A
MINI PROJECT REPORT
ON

DATA TRANSMISSION USING LIGHT FIDELITY(LI-FI)

Abstract

In this era of advanced science, a number of wireless connections are available to connect to the internet. It has become a very common and a handy tool to access wireless internet from a coffee shop to a conference hall. As the number of people accessing the wireless internet increase, the c logged airwaves make it extremely difficult to latch on to a reliable signal. One German physicist Harald Hass has come up with a solution which he names as data through illumination taking the fiber out of fiber optics by sending data through LED light bulb that varies in intensity faster than a human eye can. Identify. This technology is named as LiFi transmission which stands for light fidelity. This invention can produce data rates faster than 10 Megabits per second which is much more than that of an average broadband connection speed. Lifi is a label for wireless-communication systems using light as a carrier instead of traditional radio frequencies, as in Wi-Fi Li-Fi should not be confused with the more general term visible light communications (VLC), which is the use of the visible light portion of the electromagnetic spectrum to transmit information.

Current era many people are using internet to accomplish their task through wired or wireless network. As no of users get increased in wireless speed decreases proportionally. Though Wi-Fi gives us speed up to 150mbps as per IEEE 802.11n, it is still insufficient to accommodate no of users. To remedy this limitation of Wireless Fidelity, we are introducing concept of Li-Fi. As per German physicist Harald Haas data through illumination taking the fibber out of fiber optic by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. It's the same idea band behind infrared remote controls but far more powerful. Haas says his invention, which he calls D-LIGHT, can produce data rates faster than 10 megabits per second, which is speedier than your average broadband connection. Light-Fidelity is a label for wireless-communication systems using light as a carrier instead of traditional radio Frequencies, as in Wi-Fi. Li-Fi has the advantage of being able to be used in sensitive areas such as in Aircraft and other transportation without causing interference.

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Chapter 1

INTRODUCTION

Li-Fi is a VLC, visible light communication technology, developed by the team of scientists including professor Haas at the University of Edinburg and deals with transfer of data through illumination by taking fiber out of optics by sending data through a LED light bulb that varies in the intensity faster than a human eye can follow. Dr Haas amazed people by streaming HD video from a standard LED lamp, at TED Global in July 2011 and thereby coined the term Li-Fi. Li-Fi is now part of visible light communication (VLC) PAN IEEE 802.15.7 standard. It can be very easily explained as, if the LED is ON, you are transmitting the data means you transmit a digital 1; and if the LED is OFF you transmit a digital 0, or null, or simply no data transfer happens. As one can switch them on and off very frequently one can transmit data easily because the LEDs intensity is modulated so rapidly that human eye cannot notice, so the output in form of light appears constant and hence offering permanent connectivity. More sophistication in the transmission techniques can further increase the data rates through VLC.

Till now it was implemented through white LED bulbs only but teams at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission by using multiple LEDs or array of LEDs, where each LED transmits a different stream of data. Mixtures of red, blue, green LEDs are also used by some groups to encode different data channels by altering the light frequencies. In simple terms we can consider it to be a light-based Wi-Fi which has achieved blistering high speed in the labs at Heinrich Hertz institute in Berlin, Germany of around 500 Megabytes per second using a standard white-light LED. So quiet obviously, modems would be replaced by transceiver fitted LED lamps which can serve both in purposes of lightening the room as well as transmitting the data. The technology uses a part of an electromagnetic spectrum and was demonstrated at 2012 consumer electronics show in Las Vegas whereby a pair of Cisco smart phone was used to exchange data using light of varying intensity from their screens.

Harold Haas and his work: As it is stated, professor Haas has meanwhile showed

that the spectrum has got enough capacity to hold data and is yet has 10,000 times more availability as an infrastructure, globally. There lies a great potential in this technology to change everything that we used for accessing the data today over Internet, or streaming videos, receiving mails etc. Simply if you are receiving the light means you are connected and if you block it off you are simply off line the data could be received in familiar forms of waves like visible light, infrared or ultraviolet and thus the future possibilities are many. [1].

