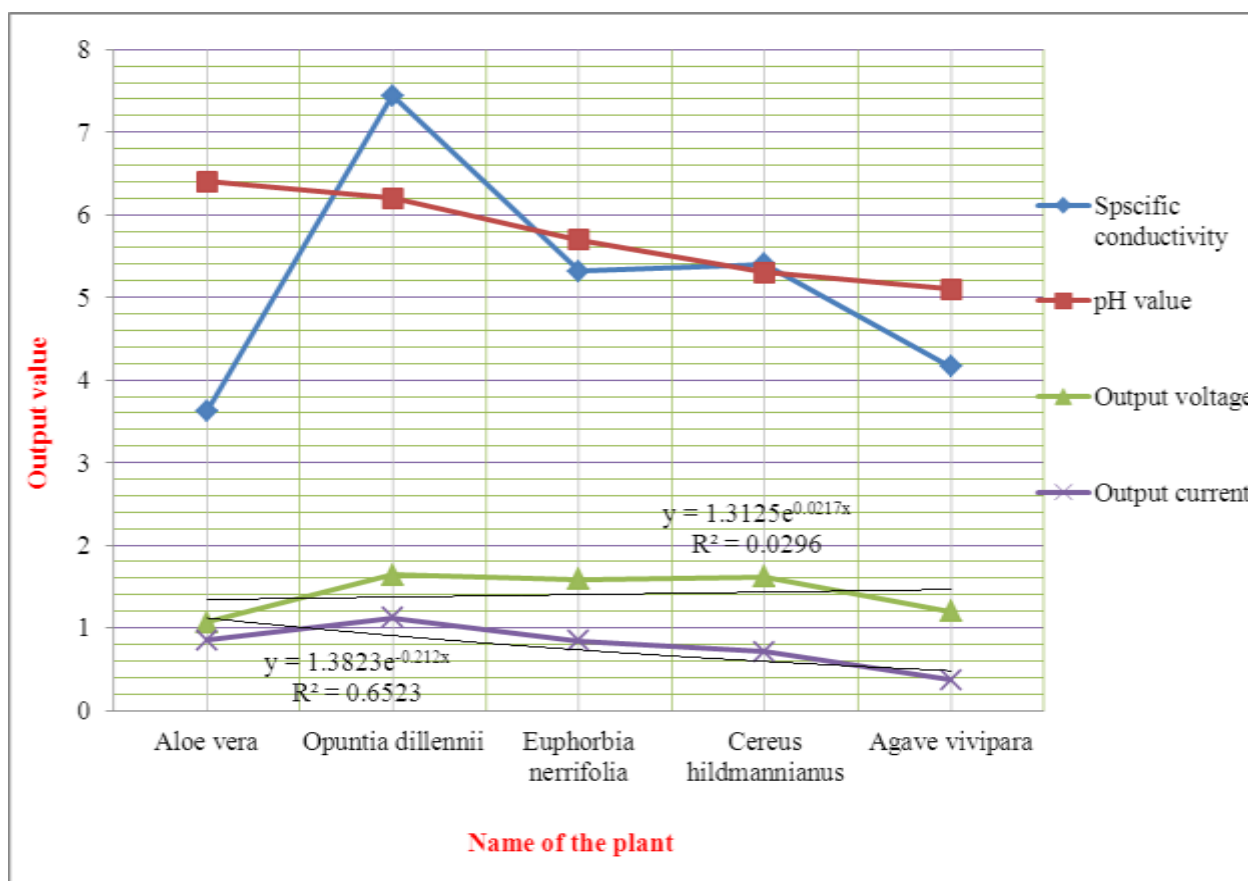
Figure (1): Correlation of output voltage, output current, specific conductivity and pH value for Ag-Mg electrode pair

As shown in above figure (1), the trendlines along with the equations and R-squared values are drawn for output voltage and output current of different plants. It is observed that maximum output voltage as well as current is generated for Opuntia dillennii plant and there is decline in both sides of exponential curve for other plants. The equation of line y = 1.312 * e

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$^{0.021x}$ with R-squared value, $R^2 = 0.029$ of exponential curve for output voltage shows that the overall decline rate is slight positive with respect to output current. The decline rate for document set of output current is low with equation $y = 1.382 * e^{-0.21x}$ with R-squared value, $R^2 = 0.652$, as compared to output voltage generated.

Conclusion:

After due analysis, it was found that the simultaneous reduction and oxidation (i.e. redox) reaction/process takes place at both the electrodes. When such type of Silver-Magnesium electrode pairs are used, that gives us typical voltage, current and power for operation of miniature electronics circuits and gadgets. It was found that Silver-Magnesium electrode pair produces more voltage as well as current values for Opuntia dillennii whereas it produces less voltage and current values for Agave vivipara. Such types of electrodes and cells are of low cost, reusable, less corrosive, pollution free and also eco-friendly for the environment [8]. As a result, such type of voltage source becomes renewable, non-conventional, cheap and an emerging low power source of electricity.

The presented and undertaken research work is in infancy, but more research will open up new ways of using trees, plants and vegetative power [1,9]. So that dependency of human being on conventional and non-renewable energies may be reduced on some extent. Let's hope that our imagination may cross boundaries and we might be plugging into the surrounding trees and plants to charge our iPods, cell phones and other gadgets using such type of green electricity.

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Design and Implementation of Fuzzy Logic Technique for Aircraft Control System

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Abstract:-

This research paper is about a Design and Implementation of Fuzzy Logic technique for Aircraft control system. In this study we describe an aircraft control system and landing of an aircraft are considered. An aircraft control system is a totally non-linear system when the final approach and landing of an aircraft are considered. It involves maneuvering flight in an appropriate course to the airport and then along the optimum glide path trajectory to the runway. We know that this path is usually provided by an instrument landing system, which transmits two radio signals to the aircraft as a navigational aid. These orthogonal radio beams are known as the localizer and the glide slope and are tramitted from the ends of the runway in order to provide the approaching aircraft with the correct trajectory for landing. The pilot executing such a landing must monitor cockpit instruments that display the position of the aircraft relative to the desired flight path and make appropriate corrections to the controls.

In this research work the fuzzy logic technique has been explained with reference to the real world problems. The problem of Aircraft control system for Fuzzy logic technique is solved using the MATLAB programming software. The Fuzzy Logic methods are used for solving the Aircraft control system problems are Fuzzy Sets, Fuzzy Relation, membership function, non-transitive method etc. This paper is totally based on software implementation of MATLAB.

Keywords: Membership function, fuzzy set, Non-transitive method, Aircraft control system, decision making, and uncertainty.

Introduction:

Fuzzy Logic:

The real world is complex , complexity arises from uncertainty in the form of ambiguity." as the complexity of the system increases , our ability to make precise and yet significant statements about its behavior diminishes until a threshold is reached beyond which precision and significance (or relevance) become almost mutually exclusive characteristics." These are the words of the LOTFI ZADEH who introduced fuzzy logic in 1965. " The closer looks at a real world problem , the fuzzier becomes its solution", observed Dr. Zadeh who published his seminal work "FUZZY SETS" in the journal or information and control.

When there is imprecision (more uncertainty) and inadequate data the fuzzy logic technique is useful. Secondly, the cost of information increases with precision. But the cost of fuzzy information is far less than the perfect or imperfect information. Thus, there are two – fold advantages of the fuzzy logic technique: Understanding of complex systems becomes easier and analysis makes the system costs effective. He used the linguistic

variable and further suggested that set membership function is the key to decision making when there is uncertainty.

The attention currently being paid to fuzzy logic is most likely the result of present popular consumer products such as washing machine, cameras, elevators, air conditioners, rice cookers, automobile, dishwashers etc. The nature of uncertainty in a problem is a very important point that engineers should ponder prior to their.

Fuzzificaion:

Fuzzification is the process of making a crisp quantity fuzzy. We do this by simply recognizing that many of the quantities that we consider to be crisp and deterministic are actually not deterministic at all. They carry considerable uncertainty. If the form of uncertainty happens to arise because of imprecision, ambiguity or vagueness then the variable is probably fuzzy and can be represented by a membership function.

In the real world such as, digital voltmeter generates crisp data, but these data are subject to experimental error. The below fig 1.1 shows one possible range of errors for a typical voltage reading and associated membership function that might represent Such imprecision.
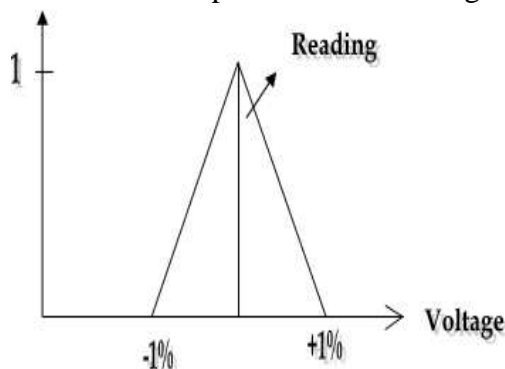
Fig 1.1 Membership function of crisp voltage reading
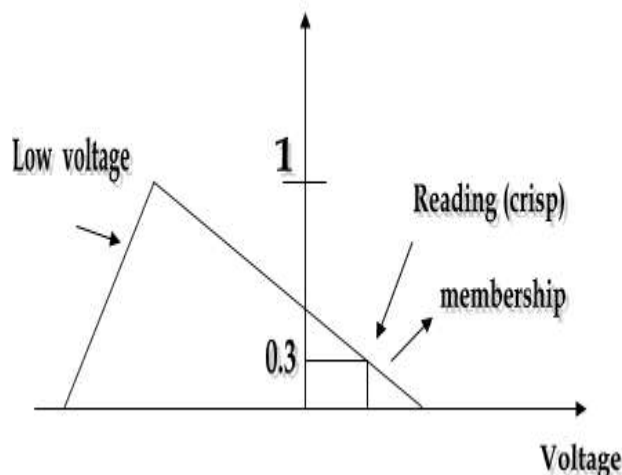
Fig.1.2 Fuzzy sets and crisp reading
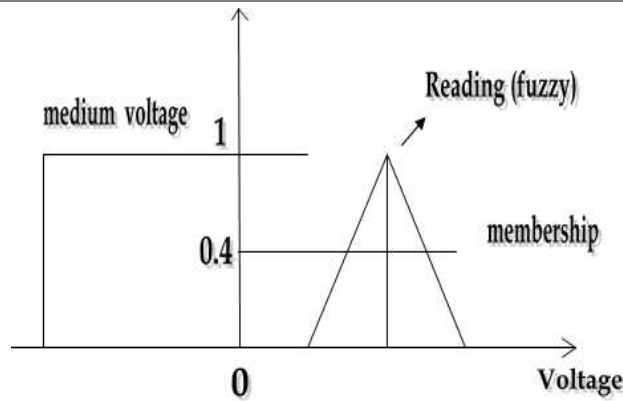
Fig. 1.3 Fuzzy set and fuzzy reading

Defuzzification:

It is the conversion of fuzzy quantity to a precise quantity. The output of a fuzzy process can be the logical union of two or more fuzzy membership functions defined on the universe of discourse of the output variable.
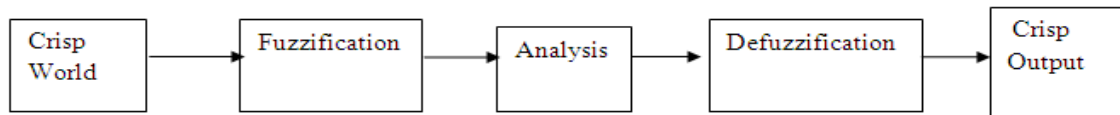
Fig (4) Block diagram of Fuzzy to Crisp Conversion

Aircraft Control System:

An aircraft control system is a totally non-linear system when the final approach and landing of an aircraft are considered. It involves maneuvering flight in an appropriate course to the airport and then along the optimum glide path trajectory to the runway. We know that this path is usually provided by an instrument landing system, which transmits two radio signals to the aircraft as a navigational aid. These orthogonal radio beams are known as the localizer and the glide slope and are tramitted from the ends of the runway in order to provide the approaching aircraft with the correct trajectory for landing. The pilot executing such a landing must monitor cockpit instruments that display the position of the aircraft relative to the desired flight path and make appropriate corrections to the controls.

Methodology:

For solving the Aircraft control system problem using fuzzy logic technique number of methods are available like Fuzzy Sets, Fuzzy relation, Cartesian product, alpha- cut, Non-transitive ranking methods etc. Among this method we have selected the Non-transitive method for solving the power transistor problem.

Nontransitive Ranking Method

When we compare objects that are fuzzy, ambiguous, or vague, we may well encounter a situation where there is a contradiction in the classical notions of ordinal ranking and transitivity in the ranking. To accommodate this form of nontransitive ranking, we introduce a special notion of relativity.

Let x and y be variables defined on universe X. We define a pairwise function

$f_y(x)$ as the membership value of x with respect to y

And we define another pairwise function

$f_x(y)$ as the membership value of y with respect to x

then the relativity function is given by

$$f(x/y) = f_y(x)/ \max[f_y(x),f_x(y)] \qquad (1)$$

is a measurement of the membership value of choosing x over y. The relativity function $f(x/y)$ can be through of as the membership of preferring variable x over variable y.

To develop the genarl case for many variables, define variables $x_1, x_2, ------, x_i, x_{i+1}, \ldots, x_n$. All defined on universe X, and let these variables be collected in a set A i.e $A = \{x_1, x_2, \ldots, x_{i-1}, x_i, x_{i+1}, \ldots, x_n\}$. We then define a set identical to set a except this new set will be missing one element xi, and this set will be termed A'. The relativity function then becomes

$$f(x_i/A') = f(x_i/ \{x_1, x_2, \ldots, x_{i-1}, x_i, x_{i+1}, \ldots, x_n\})$$
$$= \min\{f(x_i/x_1), f(x_i/x_2), \ldots, f(x_i/x_i-1), f(x_i/x_{i+1}), \ldots, f(x_i/x_n)\} \ldots \ldots \ldots (2)$$

Which is fuzzy measurement of choosing xi over all elements in the set A'. The expression in equ(2) involves the logical intersection of several variables; hence the minimum function is used. Since the relativity function of the variable with repsect to itself is identity.

$$f(x_i/x_i) = 1 \qquad \ldots \ldots \ldots (3)$$

then

$$f(x_i/A') = f(x_i/A) \qquad \ldots \ldots \ldots (4)$$

We can now form a matrix of relativity values. $f(x_i/x_j)$, where i,j=1,2,……..n, and where xi and xj are defined on a universe X. This matrix will be square and of order n, and will be termed the c matrix (c for comaprision). The c matrix can be use to rank many different fuzzy sets.

