

AUDIO TRANSMISSION THROUGH VISIBLE LIGHT

This Thesis submitted in partial fulfillment of the requirements for the Award of
Degree of Bachelor of Science in Electrical and Electronic Engineering

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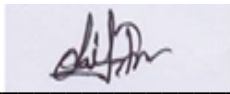
DAFFODIL INTERNATIONAL UNIVERSITY

February 2018

CERTIFICATION

This is to certify that this project are entitled “AUDIO TRANSMISSION THROUGH VISIBLE LIGHT” is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Daffodil International University in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering**. The presentation of the work was held on....

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Dedicated to ...
Our Beloved PARENTS
&
All of Our TEACHERS

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LIST OF ABBREVIATIONS

AC	Alternating Current
IC	Integrated Circuit
SMPS	Switched Mode Power Supply
ATS	Automatic transfer switch
LED	Light emitting diode
LCD	Liquid crystal display
ISP	Internet service provider
SPI	Serial Peripheral Interface
PSU	Power Supply Unit
VLC	Visible light communication
LED	Light emitting diode
Li-Fi	light fidelity
APR	Annual percentage rate
PIC	Programmable logic control
CMOS	Complementary metal–oxide–semiconductor
IEEE	Institute of Electrical and Electronics Engineers
APD	Auditory processing disorder
RF	Radio frequency
Wi-Fi	Wireless fidelity
OP	Operation Amplifier
BW	Bandwidth
WAP	Wireless Access Point
FPGA	Field Programmable Gate Array
VR	Variable Register
EM	Electro Magnetic
RF	Radio Frequency
WAP	Wireless Access Point
FPGA	Field Programmable Gate Array

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ABSTRACT

With this wireless connection, Wi-Fi is the most versatile and effective technology system that is compacted with radio frequencies for data transmission. But due to multiple accesses, Wi-Fi systems face many challenges, such as power, availability, efficiency, and security. Wi-Fi radios emit radiations that are very harmful for patients and relational waves explain the medical device. This document offers contact with the transmitter via receiver to the receiver, using the LED-technology technology, which is a line of sight only. Li-Fi technology is a technology that uses LED light to transmit audio signals that allow faster and faster data to be transmitted through Wi-Fi. The light comes almost everywhere, so the communication can also work freely with the light. Loyalty in light is a branch of optical optical communication which is an up-front technology. Using transmissions in visible light, the Li-Fi device provides wireless internal communications.

CHAPTER 1

INTRODUCTION

1.1 General Information

Information security is one of the main problems today, and it is for new approaches to the provision of information is very important. Visible Light Communication (VLC) to the tip of the information to be given, among them, the data will appear as a new method. This is safer than the current technology. As well as the very high data transmission rate close to a few Gbps. The development of different colored LEDs can produce various speeds and data rates. In this paper, Li-Fi audio system describes the development and performance analysis. Keywords: Visible light communication, development, APR, PIC microcontroller.

1.2 History

Professor Herald Hood invented the word "Li-Fi" in its 2011 Tide Global Talk, where he started the concept of wireless data from every light. He is the Chair Professor of Mobile Communications at Edinburgh University and co-founder of pure Li-Fi. General Sound Visible Light Communication (VLC), whose history goes back to the 1880s, uses the visible light part of the electromagnetic spectrum to send information. The Edinburgh Institute for Digital Communication A-Lite project was funded from January 2010 to January 2012. Haas upgraded this market to promote this technology in TAD Global Talk in 2011, and it helped to help a company in the market. Purulifi is a parent of an Manufacturer (OEM) firm ready to commercialize Li-Fi system products for integration with existing purevlc, an existing LED-lighting system. French companies established by the University of Paris-Sikélie University in Olescan, France. In October 2011, companies and industrial groups created the Li-Fi Consortium, promoting high-speed optical wireless systems and absorbing radio-based radio spectrum limited by exploiting a completely different part of the electromagnetic spectrum. Some companies provide UnileDirectory VLC products, which are not like Li-Fi - a term defined by the IEEE 802.15.7 RATA Standard Committee. VLC technology is displayed using Li-Fi in 2012. August 2013, data rates of over 1.6 gigabytes were displayed on single color LEDs. In September 2013, a

press release does not require General Li-Fi, or generally VLC system, line-sight sighting requirements. In October 2013, Chinese manufacturers were reported working on Li-Fi development kits. In April 2014, Russian company Steinscomm called a Li-Fi wireless local network called beam custard. Their current module transmits data in 1.25 gb per second (GB / second), but they speculate to increase speeds up to 5 gb in the future. In 2014, a new record was established by Sisoft, which was able to transfer data of 10 gigabytes / second speed across a light spectrum emitted by LED lighting. The CMOS optical receiver for the latest integrated Li-Fi system is implemented with glacier photodiodes, which are less sensitive. In July 2015, IEEE is operated in Gig-Mode, which increases energy efficiency as a single photon valency diode and makes receiver more sensitive. Also, this operation can be performed as quantum-restricted sensitivity, in which the receiver detects weak signal from remote distance.

1.3 Background Study

Li-fi is not a completely new discovery of technology, light infrared has been used mainly in TV remote controls since the last eighteenth century. This discovery was achieved in 2011 when creating the first Gigabit-Class Li-Fu. Franhfar IPMS and Ibisentelcom are in line with this new development. There is a unique opportunity for Li-Fi to transmit radio frequency (RF) system. Among the Wi-Fi buildings is a great for general wireless coverage and ideal for high density wireless data coverage and radio interface limitation in limited liability, therefore both technologies may be considered complimentary. Comparative measurement speed, range, data density, security, reliability, power availability, transmission / power generation, environmental impact, device to device connection, interference interference, instrument bill, market maturity, comparable measurement of any two transmission technologies. So, we can see that the Li-Fi technology system will be a great in the future.

1.4 Project Objectives

The main objectives of this project is –

- Use of Li-Fi in audio transmission can improves the speed of communication.
- Li-Fi can be used to varies areas where frequencies can be restricted.
- The audio transmission secured due to use of Li-Fi technology.

- Li-Fi technology is faster.
- The concept of Li-Fi is currently attracting a great deal of interest by the system.
- VLC is one of the advanced optical wireless communication system.

CHAPTER 2

PROJECT REVIEW

2.1 Li-Fi Technologies

Li-Fi, Integrated Smart luminous, including Li-Fi short range and for the community around the world, is used to connect to the local network environment, the wireless technology for the new technology. This technology with the speed of light, light, light that transmits information from the eyes of the people to ensure THz Visible Light Communication (VLC). Li-Fi is used in the light of the development of a cheap, durable, and safe and good work. VLC health problem, but instead may cause damage to the human body, microwaves, and uses eco-friendly green technology. But along with the EPP, VLC, and easy-to use the wireless plug and play technology, the use of the advantages of the system and uses. VLC systems in the sun at the speed of light, and LEDs are more convenient than the current Fluorescent Pipes. Wi-Fi or other RF interference with the use of the system also does not remove it, or electromagnetic interference, for visible light, free, unregulated and outdated THz. VLC harm to the human body uses eco-friendly green technology, microwave, because it is free of any health problems. There are parts of the hybrid system 4. They layer structures, the structure of a complex system, and is a model of the channel and the modulated schemes. Level structure is divided between the MAC and PHY layer. Li-Fike VLC designed for the formation of the PLC. Switch PLC transmitter and driving circuits included in the transmitter part of the development. Through the power transmission line, a signal is available through a special PLC module chip and transcodactacton earnings will be converted in the form of a sign. the power line AWGN can do, but it is a five-channel sound superposition of the varieties include:

1. Color background noise
2. A narrow band voice
3. The frequency of the main emotion sound asynchronous voice repeats

4. Asynchronous Modulation scheme between 400 THz using visible.

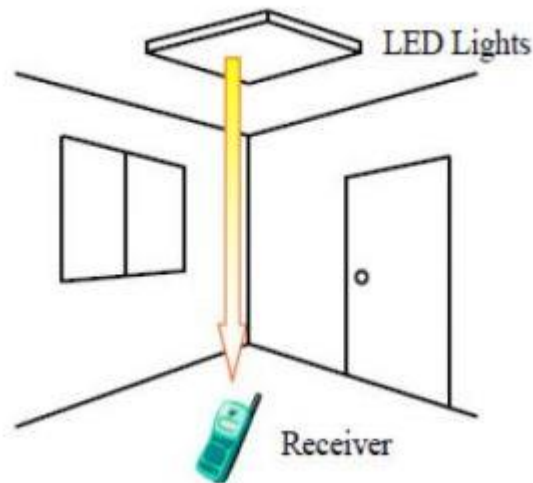


Fig. 2.1 Illumination of Li-Fi

2.2 The Li-Fi Technology System in Present

Li-Fi technology is the heart of the high-brightness LED. This light emitting diode, which turned very quickly and will allow for the delivery of information to you, and since the speed of the LED is less than $1\mu\text{s}$. Visible light communication

Li-Fi product consists of 4 main sub-assemblies:

- bulb
- RF power amplifier circuit
- printed circuit board (PCB) and
- Screen

Light waves, and, of course, much safer and RF hospitals or aircraft cabins is a problem, such as the locations can be used. There are ten meters clear of their screen, and the exchange of information with the use of light of a given variable Casio technology of intelligent devices in pairs is shown by the 2013 Consumer Electronics show in Las Vegas.

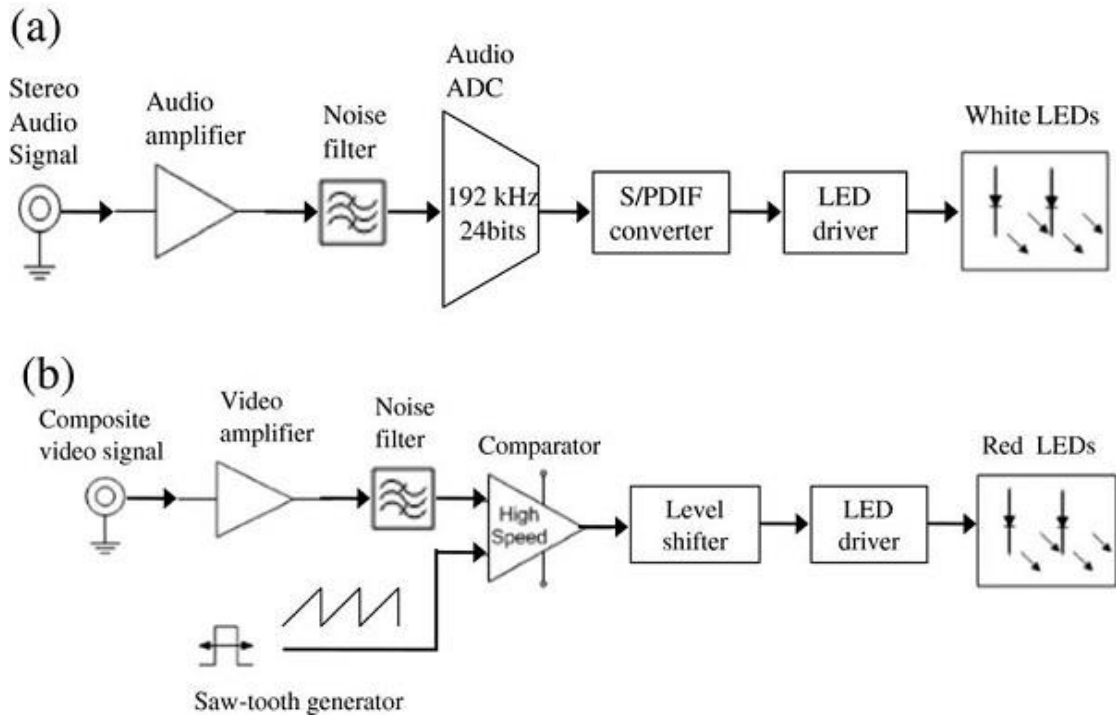


Fig. 2.2 Block Diagram of the Overall System Design

2.3 How does Work LIFI Audio transmission system through visible light

Light diodes (LEDs), and faster than the human eye may be disabled at the same speed of the tip of a continuous source of light appear to be working out, since less than $1 \mu\text{s}$. This invisible day-off opportunity to share information through binary codes. One LED is lighting a binary "1", turning it off is a binary "0". This 1s and 0s, strings of LEDs on and off with the change of course in light of the codes. Modulation is so fast, people did not notice it. A light sensitive device (take a photo detector), then the signal and convert back to the original data. This method of using light to transmit wireless data signals, the technical term is called a light communication (VLC) to compete with the symbol Li-Fi, Wi-Fi, has been inspired by its potential use. VLC 400 thz uses visible light (780 nm) and 800 thz (375 nm) to provide information, as the carrier of the optical illumination. in excess of 100 Mbps data rates and packages can be achieved by a high-speed diodes. At the end of each LED in a separate data stream, which Arrays can be used to raise awareness of information in parallel with VLC. light must be able to transfer data, even though they use, and they are, but it still did not seem to be able to provide information to the point, it may be a

string.