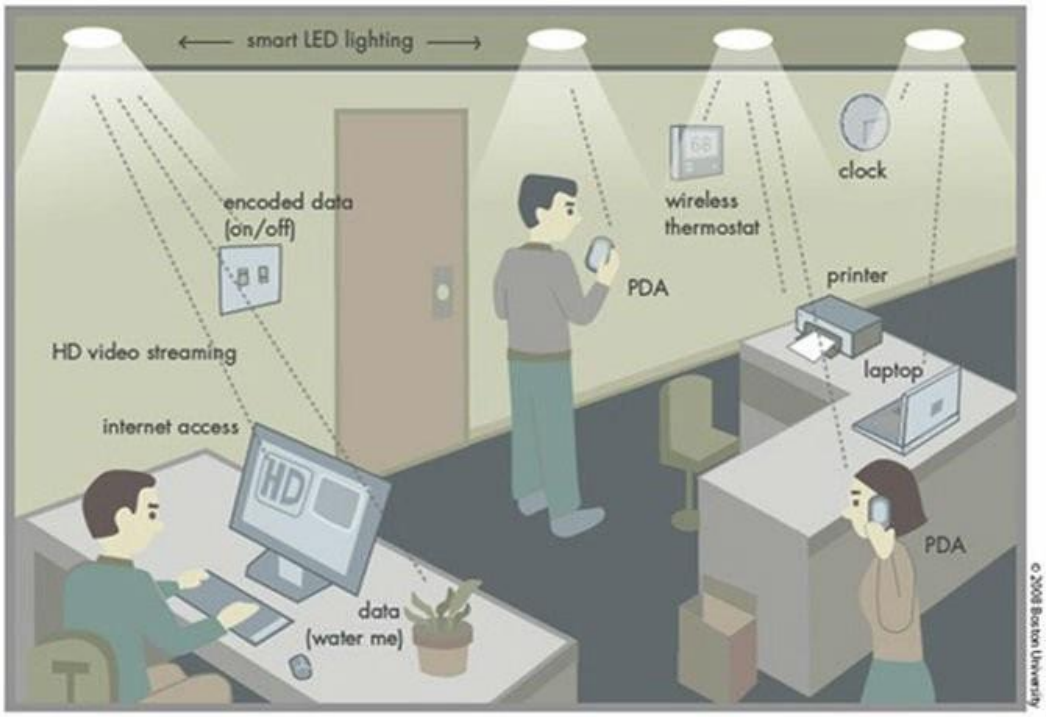

Figure 1.1: Data transfer using li-fi

1.1 Background

At TED global demonstration by Haas, where he achieved 10 Mbps transfer rate increasing it further to 123 Mbps after a month, he successfully demonstrated it by blocking the light source to block the video content received by the projector. Depleting bandwidths and faster data rates are major factors leading to further exploration of this utilitarian technique.

1.2 Objective

The prime objective of the project is to create an application that transmits data be it text, audio or video using Li-Fi technology for coping with the limited bandwidth problem we face in RF (Radio frequency) signals. For better, efficient, secure and a faster connection Li-Fi is used. One of the advantages of using Li-Fi over Wi-Fi is that it avoids radiation produced by Wi-Fi. The goal of our project is to transfer data with faster speed which is not easy to achieve through Wi-Fi and see whether transmission is possible through various mediums or not. Li-Fi can be thought as an alternative for Wi-Fi which uses light as a medium to transmit data. We aimed at the transmission of data via Li-Fi and all the possible aspects of transmitting data via light through various mediums which will give us a broad idea of where and how we can use Li-Fi for transmission of data.

1.3 Purpose, Scope and applicability

1.3.1 Purpose

In essence, a single pixel of a monitor could transmit a single channel of information to a source. Although this technology is still in its infant stages, the usefulness of this Li-Fi technology has implications for a great amount of good.

1. **Distance** - The sheer range of transmitting information could be worth the decrease in data speeds. The RONJA project in the Czech Republic can transmit a 10 Mbit/s Ethernet-type link just under a mile. As developments of this aspect continue, the range could be entirely up to the strength of the light which is emitting the information. Although the speeds are less than what they are for gigabit Ethernet, the power of the beam can allow DVD-quality streaming of video to any location connected to the Li-Fi device.

2. **Cost** - Instead of running close to a mile worth of cable, the LED-powered Li-Fi connection could be used to beam the information directly to the destination. Using a point-to-point array, office buildings can stay connected to each other without the use of additional cables being laid from one access point to another. The only problem the two buildings would be faced with is obstruction by solid objects or dense weather patterns such as heavy fog or snow.

3. **Traffic Updates** - Could you imagine having a car that uses a GPS system that receives information from traffic lights informing you of accidents and/or delays up ahead? There is a kind of system like that already in play for GPS navigational systems, but the traffic lights could be updating drivers using basic information or streaming video directly from news broadcasts.

4. **Game Consoles** - An innovative idea would be to put sensors on a television in order to receive information from game consoles. This would allow the unit to be place literally anywhere within the room as long as there is a direct line of sight to the sensor. Could you imagine a game system like the Xbox using a Kinect and all of it being completely wireless except for the power going into the unit? That will be tackled once wireless energy is perfected for practical home use.

5. **Television Interaction** - Instead of using apps or additional installations, you could theoretically hold your phone up as you sit on the couch and have every piece of information regarding the show or movie you are currently watching sent to your display even recording directly to your mobile device. Of course, this may spawn some kind of copyright lawsuit because you are illegally copying a movie or television show, but you still get the idea. There are a number of reasons why investing in Li-Fi technology can have a great benefit to the future of wireless networking. Although there are a few aspects that need to be ironed out before it can be introduced on a wide scale of practicality, the future looks to be very promising. Even if the technology was merely developed as a small-scale indoor application to beam information directly to a computer system without the use of Ethernet cable being strewn about the floor, visible-light communications could set the benchmark higher for wireless transmissions.

