A

Major Project-II Report

On

A Novel Technique to Establish Eco Scientific Zone via IoT based Hybrid Intelligent Transportation and Communication System

Submitted in Partial Fulfillment of the Requirement for the Degree of

Master of Technology
In
Computer Science and Engineering

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CERTIFICATE

This is to certify that Major Project-II Report entitled "**A Novel Technique to Establish Eco Scientific Zone via IoT based Hybrid Intelligent Transportation and Communication System**" submitted by **Himanshu Vohra, Roll no. 2K15/CSE/05** for partial fulfillment of the requirement for the award of degree Master of Technology (Computer Science and Engineering) is a record of the candidate work carried out by him under my supervision.

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DECLARATION

I, hereby declare that the Major Project-II work entitled "**A Novel Technique to Establish Eco Scientific Zone via IoT based Hybrid Intelligent Transportation and Communication System"** which is being submitted to Delhi Technological University, in partial fulfillment of requirements for the award of the degree of Master of Technology (Computer Science and Engineering) is a bonafide report of Major Project-II carried out by me. The material contained in the report has not been submitted to any university or institution for the award of any degree.

Himanshu Vohra

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Last but not the least I would like to express sincere gratitude to my parents and friends for constantly encouraging me during the completion of work.

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ABSTRACT

Eco Scientific Zone is an area that exhibits an economically, Scientifically and sustainably prosperous habitat for living. In our present world, everything that is around us is an technical invention of some brilliant minds. This web of technical jargon has affected not only our lives but our environment too. By rapidly increasing industries and indiscriminate cutting of trees we already crossed our limits to get back human friendly environment. We are creating new technologies everyday, without considering its impact on our nature. To rectify this problem, I have proposed a Novel technique to establish Eco Scientific Zone via IOT based Hybrid Intelligent Transportation and Communication System. The proposed method has a multi-dimensional aspects, where each dimension solves the plethora of problems that we face in our present world. With the help of an Hybrid Intelligent Transport and Communication System architecture with IOT devices, we can not only transfer data for long distances but can link various IOT devices that can perform multiple tasks at a single time.

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List of Abbreviations

Short form	Full Form
WiMAX	Worldwide Interoperability for Microwave Access
IoT	Internet of Things
ESZ	Eco Scientific Zone
PTP	Point To Point
PTMP	Point to Multi Point
BLE	Bluetooth Low Energy
LAN	Local Area Network
WAN	Wide Area Network
WiFi	Wide Area Network
RHI	Relative Humidity Index
DSRC	Dedicated Short Range Communication
SMS	Short Messaging Service
GOP	Group Of Pictures
M-SNG	Satellite News gathering
BS	Base station
MSS	Mobile Subscriber station
HITS	Highly Intelligent transportation System
TSP	Traveling Sales Person
RTT	Real Time Traffic
WBS	Weather Broadcasting Station
WSAN	Wireless Sensor and Actuator Networks

List of Abbreviations

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PROBLEM STATEMENT

Main Problem: *As per the study conducted, there is no secure and service oriented network that is capable of providing multiple applications simultaneously. Especially in India where women security, rural tele-density and environmental problems is one of the biggest concern.*

Till now there is no such network exist, but with the help of IoT devices and WiMAX/ airMAX basestations we can provide an Eco Scientific Zone that is capable of providing all important services to the users even in the remotest part of the country. This work will not only revolutionize the current technologies but also a step towards the upliftment of mankind. This problem is solved by solving subproblems as shown below:

Sub Problem 1 :In the world of IOT, we can easily control sensors and collect there data. But there is no way to control the mobile device via single node. Our mobile is capable of performing multiple functions, if we can use it as a sensor. From a single button capable of performing more than 100 applications of smartphone simultaneously is the dire need of time.

Sub Problem 2: The smart button that we have invented is capable of working via HC-05 ,NFC and ESP8266. But using ESP8266 and NFC won't be a efficient as compared to HC-05.

Sub Problem 3: Bottleneck in the network, bandwidth allocation, no slots available are the major problem these days. Is there any efficient way to transfer a node to the nearest basestation ?

Sub problem 4: Long distance data transmission often result in over utilization of bandwidth. For that we can have AIVCTE (Advance Image and Video Compression Technique).

Sub Problem 5: Cost of using Satellite transponders is very high, we can use Smart-Satellite News Gathering vehicles (S-SNG) for the transmission of data without using any satellites.

Sub Problem 6: Long Distance internet connectivity in rural areas or in Mountain regions using traditional wiring method sometime is not an financially viable option. For that Hybrid Intelligent Communication system can be a solution.

Sub Problem 7: Lack of tress and raising levels of pollution in our environment is one of the biggest environmental concern that won't only effect our biodiversity but also dangerously effects human health. For that step towards making an Eco Scientific Zone would be really beneficial for policy making and raising awareness.

CHAPTER 1:

INTRODUCTION

1. Eco Scientific Zone

Eco Scientific Zone is an area that exhibits an economically, Scientifically and sustainably prosperous habitat for living. In our present world, everything that is around us is an technical invention of some brilliant minds. This web of technical jargon has affected not only our lives but our environment too. By rapidly increasing industries and indiscriminate cutting of trees we already crossed our limits to get back human friendly environment. We are creating new technologies everyday, without considering its impact on our nature. To rectify this problem, I have proposed a Novel technique to establish Eco Scientific Zone via IOT based Hybrid Intelligent Transportation and Communication System. The proposed method has a multi-dimensional aspects, where each dimension solves the plethora of problems that we face in our present world. With the help of an Hybrid ITCS architecture with IOT devices, we can not only transfer data for long distances but can link various IOT devices that can perform multiple tasks at a single time. The complete ECZ zone is the one which has:

• Sensor networks and centralized control.
• Connectivity.
• Remote accessibility.
• Live or Real time Audio and Video transmission.
• Minimal congestion.
• Regional applications.
• Mobile application.
• Smart access and connectivity.
• Economically viable and prosperous model.
• Environment friendly.

2. Internet of Things

IOT(Internet of Things) is one of the major inter networking technology that is capable of connecting billions of devices together, which together share information among themselves either in Local Area Network (LAN) or Wide Area Network (WAN). It can be implemented on various protocols via:

- Zigbee

    A. Based on IEEE802.15.4

    B. Frequency 2.4 GHz.

    C. Range 10 to 100 meters.

    D. Data rate : 250kbps

- Bluetooth

    A. Standard Bluetooth 1.x , 2.x, 3.x, 4.x, 5.x

    B. Frequency 2.4 GHz.

    C. Range 50 to 150m.

    D. Data rate : up to 1Mbps

- Z-wave

    A. Standard: Z-Wave Alliance ZAD12837 / ITU-T G.9959

    B. Frequency: 900MHz (ISM)

    C. Range: 30m

    D. Data Rates: 9.6/40/100kbit/s

- 6LowPan

A. Standard: RFC6282

B. Frequency: (adapted and used over a variety of other networking media including Bluetooth Smart (2.4GHz) or ZigBee or low-power RF (sub-1GHz)

C. Range: N/A

D. Data Rates: N/A

- Thread

  A. Standard: Thread, based on IEEE802.15.4 and 6LowPAN.

  B. Frequency: 2.4GHz (ISM).

  C. Range: N/A.

  D. Data Rates: N/A

- WiFi

  A. Based on IEEE802.11n (most common usage in homes today)

  B. Frequencies: 2.4GHz and 5GHz bands.

  C. Range: Approximately 50m

  D. Data Rates: 600 Mbps maximum, but 150-200Mbps is more typical, depending on channel frequency used and number of antennas (latest 802.11-ac standard should offer 500Mbps to 1Gbps)

- Cellular

  A. Standard: GSM/GPRS/EDGE (2G), UMTS/HSPA (3G), LTE (4G).

  B. Frequencies: 900/1800/1900/2100MHz.

C. Range: 35km max for GSM; 200km max for HSPA.

D. Data Rates (typical download): 35-170kps (GPRS), 120-384kbps (EDGE), 384Kbps-2Mbps (UMTS), 600kbps-10Mbps (HSPA), 3-10Mbps (LTE).

- NFC

    A. Standard: ISO/IEC 18000-3.

    B. Frequency: 13.56MHz (ISM).

    C. Range: 10cm.

    D. Data Rates: 100–420kbps.

- Sigfox

    A. Standard: Sigfox.

    B. Frequency: 900MHz.

    C. Range: 30-50km (rural environments), 3-10km (urban environments).

    D. Data Rates: 10-1000bps

- Neul

    A. Standard: Neul.

    B. Frequency: 900MHz (ISM), 458MHz (UK), 470-790MHz (White Space).

    C. Range: 10km.

    D. Data Rates: Few bps up to 100kbps.

- LoRaWAN

    A. Standard: LoRaWAN

    B. Frequency: Various

    C. Range: 2-5km (urban environment), 15km (suburban environment)

    D. Data Rates: 0.3-50 kbps.

Zigbee, Bluetooth, Z-wave, 6LowPan, Thread, WiFi, Cellular, NFC, SigFox, Neul, LoRaWAN and many others. Each protocol has its own pros and cons, usage of these protocols depends upon the needs of the client. In this paper we will use Bluetooth (IEEE 802.15.1, but no longer maintains this standard) as our protocol. It uses short-wavelength UHF radio waves in the ISM band from 2.4 GHz to 2.485 GHz). this protocol is used for exchanging and transmitting data over a short distances to mobile or fixed devices by building a PANs (Personal Area Networks). Till now the bluetooth came with many different versions, the latest one is Bluetooth Version 5.0, which has maximum speed of 50 Mbit/s, over a maximum range of 800 feet (243 meters). In our implementation we are using Bluetooth HC-05 which is currently version 2.0 + EDR. We are using this version because of its compatibility and easy availability for the usage. Different versions of the bluetooth with there speed, capabilities and range is shown in the table below. In this paper we will show the design architecture and implementation of the hardware which can be used as a wearable system smart button, that would be capable of performing multiple mobile functions which are very much necessary in day-to-day life. List of functions to be performed is mentioned in the implementation section.

3. Bluetooth

An important short-range communications technology is of course Bluetooth, which has become very important in computing and many consumer product markets. It is expected to be key for wearable products in particular, again connecting to the IoT albeit probably via a smartphone in many cases. The new Bluetooth Low-Energy (BLE) or Bluetooth Smart, as it is now branded, is a significant protocol for IoT applications. Importantly, while it offers similar range to Bluetooth it has been designed to offer significantly reduced power consumption.

In this paper we will use Bluetooth (IEEE 802.15.1, but no longer maintains this standard) as our protocol. It uses short-wavelength UHF radio waves in the ISM band from 2.4 GHz to 2.485 GHz). this protocol is used for exchanging and transmitting data over a short distances to mobile or fixed devices by building a PANs (Personal Area Networks). Till now the bluetooth came with many different versions, the latest one is Bluetooth Version 5.0, which has maximum speed of 50 Mbit/s, over a maximum range of 800 feet (243 meters). In our implementation we are using Bluetooth HC-05 which is currently version 2.0 + EDR.

Versions	Capabilities	Speed	Range
Bluetooth 1.x	Not used anymore, basic rate bluetooth	1Mbps data rate	-
Bluetooth 2.x	Increased reliability, Enhanced data rate	3 Mbps data rate	-
Bluetooth 3.x	Enhanced data rate, High speed	25 Mbits/s	-
Bluetooth 4.x	Low energy, collecting data from devices	25 Mbits/s	200 feets
Bluetooth 5.x	To be released	4 times more than Bluetooth 4.x	800 feets

Table 1. Bluetooth versions detail

We are using this version because of its compatibility and easy availability for the usage. Different versions of the bluetooth with there speed, capabilities and range is shown in the table below. In this paper we will show the design architecture and implementation of the hardware which can be used as a wearable system smart button, that would be capable of performing

multiple mobile functions which are very much necessary in day-to-day life. List of functions to be performed is mentioned in the implementation section.

4. WiFi

Wifi is a wireless local area networking based on IEEE802.11 and currently most obvious choice for the developers these days. There are multiple devices that can use this standard as such cellphone, tablets, smart tv, smart lights, IOT devices, watches, television and many others. It plays a very crucial role in transferring data in local area from one place to another. It is mostly preferred by the developers these days because of its reliability and efficiency. Its range can be
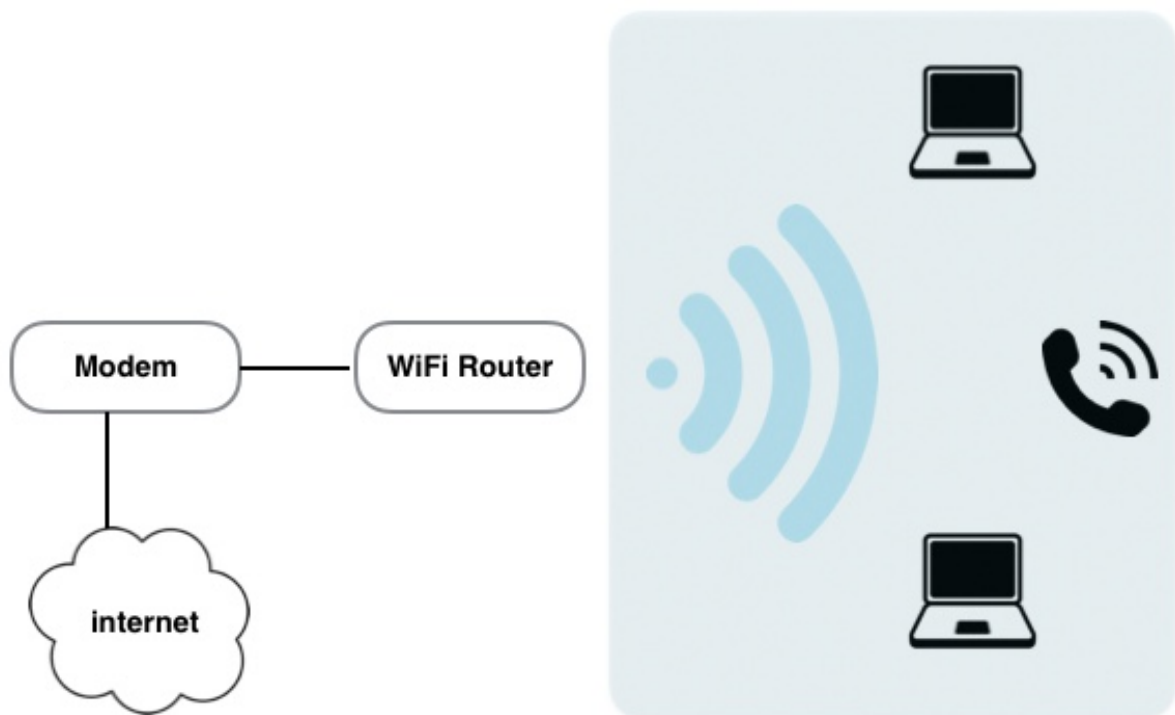
Fig 1. WiFi Architecture

easily extendable up to 50m or more. Wifi network works on a packet switching network. It converts information data into packets and transfer it across various routers. The data capacity of these packets and strength depends upon the signal strength.

5. WiMAX

The IEEE 802.16 WiMAX (Worldwide Interoperability for Microwave Access) is an emerging wireless technology that can transfer data up to 100 mbps up to the distance of 50 km or 30 miles. It is very similar to the Wi-Fi, only difference is that it covers a larger area (usually 30 miles or 50km) as compared to the traditional Wi-Fi. It has a great number of applications in wireless technologies because of it high data transmission rate.

The first version as shown in Fig 1 of the WiMAX [9] came in December 2001, spectrum allocated to it was 10-66GHz. But only obstacle it faced was that, it works in LOS (Line of sight) only. Maximum data transfer rate it can achieve was 33 to 133 mbps at 28MHz channelization. Channel bandwidths is between 20 to 28 MHz. It performs QPSK (Quadrature Phase Shift Keying), 16QAM and 64 QAM modulation technique. Major application of this version is that it can be used as backhaul.

2nd version of WiMAX came in 2003, its frequency range was between 2-11 GHz. Maximum data transmission speed that can be achieve was up to 75 Mbps at 20 MHz channel. One major change as compared to previous model was that it works in Non-Line of Sight (NLOS). Channel bandwidth is between 1.5 and 20 MHz. Modulation technique it has used is OFDM 256 (Orthogonal Frequency Division Multiplexing), OFDM 2048, QPSK, 16 QAM, 64 QAM. Major application of this version is as Wireless Digital Subscriber Line and as a backhaul.

3rd Version that came out was IEEE 802.16e, which is released around July 2005. This is most often known as mobile WiMAX. It usually works at frequency ranging between 2 - 6 GHz. Maximum data transmission rate it can achieve is 15 Mbps at 5 MHz channel. It also works as Non-Line of Sight. The channel bandwidth is same as IEEE 802.16a. Modulation technique it uses is same as 802.16a but with scalable OFDM (SOFDMA).

Final version came out in 2009 whose frequency ranges between 10-66 GHz and below 11 Ghz. Maximum bitrate it can achieve was 120 Mbps at 25 MHz and 28 MHz channelization. Modulation techniques it uses is BPSK(Binary Phase Shift Keying), QPSK, 16-QAM, 64-QAM, OFDM, OFDMA. Allocated channel bandwidth is between 25MHz and 28 MHz. The architecture of WiMAX network is shown below.

Subscribers station   Base station   Relay station

Fig 2. Point to Point Architecture

Mobile station
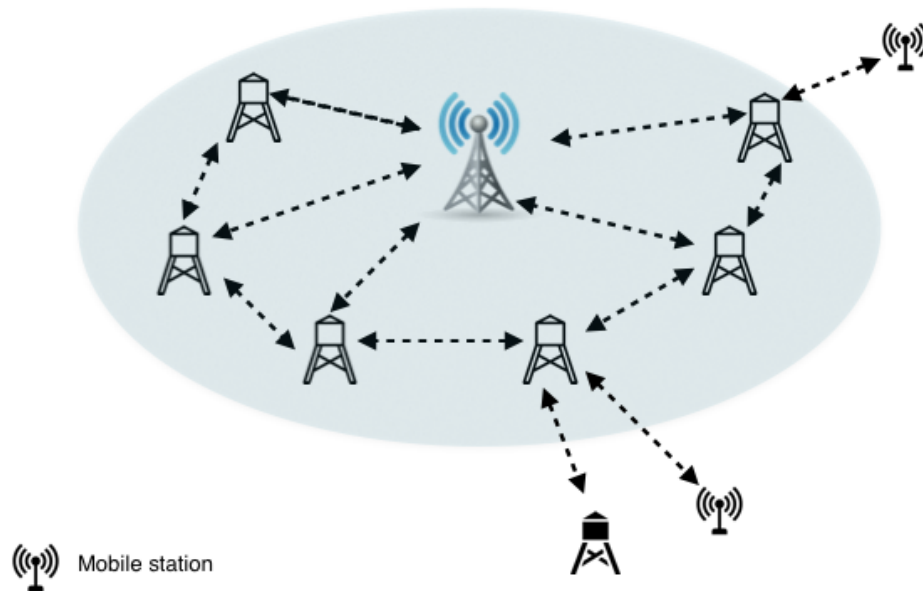
Fig 3. Point to Multipoint Architecture

6. Smart Button

AS the demand for IOT (Internet of Things) and BLE devices are increasing, the smart application that works on these platform has a huge market potential. Bluetooth Low Energy devices are small in size and capable of transferring small amount of data within range of 10m. There are multiple functions that can be performed by the smart button by clicking it. There are three types of clicks associated with the hardware, as:-

1) Single Click

2) Double click

3) Hold the button

Each and everyone of them is having there own intent call which will perform there respective function depending upon the type of click.