To determine the overall rnking, we need to find the smallest value in each of the rows of the C matrix; that is,

$$C_i' = \min f(xi/X), i= 1,2,\ldots\ldots,n. \qquad (5)$$

Where Ci' is the membership ranking value for the ith variable.

Experimental Work

Presume that four positions are available to the pilot and that four corrections P1, P2, P3, and P4 from the actual position P are required to put the aircraft on the correct course. The pair wise comparisons for the four positions are as follows;

Fp1(P1)=1	Fp1(P2)=0.5	Fp1(P3)=0.6	Fp1(P4)=0.8
Fp2(P1)=0.3	Fp2(P2)=1	Fp2(P3)=0.4	Fp2(P4)=0.3
Fp3(P1)=0.6	Fp3(P2)=0.4	Fp3(P3)=1	Fp3(P4)=0.6
Fp4(P1)=0	Fp4(P2)=0.3	Fp4(P3)=0.6	Fp4(P4)=1

In this example, the non-transitive method is very useful.

Let x and y be two variables defined on universe X. We define a pair wise function

$fy(x)$ as the membership value of x with respect to y and we define another pair wise function $fx(y)$ as the membership value of y with respect to x

Now, the relativity function given by

$$f(x/y) = fy(x)/\max [fy(x),fx(y)] \quad \ldots \ldots \ldots \ldots 3.1$$

The relativity function f(x / y) can be thought as the membership of preferring variable x over variable y. To determine the overall ranking, we need to find the smallest value in each of the row of the matrix; that is,

$$C = \min f(x/y) \quad \dots\dots\dots\dots 3.2$$
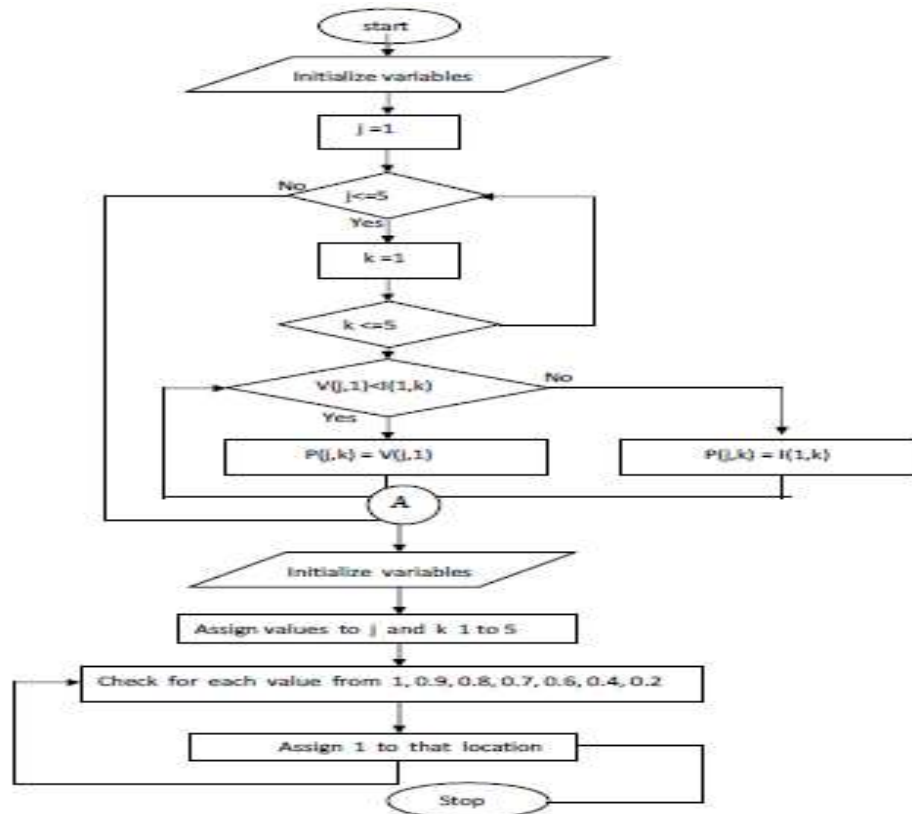
Fig: Flowchart for Aircraft control System

Programming in MATLAB:-

```
% program based on nontransitive method
% program for aircraft control system
% The pairwise comparisions for the four positions are as follows
% Fp1(p1)=1      Fp1(p2)=0.5    Fp1(p3)=0.6    Fp1(p4)=0.8
% Fp2(p1)=0.3    Fp2(p2)=1      Fp2(p3)=0.4    Fp2(p4)=0.3
% Fp3(p1)=0.6    Fp3(p2)=0.4    Fp3(p3)=1      Fp3(p4)=0.6
% Fp4(p1)=0      Fp4(p2)=0.3    Fp4(p3)=0.6    Fp4(p4)=1

P=[1 0.5 0.6 0.8;0.3 1 0.4 0.3;0.6 0.4 1 0.6;0 0.3 0.6 1]
F=zeros(4,4)
A=zeros(1,4)
for j=1:4
  for k=1:4
    F(k,j)=P(j,k)/max(P(j,k),P(k,j))        % formula of non-transitive ranking
  end
end
% Minimum of above function F in row wise and result stored in A
```

A(1,1)=min (F(1,j))
A(1,2)=min(F(2,j))
A(1,3)=min(F(3,j))
A(1,4)=min(F(4,j))

Result and Discussion

In the problem of Aircraft control system, the landing of an aircraft is considerd. The path is usually provided by an instrument landing system, which transmits two radio signals to the aircraft as a navigational aid. In this problem, foue positions are avaialable to the pilot and those four corrections P1, P2, P3, and P4 from actual position P. The method is used in this problem is nontransitive ranking. The relativity function of nontransitive rnking is given by,

$f(x/y)= f_y(x)/max[f_y(x),f_x(y)]$

From this method we could solve the actual position of the aircraft.

This problem is solved using MATLAB programming and the result is displayed given below in matrix form.

Output:

P= 1.0000 0.5000 0.6000 0.8000
     0.3000 1.0000 0.4000 0.3000
     0.6000 0.4000 1.0000 0.6000
     0.0000 0.3000 0.6000 1.0000
F= 0   0   0   0
     0   0   0   0
     0   0   0   0
     0   0   0   0
 A= 0 0 0 0
 A= 0 1 0 0
 A= 0 1 1 0
A= 0 1 1 1

Discussion

One area in which fuzzy set theory has a great potential that in psychology; in particular the psycho logistics which is essential for studying the connection between human communication and decision machines. Today, close to four decades after the artificial intelligence (AI) was born. It can finally be said that intelligent systems are becoming a reality. The soft computing has direct bearing on machine intelligence. Neuro fuzzy soft computing has a special role in the design of modern intelligent systems.

Applications Of Fuzzy Logic

- Control systems
- Pattern recognition
- Robotics
- Consumer electronics
- Automobiles
- Intelligent systems

Fuzzy Logic In Consumer Goods

Cameras , Washing machine , Air conditioners , Luxury cars , Elevators , Rice cookers , Automobile , Dishwashers , Refrigerator , Camcorders , Vac. Cleaner etc.

Scope Of Work

The scope of further research work is to develop and design some electronic circuits such as speed control motor, automatic control system and some decision making problem like weather forecast. This has been recently used for user-oriented verification of probability forecasts, but there is applied to aid forecast users in optimizing their decision making from probability forecasts.

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An Intelligent Controller for Greenhouse Temperature Control Using Fuzzy Logic

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Abstract –

The present paper deals with the design of an intelligent controller for greenhouse to control temperature inside the greenhouse. A fuzzy logic is used to control the temperature. This controller is designed to handle two inputs, two outputs and 27 fuzzy rules; also inside and outside temperature can be monitored using LCD. The temperature inside the greenhouse can be set by the user as per the need of the crop in different seasons during the lifecycle of the plant. The PWM outputs are generated to control temperature according to the set point value.

Keywords – Intelligent Controller, FLC, Fuzzy Inference, Fuzzy Logic, Greenhouse, PWM

Introduction:

The greenhouse is a structure that is covered with a material that is transparent to the visible portion of the electromagnetic spectrum, which is utilized in the growth of plant. The performance of the greenhouse is best when temperature is not too hot and not too cold. It is necessary to maintain suitable temperature at growth stage of several plants. So, with the controlled environment in the greenhouse it is possible to increase the quality and quantity of crop produce per unit land in minimum possible time [1]. So, with the controlled environment in the greenhouse it is possible to increase the quality and quantity of crop produce per unit land in minimum possible time. Automation in greenhouse is very important for successful management of the greenhouse crops [2][3]. Fuzzy control has been widely applied in industrial controls and domestic electrical equipment [4]. The automatic learning of fuzzy rules is a key technique in fuzzy control. In the present work a fuzzy logic based temperature controller is designed which will sense the inside and outside temperature of greenhouse, displays it on the screen, allows user to set inside temperature as per the requirement and activate the relays accordingly so as to maintain temperature.
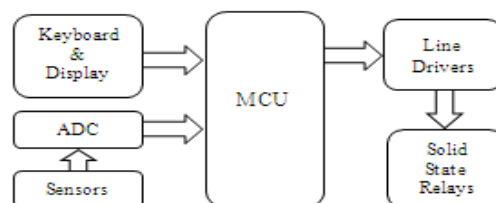
System Block Diagram2.1 Hardware

Atmel's 89C52 microcontroller was used for system design, which after initialization, reads the sensors, displays the inside and outside temperature values of on LCD and act accordingly as per the algorithm. National Semiconductor's LM 35 ICs were used as temperature

sensor to sense the inside and outside temperature of the greenhouse. The analog outputs of these sensors were converted to their digital equivalent by using 8-bit A/D converter IC. The current values of the temperature are displayed on a 20x4 LCD module. This LCD module has four rows of twenty characters in each row. The port 2 pins P2.4 and P2.7 of 89C52 were used for controlling the heating and cooling systems. The solid-state relays (SSR) were connected to these port lines the through line driver IC ULN2808. The cooling and heating systems were connected to these SSRs to generate PWM for this controller [5].

Software

The software modules were developed for system control so as to upgrade the system module wise. Following software modules were developed for the controller.

  i. Initialization,
  ii. Sensor,
  iii. Keyboard and display,
  iv. FLC, and
  v. PWM generation.

After reset, the initialization module loads the variables, stack, and other necessary registers to their default values set by the programmer, initialize the timers and start them. The sensor module reads the inside and outside temperature one by one, converts it to digital and stores them to the system memory. The keyboard and display module facilitates the user to set the inside temperature and displays the settings and temperature values on the LCD. The function of FLC module is described in section 3. The PWM outputs were generated for the cooling and heating system by PWM generation module using timer 1 interrupt of 89C52.

Fuzzy Logic Controller (FLC)

In the present design, a fuzzy logic controller (FLC) was used for maintaining the temperature inside the greenhouse to the desired set value.

The block diagram of fuzzy logic controller (FLC) is shown in Fig. 3.1
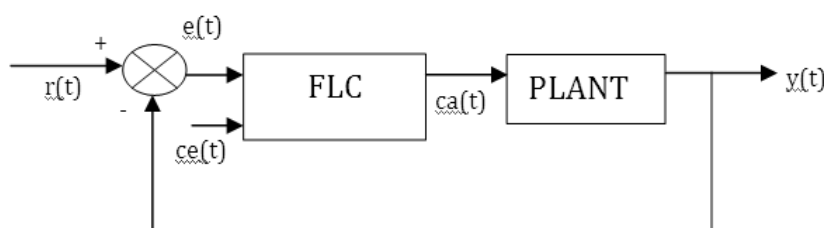
Figure 3.1 block diagram of FLC

A FLC was designed to which two input variables e and ce were given. The error value e of temperature was computed as:

e = set point - current value

And change in error ce was computed as:

ce = current e – previous e

The values of e and ce are crisp in nature, and requires to be converted to fuzzy values. The triangular membership function was used for fuzzification of error value of temperature e within the universe of discourse with nine linguistic values, as shown in Fig. 3.2, the linguistic values were NVL (Negative Very Large), NL (Negative Large), NM (Negative Medium), NS

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(Negative Small), Z (Zero), PS (Positive Small), PM (Positive Medium), PL (Positive Large) and PVL (Positive Very Large) [5]. The universe of discourse for error was (-40, +40) ^{0}C.
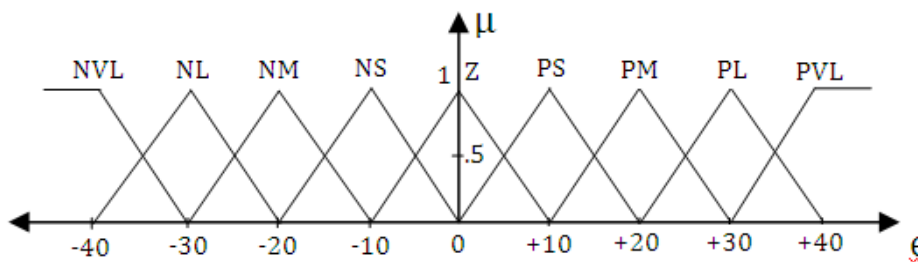
Figure 3.2 Membership function for error

The change in error ce was also fuzzified using triangular membership functions with three linguistic values NEG (Negative), Z (Zero) and POS (Positive), as shown in Fig. 3.3.
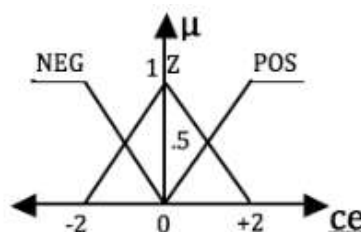
Figure 3.2 Membership function for change in error

In this controller, the decision making stage consists of fuzzy rules that decides action to be taken. This is the key component of the fuzzy control and constructed from the expert knowledge and experience. The rule base, which consists of 27 rules, was designed on the basis of knowledge from experts and literature [5], as shown in Table 3.1.