1.3.2 Scope

The scope of Li-Fi is vast. Li-Fi is an emerging technology and hence it has vast potential. The area of Li-Fi is very broad in the manner of hospitals, academics, airlines and more. It can be used in the places where it is difficult to lay the optical fiber like in hospitals and nuclear power plants. In operation theatre,

Li-Fi can be used for modern medical instruments. In traffic signals Li-Fi can be used. We can communicate with the LED lights of the cars and reduce the traffic congestion by implementing thousand and millions of street lamps to transfer data. In aircraft, Li-Fi can be used for data transmission without interfering with radar communication.

A portable Li-Fi can be brought into existence using the said principles, with which we can transmit and receive data at very high-speed rate. This can be used in a smart phone which has a photo detector in it. Consider a series of LEDs in the smart mobile nearer to the light detector and as how a Wi-Fi option is provided in the mobile, if an option known as Lifi is present, if we turn it ON the LEDs which are placed nearer to the light detector which is working as a normal LED on the phone will start acting as a portable Li-Fi where these LEDs will do the operations as mentioned above and the photo detector which is in the mobile will sense it and data will be transmitted in which ever place we are.

1.3.3 Applicability

Health technologies: For no longer time now medical technology would lag behind the rest of the wireless world. Till now operating rooms did not allowed Wi-Fi over radiation concerns, and there was also a whole lack of dedicated spectrum. Also, if Wi-Fi is implemented in many hospitals, interference from cell phones and computers can block signals from monitoring equipment. Thus Li-Fi solves both problems: lights are not only allowed in operating rooms, but tend to be the most intended fixtures in the room. And, as mentioned by Haas in his TED Talk, Li-Fi has 10,000 times the spectrum of Wi-Fi, so we can't delegate red light to priority medical data.

Airlines: Airline Wi-Fi wants captive audience to pay for the" service" of dial up on the plane. And also, they are very expensive. Passengers will soon be offered a" high-speed like" connection on some airlines. Li-Fi could easily introduce that sort of speed to each passenger reading light. It would be interruption free to and from other wireless signals on the board.

Power Plants: Wi-Fi and many other radiation or radio waves are bad for sensitive areas like those of power plants especially the atomic power plants. Nuclear power plants need fast, Li-Fi (Light Fidelity): The Future Technology in Wireless Communication 1691 inter-connected data systems to monitor things like demand, grid integrity and core temperature. Proper monitoring can save huge benefits in terms of energy and economy obviously. Li-Fi could offer safe, abundant connectivity for all areas of these sensitive locations. This would be cost effective

as well as would improve upon the current implementation's solutions.

Under sea working:

Underwater Rovers, also called toys of treasure seekers, operate from long cables that supply their power and allow them to receive signals from their pilots above. ROVs work efficiently until unless they got stuck somewhere or if the search area is huge. If made wireless and replaced with light say from a submerged, high-powered lamp then they would be free to explore more. They could also communicate with each other via headlamps, process intermediate data autonomously and periodically refer back to the surface, all the while obtaining their next batch of orders from the source.

Information Delegation:

Suppose your town is hit by earthquake and an average resident is not aware of such disastrous situations and precautions to be taken. Until he passes under a street light, he won't be aware of the emergency broadcasts. Remember, with Li-Fi, your online only till its light. Subway stations and tunnels, common dead zones for most emergency communications, pose no obstruction and could opt to provide cheap highspeed Web access to every street corner.

Various Other Areas:

Can be used effectively in the places where it is difficult to lay the optical fiber cable. In operation theatres Li-Fi can be used for modern medical instruments. In traffic signals Li-Fi can be used to communicate with the LED lights of the cars. All of the street lamps can be transferred to Li-Fi lamps to transfer data. In aircraft Li-Fi can be used for data transmission. It can be used in petroleum or chemical as well as in nuclear plants where other transmission or frequencies could be hazardous.

Learning:

Lecture Halls Can Be Fun. Okay, well maybe not fun, but better. A few teachers tell me to download lecture notes from their blog in my time. Half the time I wished I already had the notes with me so that I could follow along as the lecture progressed. Imagine how interactive the classroom could be with real-time interconnectivity between 500 devices.

GPS usage:

Satellite navigation has been one of the most important technological advances of the last 50 years. No matter how good the systems get, they still don't work where we spend the majority of our time: the great indoors. Tools have been devised that cleverly use Wi-Fi triangulation and hybrid GPS (say, GPS coordinates

combined with sensor data from a compass, pedometer, and accelerometer), but these are 1692 Dinesh Khandal, Sakshi Jain inaccurate and generally unreliable. A company called Byte Light is trying to change this situation with a system that uses LED lighting to provide devices with accurate location data. Byte Lights indoor location system works by controlling the pulses of LEDs so they work in a certain pattern. This pattern is not detectable to the human eye (its working in the range of a hundred of hertz), but can be picked up by the camera in a smart phone or tablet. Using the data gleaned from the LED modulation, the device works with an app and performs client-side calculations to figure out where it is within the structure. Wi-Fi isn't needed so networking is not a problem, and the calculations are performed on the device, so everything happens quickly.

Chapter 2

Working Principle

2.1 How Lifi Works?

The logic behind the working of light fidelity technology is much unmingled. If the LED is on, a digital string 1 is transmitted and when the LED is off then a digital string 0 is transmitted. For example, there is a LED at one end and a photodetector at the other end, whenever the LED is on, a binary 1 and when the LED is off a binary 0 is registered by the photodetector. Thus, a message is built up by many flashes of LED.

