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LEVELED-LEACH: A CLUSTER BASED ROUTING PROTOCOL FOR WSN

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ABSTRACT

Wireless sensor network consists of large number of sensor nodes which are randomly deployed in an unattended environment. Wireless sensor networks are self configurable and infrastructure less. The sensor nodes in WSN are energy constrained, because they are battery operated. Energy conservation and long lifetime of the network are major challenges in a sensor network. Data communication consumes a lot of WSN energy. There are many protocols have been proposed for power-efficient communication in a wireless sensor network. The cluster based routing protocols are best known for increasing energy efficiency, stability and network lifetime of WSNs.Due to restrictions in WSNs, where the resources are limited, many factors may affect its performance and functioning. These factors may be system throughput, delay, and energy. In this paper a clustering protocol have been propose to increase system throughput and system delay, and increase energy saving. In this paper, we propose a new routing technique called as Leveled-LEACH that can be applied to static sensor networks to produce high performance.

Keywords: Communication, LEACH ,Routing, Sensor.WSN.

I. INTRODUCTION

Wireless sensor network (WSN) constitute of homogenous, self-organized sensor nodes. These sensor nodes have the abilities of sensing, computing and routing the data towards each other and also towards base station on a wireless link using radio frequency channel. The basic task of sensor networks is to sense the data from the area of deployment and send it to their requested destination. Sensor nodes in WSNs are densely deployed in the application area for accurate monitoring. In monitoring the critical conditions like, tracking the environment application, accuracy is very critical performance measure. Hence, order of receiving gathered data is important for correct analysis and to know what actually going on in the subjected area being monitored. Similarly, in intrusion detection applications (alarm application), response time is the critical performance metric. The routing mechanism should able to transmit high priority messages in given time. This type of routing mechanism is possible only if the nodes are powered on all the time [38]. Also, a single node or link failure leads to reconfiguration of network and re-computation of the routing paths, route selection may result in either network delay by choosing long routes or degrade network lifetime by choosing short routes resulting in depleted batteries [11]. Therefore the solutions for such problems in environment monitoring should have a

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good mechanism to provide low latency, high reliability and high fault tolerance in communication, quick reconfiguration and minimum consumption of energy. Routing protocols plays a critical role in most of these kinds of activities. In addition to all these problems, the infrastructure less, limited resource nature of WSNs makes routing more complicated. Many routing protocols have been designed to address all of the above problems but all of which are more suitable in some situations having better performance while not suitable in other situations having significant limitations.

This paper proposed a new data forwarding approach which improved the lifetime of wireless sensor network levels of the layers of sensor nodes and the distance between the cluster head and base station in WSNs.

The newly proposed protocol improves network lifetime and energy consumption performance we introduce leveled routing in the wireless sensor networks .Generally it can be compared to multi-hop communication, which means the nodes within the network can be able to communicate with the help of two or more nodes, which are acting as the relay nodes, between the source and destination node.

II. RELATED WORK

2.1 Energy and Throughput Analysis of Hierarchical Routing Protocol (LEACH) for Wireless Sensor Network is proposed by Rajesh Patel Sunil Pariyani Vijay Ukani in 2011 [42],Wireless sensor networks (WSNs) have gained increasing attention from both the research community and actual users. The efficient utilization of energy source in a sensor node is very important criteria to prolong the life time of wireless sensor network. Wireless sensor networks have explored to many new protocols specifically designed for sensor networks where energy consideration is very crucial. Most of importance, given to hierarchical routing protocols based on clustering has better scalability. There are several energy efficient hierarchical routing protocols among this LEACH is famous protocol, authors have simulated LEACH in NS2 and analyzed performance ofLEACH in terms of energy, throughput and lifetime.

2.2 Hierarchical routing protocol in wireless sensor network is proposed by Harneet Kour in 2012 [44],Due to recent advancement and changes in wireless sensor network, various routing protocols have emerged. Hierarchical-based routing is a cluster based routing in which high energy nodes are randomly selected for processing and sending data while low energy nodes are used for sensing and send information to the cluster heads. This property of hierarchical-based routing contributes greatly to the network scalability, lifetime and minimum energy. In this paper, we will discuss various hierarchical routing protocols in wireless sensor networks.

2.3 Energy-Efficient Communication Protocol for Wireless Microsensor Networks is proposed by Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan in 2000 [13], Wireless distributed micro-sensor systems will enable the reliable monitoring of a variety of environments for both civil and military applications. In this paper, authors look at communication protocols, which can have significant impact on the overall energy dissipation of these networks. Based on authors' findings the conventional protocols of direct transmission, minimum-transmission-energy, multi-hop routing, and static clustering may not be optimal for sensor networks, paper propose LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network.

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2.4 Enhanced LEACH Protocol for Wireless Sensor Networks is proposed by A.Koucheryavy, Ahmed Salim, and Walid Osamy in 2013 [53], works in Wireless sensor networks (WSNs) to are composed of many low cost, low power devices with sensing, local processing and wireless communication capabilities. Minimizing energy dissipation and maximizing network lifetime are important issues in the design of routing protocols for sensor networks. In this paper, the cluster routing protocol LEACH (Low-Energy Adaptive Clustering Hierarchy) is considered andimproved.

2.5 Modified LEACH – Energy Efficient Wireless Networks Communicationwas proposed by Abuhelaleh et.al.. The operation of the Mod-LEACH [51] occurs in rounds, and rounds are classified into two kinds, the full transmission round and the half transmission round.Modified-LEACH provides large sensor networks with high energy saving, and high level of performance, more than nine times better than LEACH and twice better than TCCA. At the same time it produces a much higher level of network stability than offered by LEACH. These results show that our proposal provides an efficient solution for high performance sensor networks communication.

2.6 DE-LEACH: Distance and Energy Aware LEACHwas proposedby Surender Kumar et. al. [52]. This protocol proposed a new energy efficient clustering protocol DE-LEACH for homogeneous wireless sensor network which is an extension of LEACH. DE-LEACH elects cluster head on the basis of distance and residual energy of the nodes. Proposed protocol increases the network life, stability and throughput of sensor network and simulations result shows that DE-LEACH is better than LEACH.

2.7 iMOD LEACH: improved MODified LEACH Protocol for Wireless Sensor Networks proposed by S.Ahmed et. al. [53]. In this research, authors have proposed iMODLEACH protocol which was an extension to the MODLEACHprotocol. Simulation results indicate that iMODLEACH outperforms MODLEACH in terms of network life-timeand packets transferred to base station. The mathematical analysis helps to select such values of these parameterswhich can suit a particular wireless sensor network application.

III. PROBLEM DEFINITION

There can be the following challenges during routing in WSN:

- The flow of gathered data is towards base station/sink from all source nodes in all applications.
- Resource management is critical.
- Application-specific nature.
- Location based data collection needs nodes position awareness.
- Data redundancy.

Considering all of the above challenges routing protocols should have the capabilities to handle WSN characteristic for reliable and efficient communication in the network. Different routing mechanisms have been proposed to address routing problems in WSNs taking into account WSNs network architecture and application demands. But not all protocol are so much reliable and of adaptive nature.

IV. PROPOSED PROTOCOL: LEVELED-LEACH

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The newly proposed protocol improves network lifetime and energy consumption performance we introduce leveled routing in the wireless sensor networks.Generally it can be compared to multi-hop communication, which means the nodes within the network can be able to communicate with the help of two or more nodes, which are acting as the relay nodes, between the source and destination node.In our research different clusters are made with the help of range levels of the sensor nodes and then a cluster head is selected on the basics of LEACH protocol. Here the cluster head will not communicate to the base station directly. But will first choose a next level cluster head which one is closer to it and then that cluster head will communicate the data further towards the base station. Multi-hop or ad hoc, wireless networks use two or more wireless hops to convey information from a source to a destination. There are two distinct applications of multi-hop communication, with common features, but different applications.

V. SIMULATION SETUP

Simulation has been done in MATLAB. The experiment is applied on newly proposed Leveled LEACH protocols; we applied them on three different network sizes (100, 1000, and 10000 sensors); for each size, 1000 rounds were processed with the following initial values of main parameters:

- The desired percentage of CHs (P) is set to 0.05.
- Each sensor starts with 0.5 j energy.
- The amplifier energy is assumed to be 100 pj.
- The electronic energy is assumed to be 50 nj.
- Each sensor data range is set to 30m.
- The message size of a sensor data is set to 50 bits.
- Each node has 2000-bit data packet to send to the BS.

VI. RESULTS AND ANALYSIS

6.1 The Dead Nodes After Each Round

The following diagram represents the dead nodes in each round when we run the proposed algorithm. The dead nodes here mean that the sensor nodes are now not responding due to total decay in energy.