For making phone calls and sms services user have to enter the corresponding mobile destination mobile number manually. For the advanced services like Hang up calls and Skype, user have to log in with username and password. This smart application is designed to run in as background application, even if the user closes this application, it will still work (until unless user exits from its services manually). For advanced services the facility of Sign in and Sign up is provided to the users, to access certain services which requires user permissions. Another major problem that most of the devices faces is the loss of data when system reboots. To overcome this challenge, we came out with a method that will configure all data from the application and store it in ints internal memory, so when the phone reboots, application will be resumed from where it is stops.

Fig 4. Smart button functioning

7. Motivation

In many rural areas in India there is no internet access because of this many people lacks basic services. Major obstacle that we face in internet establishment in these areas is high cost of implementation if we are using DSL, its routine service management, sometime we are not able to set up base station, lack of experts in those areas and many others. The same issue is also for the mountain areas, placing DSL line in mountain areas is not a viable option. At the time of disasters, many systems stop functioning which result in lack of communication in affected areas. To overcome all these challenges, setting up a WiMAX base station at a fixed location is the best solution. Not only in the rural areas but also in developed cities, the great application of using WiMAX is in security/surveillance, road sensors, real time news transmission, live video telecasting, Automated weather stations, Variable message signs on roads, traffic video monitoring
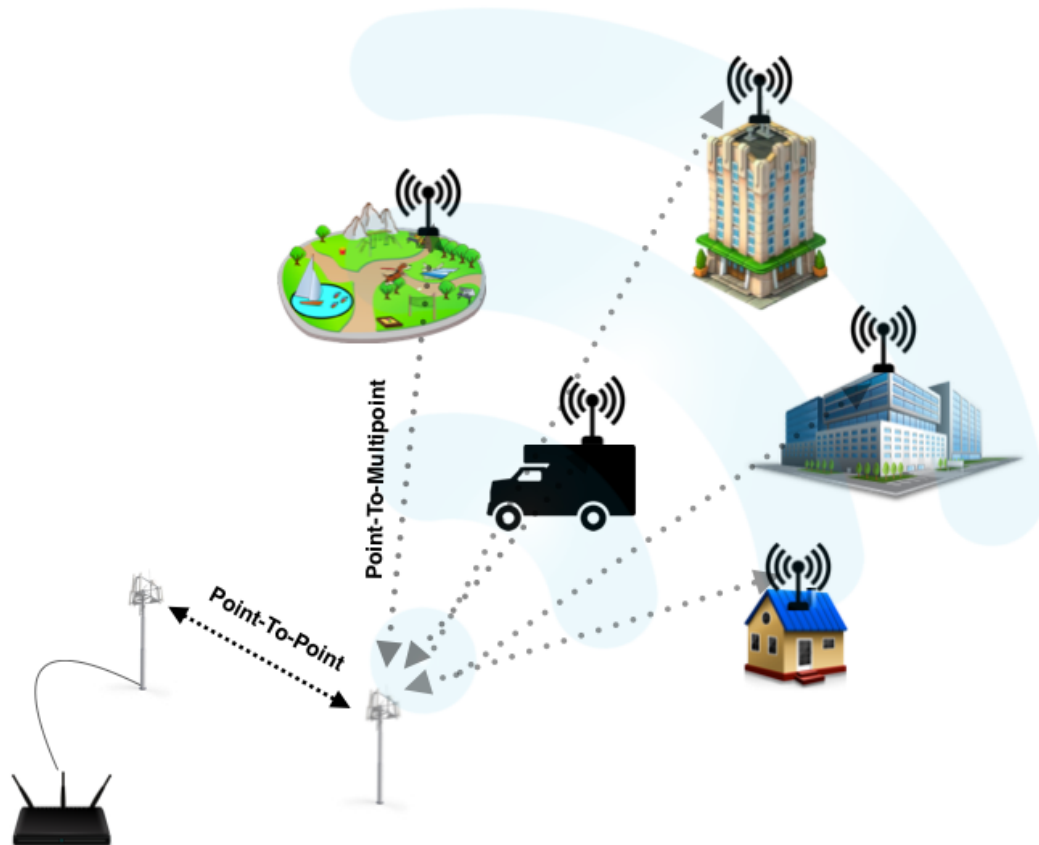
Fig 5. User accessibility over long distances.

cameras, radio transmission station, broadband base station, managing traffic signals and many others as we explore. In this thesis we will focus on these different applications. Providing a large scale internet coverage, not only for the cities but also for the rural, relatively isolated and sparsely populated areas. As we know that rural Teledensity and network connectivity is still a underlying problem in our country, currently 8%. Access to high-speed internet in these can benefit in numerous ways, for the farmers, they can be regularly update about the weather via WBS (Weather Broadcasting Station), by having better access to internet we can provide a better education standards for children as well as adults, which would overall increase the literacy as well as employability rates in these areas. This will not only improve the livelihoods of those people who are completely untouched by this technology but this will also increase the nation's socio-economic growth. Rural India is expected to account for 40% of the 250 million new wireless users as per a recent study conducted by FICCI and Ernst and Young. If these subscribers had access to broadband and high-speed Internet as shown in Fig 2, every citizen would truly be able to participate in and benefit from the global information revolution and contribute to a balanced growth of the nation.

This thesis not only focuses on the rural connectivity but also provide a step toward upliftment of humankind. By estimating the relative humidity of a different region in an area we are able to get an estimate of number of trees and can calculate the adequate number of trees that can be planted to make a zone a habitable zone. India is already suffering main disease, this technology can help us to reduce or in future eradicate certain diseases like Asthma, virus infections, Dust mites infections, lungs cancer and many others. There are always two facets of coin, we have already seen one and its impact on environment, now its time to give back something to our mother nature.

8. Research Objective

Prior objective of the research work is to establish a secure and service oriented zone based on Internet Of Things and WiMAX basestations that can transfer data across long distances. The proposed algorithms are capable to reduce congestion in network and can easily transfer mobile nodes based on shortest path. The research work focuses on to ease the task of the user for that smart button is invented. The smart button based on HC-05 and ESP 2866 are capable of performing multiple task by clicking single button. As India is a vast country there are still many remote areas where internet facilities are not yet available. In that case instead of using the traditional wiring system to provide them internet connectivity we can use Intelligent Communication System based on WiMAX and AirMax basestation. The architecture that we have developed is not only for the remote areas but it can be used for the numerous activities. It can also be used in service oriented network for the entrepreneurs, in the defense areas along the border line for the radar network, for the safety of women by sharing of GPS coordinates, surveillance system, vehicles connectivity, using basestation for transmitting signals instead of using transponders. Such a multidimensional aspects are the main priority in this research work which would not only help in revolutionizing the present technology but also helps in upliftment of human kind that would provide safe and habitable zone.

CHAPTER 2:

RELATED WORK

1. Related Work

As shown in [1] an "optimized OPC UA transport profile to bringing bluetooth low energy device into IP networks", it proposes the method to optimize OPC UA network footprints. It has also used BLE device that creates a network profile, but the main problem in such devices is that multiple devices cannot be connected at the same time. It can still be used in multiple industries.

As shown in [2] it shows the "Bluetooth based tree topology network for wireless industrial applications". They have proposed a method that can implement a tree topology using the BLE hardware. The particular application can be extended to wireless network too, but in this method time complexity plays a very crucial role. Performance is shown by the NS 2 software.

As shown in [3] a "BLE-based data collection system for IoT", they developed this with help of Arduino board. The feasibility of the system can be measured only if the distance between the collector and the gateway is below 6 meters.

As shown in [4] "The Design of Home Monitoring System by Remote Mobile Medical" , "The paper has designed a remote mobile medical home monitoring system which is based on the Internet of things. The system consists of physiological parameter acquisition node, intelligent mobile terminal and remote monitoring platform".

As shown in [5] "A Review of Connectivity Challenges in IoT-Smart Home", it describes connectivity of various device in the home as a smart home. It connected multiple devices via IoT. But the same problem of multiple devices connection is occurring again.

As [6] "Poster Abstract: Architecture Proposal for Heterogeneous, BLE-based Sensor and Actuator Networks for Easy Management of Smart Homes","This paper proposes an architecture for Wireless Sensor and Actuator Networks (WSAN) using the new standard Bluetooth Low

Energy (BLE). This architecture can be used as reference for the deployment of real and flexible monitoring platforms based on Internet of Things (IoT) scenarios such as smart homes, making a multitude of tasks easier to the user. A general overview of the architecture is presented as well as a specific description of its different layers".

As shown in [7] "Mobile based Horne Automation using Internet of Things(IoT)", in this paper "a prototype smart home automation using loT is presented. This research work will be carried forward by integrating relays to Arduino board for controlling home appliances from a remote location in a real scenario. As an extension, authors propose a generic loT framework and use cloud computing infrastructure for connecting and managing remote devices and also store sensor data. Authors plan to productize proposed home automation solution so that more number of people can use loT in a smart environment."

As Shown in [8] "Role of BLE in Proximity Based Automation of IoT: A Practical Approach", in this paper "The implementation of the proposed framework demonstrates how various technologies fit together in the scheme of Internet of Things. GPS doesn't progress well for indoor environment and this is where BLE based proximity solutions come into picture. BLE based solutions provide a way to overcome this problem through proximity advertisement messages which allows you to calculate the distance of the AltBeacon node with relative to the phone running the application. A real world use case scenario was considered and implemented on Android platform to effectively manage the triggering of events based on proximity. The proximity solutions allows to deliver valuable and relevant information to the end user. Our method is compatible with RESTful services so that our framework is flexible and could be used across various computing environment. Our future plan is to experiment using various sensor nodes that can be used to address other real world IoT problems. With all these research challenges we firmly believe that we have a very exciting time ahead of us in the area of IoT and BLE."

As shown [9], "Implementation of interactive home automation system based on email and bluetooth technologies". In this paper " implementation details of two prototype home automation systems are presented. the email based HAS can be used for remotely controlling the home appliances, whereas the Bluetooth based HAS can be used for controlling the home appliances

when we are at home. The home automations system using email responds quickly to the email request sent by the user. The program checks for new emails in the inbox of Raspberry pi email account ever 1s. The disadvantage of the email based HAS is that the internet should be active at home and at the user end for proper functionality of the system. Bluetooth based HAS is implemented using an android mobile with Bluetooth controller application. This scheme provides an easy method of controlling the appliances when we are at home. As the range of Bluetooth is limited to few meters, it cannot be used over long distances".

As shown in [10], "Low cost Arduino wifi Bluetooth Integrated path following robotic vehicle with wireless GUI remote control". in the paper, "The major aim of our research article is to study the complete design and operation of wireless path following robotic vehicle from the engineering perspective and to create an enhanced working model of moving robot integrated with sensors having significant improvement in obstacle detection and control with the help of infrared sensors which makes the design very unique. Our main objective was to construct a Bluetooth Wi-Fi enabled robotic vehicle with Arduino technology which can be used for multipurpose applications in military, spyware, industrial and commercial applications like searching operations, capturing of data and images in various areas, collecting data from nuclear radioactive hazard prone areas ,detecting obstacles and reaching destinations using shortest optimal route saving time and enhancing efficiency. Our wireless path following robotic vehicle has been successfully designed, implemented and tested for all conditions. It can work with high accuracy, precision and control providing stability to the movement mechanism taking optimal route collecting data with feedback signals on GUI remote control unit. On the basis of test results GUI JAVA based application controller using Wi-Fi for long range and Bluetooth for short range from remote controlling device enables its operation in both manual and automatic mode, we can send the control signals to the Arduino nano board for providing control signal based upon obstacle detection providing optimal performance creating a benchmark in robotic design and control technology. With the help of our innovative novel creative technical design, we can implement lot of data capturing, processing and transmission using infrared sensors, choosing optimal path to the destination using autonomous mode along with wireless control technology amalgamation. We enable easy wireless control of the robotic vehicle, to maintain simplicity of design, good

flexibility, portability, robustness with significant potential of future research in the field of robotics engineering domain. This research of robotic vehicle can be enhanced further in various research works to integrate various technologies with variety of electronic sensors and data processing modules to obtain variety of technical data outputs augmenting the efficiency and performance of the wireless path planning intelligent robotic vehicle."

As shown in [11], "Using Arduino to Develop a Bluetooth Electronic Scale for Water Intake", In this paper, "In this paper, we used an Arduino platform to develop Bluetooth electronic scale system and provide an algorithm to find the user water intake during a period of time. Bluetooth module can be used to connect Arduino and smart phone as long as at the appropriate distance. The system can read the weight values from Bluetooth electronic scale and to show the result on smart phones. Meanwhile, the system can calculate the amount of water intake from Bluetooth electronic scale. The test results show that the amount of water intake is consistent with the original desired effect. The experimental accuracy of this experiment is 0.1g. The weight values can be achieved in real life on many items weighing. The theoretical error of this experiment is 0.5g; the errors are mainly due to the temperature, the current output instability and other causes. In the future, we will add more scale functions, such as increase recognition of cups, the RFID for users' recognition, the daily water intake suggestions and so on. Meanwhile, we can also record the amount of drinking water in a day, a month and a year by the cloud storages."

As shown in [12], "Zigbee Based Centralized Patient Monitoring System", in this paper " In this project, Centralized patient monitoring system has been successfully implemented using Zigbee technology and the data is loaded on to the central monitor successfully. We have measured three physiological parameters successfully. These sensors were successfully designed using their respective circuit to reduce the cost and size. The Zigbee module can work up to 100 meters. We can measure data for N number of patients. In the near future we can use dual supply micro-controller and get negative axis waveform of ECG. Further non- invasive vital sensors can be readily configured. We can also measure blood pressure, humidity, carbon dioxide, Spo2, Respiration rate and blood PH in near future by designing particular sensors circuit. We can also send notification to doctors using android application at large interface. Moreover if the doctor or

clinical are not present during an emergency, a robot can be designed to take necessary steps automatically and provide particular remedy to the patient regarding a particular problem."

As shown in [12], "A Discrete Addressing Scheme for Wireless Sensor Networks based Internet of Things", in this paper "This paper has proposed a cluster based addressing scheme for energy constrained Wireless Sensor Network for Internet of Things paradigm. Every cluster in the Wireless Sensor Network can be seen as an independent IoT application. The cluster based addressing scheme uses IEEE 802.15.4 std. communication protocol with 16 bit short address for assigning the addresses to clusters and cluster-nodes. In future, this address space can be extended to IEEE 802.15.4 std. provided 64 bit long address for address assignment using proposed addressing scheme in order to enlarge the size of IoT application driving clusters."

As shown in [13], "The design of intelligent music system based in internet of things", in this paper "After hardware debugging, software debugging and integrated debugging, the intelligent music system has possessed multi sound source input function and selection of the music playback mode. Not only local music in SD card can be played but also mobile app control is realized by wifi wireless module. Also music can be played by handheld devices with bluetooth when the devices connects to the system. With the radio function, after choosing the frequency band, you can listen music or other information conveniently. Overall, the intelligent music system has achieved the requirements of design. The music system can further expand the capabilities of cloud resource access, which can play music on cloud randomly etc."

Versions	Capabilities	Speed	Range
Bluetooth 1.x	Not used anymore, basic rate Bluetooth	1Mbps data rate	-
Bluetooth 2.x	Increased reliability, Enhanced Data Rate	3 Mbps data rate	-
Bluetooth 3.x	Enhanced Data rate, High speed	25 Mbits/s	-
Bluetooth 4.x	Low energy, collecting data from devices	25 Mbits/s	200 feets
Bluetooth 5.x	To be released	4 times more than Bluetooth 4.x	800 feets

Table 2. Bluetooth Version Detail.

CHAPTER 3

Implementation of Interactive Wireless Smart Button Communication via BLE hardware and Mobile device

1. Problem Statement

As increase in the technical jargon these days, there is huge number of applications that need to be managed. Using phone again and again sometimes becomes really hectic. What if we can control multiple functions of smartphone without touching smartphone ? Can we achieve an Eco Scientific Zone with just one device that is capable of proving security without affecting environment ?

Answer is **YES**.

There are huge number of problems that needed to be addressed like:

- Women/Men security
- Sharing Location
- Instant calling
- Navigation
- Tracking
- Multiple messages
- Instant E-mails (Without touching smartphone)
- Clicking Photographs (Without touching smartphone)
- Music play (Without touching smartphone)

2. Abstract

As the demand for IOT (Internet of Things) and BLE devices are increasing, the smart application that works on these platforms has a huge market potential. Bluetooth Low Energy devices are small in size and capable of transferring a small amount of data within the range of 10m. This paper presents an application that connects with BLE device that will allow the user to perform multiple operations on its cellphone. For this purpose, we will use HC-05 Bluetooth module and Arduino Uno board. The application is capable of providing the emergency messages, GPS coordinates, different applications and phone control. The hardware is platform independent, can be used with IOS, Android or Window devices.

3. Introduction

IOT(Internet Of Things) is one of the major inter-networking technology that is capable of connecting billions of devices together, which together share information among themselves either in Local Area Network (LAN) or Wide Area Network (WAN). It can be implemented on various protocols via Zigbee, Bluetooth, Z-wave, 6LowPan, Thread, WiFi, Cellular, NFC, SigFox, Neul, LoRaWAN and many others.

Fig 6. Smart button Architecture

Each protocol has its own pros and cons, usage of these protocols depends upon the needs of the

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client. In this paper, we will use Bluetooth (IEEE 802.15.1, but no longer maintains this standard) as our protocol. It uses short-wavelength UHF radio waves in the ISM band from 2.4 GHz to 2.485 GHz). This protocol is used for exchanging and transmitting data over a short distance to mobile or fixed devices by building PANs (Personal Area Networks). Till now the Bluetooth came with many different versions, the latest one is Bluetooth Version 5.0, which has a maximum speed of 50 Mbit/s, over a maximum range of 800 feet (243 meters). In our implementation, we are using Bluetooth HC-05 which is currently version 2.0 + EDR. We are using this version because of its compatibility and easy availability for the usage. Different versions of Bluetooth with their speed, capabilities, and range are shown in the table below. In this paper we will show the design architecture and implementation of the hardware which can be used as a wearable system smart button, that would be capable of performing multiple mobile functions which are very much necessary in day-to-day life. List of functions to be performed are mentioned in the next section.