Many other highly developed technologies can be used I increasing the data rate of VLC, a recent research in Berlin attained rates of 500 megabytes per second. Parallel data transmission where each LED generates a separate data stream and has been focusing on many teams in the University of Oxford and Edinburg.

Chapter 3

Circuit Description

3.1 Block Diagram

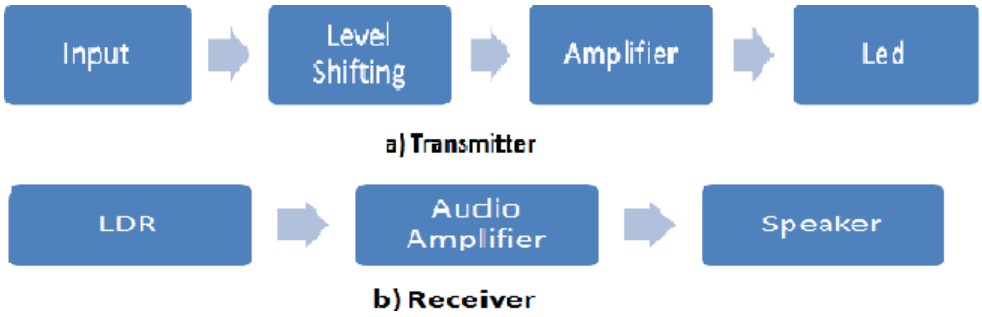

Figure 3.1: block diagram

3.2 Circuit Diagram

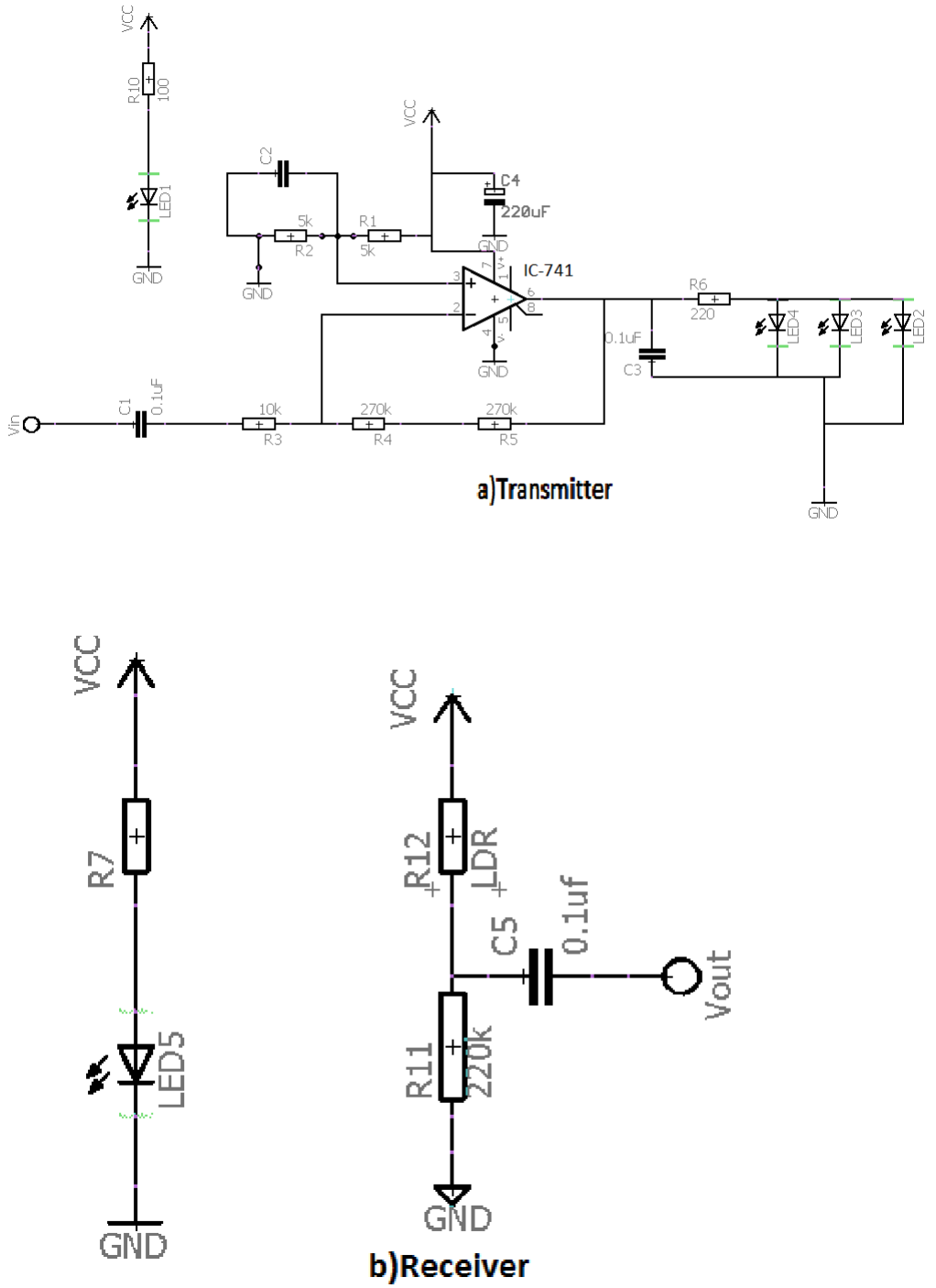

Figure 3.2: circuit diagram

3.3 Working of Circuit

Input voltage for circuit both transmitter and receiver are 5.0V at 50mA. Two LED (orange) are used to show that both transmitter and receiver are powered on.