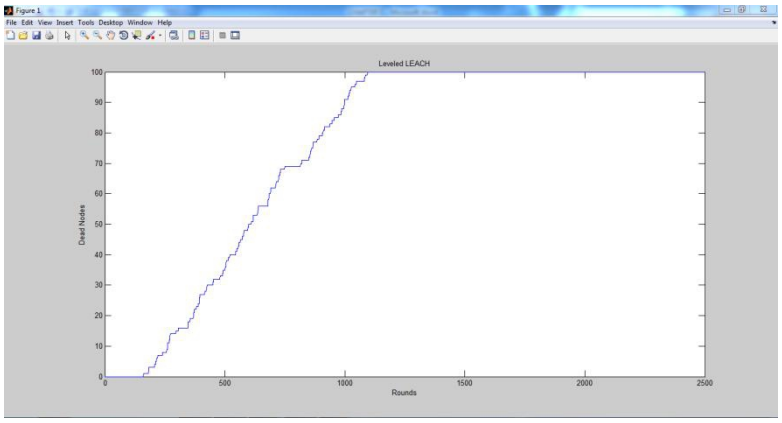

Figure1: Number of Rounds vs Dead Sensor Nodes

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As the number of nodes gets increasing number of dead nodes also goes on increasing and at one level it becomes constant when there are only few nodes left or no nodes have been left.

6.2 Packets sent to Base Station

The packets to base station here mean that the cluster heads are continuously sending the data packets towards the base station after gathering data from all sensor nodes from its cluster area or level. The packets to base station are goes on increasing as the network has been established and the entire sensor network is alive. After the sensor nodes are starts turning off due loss in energy the packets to base station remains constant after some time and will become zero after the whole network has been shut down.

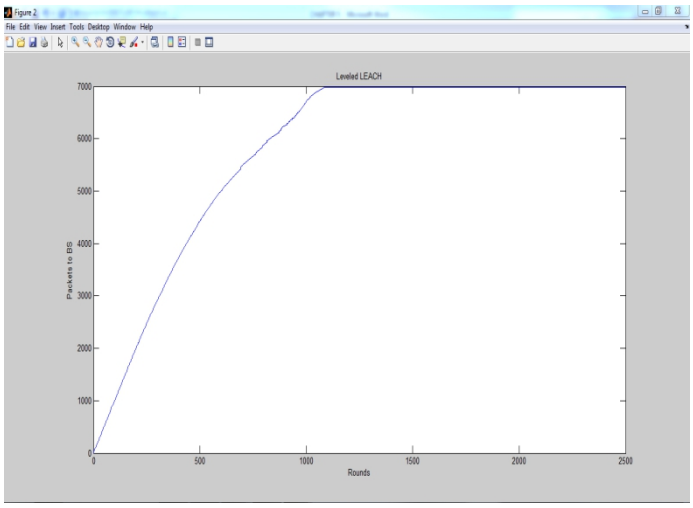

Figure2: Number of Rounds vs Packets to Base Station

6.3Number of Cluster Heads after each Round

The number of cluster heads here means that the sensor nodes are elected as the cluster head at each level which gather data continuously from other sensor nodes present at that level and send data packets towards the base station. The number of cluster heads randomly goes on increasing and decreasing as the network has been established. After the sensor nodes are starts turning off due loss in energy the number of cluster heads will goes on decreasing and after some time will become zero after the whole network has been shut down.

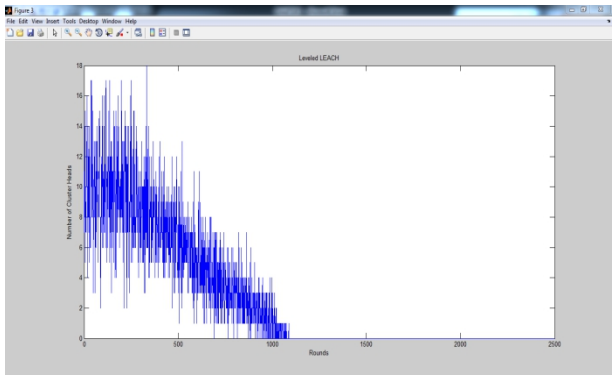

Figure3: Number of Rounds vs Number of Cluster Heads

6.4Number of Packets sent to Cluster Head after each round

The packets to cluster heads here mean that the sensor nodes are continuously sending the data packets towards the cluster heads after sensing some environmental application. The packets towards cluster heads are goes on increasing as the network has been established and the entire sensor network is alive. After the sensor nodes are

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starts turning off due loss in energy the packets to cluster heads remains constant after some time and will become zero after the whole network has been shut down.

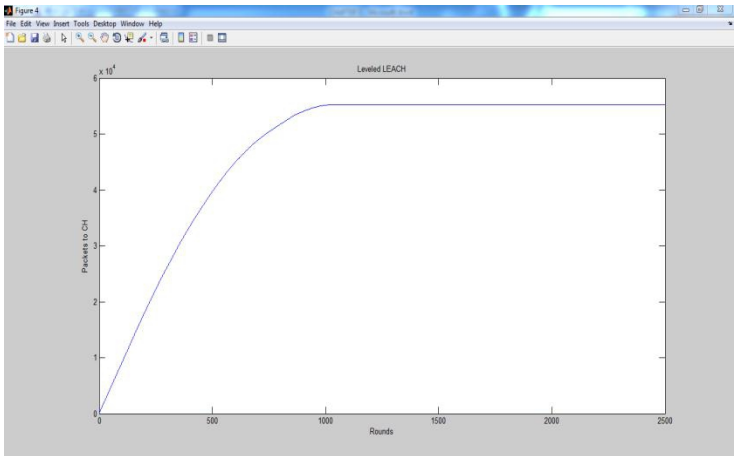
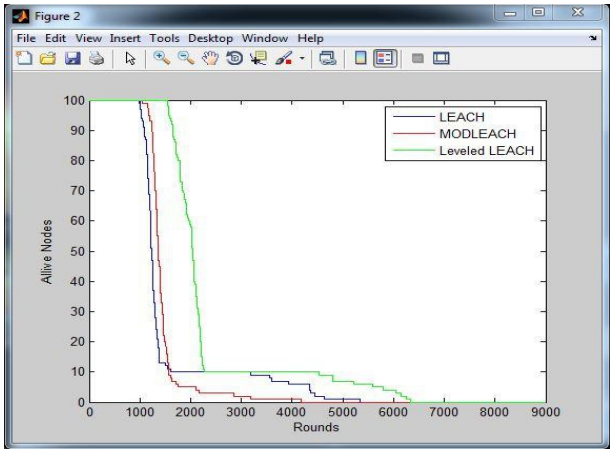


Figure4: Number of Rounds vs Number of Packets Sent Towards Cluster Heads

VII. DISCUSSION

From the results it can also be seen that Leveled-LEACH showed better performance than other algorithms as it less processing power and less time to select the cluster heads in the leveled network. It do not consume much energy in case of transmission of data, while the MODLEACH and LEACH takes too much time and too much energy in forming clusters and also electing the cluster heads.It improves the network lifetime, stable region and throughput of sensor network. For increasing the network energy efficiency it uses a residual energy and level based cluster head election scheme. Leveled-LEACH ensures that nodes which are far away from base station will become cluster head only when they have sufficient energy for performing this duty and nearby nodes particularly at the edge of its level. Also a node in the mid of the level of a sensing region have the highest probability to become a cluster head in a round. Simulation result shows that the proposed scheme is better than MODLEACH and LEACH in energy efficiency and network life.



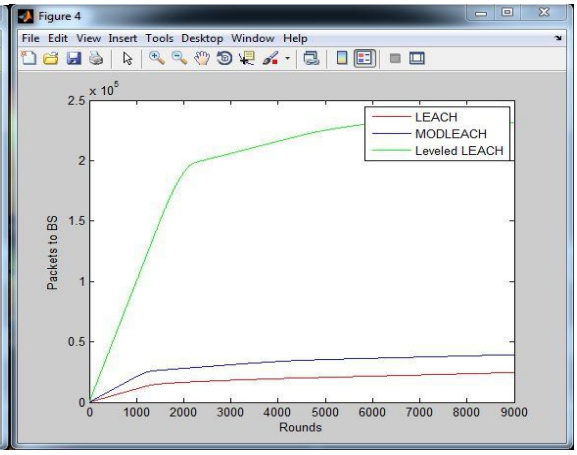


Figure 5: Analysis of Alive Nodes Per Round **Figure 6: Analysis of Packets to Base Station Per Round**

VIII. CONCLUSION AND FUTURE SCOPE

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Proposed protocol describe an energy-efficient multi-hop routing protocol using leveling in sensor node network for the purpose of maximization of the life time of wireless sensor network and for the minimize energy consumption of sensor network. It chooses cluster head randomly in the levels of the data transmission in the network. The level of the data transmission in the network has been defines by using the base station messages at the starting of the wireless sensor networks.The cluster head selection technique at the levels is similar to that of LEACH protocol that causes that the current energy of some cluster heads of cluster are less or their distances to base station are far from the nodes, due to the heavy energy burden the cluster head will soon die and life time of network minimized.The future directions for routing in WSN vary from network structure to, application types to application demands. Different applications have different sensitivity factors. Different network designs have different constraints with respect to varying challenges. There are different issues at design level of WSN, like node deployment, heterogeneity, localization and synchronization which needs to be explored further. There are various protocols already developed for WSNs need to be compared with respect to WSNs application classes.