Versions	Capabilities	Speed	Range
Bluetooth 1.x	Not used anymore, basic rate Bluetooth	1Mbps data rate	-
Bluetooth 2.x	Increased reliability, Enhanced Data Rate	3 Mbps data rate	-
Bluetooth 3.x	Enhanced Data rate, High speed	25 Mbits/s	-
Bluetooth 4.x	Low energy, collecting data from devices	25 Mbits/s	200 feets
Bluetooth 5.x	To be released	4 times more than Bluetooth 4.x	800 feets

Table 3. Bluetooth Details

4. Related Work

There is very little work done in the field of smart button, where multiple devices can be connected to the single mobile devices. This concept is very much similar to the Master-Slave configuration of the Bluetooth. In current HC-05, it does not have the capability of getting connected with multiple devices. To make it connected to multiple devices, Bluetooth version 4 has been used. Multiple functions can be performed via this device as it can be used for controlling different phone operations, opening applications, sending emergency messages/ distress messages, video/phone calls etc. The architecture and design of smart button is shown in section IV.

Most of the work done in this field is using Arduino board which act as a micro-controller. In [11], Arduino is used to develop Bluetooth Electronic scale for water intake. Whereas in [13], a discrete addressing scheme has been designed for wireless sensor networks based on Internet Of Things. In [12] the Zigbee protocol is used as the patient monitoring system. The role of BLE is not just limited to the data collection, it can also be used as for the proximity sensors as shown in [8]. There are multiple applications that can be made using Arduino but this micro-controller occupies a lot of physical space, that makes hardware huge and bulky. We overcame this problem and reduced the overall size of the hardware.

5. Functions to be performed

There are lots of different functions which can be invoked remotely by the smart button by clicking on it. For invoking multiple functions, we have designed three types of click button in the hardware:-

1. Single Click
2. Double click
3. Hold the button

As displayed in Table 2, it shows different functions related to the phone control. All the activities under the phone control have their own user interface dialog which will allow

configuring its related settings in the app and performing their respective function depending upon the type of click. In the designed application, we have provided the facility for configuration of various services. For making phone calls and SMS services, the user has to enter the corresponding destination mobile number manually in an application installed on the smartphone. For the advanced services like Hang up calls and Skype, users have to log in with username and password. This smart application is designed to run in as a background application, even if the user closes this application, it will still work (until unless user exits from its services manually). There is a facility being provided to users for Sign in and Sign up to access certain services which require user permissions like Gmail, Facebook. One of the main advantages of this smart application is that it can retain all the previously configured data in its internal memory so that when the phone reboots, the application will be resumed from where it stops.

Apart from the phone control, the communication system is also designed that will perform multiple functions as shown in Table 3. The user can send its current location in the message as location and coordinates via accessing GPS. Now day's women security is the major concern in India, to mitigate this problem having an opportunity to share location can be one of the best solutions. The sharing location can be done via 2 methods. First, location coordinates will be sent automatically in every 5 seconds, so that we can easily trace the user. The interval between two consecutive messages can be set by the user. Second, the location coordinates will be sent once on clicking. This method is one of the core solutions of the Intelligent Transportation and Communication system. There are numerous applications for this in the field of transportation and communication. There is a facility of sending GPS coordinates through e-mail instead of SMS; by this, the user message charges can be reduced. For the navigation, the user has to set the destination manually and then by pressing button navigation will be started.

Other miscellaneous activities like music control as shown in Table 4, which allows the user to play/pause music, Navigate music, that will toggle, play, pause, next, previous, forward, rewind etc. Other activities like FM radio, Music, VLC can easily be played and configured. The volume control will be used to control the volume of the system sound, ringtone, and media sound, it will configure the setting for the volume level in the range of 0 to 10, where 0 signifies silent and 10

signifies the highest volume. Fake call as shown in the Table 5 will allow the user to call himself or someone else, it is preconfigured that will allow the user to enter the mobile number manually. If the phone is lost then there is an option of buzzer that will allow the user to find his cellphone via ringing and vibrating.

There are various functionalities like controlling lights, parking sensors, water sensors and much more can also be configured through this developed device. Therefore, this will allow creating an umbrella of different type of services as per user requirements.

Phone Control	Description
Lock Screen	This will lock the screen of phone after clicking on smart button
Phone Call	The user will first assign the mobile number from the contact list and configure as follows:- Single Click -> make call Double Click -> end call
Open camera -Take Photo	When the smart button is clicked on, then Camera of the phone will open. Configure the camera as follows:- Single Click -> Open camera Double Click -> Take Photo
Record Audio	The audio recording will start as follows:- Single Click -> Recording started Double Click -> recording saved
Connect WiFi	When smart button is clicked, then phone will be connected to preconfigured WiFi networks
SMS	When smart button is clicked, SMS will be delivered to configured mobile number
Launch Application	This will be used to open any installed app on the phone. For this functionality, all the installed app will be listed in smart app and anyone of these can be assigned to button Single Click -> Open App Double Click -> Close App *Example:* *Skype App: - Voice Call, Video Call, and Chat*

Table 4. Phone Controls and there description

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Communication	Description
Send Gmail	When the smart button is clicked, then Gmail will be sent to the preconfigured Gmail. UI is provided in which user can configure recipient and sender address along with subject and message
Navigation	This will try to use Google navigation after clicking on a smart button. UI is provided in which user will configure current and destination location along with navigation type as follows: Drive, public, Bicycle, Walk Single Click -> Start Navigation Double Click -> Stop Navigation Single Click -> make call Double Click -> end call
Share location	The Location (Lat/Long) and address of user will be sent to the configured mobile number via SMS. UI is provided in which there will be an option for entering recipient mobile number and body of the message. Location of user will be sent after predefined time of interval
Hang Up Call	This will be used for ending an Incoming and Outgoing call with a predefined message.

Table 5. Communication Controls and there description

Music Control	Description
Songs Play	The song to be played will be selected from the playlist of the phone Single Click -> Play configured song Double Click -> Stop the Song
Navigate Music	For Navigation, smart button can do the following function: - Toggle, Play, Pause, Next, Previous, Forward, Rewind All the above functions can be specific to the following application:- FM Radio, Music, VLC, etc
Volume Control	To control the phone volume control, the smart button will be configured for setting the volume level in the range of 0-10 (0 is silent and 10 is highest). These volume setting can be assigned to the following: System Sound, Ringtone, Media Sound

Table 6. Music Controls and there description

Fun	Description
Fake Call	Preconfigured fake call from selected person will be called to the phone Single Click -> Make Fake Call Double Click -> Stop the call
Buzzer	A Buzzer sound will be played when user clicks on smart button

Table 7. Music Controls and there description

6. Design Framework

The developed device is compatible with both Android and IOS devices. For the Android device, we have used Java platform for designing the application, whereas Swift is used for the IOS application. Apart from this, the configuration of the button by smartphone is also provided. Currently, the battery that we are using is CMOS lithium ion battery 2x2x2 cm weighing 9.1 grams. The power to the button can be supplied with any coin cell battery or any other type of device. This will eventually increase the reliability of the device. The rest of features of hardware are shown in TABLE 6. The application and hardware design of the smart button is shown in the figure below.
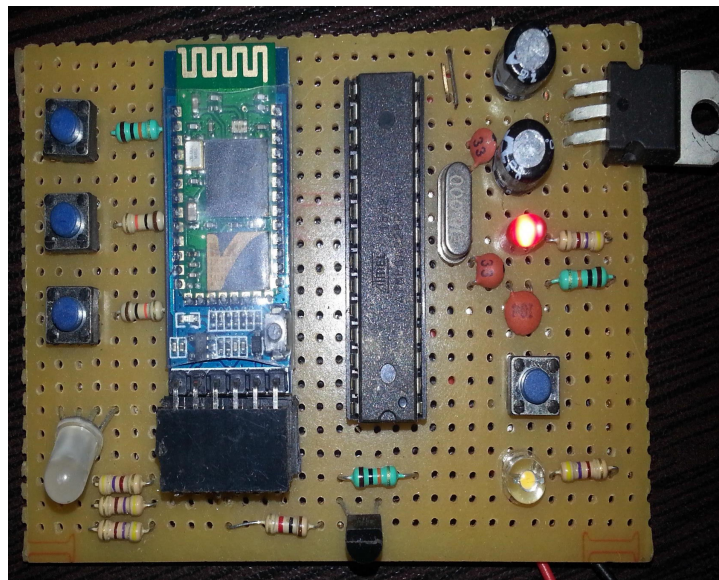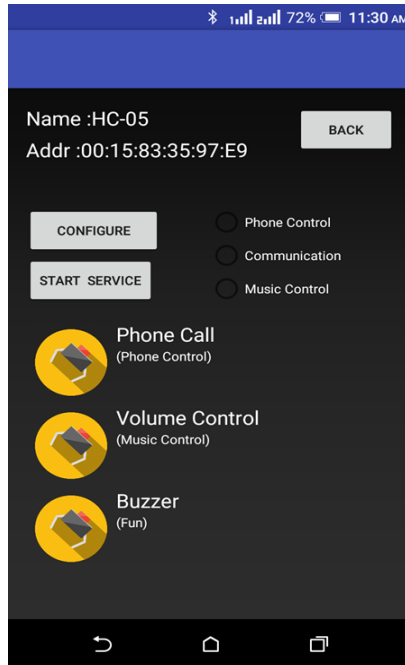

Fig 7 Design architecture of smart button.
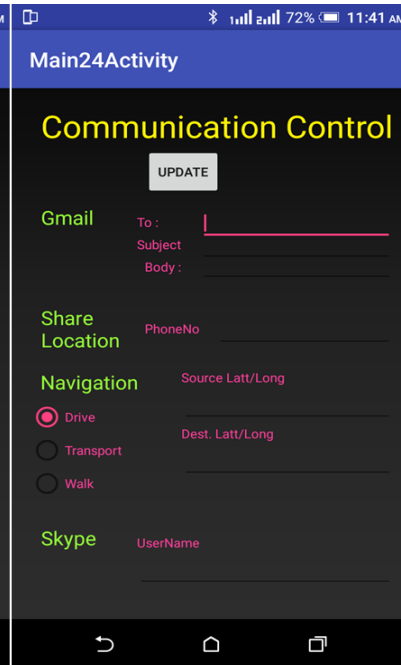
Fig 8. User interface Menu   Fig 9. User interface control
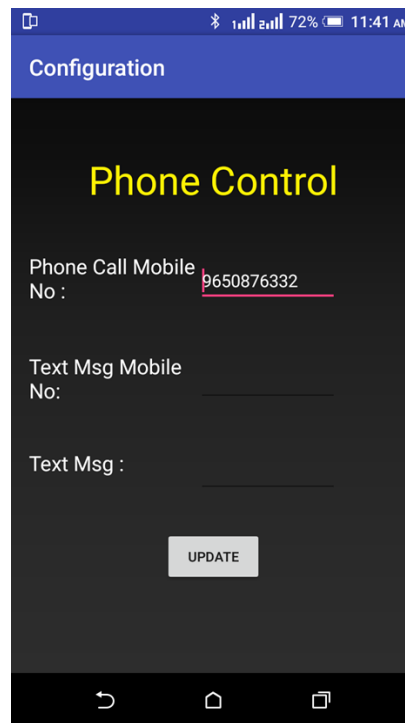

Fig 10. User interface for   Fig 11. User interface for
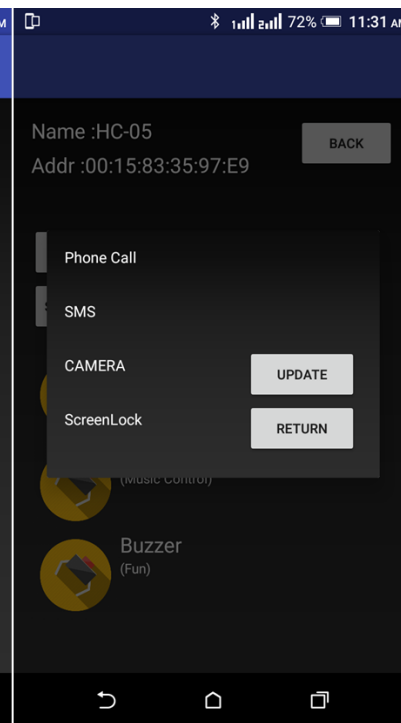phone control   selecting functions

7. Result Analysis

The performance of the developed system is evaluated with respect to energy efficiency, distance and strength of signal between application and button. The energy efficiency is measured in terms of mobile phone's battery life. The maximum battery capacity of the HTC desire 816 smartphone is 2600mAh. The message communication between the smart app and button is evaluated over three wireless technologies (BLE, Normal Bluetooth and WiFi). The fig. 5 shows the power consumed by running smart app for 8 hours continuously. It is clear that BLE is energy efficient for executing the smart app for long time and hence increases battery lifetime.
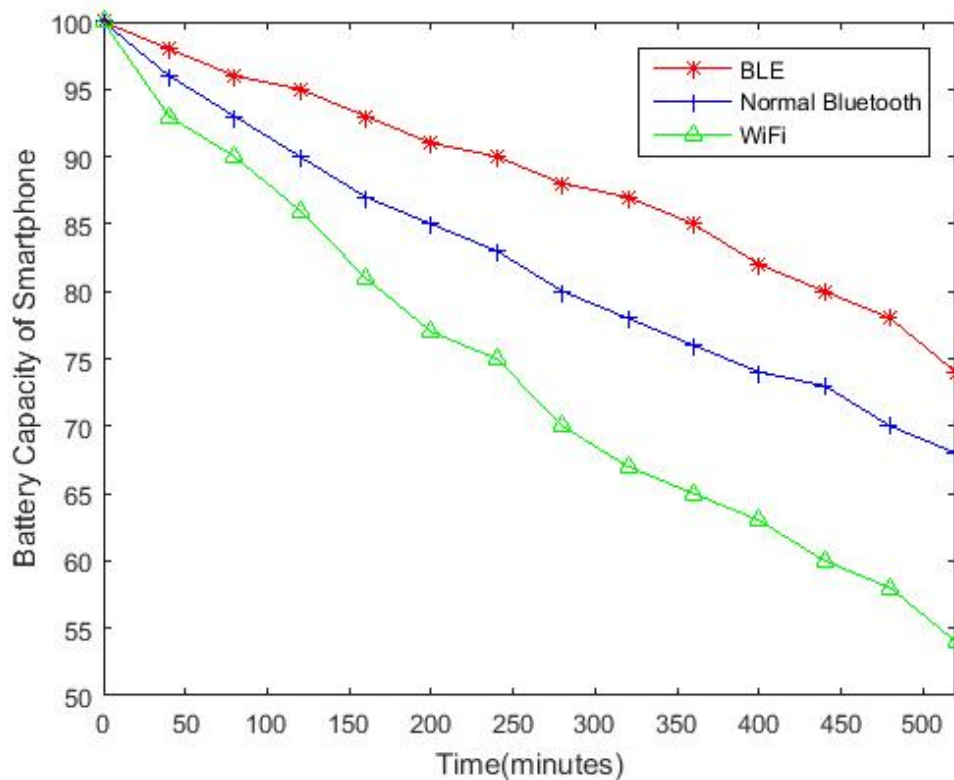
Fig 12. Graph between time and battery capacity if smartphone

The developed Smart Button hardware has been tested with various Android mobile devices under all possible environments in terms of its distance with respect to the mobile device. The detailed analysis is shown in the graph and table 7 below.

The figure 32 shows that if the user moves away from the mobile device, then the strength of the signal received by the button will decrease faster. So, the command sends by a mobile device will be received by the button only when it is in the range of the smartphone.
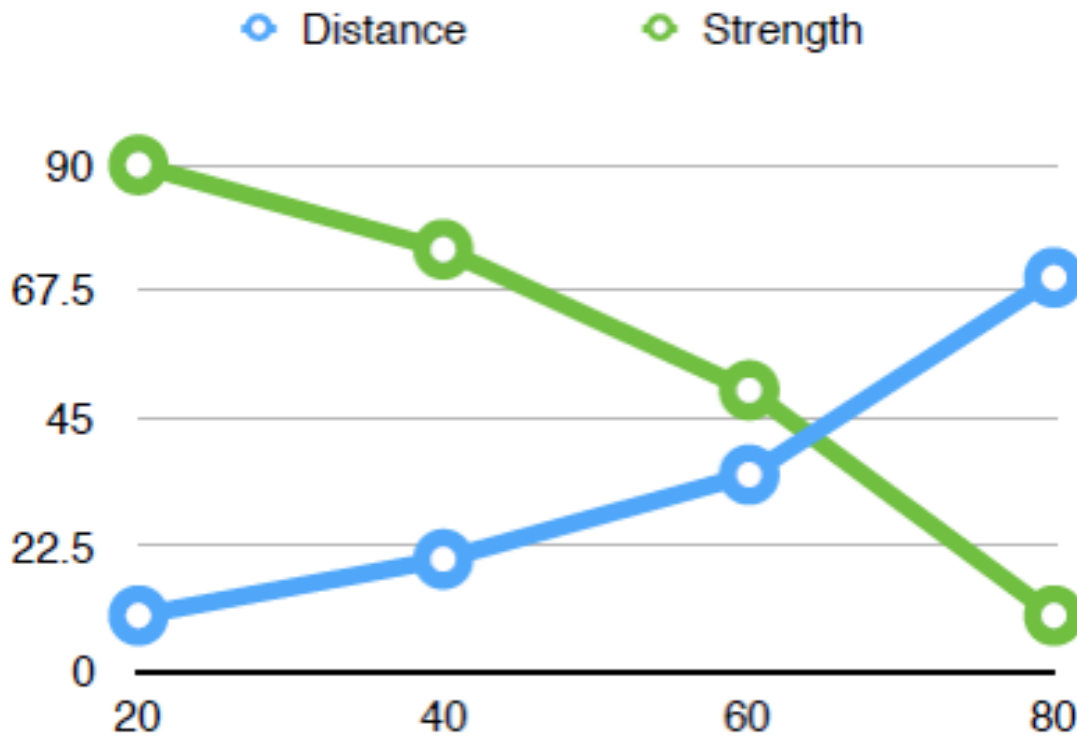
Fig 13. Graph between Distance and strength smartphone

Distance (m)	Density Obstruction	Width (mm)	LOS	NLOS
70	Nil	Nil	Yes	No
35	0.74 kg/m^3	60	No	Yes
20	1845 kg/m^3	120	No	Yes
10	2400 kg/m^3	300	No	Yes

Table 8. Distance, Density obstruction and width for LOS and NLOS

It is clearly described that the button will work efficiently when there is a proper line of sight between the smartphone and button. Otherwise, communication will be interfered by obstacles present between the both.