Table 3.1 fuzzy logic rule base

ca \ e \ ce	NVL	NL	NM	NS	Z	PS	PM	PL	PVL
NEG	VH	H	LH	M	VL	M	LH	H	VH
Z	VH	VH	H	LH	VL	LH	H	VH	VH
POS	VL	VL	VL	VL	VL	VL	VL	VL	VL

On the basis of error value, cooling or heating system were selected automatically by the system. If error is positive the heating system will be selected otherwise cooling system was selected and control action by FLC would be applicable to selected system.

The general form of fuzzy logic rule is:

IF (condition 1) AND (condition 2) THEN (action)

The control action is also fuzzified using triangular membership function as shown in Fig. 3.4 and has linguistic values VL (Very Low), L (Low), M (Medium), LH (Little High), H (High) and VH (Very High).
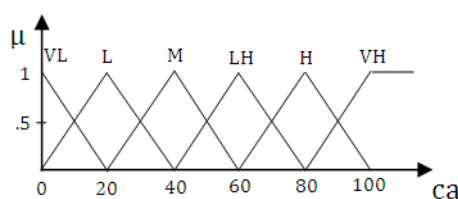
Figure 3.4 membership functions for control action

On the basis IF-THEN rules, the fuzzy inference engine computes the control outputs after processing the input data. The fuzzy rule-based is defined using Mamdani inference [4][6] system. These outputs are fuzzy values, which are then converted to crisp value in defuzzification stage.

Defuzzification:

To convert the fuzzy values obtained by decision-making stage into non-fuzzy or crisp value, the Center Of Gravity (COG), also known as Center Of Area or Centroid, method was used [6]. This method has proven to work well with efficient an accurate results [6][8]. The defuzzified output for the process is calculated by using the equation [9]-

$$y = \frac{\sum_{k=1}^{n} \mu(y_i) \times y_i}{\sum_{k=1}^{n} \mu(y_i)}$$

Where,

y: control action by FLC

k: No. of fuzzy variables

yi: Peak value of ith clipped fuzzy set

$\mu(yi)$: Membership value of ith clipped fuzzy set

The crisp value obtained from defuzzification stage for the corresponding values of e and ce were stored in the internal ROM as look up table and these values were used to access these crisp values from the look up table. The value read from the look up table was used as percentage on-time duty cycle for PWM output, which was generated using timer 1 interrupt service routine. The PWM output was used to control either cooling or heating system depending on the error value e. The above procedure was repeated to maintain the temperature of greenhouse as per the set point.

Result and Discussion

A fuzzy logic based intelligent controller was implemented using microcontroller 89C52 for the control of temperature inside the greenhouse. The software modules were developed and individually tested. The performance of the whole system was then checked. After reset, on completion of initialization, the system displays and the various parameters on the LCD screen. The sensor module sense the temperature and displays the latest data on the screen. The performance of the controller was tested for various set points. The PWM outputs generated by controller maintains the temperature in the greenhouse close to the set point

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Enhancement of Bandwidth and Reduction of Mutual Coupling in Microstrip Antenna Array

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Abstract—

The paper demonstrates the improved performance of microstrip antenna array using fork shape slot type electromagnetic band structure in the ground plane and U shape patch type electromagnetic band gap structure on the surface. The proposed antenna array is producing overall bandwidth and increased gain of 75.91 % and 10.31 dB as against 4.89 % and 6.81 dB of conventional antenna array. Additionally, a virtual size reduction of 26.73 % is also obtained. Moreover sizable reduction in mutual coupling and backward radiation are also noticed in the modified microstrip antenna array. The dielectric substrate used to design and fabricate the microstrip antenna arrays is FR-4 glass epoxy. Mentor Graphics IE3D software is employed to design the microstrip antenna arrays and vector network analyzer is used to obtain the measured results.

Index Terms— Dielectric Substrate, Electromagnetic Band Gap Structure, Mutual Coupling, Resonant Frequency.

introduction

An antenna is defined as electrical device used to transmit and receive electromagnetic waves. An antenna array is a serial arrangement of antenna elements with proper spacing between the antenna elements. Microstrip antennas are a group of antennas which can be easily fabricated. They have a dielectric substrate loaded in between the radiating patch and finite ground plane. These antennas suffer from few limitations of surface wave excitation and narrow bandwidth. [1-3]. Researchers have come across different methods to limit the problems of microstrip antennas. Electromagnetic band gap (EBG) structures have been the primary and frontrunners in this aspect. These are defined as periodic structures which have the ability to stop or allow the passage of electromagnetic waves in certain frequency bands for all angles of incidence. With the extensive growth in technology, EBG structures have emerged as one of the most efficient and sought after structures in enhancing the performance of microstrip antenna arrays. Recently, there is an increasing interest in the use of EBG structures. When a microstrip antenna array radiates electromagnetic waves, a small amount of power is transmitted into free space and a majority of power is lost in the dielectric. There is a necessity to overcome this serious drawback of microstrip antenna arrays. [4-5].

microstrip antenna design

The first step involves the design cif conventional microstrip antenna array (CMAA). It has four identical rectangular radiating elements fed by corporate feeding technique. The design frequency of CMAA is 6 GHz. The distance between the adjacent radiating elements of CMAA

is $\lambda/4$, where λ is the wavelength at the design frequency of 6 GHz. CMAA is fed by corporate feeding method. The dielectric substrate employed is FR-4 glass epoxy with dielectric constant and loss tangent equal to 4.2 and 0.0245 respectively. The height of the substrate is 1.6 mm. The length and width of each of the radiating elements or patches of CMAA are designated by L_p and W_p. The width of the radiating patch is determined by using equation (1).

$$\frac{c}{2f_r\sqrt{\frac{\varepsilon_r+1}{2}}}$$

(1)

In equation (1), c is velocity of light equal to 3×10^8 m/s, f_r is the design frequency equal to 6 GHz and ε_r is dielectric constant of substrate equal to 4.2. Therefore the width of the radiating patch is equal to 11.76 mm. The length of the radiating patch is calculated by using equation (2)

$$L_{eff} - 2\,\Delta l \tag{2}$$

where

L_{eff} is given by equation (3)

$$\frac{c}{2f_r\sqrt{\varepsilon_e}} \tag{3}$$

and ε_e is given by equation (4)

$$\varepsilon_e = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left(\sqrt[-\frac{1}{2}]{1+\frac{12h}{W}}\right) \tag{4}$$

In equation (4) h is height of the substrate equal to 1.6 mm and W is width of the radiating patch equal to 11.76 mm.

Δl is given by equation (5)

$$\frac{0.412h\,(\varepsilon_e+0.3)(\frac{W}{h}+0.264)}{(\varepsilon_e-0.258)(\frac{W}{h}+0.8)} \tag{5}$$

Using equations (2), (3), (4) and (5) the length of the radiating patch is equal to 15.73 mm. The other dimensions of CMAA are calculated by using the formulae available in literature review. The schematic of CMAA is depicted in Fig.1.
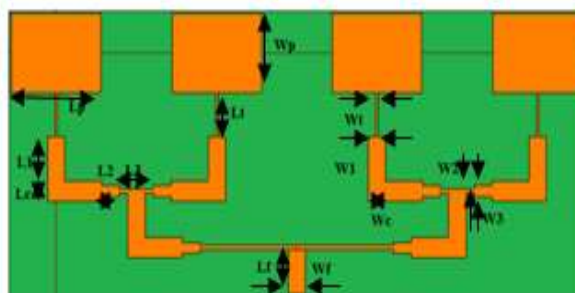
Fig. 1. Schematic of CMAA.

The dimensions of all the parts of CMAA are shown in Table I.

TABLE I. PARAMETER VALUES OF CMAA

Parameter	Value(mm)
Length of the patch (Lp)	15.73
Width of the patch (Wp)	11.76
Length of the quarter wave	6.47

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transformer (Lt)

Width of the quarter wave transformer (Wt)	0.47
Length of the 50Ω line (L1)	6.52
Width of the 50Ω line (W1)	3.05
Length of the coupler (Lc)	3.05
Width of the coupler (Wc)	3.05
Length of the 70Ω line (L2)	6.54
Width of the 70Ω line (W2)	1.62
Length of the 100Ω line (L3)	6.56
Width of the 100Ω line (W3)	0.70
Length of the feed line (Lf)	6.52
Width of the feed line (Wf)	3.05

The schematic depicted in Fig.2 is the arrangement of elements of CMAA to measure the mutual coupling between the antenna elements. All the four antenna elements are fed independently with the same amount of power and are seperated by the same distance as that in Fig.1.
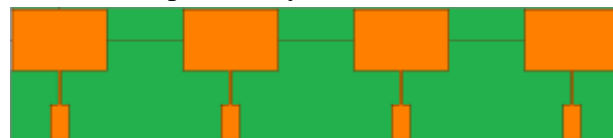
Fig. 2. Schematic of arrangement of CMAA for the measurement of mutual coupling.

proposed microstrip antenna array

The design of proposed microstrip antenna array (PMAA) involves the modification of ground plane and surface of CMAA. The ground plane of PMAA has fork shape slot type EBG structure and the surface is replaced with U-shape patch type EBG structure. The unit cell of EBG structure etched in the ground plane of PMAA is depicted in Fig. 3.
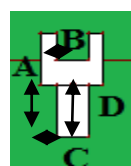
Fig. 3. Schematic of unit cell of fork shape slot type EBG structure.

The dimensions of schematic shown in Fig. 3 are A = 10 mm, B = 2.5 mm, C = 2 mm and D = 5 mm respectively.

The schematic of fork shape slot type EBG structure is depicted in Fig. 4. The EBG structure is a matrix of 4×14 of unit cells depicted in Fig. 3. Each unit cell of Fig. 4 is periodically separated from its immediate neighbour by a distance of 3 mm in the direction of x-axis and y-axis. The periodicity of unit cells of Fig. 4 is represented by S.
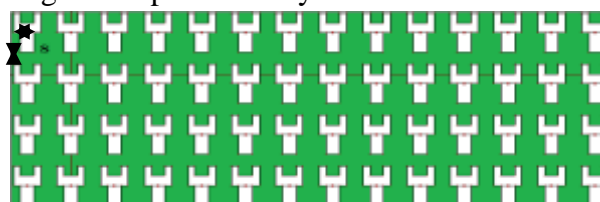
Fig. 4. Schematic of fork shape slot type EBG structure.

The schematic of unit cell of U-shape patch type EBG structure is depicted in Fig. 5. The dimensions of schematic shown in Fig. 5 are M = 5 mm and N = 4 mm respectively.
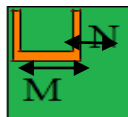
Fig. 5. Schematic of unit cell of U-shape patch type EBG structure.

The schematic of U shape patch type EBG structure is depicted in Fig. 6. The EBG structure is a matrix of 3×2 of unit cells depicted in Fig. 5. Each unit cell of Fig. 6 is periodically separated from its adjacent neighbour by a distance of 1 mm in the direction of x-axis and y-axis. The periodicity of unit cells of Fig. 6 is represented by P.
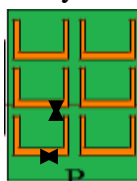
Fig. 6. Schematic of U shape patch type EBG structure.

The fork shape slot type EBG structure and U-shape patch type EBG structure depicted in Figs. 4 and 6 are loaded in the ground plane and on the surface of CMAA to design PMAA. The U-shape patch type EBG structure is placed in between the radiating patches. The schematic of PMAA is depicted in Fig. 7.
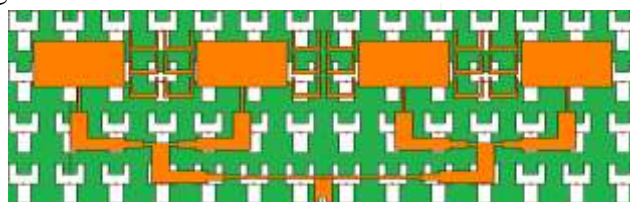
Fig. 7. Schematic of PMAA.

The mutual coupling coefficients of PMAA are determined by using the schematic shown in Fig. 8. The schematic of Fig.8 is obtained by loading the fork shape slot type EBG structure in the ground plane and U shape patch type EBG structure on the surface of Fig. 2.
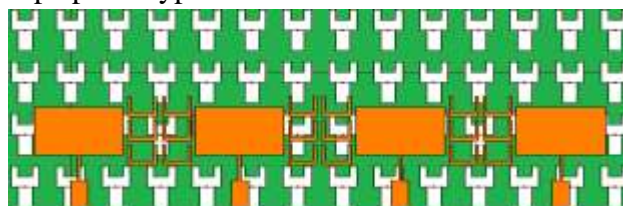
Fig. 8. Schematic of setup of PMAA for the measurement of mutual coupling.

The photographs of conventional and proposed microstrip antenna arrays are depicted in Figs. 9, 10, 11 and 12 respectively.

Fig. 9. Photograph of CMAA.

(a) Front view   (b) Back view
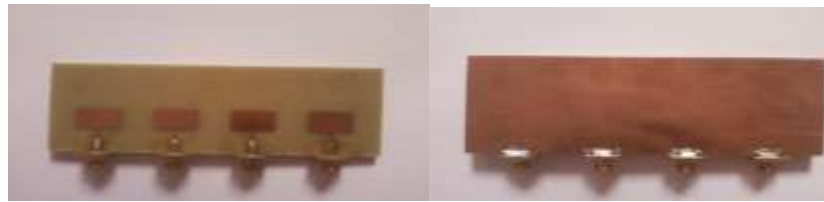
Fig. 10. Photograph of arrangement of CMAA for mutual coupling measurement.

(a) Front view   (b) Back view
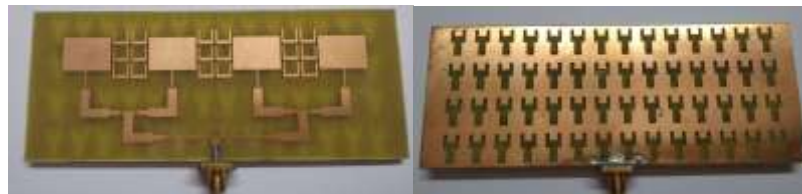
Fig. 11. Photograph of PMAA.