Input is applied through audio jack from mp3 player or mobile phone, which is then level shifted by 2.5V by parallel combination of resistor at non-inverting terminal (pin 3). Op-amp is used as inverting amplifier. Input is then amplified by op amp. The output (pin 6) of op amp is then feed to three led whose intensity is varied with respect of amplitude of input signal.

Light from LED (Blue) falls on LDR (Light dependent resistor) which changes resistances which in turn changes the voltage across resistor (220K). Output is then capacitor coupled which removes the DC component and output is finally amplified by audio amplifier and the feed to speaker.

Chapter 4

Component Description

Table 4.1: Components table

sr.no	Component	values	Quantity	Price (Rs.)
1	op-amp (IC 741)	-	1	20
2	LED	10mA	5	15
3	Ceramic Capacitor	33nf (1)0.01uF (2)	3	6
4	LDR	-	1	10
5	Resistor	5k	2	4
		220k	1	2
		100	2	4
		220	1	2
		270k	2	4
		10k	1	2
6	Speaker	2.5W	1	1000
7	Socket	-	1	4
8	Electrolytic Capacitor	220uF	1	5

IC-741 It consists of two inputs two outputs, namely inverting and non-inverting terminals. This 741 IC is most commonly used in various electrical and electronic circuits. The main intention of this 741-op amp is to strengthen AC DC signals and for mathematical operations. The applications of operational amplifier mainly involve in filters, comparators, pulse generator oscillators, etc.

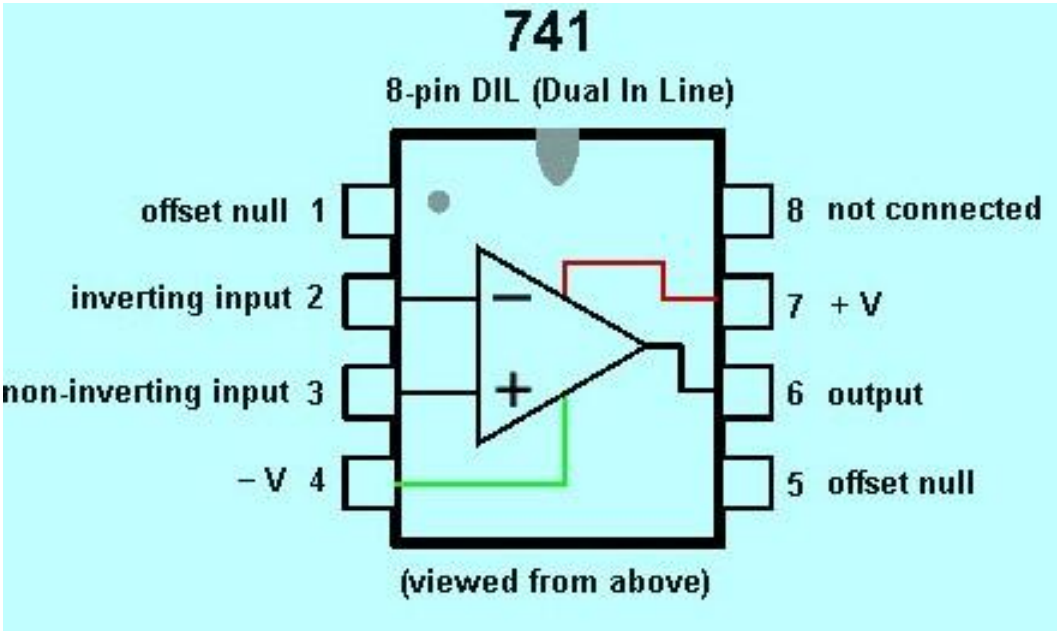

Figure 4.1: OP-AMP(IC-741)

Light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current pass through it. The light is not particularly bright, but in most LEDs, it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers). Some LEDs emit infrared (IR) energy (830 nanometers or longer); such a device is known as an infrared-emitting diode (IRED).