CHAPTER 4

1. Problem statement

The smart button that we have invented is capable of working via HC-05 ,NFC and ESP8266. But using ESP8266 and NFC won't be a efficient as compared to HC-05. The research paper has been published in International Conference on Commuting Communication and Automation (ICCCA 2017) regarding "Design Architecture and Comarison of Interactive Smart Button using HC-05 and ES8266" which shows that using HC-05 we can achieve higher efficiency as compared to ESP8266 and NFC.

2. Abstract

IOT devices are playing a leading role in most of the wireless networks these days, mostly in network analysis, information gathering and data transmission. But very limited work is done in the field of controlling devices via IOT protocols. In this paper, we are proposing a smart button that would be capable of handling multiple functions of smartphone. These function includes sending GPS coordinates and location, controlling camera, navigation, music player, Skype, Gmail etc. For all these purposes we are using HC-05 module that works as a wireless module IEEE 802.11. At the end of the paper we have shown comparison between ESP8266 and HC-05 module and its strength analysis.

3. Introduction

IOT(Internet of Things) is the major market player these days in terms of networking and technology. It is capable of connecting billions of devices together for the purpose of information gathering, network analysis and inter networking. IOT itself means inter networking of devices, vehicles, sensors, buildings and other things. It has a variety of features not only in the field of

computer science but in biomedical, civil, electronics, electrical etc. According to the global standard initiative on IOT, they defined IOT as "infrastructure of the information society". It is capable of sensing information remotely and to transmit data to remote devices effectively.
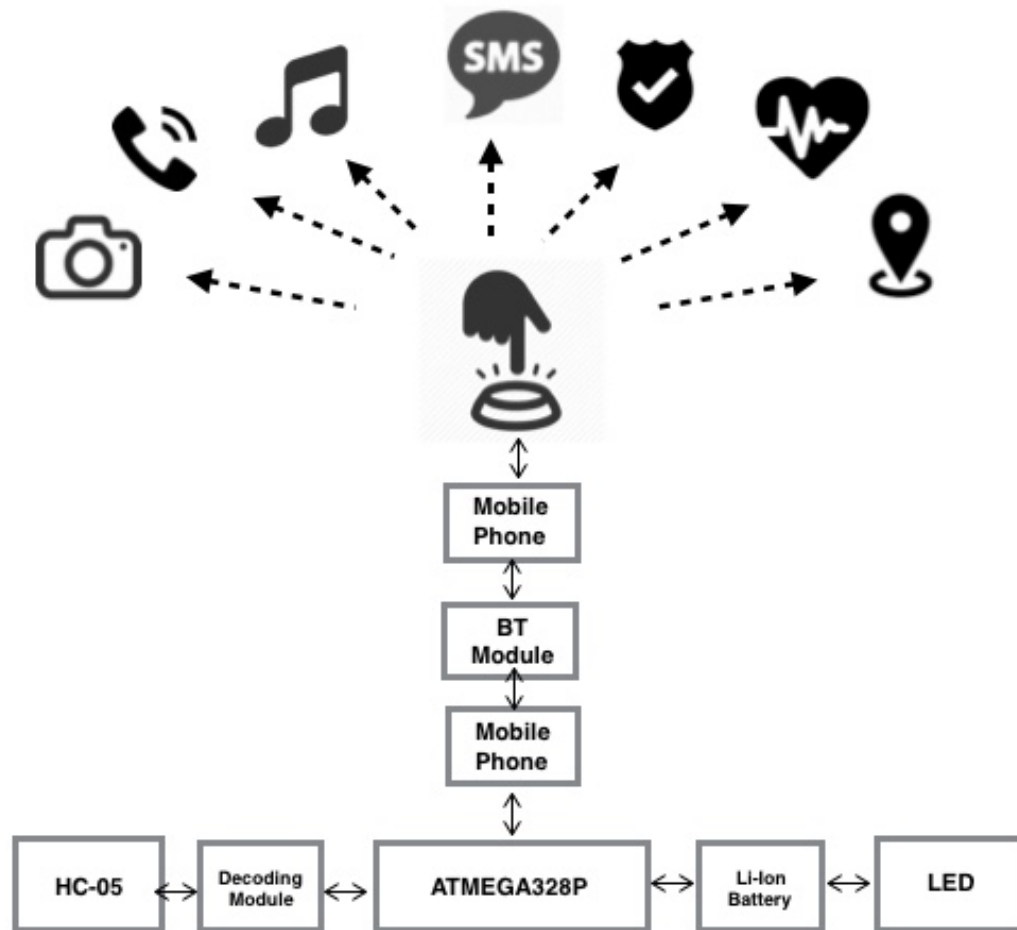
Fig 14. Block architecture of ESP8266 as a smart button

Because of it advanced connectivity, there is not only machine to machine (M2M) connectivity but also Human to machine connectivity. IOT devices can work on various protocols such as Zigbee, Bluetooth, Z-wave, 6LowPan, Thread, WiFi, Cellular, NFC, SigFox, Neul, LoRaWAN and many others. Each protocol has its own pros and cons, usage of these protocol depends upon the client needs. In this paper, we will use ESP8266 which is a wireless module that works on standard IEEE 802.11. It has full TCP/IP stack and Micro control Unit(MCU). In this paper, we will study the implementation of the smart button that will remotely control multiple functions of the smartphone. Women security is one of the major issue these days. By this smart button, their

protection can be assured by sending the GPS coordinates and exact location of the client. Not only this, we can perform multiple functions like Music Control, Navigation, calling services, SMS services, Skype video calling, sending emails and many other. All these functionalities are very crucial in the day to day life. In this paper, we have gone through all possible aspects that can be done through the smart button. We have discussed its architecture and its working in analysis section. The Block diagram shown in Fig.1 depicts the basic structure of the device in Bluetooth configuration. Single button is capable of performing multiple operations like turning on camera and saving picture in cellphone memory, making phone calls using calling services, turning on music which includes volume control, navigating songs, play videos. Other functionalities like heart beat sensing, sending SMS, turning on navigation system, sending emergency messages, sending GPS coordinates to multiple cellphones, tracing path through GPS coordinates and most importantly for the security purpose.

4. Literature Review

The device is based on ATMEGA328P integrated circuit which is compatible with Android as well as IOS platform. The programming in IC can be done by using Arduino Uno board. The classification based on different functions that can be performed by this device is truly an unimaginable scenario. As in [6], the practical approach of proximity sensor is shown, where as in [7], Zigbee based patient monitoring system is shown. In the field of wireless sensors, not only Arduino but many other similar board can be used according to the preferences. Different protocols as Zigbee, Bluetooth, Z-wave, 6LowPan, WiFi, Cellular, NFC, SIgFox, Neul, LoraWAN can be used. Some are efficient for longer distances like WiFi or cellular, or some can be used for extremely short distance like NFC. As in [8], Arduino is used to Develop a Bluetooth Electronic Scale for Water Intake which can be used numerous applications. Before working on Bluetooth we should know its hierarchy of changes. We have used Bluetooth 4.0 which is very efficient in power saving and can transfer with the speed of 25 Mbit/s up to 200 feet. It uses short-wavelength UHF radio waves in the ISM band from 2.4 GHz to 2.485 GHz). this protocol is used for exchanging and transmitting data over a short distances to mobile or fixed devices by building a

PANs that is Personal Area Network. In this paper we will show the comparison of the interactive smart button between WiFi and Bluetooth

5. Proposed Functions

There are multiple functions that can be performed by the hardware by clicking it. There are three types of clicks associated with the hardware, as:-

1) Single Click
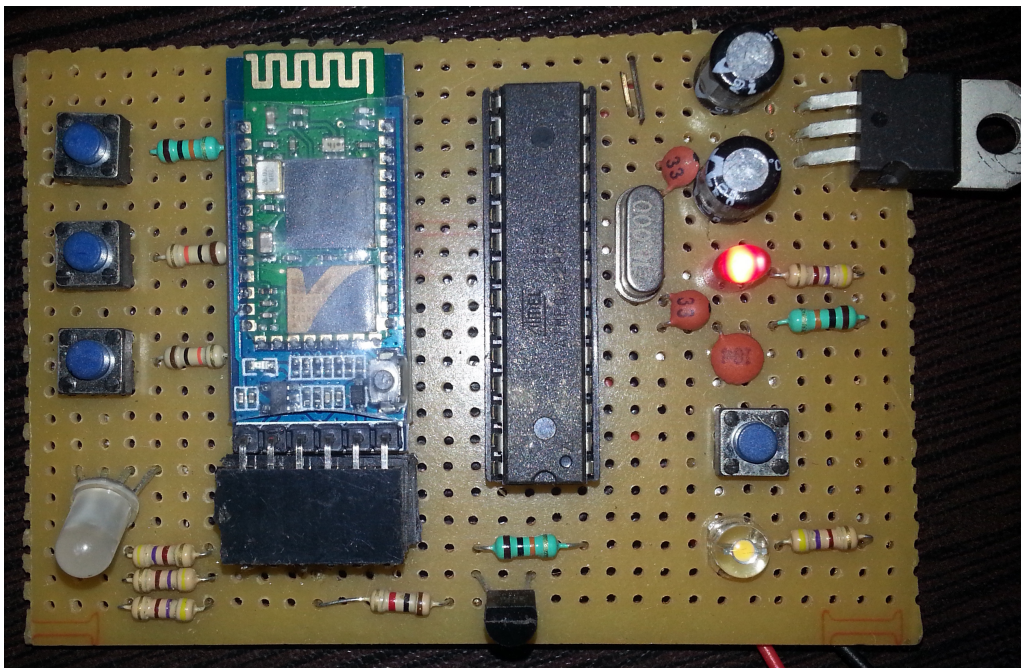2) Double click
3) Hold the button

Fig 15. System architecture of ESP8266

As shown in the Table 2, different functions that are related to the phone control are shown. Each and everyone of them is having there own intent call which will perform there respective function depending upon the type of click.

For making phone calls and sms services user have to enter the corresponding mobile destination mobile number manually. For the advanced services like Hang up calls and Skype, user have to log in with username and password. This smart application is designed to run in as background application, even if the user closes this application, it will still work (until unless user exits from its services manually). For advanced services the facility of Sign in and Sign up is provided to the users, to access certain services which requires user permissions. Another major problem that most of the devices faces is the loss of data when system reboots. To overcome this challenge, we came out with a method that will configure all data from the application and store it in ints internal memory, so when the phone reboots, application will be resumed from where it is stops. Classification based on functions is shown in the Table. 1. It consist of phone control, communication control, Music control and some other miscellaneous activities.

6. Design Architecture

The board is platform independent can work on Android as well as IOS platform. Mode of programming used is in Java for Android and Swift is used for designing application in IOS
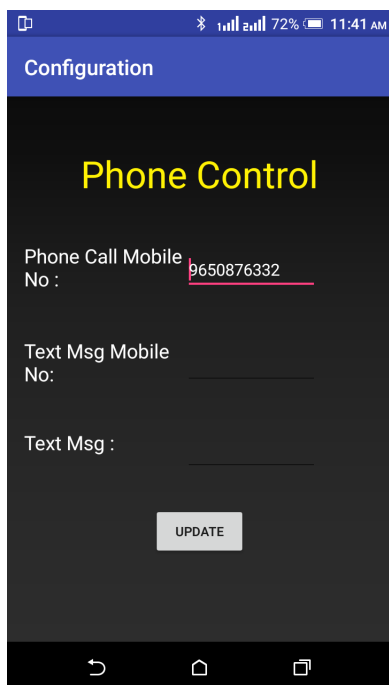
Fig 16. User interface of ESP8266 as phone control
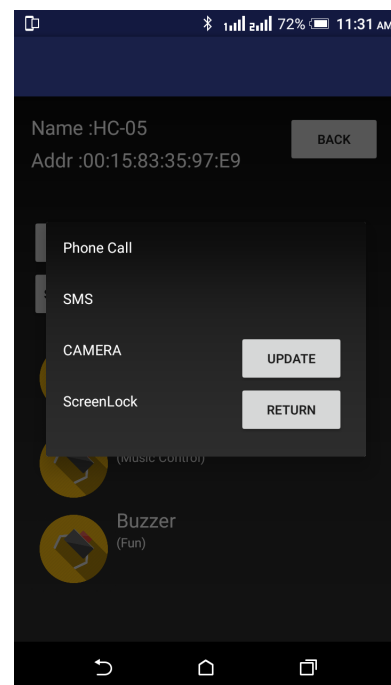
Fig 17. User Interface of function menu of application in ESP8266
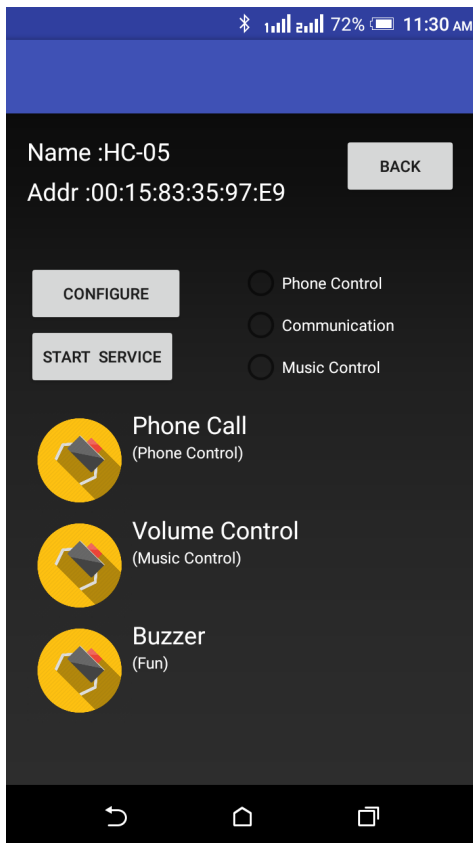
Fig 18. User Interface of multi functions of in ESP8266
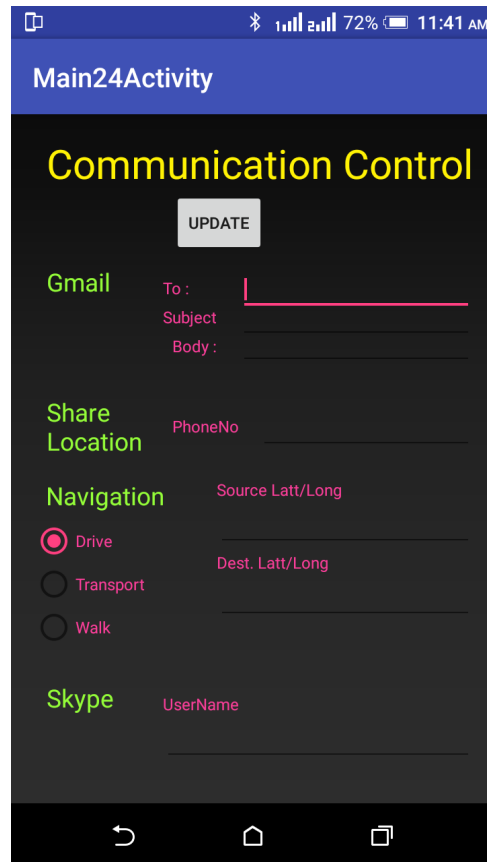
Fig 19. User Interface of Communication control of application in ESP8266

platform. Other services required root access that can be grated manually by the user. Efficiency of device is calculated on the basis of battery utilization of smartphone and battery efficiency of the hardware. If we want to run this same system in WiFi module then we need ESP8266. But using hardware on WiFi will result in massive battery utilization that will drain battery.

7. Result Analysis

The result analysis of two hardwares working on WiFi module (ESP286) and Bluetooth module (HC-05) is shown in Fig. 5. This graph depicts the relationship between battery efficiency
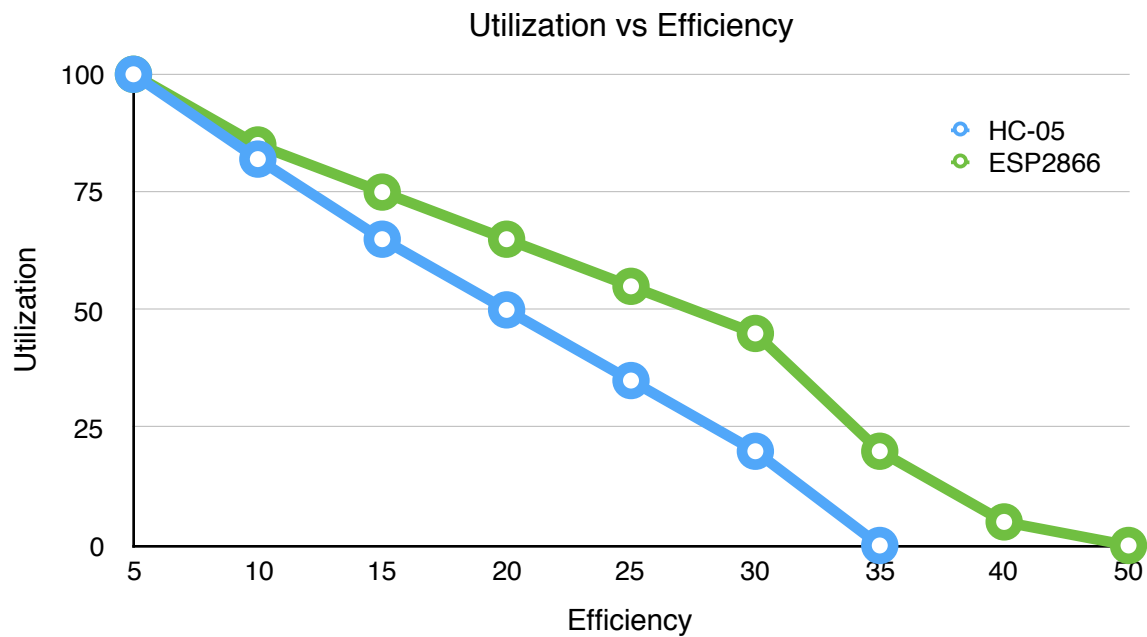
Fig. 20 Graph depicting relationship between utilization and efficiency of battery consumption of hardware.
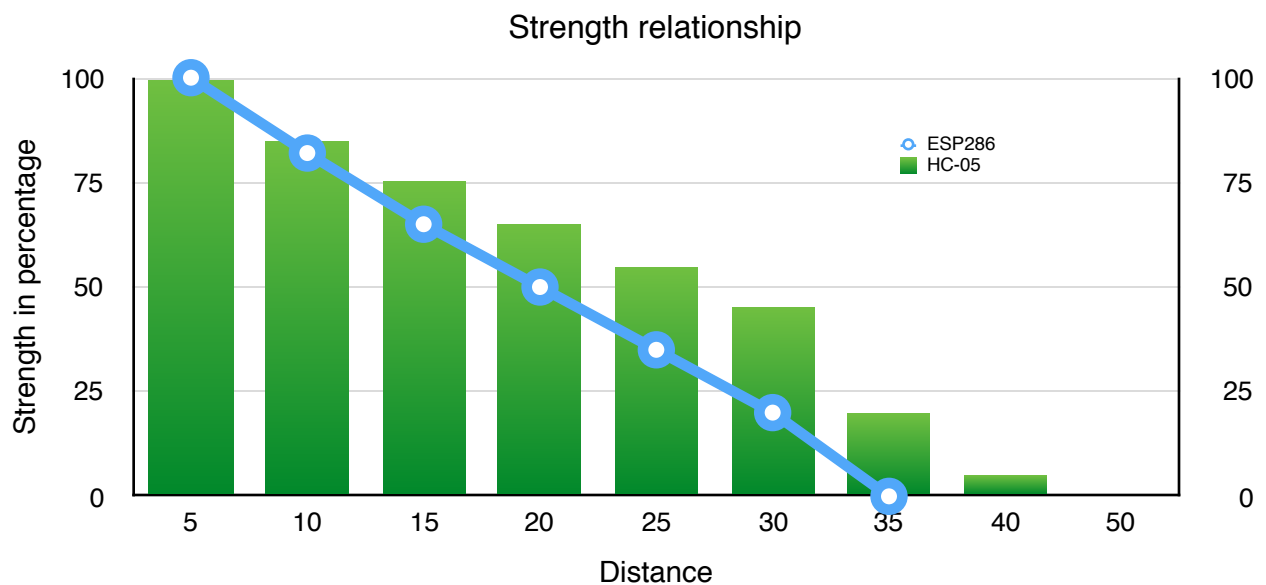
Fig. 21 Graph depicting relationship between Strength and distance of WiFi and Bluetooth module.

and utilization. We can witness huge difference between these two modules. The WiFi module consumes higher current as compared to Bluetooth module, that's why duration and life of such device is is shorter as compared to other one. The Fig.6 shows strength of Bluetooth and WiFi module. The strength comparison of WiFi is higher as compared to Bluetooth module.