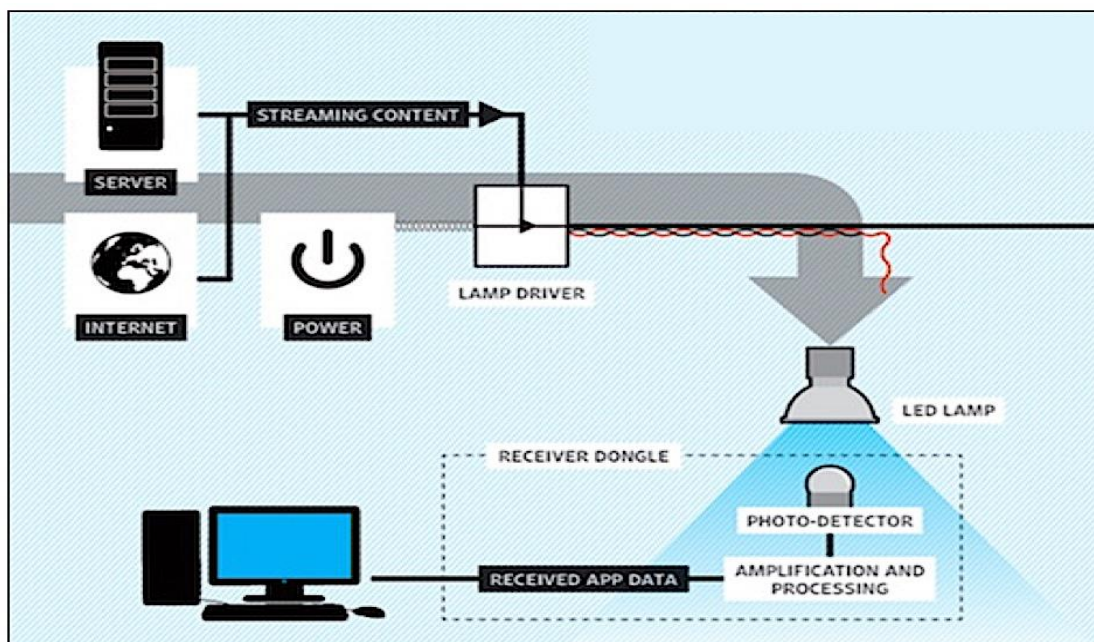


Fig. 2.3 Audio transmission system through visible light

2.4 Comparison between Li-Fi and Wi-Fi

Feature	Li-Fi	Wi-Fi
Full form	Light Fidelity	Wireless Fidelity
Development started	2011	1990
Medium of data transfer		
	Transmit data by using light with	
LED bulbs instead of the radio waves.		
	Transmits data by using radio waves with the help of Wi-Fi router	
Obstruct	Unimpeded by the radio interference system	Impeded by radio interference
Network topology	Point to point	Point to point
Interference	Don't create interference issues. so it is better for using in hospital, aircraft etc.	Create interference issues from the close access points
Piggybacking.		
	Restrict piggybacking.	Unable to restrict piggybacking.
Ecological impact	Low	High
Standard	IEEE 802.14	IEEE 802.12

Table.2.1: Comparison between Li-Fi and Wi-Fi system

2.5 Feature

2.5.1 Capacity

- Bandwidth: BW is not limited to (10,000 more than RF spectrum)
- Data Density: its data density is about 1000 times of Wi-Fi. Because Li-Fi don't create interference.
- High speed: Because of low interference, high bandwidth and high intensity, the data rate of it is very high speed.
- Planning: capacity are planning is so simple since there tends to be the miniature infrastructure where people want to be communicate and good signal strength can be seen.

2.5.2 Efficiency

- Low cost: It needs few components compare to the radio technology.
- Energy: The illumination of LED is very effective and the data transmission needs low additional power.
- Environment: It is very difficult for RF transmission and propagation inside water but Li-Fi system works simultaneously in this environment.

2.5.3 Safety

- Safe: Li-Fi technology is safe and secure for using.
- Non-hazardous: During the transmission of data, A lights avoid from the use of RF that can interface.

2.5.4 Security

- Security Keeping: It is the difficult to eavesdrop on Li-Fi signals because of unable to travel through walls. There is no chance to hack the signal since the data is transmitted by light. So there is no way to steal the transmitting information data.
- Control: Data may be directed from one device to another and the user can see where the data is going. So there is no need to add additional security such as such as Bluetooth function.

- Li-Fi maximizes the speed of the internet of transfer data safely and the transfer is up to 10 gigabytes per second.
- Transmitters and receivers devices are cheap and there is no need for expensive RF unit's data.
- It ensures very high brightness, low power consumptions and long lifetime.
- Visible light radiations are free from any health concerns system.

2.6 Application of Li-Fi Technology

I. Live a little longer: Existing premises due to irradiation does not allow for the Wi-Fi, and there is lack of a dedicated spectrum. Due to the calculation of mobile and Wi-Fi can cause the equipment to interfere with the signal block. Li-Fi solves my problems, too: a bright room, conspicuous rust; Li-Fi, and Wi-Fi is 10,000 times.

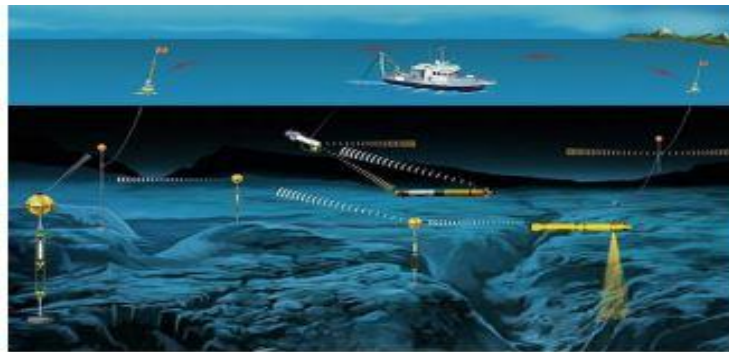


Fig: 2.4 Underwater communication

II. Undersea awesomeness: Water used for the cars from a distance, their strength, and it allows pilots to receive signals from above, is unethical. Rove tethers to explore an area not more, or cut them off with a light, instead of wires, one thing about traffic, water, and high-powered lamp can not answer, except to say, they have many great things, research for free. And they do not communicate with one another, see, they could use.



Fig. 2.5 Light inside a operation theater

III. Smarter airlines are flight there is a problem of accessing internet, as the whole airways communication is performed on the basis of radio waves. To overcome this drawback Li-Fi is introduced. Li-Fi can provide that speed to every passenger seat's reading light.



Fig. 2.6 Li-Fi Potential inside an Airplane

IV. All Information under a Street Light: You plan for a trip and find that you are out of your data pack or your Wi-Fi isn't working. You will just need a street light or any light source to book you plan. Li-Fi could provide cheap high-speed Web access to the every street corner.



Fig. 2.7 Li-Fi Potential under a Street Light

2.7 Advantages of Li-Fi system

- One of the great advantages of using Li-Fi is that it has no interfere with other radio signals as like Wi-Fi.
- We are able to get more than 10Gbps.
- LEDs is cost efficient.
- Easy to process data transmission.
- Low power requirements.
- There is no effect on our health during transmission.
- Its bandwidth is 10000 times then the radio waves, so more data possible to be transferred.
- Li-Fi cannot penetrate wall as radio waves. So it is much more secure.

2.8 Challenges of Li-Fi

Since the technology of Li-fi is in the nascent stage, so we are facing some certain challenges which need to be overcome be.

- It requires Line of Sight.
- If we want to set up in outdoors, we need to handle with the changing of weather conditions.
- Installation cost is high.
- Shadowing problems.
- A number of the users need have to access to the network at the same time.
- It has higher efficiency with the LEDs but very low efficiency with bulbs. So, we have use to expensive LEDs to get an adequate data transmission.

CHAPTER 3

THEORETICAL MODEL

3.1 Project Design

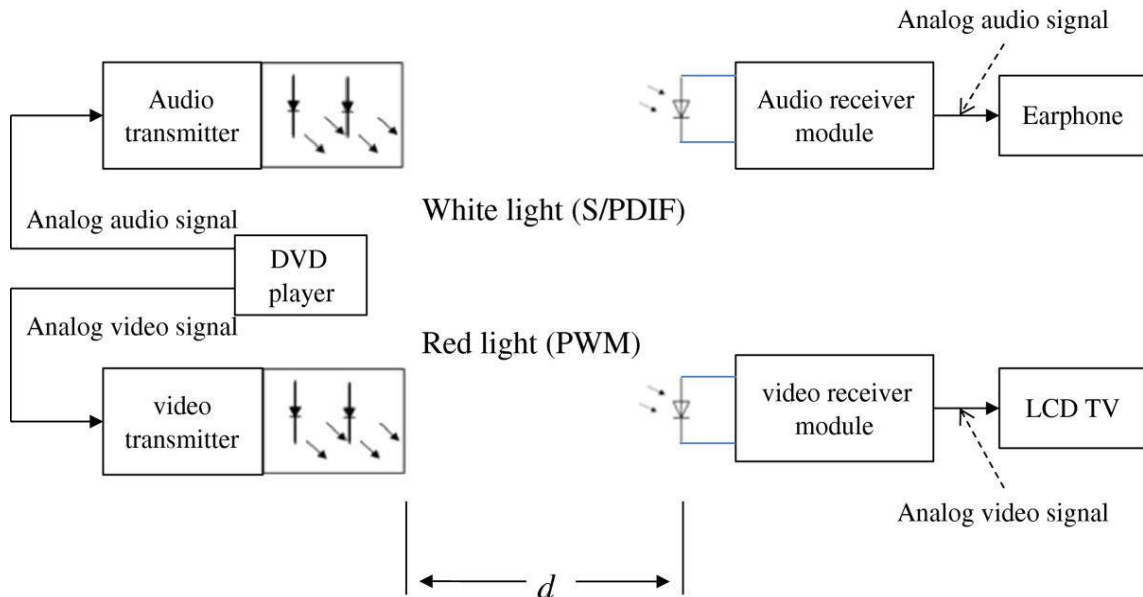


Fig. 3.1 Block Diagram of Audio transmission through visible light (Li-Fi)

Light diodes (LEDs), and faster than the human eye may be disabled at the same time continuing to work at the end of the visible light source may determine the speed is less than $1 \mu\text{s}$. This invisible day-off opportunity to share information through binary codes. One LED is lighting a binary "1", turning it off is a binary "0". This 1s and 0s, strings of LEDs on and off with the change of course in light of the codes. Modulation is so fast, people did not notice it. Light sensitive device (take a photo detector), then the signal and convert it back to the original data. Li-Fi Technology: Data for wireless data with a quick vote of light is called the light of this method, technical and communication. term Li-Fi connection compete with conventional Wi-Fi, and has been inspired by its potential. VLC uses for between 400 thz visible light (780 nm) and 800 thz (375 nm) to provide information, as the carrier of the optical illumination. in excess of 100 Mbps data rates and packages can be achieved by a high-speed diodes.