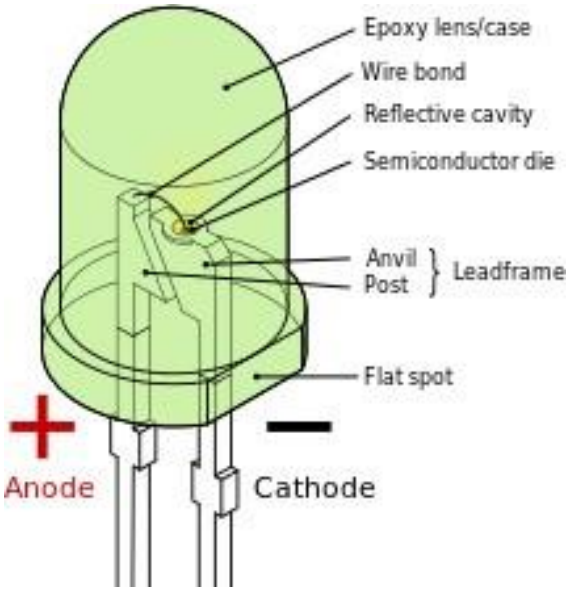

Figure 4.2: LED

A **resistor** is a passive two-terminal electrical component that implements Electrial resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators.

Figure 4.3: RESISTOR

An **LDR** is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances: Daylight=5K , Dark= 20M

Figure 4.4: LDR

An **electrolytic capacitor** is a type of capacitor that uses an electrolyte to achieve a larger capacitance than other capacitor types. An electrolyte is a liquid or gel containing a high concentration of ions. Almost all electrolytic capacitors are polarized, which means that the voltage on the positive terminal must always be greater than the voltage on the negative terminal.

Figure 4.5: ELECTROLYTIC CAPACITOR

A **ceramic capacitor** is a fixed-value capacitor in which ceramic material acts as the dielectric. It is constructed of two or more alternating layers of ceramic and a metal layer acting as the electrodes. The composition of the ceramic material defines the electrical behavior and therefore applications. Ceramic capacitors are divided into two application classes:
Class 1 ceramic capacitors offer high stability and low losses for resonant circuit applications.
Class 2 ceramic capacitors offer high volumetric efficiency for buffer, by-pass, and coupling applications.

Figure 4.6: CERAMIC CAPACITOR

The **speaker** we have used in this project is LG PH1 It is a small, basic wireless speaker. Battery life for the speaker is about 4-5 hours when just listening to music, but will obviously be a bit less if you also use the lights often.
Physical
1. Size (W x H x D) mm =81 X 88 X 82
2. Net Weight (Kg)=1.9 Kg
3. Carton Size (W x H x D) mm=536 x 220 x 162 4. Gross Weight (Kg)=3.1 Kg

Power
1. Power Requirement= 5V 1.2A
2. Power-on mode (Charging status) = 300mA20 mA 3. Stand-by mode (Bluetooth function off) = 0.5W

Figure 4.7: SPEAKER

Chapter 5

Software Description

5.1 Eagle Software:

EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer-aided manufacturing (CAM) features. EAGLE stands for Easily Applicable Graphical Layout Editor (German: Einfach Anzuwendender Grafischer Layout-Editor) and is developed by CadSoft Computer GmbH. The company was acquired by Autodesk Inc. in 2016.

Features:

EAGLE provides a multi-window graphical user interface and menu system for editing, project management and to customize the interface and design parameters. The system can be controlled via mouse, keyboard hotkeys or by entering specific commands at an embedded command line. Multiple repeating commands can be combined into script files (with file extension .SCR). It is also possible to explore design files utilizing an EAGLE-specific object-oriented programming language (with extension. U L P)

History:

The German Cad Soft Computer GmbH was founded by Rudolf Hofer and Klaus-Peter Schmid Inger in 1988 to develop EAGLE, a 16-bit PCB design ap- plication for DOS. Originally, the software consisted of a layout editor with part libraries only. A schematic editor and an auto-router module became available as optional components later on. In 1992, version 2.6 changed the definition of layers, but designs created under older versions (up to 2.05) could be converted into the new format using the provided UPDATE26.EXE utility. EAGLE 3.0 was changed to be a 32-bit extended DOS application in 1994. On 27 June 2016, Autodesk announced the acquisition of Cad Soft Computer GmbH from Premier Farnell, with Premier Farnell continuing to distribute Cad soft products for Autodesk.

Autodesk changed the license to a subscription-only model starting with version 8.0.0 in 2017. Only 64-bit versions remain available any more. The file format used by EAGLE 8.0.0 and higher is not backward compatible with earlier EAGLE versions.

5.2 Steps to Use Eagle:

Step 1: Starting New Project and Adding Components
First open eagle. Cad then you need to hover over FILE then NEW then click on schematic. After that you should have a new window pop up. This is where you are going to draw your schematic. To add a component, you need to click the add button. Then find your component. Click OK and you should have the schematic sign of your component, just click and it will be added. That I show you add a part. Keep doing that Intel you have all the parts you need. To turn a component all you have to do is right click.
Step 2: Connecting Components
To connect your components, you have to click the wire button. Then click on one part you want to connect then click the other. If you right click then the angle that the line turns at and direction will change.
Step 3: Converting Schematics to Boards
To convert your schematic to a board all you have to do is press the board button. Ones you clicked that a window should pop up and you should see your components outside of the square.to move your components click the move button. The yellow lines that you see connecting your components means that they are unrouted. There are 2 ways to rout your component.one way is by hand and the other way is using the auto route button. To rout by hand, you click the rout button then click the two ends of the components. When the line that you make is red then it's on the top of the board if the line is blue than it is on the bottom.to use auto route just click auto.
Step 4: Other Things
You can also add text in your board all you have to do is click the button that seas text, type what you want it to say then click ok. Your text might come up in red or blue this Is not good but it is ease to fix. All you have to do Is click select layer button then find ether Tsilk or Bsilk. Tsilk means that your text will be on the silk layer on the top of the board. Bsilk means that your text will be on the bottom of the board. Then click where you want your text to be just make sure that it is not over any holes, or pads.
Step 5: Finished