CHAPTER 5

Intelligent Transportation and Communication System

1. Problem Statement

<u>Sub Problem 3</u>: **Bottleneck in the network, bandwidth allocation, no slots available are the major problem these days. Is there any efficient way to transfer a node to the nearest basestation ?**

<u>Sub problem 4</u>: **Long distance data transmission often result in over utilization of bandwidth. For that we can have AIVCTE (Advance Image and Video Compression Technique).**

<u>Sub Problem 5</u>: **Cost of using Satellite transponders is very high, we can use Smart-Satellite News Gathering vehicles (S-SNG) for the transmission of data without using any satellites.**

<u>Sub Problem 6</u>: **Long Distance internet connectivity in rural areas or in Mountain regions using traditional wiring method sometime is not an financially viable option. For that Hybrid Intelligent Communication system can be a solution.**

2. Abstract

Transportation managers recognize that real time information is critical to the efficient and effective flow of vehicles through their networks. But too often, the capture of this information is limited to places where the information network already exists, and not necessarily where the most useful information is generated. We have found the solution for this problem by providing last mile wireless access from ITCS that uses an intelligent transportation system approach by the hybrid wire-line/wireless technology. This hybrid technology is cost effective as well as economical with respect to Indian network utilization and specially to those areas where WAN

capabilities are challenged via using wires and fiber optics, at those places this hybrid technology comes out to be very cost effective.

Apart from that the major problem of current system is the bottleneck. We have designed an algorithm for efficient handover of nodes to the nearest base station, the problem is very much similar to Traveling Salesperson Problem (TSP) that is an NP-Complete problem, provably within a constant approximation of the optimal solution.

We have also designed an compression technique for the maximum compression of a high quality video file without pixel degradation, and came out with an efficient way to transfer it over longer distances.

3. Introduction

The fast and secure network has become vital is present information age. There is bulk of confidential data to be maintained by all the users in different service sectors and organizations. But because of lacking networking infrastructures as well as bottleneck in current system, the data cannot be maintained easily. Thus arises the need for Intelligent Transportation and Communication System. Transportation managers recognize that real time information is critical to the efficient and effective flow of vehicles through their networks. But too often, the capture of this information is limited to places where the information network already exists, and not necessarily where the most useful information is generated. We have found the solution for this problem by providing last mile wireless access from ITCS that uses an intelligent transportation system approach by the hybrid wire-line/wireless technology. This hybrid technology is cost effective as well as economical with respect to Indian network utilization and specially to those areas where WAN capabilities are challenged via using wires and fiber optics, at those places this hybrid technology comes out to be very cost effective.

With this wireless extension, traffic managers can capture field ITS data such as remote streaming video and traffic counters providing data connectivity to remote ITS devices such as variable message signs and dynamic speed limit signs. Supervisors using this real time video information can greatly increase both transportation efficiency and safety of commuters. An integrated Traffic Management Center allows data acquired during incidents to be used in real

time to update Dynamic Message Signs that direct traffic and provide instruction. Automation of information flowing from roadside traffic sensors can activate and update Dynamic Message Signs without human intervention. One of the biggest challenge of women safety can be easily monitored. We have designed our Intelligent Transportation System in such a way that there won't be any bottleneck.

The proposed WiMAX implementation in Delhi would not only reduces the overall cost of the internet usage by a subscriber but it also provides a backbone to the economy well-being of the people living in relatively isolated and sparsely populated areas. In India there are numerous villages and places which are completely untouched by the internet technology. By this successful implementation of the WiMAX technology we can provide them an easy access of internet with very low cost and many securities which are currently a very big administrative challenge for the Government of India.

In this project we are focusing on:

- Providing a large scale internet coverage, not only for the cities but also for the rural, relatively isolated and sparsely populated areas. As we know that rural tele-density and network connectivity is still a underlying problem in our country, currently 8%. Access to high-speed internet in these can benefit in numerous ways, for the farmers, they can be regularly update about the weather via WBS (Weather Broadcasting Station), by having better access to internet we can provide a better education standards for children as well as adults, which would overall increase the literacy as well as employability rates in these areas. There are numerous Govt. initiated plans like e-banking, e-marketing, e-learning, Gramin vyavasye yojna and routine transactions for taxes and bill payments, all of these can be done by technology. This will not only improve the livelihoods of those people who are completely untouched by this technology but this will also increase the nation's socio-economic growth. Rural India is expected to account for 40% of the 250 million new wireless users as per a recent study conducted by FICCI and Ernst and Young. If these subscribers had access to broadband and high-speed Internet, every citizen would truly be able to participate in and benefit from the global information revolution and contribute to a balanced growth of the nation.

- Providing the intelligent transportation system through the wireless extension and the traffic managing counters that can capture the complete RTT (Real Time Traffic) field through the wireless extensions providing remote streaming video and the traffic counters which will provide the connectivity to the Intelligent Transportation System (ITS) devices that will provide the dynamic signals, traffic updates as well as the dynamic speed limit signs. By having the real time analysis of the traffic via wireless extensions that will be connected via WiMAX network can easily help people to get the continuous regular updates about the crowded roads as well as accidents prone area. Emergency vehicles can easily choose a path by pre knowing the traffic trends. Supervisors using this real time video information can greatly increase both transportation efficiency and safety of commuters. All these things including dynamic sign boards as well as intelligent transportation system requires no human intervention. A single base station can tie together multiple locations in point-to-multipoint network.

- We can have a long range cost-effective high quality live video transmission in H.264/ standard resolution/mp4 without any loss of packets. Generally for the transmission of live news we require SNG (Satellite News Gathering) vehicles. For the LNR(Live News Gathering) these SNG vehicles are required to buy the lease for transponder in satellite which is very expensive ($66,000 - $70,000) after that you need to deploy very high-power.

- amplifiers, direct satellite dish-antenna, up/down converters etc. Where as if we use the WiMAX then we doesn't require any of these things. We can directly send gather the LNR and transmit over a distance of 50km - 70km. The initial setup cost of WiMAX as compared to the SNG method is way much less. The separate transcoding device is to be used that will compress the live news video in a MPEG-4/H.264 resolution and transmitted over the channel. Single WiMAX tower is capable of handling more than 20 vehicles if they use this service. This is the cost effective as well as feasible method for the live transmission of news in a distance of more than 50km in Delhi region.

- The important application of WiMAX can be is the surveillance system. In India the security is the one of major concern, we can use the IP video surveillance over the WiMAX network that would result in tremendous decrease in the crime in our country. We can use the IP

camera that would capture the analog signal and convert it into the IP video packets (digital packets) then these packets are fed to the micro computer. High resolution images can be captured at very low bandwidth and from very long distances. There are many places where using ethernet cables or coaxial cables can not be used, for example, in mountain regions, sparsely populated areas where high maintenance is required, in such places having cables is not a feasible solution. Here we can use this Wireless IP cameras that uses WiMAX network to transmit the live video footage across long distance. Not only here, but it has numerous applications, we can mount it over police vehicles as well as over fire fighters, which would be a great help for them.

- To make the system fast and reliable we have designed an algorithm that will help to redirect the ME to the nearest base station at the time of congestion. It uses the concept of shortest path between the node, in general finding the solution for this problem is an NP-Complete that is a TSP (traveling sales Person) problem, so we will adopt a heuristic approach for this problem.

4. Objective

This hybrid technology is an complete end-to-end solution for the various hurdles that are faced by the long distance network telecommunication as well as networking problems. The various scopes of this implementations an ease the overall administrative challenge of Indian Govt regarding technological advancement as well as its development.

- To provide a cost effective and feasible solution for the internet access in the rural and sparsely populated areas.

- To raise the education standards in less developed areas, that would result in increase in literacy rate for both children and adults.

- To increase the rural tele-density and telecommunication networking.

- To provide the highly intelligent transportation system (HITS) that requires no or very less human intervention.

- Remote streaming of video at crowded places and over traffic lights that would help in increasing transportation efficiency.

- Emergency vehicles can easily find the path and can take a detour from less traffic area.

- By having dynamic sign boards or a highway advisory radio that would provide the current news of traffic in that area, resulting in saving time and the safety of commuters.

- To provide road sensors which are linked with camera, that would capture over speeding vehicles.

- To provide a cost effective high resolution live news video transmission that does not require any satellite news gathering system.

- To provide a highly cost effective surveillance system that uses WiMAX network for the transfer of raw footage.

- Transmission of raw footage by the cameras mounted on police vehicles which can be used to videotape crime scene or in criminal pursuit.

- To reduce the congestion in the network an algorithm is designed to transfer a node to nearest base station.

- To increase the socio-economic growth of the country.

5. Proposed Work

Algorithm 1

Problem statement: In the current system the major challenge that we face is the congestion and bottleneck in the network. When the current network is full and there is no slot vacant for the bandwidth allocation then that node will be forwarded to any other base station. The current algorithm provides a vacant slot in any nearby station respective of path travelled.

Proposed Solution: *Congestion control via node handover algorithm.*

INPUT: *Assign set of areas to each base station $A = \{a_1, a_2, \cdots\cdots, a_l\}$. The minimum distance selected as ω. Let V_i be the listed nodes. Scheduling nearest base station to the node, to select appropriate network for the ME.*

OUTPUT: *A path on which data packet shall visit $\Psi = \{p_0 p_1 p_2 p_3 p_4 \ldots p_n p_0\}$.*

I. Initially select all the selected areas as as_i, unvisited and unlisted counter $k = S_n$. Let the current path of the data packet is $\Psi = p_0 p_1$.

II. **While k!=0 do p**

    A. select current node as p_1.

    B. Select p_0 point at the minimum distance ω.

    C. On the basis of the point p0 and p1 we draw an ellipse which uses p_0 and p_1 as its foci and is tangent to a_j. The data table will be collected by the initial node from the boundary nodes which are placed at the boundaries of ellipse .

    D. **If(any one of the node from list has vacant place)**

        1. select the node for the ME

        2. **else**

        3. select any one of the node, b

4. Break the tie by minimum node ID and mark the nodes.

E. Name the new node as p_3.

F. **Decrement** counter k=k-vi. Thus the number of edges in the path increases by one.

G. Increment the ω linearly.

F. Continue the same procedure again till the vacant slot is found.
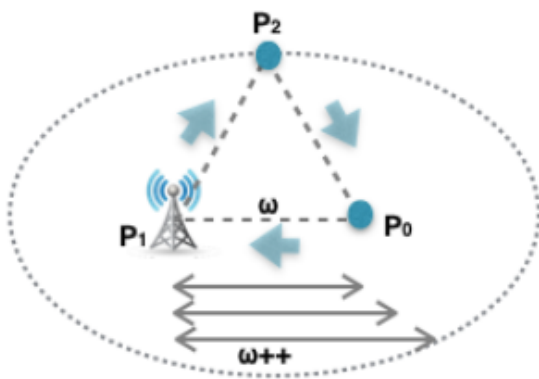
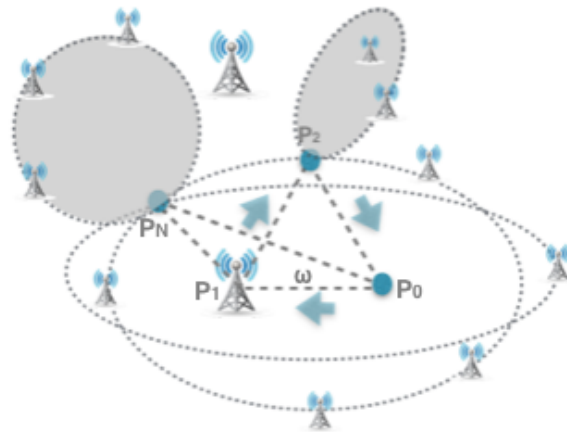III. **end while**

Fig 22.Ellipse model for 3 nodes

Fig 23.Ellipse model for multiple nodes
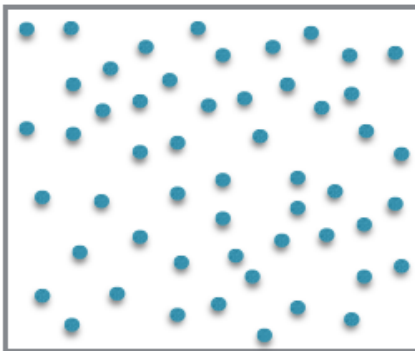
Fig 24. Vornoi diagram before applying algorithm
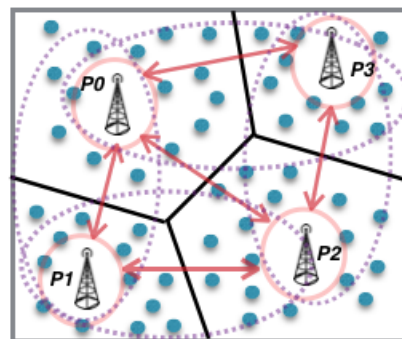
Fig 25. Vornoi diagram after applying algorithm

Algorithm 2

Problem statement: If we use the high quality cameras to transfer a surveillance videos over long distances, the output video size is in .mp4 format at 32fps, 40fps or 52fps. Such videos consume lot of space (5 min videos can go up to 4GB), the bandwidth consumption while transferring such video is relatively high. For better bandwidth utilization we have proposed an algorithm that will use video, which we eventually reduces the bandwidth consumption.

Proposed solution: The footage generated by the the PTZ camera are of very high quality that requires a very good connection, in this case huge amount of bandwidth is required to transmit the data. For this we often need to deploy extra base station that can satisfy there request. To nullify the need for extra base station we came up with a solution that will compress the video at the transmitter side and then transmits the data for longer distances without any pixel degradation.
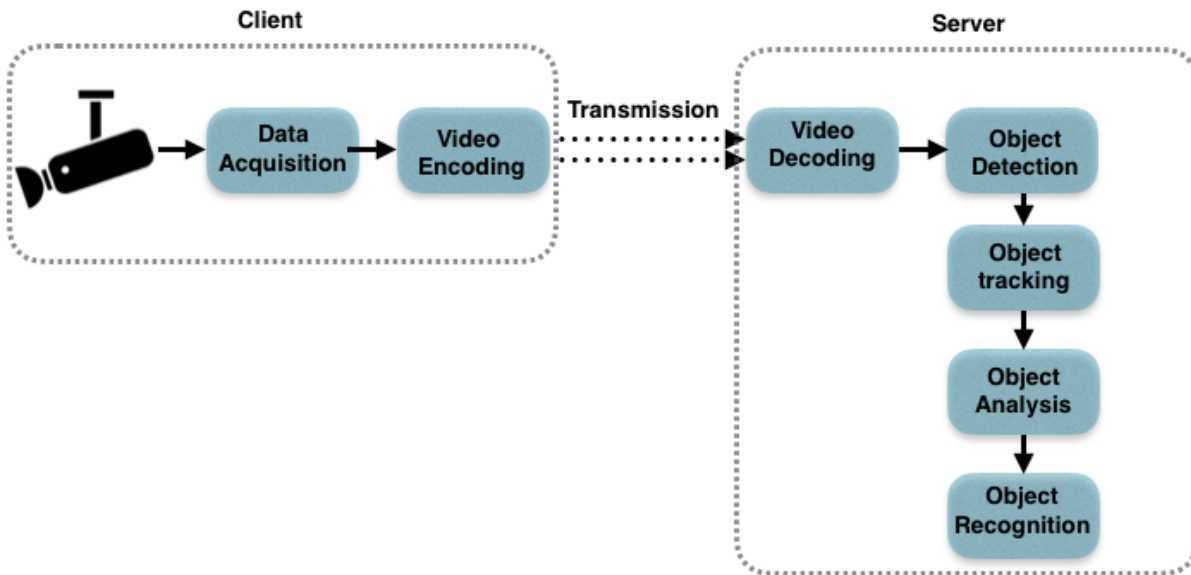
Fig 26.Video compression architecture