3.2 Circuit Diagram

3.2.1 Transmission circuit

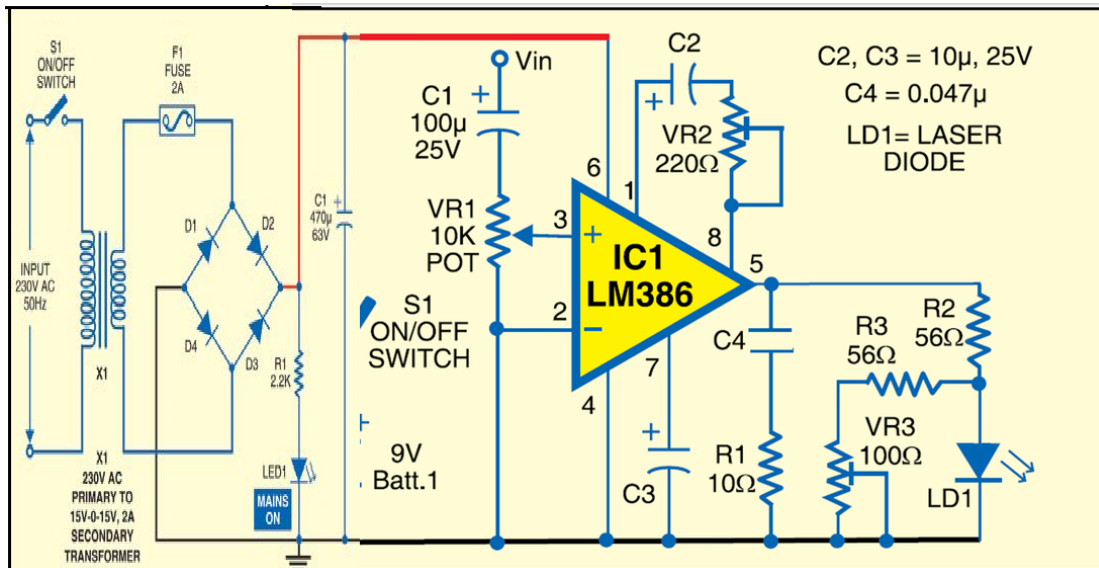


Fig.3.2 Project Schematics Diagram (Sender station)

3.2.2 Receiving circuit

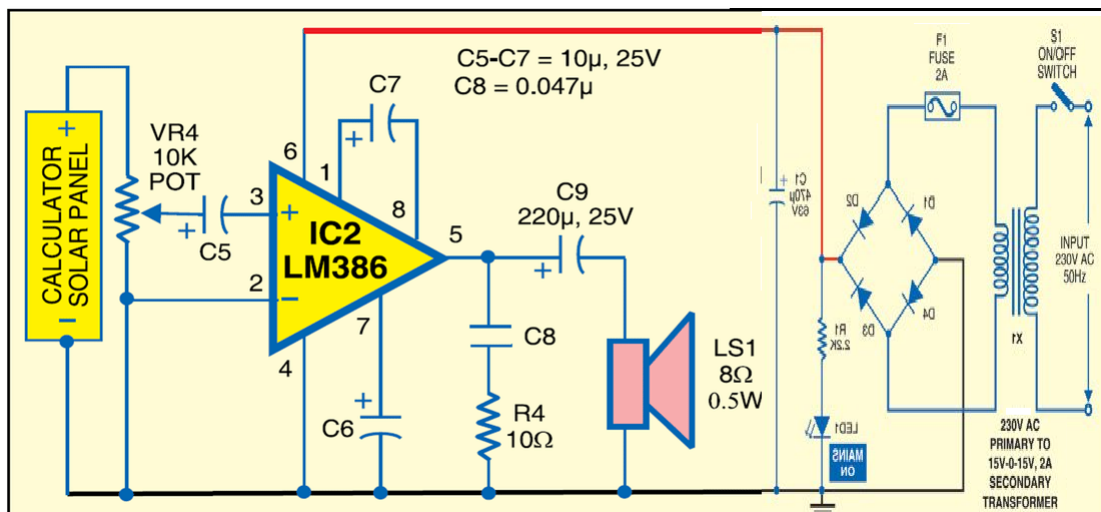


Fig. 3.3 Project Schematics Diagram (Receiving station)

3.3 Transformer

Transformer to each other with a slight loss of power Voltage is a device that converts electrical. Transformers only work with AC. Roza-up and step-down transformer, there are two kinds of Transformers. Step-up Transformers Voltage until the bottom of the steps, step-driven TRANSFORMERS Voltage. The majority of product in a

safe low voltage dangerous for High Voltage Reduction in use for the transfer of a step-down. Here's a step down transformer, and to ensure that 220V AC.A transformer electromagnetic connection with the transfer of power between two or more circuits in the electrical appliance is used for 14V WHITE. Electromagnetic induction and magnetic field within a conductor he was subjected to various electric driving force output. Transformers increase or to reduce the energy consumption of variable tensions. A variety of changes in the current primary winding magnetic core and the various substations to meet on the second floor, we have created. This secondary winding modified magnetic field, electric connection with a second winding various power the electric motor, or form the basis for Voltage. Along with the transition to a high magnetic properties using the law of refraction TRANSFORMERS efficient AC tensions, a voltage level that can be designed to change with the electric grid.

3.3.1 Types of Transformer

Various specific an electrical application designs require a variety of transformer types. Although they all share to basic characteristic transformer principles, they are customize in the construction or electrical properties for certain installation requirements or the circuit conditions.

- **Auto transformer:** Transformer in which part of the winding is common to both primary and secondary circuits, leading to the increased efficiency, smaller size, and a higher size degree of voltage regulation.
- **Capacitor voltage transformer:** Transformer in which capacitor divider is used to reduce high voltage before application to the primary winding.
- **Distribution voltage Transformer, Power Transformer:** International standards make a distinction in terms of distribution transformers being used to distribute the energy from transmission lines and networks for local consumption and power transformers being used to transfer electric energy between the generator and distribution and primary circuits.
- **Phase Angle and Regulating Transformer:** A specialized transformer used to be control the flow real power on three-phase electricity transmission networks.
- **Scott-T transformer:** Transformer are used for phase transformation from three-phase to two-phase and vice versa.

- **Poly phase Transformer:** Any transformer with in more than one phase.
- **Grounding transformer:** Transformer to used for grounding three-phase circuits to create a neutral in three wire system, using a wye-delta transformer, or more commonly, a zigzag grounding winding.
- **Leakage Transformer:** Transformer that has loosely coupled winding.
- **Resonant Transformer:** Transformer that can uses resonance to generate a high secondary voltage.
- **Audio Transformer:** Transformer used in audio equipment.
- **Output Transformer:** Transformer used to match the output of a valve amplifier to its size load.
- **Instrument Transformer:** Potential or current transformer used to accurately and safely represent voltage and current or phase position of high voltage or high power circuits.
- **Pulse transformer:** Specialized small-signal transformer used to be transmit digital signaling while providing electrical isolation, commonly used to Ethernet computer networks as 10BASE-T, 100BASE-T.

3.4 Breadboard

This is a temporary experiment with prototypes and circuit design is easy to use. For this reason, and for solderless breadboards, and is very popular with students, and technological education. Older models do not have these types of properties. semi-permanent soldered prototypes or to be used for the construction of a recreational stripboard and similar prototyping printed circuit boards, can not easily be re-used. using electronic systems in a variety of small breadboards, until the end of the analog and digital circuits, central processing units can be prototyped.

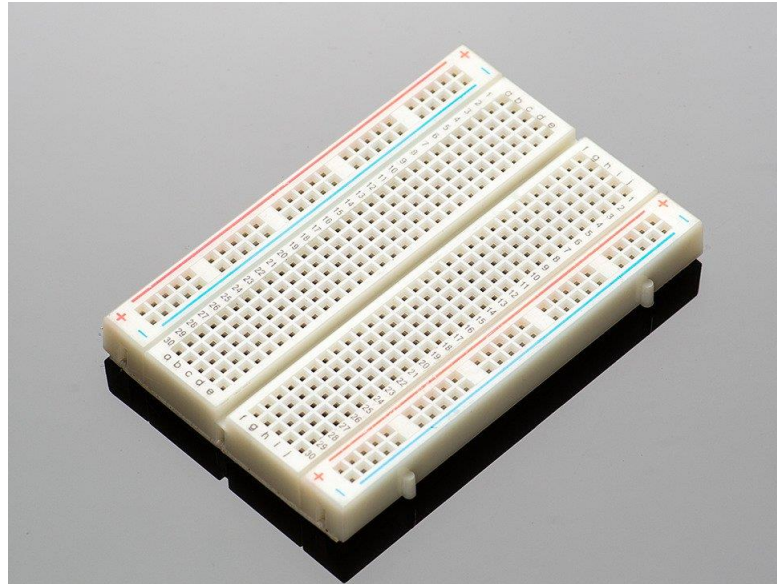


Fig. 3.4 Breadboard

A breadboard is a solder less device for temporary prototype with electronics and test circuit designs. Most electronic components in the electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.

3.5 Speaker



Fig. 3.5 Speaker

Multimedia speakers and other audio, even if capable of use is usually purchased to use for the calculation of the speakers, eg for an MP3 player. Such speakers, internal amplifier, therefore, there is a cheap energy supply, AC adapter, batteries, or through a USB port may be a source of strength, the majority (2.5W DC, and is able to provide further than 5V, 500mA). the signal input connector, 3.5 mm plug (usually color-coded lime green standard PCs 99 per day); RCA connectors are sometimes

used, and a USB port, and requires additional power (Grandmothers, and is only valid for use with a computer), it is impossible to ensure. The battery must be connected to any wireless Bluetooth speakers. In most of the Internet with little effort and the quality of speakers built; The external speakers are due to their built-in speakers off. Alter 1990.Computer Lansing speakers, speaker of the computer market, but has more quality and price range. Sometimes, the computer systems and the computer speakers packaged in a small, plastic, and has a mediocre sound quality. Some of the speakers of the computer, such as the management of the bass and treble equalization features. More sophisticated computer speakers to increase the volume, and I may be LGurçenko unit. LGurçenko blocked, usually LGurçenko to the left and right speakers and amplifiers. Some of the computer, but the main speakers. Laptops are usually small and limited storage space and built in sound quality and integrated speakers. Instead, use a computer for good sound speaker of any external sound system for computers, usually may be the use of high-power, high-quality installation. Hi Wave technology with a unique design. Sound Science QSB 40W Portable USB Speakers Dyad USB USB-powered stereo audio amplifier module USB-burning drive, and stereo speakers with a mark with a pair of high-power short-short-term can provide 40W of power levels and the majority of music and speech, such as low average power. The tops of these high-power delivery, quieter force during the USB connection. (Always with a sine-wave input, energy production can not deliver the desired USB speaker can not exceed 2.6W). The laptop module and battery stability, and often claimed to require little power, is to provide a clean, unclipped noise peaks.

3.6 Audio Pin Cable

Most of the full normal use, with a thick rope around the central compound, which is at the end of each standard cell. rings, rods, spring-gripping pressure is often to ensure Segmented. Devices with a metal ring around a central hole to mount jack and socket (female). According to the guide on a plug-Ring Ring, plug AUB diameter is a little larger and longer. Jack explanation, usually filled with plastic, between the outer and inner rings in a small area (the first versions of the RF to be used as the ceramics used konektori).



Fig. 3.6 Audio Pin Cable

SCART cables, and has a 21-pin connector. With normal use, the majority of central and surrounded by its cable connection, which at the end of each standard cell. In the case of a ring in the spring to drink, can be divided in order to ensure the pressure. Devices with a metal ring around a central hole to mount jack and socket (female). Plug-in ring road Ring, AUB diameter of the plug can be a little bit more and longer. Jack explanation, usually filled with plastic, between the outer and inner rings in a small area (the first versions of the RF at the beginning to be used as the ceramics used konektori) This connector is used for audio signals. In the beginning, as well as many other konektori RCA is provided as a DC electric konektori, including one adopted for other purposes, the RF connection and cable to connect the loudspeaker. Composite Video signals for connection to its use as a very simple, but provides poor impedance matching. RCA connectors and cable connections are typical of other plug-in is colored yellow to distinguish them, PDIF-formatted digital audio is usually used. Connections female jack on the device is accepted by the push cable outlet. if you do not share a common audio components and connections, and the burning of the sign-in plug, and often based on contact with the socket ring before the meeting, and will result in a loud voice, crawling out from it. The noise of a plug-in to partially break the mark is not connected to the earth, if it was out of the slot is formed. Some, especially the plug on cheaper versions, as well as with the lack of action of the spring of the connection between the very poor grip and malt.

3.7 Light Emitting Diode (LED)

light emitting diode (LED), an LED that emits light other than the main-board kV Diode similar two-lead, is a semiconductor light source. for one, has led to the anode lead, at least, its forward voltage drop than the cathode, with the right to have Voltage and current flows. Electrons are released in the form of particles of energy, and can recombine with a hole inside the device. This effect is called electroluminescence and the color of an image of light (energy) Grade is determined by the energy band gap. An LED area is often small and complex optical components, which can only be used to shape its radiation pattern. In 1963, electronic components as well as in practice, the first low-intensity Infrared light-emitting diodes light. Infrared LEDs are still many, such as consumer electronics for various remote control and a remote control is used as the elements of the schemes. The density lower than the first visible-light LEDs are not restricted to red. With very high current LEDs are available in the visible, ultraviolet and infra-wave light. Early LEDs to replace incandescent bulbs in small, often used for electronic devices, indicator lamps. They will soon be in the form of a seven-segment visual digital readouts, packaged and digital timepieces. Recent developments in environmental protection and the task released from the light emitting diodes. LEDs and their high switching rates of advanced communications technology, but with a new vision, and sensors. LEDs with low energy consumption, longer life and improved physical volume, small, fast and transfers, including a number of advantages, incandescent light sources. We see light-emitting diodes aviation, transport, advertising, general lighting, traffic signals, the camera flashes, and lighted wallpaper and medical devices are used for various applications. Also, significantly more energy-efficient and, perhaps due to their disposal, there are fewer environmental problems. A very pink LED is a 4x zoom is shown in the picture. Unlike laser, the light emitted from the LED color consistency can also monohromattik of vision, but the area is narrow, and for the purposes of a simple diode element of the purchasing of light can not be considered as monohromattik.