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ROBOT CONTROL USING MOBILE PHONE

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ABSTRACT

Recently, robot technology has gained popularity because of labour shortage, ability to work for long hours, etc. Conventionally, wireless control robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. Use of a mobile phone for robotic control can overcome these limitations. It provides the advantages of robust control, working range as large as the coverage area of the service provider. Although the appearance and capabilities of robots vary vastly, all robots share the features of mechanical, movable structure under some form of control. The control of robot using mobile phone involves three distinct phases: Reception, Processing and Action. Here the reception is done by DTMF decoder unit (HT9170), processing is done by on-board microcontroller (LPC2148) and the action is performed using motors (DC gear motors). The Camera is mounted on the robot to record and capture images of remote areas. The Robot is controlled according to the user's key press. The microcontroller is programmed in Embedded C language using Keil microvision4 compiler. Flash magic is used as a tool for user interface. The mobile control system has the ability to move in different directions such as left, right, forward, backward and stop according to user's keypress and to capture images of remote location. Mobile phone operated control is best because there is no limitation of range.

Keywords: DTMF Decoder Unit (HT9170), Microcontroller (LP2148), Motor Driver (L293D) and Flash Magic.

I. INTRODUCTION

A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine which performs a variety of tasks that is guided by a computer program or electronic circuitry.

Robotics inspires to make connections across several disciplines rather than learning topics in isolation as it combines mechanical, electronic, electrical and programming skills [1]. It gives visual grasp of math and science, builds logical thinking that brings out innovation and creativity and enhances problem solving skills.

Applications- Manufacturing industry, medical science, robots in space, national defense, transportation, agriculture etc.

II. PROBLEM STATEMENT

Conventionally, robots controlled by wireless communication employ radio frequency (RF) circuits, which have the drawbacks of limited working range, limited frequency range and the limited control. Use of a mobile phone for robotic control can overcome these limitations.

It provides the advantage of robust control, working range as large as the coverage area [2] of the service

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provider.

III. CONSTRUCTION

When constructing any robot, one major mechanical constraint is the number of motors being used. Either a two-wheel drive or a four-wheel drive can be used. Though four-wheel drive is more complex than two-wheel drive, it provides more torque and good control. Two-wheel drive, on the other hand, is very easy to construct [3]. The chassis used in this model is a plastic plate. Motors are fixed to the bottom of this sheet and the circuit is affixed firmly on top of the sheet. A cell phone is also mounted on the sheet. In the four-wheel drive system, the two motors on a side are controlled in parallel. So a single L293D driver IC can drive the rover.

IV. METHODOLOGY

The block diagram of the project is as shown in fig 1. It consists of DTMF decoder (HT9170), Arm7 microcontroller (LPC2148), Motor driver (L293D), Wireless camera module, two mobile phones (one mounted on the module and other with the user) and user PC.The method of project operation is explained below.

Here, the robot is controlled by a mobile phone attached to the robot. In the course of a call, if any button is pressed, a tone corresponding to the button is heard at the other end of the call [4]. This tone is called "dual-tone multiple frequency" (DTMF) tone. The robot perceives this DTMF tone with the help of the phone stacked in the robot

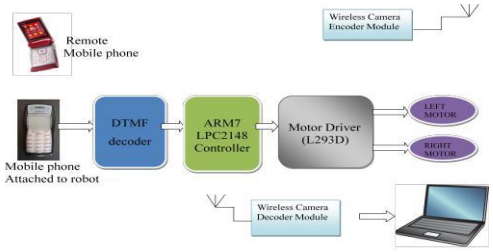

Fig.1. Block Diagram of Mobile Controlled Robot

The received tone is processed by the ARM7 microcontroller with the help of DTMF decoder HT9170. The decoder decodes the DTMF tone into equivalent binary digit and this binary number is sent to microcontroller. The microcontroller is preprogrammed to take a decision for any given input and outputs its decision to motor drivers in order to drive the motors for forward and backward direction or a turn. The mobile that makes a call to the mobile phone stacked in the robot act as a remote. So this robot system does not require the construction of receiver and transmitter units. DTMF signaling is used for telephone signaling over the line in the voice frequency band to call the switching centre. The version of DTMF used for telephone tone dialing is known as "Touch-Tone".

DTMF assigns a specific frequency to each key so that it can easily be identified by the electronic circuit.

V. HARDWARE REQUIREMENTS

The hardware requirements of the robot control system are given in below table 5.1.

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Table 5.1: hardware Requirements of a Robot Control

SL NO.	Components Name	Qty
1	ARM7 IC LPC2148	1
2	DTMF decoder IC HT9170	1
3	Motor driver IC L293D	1
4	Motors	2
5	Crystal Oscillator(3.579 MHz)	1
6	Voltage regulators (7812,7805,1117)	3
7	Wireless camera	1
8	Resistor, LEDs	1, 6
9	Battery (12 V)	1
10	Mobiles	2

5.1 LPC2148 Micro Controller Board

The LPC2148 are based on a 32 bit ARM7 CPU with real-time emulation and embedded trace support, together with 512 kilobytes of embedded high speed flash memory ranging from 32 kb to 512 kb. A 128 bit wide memory interface and unique accelerator architecture enable 32 bit code execution at maximum clock rate [5]. These microcontrollers are particularly suitable for industrial control, medical systems and access control. With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.

5.2 DTMF Decoder

The decoder decodes DTMF audio signal to 4 bit binary TTL level output with LED indication. Suitable for use with microcontroller, remote and robotic applications[8].

5.3 Motor Driver

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L293D Motor driver is simple and reliable DC motor driver. This motor driver can handle current up to 1 ampere.

5.4 Wireless Camera

It has two units, a Camera Capture Module & Wireless receiver Module. The function of this module is to take the snap of the remote location and perform the wireless transmission of the obtained snapshot.

At the Base station there is a wireless receiver module. The function of this unit is to receive the Snap of picture transmitted by the Capture module from remote location and process it and give the user the photographic view of location. The received pictures can be directly viewed on the T.V by using the video output jack on the module. The received pictures can also be viewed on the laptop by the use of additional Audio/Video card module integrated on the Laptop.

5.5 Motors

The motors are used for the movement of the robot, which are of DC gear motors operated at 12V DC power supply. Two motors have been used to rotate the two wheels clockwise or anticlockwise[9].

This provides motion to the robot. Motors are arranged in a fashion called H-Bridge. H-Bridge is an electronic circuit which enables a voltage to be applied across a load in either direction.

It allows a circuit full control over a standard electric DC motor. That is, with an H-bridge, a microcontroller, logic chip, or remote control can electronically command the motor to go forward, reverse, left, right and stop.

5.6 Power Source

To generate required power source to drive the vehicle 12V, 1.2A, rechargeable, lead acid heavy duty battery is used. Two different DC levels of +5V & +12V are used. The battery as it is delivering 12V is used to drive the DC motors & H-Bridge, where as for the remaining electronic circuitry consists of microcontroller & DTMF decoder chip requires +5V constant source[7].

To generate a stable supply of +5V, 7805 three terminal voltage regulator chip is used which provides constant supply, though the battery terminal voltage falls down to 8V.

The DC motors are designed to operate at 12V DC & each motor consumes a maximum current of 150 milli-amps, there by two motors together consumes 300 milli-amps, the remaining circuitry including microcontroller will consume another 150 milli-amps, hence the entire system consumes around 450 milli-amps approximately.

5.7 Mobile Phone

The mobile phone (also called a wireless phone or cellular phone) is a portable electronic device used for mobile voice or data communication over a network of specialized base stations known as cell sites. In addition to the standard voice function of a telephone, current mobile phones may support many additional services such as SMS for text messaging, email, packet switching for access to the Internet, gaming, Bluetooth, infrared, camera with video recorder and MMS for sending and receiving photos and videos. These days mobile phones connect to a cellular network of base stations (cell sites), which is in turn interconnected to the public switched telephone network (PSTN). When the mobile phone or data device is turned on, it registers

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with the mobile telephone exchange, or switch, with its unique identifiers, and can then be alerted by the mobile switch when there is an incoming telephone call. The handset constantly listens for the strongest signal being received from the surrounding base stations, and is able to switch seamlessly between sites. As the user moves around the network, the "handoffs" are performed to allow the device to switch sites without interrupting the call.