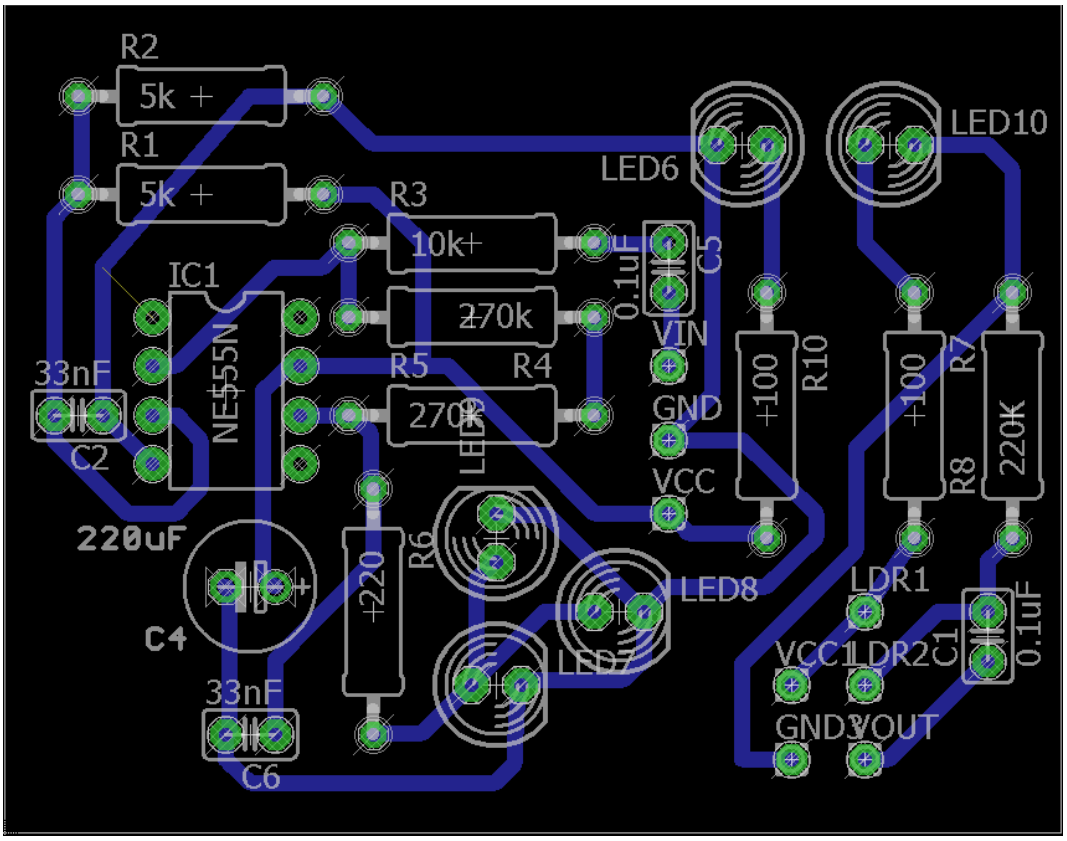

Figure 5.1: PCB Layout

Chapter 6

PCB Making Process

6.1 Steps for PCB Making Process:

Step 1: Take printout of the negative photo resist PCB layout on butter paper.
Step 2: Cut the copper clad according to the size of your PCB layout circuit leaving enough spaces at the boundaries to hold them.
Step 3: Scrub the cut copper clad thoroughly in order to clear the dust particles on the surface.
Step 4: Dip this cleared copper clad in the photo resist solution and carefully drip off the extra solution.
Step 5: Keep this wet copper clad in the oven at 500C for about two to three minutes until it is dried up.
Step 6: Next keep the butter paper print out on top of which the copper clad is kept in the device through which we are going to pass UV light in order to print the circuit layout on the copper clad for about 5 minutes.
Step 7: After that dip the clad into developer solution, after which the print will be partially visible.
Step 8: Final step is to make this partially visible layout properly visible by dipping the clad into FeCl3 solution and keep checking the copper clad after 5 to 10 minutes else there are chances of it getting burnt. Wash it with water then let it dry.
Step 9: After all these processes we will get a final properly printed PCB layout.
Step 10: Next drill the holes for the terminals of components.
Step 11: Then fit the components as per circuit and solder them. **Step 12:** Test for the output and the project is ready.