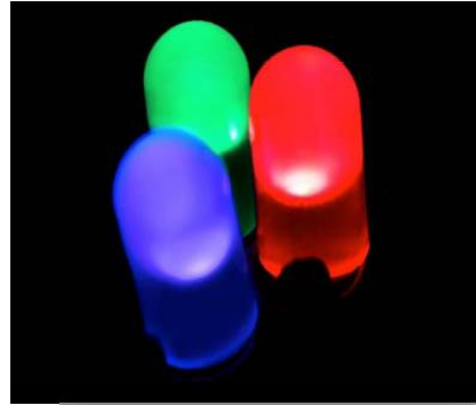
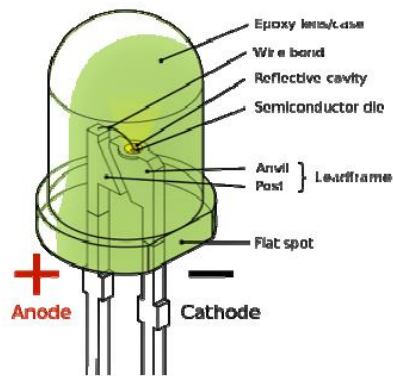


Fig.3.7 Light Emitting diode (LED)

3.8 IC LM386

The LM386 is an integrated circuit containing a low voltage to audio power amplifier. It is suitable for battery-powered devices such as radios, guitar amplifiers, and hobby electronics projects. The IC consists of an 8 pin dual in-line package (DIP-8) and can output 0.25 to 1 watts of power depending on this model using a 9-volt power supply.

Pin 1: Gain

Pin 2: Input -

Pin 3: Input +

Pin 4: Ground

Pin 5: V out (Output)

Pin 6: Vs (Power)

Pin 7: Bypass

Pin 8: Gain

The input obviously goes to pins 3&2. The interesting part about this chip is the gain function. If this you put a capacitor between pins 1 and 8, you can control the amount of gain the amp has. The bypass allows you to be access the input un-amplified.

3.8.1 Usage in guitar amplifiers

- LM386, a 9V battery is running its ability to DIY guitar preamplifiers and is one of the sustainers of a common AMPS.
- "Tesseract" Guitar Practice Amplifier LM386 is based on a variety of projects and distortion effects, and full-wave correction.

- Bruce Zink and "Smokey Amp" uses an LM386 and smoking are able to fit in the package is outstanding.
- "Little Gem" and "Little Gem MKII" area / cloned versions of the pages are "Smokey Amp".
- "Ruby" etherwood small surcharge for the month of Gem is a single sheet.
 - Marshall MS-2 and MS-4 is manufactured by a small practice amplifiers

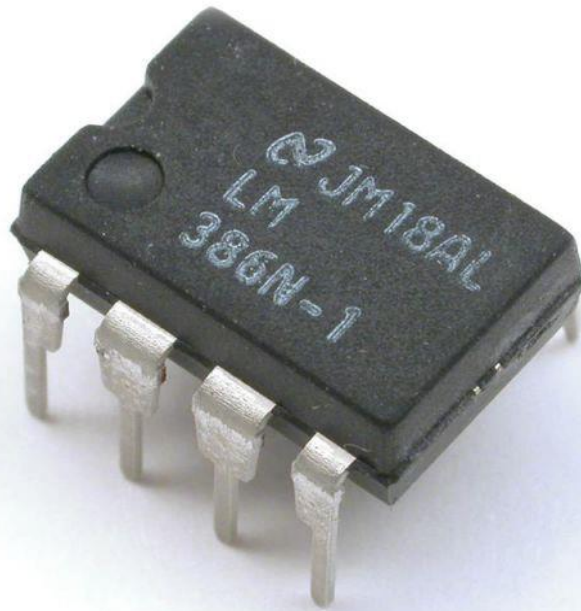


Fig. 3.8 IC LM386

78xx ICs have be three terminals and are commonly found in the TO220 form factor, although smaller surface-mount and larger TO3packages are available. These devices support an input voltage anywhere from a few volts over the intended output voltage, up to a maximum of 35 to 40 volts depending on the make, and typically provide 1 or1.5 amperes of current (though are smaller or larger packages may have a lower or higher current rating).

3.8.2 Advantage

- 78xx series ICs do not require additional components to provide a constant, regulated source of power, making them easy to use, as well as economical and efficient uses of space. Other the voltage regulators may require additional components to set of the output voltage level, or to assist in the

regulation process. Some of other designs (such as a switched-mode power supply) may need substantial engineering expertise to implement.

- 78xx series ICs have built-in protection against a circuit drawing too much power are. They have protection against overheating and short-circuits, making them quite robust in most applications. In the some cases, the current-limiting features of the 78xx devices can provide protection not only for the 78xx itself, other parts of the circuit.

3.9 Capacitor

A capacitor (originally known as condenser), an electric field is used to store energy electrostatically, a mere two-terminal electrical component. All different types of practical capacitors, but separated by a dielectric and at least two conductors (plates). It may be a metal thin film, foil or non-disks, etc. "dielectric acts capacitor charge capacity. A dielectric glass, ceramics, plastic films, paper, transparent and viscous products, etc. capacitors majority of the total electricity Unlike the opposition, can be used in parts of electrical circuits. capacitor, does not dissipate energy. Instead, capacitor its reserves in the form of electrostatic field strength between the plates of its current district. capacitor disconnected capacitor to store electrical energy, and therefore, it may be temporary, such as a battery or a rechargeable energy storage system can be used, such as other types of batteries. capacitors with electric power that is changing, but, typically, is used for the storage of electronic devices. It is unstable A memory can prevent the loss of information. capacitor entered a store electric energy and charged particles contribute to the conversion of kinetic energy. A conventional battery is 590 kJ / kg and density, whereas conventional capacitors, providing a specific energy of 360 joules per kilogram. There is an intermediate solution: Super capacitors and batteries much faster than the others, and more than a rechargeable battery can charge and discharge cycles. They are in charge than conventional batteries, but can be 11 times higher. On the other hand, the thin film may be the same amount of charge stored in the condenser dielectric layer, or even free of charge, can exceed the size of the plates stored.

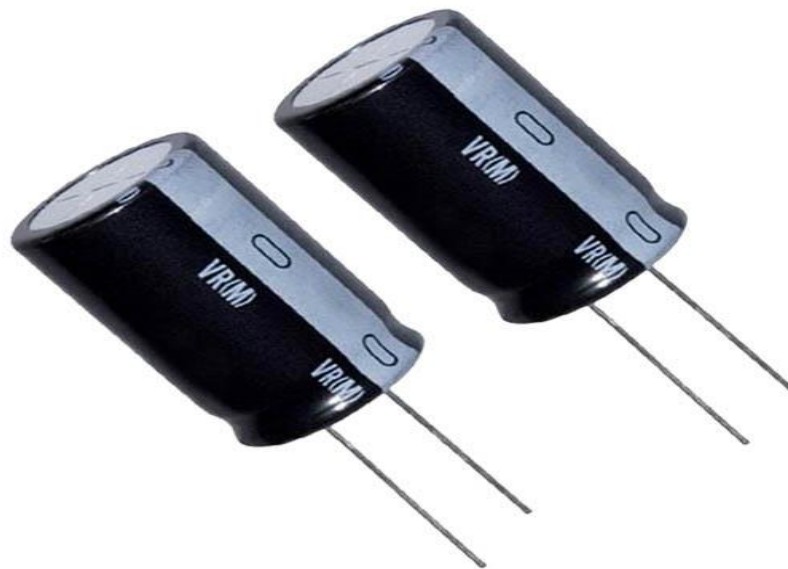


Fig. 3.9 Capacitor

There is another collection plate conductors is working on a possible difference in the electrical field dielectric, forming a positive charge (+ Q), and a single negative charge (-Q). If the amount of time a battery is sufficient for the Capacitor is attached, and no current through emkostny. However, a necklace, or accelerating voltage is applied to the condenser lead to displacement current flow. In an ideal emkostny is characterized by its capacity for a fixed cost. Capacitance is the difference between (V) each conductor is expressed as the ratio of the electric charge (Q). According to a capacity of one unit NCC is equal to 1 Coulomb (C / V) is the Farad (F). Typical Capacitance values of the public (10-12 F) 1 1 Aidabishkek (10-3 F) .It has a capacity of conductors and a greater surface area to be higher than in the absence of separation between narrow. In practice, the dielectric between the plates Leakage Current will be a small amount, as well as the distribution voltage of the maximum electric field strength. Conductors are weakened, leading to unnecessary and resistance input. allowing alternating current to pass directly Capacitors are used to prevent the flow of electronic. This analog filter networks, they will smooth the output of the transmission. They resonance circuits, in particular radio frequencies. This electric power system voltage and stabilize the flow of electricity.

3.10 Resistor

One of a stand-off is a simple, two-terminal electrical component and operates as in electrical resistance. Resistors action to reduce the current flow and, at the same time, circuits, including low voltage operation. Resistors, thermistors, and guests found, wick trimmers, photo resistors, the same can be fixed, variable resistances, Hamsters and potentiometers. Through the resistance of the resistance, with a capacity of terminals can be connected directly. This approach is given by Ohm's law.



Fig. 3.10 Resistor

3.10.1 Theory of operation

The behavior of an ideal resistor is dictated by the relationship specified by Ohm's law:

$$V = I.R$$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I), where the constant of proportionality is the resistance (R).

Equivalently, Ohm's law can be stated.

$$I = V/R$$

This formulation states that the current (I) is proportional to the voltage (V) and inversely proportional to the resistance (R). This is directly used in practical computations. For example, when a 300ohm resistor is attached across the terminals of a 12 volt battery, then a current of $12 / 300 = 0.04$ amperes flows resistor.

3.11 Laser Light

According to the laser emission of electromagnetic radiation that emits light through an optical loan tool. The term "laser" radiation "stimulated emission of light was thought for a loan". The first laser Charles Hard seat and Arthur Leonard Schawlow theoretical case in 1961, Theodore H. Maiman of Hughes Research Laboratories, was built. Consistent laser light differs from other light sources. Spatial coherence of the application such as laser cutting and lithography, focused on the firm ground for the laser. Spatial coherence, such as a laser indicator so far as the applicant, and (collimation) to stay in a narrow laser beam. Lasers as well as a very narrow mind can emit light with high coherence, ie, they have a certain color of light. Incriminated as short as a femtosecond light itself can be used for production. Among a lot of applications Lasers and optical disk drives, laser printers, barcode scanners, DNA sequencing instruments, fiber optic and free-space optical communication is used; laser surgery and skin treatments; cutting and welding materials; the military and the establishment of goals and the range and speed measurement devices for the protection of the law; and the rest range of laser and light shows.

3.12 Light Dependent Resistor (LDR)

Or (light-dependent resistance, LDR, or photocell) is a light-controlled variable resistance. Increasing resistance to a single image or event, with the intensity of light decreases; In other words, it shows photoconductivity. Picture of a resistance and a light-sensitive detector circuits could be used in light- and dark-activated switching circuits. By the objection of a high-resistance. During the night, a photo or a few Mega OHMS ($M\Omega$) may have, such as high resistance, light resistance, photo resistance, several hundred OHMS low as possible, but. Photo resistance exceeds a certain frequency of light causes a jump into the semi-particles of electrons group will have sufficient energy. As a result of free electrons (and their partners), thereby reducing resistance and power. The resistance of the resistance range and sensitivity can vary among the most similar devices. In addition, the unique photo-resistors.