(a) Front view   (b) Back view
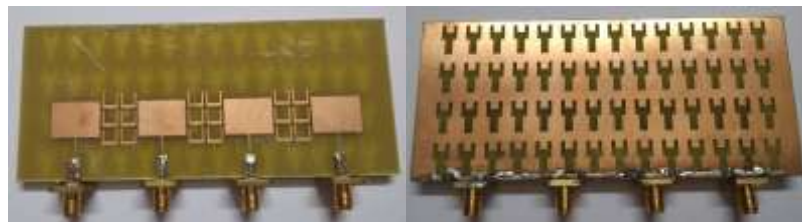
Fig. 12. Photograph of arrangement of PMAA for mutual coupling measurement.

(a) Front view   (b) Back view

measured results

The measured results of CMAA and PMAA are obtained using vector network analyzer. Various parameters like bandwidth, return loss, resonant frequency, mutual coupling, gain, forward and backward powers are employed to evaluate the performances of CMAA and PMAA. Figs. 13, 14 and 15 depict the graphs of return loss and mutual coupling versus frequency of CMAA.
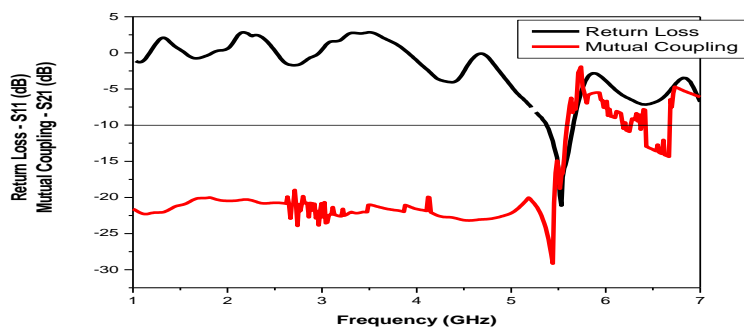
Fig. 13. Graph of return loss and mutual coupling – S_{21} versus frequency of CMAA.
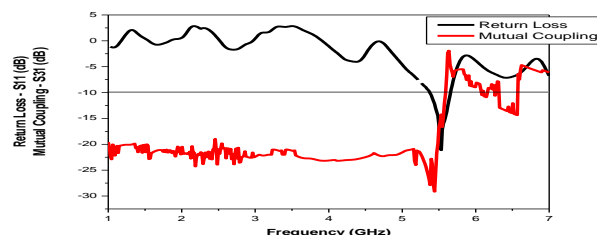
Fig. 14. Graph of return loss and mutual coupling – S_{31} versus frequency of CMAA.
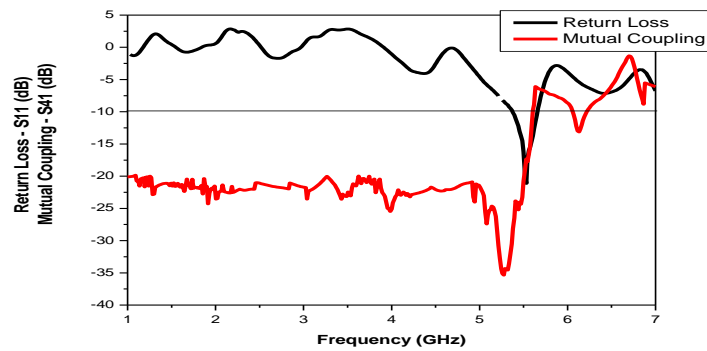
Fig. 15. Graph of return loss and mutual coupling – S_{41} versus frequency of CMAA.

Figs. 13, 14 and 15 depict that CMAA is resonating at a fundamental frequency of 5.53 GHz. The return loss produced at the resonant frequency is equal to -21.06 dB. The parameter bandwidth is calculated from the graph of return loss versus frequency. It is calculated by subtracting the lower frequency from the upper frequency where the return loss graph is crossing the -10 dB line. Therefore the bandwidth of CMAA is equal to 273 MHz. The bandwidth (%) is determined by using the equation (6)

$$\frac{Bandwidth}{Resonant\ frequency} \times 100\%$$

(6)

Hence bandwidth (%) of CMAA is equal to 4.89 %. CMAA is producing a very narrow bandwidth of 4.89 (%).

From Figs. 13, 14 and 15 the values of mutual coupling at the resonant frequency of 5.53 GHz are equal to S_{21} = -16.95, S_{31} = -14.22 and S_{41} = -17.30 dB respectively. As the values of mutual coupling of CMAA are greater than -20 dB, they are considered to be very high and detrimental. Also, the graphs of return loss and mutual coupling versus frequency of CMAA are overlapping each other at the resonant frequency of 5.53 GHz. This has a serious effect on the transfer of information between the adjacent radiating elements. This means there is interference of signals between the radiating elements of CMAA.

Figs. 16, 17 and 18 depict the graphs of return loss and mutual coupling versus frequency of PMAA.
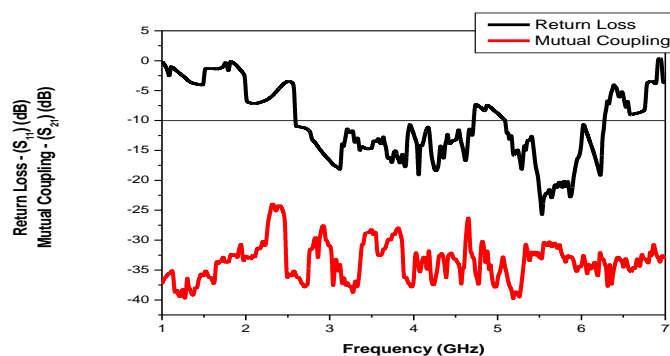
Fig. 16. Graph of return loss and mutual coupling – S_{21} versus frequency of PMAA.
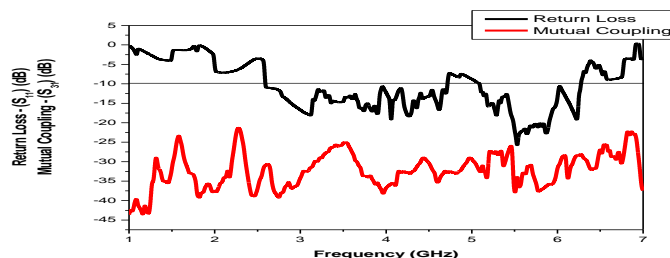
Fig. 17. Graph of return loss and mutual coupling – S$_{31}$ versus frequency of PMAA.
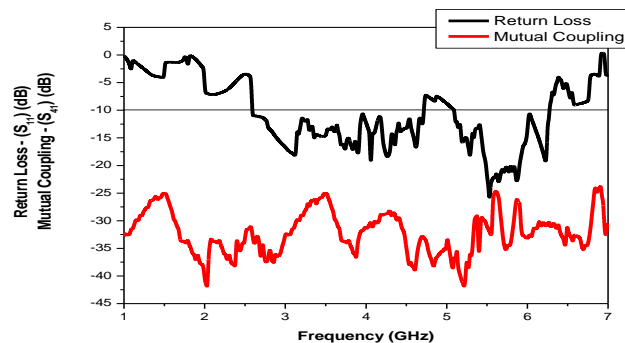
Fig. 18. Graph of return loss and mutual coupling – S$_{41}$ versus frequency of PMAA.

Figs. 16, 17 and 18 depict that PMAA is resonating at two frequencies i.e. 4.05 and 5.53 GHz respectively. The return losses produced at these resonant frequencies are -19.11and -25.83 dB respectively. The bandwidths yielded at these resonant frequencies are 2130 and 1140 MHz respectively. Hence the overall bandwidth (%) of PMAA is equal to 75.91 %. The bandwidth (%) of PMAA is greater than that obtained by CMAA. Hence PMAA is a better antenna than CMAA in terms of bandwidth (%).

The values of mutual coupling produced by PMAA at the resonant frequency of 5.53 GHz are   -33.81, -32.17 and -31.95 dB respectively. These values of mutual coupling are much lesser than that obtained by CMAA. Moreover the graphs of return loss and mutual coupling versus frequency of PMAA are not overlapping each other at the resonant frequency of 5.53 GHz. The non overlapping nature implies that interference level of signals between the transmitting element 1 and the receiving elements 2, 3 and 4 is reduced. Therefore there is better transmission and reception of electromagnetic signals in PMAA than that in CMAA. Hence PMAA is performing better than CMAA in terms of mutual coupling.

The gains of CMAA and PMAA are determined by using equation (7).

$$G = 20 \log_{10}\left(\frac{4\pi R}{\lambda}\right) + 10 \log_{10}\frac{Pr}{Pt} - Gt \tag{7}$$

In Equation (7), P_t is transmitted power, P_r is received power, G_t is gain of transmitting antenna, R is distance between the transmitting and receiving antennas and λ is wavelength at the resonant frequency of 5.53 GHz. The gain of the transmitting antenna (G_t) is calculated by using Equation (8)

$$Gt = 10 \log_{10} Gs$$

(8) G_S is calculated by using Equation (9)

$$Gs = \frac{2\pi ab}{\lambda^2} \tag{9}$$

In Equation (9), a and b designate the length and width of the transmitting antenna. The standard pyramidal horn antenna is used as the transmitting antenna for the gain calculation. CMAA and PMAA are employed as receiving antennas. The length and width of the standard pyramidal horn antenna are a = 24 and b = 14 cm respectively.

The distance (R) between the transmitting and receiving antennas is given by Equation (10).

$$R \geq \frac{2D^2}{\lambda} \tag{10}$$

In Equation (10), D is the larger dimension of standard pyramidal horn antenna equal to 24 cm and λ is the wavelength at the resonant frequency of 5.53 GHz. Substituting the appropriate

parameters in equation (10), the transmitting and the receiving antenna are separated by a distance of R = 71.86 m.

Initially considering CMAA as the receiving antenna, the transmitted and received powers are equal to 8.7μW and 12.414 nW respectively. Using equation (7) the gain of CMAA is calculated as equal to 6.81 dB. In the next case considering PMAA as the receiving antenna, the transmitted and received powers are equal to 8.7μW and 27.79 nW respectively. Using equation (7) the gain of PMAA is calculated as equal to 10.31 dB. In the presence of fork shape slot type and U shape patch type EBG structures, the gain of CMAA is enhanced from 6.81 to 10.31 dB. Therefore, PMAA is a better antenna than CMAA in terms of gain.

Fig.19 shows the radiation patterns of CMAA and PMAA. The radiation graph is obtained by plotting the electromagnetic power from 0^0 to 360^0.
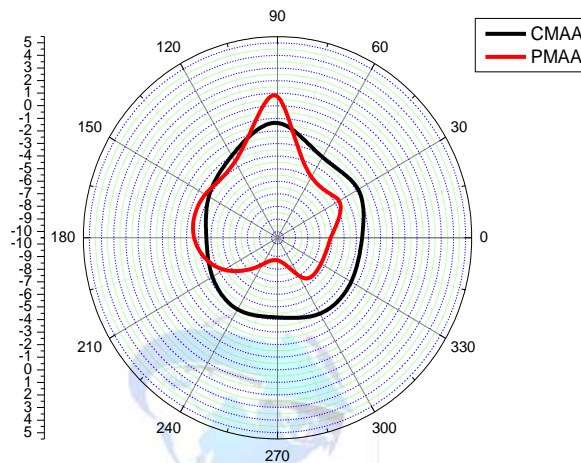
Fig. 19. Radiation plots of CMAA and PMAA.

The forward and backward powers radiated by CMAA and PMAA are determined from the radiation patterns depicted in Fig. 19. The forward and backward powers are measured at the angles of 90^0 and 270^0. As far as CMAA is concerned the forward and backward are equal to -2 and -4.5 dB respectively. In the case of PMAA the forward and backward powers are equal to 0.5 and -9 dB respectively. Comparing CMAA and PMAA in terms of power radiated in forward and backward directions, PMAA is radiating increased power in the forward direction and decreased power in the backward direction compared to CMAA. Therefore with the introduction of fork shape slot type and U shape patch type EBG structures; the performance of PMAA is improved compared to CMAA. Hence PMAA is a better candidate than CMAA in terms of forward and backward powers.

The parameter Front to Back ratio (FBR) is calculated by subtracting the backward power from the forward power. Hence the FBR values of CMAA and PMAA are equal to 2.5 and 9.5 dB respectively. As the FBR value of PMAA is greater than that of CMAA, it means PMAA is a better radiator than CMAA by radiating better in the desired direction i.e. the forward direction.

The parameter virtual size reduction (%) is determined by using equation (11)

$$\left(\frac{f_1 - f_2}{f_1}\right) \times 100$$

(11)

In equation (11), f_1 and f_2 are the fundamental resonant frequencies of CMAA and PMAA

respectively. f_1 and f_2 are equal to 5.53 and 4.05 GHz respectively. Hence the virtual size reduction produced by PMAA is equal to 26.73 %.

To summarize, the introduction of EBG structures has improved the bandwidth and gain of CMAA from 4.89 % and 6.81 dB to 75.91 % and 10.31 dB. The mutual coupling values are decreased from S_{21} = -16.95, S_{31} = -14.22 and S_{41} = -17.30 dB to S_{21} = -33.81, S_{31} = -32.17 and S_{41} = -31.95 dB respectively. Fair amount of reduction in back lobe radaition and increase in power in forward direction is obtained. Additionally a virtual size reduction of 26.73 % is also obtained. Therefore, PMAA is a better performer than CMAA.

Table II shows the summarized results of CMAA and PMAA.

Table II. SUMMARIZED RESULTS OF CMAA AND PMAA.

Type of Antenna	Resonant Frequency (GHz)	Return Loss (dB)	Band Width (MHz)	Overall Band Width (%)	Gain (dB)	Mutual Coupling – S_{21} (dB)	Mutual Coupling – S_{31} (dB)	Mutual Coupling – S_{41} (dB)	Forward Power (dB)	Backward Power (dB)	FBR
CMAA	5.53	-21.06	273	4.89	6.81	-16.95	-14.22	-17.30	-2	-4.5	2.5
PMAA	4.05 5.53	-19.11 -25.83	2130 1140	75.91	10.31	-33.81	-32.17	-31.95	0.5	-9	9.5

conclusion

The conventional and proposed microstrip antenna arrays using fork shape slot type electromagnetic band gap structure and U shape patch type electromagnetic band gap structure have been designed and fabricated successfully. In the presence of EBG structures the performance of conventional microstrip antenna array is enhanced in terms of bandwidth (%), gain and mutual coupling. The proposed microstrip antenna array is also showing better radiation characteristics in terms of reduction of back lobe radiation and increase in forward power. A good amount of virtual size reduction is also obtained. Therefore PMAA is a better candidate than CMAA.