5.8 Voltage Regulators

Voltage Regulators are used to regulate the output Voltage. Regulator IC is a three pin IC. It converts unregulated DC current into regulated DC current. Normally we get fixed output by connecting the voltage regulator at the output of the filtered DC. It can also be used in circuits to get a low DC voltage from a high DC voltage. There are two types of voltage regulators.

1. Fixed voltage regulators (78xx, 79xx)
2. Variable voltage regulators (LM317)

VI. SOFTWARE REQUIREMENTS

Here the programming language is embedded C, software used such as Keil, Flash Magic are explained.

6.1 Embedded C

C language has become a popular programming language because of its many user friendly features. It is both general purpose and specific purpose programming language. Programs written in C are efficient and fast. It is a robust language whose rich set of built-in functions and operators can be used to write any complex program. C compiler combines the capabilities of an assembly language with features of high level language and therefore it is well suited for writing both system software, including implementing operating systems and embedded system applications and business packages.

6.2 Keil Software

Keil development tools support every level for software developer from the professional application engineer to the student just learning about software development. Keil C compiler, micro assemblers, debuggers, real time kernels, single board computers and emulators support all processors[6]. The Keil development tools are designed to solve the complex problems faced by software developers.When starting a new project the processor from the device database is selected and the IDE sets all compilers, assemblers, linkers and memory options for the selected processors. Numerous example programmes are included to get started with the most popular processor devices. The Keil debugger accurately simulates on chip peripherals of processor device.Simulation helps in understanding the hardware configuration and avoids the time wasted on setup problems.

6.3 Flash Magic

Flash magic is a PC tool for programming flash microcontroller from NXP using in serial or Ethernet protocol in target hardware. Its features are straight forward and intuitive user interface programs Intel hex files. Automatic verification after programming is available. It controls RS232 signals to place the devices into boot ROM and execute modes automatically, displays information about the selected hex files including creation and

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modification dates, flash memory used, percentage of current device used. It displays the contents of flash in ASCII in hexadecimal formats. NXP semiconductors produce a range of microcontroller that features both on-chip flash memory and the ability to be the programmed using In-system programming technology. Flash magic is window software from Embedded systems Academy that allows easy access to all the ISP features provided by the devices.

VII. RESULTS

The Robot control system has the ability to move in different directions such as left, right, forward, backward and stop according to user' s keypress and to capture images of remote location.

This is a robot with wireless visual system that the user can observe and control the movements via mobile.The primary purpose of the mobile phone operated land rover with DTMF decoder is to know the information in the places where we cannot move. The robot perceives the DTMF tone with the help of the phone stacked in the robot. It provides the advantage of robust control, working range as large as coverage area of service provider.

The final robot control system module is shown in fig.2.

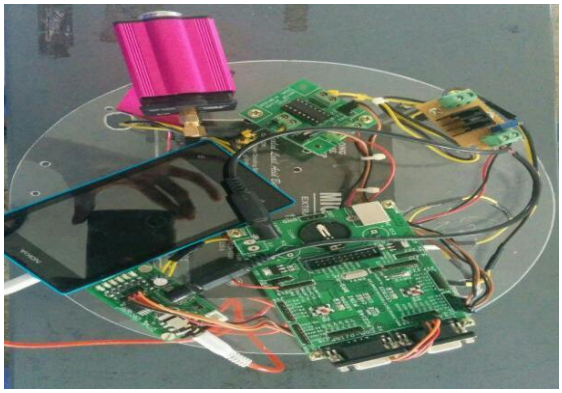

Fig.2. Final Module

VIII. ADVANTAGES AND APPLICATIONS

This gives the details of advantages and applications of the project.

8.1 Advantages

The Robot has ability to survey the environment or situation at certain place using wireless camera. The visual gathering from the robot can be recorded and viewed by human directly. The mobile controlled robot that has ability to move in different directions according to user' s keypress and to capture images of remote location. This is a robot with wireless visual system that the user can observe and control the movements via mobile.

The advantages are as follows

- Wireless control.
- Noise free operation.
- Unlimited control options.
- Vehicle Navigation with use of 3G technology.
- The operation is quite simple.

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- Takes in use of the mobile technology which is almost available everywhere.
- This wireless device has no boundary of range and can be controlled as far as network of cell phone.
- From a performance standpoint, the perceived benefits of a robotic security or surveillance capability are numerous and well documented.
- Humans are removed from direct exposure to potentially dangerous situation.
- Robotic systems can perform many security and surveillance functions more effectively than humans, giving us information that humans cannot get.
- They can perform tasks faster than humans and much more consistently and accurately.
- They can capture moments just too fast for the human eye to get.
- They can entertain us and help us in certain tasks.

8.2 Applications

There are wide range of applications which are as listed below.

- Cell phone controlled robot can be used in the borders for displaying hidden Land mines.
- The robot can be used for reconnaissance or surveillance.
- The robot can be used anywhere there is the service provider tower of the connection provided that is mounted on robot.
- It can be adequately implemented in national defense through military-industrial partnership.
- It can be vastly applied in Resorts, borders of noted buildings.
- Installation of combat robots in the stadiums, sacred places, government and non government organizations assures top security.

IX. CONCLUSION

Conventionally, wireless control robots use RF circuits, which have the drawbacks of limited working range, limited frequency range and limited control. Use of a mobile phone for robotic control can overcome these limitations. It provides the advantages of robust control, working range as large as the coverage area of the service provider. Although the appearance and capabilities of robots vary vastly, all robots share the features of mechanical, movable structure under some form of control. This system has the ability to move in different directions such as left, right, forward, backward and stop according to user’s keypress and to capture images of remote location.

X. FUTURE SCOPE

So far the present system is designed mainly for the supervision applications. In the area of suspectance, the robot can be directed and if any smoke or gas is identified the robot can produce alarm and also informs the operator. The comments from the operator can also be transmitted to the area where the robot moves. Further the key board can be interfaced with the TV receiver to increase the number of comments given to the robot. Amplifier is needed to be connected to the speaker of the mobile interfaced with the robot to pass the comments directly through mobile from the remote mobile. The above system can also used for military purpose as bomb

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detection and as spy robot. Integrated factory automation systems, to which robot technology is key, affect nearly all types of manufacturing. In the near future, productivity and competitiveness in these industries will depend in large part on flexible automation through robotics. And further enhancement are:-Compact design, Quick movement, Improved reliability, Night vision camera, Replacement of transmitter with low power transmitter & receiver which is highly sensitive to reduce the power consumpion.

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ACCESS STRUCTUTE FOR MULTİPLE QUERİES İN ATTRİBUTE BASED ENCRYPTİON

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ABSTRACT

Attribute Based Encryption successfully assimilates Encryption and Access Control. In ABE a set of descriptive attributes are used as an identity to generate a secret key, also to perform access control it serves as the access structure. Every ABE scheme uses an access tree for resolving the combination of attributes submitted by a user. These attributes are transformed into a key through an access tree. Most of the access trees are based on binary trees. We propose an access structure based on n-ary trees.

Keywords—IBE, Access Structure, ABE, Access Controll.

I. INTRODUCTİON

Whenever encryption is used for communication, often asymmetric or public key encryption is used. Asymmetric keys must be many times longer than keys in secret-cryptography in order to boast equivalent security [1]. In 1984 Shamir proposed a new public key encryption scheme in which the public key can be any arbitrary string. The original motive behind identity-based encryption scheme was to reduce the certificate management in e-mail systems. When A sends mail to B at b@name.com he just encrypts his message using the public key string “b@name.com”. There will no requirement for A to obtain B’s public key certificate. When the encrypted mail is received by B, he contacts a third party that is known as “Private Key Generator (PKG)”. To read that mail B first authenticates himself to the PKG to obtain his private key. After obtaining the private key B can read the mail. After this many versions have been proposed to obtain Identity Based Encryption [2, 3] . One issue of encrypting data is that it acutely restraints the strength of users to selectively share their encrypted data at a fine-grained level. To improve security of Identity Based Encryption and to provide fine grained access control Sahai and Wateres proposed a new encryption scheme named as “Attribute Based Encryption” in year 2006 [4, 5]. When ABE scheme applied on practical applications, ABE envisioned as an encouraging tool for the implementation of fine grained access control [6]. Two complementary forms of Attribute Based Encryption are proposed: KP-ABE (Key Policy Attribute Based Encryption) [4] and CP-ABE (Ciphertext Policy Attribute Based Encryption) [5]. In KPABE, private keys are combined with an access control structure which ia more

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generalized and ciphertexts are defined with a set of defined attributes [7, 8, 9].In CP-ABE scheme attributes are attached with keys while access structures are embedded into the ciphertext [10].