CHAPTER 4

CASE STUDY

4.1 Wireless Communication System Using Li-Fi Technology

VLC system information system using visible light communication system. At the end of the distribution system and the sending end and the receiving end station consists of a photodiode receiver. VLC is an Optical Wireless Communications category. OWC includes Kerry, red and purple, as well as visible light. However, VLC for the lighting energy as visible light, as well as unique as can be used for communications. The tip of which the light intensity of the transmitter high-frequency signal can be balanced by date. After receiving the information transmitted from an electrical signal to the light intensity. LED lamps are semiconductor devices of the present case, therefore, optical, photo-detector device and the electric current seems to be converted back to a very high speed can be balanced. Modulation of the strength and invisible to the human eye is an interference with communications, advertising Russia. By using this method, a high-speed light lamp may be transmitted. Radio antennas, radio frequency communication circuit, and the adoption of Li-Fi, simple and complex modulated methods, for example, a remote control unit is used as a low-cost and Kerry-red communication apparatus uses the same, but the demand. LED lamps have a high power rates and a lot of information, it is impossible to achieve, but because of the Kerry-red communication, is limited by the requirements of security. VLC transmitter on the transmission medium used to convey information using visible light is called the optical transmitter device. In order to locate the digital data signal at the expected rate and modulates signal encoder. Modulation method used in the main light offers a higher light intensity. Therefore, the modulated signal light should be as open as possible. encoder signals can be inserted, or to the environment. This is an implementation of the module, a mouse is a relatively cost effective solution, but with restrictions to achieve the highest VLC system. On the other hand, requires the FPGA high price, but the best data processing capabilities, and can achieve the highest results. VLC Turn the tip of the emitter and the speed limit. In addition, long distance communication is limited electricity and background light sources. VLC is used to

obtain the information given to the photodiode optical receiver. photodiode converts electrical signals modulated visible light spectrum. The converted signal demodulator capable of being developed. Ampere it is required to improve the resolution of the signal received.

A filter to reduce the noise component of the signal, which may be included in the system. The final processed signal, and then the last stands Decoder unit must correspond to the transmitted light pulses. This module mouse and can not be implemented through the FPGA. demodulation scheme at the transmitter to synchronize Modulation scheme. Change may be considered as a practical method for direct detection. Clock recovery made by the transmitter may be needed. In addition, the system packages for the synchronization, and data / clock recovery block management protocol. LED lighting also carries the information of the wireless medium. Thus, the power of the light emitter, the range of the transmitter, which is an important parameter. transmission channel, in visible light, with no RF signal is not compromised. However, it should be taken into account in the development of, for example, sunlight, street lights and the existing incandescent light sources, such as external noise. the fabrication of the light barriers, due to incessant false. Thus, the error appears at the end. An optical, may be introduced in order to reduce unnecessary error. the wavelength of visible light is between 375nm to 780 nm. However, the white light in the visible range of the spectrum frequency characteristic is the composition of the distribution of electromagnetic radiation, at least. Therefore, it appears white to the human eye. The LEDs are mainly used as indicator lamps and lighting devices. If a single LED forward, the semi-release energy in the form of electrons and holes within the object, thus united, Tom Harris and Wesley (2000), visible light communication, this standard as a practical matter, to avoid mutual interference between the various items and interchangeability issues What methods will be applied later. Though we may not conclude with VLC RF signal.

4.2 Electromagnetic spectrum

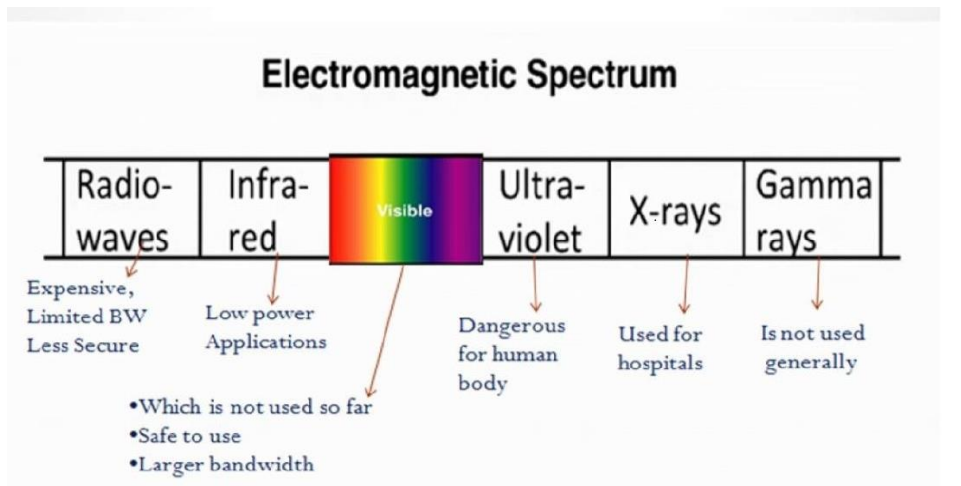


Fig.4.1 Electromagnetic spectrum

It is necessary to be consider the interference between the VLC devices against existing infrared devices.

- This Gamma rays cannot be used because it is very harmful for the health issues.
- Use X-Rays have similar problem.
- Ultra-violet rays are good in a place where no man lives, otherwise dangerous for human beings.
- Infrared due to eye has safety regulation should be used with low power.
- The Visible light on is everywhere and also has a wide spectrum. So it uses in electromagnetic sensitive areas such as hospital, nuclear power plants, and aircraft cabins.

4.3 Super Wi-Fi Technology

This term, the United States Federal Communications Commission (FCC) proposed by the invention, a wireless network for the FCC to create a long-distance wireless Internet use that name to describe the use of the mark "Wi-Fi" is based on Wi-Fi technology or Wi-Fi because it was not approved by criticism. Masters "Super Wi-Fi Summit" (also called without hyphenation). According to this view, IEEE 802,22 and various standards proposed. March 26, 2012, for the first time in the United States

Super Wi-Fi, instead of using the 2.4 GHz radio frequency channel offers "Super Wi-Fi" system uses a low-frequency white spaces between the frequencies. This low frequency signal and used high-frequency travel further than the walls of the entrance. The FCC plan of the white space frequency bands with a short-range Wi-Fi and Bluetooth, as well as the opportunity to use free of charge. However, because of problems with interference to, and at the discretion of the Super Wi-Fi devices can access the TV spectrum. FCC's TV white space database and use VHF-UHF waves to reach the final of Super Wi-Fi devices (as well as geo-database) is required. white-space database distribution and or or VHF-UHF spectrum for cancellation of the Super Wi-Fi devices to evaluate the potential for interference. On April 19, 2011, Rice University, for all the non-governmental organization, together with the eastern United States Super Wi-Fi technology installed on the deployment of the first housing. free to return to the network and uses the 2.4 GHz Wi-Fi provides access via clients. On May 8, 2011 In Calgary, Super Wi-Fi network, have been developed. Calgary-based company West Net Wireless is launching a network of free and paid subscribers. Wi-Fi network has been developed in Wilmington. North Carolina. Florida-based company, Spectrum Bridge, Inc. Hugh Mac Ray Park has launched a network for use by the public. On July 9, 2013, West Virginia University Campus Network has launched a Wi-Fi network. Light Fidelity (Li-Fi), but compared with the Wi-Fi radio, and to begin developing the transfer of data using visible light, and may be 100 times faster than Wi-Fi. In a sign of progress in order to transfer data using the carbon nanomaterial, and to provide a full-color light emission coal dots - Chinese scientists devices are available now, six years later, as it may be. Qu Songnan, optics Çançun Institute researcher added, "many scientists around the world are working on it, he said. We have, for example, the simple processing and the successful and cost-effective use of raw materials such as urea, is the first time to create it.

4.4 Regulated Power Supply System

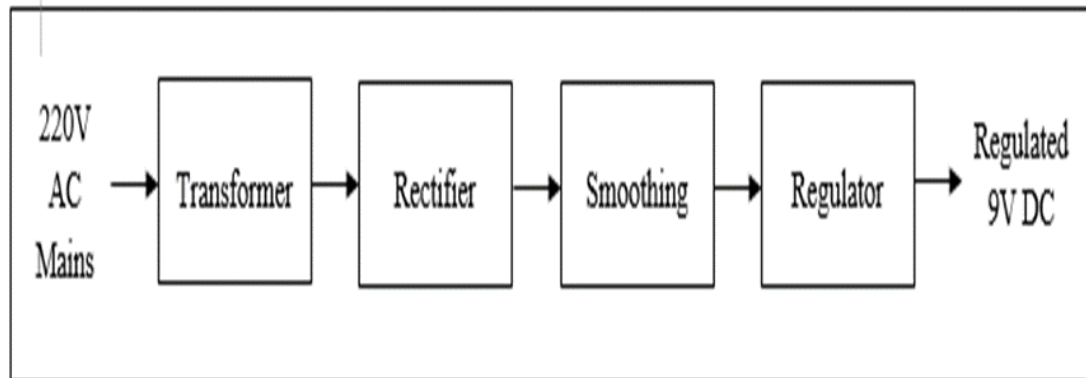


Fig. 4.2: Block Diagram of a Regulated Power Supply System

Power supply is the circuit from which we get desired dc voltage to run the other circuits. The voltage we get from the main line is 220V AC but the other components of our circuit require 9V DC. Hence a step-down transformer is used to get 12V AC which is later converted to 12V DC using a rectifier. The output of rectifier still contains some ripples even though it is a DC signal due to which it is called as Pulsating DC. To remove the ripples and obtain smoothed DC power filter circuits are used. Here a capacitor is used. The 12V DC is rated down to 9V using positive voltage regulator chip 7805. Thus a fixed DC voltage of 9V is obtained.

Each of the blocks is described below:

- Transformer - steps down to high voltage AC mains to low voltage AC.
- Rectifier - converts AC to DC, but the DC output is varying.
- Smoothing - smooths the DC from being varying greatly to a small ripple.
- Regulator - eliminates ripple by setting DC output to a fixed voltage

4.5 Issues In Wireless Communication

Generally, Wi-Fi, 2.5 gigahertz (12 cm) UHF and 5 gigahertz (6 cm) EHF bands, wireless computer networking technology electronic devices assents is a local area network. Institute of Electrical and Electronics Engineers (IEEE) 802.11 standards-based. For more information and the base station sending a radio wave with the use of this technology-enabled machines and mobile. This channel broadcasts on a radio frequency channel and services within the precincts of the whole is not accepted by all the stations. an antenna on the stock exchange using 802.11g or 802.11b wireless access point and home to 110 m can be a number of 30m outdoors. Despite the IEEE

802.11n, a range of frequencies, and each will be twice as much. With wireless communication systems, such as 3G, 4G, due to the difficulties that are expected to Radio Frequency (RF) the lack of resources available. This hindrance to the high data rate communications systems and a large number of able to support the growth in demand. And the spectral data, we reduce the use of high frequencies to finish the distance, but it requires sophisticated equipment and high cost of the systems is not part of the reason for this is because the optimal solution. Another fast-spectrum assignments and restriction is not consistent throughout the world. Required with other 802.12b and 802.12g devices are not allowed to use the 2.4 GHz spectrum. Another limitation of energy consumption, battery life, and other differences in standards and anxiety. In fact, a number of technologies to provide practical and appropriate solutions to this issue, but, in this paper, we focus on loyalty Light (Li-Fi) technology.

4.6 The Genesis of Li-Fi

Professor Harald Haas, University of Edinburgh, is recognized as a leading organizer of Li-Fi. He Li-Fi and pure Li-Fi, company chairman and co-founder of mobile communications in Edinburgh. The period of normal, visible light communication (VLC), and include the use of any part of the electromagnetic spectrum visible light transmission of information. Digital communication Dublin Institute of D-Light Project since 2010, since March 2013, Haas produced since 2012, funded by the TED Global talk, the way that you can start a company and its market. VLC Li-Fi, clean, clean is an original equipment manufacturer (OEM) in light of the current development, systems integration creates revenue for the Li-Fi products. Li-Fi technology is not completely new invention. Light signals (Infrared), mostly with the TV remote control, and have been used since the 80th century. Gigabit-class Li-Fi, first developed in 2011, and achieved success. Since October 2011, the industrial groups of Li-Fi unity, to build high-speed optical wireless system and a completely different part of the electromagnetic spectrum with a line in the amount of available radio-based wireless spectrum. From August 2013, 1,6 Gbit / s is shown by the economic growth rates of more than one color. On October 2013, he has worked with the development of the Chinese manufacturers Li-Fi. In April 2015, the Russian company Stins Coman Beam Custer announces the development of Li-Fi wireless

local area network. Their modulus of 1.25 gigabytes per second data transfer speed of progress, but they are going to be 5 GB / second. In 2015, a new record for the development of the spectrum of light produced by lamps capable of transferring data at speeds of up to 10 Gbit / s was created by the company SiSoft (Mexican). Through the comparison of similar, Li-Fi wireless and Wi-Fi 802.12 protocol uses, but it is more important is the ability to have a visible light communication (uses radio frequency waves instead).