Video compression used in video surveillance system spans from Motion JPEG [11], MPEG-1 , MPEG-2 , MPEG-4, H.261 , H.263 , and currently state-of-the-art H.264/AVC. Motion JPEG encodes each frame independently, which removes only the spatial redundancy. Video compression standards further take advantage of the temporal correlation with motion estimation. The frames coded in this way are referred to as INTER frames, whereas in INTRA frames only spatial redundancies are exploited. While the high coding efficiency of INTER frame coding can significantly reduce the size of the
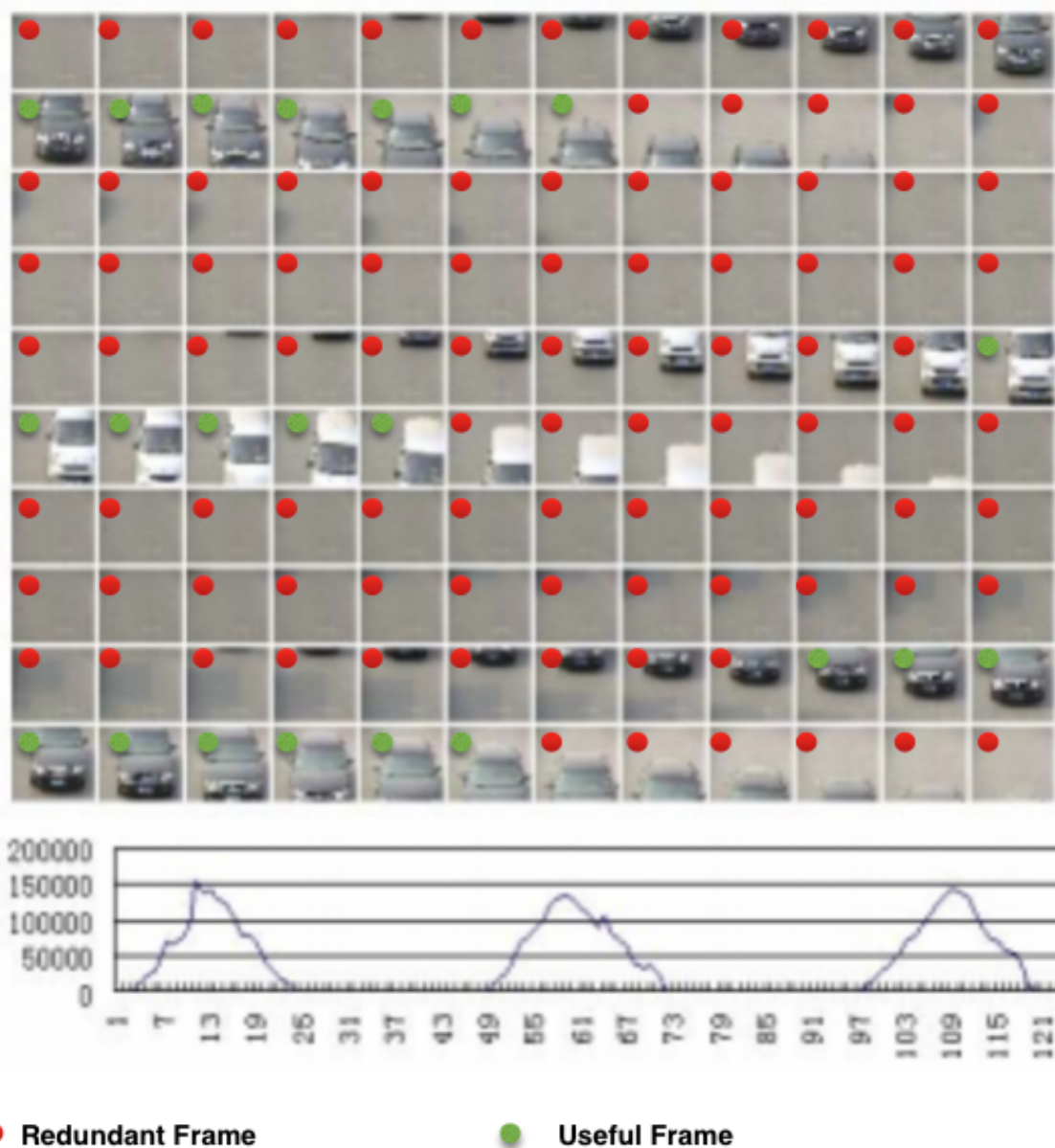
Fig 27.Video compression architecture

captured video with no or small loss of the video quality, it is also desirable to insert an INTRA frame periodically in a group of pictures (GOP) to enable easy access to the contents, which is important for surveillance video search and analysis.

The output of the camera will be in raw video mp4 format, this video is transferred to the video encoder box, and then it will be transmitted to the server side, where video decoding will take place. After the decoding, object detection, object tracking and object recognition will be done by 6th sense technology.

In the encoder the video will be converted to motion JPEG format. In PTZ cameras the video is made at 52 frames per sec. Therefore, for every second 54 Jpeg images will be generated. Now from these only some of the frames are essential where as rest are redundant. software will carefully remove the redundant images, every 8th image is the key image, that contain the information about the vehicle.

Fig 28.Result for capturing image frames via compression algorithm

Index of method	Data size of 124 frames	Replay quality	Quality of key frame	Detail in key frame: vehicle-license-plate and logo
1	183,704 Bytes	Better	Better	
2	138,152 Bytes	Bad	Bad	
3	147,053 Bytes	Good	Good	
4	139,174 Bytes	Best	Best	

*Fig 29.Number plates will be traced without any human intervention.
Depending upon the quality of the key frame selected.*

6. Deployment Environment

For providing the large scale internet coverage in the field we can have the approach of either PMP or mesh network. In PMP (Point to Multi Point) network generally aims at providing the last-mile access to a broadband internet service provider. In this it necessary to have a subscriber station (SS) within the transmission range and directly in Line Of Sight (LOS) of the base station. Where as the mesh mode is the flexible one, in this we can have a mesh with a multi-hop environment, in this we can have an ad-hoc network where each node is acting as a relaying routers. For the cost-effective solution the multihop communication is becoming more and more important these days. The really station is the special type of SS that can forward the traffic to other RS or BS.

Fig 30. Point to Point framework

Comparing to the PMP mode, mesh mode is flexible and can be easily deployed in an infrastructure. The PMP mode is show in the Fig 1 as shown above.

Here in this PMP mode, all these SS are in transmission range and in clear LOS of BS. The mesh network is shown in fig 2. In this mesh network, the ad-hoc network is created with the help of relay stations. Here mobile station is not within the range but it can still access the internet
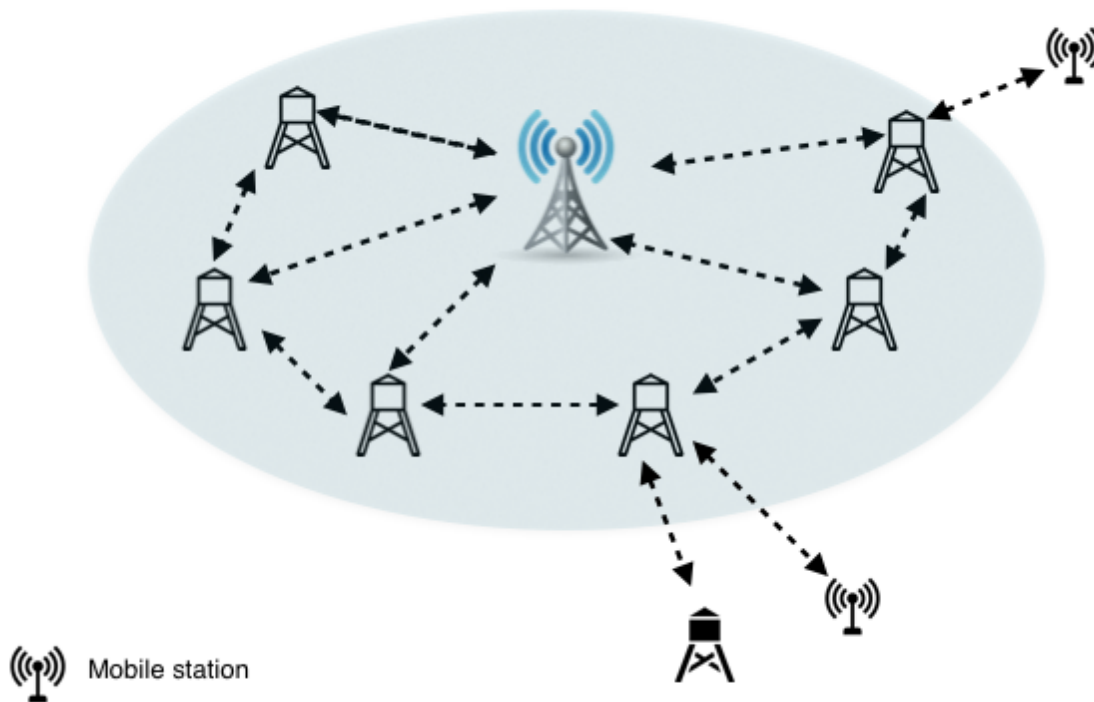
Fig 31. Point to Multipoint framework

because of relay station. Therefore flexibility is the main reason behind using the mesh network. In the rough terrains where it is impossible to use the cables or ADSL lines we can use this mesh network to access the internet.

To simply provide the internet access, straightforward approach is to provide a unicast connection between SSs (including RSs and MSs) and the base station, which has the link towards the internet.

This WiMAX station is able to provide the broadband wireless unto 30 miles for the fixed station and 5 - 10 miles for the mobile station. Some of the silent features of using the mobile WiMAX is:

I. Because of the MIMO antenna technique and along the flexible sub-channelization scheme results in the high download rates unto 63 Mbps per sector and peak uplink at 28Mbps at 10 MHz channel.

II. We can easily switch to different channels ranging from 1.25 MHz to 20 MHz.

III. Security is supported via digital certificates, username/password schemes.

IV. It supports optimized handover schemes with latencies less than 50 millisecs to ensure real-time applications such as VOIP perform without service degradation.

V. Quality of Service is guaranteed because of end-to-end connection.

6. Statistical Analysis of Region for Implementation

According to the latest survey, the total population of Delhi city is 16.3 million and with total area covering 1484 square kilometers (573 sq mi). It has a length of 51.9 km (32 mi) and a width of 48.48 km (30 mi). To cover the entire region we will use the fixed base station WiMAX.
The covering radius of the one base station is 50 km but as the distance increases the service and the data rate also degrades, we will study this in later section. We assume the radius of the cell to be 30km. Therefore the area covered by the single WiMAX is:

Area of the cell is calculated as:
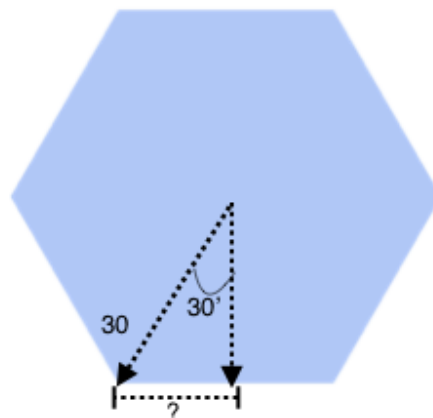
Total area is calculated as:

Angle per side = 360/6
= 60 degrees

Therefore, side length of hexagon is:

=> sin(30)= x/30
=> x = 15

$$A = \frac{3\sqrt{3}}{2}a^2$$

Fig 32. Area Calculation

Therefore total area = 2338.27 km

As we can see that total area of cell covered in way much higher than the overall area of the region, therefore there is no need to use the really station to increase the transmission range. Now dividing the equal bandwidth among all citizens would be a real challenge, for this we allocated fixed slots and a fixed limit to the users to access the internet. On experimental basis we will provide the speed of 64 kbps to each user.

Statistical Analysis of the region/ Deployment parameters	
Area of Delhi	1484 sq km
Length of Delhi	51.9 km
Width of Delhi	48.48 km
Radius of the cell	30km approx
Area of the cell	2338.27 sq km
Speed allocated per slot	64 kbps
Number of slots per cell	1440
Total Internet users in Delhi	12.5 million
Total cells required	8680
On average cells working	4340
Number of CCTV for traffic analysis	720 x 4 (for traffic analysis only)
Equipment cost	54.25 crores approx
Site Cost	21.70 crores approx
Backhaul Cost	10 crores approx
Operation Cost	8 crores
Engineering Cost	8 crores
Significant height of the base station	25m
Cost estimation	**101.95 crore ($15.21 million) approx**

Table 9. Statistical Analysis

On the basis of algorithm 1, *Congestion control via node handover algorithm* that is discussed in proposed work, We will decide the position of the base station nodes. For

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the implementation in Delhi region, we have done the statistical analysis of the region, on basis of that the deployment can be done.

7. Speech and Video transmission

We have proposed and efficient wireless image, speech and video transmission over longer distances over the hybrid network. This application is one of the subset of Intelligent Transportation System. To make sure it is efficient the existing WiMAX system with highest transmission rate, the error rate possessed by the same must be as low as possible. While transferring the live footage from the mobile vehicles like police vehicles, fire fighting trucks, News vehicles we need special equipments. Generally for the transfer of live news we need SNG (Satellite News Gathering) vehicles, without these the data cannot be sent. For these we need to have special equipments as well as we have to buy the lease to use the satellite. These SNG requires a dish which send signal to the satellite, and these signals are received by the transponders of satellite. The quality of the data depends upon the number and depth of the transponder. NDTV
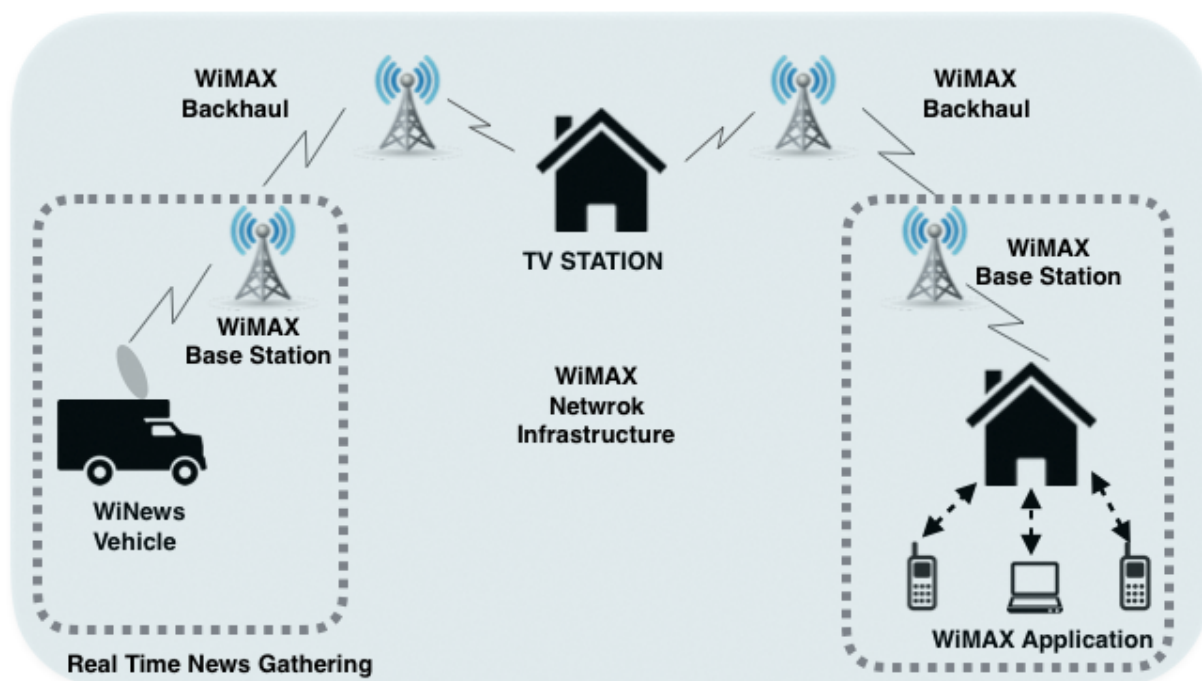

Fig 33. WiMAX Network Infrastructure

news channel uses NSS6 satellite, it has in total 12 transponders. The transponders are of KU bands generally in giga hertz, then the channelization is done and the data is redirected to the control unit. This whole process is a time consuming as well as very expensive. The setup cost itself for the 5 Mbps bandwidth channel is $343,000 to $429,000 after this you have buy the lease of satellite to use the transponder. The cost of lease can be between $65,000 to $70,000. Which is way much expensive, to reduce the cost we can implement this via WiMAX. It is the best cost effective, feasible and very economical solution as compared to the traditional SNG vehicles.

The basic technique that has been used to decrease the error rate is done by AWGN channel.

First of all, 256 x 256 image input with 96 samples per frame for image and 30138 samples with 1/35 sample time for the process of frame based speech output are taken. Once the data is received in terms of either speech or image, the randomization would be performed which will be applied for encoding. The encoder of the WiMAX system is the combination of Reed-Solomn (RS) code as an outer code and Convolution code (CC) as an inner code. The encoded baseband data is modulated by means of QAM which is applied for OFDM process as the physical layer of WiMAX system is made up of OFDM. In OFDM process, the in phase and quadrature phase components of the symbols will undergo through the process of IFFT so that requirement of effective bandwidth can be made approximately half without any inter symbol interference. For the simulation purpose, the communication medium is considered to be suitable for long distance system wherein average fading is assumed to be constant throughout the path.

The analysis of the image and its bit rate error is done shown in fig 10. It shows the method for the error rate calculation for the bit rate loss and its effect.

We can also consider a combination of approaches using multicast, layer encoded video and adaptive modulation of transmissions. Using these, we can develop an algorithms to ensure efficient, fair and timely delivery of video in WiMAX networks. The

corresponding resource allocation problem is challenging because scheduling decisions (within a WiMAX base station) are performed in real-time across two dimensions, time and frequency. Moreover, combining layered video with appropriate modulation calls for novel MAC algorithms.