When the security of a system is considered with multiple parties who are working together to capture a resource, access structures are used. These structures are combined with cryptography schemes and are called access control policy. An access control policy defines the kind of users who would have authority to read the documents. These access control policies are helpful in secure key management. To define any access control policy and implementing that policy for users is still a challenging task. Any access control policy should be implementing in such a way that system's resources will be protected and there should be no way for information outflow, while bounds on access should not interrupt ease of use. If we limit the number of users in for multiple roles that might be open-to a user like moving files, copying files, sending files with email attachment, needs a better fine grained access control mechanism [11]. The situation gets even more complex as distinct users take unique roles with different policy and different functionality apply to each role. So we have proposed a n-ary access structure that will provide better access control.

II. LITERATURE SURVEY

In large distributes systems fine grained access control is an important factor from always. A lot work has been done in this field and many access structures have been used. We have reviewed some of them which are used in encryption techniques. They are:

- **Fine Grained Access Control:** Systems that has fine-grained access control allow flexibility in specifying the access rights of individual users**.** Fine grained access control techniques employ a trusted sever to store data. Access control depends on software checks to ensure that authorized access**.** For fine grained access control some systems use hierarchy structures. The data in this scheme is classified according to the given hierarchy and data encryption takes place under the public key that is declared for the set of attributes.

- **Secret-Sharing Schemes (SSS):** These schemes are used to divide a secret among the users. Every SSS uses some access structure that defines the set of users, who can reconstruct the divided secrets by using their piece of shared secret. There were many schemes [14, 15, 16, 17] like threshold gate, Monotone and Non-Monotone Access structures, matrices, binary trees etc.

- **Monotone Access Structure:** Large enterprises, military organizations and academic institutions allow users to be categorized into user Groups [12]. To access the data in such organizations some access control policies are expressed as monotone Boolean expressions on user groups. Monotone access structures are commonly used for encryption where such users groups are present like role-based access control models [13]. In these models files are associated with a monotone Boolean expression B_f on attributes. A user can access a file f if and only if the attributes of that user satisfies the monotone B_f. But in Monotone Access structures only positive "AND"," OR" or "Thresholds (d out of k)" are considered, in these structure there is no room for Any negative Boolean Expression like "NOT" .

$$(a \ AND \ b) OR \ c$$

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- **Non-Monotone Access Structure:** These access structures work same as Monotone Access Structure. The only difference is that Non-Monotone Access Structures are also applied on negative attributes who uses "NOT" as there Boolean symbol.

$$(a\ AND\ b)\ OR\ c\ OR\ (NOT\ d)$$

- **Matrices:** These access structures are work upon the valu of matrix calculation [18]. If access tree has *l* nodes then it will be presented like *l* rows in the matrix M. If a matrix M has *n* columns that mean the number of shared secrets are *n*.. Total number of valid shares in the share-generating matrix M will be calculated in polynomial time.

- **Binary Tree:** In such scheme indexed binary search tree is used as the access structure. So the secret can share easily with the choice, also a constant and small size ciphertext will be generated [19]. This scheme provides linear order complexity and allows multiple choices of attribute combinations. This Access structure also reduces the runtime.

III. OUR PROPOSAL

When threshold access structures are used, they have limited combinations of subsets of attributes and have issues in immediate key-revocation; even if keys have been transformed over different time period, because revoked keys are valid till the end of time period. They in turn can affect the runtime and increase height of access structure. To decrease the depth of tree we can increase the order of tree. If the values at leaf nodes are to be used as ID's we require a tree structure that produces unique values for every root-leaf path. Moreover such values when generated by binary tree are highly predictable. Hence, the higher order trees along with a proper weighing of child branches can be used to generate ID's based on attributes of users. These ID's will be more difficult to guess. Hence, it will provide more security. The weighing scheme that we combine with n-ary tree in the proposed structure can also be changed every time; hence this is a promising technique for key-revocation.

Access Structure {T} **:** Let U ={ $A_1, A_2 \dots\dots A_k$} be the set of attribute system excluding the root node. These attributes are presenting at the nodes {$n_1, n_2 \dots, n_k$}, k represent the total number of nodes. To make the n-ary tree we have 0 to n total children of root node. Each node will then expand i+1 times, here i represents the count of that child node(n_i). Here nodes are presenting the associated ID while total combinations of attributes are shown at the every leaf node with the computed value:

$$LT = \sum_{i=1}^{k} label_{n_i} * k^{i-1}$$

Algorithm: n-ary access tree *T* {n,i,LT}

Start from root node.

Step 1: Total number of nodes = n ; for n-ary access tree.

Step 2: If n≠0 then

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{

root node will have n+1 children(from 0 to n).

and goto step 3.

}

else

exit.

Step 3: for every node n_i

Expand n_i for i+1times from 0 to i.

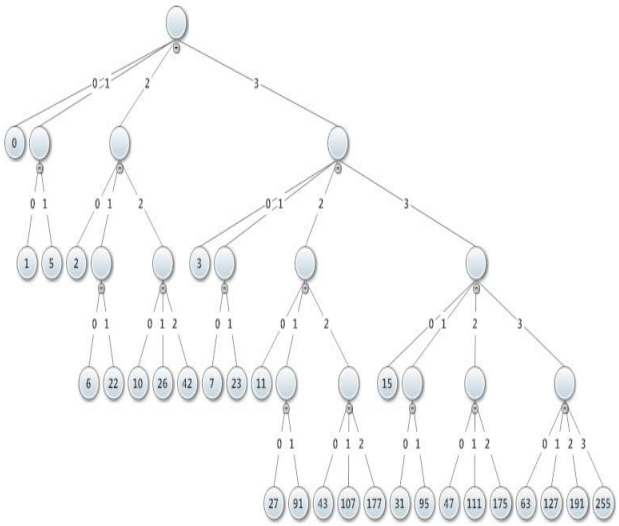
Repeat step 1 and 2 till every leaf node is achieved.

Step 4: Calculate the total value at leaf node LT.

Step 5: LT= total no. of combinations

This can be explained with the help of an example. If we are generating a 3-ary tree then there will be 4 nodes from root node$\{0, 1, 2, 3\}$. 0th node will expand once having only 0 , 1st node will expand twice for 0 and 1, 2nd node will expand thrice for 0, 1, 2 and 3rd node will be expand four times from 0 to 3. Now we can use this access tree with any identity based scheme.

The 3-ary access structure is shown:



IV. ACCESS STRUCTURE APPLIED ON COCK'S IBE MODEL

For instance we are using this access structure with cock's identity based encryption [12]. At the place of local ID we are passing the ID which we have calucated after apply hash function to our access structute T. In year 2001 Clifford Cocks proposed an encryption scheme that i s based on quadratic residues. encrypt messages only bit per bit. This security scheme was an identity based encryption scheme, named as Cock's Identity Based Encryption.

Protocol: In this scheme a third party called PKG (private key generator) is present.

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1. **Set-Up(1^n):** PKG chooses a Blum Integer N=*mpk*= pq as the master public key. Where p and q both are prime and congruent to 3 mod 4, also kept secretly by the authority. Also prepare a set S={S_+, S_-} with Jacobi symbol +1(in S_+) and -1(S_-).
2. **Key Generation(*T*, ID, N, <p,q>):**
   i. $ID \leftarrow hash(T)$
   ii. $a \leftarrow hash(ID)$

   a is now an element of S(either S_+ or S_-). a is now of fixed bit length.

   iii. Compute $= a^{\frac{N+5-p-q}{8}} \bmod N$. Here r represents the quadratic residue.
   iv. Set <ID, r > this is the generated key.

3. **Encryption (*T*, ID, N, b):** Now we need to encrypt any bit b.
   i. $ID \leftarrow hash(T)$
   ii. $a \leftarrow hash(ID)$
   iii. $m \leftarrow v(b)$

   v is mapping which maps $0 \leftarrow +1$ and $1 \leftarrow -1$.

   iv. $t_1, t_2 \leftarrow S_m$

   we select t_1, t_2 randomly but it will depend on the value of m. if m is +1 then take value from S_+ and if m is -1 then we'll take the value from S_-

   v. Now to create ciphertext we use the t_1 *and* t_2 .

   $C_1 = t_1 + at_1^{-1}$

   $C_2 = t_2 - at_2^{-1}$ Here encryption is done.

4. **Decryption(*T*, *T'*, *N*):**

User who wants to decrypt the message shows its access tree to PKG. PKG now check whether the attributes combination of this user is match with the original one.