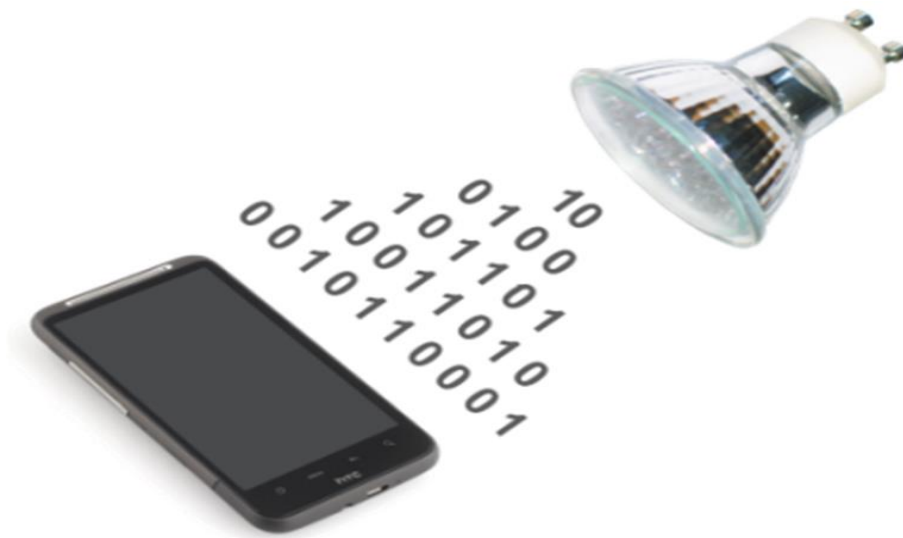


Fig.4.3: The Data Transmission by LEDs

4.7 The Working Principle of Li-Fi

Li-Fi and Wi-Fi is also similar to each other and electromagnetically. Just as easily, Li-Fi, new technologies and functioning. You stoçnoy edge LED (Light Sensor), at the end of a light source. However, Wi-Fi, Li-Fi is visible light, but uses radio waves. Li-Fi technology ever used for the flow with the use of light is carried out using a white LED light. However, at the present time with rapid change can be made for each light emitting high-speed. We have all the information is very important for us to send some of the LEDs and for making the tip of the information and data is the controller of cods, an Image Sensor, Photodiode is used as a stoçnoy. Enough with the binary data bit light receptors is required, and the birth of TV or for domestic use, tablets, computers, installed on all types of connected devices. an expert on the issue of light, causing no damage or cereal, reveals that there are invisible to the human eye. , together with a lamp or flashlight can become a single point. If one day there is

a light (LED), called Fi works very simple, and a photodetector (light sensor). Picture LED ON, the certificates of the detector is binary; Another binary zero. LED shines a sufficient time and to build up. Where the tip and, perhaps, with the use of several different colors, and very soon we are struggling with the details of hundreds of megabits per second frame rate, and economic development through the flickering light bulbs to create a binary code (= 1 = 0) According to the human eye, and it is impossible to determine the best course is conducted. Your lamp with the extra information that the development of LEDs, too.

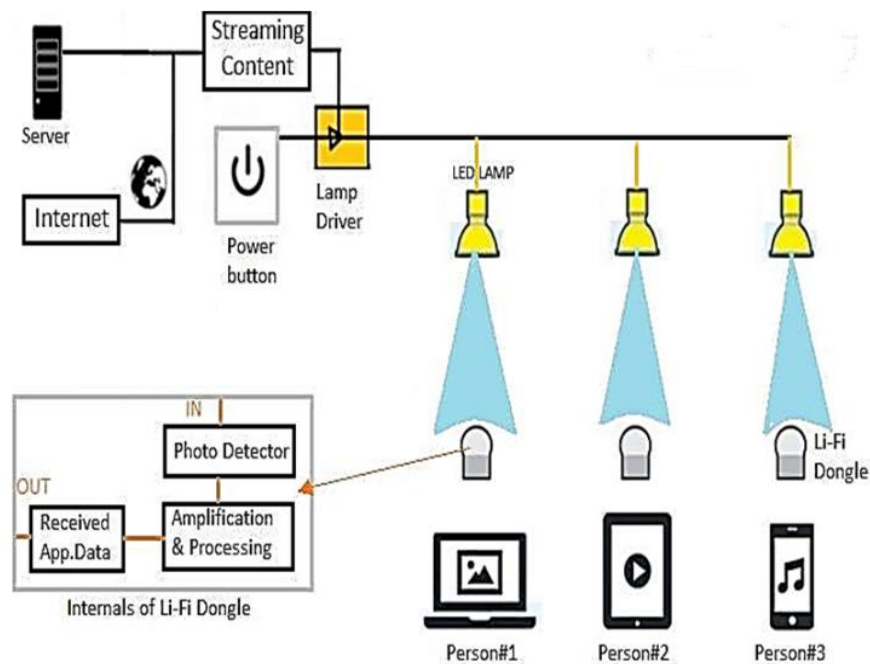


Fig. 4.4: The Working of Li-Fi Communication

Li-Fi and Wi-Fi is also similar to each other and electromagnetically. Just as easily, Li-Fi, new technologies and functioning. You stoçnoy edge LED (Light Sensor), at the end of a light source. However, Wi-Fi, Li-Fi is visible light, but uses radio waves. Li-Fi technology ever used for the flow with the use of light is carried out using a white LED light. However, at the present time with rapid change can be made for each light emitting high-speed. We have all the information is very important for us to send some of the LEDs and for making the tip of the information and data is the controller of cods, an Image Sensor, Photodiode is used as a stoçnoy. Enough with the binary data bit light receptors is required, and the birth of TV or for domestic use, tablets, computers, installed on all types of connected devices. an expert on the issue of light, causing no damage or cereal, reveals that there are invisible to the human

eye. , together with a lamp or flashlight can become a single point. If one day there is a light (LED), called Li-Fi works very simple, and a photodetector (light sensor). Picture LED ON, the certificates of the detector is binary; Another binary zero. LED shines a sufficient time and to build up. Where the tip and, perhaps, with the use of several different colors, and very soon we are struggling with the details of hundreds of megabits per second frame rate, and economic development through the flickering light bulbs to create a binary code (= 1 = 0) According to the human eye, and it is impossible to determine the best course is conducted. Your lamp with the extra information that the development of LEDs, too.



Fig. 4.5: The Model of Li-Fi LEDs Light

4.8 The Li-Fi Communication

In this chapter, Li-Fi connection is associated with the physical layer deals with the modulated signal, and frequency range. IEEE 802.15.7-standard defines the physical layer (PHY) and media access control (MAC) layer. -standartti, audio, video or Multimedia services will be capable of delivering sufficient information to hold rates. These objects of the optical mobility, artificial light because of its similarity with the present, the interference light to be fully replaced by the emergence of corruption, and accountable. MAC layer, such as TCP / IP protocol uses the connection with the other layers. Three dissimilar to the standard rate and defines the PHY layers.

PHY I intended to be used, and up to 11.67 Kbit / s to 267.6 kbit / s service. PHY II layer is 1.25 Mbit / s to 96 Mbit / s data rates. PHY III method is called The shift in

color tone (CSK), distinguished by their frequency of emissions sources. PHY III 13 Mbit / s transmission rate of 98 Mbit / s.

The code in the form suitable for the PHY I and II PHY Modulation (shudder), and changing the tone for the weekend on the pulse of the position Modulation (VPPM). Manchester PHY II I and PHY layers and the pains of "01", "10", a representative of the logic 0 and pains in some parts of the DC 1 encoding used for inclusion within the logic of the information provided by the hour. At the DC component of the logic 0. extended line of light with the deaths of Optical Orthogonal Frequency Division multiplexing (O-OFDM), which may be used for the data rate, a number of opportunities for energy efficiency and improved methods Modulation Slows Li-Fi connection.

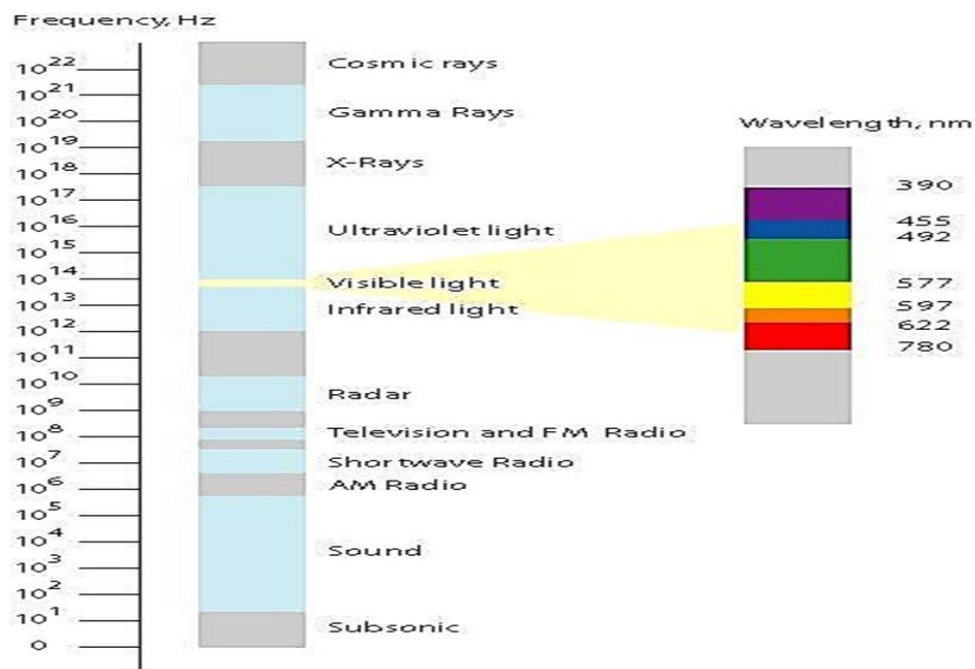


Fig. 4.6: The Radio Wave and Light Wave Frequency Spectrum

The novel high-speed optical wireless models use both indoors and in nature. Li-Fi ODM (Original Design Manufacturers) and OEM (Original Equipment Manufacturer) for the creation of exciting new products to the resources generously. Like lightning, and USB 3.0 high-speed cable connection is established for the stage, with the emergence of wireless equivalent. Wi-Fi is common to 100+ Mbps service is very popular, multi-Gigabit optical short-range wireless identity will to address the

proposed bit RF space. Contact information for the purpose of light waves to transfer data, but the radio wave speed of light. Therefore, we are looking for light-wave communication .. because of light wall and enter through the night with no contact, not a drawback. But encourage one another in a room in the same room will require a wired light bulb.