8. High Utility Video Surveillance System

Video surveillance on public transport is a useful tool to fight against anti-social behavior like vandalism, harassment, graffiti and terrorism. Real-time video surveillance on moving public transport faces serious technological challenges mainly due to limited throughput offered by existing communication technologies at high vehicular speeds. Success of real-time video surveillance on public transport heavily depends on future communication technologies like WiMAX. WiMAX has emerged as an exciting technology with promises to offer high throughput and improved quality of services (QoS), key requirements for video surveillance on public transport. WiMAX however, offers limited throughput at high vehicular speeds mainly because of multi-path fading that causes high bit error rate at the receiver at vehicular speeds.
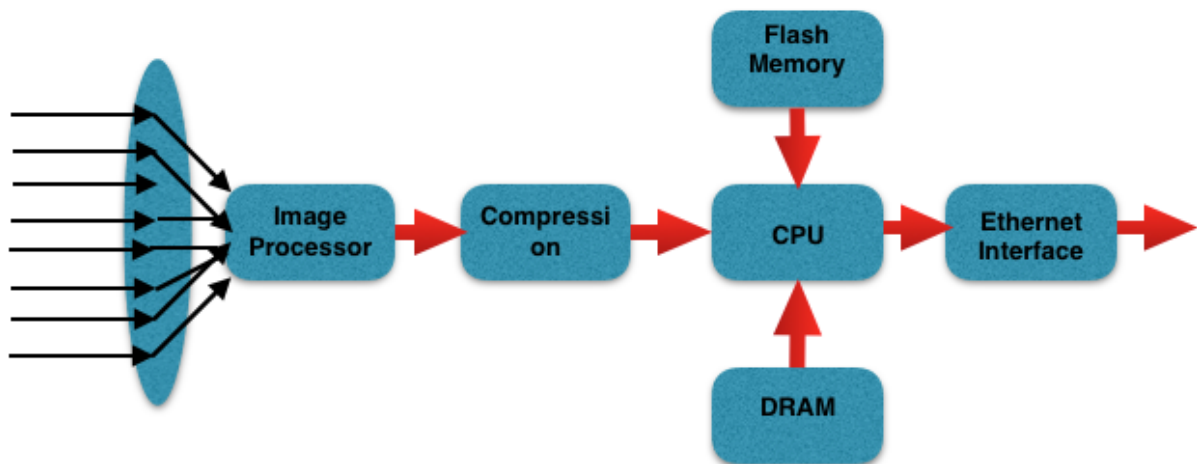
Fig 34. Image processing

Fig 35. Delhi NCR area

Apart from this, we will deploy the camera all over the Delhi region for traffic analysis and transmitting the data to the headquarters where the traffic managers can easily monitor. For the Intelligent transportation system we will deploy the cameras that would stream the raw footage of the traffic to the traffic control room. It would not only aid the commuters but also gathers the valuable data through monitoring. For the experimental purpose we will use the Ambarella S2L55M Real Time 3.0MP 2 Array LED Infrared
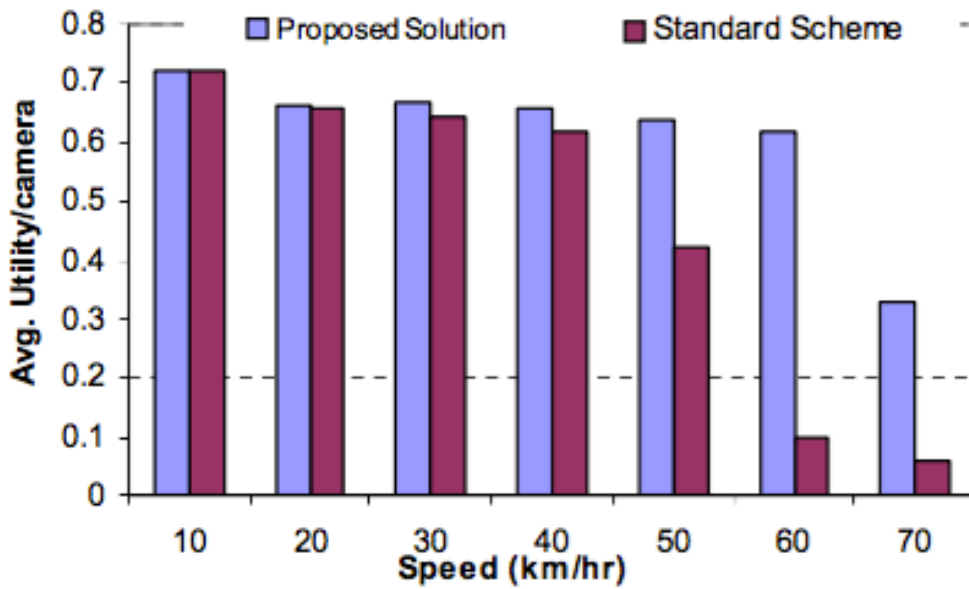
Fig 36. Speed vs Average utility/camera
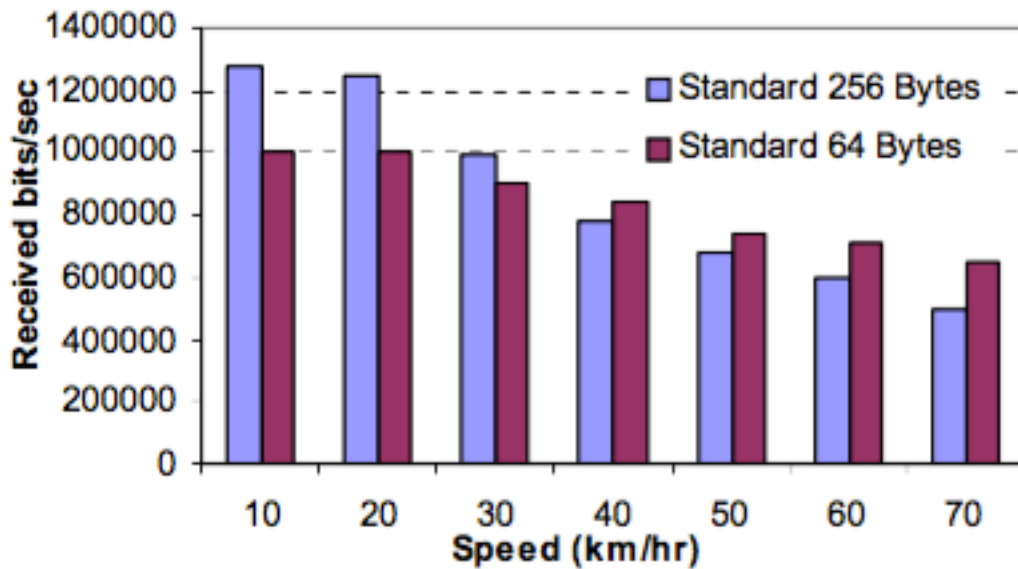
Fig 37. Speed vs Received bits/sec

WDR CCTV Security Traffic Light Camera IP and PTZ dome camera. Here as the analog

footage is captured by the camera it would covert it in to digital signal by the inbuilt AD/

DA converter. The digital signal will be propagated to the micro computer where digital signal will be converted to the video IP packets.

After converting it into video packets it is transferred to the control room throng the WiMAX network. The compression algorithm used is the H.264 resolution.

According to the survey there are total 720 red lights signal in Delhi if we are transferring the RTS information in raw footage that would require high bandwidth, by compressing it then on average uplink speed required per camera is 250 kbps. There is no need to create slots here because the mobile user is fixed here, so number of traffic junctions stays same as they are allowed in the cell.

Here we have divided the entire regions in four main zones, that is North, South, East and West. For the experimental purpose we will deploy the 3 cells which are sufficient for the entire region. 250 traffic junctions are allotted per cell. These cells are capable of transmitting the data directly to the control room, it works in complete decentralized way. There is no need of further alteration in the footage at the control site, because the raw footage is compressed at its own location.

At some busy points we will use point to point (PTP) sectored antennas because they can transmit signal at very high speed of 300mb/sec.

9. Analysis of Result

It shows the maximum proposed clustering DSRC throughput. There are least amount of users per cluster, which translates to more clusters for the same amount of total users in the system, yields the most throughput. Hence, the available bandwidth per user in a DSRC clustered network will outpace that of a system without clustering. It can also mean that a margin of bandwidth is available to handle any extra overhead incurred in the DSRC system as a result of this concentration of traffic.

Fig 38. Graph between users per DSRC cluster and improvement in Efficiency.

In next figure can be seen that our proposed system provided an improvement in system capacity with an increase in cluster size.

For example, if there are 20 active users in the system, our proposed WiMAX/DSRC system prohibits an improvement of over 30% in efficiency over the WiMAX-only system. In addition, the efficiency increases with an increase in active users.

CHAPTER 6

1. Problem Statement

<u>**Sub Problem 7**</u>**: Lack of tress and raising levels of pollution in our environment is one of the biggest environmental concern that won't only effect our biodiversity but also dangerously effects human health. For that step towards making an Eco Scientific Zone would be really beneficial for policy making and raising awareness.**

2. Introduction

The pollution level of our country is increasing day by day and one of the most important reason for this is lack of trees and deforestation. Present number of vegetation in our country is not sufficient to act as a sink for the different harmful gases that are present in our atmosphere. This ultimately affects not only our ecosystem but also the health of an individual. The percentage if plantation or vegetation in a particular zone affects the relative humidity of that area. On the basis of the Relative Humidity index of a particular zone we can easily determine whether an area is qualified to be habitable zone or not. This habitable zone it the backbone of the Eco Scientific Zone. We will implement this experiment in an area of 163 acre land and then compare it with the NCR Delhi region to check whether it is qualified to become an Eco Scientific Zone or not. With the help of the IoT device we will determine the RH intensity and the temperature of different regions.

3. Proposed Work

IOT devices are used to get the estimation of temperature and RH index. For this we have divided the complete area into multiple clusters. Each clusters will get the specific set of values that will calculate the RH index of that particular region. Each IOT device in the particular area will be connected via centralized server which will continuously monitor the readings. Different values of RH index will indicate the possibility of diseases occurring in that area.
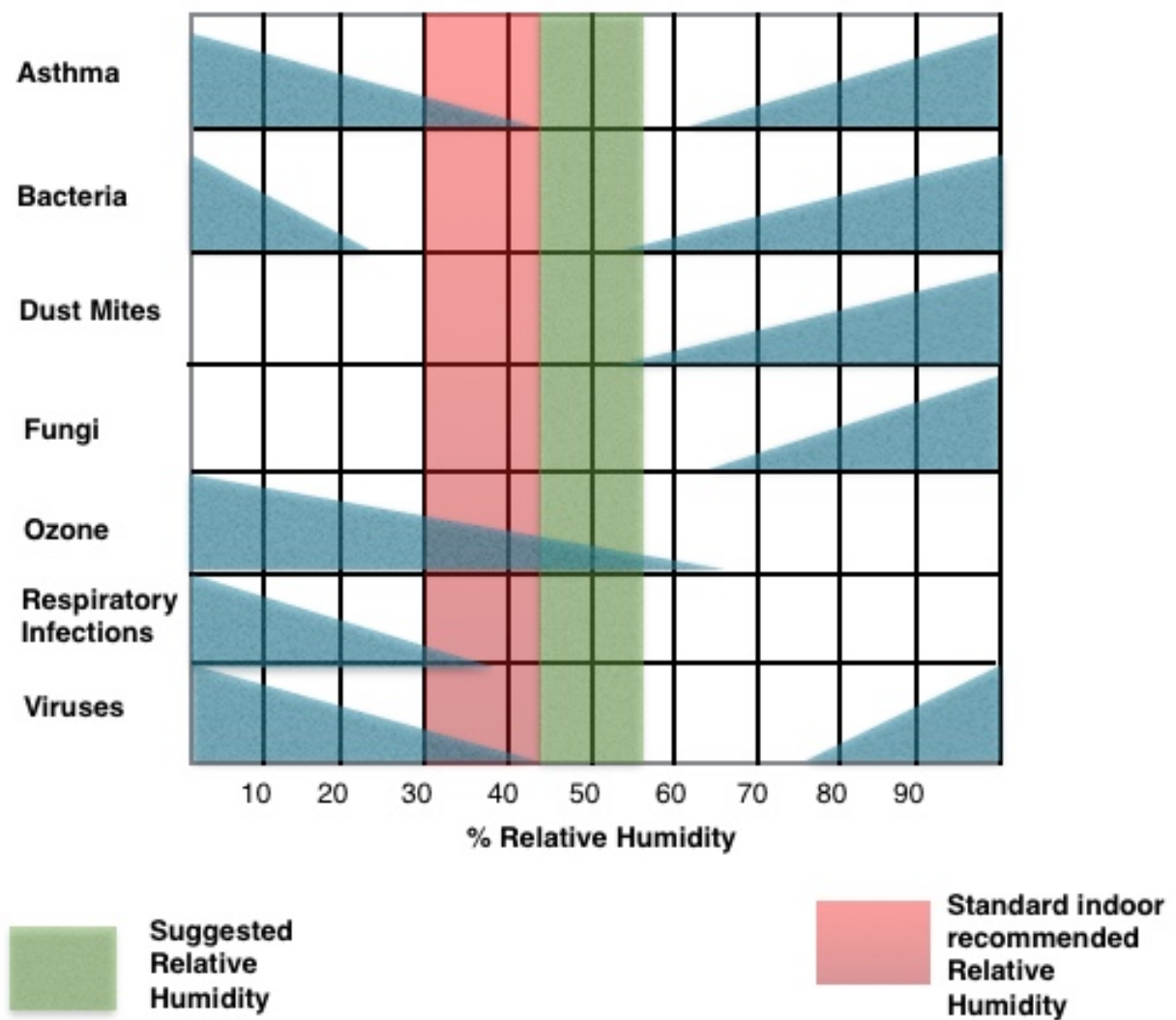
Fig. 39 Suggested and Standard indoor Relative Humidity and its impact

Area	Temprature	Relative Humidity Index	Time Period
Z-1	36.01° C	18%	1 Day
Z-2	29.99° C	24%	1 Day
Z-3	41.29° C	12%	1 Day
Z-4	17.16° C	53%	1 Day
Z-5	15.48° C	59%	1 Day
Z-6	14.83° C	64%	1 Day
Z-7	15.41° C	64%	1 Day
Z-8	14.99° C	64%	1 Day
Z-9	14.90° C	63%	1 Day
Z-10	14.71° C	64%	1 Day
Z-11	14.62° C	64%	1 Day
Z-12	14.69° C	65%	1 Day

Table. 10 Readings Temperature, RHI of sensors at different zones areas in an interval of 24 hours.

4. Result Analysis

The data we acquired of different regions is shown in the table above. The data is collected via IOT device which are distributed at many places.

All the devices are connected to one central server, which will control them. The design architecture of the device is shown in the figure. If we compare the result that we got with the graph, we can see that, there are many places where RHI index is high and is not suitable for living. These area can have a serious impact on human lives. The areas with low RHI index shows that they lack vegetation. If we can increase vegetation of that particular area then we can get the RHI within the permissible range.

For the implementation of the project, we have divided the 163 acre land into 12 units. In each unit IoT device is placed that will transfer the data to one central system running. As shown in the figure below.

```
Temperature = 29.28 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = -128.25647 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = 29.28 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = -128.25647 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = 29.28 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = -20.00 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = 29.27 deg. C
Humidity = 39 %
Light = 0 lux
-------------------------------------------------------------------
Temperature = -128.25647 deg. C
Humidity = 40 %
Light = 0 lux
-------------------------------------------------------------------
```

Fig. 40 Data received at the central server in ubuntu system.
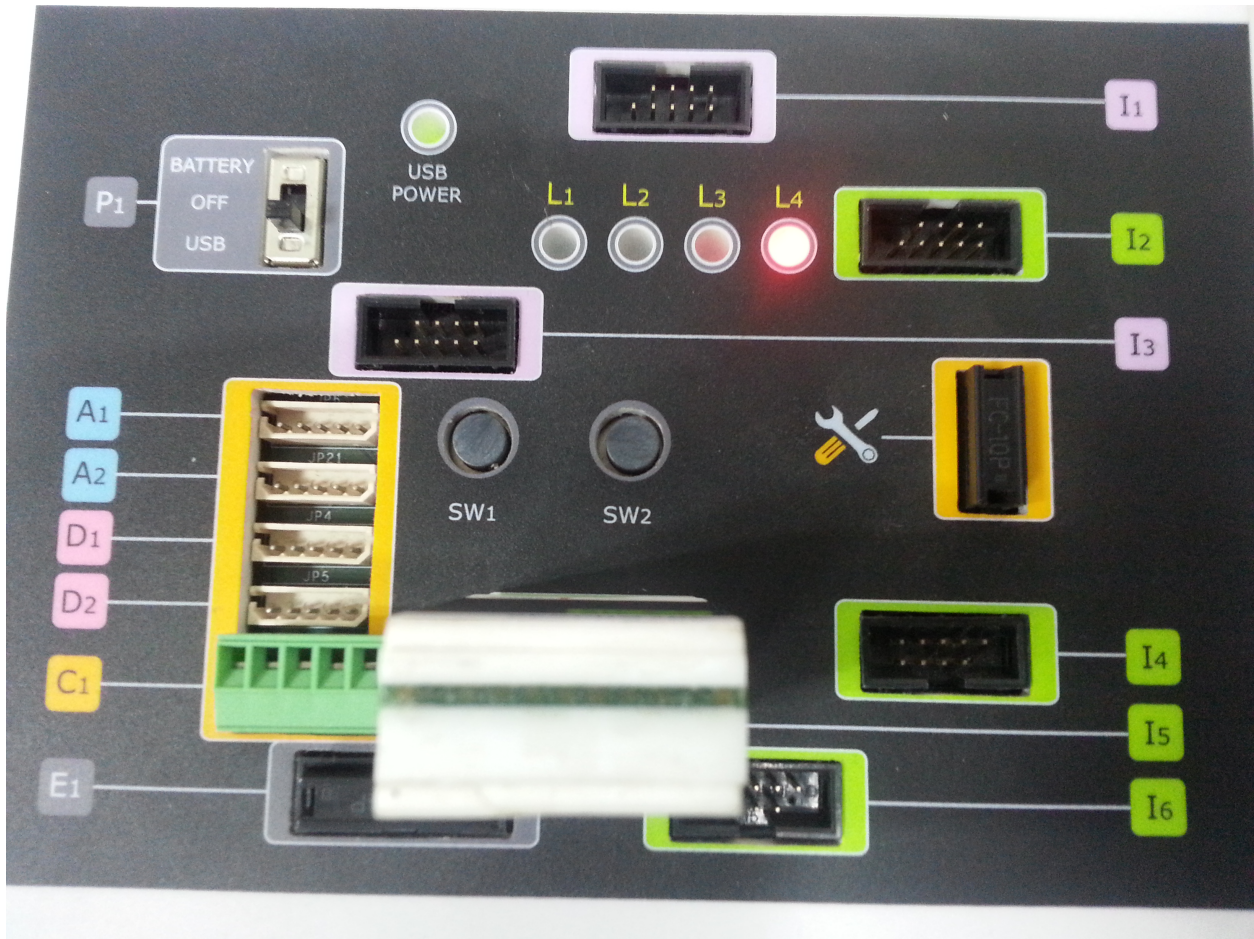
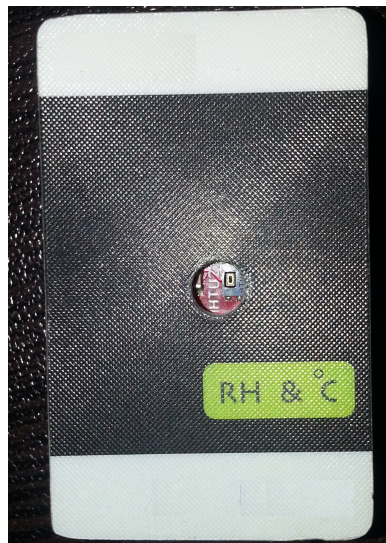Fig. 41 IOT Device that is used to collect data in central server