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Evaluation of Mixed Multicast Architecture for Internet of Things Environment Using Adaptive Fountain Code

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Abstract:

The Internet of Things (IoT) is expected to accommodate every object which present in this world or exist in the near future. This paper is focused on the analysis of five different IoT related mixed multicast architecturetechniques such as multicast routing for multimedia communication,compressed sensing via dictionary learning and approximate message passing, an efficient tree based self-organizing protocol, energy efficient self-organizing multicast routing protocol, design and performance evaluation of mixed multicast architecture for internet of things environment etc.The security challenge present in IoT multicast applications is the objective of this work. An adaptive fountain code design is proposed in this paper to enhance the security for multicast in IoT with the present of the eavesdropper. The main features of the proposed scheme include two folds: (i) dynamical encoding scheme which can effectively decrease intercept probability at the eavesdropper; (ii) increasing the transmission efficiency compared with the conventional non- dynamical design. The analysis and simulation results showsthat the proposed scheme can effectively enhance information security while achieving higher transmission efficiency with a little accredited complexity, thus facilitating the secured wireless multicast transmissions over IoT.

Keywords—Self-organizing multicast routing.Tree based self-organizing protocol, Multicast routing protocol, mixed multicast architecture, adaptive fountain code.

Introduction:

Internet of Things (loT) has been envisioned as a key networking paradigm to bridge the gap between the cyber and physical world. [1].The internet of things (IoT) has drawn attention recently as a means of connecting the proliferating embedded devices to the Internet [2]. Internet of Things enables objects to collect or exchange data using many network technologies, such as sensor networks, wireless communication, data collection, etc. Among them, sensor network is indispensable to IoTs. [3].Reliable network can be constructed for internet of things with the help of tree structure.[4]. Unicast, multicast, and broadcast are three basic methods used to transmit data over a network. A multicast implementation is considered more complex because users must be distributed into groups and their locations re-identified.[5].

This paper, discusses five different schemes such as multicast routing for multimedia communication, compressed sensing via dictionary learning and approximate message passing, an efficient tree based self-organizing protocol, energy efficient self-organizing multicast routing protocol, design and performance evaluation of mixed multicast architecture for the internet of things environment. These schemes provide the better performance metrics are end-to- end

delay, packet loss, throughput, energy consumption, and transformation rate between traditional multicast architectures.

But these methods also have some problem so to overcome such problems proposed a an adaptive fountain code design, to enhance the security for multicast in IoT.

Background:

Many studies on IoT have been done to develop the scheme in recent past years.Such schemes are:

A multicast routing for multimedia communications in the internet of things proposes two algorithms for the establishing multicast routing tree for multimedia data transmissions. [1].A compressed sensing-based approach combines the dictionary learning (DL) method and the approximate message passing (AMP) approach. The approach can be used for efficient communication in the multimedia Internet of Things (IoT).[2].The method proposed is an efficient tree-based self-organizing protocol (ETSP) for internet of things. All nodes are divided into two kinds: network nodes and non-network nodes in ETSP[3].An energy efficient self-organizing multicast routing protocol for internet of things network proposesESMR, the nodes are categorized under two sorts: one is the network node and another is the non-network node. [4]. A design and performance evaluation of mixed multicast architecture for internet of things environmentproposes a mixed multicastarchitecture for IoT environments that employs the centric, hierarchical, and distributedtraditional multicast architectures.[5].

This paper introduces five scheme such asmulticast routing for multimedia communication,compressed sensing via dictionary learning and approximate message passing, an efficient tree based self-organizing protocol, energy efficient self-organizing multicast routing protocol, design and performance evaluation of mixed multicast architecture for IoT environment.

The paper is organizedas follows:

Section I Introduction. **Section II** discusses Background. **Section III** discusses previous work. **Section IV** discusses existing methodologies. **Section V**discusses attributes and parameters and how these are affected. **Section VI** proposed method.**Section VII** represents outcome and possible results. **Section VIII** concludes this review paper.

Previous Work Done

In research literature, many multicast methods have been studiedto enhance the security for multicast in IoT.

Jun Huang et al. (2017) [1] has proposed fast multi-constrained multicast routing algorithms for tackle the problem of multicast routing which supporting multimedia communications in IoT. The proposed algorithms are able to establish point-to multipoint trees for meeting multiple QoS constraints.

Zhicheng Li et al. (2017) [2] has proposed compressed sensing via dictionary learning and approximate message passing for multimedia internet of things. Which propose the use of an efficient compressed sensing (CS) framework to reduce the amount of multimedia data they need to transmit.

Tie Qiu et al. (2016) [3] has proposed an efficient tree-based self-organizing protocol for internet of things. Which proposed an Efficient Self-organization Protocol (ETSP) in tree-based network.

S.Nisha et al. (2017) [4] has proposed an energy efficient self-organizing multicast routing (ESMR) protocol for internet of things network. The root node floods broadcasting packets to surf for the child nodes.

Omar Said et al. (2017) [5] has proposed a mixed IoT multicast architecture using the three traditional multicast architectures.And analyze centric, hierarchical, and fully distributed multicast architectures with regard to IoT environment.

Existing Methodologies

Many multicast security schemeshave been implemented over the last several decades. There are different methodologies that are implemented for different security enhancement for multicast .i.e. multicast routing for multimedia communication,compressed sensing via dictionary learning and approximate message passing, an efficient tree based self-organizing protocol, energy efficient self-organizing multicast routing protocol, and design and evaluation of mixed multicast architecture for internet of things environment.

Multicast routing for multimedia communications:

This proposed two algorithms for the establishing multicast routing tree for multimedia data transmissions. The proposed algorithms leverage an entropy based process to aggregate all weights into a comprehensive metric, and then use it to search a multicast tree on the basis of the spanning tree and shortest path tree algorithms.This algorithm is able to establish point-to multipoint trees for meeting multiple QoS constraints. [1].

Compressed sensing via dictionary learning and approximate message passing:

The method proposed in this paper compressed sensing-based approach, which combines the dictionary learning (DL) method and the approximate message passing (AMP) approach. This paper propose the use of an efficient compressed sensing (CS) framework as a strategy to be used by IoT devices to reduce the amount of multimedia data they need to transmit, while ensuring that the complete data can be recovered with high fidelity at the receiver. AMP is a signal reconstruction algorithm framework, it can be explained as an iterative denoising process. The DL method seeks an adaptive dictionary for realizing sparse signal representations and provides good performance in signal denoising. [2].

An efficient tree-based self-organizing protocol:

All nodes are divided into two kinds: network nodes and non-network nodes in ETSP. Network nodes can broadcast packets to their neighbouring nodes. Non-network nodes collect the broadcasted packets and determine whether to join network. Non-network nodes can be turned into a network nodes when they join the network successfully. The topologyadjusted dynamically to balance energy consumption and prolong network lifetime.The network nodes are classified into three types: root node, sink node, sensor node. The data aggregation technology used in tree-based network to reduce the energy consumption and network load.[3].

An energy efficient self-organizing multicast routing protocol:

This paper proposedESMR, the nodes are categorized under two sorts: one is the network node and another is the non-network node. The nodes which are already in the network are referred as the network nodes. The non-network node utilizes diverse measurements along with Markov process, to measure a network node's weight. The non-network node then sends request to the sink node to enter into the network.The root node floods broadcasting packets to surf for

the child nodes. Once the non-network node receives the broadcasted packets, it may joined successfully, it will be turned into network nodes. Thus with this technique, proposed work (ESMR) can construct a tree structured network efficiently.[4].

Design and performance evaluation of the mixed multicast architecture for internet of things environment:

This paper proposed mixed multicastarchitecture for IoT environments that employs the centric, hierarchical, and distributedtraditional multicast architectures. The target is to determine the most suitabletraditional multicast architecture, relative to the current state of IoT system.An algorithm first to manage the proposed multicast architecture then anIoT case study for each traditional multicast architecture is demonstrated and analysed centric, hierarchical, and fully distributed multicast architectures with regard to IoT environment.[5].

Analysis And Discussion

Multicast routing for multimedia communication shows theboth analytical and experimental results have demonstrated that the one of the proposed algorithms is superior to a representative multi constrained multicast routing algorithm in terms of both speed and accuracy. [1]. Compressed sensing via dictionary learning and approximate message passing show the experiments that the quality of the reconstructed signals are better with the DL-AMP framework (SGK-AMP) than those obtained with other algorithms in the literature. The resultant improvement in reconstruction makes the DL-AMP framework suitable for multimedia IoT devices[2].An efficient tree based self-organizing protocol show that proposed protocol can construct a reliable tree-based network quickly. With the network scale increasing, the self-organization time, average hop, and packet loss ratio will not increase more[3].Energy efficient self-organizing multicast routing protocol proved to reduce the energy consumption, increases the successrate and improves the lifespan of sensor networks.[4].Multicast routing for multimedia communicationshows theperformance metrics are end-to-end delay, packet loss, throughput, energy consumption, and transformation rate between traditional multicast architectures. [5].

Proposed Methodology

The implementation mechanism of the Dynamically Constructed Fountain Code is illustrated as in the following figure. The DC Fountain Code are shown in two sides: the transmission scheme in multicast networks and the dynamical fountain-encoding mechanism in the transmitterThe transmission process of BS is depicted in figure during each time slot. Remarkably, the large data file is divided into K equal-length data packets before introducing the fountain encoder. According to the dynamical fountain-encoding scheme BS conducts the dynamical fountain-encoding procedure. Then after the CRC encoding at the data link layer and the channel encoding at the physical layer, BS delivers the fountain packet to each multicast object through the wireless channels. The delivered fountain packet are easy to be intercepted by the eavesdropper (Eve) in the wireless channel. Because of different channel conditions of the multicast objects, the fountain packets can be hardly received by all objects at one time. Those objects which receive the fountain packet are required to send ACK signals back to BS. After receiving the ACK signals, BS "simulates" the decoding procedure and records the index set of decoded data packets denoted as Di from the objects whose ACK signal is received by BS.

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Finally, if the element number of set Di of all objects equals K, BS stops encoding process. Contrarily, if theelement number of set Di for at least one object is less than K, BS continues the fountain-encoding process at next time slot and repeats these process introduced.Only ACK signals are required to be sent back to BS from objects during each time slotand BS automatically "simulates" the decoding process and records the set Di for them. This transmission scheme intercept in the multicast channels.
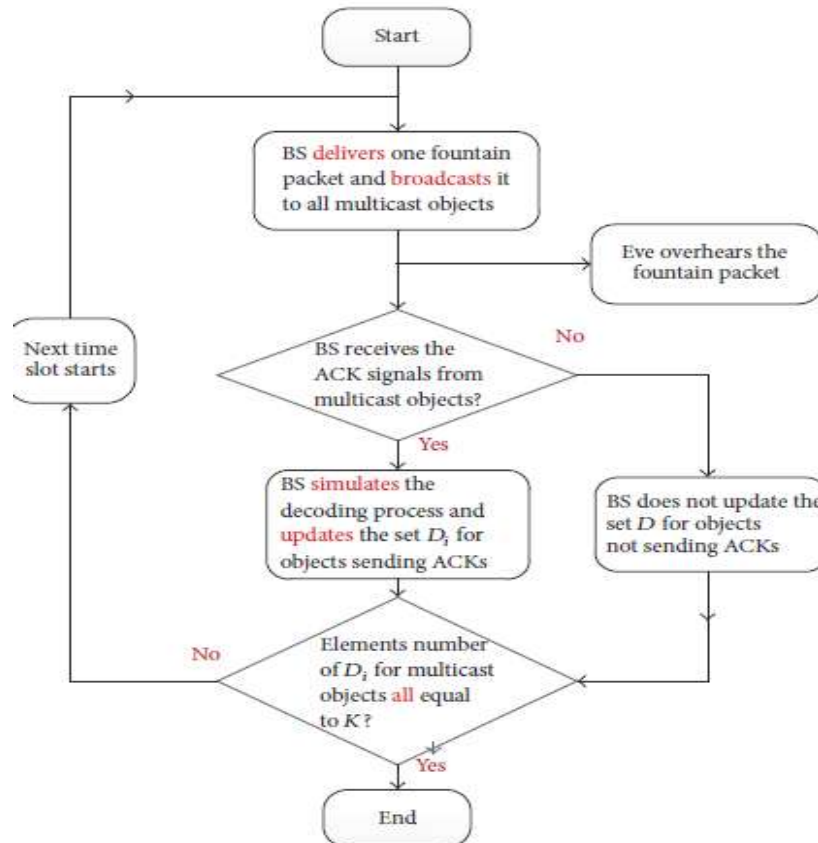
Figure: The Transmission Flow Chart For BS During One Transmitting Slot.

Algorithm: DC fountain-encoding procedures

1) BS records the rowers for full-0-lines and full-1-lines of matrix P and respectively stores them in matrix ln 0 and ln 1.
2) Determine whether the matrix ln 1 is empty.

   If ln 1 is not empty

∗ Encoding rules are as follows:

   a. Randomly choose **one** element from ln 1 denoted as Sc.
   b. Take out **all** elements from ln 0 denoted as $S0,1, S0,2, . . . , S0,t$
   c. The ecoded fountain packets are the exclusive-or of:
      $xfTs = Sc \oplus S0,1 \oplus S0,2 \oplus \cdots \oplus S0,t,$
      where $xfTs$ denotes the encoded fountain packet during Ts-th slot.

else

   ∗ Switch to Step (3).

3) Determine whether the length of ln 0 is smaller than $K/4$.
   If length (ln 0) $\leqslant K/4$

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A. Compute the sum of each row as P line. Find the maximum value in P line and records one of the corresponding rowers as S max.

B. Traverse K lines to search for several lines whose rowers are denoted as $Sr,1, Sr,2, . . . , Sr,n$ to meet the following conditions:

• Assume the matrix made by $Sr,1, Sr,2, . . . , Sr,n$ and S max is defined as P temp. The sum of each column for P temp must be less than 2.