If ***T*= *T'***

Then PKG gives the key <ID, r > to the user, else reject the request**.**

   i. $a \leftarrow hash(ID)$
   ii. If $r^2 = a \bmod N$

   then

   $d = C_1$

   iii. $r^2 = -a \bmod N$

   then

   $d = C_2$

   else d= garbage.

   iv. Calculate m =Jacobi$(d + 2r, N)$
   v. $b \leftarrow v^{-1}(m)$

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V. CONCLUSİON

Attribute Based Encryption is gaining popularity due to increasing use of smart devices and new innovations in cloud computing, to get more data security . IBE is a generalized form of ABE, we transform IBE into ABE with the help of any defined access structures. ABE essentially needs structures for transforming a set of attributes into a user id or a key. Proposed access structure is capable of resolving many combinations of attributes as compared to available structure. It also resolves the problem of key-revocation by changing the combination of attributes every time. In our work we use this access structure in Cock's IBE scheme that is based on quadratic residues. In future this access structure can be implemented with other encryption schemes who uses different approaches and to get more security and very fine grained access control.

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LIGHT FIDELITY (LI-FI)-THE FUTURE TECHNOLOGY IN WIRELESS COMMUNICATION

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ABSTRACT

The first word that comes to your mind when you read the title is Wi-Fi (wireless fidelity), most of us are familiar to this, it uses 2.4-5 GHz RF (radio frequency) to deliver internet access around a wide area. Whenever you are using internet over a wireless network you may be deprived of the speed over that network. As more and more user's get connected to the network, the rate of data transfer gets reduced. So when people with their many devices access wireless internet, clogged airwaves are going to make it increasingly difficult to latch onto a reliable signal. The wireless network uses radio waves for the transmission of the data. But radio waves are just one part of the spectrum that can carry our data. We have become quite dependent upon this nearly ubiquitous service. But like most technologies, it has its limitations. So a question arises in our mind that can't we use the other part of the spectrum? The answer is "YES". The part of spectrum that we can use conveniently is the visible spectrum. German physicist, Dr. Harald Haas, has put forward the idea of "Data through Illumination"—taking the fiber out of fiber optics by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. He envisions a future where data for laptops, smart phones, and tablets is transmitted through the light in a room. And security would be snap– if you can't see the light, you can't access the data.

Keywords: LED (Light Emitted Diode), PPM, FSK.

I. INTRODUCTION OF LI-FI

The technology of Li-Fi began during the 1990's in countries like Germany Korea and Japan where they discovered LED's could be retrofitted to send information. Haraldhass continues to wow the world with the potential to use light for communication. As in now days we are just using radio spectrum to make communication and using radio waves as a packet carrier. Li-Fi refers to wireless communication systems that have light as a carrier rather than of radio frequencies, Radio frequency technology using the Wi-Fi. Li-Fi always uses the electromagnetic sensitive areas such as in aircraft or nuclear power plants, without causing the environment. However, the light waves used cannot effect by the walls, which make Li-Fi significantly more secure relative to Wi-Fi[5].

The current wireless communication uses radio waves. But the radio spectrum is very short and the no of users are increasing every day. There are around 1.4 million masts in world-wide and about 8 billion users and increasing day-by-day. By the increasing of more and more users radio spectrum is unable to give proper bandwidth to each user. To overcome the spectrum one technology was introduced by Dr. Harald Haas in July,

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2011, i.e. wireless communication using visible light. This new communication technology was named as Li-Fi (light fidelity). In Li-Fi the radio waves were replaced by the visible light to communicate This was named as Visible Light Communication (VLC) [3].

II.ELECTROMAGNETIC SPECTRUM

The electromagnetic spectrum is the range of all possible frequencies of electromagnetic radiation. The "electromagnetic spectrum" of an object has a several meaning, instead of the characteristic distribution of electromagnetic radiation emitted or absorbed by that particular object.

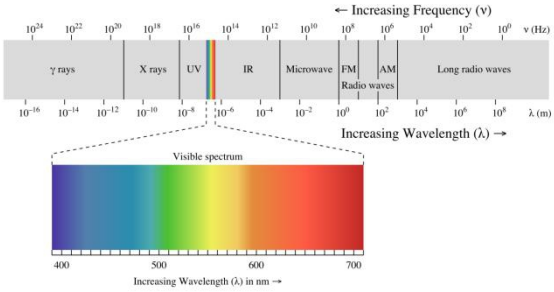

Figure 1: Electromagnetic Spectrum

A Range of the spectrum Electromagnetic waves are defined by any of the following three physical properties: frequency *f*, wavelength λ, or Photon energy *E*. Frequencies observed in a astronomy range from 2.4×1023 Hz (1 GeV gamma rays) down to the local plasma frequency of the ionized interstellar medium (~1 K Hz). Wave frequency is directly proportional to the Wavelength, so gamma ray contains size like an atom due to very short wave length; however, spectrum wavelength is so much longer like a universe. Due to the proportionality of photon with respect to wave frequency, gamma ray photons have the highest energy (around a billion electron volts). However radio wave photons have very low energy (around a femto electron volt). These relations are illustrated by the following equations:

$F = \frac{c}{\lambda}$, or $F = \frac{E}{h}$ or E=hc/λ

Where:

c = 299,792,458 m/s is the speed of light in vacuum and

h =6.62606896(33) ×10−34 J s = 4.13566733(10)×10−15 eV is Planck's constant.

VLC (Visible Light Communication)

The general term visible light communication (VLC) includes any use of the visible light portion of the electromagnetic spectrum to transmit information. Many people's first exposure to optical wireless technology was VLC [4]. This emerging technology offers optical wireless communications by using visible light. The visible spectrum is 10000 times larger than that of radio spectrum. The premise behind VLC is that because light is present everywhere now a days, communications can ride along for nearly free. One of the biggest attractions of VLC is the energy saving of LED technology. 19% of the worldwide electricity is using by light.

A VLC interest group is certified by the IEEE 802.15. The final standard was approved in 2011. The standard of VLC specifies VLC comprising between mobile-to-mobile (M2M), fixed-to-mobile (F2M) and infrastructure-to-mobile (I2M) communications. The main motive of the VLC is to focus on the medium-range communications for intelligent traffic systems at low-speed and on high-speed, short-range mobile to mobile

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and fixed to mobile communications to exchange, for example, video, audio data. Data rates are supported from some 100 kbps up to 100 Mbps using different modulation schemes [4].

III.DRAWBACKS OF CURRENT WIRELESS TECHNOLOGY

The current wireless communication uses radio waves. But the radio spectrum is very short and the no of users are increasing every day. There are around 1.4 million masts in world-wide and about 8 billion users and increasing day-by-day. By the increasing of more and more users radio spectrum is unable to give proper bandwidth to each user.

So there are some drawbacks of current wireless system are as given below:

Availability**:** Even though current wireless system promises the large coverage area, but they are not available in remote areas. In remote area planting a base station is not affordable for communication companies. Hence availability of RF communication is having limitations.

Efficiency**:**There are 1.4 million cellular radio masts deployed worldwide? And these cellular radio masts are base stations. And here more than five billion of cellular devices are present. These RF cellular masts consume lot of energy. Most of the energy is not used to transmit data but to cool the base stations. These cellular must have efficiency up to 5%.HenceRF communication is inefficient.

Capacity**:** With these mobile phones, we can transmit more than 600 terabytes of data in a month. And wireless communications has become a utility like electricity and water. Because of this importance I decided to look into the issues of this technology. Water is so fundamental to our lives. RF communication has a problem of a limited bandwidth, hence it running out of capacity.

Security**:**Radio waves Radiofrequency can penetrate through wall and hence it can be hacked. Wi-Fi networks that are open (unencrypted) can be monitored and used to read and copy data which is transmitted over the network. While another security method is used to secure the data, like a VPN (virtual private network) or a secure web page.

IV. LI-FI WORKING

Li-Fi is typically implemented using white LED light bulbs at the downlink transmitter. These devices are basically used to discover only by applying a constant current. While by using the fast and suitable variations of the current, the optical output can be made to reach at a high speeds. This type of property of optical current is used in Li-Fi setup. The type of operational procedure is so simple-, if the LED is on, you can transmit a digital 1and if the LED is off then you can transmit a 0. By switching the LED on and off, very quickly, gives nice opportunities for transmitting data hence all this is possible by LEDs and a controller that coded data into those LEDs. The data rate can be varied at which the LED's flicker depending upon the data we want to encode. Further experiments can be made in this method, by using an array of LEDs for parallel data transmission, or by applying the mixtures of red, green and blue LED to alter the light's frequency with each frequency encoding a different data channel. Such experiments promise a theoretical speed of 10 Gb/s – meaning one can download a full high-definition film in just 30 seconds. When a constant current is applied to an LED light bulb a constant stream ofphotons are emitted from the bulb which is observed as visible light. The light dims up and down when the current is varied slowly. LED bulbs are semi-conductor devices by which a output can be modulated at

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extremely high speeds which can be detected by a photo-detector device and converted back to electrical current.