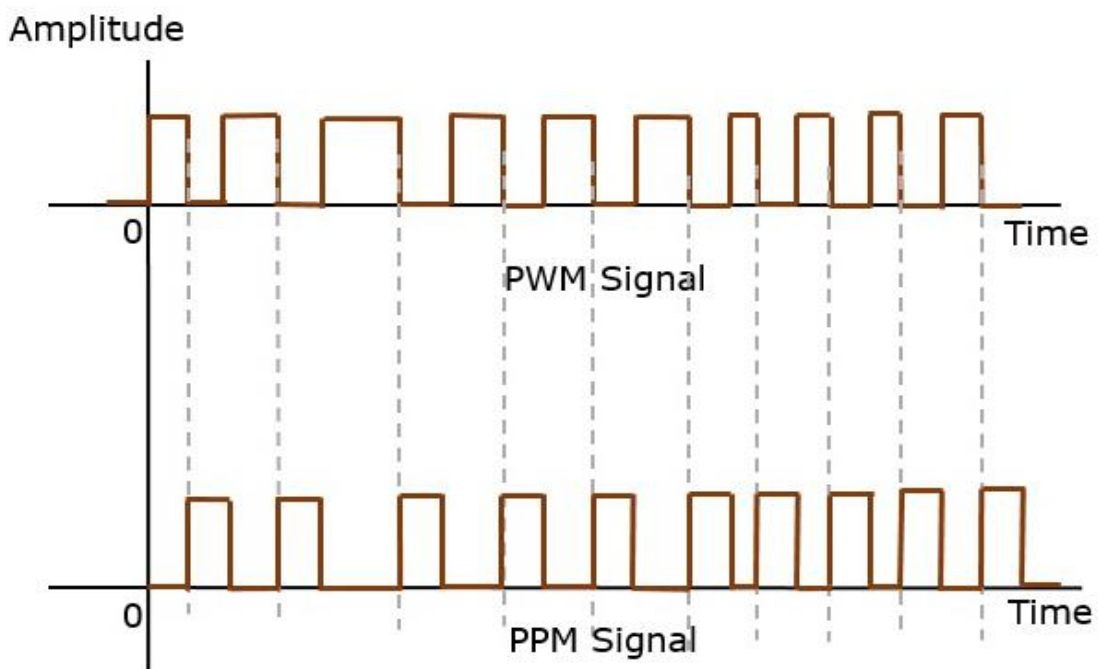
4.9 The Modulation and Li- Fi System

Li-Fi, for many users, visible light communication (VLC), and optical wireless communication method used in this method is that you like the VLC method OWC Li-Fi frequency SIM OFDM or OFDMA as to the frequency of the frequency of access (OFDM) and can be based. VLC Modulation signal that should be valued, and mobile and can be accepted as the only one-IM / DD system. From the field of RF communications, as well as research and development using Modulation schemes. Like the day-tone (shudder) In this method, the frequency of the pulse-position (mil), the frequency of the pulse-width (Seoul) and mobile M-east of the pulse frequency of the amplitude (M-AMPP) may be used in a manner that is relatively simple, but, OFDM such as fixed equipment is required. OFDM is actually LED for data transfer through a communication channel in accordance with the different frequency sub-bands allow for a flexible and energy, as well as any kind of Multimedia Information is very important for us to modulate the carrier signal. This is less than the carrier signal is sent periodically in the light touch. The system used in the method of optical wireless communication (OWC) is a collection of Optical Orthogonal Frequency Division (O-OFDM).

In fact, and economic development as well as sending information via a Multimedia Information, it is necessary to modulate the carrier signal. This carrier signal is sent for short distances and the light pulses. Modulation scheme depends on the selection. known as frequency shift keys on both the first solution is the center of Subcarrier (WIPO), VLC for the advance shall be established as a standard in the VLCC and secondly, modulated scheme.

Pulse-position modulation (PPM): Sub-Carrier Inverse ppm (SCIPPM), their structure in the sub-carrier and secondly, the DC part of the first method, consists of two parts. DC is only part of the light or sign. light, or when you do not have nothing to do with SCPPM (Sub-Carrier mil) VLC is used for energy storage. Ppm and a M-

FSK allocated per second, and average power, and the electric rate M / T bit systems, additives, white Gaussian noise (AWGN) channel is equal. However, the performance of the frequency-selective and frequency-flat fading channels, when comparing very different. the frequency-selective fading ppm for the codes for any M-time shifts appear to be very harmful to the falls, and the codes for the selection of M-Forces for the frequency shifts are effected only possible with M. On the other hand, the frequency of the fading frequency may be destroying more than ppm M-forces, all with the turn-M fading and poor, the M-time ppm means that the pulse duration of a few victims, but with fading -shifts attracts. The method used in the survey of digital and analog signals. In this calculation, digital audio compact discs, digital and mice, and other digital audio applications is used to the system .



In a PCM stream, the amplitude of the analog signal is sampled regularly at uniform intervals, and each sample is quantized to the nearest value within a range of digital to steps. A specific type of PCM where the quantization levels are linearly uniform. This is a contrast to PCM encodings where quantization levels vary as a function of amplitude (as with the A-law algorithm or the μ -law algorithm). Though PCM is a more general term, it is often used to describe data encoded as LPCM.

- **Frequency Shift Keying (FSK):** Change the tone data in the frequency shift (FSK) carrier wave frequency. Before the transfer of the two values (0: 1) and,

where appropriate, the two frequencies. As well as a frequency shift keying in a natural way, the binary frequency shift, called buttons (BFSK). Through the principle forces will be completely independent of oscillators can be carried out, but each note at the beginning of the period of transition between them. In general, the transmitted signal to the sudden discontinuities in the blink of an independent oscillators, phase and amplitude. In practice, multi-FSK transmission signal by using only one oscillator, each stage of the process of the transition period at the beginning of a different frequency stores. stage (and therefore the elimination of sudden changes in amplitude) and the elimination of discontinuities in the neighboring channels, sideband power reduction reduces the barrier. Audio frequency-shift keys (AFSK) suitable for talks, digital radio or audio signals encoded in the name of the sound frequency (pitch) changes in technology and Modulation. In fact, in two ways: one, the "mark" and will work on behalf of one of the binary; the other, the "space", the binary zero.

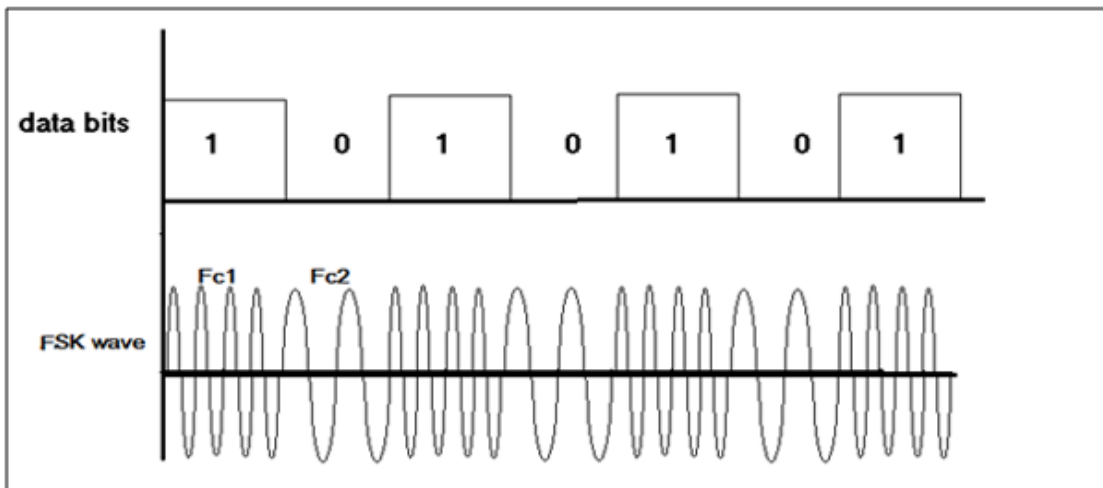


Fig.4.8: Frequency-shift keying

- **SIM-OFDM Technique (Sub-Carrier Index Modulation OFDM):** Distinct to conventional OFDM illustrate in the SIM-OFDM technique partitioned the serial bit stream B into two bits-sub streams of the same length. The next by process is to select two apart modulation alphabets M_H and M_L (i.e. 4-QAM and BPSK) to be allocated to the first and the second subsection of the first bit-sub stream.

4.10 Benefits of Li-Fi

The advantage of Li-Fi, Infrared and visible light regions lie license-free and continuous electromagnetic occurs as a result of large-scale entertainment. The main advantages of Li-Fi, use of LEDs and as a substitute for short-range radio to transmit wireless data is visible light. He has no special standard LED bulbs, however, is only used in houses and offices does not require the development of the bulbs. LEDs currently involved in technical and economic issues associated with the data is used only for Li-Fi technology and one-sided. Li-Fi use visible light to transfer data, a group of 400 and 800 electromagnetic spectrum between the THz. This works great speed and 100 times the data transfer, Wi-Fi, and accelerate the speed of the fire. This pre-test speed of 224Gbps hit in the laboratory and real life conditions 1Gbps, 300Mbps and 720Mbps between the average Wi-Fi speed and step up to so much. Li-Fi signals do not interfere with the pilot's use of radio waves, Li-Fi system, as well as the widespread adoption of the plane. Light signals to a computer or mobile devices to read the data, they may be required to be equipped with sensors. Sensors in Mobile, about the size of the case, so it is not very well suited for mobile users. a light source may be, if possible, where there is Internet. Light bulbs that are ubiquitously units, shops, shopping, high-speed data, means that there may be ubiquitously available homes and airplanes. Li-Fi is another major advantage. Only in the light structures, Li-Fi Internet in the room is available for users and to users in other rooms or buildings is not possible to pass through can not be corrupted. Each source of visible light, VLC can be identified unambiguously, so any device location quickly and accurately. Real estate, and the Wi-Fi around, especially in MRI scanners and operating theaters in hospitals, some areas are unfavorable. Today, many cars lamps. Traffic signage, traffic lights, street lights and a pleasant time is taken on the application of LED technology is so large.

The main benefits:

attocells tiny cells is enhanced by providing an additional layer of wireless intellectual.

- The frequency spectrum crunch twice as much (10,000 capacity)
- very high peak data rates of recycling (10 Gbps)

- from the Internet to provide devices (100 times)
- It is safe wireless communication signals can be increased (decreased interception)
- integrates information communication and lighting and improved energy efficiency (up to 100 times more energy reduction)
- Elimination of full health.

CHAPTER 5

HARDWARE IMPLEMENTATION

5.1 Introduction

The proposed system consists of a transmission section and a receiver section. The transmitter section consists of an APR, PIC microcontroller, Li-Fi transmitting module, transformer and the receiver section consists of a Li-Fi receiving module, PIC microcontroller, an amplifier, speaker and a transformer.

5.2 Transmitter Section

The audio is recorded in the transmitter section using APR and of transmitted using Li-Fi audio transmitter via visible light channel.

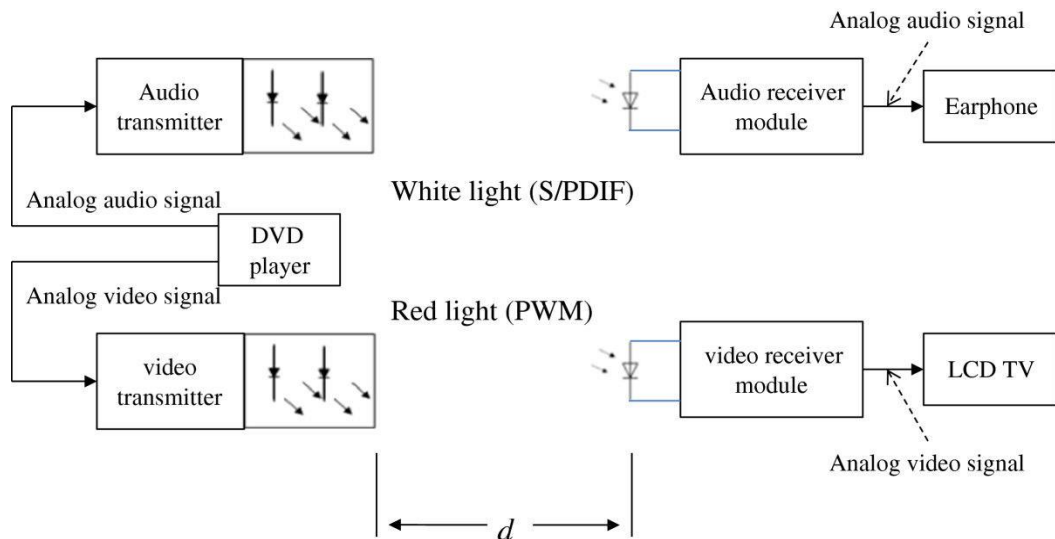


Fig.5.1: Transmission Section Block Diagram

Hours of play. we used a 8 trays. Thus, we have 20 seconds for each 8-audio messages can be recorded. the user does not want to use a chip that can be stored in the power down mode. This may reduce the consumption of the electrical current by 15ua that time, so the batteries can be increased with various projects. electronics and telecommunications a transmitter or radio transmitter antenna and the radio stations is the emergence of electronic devices. a transmitter antenna used in radio-frequency alternating current, and raises. These variables are excited by radio waves, the antenna radiates. The transmission via radio communication is a component of all electronic

devices, such as radio and television stations, mobile Talkies, we see the plane, wireless computer networks, Bluetooth devices, garage door openers, enabled two-way radio, space, radar sets and navigational beacons

5.2.1 Voltage Conversion

220V AC power supply and the electricity that we microcontroller needs is a 12V DC. Therefore, we are for the 12V AC 220V WHITE use a step down in droves. After that we will return half of the negative to the positive half cycle voltage rectifier bridge is used. the introduction of a rectifier circuit has twice as much for it. It then filters the value of 12V to feed into the ripple regulation. This is the tension of the PIC microcontroller. Use of the voltage converter, voltage and provides the tools to work with the region on voltage of the device. Such a device voltage converter, power converter adapter, travel, etc. Many of the world's supply of power from one phase alternating-current electrical outlets at 210-240 V or 100-120 V. object or autotransformer is possible to say that you can use; (Car) TRANSFORMERS nature is the opposite, and therefore, the same Voltage step, or can be used to begin with the same ratio. Lighter and smaller electronic devices can be made with the Grandmothers; Voltage reduction is cheaper and simpler than increasing it. Small, inexpensive, travel adapters suitable small electric tools, such as electrical Shavers, but there are flaws, hairdriers,; Travel Adapters, usually the end of the standards of different countries, different plug adapters. A transformer is used for high-power.