C. The encoded fountain packet is the exclusive-or of:

$xfTs = S$ max $\oplus Sr,1 \oplus Sr,2 \oplus \cdots \oplus Sr,n,$

where $xfTs$ denotes the encoded fountain packet during Ts-th slot.

∗ Encoding rules follow:

else

∗ Encoding rules follow:

i. Remove the full-0-lines from P.

ii. Compute the sum of each row as P line. Find the minimum value in P line and records the corresponding rowers stored in S min.

iii. Assume the matrix made by S min is defined as P temp. If the sum of each column in P temp is larger than 1, repeat the next step.

iv. Find the maximum value of the sum of each column in P temp and records one of the corresponding columns as Cmax. Choose the rowers from that column whose elements is non-zero and stored as Rmax. Then find the maximum value of the sum of each row in the matrix made by Rmax and delete the corresponding row from S min.

v. Assume the rowers of S min is denoted as $Sr,1, Sr,2, . . . , Sr,m.$The encoded fountain packet is the exclusive-or of:

$xfTs = Sr,1 \oplus Sr,2 \oplus \cdots \oplus Sr,m,$

vi. where $xfTs$ denotes the encoded fountain packet during Ts-th slot.

This proposes the dynamically constructed fountain encoding process. According to the number of decoded data packets, the "encoding structure matrix" denoted as $PK{\times}M$ is generated, where$K$denotes the number of data packets and$M$denotes the number of multicast objects. The initial value of the elements in P is set to 1.The element of$PK{\times}M$, denoted as pij, is the decoding indicator and its value equals 1 (0) if the jth multicast object has (not) decoded the ith data packet. Moreover, the index set of total data packets is denoted as $\{S1, S2. . .SK\}$.According to the value and the state of P, the dynamical fountain-encoding scheme is presented in Algorithms.

Outcome And Possible Results

The performances of dynamically constructed fountain code and two baseline schemes. The performance compared in terms of the intercept probability for Eve, transmission efficiency, and recovering proportion for Eve. In addition, the performance analysis and simulation results are also performed to demonstrate that the proposed scheme outperforms the traditional non dynamical fountain-encoding schemes with the lower intercept probability and higher transmission efficiency, imposing a little accredited complexity for multicast networks.The analysis and simulation results shows that the proposed scheme can effectively enhance information security while achieving higher transmission efficiency with a little accredited complexity,acilitating the secured wireless multicast transmissions over IoT.

Conclusion

This paper presented a fountain-encoding scheme aimed at achieving data security in the multicast system of the IoT, which can dynamically change the encoding rules in order to reduce the intercept probability. Requiring multicast objects to provide feedback on ACK signals, the transmitter simulates the decoding procedures and records the index of recovered data packets. As per these recorded information, the transmitter completes the dynamical fountain-encoding design which targets increasing the decoding rates of the multicast objects. In this manner, multicast objects can complete decoding quickly while the eavesdropper hardly overhears enough fountain packets to decode the original data, which effectively reduces the intercept probability for Eve.

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Cloud Computing With Big Data: Challenges & Issues

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Abstract:

The amount of data in world is growing day by day. Data is growing because of use of internet, smart phone and social network. Big data is a collection of data sets which is very large in size as well as complex. Now a days, Big data is one of the most talked topic in IT industry. It is going to play important role in future. Big data changes the way that data is managed and used. Communicating by using information technology in various ways produces big amounts of data. Such data requires processing and storage. The cloud is an online storage model where data is stored on multiple virtual servers. Big data processing represents a new challenge in computing, especially in cloud computing. Data processing involves data acquisition, storage and analysis. In this respect, there are many questions including, what is the relationship between big data and cloud computing? And how is big data processed in cloud computing? The answer to these questions will be discussed in this paper, where the big data and cloud computing will be studied, in addition to getting acquainted with the relationship between them in terms of safety and challenges. I have suggested a term for big data, and a model that illustrates the relationship between big data and cloud computing.

Keywords: Big Data; security; systematic mapping study, cloud, resources, 'five Vs'.

Introduction

Data is the raw material for information before sorting, arranging and processing. It cannot be used in its primary form prior to processing. Information represents data after processing and analysis. The technology has been developed and used in all aspects of life, increasing the demand for storing and processing more data. As a result, several systems have been developed including cloud computing that support big data. While big data is responsible for data storage and processing, the cloud provides a reliable, accessible, and scalable environment for big data systems to function. Big data is defined as the quantity of digital data produced from different sources of technology for example, sensors, digitizers, scanners, numerical modeling, mobile phones, Internet, videos, e-mails and social networks. The data types include texts, geometries, images, videos, sounds and combinations of each. Such data can be directly or indirectly related to geospatial information.

Cloud computing refers to on-demand computer resources and systems available across the network that can provide a number of integrated computing services without local resources to facilitate user access. These resources include data storage capacity, backup and self-synchronization. Most IT Infrastructure computing consists of services that are provided and delivered through public centers and servers based on them. Here, clouds appear as individual access points for the computing needs of the consumer. They are an online storage model where data are stored on multiple virtual servers, rather than being hosted on a specific server, and are

usually provided by a third party. The hosting companies, which have advanced data centers, rent spaces that are stored in a cloud to their customers in line with their needs.

The relationship between big data and the cloud computing is based on integration in that the cloud represents the storehouse and the big data represents the product that will be stored in the storehouse, since it is not possible to create storehouses without storing any product in them. The traditional databases known as 'relational' are no longer sufficient to process multiple-source data. For example, how can these traditional methods deal with data such as record of transactions, customer behavior, mobile phone and GPS navigation, and others. Here comes the role of cloud computing. At this point, a relationship between big data and the cloud will arise. In this paper, the relationship between them will be discussed, in addition to the challenges and issues that Big Data may encounter.

Big Data:

Big data comes and is composed through electronics operations from multiple sources. It requires proper processing power and high capabilities for analysis. The importance of big data lies in the analytical use which can help generate an informed decision to provide better and faster services.

The term big data is called on the huge amount of high-speed big data of different types; this data cannot be processed and stored in regular computers. The main characteristics of big data known as 'five Vs', are as follows:

1. Volume: It represents the amount of data produced from multiple sources which show the huge data in numbers by zeta bytes. The volume is most evident dimension in what concerns to big data.

2. Variety: It represents data types, with, increasing
the number of Internet users everywhere, smart phones and social networks users, the familiar form of data has changed from structured data in databases to unstructured data that includes a large number of formats such as images, audio and video clips, SMS, and GPS data.

3. Velocity: It represents the speed of data frequency from different sources, that is, the speed of data production such as Twitter and Facebook. The huge increase in data volume and their frequency dictates the need for a system that ensures super-speed data analysis.

4. Veracity: It represents the quality of the data, it shows the accuracy of the data and the confidence in the data content. The quality of the data captured can vary greatly, which affects the accuracy of analysis. Although there is wide agreement on the potential value of big data, the data is almost worthless if it is not accurate.

5. Value: It represents the value of big data, i.e. it shows the importance of data after analysis. This is due to the fact that the data on its own is almost worthless. The value lies in careful analysis of the exact data, the information and ideas it provides. The value is the final stage that comes after processing volume, velocity, variety, contrast, validity and visualization .

Cloud Computing:

It is a term that refers to on-demand computer resources and systems that can provide a number of integrated computer services without being bound by local resources to facilitate user access. These resources include data storage, backup and self-synchronization, as well as software processing and scheduling tasks. Cloud computing is a shared resource system that can

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offer a variety of online services such as virtual server storage, and applications and licensing for desktop applications. By leveraging common resources, cloud computing is able to achieve expansion and provide volume.

A. Characteristics of cloud computing

That cloud computing is one of the distributed systems that represents a sophisticated model. NIST has identified important aspects of the cloud, as it shortened the concept of cloud computing in five characteristics as follows:

1) On-demand self-service: Cloud services provide computer resources such as storage and processing as needed and without any human intervention.

2) Broad network access: cloud computing resources are accessible over the network , mobile and smart devices even sensors can access computing resources on the cloud.

3) Resource Pooling: Cloud platform users share a vast array of computing resources; users can determine the nature of resources and the geographic location they prefer but cannot determine the exact physical location of these resources.

4) Rapid Elasticity: Resources from storage media, network, processing units and applications are always available and can be increased or decreased in an almost instantaneous fashion, allowing for high scalability to ensure optimal use of resources.

5) Measured service: Cloud systems can measure the processes and consumption of resources as well as surveillance, control and reporting in a completely transparent manner.

B. Cloud computing service models.

Cloud computing types are classified on the basis of two models:

1) Software as a service (SAAS): Cloud service providers provide various software applications to users who can use them without installing them on their computer. The user is not responsible for anything other than adjusting the settings and customizing the service as appropriate to his needs. SAAS helps big-data clients to perform data.

2) Platform as a service (PAAS): Cloud service providers provide platforms, tools and other services to users, where the cloud service provider manages everything else, including the operating system and middleware., with resources that enable you to deliver everything from simple cloud-based apps to sophisticated.

3) Infrastructure as a service (IAAS): Cloud service providers provide infrastructure such as storage, computing capacity, etc. is a form of cloud computing that provides virtualized computing resources over the Internet , In an IaaS model, a third-party provider hosts hardware, software, servers, storage and other infrastructure components on behalf of its users.

4) DaaS : It is the alternative cloud computing model, as it differs from traditional models like (SAAS, IAAS, PAAS) in providing data to users through the network, as data is considered the value of this model in conjunction with cloud computing based on solving some of the challenges in managing a huge amount of data. For these reasons, DaaS is closely related to big data whose technologies must be utilized. DaaS provides highly efficient methods of data distribution and processing. DaaS is closely related to SaaS (storage as a service) and SaaS (software as a service) which can be combined with one of these models or both of them.

The Relationship Between The Cloud And Big Data

Cloud computing is a trend in the development of technology, as the development of technology has led to the rapid development of electronic information society. This leads to the phenomenon of big data and the rapid increase in big data is a problem that may face

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the development of electronic information society. Cloud computing and big data go together, as big data is concerned with storage capacity in the cloud system, cloud computing uses huge computing and storage resources. Thus, by providing big data application with computing capability, big data stimulate and accelerate the development of cloud computing. The distributed storage technology in environmental computing helps to manage big data.

Cloud computing and big data are complementary to each other. Rapid growth in big data is regarded a problem. Clouds are evolving and providing solutions for the appropriate environment of big data while traditional storage cannot meet the requirements for dealing with big data, in addition to the need for data exchange between various distributed storage locations. Cloud computing provides solutions and addresses problems with big data. The cloud computing environment is expanding to be able to absorb big amounts of data as it follows the policy of data splitting, that is, to store data in more than one location or availability area. Cloud computing environments are built for general purpose workloads and resource pooling is used to provide flexibility on demand. Therefore, the cloud computing environment seems to be well suited for big data.

Big data processing and storage require expansion as the cloud provides expansion through virtual machines and helps big data evolve and become accessible. This is a consistent relationship between them. Google, IBM, Amazon and Microsoft are examples of the success in using big data in the cloud environment. In order for the cloud environment to fit with big data the cloud computing environment must be modified to suit data and cloud work together. Many changes are needed to be made on the cloud: CPUs to handle big data and others.

Challenges In Big Data And Cloud Computing

The security challenges in cloud computing environments fall under several levels: the network level which includes dealing with network protocols and network security such as distributed nodes, distributed data, and communications between the nodes; authentication level where the user handles encryption / decryption techniques, authentication methods such as contract administrative rights, authentication of applications and nodes, and logging entry; the data level which is concerned with data integrity and availability as well as data protection and data distribution. Cloud computing follows the policy of shared resources, where the privacy of data is very important because it faces some challenges like integrity, authorized access, and availability of (backup / replication). Data integrity ensures that data is not corrupted or tampered with during communication. Authorized access prevents data from infiltration attacks while backups and replicas allow access to data efficiently even in case of technical error or disaster in some cloud location.

Big data face some challenges as they can be classified into groups: data sets, processing and management challenges. When dealing with big amounts of data we face challenges such as volume, variety, velocity and verification which are also known as 5V of big data. Also, in the field of computer networks the cost of communications is a major concern compared to the cost of processing the same data, as the challenge is to reduce the cost of communications to the minimum while meeting the requirements of storage and additional data from the general cloud to handle big data . Among the factors ฺand challenges that affect the processing of big data in a timely manner is The bandwidth and latency . Where several challenges can be summarized in the relationship between big data and cloud computing.

i) Data Storage: The storage of big data through traditional storage is problematic because hard drives often fail, data protection mechanisms are not effective, and the speed of big data requires storage systems in order to expand rapidly, which is difficult to achieve with conventional storage systems. Cloud storage services offer almost unlimited storage with a great deal of error tolerance, which offers potential solutions to address the challenges of big data storage.

ii) Variety of data: Big data naturally grow, increase and vary, which is the result of the growth of almost unlimited sources of data. This growth leads to the heterogeneous nature of big data. Generally speaking, data from multiple sources of different types and representations are highly interrelated. They have incompatible shapes and are inconsistent. A user can store data in structured, semi- structured, or unstructured formats. Structured data format is s u i t a b l e f o r today's database systems, while semi- structured data formats are only fairly suitable. Unstructured data is inappropriate because it contains a complex format that is difficult to represent in rows and columns.

iii) Data transfer: The data goes through several stages: data collection, input, processing, and output. Big data transfer is a challenge, so data compression techniques need to be reduced to reduce the volume, where data volume is a hindrance to transfer speed. It also affects the cost, while cloud computing provides distributed storage resources and data transfer on high-speed lines, reducing costs through virtual resources and resource use at user's request.

iv) Privacy and data ownership: The cloud environment is an open environment and the user's role in monitoring is limited. Privacy and security are an important challenge for big data. Big data and cloud computing come together in practice. According to (IDC) estimates, by 2020, around 40% of global data will be accessed by cloud computing. Cloud computing provides strong storage, calculation and distribution capability to support big data processing. As such, there is a strong demand to investigate the privacy of information and security challenges in both cloud computing and big data.

2) What Is Big Data's Relationship To The Cloud?

How does the cloud computing environment correspond to big data? The answer to this question reflects the relationship between them. This is done through the cloud computing features to handle big data, the resources provided by cloud computing, the resource service to provide service to many users where the various physical and virtual resources are automatically set and reset upon request. Cloud computing has access from anywhere to data resources that are spread all over the world by using a (public) cloud to allow those sources faster access to storage. The nature of big data is generated by technologies and locations worldwide, so the cloud resource service provides and helps in the collection and storage of big amounts of data resulting from the use of technologies.