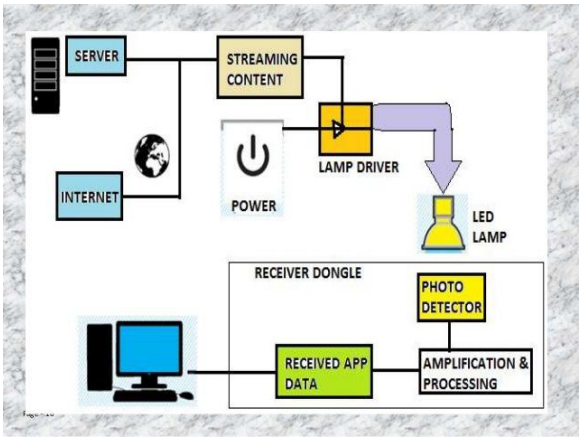

Figure 2: Working Process of Li-Fi

Due to the intensity modulation imperceptible in to the human eye, a communication is just becomes seamless as RF. High speed information can be transmitted from an LED light bulb by using this technique [3].

V. MODULATION TECHNIQUES USED IN LI-FI

In order to actually send out data via LED, like any multimedia data, it is necessary to modulate these into a carrier signal. This carrier signal consists of light pulses sent out in short intervals.
How these are basically depends on the chosen modulation three of which are:

5.1 Pulse-Position Modulation (PPM)

Sub-Carrier Inverse PPM (SCIPPM), method whose structure is divided into two parts (1) sub-carrier part and (2) DC part. The DC part is only for lighting or indicating. When there is no need of lighting or indicating SCPPM (Sub-Carrier PPM) is used for VLC to save energy.

5.2 Frequency Shift Keying (FSK)

In frequency shift keying (FSK) data is represented by varying frequencies of the carrier wave. Before transmitting two distinct values (0 and 1), there need to be two distinct frequencies. This is also the normal form of frequency {shift keying, called binary frequency shift keying (BFSK).

5.3 SIM-OFDM Technique (Sub-Carrier Index Modulation OFDM)

Unlike traditional OFDM depicted in the SIM-OFDM on scheme technique splits the serial bit-stream *B* into two bit-sub streams of the same length [3]. Unlike traditional OFDM depicted in the SIM-OFDM technique splits the serial bit-stream *B* into two bit-sub streams of the same length. . The next step is to select two different modulation alphabets *M*H and *M*L (*i.e.* 4-QAM and BPSK) to be assigned to the first and the second subsets of the first bit-sub stream.

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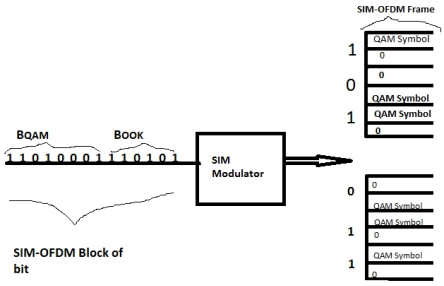

Figure3: Modified SIM-OFDM Modulation

For spectrally-efficient implementation, the majority subset of the first bit-sub stream is allocated the high-order modulation while the minority subset is allocated the low-order modulation (e.g. BPSK).Finally, the second bit-sub stream is mapped by modulating the subcarriers belonging to the majority subset according to the constellation size of *M*H, and the third bit-sub stream is mapped by modulating the subcarriers belonging to the minority subset according to the constellation size of *M*L. Fig. illustrates an example on SIM using two different modulation instead of OOK modulation[3].

VI. DIFERENCE BETWEEN LI-FI AND WI-FI

).	Parameters	Wireless Technologies	
		Light Fidelity	Wireless Fidelity
	Speed for data transfer	Faster transfer speed (>1 Gbps)	Data Transfer speed (150 Mbps)
	Medium through which data transfers occurs	Used Light as a carrier	Used Radio spectrum
	Spectrum Range	Visible light spectrum has 10,000 time broad spectrum in comparison to radio frequency	Radio frequency spectrum rang less than visible light spectrum.
	Cost	Cheaper than Wi-Fi because free band doesn't need license and it uses light.	Expensive in comparison to I because its uses radio spectrum.
	Network topology	Point to point	Point to point
	Operating frequency	Hundreds of Tera Hz	2.4 GHz

VII.CONCLUSION

Li-Fi solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. If his technology can be put into practical use then every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the safe, attractive, and beautiful future. The new technology Li-Fi is currently attracting a great deal of interest of researchers because it may offer a great and very efficient alternative to radio-based wireless. One of the shortcomings is that it can only work in direct line of sight.

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HIGH-RATE WIRELESS COMMUNICATION: GI-FI

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ABSTRACT

The rapid advancement in the field of science and technologies has hold pressure on Wi-Fi, Bluetooth, broad bands, modems which in turn has also lower their speed of transferring and receiving data, so as to push wireless communication to faster drive a new evaluation of Gi-Fi technology has taken place. Gi-Fi or Gigabits Wireless is the world's first transceiver integrated on a single chip that operates on 60GHz on the CMOS process. It has enormous advantages in comparison with the present technologies, it offers faster information rate in Gbps, less power consumption and low cost for short range transmission. The break in Wi-Fi, Bluetooth, etc. by Gi-Fi will prove to be vital in enabling the digital economy of the future.

Keywords: Bluetooth, C-MOS, Gi-Fi, Wi-Fi, Wi-Max.

I. INTRODUCTION

Introduction of technologies like Wi-Fi (IEEE-802.11b) and Wi-Max (IEEE-802.16e) [1] has proved a revolutionary solution to "last mile" problem but the original speed for data exchange has been limited and slow but the man's continuous quest for even better technology despite the substantial advantages of present technologies led the invention of new, more up-to-date standards for data exchange rate i.e., Gi-Fi, developed by researchers of Melbourne University.

Gi-Fi stands for Gigabits (fidelity), Wireless, Gi-Fi is a wireless transmission system which is ten times faster than other wireless short range technologies and its chip delivers short –range multigigabits data in a local environment. It promises to have speed of 5Gbps (gigabits per seconds) within a confined range of ten metres, which is ten times greater than the current transfer rates of other short ranges technologies. Gigabits wireless uses a single 5mm square chip and a 1mm wide antenna burning less than 2milliwatts power to transmit data wirelessly over specific distances. It has both the transmitter and receiver fabricated on a single chip using the CMOS (complementary metal oxide semiconductor) process. It operates on 60GHz frequency band thereby allowing it to send large files, audio, video data within a fraction of seconds.

The main and important component of a Gi-Fi system is its subscriber station which is available to several access points. It supports standard of IEEE 802.15.3C which uses small antenna at the subscriber support millimetre-wave wireless PAN network [2].In this network, the antenna is mounted on the roof and it supports Line Of Sight (LOS) [3] operation. This millimetre-Wave WPAN will operate in the new and clear band including 57-64GHz unlicensed band defined by FCC 47 CFR 15.255.The millimetre-wave WPAN will allow high coexistence(close physical spacing)with all other microwave system in the 802.15 family of WPANs. It transmits multiple signals simultaneously across the wireless paths within separate frequencies to avoid interferences.

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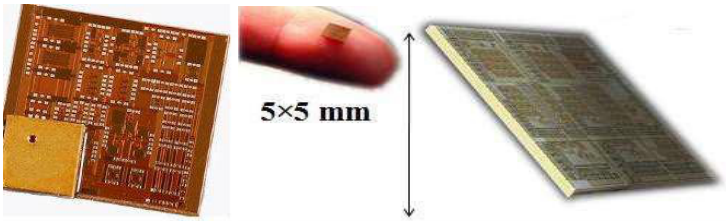

Figure 1: Silicon Chip Used in gi-fi [3].

II. NETWORK EVOLUTION

Communication technology is divided into two types i.e. wired technology and wireless technology .The evolution of wireless technology has ledto Bluetooth, Wi-Fi, GI-Fi technology

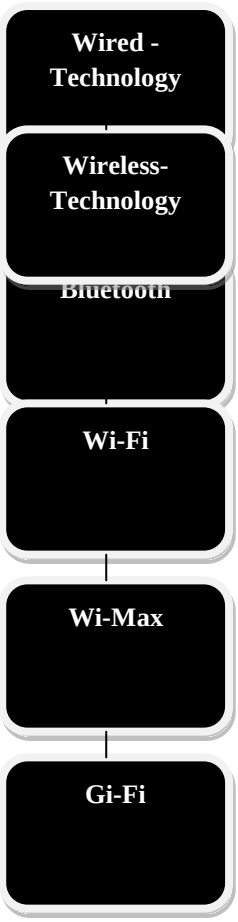

Figure 2: Hireachly of Networks

Initially, for many years cable ruled the world, but the installation of wires caused a greater difficulty and thus led to wireless access. The foremost of this is Bluetooth which can cover 9-10mts.Wi-Fi followed it having coverage area of 91mts i.e. Wi-Fi style access will be limited to a 4-to-6 mile perhaps 25 square miles or 65 square km of coverage than through the stronger line-of –sight antennas, Wi-Max rooted the communication which enabled a maximum range but further the high cost of infrastructure have not yet made it possible for these technologies to become a total threat to cellular networks, so as to uproot this problem of Wi-Fi a major development in the field of communication has taken place by inventing Gi-Fi.