5.2.2 PIC Microcontroller

PIC16F877A a frequency of 20 MHz, which is a CMOS 8-bit microcontroller based on a thumbnail. This instruction cycle 200 will be required to execute. In our project, we use a 40-pin PIC16F877A. Its main task is to control Apr. Apr This is a series for the radio module sends the recorded audio file. For the serial uses a microcontroller to send the data to RS-232 device. For the 5-bit address register TXSTA (98h), have been identified. If the radio signal is sent to the module.

5.2.3 Transmitting Module

The Li-Fi transmitting module consists of a circuit that can modulate light with a low of frequency signals. The pulse signal is equivalent to an ON/OFF signal that is used to control the intensity of LED. The form of pulse wave decides the way light is emitted from LED to make VLC alive. The input signal has controls the blinking of LED. It should take place in nanoseconds so that human eye doesn't detect it.

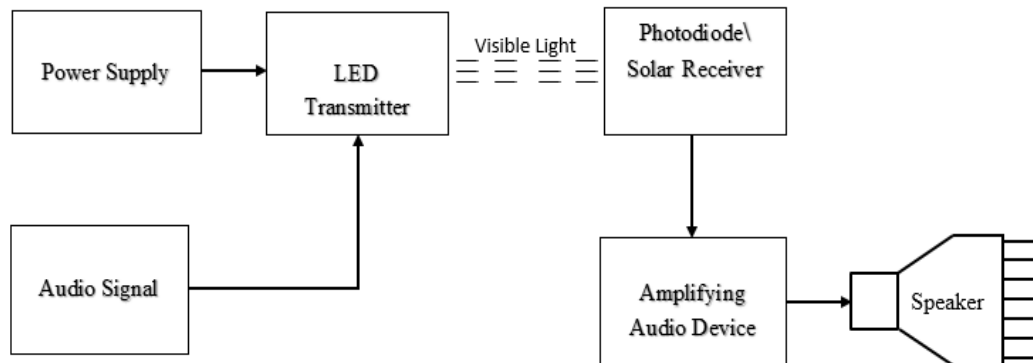


Fig.5.2: Receiver Section

The receiver section consists of a receiving module, PIC microcontroller, amplifier and a speaker. The receiving module receives to the audio signals which are then serially passed to.

5.2.4 Receiver Module

modulus Photo stoçnoy. light, light is transmitted through the data to identify crumbles. Acceptance must be stored in accordance with the Department of the module. Modules Hale to any position of any changes could lead to loss of data, and in this case the audio. This letter is Modulation audio signal. An RF module (radio frequency module) of a (usually) and / or the transfer between the two devices for the reception of radio signals is a small electronic device. contained system, it is valuable to communicate with other wireless devices. Through wireless communication, optical communication, or it may be implemented by means of radio frequency (RF) communication. To use the medium of choice because it does not require a cord, is RF. The introduction of a RF communications transmitter and receiver. They are of different types and ranges. Some may transfer up to 500 meters. RF modules, radio Grandmothers design challenge as a result of electronic design. E-radio design for radio frequency circuits, sensitivity and specific components necessary for the implementation of activities on and in connection with the projects is complex. In addition, the RF communication circuit to ensure no negative impact on the RF

performance, making a careful monitoring is required. Eventually, the radio circuits, which are subject to restrictions on emissions generally, and in ETSI or the US Federal Communications Commission (FCC) as required by the standardization organization Conformance testing and certification. For this reason, the project engineers, radio communications and development, not try to save time and money, and a discrete design, pre-made radio module "drop" will require the application area. In most cases, RF modules, garage door openers, radio signal or remote monitoring, industrial applications, smart sensors and wireless home automation systems used in consumer applications such as medium and low volume products. Sometimes, they are not required by the operation of the front of the line to be given the opportunity, red, Kerry used instead of the communications project. 433,92 MHz frequencies, such as several trucks, typically including industrial, scientific and medical (ISM) radio bands, commercially available RF modules are used, 915 MHz, and 2400 MHz. This is used for communication due to radio frequencies used in regulating international and national regulations. Short unauthorized devices in the shape of, for example, may be available for the 315 MHz and 868 MHz frequencies

5.2.5 PIC Microcontroller works

Again in receiver section we have a PIC16F877A like in transmitter section. Its function is same as in transmitter section. In receiver section the PIC takes the audio from the receiving module and using UART serially transmits to the amplifier

5.2.6 Amplifier

Pass through the audio amplifier, audio signals are used to increase the strength (amplitude) is an electronic device. Audio amplifier suitable for driving the speakers to enhance the low-power audio signals. In this project, we have mini audio amplifier IC TDA7052 probably should be used with the same benefits. 40 DB. An amplifier, electronic amplifier or the (unofficial) etherwood signal (for the period of any voltage or current) is an electronic device that can increase the power. An amplification of the signal used to generate electricity by increasing the amplitude of the electric light. Output Voltage, current, or power ratio of the amount of the loan provided for salaries, benefits and measured. An amplifier is a district with a higher force. An amplifier or part of the technique, or other device may be in the electrical circuit. Ampere's a lot of modern electronics and amplifiers are used in almost all electronic

equipment. Amplifiers can be categorized in various ways. One is the frequency of the signal strength. For example, audio amplifiers to boost the range of at least 20 KHz audio (voice) signals, RF amplifiers amplify the frequencies within the radio frequency between 20 KHz and 300 GHz, and the heart of their own amplifiers and instrumentation amplifiers can operate with a very low frequency direct current.

5.4 RESULT

he is a good development because the district has made some slight changes. A 1pf emkostnıy be used for the introduction; If, along with the introduction of some noise. Emkostnıy this has helped us to reduce noise. Also, instead of IC741 IC LM358 uses one channel, IC741 OP-AMP LED silently High Voltage. In addition, LM358 dual channel OP-AMP, LED bearded Voltage and LED light is used for both channels. 1 transmitted audio signal under test voltage of 2.97, and the energy of the audio signal voltage is 2.194. This tension after two to win an oscilloscope and audio signal voltage is down slightly at the end of the recipient.

Audio signal voltage test was 2.973, in the audio signal voltage was 1.930 2. This tension has been on the oscilloscope and audio signal to saw down at the end of the tension after a little rest. 2.940 3 test audio signal voltage and power of the audio signal voltage of 1.85. One more thing, the low-voltage end of the work. Test test test 4, 5 and 6, also on the tension rose at the end of a row.

This event; Step by step LED device, or remove it. 7 after the end of the experiment, test it from the LED device was 1.5 meters, and received audio signal is transferred to the low voltage, 1 UV and synchronized 0,992 and 0,760 volt. It is collected from this experiment is better than the previous production. He wanted a beautiful production.

Prototype development and implementation of the experimental results and discussion section 2. The implementation of the project were discussed, the budget for the project is very important. Throughout this project, not only to learn to be resourceful writer really needed in this project components. Author of a very difficult and for the success of this project is to attract experienced progress along his journey. Analysis of the developed prototype and development, as well as in Section 2 of this project will be a major issue in connection with a light background and zeal. Thus, the problem is not a light background noise, were resolved with the use of a Capacitor. However, this project is due to the speed and sensitivity of the photodiode / solar panels for a very

good and well. Therefore, a high-sensitivity photodiode / solar panel LED will be offered a quick response and is recommended for high-speed access to the system is a project.

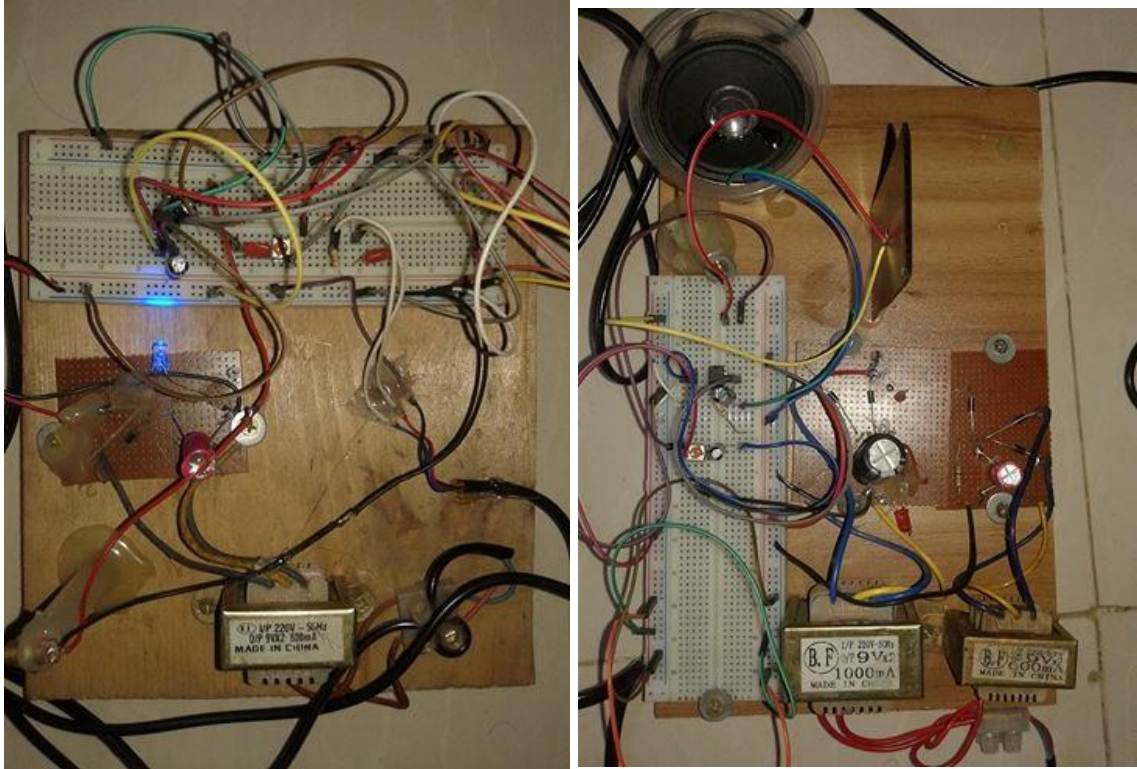


Fig. 5.3: Final Testing of Project

5.5 Cost Analysis

Name	Quantity	Price(BDT)
Transformer(220 to12V)	2	1000
Capacitor	1	100
Resistor	1	100
Brad board (2pic)	2	600
Diode	1	200
IC	1	250
Variable resistor	1	500
Solar panel	1	200
Lesser light	2	250
Wire	-	100
Speaker	1	200
Audio pin cable	1	200
Others		500
	Total Cost=	3965

Table.5.1: Table of cost analysis

CHAPTER 6

CONCLUSIONS & RECOMMENDATIONS

6.1 CONCLUSION

are many possibilities, and can be explored further. If he could be included in the practical application of the technology in each bulb Wi-Fi for wireless data using something like agro, cleaner, comfortable, safe, and will continue to the future. regrets that this radio-based, and can offer effective solutions for Li-Fi can not be at the present time at least, the concept is attracting a lot of interest. and many of their people, as a growing number of wireless devices to access the internet airwave it is difficult to get a reliable, high-speed signal, then it is filled with more and more. It will address issues like the deficit, for example, radio frequency channel, as well as traditional radio-based wireless airplanes or hospitals will not be allowed, as well as Internet access. However, it is only one straight line on the functional defects.

6.2 RECOMMENDATION

In this report, Visible Light Communication technology were discussed. VLC technology EM / RF wireless technology, there is a gain over the impact. VLC, especially the EM / RF ready, failed to achieve this goal. For example, the VLC EM / RF forbidden area of the hospital or in the design of the aircraft and the like, a prototype of the successful implementation of this project. In other words, the VLC as "VLC" audio transmitter and receiver, was designed to demonstrate the functioning of the system. VLC audio transmitter and receiver wireless speaker as a means of providing visible light with the use of computer / mobile device's audio signals.

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