The cloud computing structure can expand the solid equipment to accommodate small and big data volumes. The cloud can expand to handle big amounts of data by dividing the data into parts, automatically done in IAAS. Expanding the environment is a big data requirement. Cloud computing has the advantage of helping to reduce costs by paying for the value of the resources used, which helps to develop big data. Flexibility is also regarded a requirement for big data. When we need more storage for data the cloud platform can dynamically expand to meet proper storage needs when we would like to handle a large number of virtual machines in a single time period. For error tolerance, the cloud helps to handle big data in the extraction and storage

process. Error tolerance helps SLAs, as well as QOS levels. Service level agreements specify different rules for regulating availability of cloud service.

Big data are characterized by diversity, i.e. they are of different types and therefore require big data. ETL technology, therefore, deals with data diversity, as ETL represents several functions such as extraction, conversion, and loading. These three functions are combined into one tool to pull data from one database and place it in another database. It helps to convert databases from one form to another.

Big data relies on data integrity to be effective. If you store big data at the local level, it will take a huge amount of work to manually merge all data to manage it. The cloud can do this work for the user, offering one site to store and manage all commercial data. In this way, you can get one source of the truth, without exhausting your time and resources to manually merge the data.

Cloud computing offers features and benefits to big data through ease of use, access to resources, low cost in resource utilization on supply and demand, and reduces the use of solid equipment used to handle big data. Both big data and the cloud aim to increase the value of a company while reducing investment costs. The cloud reduces the cost of managing local software, while big data reduces investment costs by encouraging more prudent business decisions. It seems only natural that these two concepts together provide greater value to companies.

Big Data Technical Issues And Challenges

A. Fault Tolerance: With the advent of technologies like cloud computing the aim must remain such that whenever failure occurs the damage done must occur within acceptable threshold rather than the entire work requiring to be redone. Fault-tolerant computing is tedious and requires extremely complex algorithms. A foolproof, cent percent reliable fault tolerant machine or software is simply a far-fetched idea. To reduce the probability of failure to an acceptable level we can do.

B. Divide the entire computation to be done into tasks and assign these tasks to different nodes for computation.

C. Keep a node as a supervising node and look over all the other assigned nodes as to whether they are working properly or not. If a glitch occurs the particular task is restarted. There are however certain scenario where the entire computation can't be divided into separate tasks as a task can be recursive in nature and requires the output of the previous computation to find the present result. These tasks can't be restated in case of an error. Here checkpoints are applied to keep the state of the system at certain intervals of time so that computation can restart from the last checkpoint so recorded.

D. Data Heterogeneity: 80% of data in today's world are unstructured data. It encompassed almost every kind of data we produce on a daily basis like social media interaction, document sharing, fax transfers, emails, messages and a lot more. Working with unstructured data is inconvenient and expensive too. Converting these to structured data is unfeasible as well.

E. Data Quality: As has been mentioned earlier, storage of big data is very expensive and there is always a tiff between business leaders and IT professionals regarding the amount of data the company or the organization is storing. The quality of data is an important factor to be looked into here. There is no point in storing very large data sets that are irrelevant as better result and conclusions can't be drawn from them. Ensuring

whether the amount of data is enough for a particular conclusion to be drawn or whether the data is relevant at all are further queries.

F. Scalability**:** The challenge in scalability of big data has led to cloud computing. It is capable of aggregating multiple different workloads with different performance goals into very large clusters. This needs high level of sharing of resources that is quite expensive and brings along with it various challenges like executing various jobs so that the goal of every workload is met successfully. It also has to deal with system failures in an efficient manner as it is quite common when working with large clusters. Hard disk drives being replaced by solid state drives and phase change technology do not have the same performance between sequential and random data transfer. The kind of storage device to be used is thus a large question looming around big data storage issue.

Big Data Privacy And Security Issues And Challenges

Often in big data analysis, the personal information of people from a database or from social networking sites need to be combined with external large data sets. Thus facts about anyone which might have been confidential become open to the world. Often it leads to taking insights in people's lives of which they are unaware of. Often it happens that a more educated person having better knowledge and concepts about big data analysis takes advantage of predictive analysis over a person who is less educated than him.

Future Scope And Development

As far as the future of big data is concerned it is for certain that data volumes will continue to grow and the prime reason for that would be the drastic increment in the number of hand held devices and internet connected devices, which is expected to grow in an exponential order. SQL will remain as the standard for data analysis and Spark, which is emerging, will emerge as the complimentary tool for data analysis. Tools for analysis without the presence of an analyst are set to take over, with Microsoft and Salesforce both recently announcing features letting non-coders to create apps for viewing business data. As per IDC half of all business analytics software will include intelligence where it is needed by 2020. In other words it can be said that prescriptive analytics will be built into business software. Programs like Kafka and Spark will enable users to make decisions in real time. Chief Data Officer will be a common sight in companies in the recent future though it is thought that it won't last long. Autonomous agents and things like robots, autonomous vehicles, virtual personal assistant and smart devices will be a huge trend in the future. Big data talent crunch as is seen these days will reduce in the coming days. The International Institute for Analytics predicts that companies will use recruiting and internal training to budding data scientists to get their own problems done. Businesses will soon be able to buy algorithms rather than program them by themselves and add their own data to it. Existing services like Algorithmia, DataXu, and Kaggle will grow in a large scale, that is algorithm markets will emerge. More companies will try to derive their revenue from their data. The gap between insight and action in big data is going to reduce and more energy will be given to obtaining insights and execution rather than collecting big data. Fast and actionable data will replace big data. Companies are expected to ask the right questions and make better use of the data they have, much of the big data they have are unused these days

Conclusion

Big data and cloud computing have been studied from several important aspects, and we have concluded that the relationship between them is complementary. Big data and cloud computing constitute an integrated model in the world of distributed network technology. The development of big data and their requirements is a factor that motivates service providers in the cloud for continuous development.

Cloud computing represents an environment of flexible distributed resources that uses high techniques in the processing and management of data and yet reduces the cost. All these characteristics show that cloud computing has an integrated relationship with big data. Both are moving towards rapid progress to keep pace with progress in technology requirements and users.

To handle big data and to work with it and obtaining benefits from it a branch of science has come up and is evolving, called Data Science. Data Science is the branch of science that deals with discovering knowledge from huge sets of data, mostly unstructured and semi structured, by virtue of data inference and exploration. It's a revolution that's changing the world and finds application across various industries like finance, retail, healthcare, manufacturing, sports and communication. As far as security is concerned the existing technologies are promising to evolve as newer vulnerabilities to big data arise and the need for securing them increases.

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Secure Mobile Computing

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Abstract:

As more and more people enjoy the various services brought by mobile computing, it is becoming a global trend in today's world. At the same time, securing mobile computing has been paid increasing attention. In this paper, we discuss the security issues in mobile computing environment. We analyze the security risks confronted by mobile computing and present the existing security mechanisms.

Mobile Computing   at Glance The last few years have seen a true revolution in the telecommunications world. Besides the three generations of wireless cellular systems, ubiquitous computing has been possible due to the advances in wireless communication technology and availability of many light-weight, compact, portable computing devices, like laptops, PDAs, cellular phones, and electronic organizers. The term of mobile computing is often used to describe this type of technology, combining wireless networking and computing. Various mobile computing paradigms are developed, and some of them are already in daily use for business work as well as for personal applications. Wireless personal area networks (WPANs), covering smaller areas (from a couple of centimeters to few meters) with low power transmission, can be used to exchange information between devices within the reach of a person. A WPAN can be easily formed by replacing cables between computers and their peripherals, helping people do their everyday chores or establish location aware services. One noteworthy technique of WPANs is a Bluetooth based network. The most well-known representatives of WLANs are based on the standards IEEE 802.11 [1], HiperLAN and their variants. IEEE 802.11 has been the predominant standard for WLANs, which support two types of WLAN architectures by offering two modes of operation, ad-hoc mode and client-server mode. In ad-hoc mode (Figure (a)), connections between two or more devices are established in an instantaneous manner without the support of a central controller. The client-server mode (Figure (b)) is chosen in architectures where individual network devices connect to the wired network via a dedicated infrastructure (known as access point), which serves as a bridge between the mobile devices and the wired network. This type of connection is comparable to a centralized LAN architecture with servers offering services and clients accessing them. Ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any centralized administration or standard support services regularly available on the wide area network [2]. Due to its inherent infrastructure-less and self-organizing properties, an ad hoc network provides an extremely flexible method for establishing communications in situations where geographical or terrestrial constraints demand totally distributed network system, such as military tracking, hazardous environment exploration, reconnaissance surveillance and instant conference.
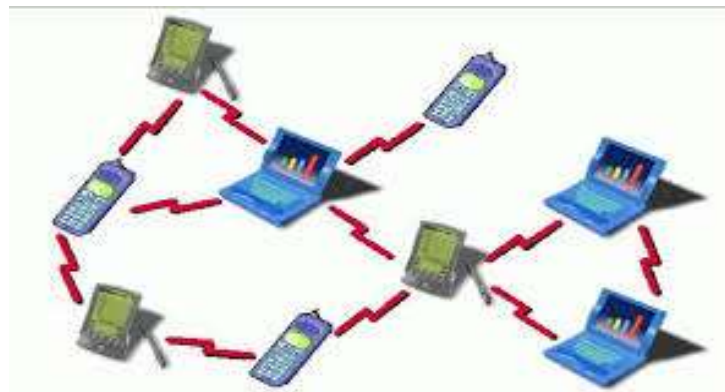
(a) Infrastructure-less Network
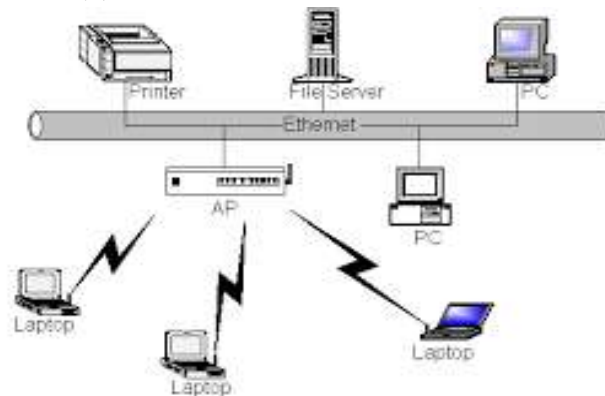
(b) Infrastructure-based Network

Why is Security an Issue?

Security is a prerequisite for every network, but mobile computing presents more security issues than traditional networks due to the additional constraints imposed by the characteristics of wireless transmission and the demand for mobility and portability. We address the security problems for both infrastructure-based WLANs and infrastructure-less ad hoc networks.

Security Risks of Infrastructure-Based WLANs

Because a wireless LAN signal is not limited to the physical boundary of a building, potential exists for unauthorized access to the network from personnel outside the intended coverage area. Most security concerns arise from this aspect of a WLANs and fall into the following basic categories:

1) Limited Physical Security
2) Constrained Network Bandwidth
3) Energy Constrained Mobile Hosts

WLAN Basic Security Mechanisms

The IEEE 802.11b standard identifies several security services such as encryption and authentication to provide a secure operating environment and to make the wireless traffic as secure as wired traffic. In the IEEE 802.11b standard, these services are provided largely by the WEP (Wired Equivalent Privacy) protocol to protect link-level data during wireless transmission between clients and APs. That is, WEP does not provide any end-to-end security but only for the wireless portion of the connection. Apart from WEP, other well-known methods that are built into 802.11b networks are: Service Set Identifier (SSID), Media Access Control (MAC) address filtering, and open system or shared-key authentication.

SSID:

Network access control can be implemented using an SSID associated with an AP or group of APs. Each AP is programmed with an SSID corresponding to a specific wireless LAN. To access this network, client computers must be configured with the correct SSID. Typically, a client computer can be configured with multiple SSIDs for users who require access to the network from a variety of different locations. Because a client computer must present the correct SSID to access the AP, the SSID acts as a simple password and, thus, provides a measure of security. However, this minimal security is compromised if the AP is configured to "broadcast" its SSID. When this broadcast feature is enabled, any client computer that is not configured with a specific SSID is allowed to receive the SSID and access the AP.

MAC Address Filtering:

While an AP can be identified by an SSID, a client computer can be identified by a unique MAC address of its 802.11b network card. To increase the security of an 802.11b network, each AP can be programmed with a list of MAC addresses associated with the client computers allowed to access the AP. If a client's MAC address is not included in this list, the client is not allowed to associate with the AP. MAC address filtering (along with SSIDs) provides improved security, but is best suited to small networks where the MAC address list can be efficiently managed. Each AP must be manually programmed with a list of MAC addresses, and the list must be kept up-to-date.