Fig. 42 IOT sensor to measure RHI and Temperature
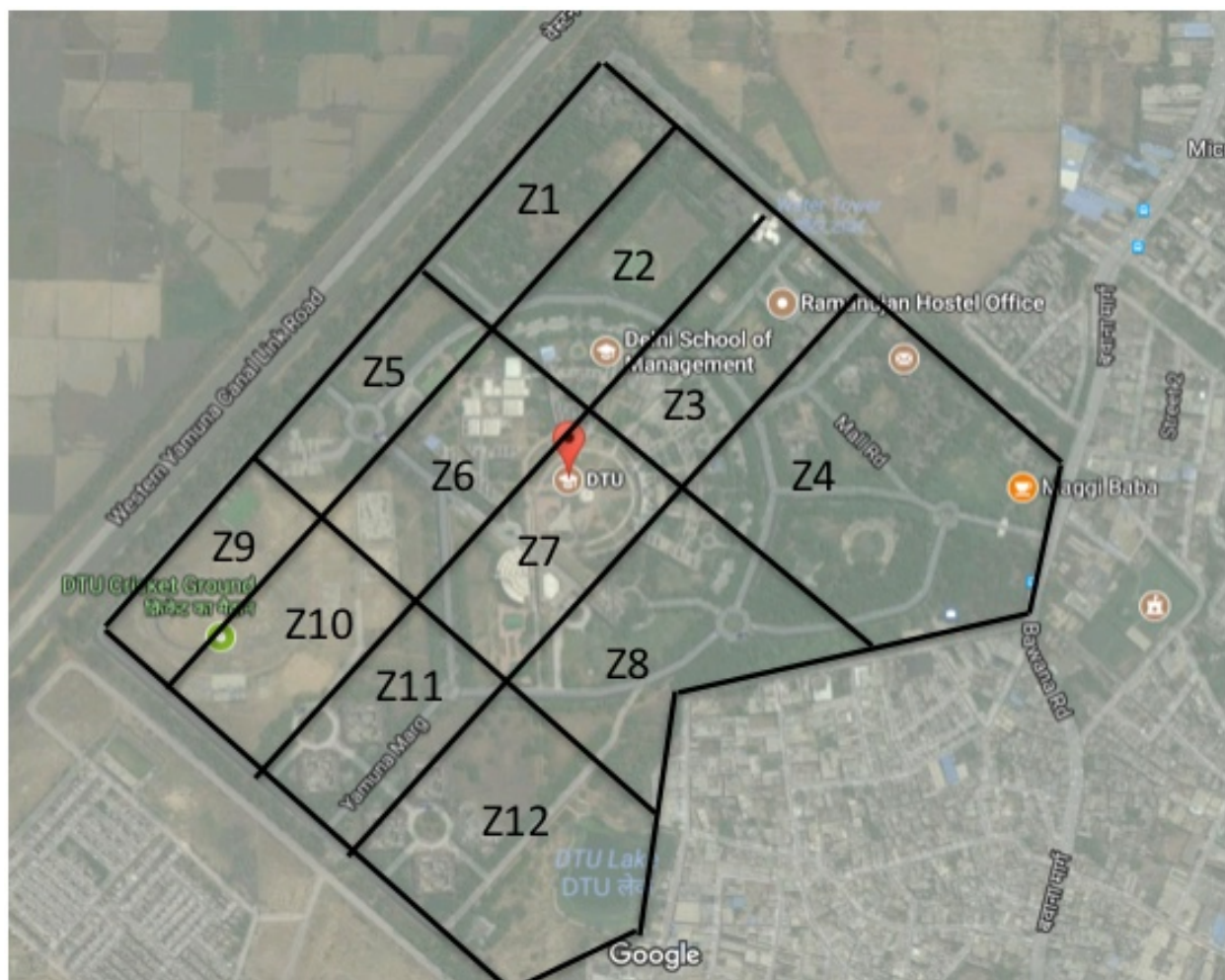
Fig. 43 Zonal distribution of an area

CHAPTER 7

How can it be Service Oriented ?

1. Revenue Model

The revenue model is divided in 3 phases, the revenue generated from each phase will be used as capital for the next phase.
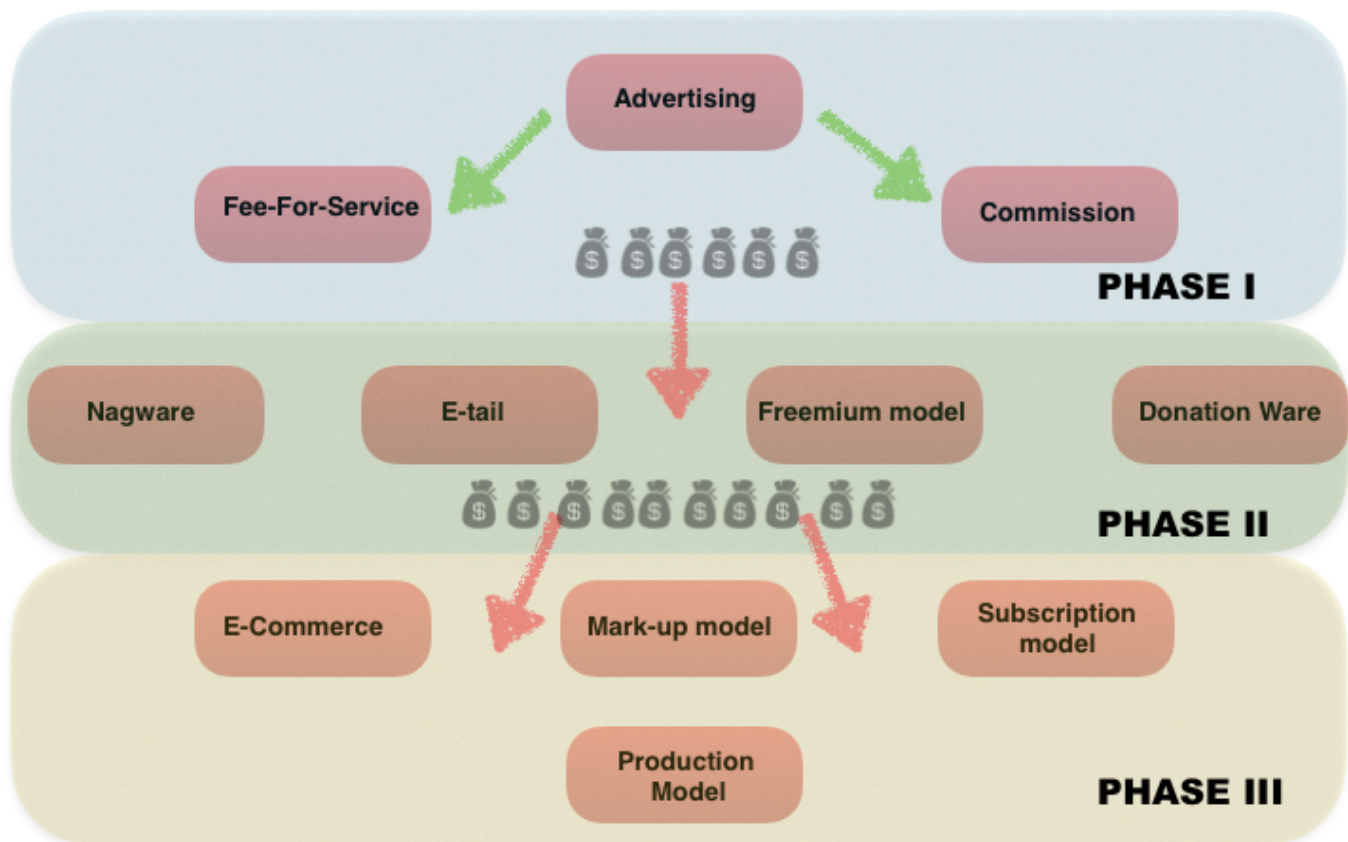
Fig. 43 Revenue Model

- We will use our platform where content is provided to the customer as an advertising space. We will generate our revenue through various adverts provided by the clients. It is great platform for marketing communication that can be used to promote or sell something.
- It can be area/district specific.
- We will have e-advertisement on Android/IOS application in handheld devices as well as on website.
- Greater revenue is generated by the LED/dynamic banner advertising in the city that is controlled by ITCS.

Commission model

- It is done when our business charges a fee for a transaction that it mediates between two parties. This is done by offering different services on the handheld devices, services like bill payment, online mobile recharge, online DTH recharge and also by linking to a third party like Zomato and bookmyshow that offers great deal of offers to the users.

Fee-For-Service

- Here we will charge customers for the amount of services they use. These services includes
  - On-demand movies
  - Internet slots
  - cloud services
  - Other services, that includes distributed services.

Freemium model

- These are Android/IOS specific. Here we will offer our services free of charge (typically digital offerings such as software, content, web services or other) and later we will charge customers for a premium for advanced features, functionality, or related products and services.

Nagware

- By this method we will persistently reminds the user to register it by paying a fee. It can be done by popping a message on the screen when the user opens our application or program or intermittently while the user is using the application.
- This will be for the subscribed users.

E-tail

- This will focus on the electronic payment methods, cash on delivery, and delivery of the products and the services to the users.
- The products includes delivery of DVD, CD, BLU-RAY and others.

Donationware

- It is the optional amount that users can pay for the development in rural/urban sectors.

E-commerce

- Most of the services that we provide are online based. Revenue will be generate by buying services and products online.

Revenue analysis by Dynamic/LED advertisements (Outer Ring Road)	
No: of Vehicles passes by per day	150,000
Charge per user	0.78
Total no of screens deployed	500
Revenue Generated per screen (on avg)	₹117,000
Total revenue generated from all screens per day	₹58,500,000 (approx)

Table. 11 Revenue analysis by Dynamic/LED advertisements (Outer Ring Road)

Mark-up model

- In this we will buy products from manufacturers, mark up their prices, and resell them to end customers. These products include CD, DVD,Blu-Ray disc, internet and many other services.

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Subscription model

Table. 12 Revenue analysis by E-advertisements

Revenue analysis by E-advertisement (In-Delhi)	
Total no of users	12.5 million
Average users	6.25 million
Platform	Android/IOS
CPC	$0.10
CPM	$1.00
2500 views	$50
5,000 views	$97.50
10,000 views	$190
25,000 views	$462
50,000 views	$900
100,000 views	$1750
200,000 views	$3400
Cost estimation	$625000 (approx)

- Our business provides a product and service to a customer who in return pay a pre-determined fee at contracted periods of time to the business. It can be a monthly payment or yearly subscription.

Production model

- On the final phase of the company we will start the production of e-watches and telecom hardware products. Revenue will be generated by directly selling of these products.

2. Revenue Stream:

In the very first phase we are focusing on advertising model, fee-for-service model and commission model. The money coming from these sources will be used as a capital for the next

phase. The rates will be charged depending upon the current going rate, audience and comparing to other services in same field and finally to maintain a predictable revenue stream. Depending upon our network expansion, in our initial phase we will cater 12.5 million people all over Delhi.

The cost for advertisement will be on the basis of number of users available in the network:

LED/Dynamic ad banners:

- On average ring road number of users passes by are 150,000. The charge rate will be according to 0.78 per user. That would sum up to tap 1.14 lakh rupees per day for one screen.

E-advertisement

- This advertisement will be done on the on the Android/IOS devices that can be hand held. This will be done via CPC (Cost Per Click) and CPM (Cost Per Mille). On average CPC is $0.10 and CPM is $1.00.

The revenue generated from e-advertisement is shown in the table on next page. This advertising can boost up the sales of our services as well as satisfy the needs of the customers. The ads will focus on different segments of the users depending upon their age groups. These ads are not only for the big business dealers but also for small business firms, we can broadcast their advertisements in there local areas or in specific districts and depending upon that we will generate our revenue.

In future phases we will find new revenue streams via new, novel, potentially lucrative, innovative and creative means of generating income.

Revenue Generated by Government contracts:

The maintenance cost and training cost will be provide on contract basis by the Govt.

3. Competitor Analysis

Currently there is no company in the market that provides these much services as we do, each our services are interlinked with each other that makes a complete single umbrella network. Focusing on particular domains, our competitors are entertainment services providers like Netflix and Airtel. But all these services dpn't provide cloud services and many other facilities as shown in table on next page.

Key Industry Success Factors	Weighting	ganna.com rating	ganna.com weighted	Netflix rating	Netflix weighted
Product innovation	0.08	5	0.4	5	0.08
Entertainment services	0.1	15	1.5	15	1.5
Security to users	0.1	6	0.6	5	0.5
Economies of scale	0.02	12	0.24	10	0.2
Customer focus	0.07	14	0.98	10	0.7
Network solution	0.06	0	0	0	0
Customer terminal	0.1	15	1.5	5	0.5
Govt sector	0.1	0	0	0	0
Service Groups	0.06	0	0	0	0
On-demand application	0.06	12	0.72	15	0.9
Marketing	0.1	15	1.5	7	0.7
Defense	0.07	0	0	0	0
Rural region	0.08	0	0	0	0
	1	Max 20	7.44	Max 20	5.08

Table. 13 Comparison of services

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Key Industry Success Factors	Weighting	Airtel rating	Airtel weighted	Cisco	Cisco weighted
Product innovation	0.08	10	0.8	12	0.96
Entertainment services	0.1	9	0.9	2	0.2
Security to users	0.1	15	1.5	18	1.8
Economies of scale	0.02	20	0.4	15	0.3
Customer focus	0.07	20	1.4	15	1.05
Network solution	0.06	15	0.9	20	1.2
Customer terminal	0.1	15	1.5	5	0.5
Govt sector	0.1	0	0	12	1.2
Service Groups	0.06	15	0.9	15	0.9
On-demand application	0.06	10	0.6	0	0
Marketing	0.1	18	1.8	12	1.2
Defense	0.07	0	0	15	1.05
Rural region	0.08	5	0.4	2	0.16
	1	Max 20	11.1	Max 20	10.52

Table. 14 Comparison of services

4. Uniqueness:

Till now no one in the market is providing this much services to the users, we are not just focusing on the convenience of the user but also for the development of socio and economic growth of the country. Our aim is not only to provide the cost effective services to the users but also to provide better access to the advanced technological resources. If we compare our country with other developed countries, they satisfy their customer platform by providing all possible services, that includes cloud services, entertainment services, network solution and security all together. We want to provide our customers all these services at one platform, so that all there devices can be easily interlinked and connected through our umbrella network.

PRICE ANALYSIS

ACTUAL SUMMARY

- On Demand services
- E-advertisement
- Network solutions
- Wi-News
- Other
- Entertainment
- Dynamic ad
- Internet access
- Rural initiatives

BUDGET VS. ACTUAL
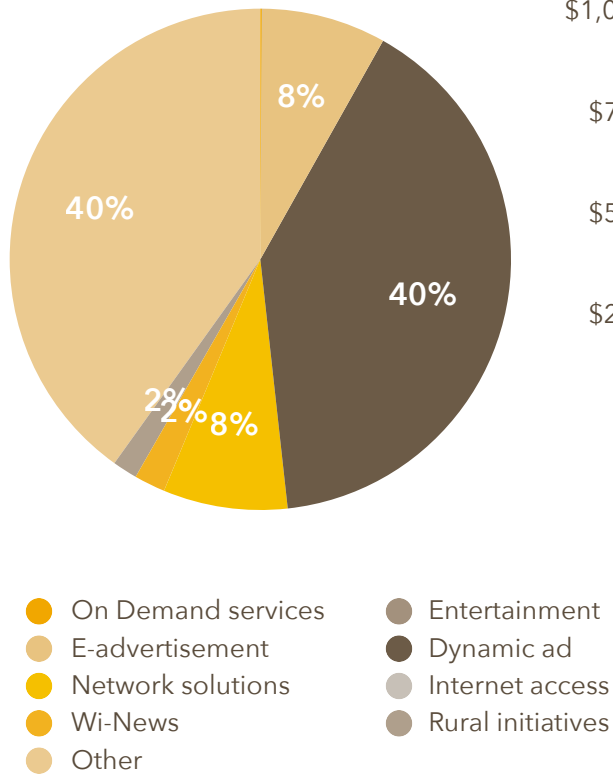
- Existing(per user/per day)
- Actual
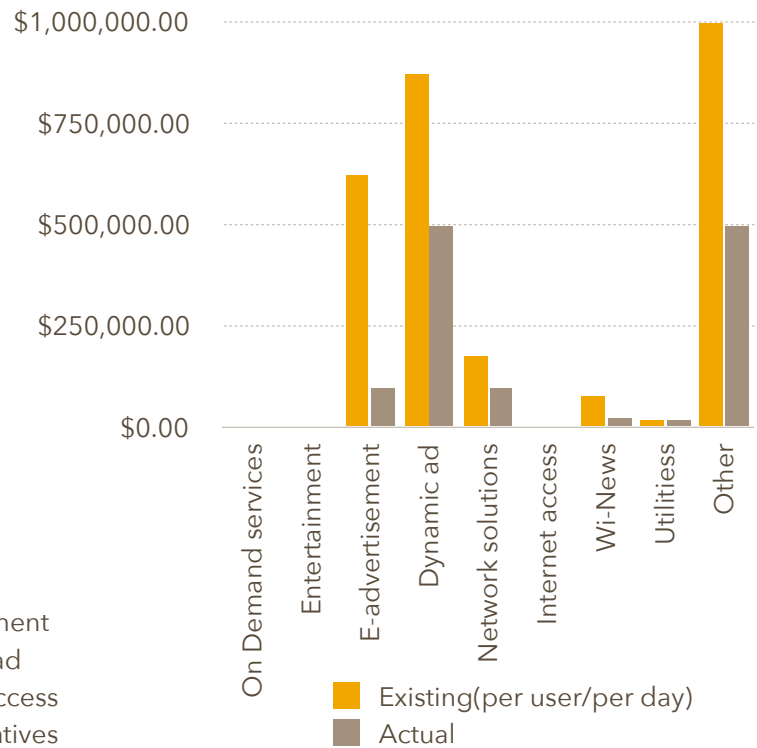
SUMMARY BY CATEGORY

Category	Existing(per user/per day)	Actual	Difference
On Demand services	$2,000.00	$1,200.00	$800.00
Entertainment	$500.00	$300.00	$200.00
E-advertisement	$625,000.00	$100,000.00	$525,000.00
Dynamic ad	$873,000.00	$500,000.00	$373,000.00
Network solutions	$180,000.00	$100,000.00	$80,000.00
Internet access	$100.00	$30.00	$70.00
Wi-News	$80,000.00	$25,000.00	$55,000.00
Rural initiatives	$20,000.00	$20,000.00	$0.00
Other	$1,000,000.00	$500,000.00	$500,000.00
Total	$2,780,600.00	$1,246,530.00	$1,534,070.00

Table. 15 Summary By Category

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CHAPTER 8

CONCLUSION

In this research paper we have proposed novel technique to establish an Eco Scientific Zone for safe and security oriented network framework via Hybrid Intelligent Transportation and Communication System. The main objective of this project was to establish an Eco Scientific Zone, that is capable of providing multiple applications and services to the users. The design architecture of a smart button based on HC-05 and ESP8266 for the ESZ has been successfully created and it is showing successful results. The comparison between HC-05, ESP8266 and NFC is done which shows that HC-05 is way much efficient then ESP8266. The proposed optimization algorithm has efficiently transferred the customer terminal from one base station to other in constant time. The AIVCTe (Advanced Image and Video Transmission Technique) has significantly reduced the bandwidth consumption as well as provided many different services to the different segments of the customers. The case study analysis of the Delhi region as been done successfully with all the technical and economical inspection for the implementation of ITCS. In contrary to image and speech transmission, WiMAX is not effective for the transmission because of limited bandwidth, in that place we can use airMAX basestation that would significantly reduces cost of operation and provides maximum throughput over long distance. Significant work is required to be done in future on compression technique via AIVCTe for the transmission of bulk data over long distances. The overall network establishment would act as an nation-wide development in the field of transportation and communication.

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