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III. WORKING PRINCIPLE USED IN GI-FI:

NICTA, Australia Information and Computer Technology in collaboration with University of Melbourne have chosen to develop this technology in the 57-64GHz unlicensed frequency band on a single chip that operates on the CMOS (complementary metal –oxide-semiconductor) process the most common semiconductor technology as the millimetre-wave range of the spectrum makes possible high component on-chip integration as well as allowing for the integration of very small high gain arrays. The available 7GHz of spectrum results in very high data rates, up to 5 gigabits per second to users within an indoor environment, usually within a range of 10 meters .It satisfies the standards of IEEE 802.15.3C .

In this we will use time division duplex (TDD) [4] for both transmission and receiving. Here data files are up converted from IF range to RF60Ghz range by using 2 mixers and we will feed this to a power amplifier, which feeds millimetre wave antenna. The incoming RF signal is first down converted to an IF signal cantered at 5 GHz and then to normal data ranges. Here we will use heterodyne construction for this process to avoid leakages due to direct conversion and due to availability of 7 GHz spectrum the total data will be will be transferred within seconds.

Here we will use millimetre wave antenna which will operate at 60 GHz frequency which is unlined band because of this band we are achieving high data rates energy propagation in the 60 GHz band ,which has unique characteristics that make possible many other benefits such as excellent immunity to co-channel interference high security ,frequency re-use. Point to point wireless system operating at 60 GHz has been used for many years for satellite communications. This is because of high oxygen absorption at 60 GHz, as shown in the figure 5. The absorption at 60 GHz signals over distances, so that signals cannot travel far beyond their intended recipient .For this reason 60 GHz is an excellent choice for convert communication. Ultra Band Frequency (UWB) [5], usage a technology with high bit rate, high security and faster data transmission, it is a zero carrier technique with low coverage area so we have low power consumption. Hence UWB is a technology for transmitting information and spread it over a large bandwidth so that it should to able to share spectrum with other users.

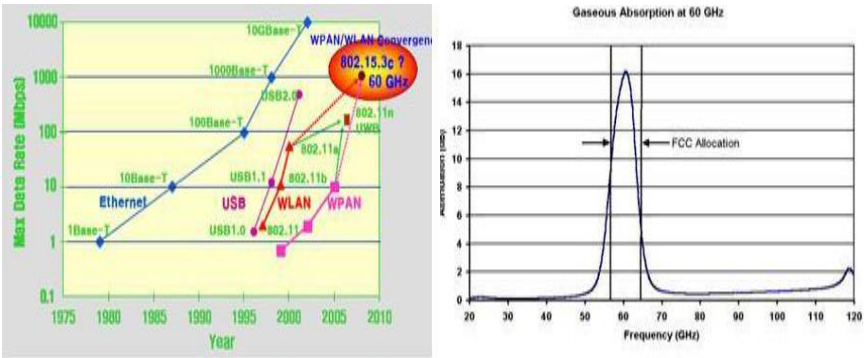

Figure: 3 (From Left To Right) Showing 7ghz Spectrum, Oxygen Attenuation V/S Frequency [6][7].

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IV. ADVANTAGES OF GI-FI

1. High Speed Of Data Transfer – Because of wider availability of continuous 7 GHz spectrum results in high data rates. As the name itself indicates data transfer rate in giga bits per second. Speed of Gi-Fi is 5 gbps. An entire high definition (HD) movie can be transmitted to a cell phone within a second.
2. Less Interference In Data Transfer –It uses 60 GHz millimetre wave spectrum to transmit the data, which makes its cellular network less crowded and the chip provides hundred times faster than the Wi-Fi with less interferences.
3. Low Power Consumption- Power Consumption of present technologies such as Wi-Fi and Bluetooth are 5mw and 10 mw but chip used in Gi-Fi uses tiny one-millimetre antenna and it has less than 2 mili watts of power consumption that in current technologies if compared is very less.
4. Provides High Security- Among the factors that have held back enterprise uptake of wireless LANs outside green field sites have been security fears and lack of performance compared to wire line Ethernet. About 70 per cent of firms have deployed their WLAN in a secure firewall zone but are still using the old WEP protocol, which does not protect the application layer effectively, so better encryption is urgently needed. Secure encryption technology in Gi-Fi ensures privacy and security of content as Gi-Fi technology is based on IEEE 802.15.3C and this standard provides more security since it provides optional security in the link level and service level.
5. Cost Effective - Gi-Fi is based on an open, international standard. Mass adoption of standard, and the use of low cost, mass produced chipsets, will drive costs down dramatically and the resultant integrated wireless trans receiver chip which transfer data at high speed low price $ 10 only which is very less as compare to present systems as go on development the price will be decreased. Hence it can be said that Gi-Fi is economically feasible.
6. Simplicity-One of the problems with wire connections and cables is complexity for connecting, but in the Gigabit wireless technology simplicity is one of the features. Simple connection improves the consumer experience.
7. Removing Cables-For many years cables ruled the world of communication, but use of cables lead to great loss of information and was cumbersome. Gi-Fi technology removes need for cables to connect consumer electronics devices and the entire device in the range of 10 meters can be connected in order to transmit the data wirelessly.
8. Small-Size: It uses a chip sized 5mm per side.
9. High Level OF frequency Re-Use Enabled- the communication needs of multiple customers within a small geographic region can be satisfy by this technique. This Gi-Fi technology allows wireless streaming of uncompressed high-definition content and operates over a range of 10 meters without interference. It is highly portable and can be constructed in everywhere. Entire transmission system can be built on a cost effective single silicon chip that operates in the unlicensed, 57-64 GHz spectrum band. Gi-Fi technology also enables the future of information management to an easy deployment with the small form factor .It deploys line of sight operation having only shorter coverage area, it has more flexible architecture.

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Characteristics	Bluetooth	Wi-Fi	Gi-Fi
Specification Authority	Bluetooth SIG	IEEE, WECA	NICTA
Development Start date	1998	1990	2004
PrimaryDevices	Mobile phones,PDAs, Consumer Electronics OfficeIndustrial,automationDevices	Notebooks, Computers, DesktopComputers,Servers	Mobile phones, Home Devices, PDAs, Consumer, Electronics, Office, Industrial,automation Devices
Power Consumption	5mw	10mw	<2mw
Data transfer rate	800Kbps	11Mpbs	5Mbps
Range	10m	100m	10m
Frequency	2.4GHz	2.4GHz	57-64GHz
Usage location	Anywhere two Bluetooth devices exist.	Within the range of WLAN infrastructure.	Highly portable.

Figure 5: Comparison of Gii-Fi And Other Technologies [8]

V. APPLICATIONS OF GI-FI

There are many usage scenarios that can be address by Gi-Fi .Gi-Fi is highly practice oriented technology marked with lots of uses in current world. .Gi-Fi provides a completely new set of optical technologies and technologies offer to fulfil house hold appliances and office appliances.Gi-Fi has also spread its wings broad casting video signal transmission system in sport stadium and inter –vehicle communication system, Media Access Control (MAC) and imaging.

Figure 6: Various Uses of gi-fi.

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VI. CONCLUSION

Gi-Fi has practical and viable possibilities which are need to be explored further, it is a up growing and on growing technology giving a stiff vying to developed and developing technologies. The abstraction of Gi-Fi has win over the interest of many making it more attractive. Future use of Gi-Fi are highly noticeable with great benefit and relives Wi-Fi consumption.

VII. FUTURE SCOPE

As the range is limited to shorter distances only we can expect can expect the broad band with same speed and low power consumption

- Easily Embedded Into device
- Wireless Office and Home Equipment
- Great Reliability and Ability
- Greater Potential
- Wireless HD

A completely integrated single chip transceiver has been fabricated tested and demonstrated in Gi-Fi chip and a transceiver with integrated phased array antenna on 65nm CMOS technology has been sent for fabrication. Gi-Fi technology demonstrates the world's first fully integrated interesting features of this new technology it can be predicted that transceiver on CMOS technology operating at 60 GHz and provides new technique for integrating antennas on CMOS. Demonstrations of Gi-Fi technology can be arranged showing the - huge potential it has to change the way consumers use their in home electronic devices. The Gi-Fi team is looking for partners interested in commercializing its 60GHz chips and with growing consumer adoption of High-Definition (HD) television, low cost chip and other the anticipated worldwide market for this technology is vast. Within next few years, we expect Gi-Fi to be the dominant technology for wireless networking. By providing low-cost, high broadband access, with very high speed large files swapped within seconds it could develop wireless home and office of future.

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