Authentication:

In a WLAN, an AP must authenticate a client before the client can associate with the AP or communicate with the network. The IEEE 802.11b standard has defined two types of authentication methods: open system and shared Key. Open system authentication allows any device to join the network, assuming that the device SSID matches the access point SSID. Alternatively, the device can use the "ANY" SSID option to associate with any available AP within range, regardless of its SSID. When wireless devices are configured to operate in this mode, Wired Equivalent Privacy (WEP) data encryption is used and it requires that the station and the AP have the same WEP Key to authenticate, thus preventing the client from sending and receiving data from the AP, unless the client has the correct WEP key. IEEE 802.11 Authentication Modes Authentication Request Authentication Response Mobile Host Access Point Authentication Request Authentication Challenge Authentication Response Authentication Result Open System Authentication Shared Key Authentication Mobile Host Access Point Shared Key Distributed 5 authentication,
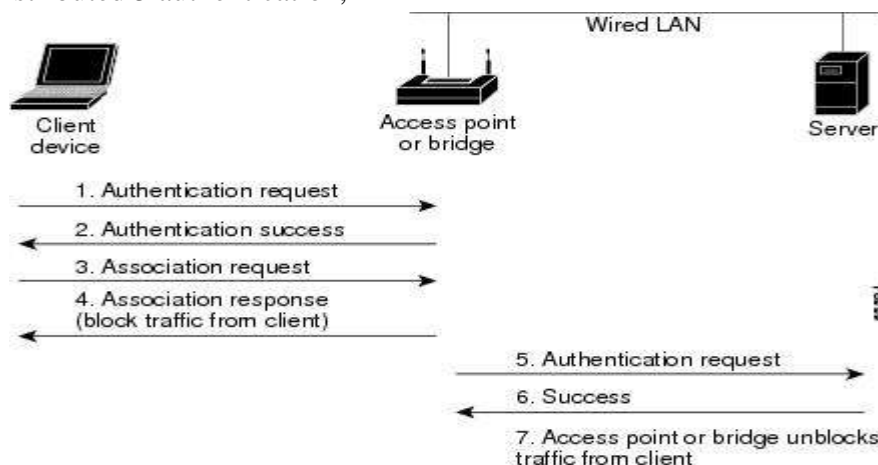
Fig. IEEE 802.11 Authentication Modes

WEP-Based Security:

WEP security protocol encrypts the communication between the client and an AP. It employs the symmetric key encryption algorithm, RC4 Pseudo Random Number Generator. Under WEP, all clients and APs on a wireless network typically use the same key to encrypt and decrypt data. The key resides in the client computer and in each AP on the network. The 802.11b standard does not specify a key-management protocol, so all WEP keys on a network usually must be managed manually and are static for a long period of time. This is a well-known security vulnerability. Support for WEP is standard on most current 802.11 cards and APs. WEP specifies the use of a 40-bit encryption key. The encryption key is concatenated with a 24-bit "initialization vector" (IV), resulting in a 64-bit key. This key is input into a pseudorandom number generator. The resulting sequence is used to encrypt the data to be transmitted. However, WEP encryption has been shown to be vulnerable to several cryptographic attacks that reveal the shared key used to encrypt and authenticate data, such as IV key reuse, keystream reuse, message injection, and so on [3][4]. Because of this, static WEP is only suitable for small, tightly managed networks with low-to-medium security requirements. It is clear that these traditional WLAN security that relies on SSIDs, open system or shared key authentication, MAC address filtering, and static WEP keys is better than no security at all, but it is insufficient, and a new security solution is needed to secure mobile computing.

Security Schemes for Ad Hoc Networks In the recent research of security in wireless ad hoc networks, several good security approaches have been proposed, and they generally fall into three categories as

1) Secure Routing
2) Trust and Key Management
3) Service Availability Protection.

Conclusion

Mobile computing technology provides anytime and anywhere service to mobile users by combining wireless networking and mobility, which would engender various new applications and services. However, the inherent characteristics of wireless communication and the demand for mobility and portability make mobile computing more vulnerable to various threats than traditional networks. Securing mobile computing is critical to develop viable applications. In this we discussed the security issues faced by mobile computing technology. We analyzed the various security threats and describe the existing current countermeasures. We have seen that many security solutions have been proposed to securing WLANs, but no one is able to claim that it solves all the security problems, or even most of them.

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An Introduction to Big Data Concepts

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Abstract:

The term "big data" recurrently use in this epoch, 'Big Data' is also a data but with a huge size, as it is the act of gathering and storing huge amounts of information. 'Big Data' is a term used to explain gathering of data that is huge in size and yet growing exponentially with time. In short, such a data is so bulky and complex that none of the traditional data management tools are capable to store it or process it efficiently. Big data challenges consist of capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy and data source. Big data is often distinguished by the 3Vs. Many of the big data solutions that are mostly accepted right now fit into different categories of technologies.

Keywords: Big Data, huge, 3Vs

Introduction:
What Is Big Data?

Data is just information. Your name is a data point, your age, s your name, your address, even your gender. Big data is huge data sets from all the small bits of data a business or a website collects. Big Data is a constant evolution/revolution in how data is used, stored and processed, whereas traditional data is simpler like the type of smaller data sets you find in Excel spreadsheets. Big data is a term defined for data sets that are huge or intricate that conventional data processing applications are inadequate. Big Data basically consists of analysis vitality, capturing the data, data creation, searching, sharing, storage capacity, transfer, visualization, and querying and information privacy [1]. Big data challenges consist of capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy and data source. Big data is often distinguished by the 3Vs: the tremendous volume of data, the broad variety of data types and the velocity at which the data must be processed. Those characteristics were first identified by Gartner analyst Doug Laney in a report published in 2001[2]. More recently, several other Vs have been added to descriptions of big data, including veracity (i.e., how much noise is in the data), value and variability. Although big data doesn't compare to any specific volume of data, the term is often used to explain terabytes, petabytes and even exabytes of data captured over time. Big data is an developing term that describes a large volume of structured, semi-structured and unstructured data.

Big Data Source

Big data has many sources. For example, every click of mouse on a web site can be captured in Web log files and analyzed in arrange to better understand shoppers' buying behaviors and to influence their shopping by energetically recommending products. Social media sources such as Facebook and Twitter generate remarkable amounts of comments and tweets. This data can be captured and analyzed to recognize, for example, what people assume about new product introductions. Machines, just like smart meters, generate data. These meters

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continuously stream data about electricity, water, or gas utilization that can be shared with customers and collective with pricing plans to encourage customers to move some of their energy utilization, such as for washing clothes, to non -peak hours. There is a remarkable amount of geospatial (e.g., Global Positioning System) data, such as that produced by mobile phones, that can be used by applications like Google Map to help you identify the locations of friends and to obtain offers from nearby stores and restaurants. Image, voice, and audio data can be examined for applications such as facial recognition systems in security systems.

Categories which come under Big Data

Big data works on the data produced by a variety of devices and their applications. Following are some of the fields that are concerned in the Big Data.

Black Box Data:

It is an integrated by flight crafts, which stores a large sum of information, which includes the conversation between group members and any other communications (alert messages or any order passed) by the technical grounds duty staff.

Social Media Data:

Millions of people across the world use Social networking sites such as Face book and Twitter that contains the information and the views posted by them.

Stock Exchange Data:

Stock Exchange holds information about the 'buyer' and 'seller' decisions in terms of share between different companies made by the customers.

Power Grid Data:

The power grid data holds the information consumed by a particular node in terms of base station.

Transport Data:

It includes the data's about model, capacity, distance and availability of a vehicle from various transport sectors.

Search Engine Data:

Search engines recover a large amount of data from different sources of database.

Significance of Big Data

The significance of big data is how you make use of the data which you have. Data can be obtained from any source and analyze it to resolve that enable us in terms of

1) Cost lessening
2) Time reductions
3) New product expansion and optimized offerings
4) Smart decision making.

Big data have great impact on business strategy if that combine with high-powered analytics just like:

- In real time operations find out the base cause of failures, issues and faults.
- Generating coupons at the point of sale seeing the customer's tendency of buying goods.
- Immediately recalculating entire risk portfolios.
- Detecting fake behavior before it affects and risks your organization.

The V's Of Big Data [6]
Volume:

Volume refers to the incredible amounts of data generated each second from social media networks, business transaction systems, customer databases, medical records, internet click

stream logs, mobile applications , cell phones, cars, credit cards, Machine to Machine(M2M) and real-time data sensors used in internet of things (IoT) environments, photographs, video, the collected results of scientific experiments etc. Using traditional database technology this huge amounts of data can no longer store and analyze because data have become so large.

Variety:

Variety is defined as the diverse types of data used. Data today looks very varied than data from the precedent. We no longer just have structured data (name, phone number, address, gender, etc) that fits pleasant and neatly into a data table. Today's data is unstructured. In fact, 80% of the entire world's data fits into this category, including photos, video series, social media updates, etc [3]. New and pioneering big data technology is now allowing structured and unstructured data to be gathered, stored, and used simultaneously.

Velocity:

Velocity refers to the speed at which huge amounts of data are being produced, collected, processed and analyzed. Each day the amount of emails, twitter messages, photos, video clips, etc. increases at fast speeds around the world. Every second of every day data is growing. Not only data analyzed, but also the speed of transmission, and access to the data also remain instantaneous to allow for real-time access to website, credit card verification and instant messaging. Big data technology allows us now to analyze the data while it is being generated, without ever putting it into databases. Sets of big data are updated on a real- or near-real-time basis, compared with daily, weekly or monthly updates in many conventional data warehouses. Velocity is also significant as big data analysis develops into fields like machine learning and artificial intelligence (AI), where analytical processes automatically find patterns in the collected data and use them to generate insights [4].

Veracity:

Veracity is the quality or reliability of the data. To check Just how accurate is all this data? For example, think about all the Twitter posts with hash tags, abbreviations, typos, etc., and the consistency and correctness of all that content. Gleaning loads and loads of data is of no use if the quality or reliability is not accurate. Another good example of this relates to the use of Global Positioning System (GPS) data. Often the GPS will "drift" off course as you inspect through an urban area. Satellite signals are lost as they bounce off tall buildings, other structures or surfaces. When this occurs, location data has to be merged with another data source like road data, or data from an accelerometer to provide accurate data.

Value:

Value referred to the worth of the data being extracted. Having continuous amounts of data is one thing, but unless it can be turned into value it is useless. While there is a clear relation between data and insights, this does not always mean there is value in Big Data. The most important part of embarking on a big data initiative is to understand the costs and benefits of collecting and analyzing the data to ensure that ultimately the data that is gathered can be monetized [9].

Big Data Technologies

Many of the big data solutions that are mostly accepted right now fit into one of the following categories:

1. The Hadoop Ecosystem: It is the core component of processing in a Hadoop Ecosystem as it provides the logic of processing. In other words, MapReduce is a software framework which helps in writing applications that processes large data sets using distributed and parallel algorithms inside Hadoop environment[7].

2. Spark: Basically Spark is a framework just like Hadoop - which offers a number of inter-connected platforms, systems and standards for Big Data. Apache Spark is a unified analytics engine used for big data processing, with built-in modules for streaming, SQL, machine learning and graph processing. Apache Spark is an open source big data processing framework built around speed, ease of use, and sophisticated analytics.

3. R : R another open source project, is a programming language and software environment designed for functioning with statistics. It is used by data scientists, it is managed by the R Foundation and available under the GPL 2 license. Several accepted integrated development environments (IDEs), including Eclipse and Visual Studio, support the language.

4. Data Lakes: A data lake is a system or repository of data stored in its natural format, usually object blobs or files. A data lake is typically a single store of all enterprise data including raw copies of source system data and transformed data used for tasks such as reporting, visualization, analytics and machine learning[5].

5. NoSQL Databases: NoSQL (commonly known as "Not Only SQL") represents a completely different framework of databases that allows for high-performance, agile processing of information at huge scale. NoSQL is a database infrastructure that has been very well-adapted to the heavy demands of big data.

6. Predictive Analytics: The predictive analytics requires a high level of skill with statistical methods and the ability to build predictive data models. It is typically the domain of data scientists, statisticians and other skilled data analysts.

7. In-Memory Databases: In-memory databases have established themselves as a successful form of technology for storing and processing data. They enable companies that have to handle huge amounts of data to analyze big data as rapidly as possible and access it at any time.

8. Big Data Security Solutions: Big data security is the collective term for all the measures and tools used to guard both the data and analytics processes from attacks, theft, or other malicious.

9. Big Data Governance Solutions: Effective data governance can enhance the quality, availability, and integrity of an existing big data technologies need to be improved to efficiently store. It supply the base for making sure that the data used for big data analytics is accurate and appropriate, as well as providing an audit trail so that business analysts or executives can see where data originated.

10. Self-Service Capabilities: **Self-Service Analytics** is a form of business intelligence (BI) in which line-of-business professionals are enabled and encouraged to perform queries and generate reports on their own, with nominal IT support. Self-service analytics is often described by simple-to-use Business Intelligence tools with basic analytic capabilities and an underlying data model that has been simplified or scaled down for ease of understanding and easy data access.

11. Artificial Intelligence (AI): Big data technology includes capturing and storing the data, and then analyzing data to make strategic decisions and improve business outcomes. When big data assembles AI, they have the latent to transform both, the way data is structured and the way machines learn.

12. Streaming analytics**:** Streaming Analytics is the capability to continuously calculate statistical analytics while moving within the stream of data. Streaming Analytics permits management, monitoring, and real-time analytics of live streaming data.

13. Edge Computing: Edge Computing (EC) allows data generated by the Internet of Things (IoT) to be processed near its source, rather than sending the data great distances, to data centres or a Cloud.

14. Blockchain**:** The blockchain is a decentralized ledger of transactions, where every network participant validates the transaction so that the data stored is immutable and cannot be forged.

15. Prescriptive Analytics**:** Prescriptive analytics is relatively a new field in data science. Prescriptive analytics showcases viable solutions to a problem and the impact of considering a solution on future trend.

Applications

Banking

Huge amounts of data flowing in from numerous sources, banks have to find out unique and new ways to manage big data. It's important to examine customers needs and provide them service as per their requirements, and minimize risk and fraud while maintaining regulatory compliance. Big data have to deal with financial institutions.

Government

When government agencies are controlling and applying analytics to their big data, they have spontaneous a lot in terms of managing utilities, running agencies, dealing with traffic blockage or preventing the affects crime.

Education

Educationalist regarding Big Data provides a significant impact on school systems, students and curriculums. By analyzing big data, they can identify at-risk students, ensuring student's progress, and can implement an improvised system for assessment and support of teachers and principals in their teachings.

Health Care

In health care maintain Patient records, Treatment plans, Prescription information etc., everything needs to be done rapidly and exactly and some aspects enough transparency to satisfy severe industry regulations. Effectual management results in good health care to representation hidden insights that improve patient care [8].

Manufacturing

Manufacturers can advance their quality and output while reducing waste where processes are known as the main key factors in today's highly competitive market. Several manufacturers are working on analytics where they can solve problems quicker and make more responsive business decisions.

Retail

Customer relationship maintains is the leading challenge in the retail industry and the best way to manage will be to manage big data. Retailers must have unique marketing ideas to sell their products to customers, the most effective way to handle transactions, and applying unplanned strategy of using innovative ideas using Big Data to improve their business.

Conclusion:

Big data can be analyzed as the most recent generation in the development of decision support data management. Big data is the fourth generation of decision support data management. The capability to capture, store, and analyze high volume, high velocity, and high variety data is allowing decisions to be supported in new ways. It is also creating new data management challenges. Big data has generated a range of new data management technologies, platforms, and approaches.

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