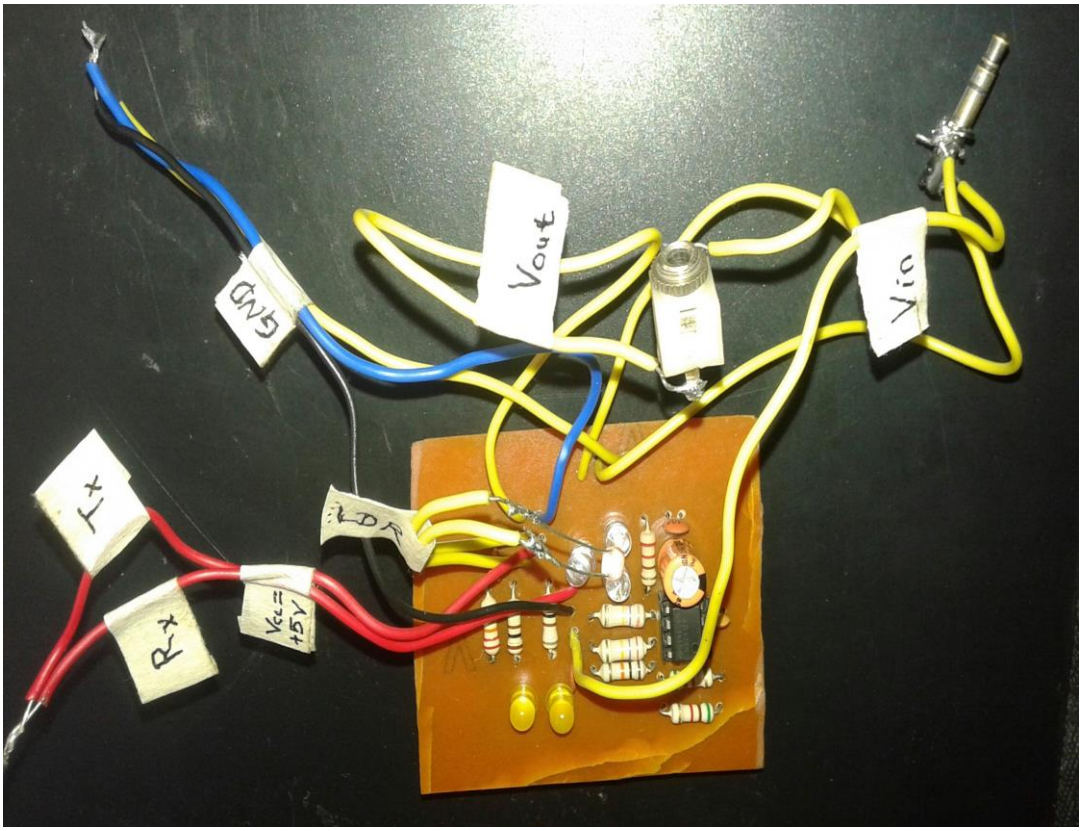

Figure 6.1: Final PCB

Chapter 7

Advantages and Disadvantages

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- **Advantages:**

Efficiency: Li-Fi works on visible light technology. Since homes and offices already have LED bulbs for lighting purposes, the same source of light can be used to transmit data. Hence, it is very efficient in terms of costs as well as energy. Light must be on to transmit data, so when there is no need for light, it can be reduced to a point where it appears off to human eye, but is actually still on and working.
Availability: Wherever there is a light source, there can be Internet. Light bulbs are present everywhere in homes, offices, shops, malls and even planes, meaning that high-speed data transmission could be available everywhere.
Security: One main advantage of Li-Fi is security. Since light cannot pass through opaque structures, Li-Fi Internet is available only to the users within a room and cannot be breached by users in other rooms or buildings.

Disadvantages:

Disadvantages of Li-Fi technology include:

Internet cannot be used without a light source. This could limit the locations and situations in which Li-Fi could be used. Because it uses visible light, and light cannot penetrate walls, the signal's range is limited by physical barriers. Other sources of light may interfere with the signal. One of the biggest potential drawbacks is the interception of signals outdoors. Sunlight will interfere the signals, resulting in interrupted Internet. A whole new infrastructure for Li-Fi would need to be constructed.

Chapter 8

CONCLUSION

Possibilities for future utilization are abundant. Every light bulb can be converted into li-fi signal receptor to transfer data and we could proceed toward the cleaner, safer greener and brighter future. As we know that the airways are getting clogged day by day Li-fi can offer a genuine and very efficient alternative. Li-Fi is enabled by advanced digital transmission technologies. Optical cell networks based on Li-Fi are the link between future energy efficient illumination and cellular communications. They can also harness unregulated, unused and vast amount of electromagnetic spectrum and can even enable ever smaller cells without the need for new infrastructure. The issues of shortage of radio frequency can be tack- led easily with only limitation being that it works in direct line of sight of light. There are no dead ends to technology and science. Now both light and radio waves can be used simultaneously to transfer data and signals.
Scope in India and abroad:
Given the bandwidth crunch being faced, Li-Fi provides a great solution as it uses optical spectrum instead of radio spectrum. Also, LED-based technology is tantalizingly close to solving both the indoor location problem (accuracy and information update intervals) and also high-speed data communications, using an infrastructure that has already been deployed primarily for lighting purposes. Despite a number of fundamental barriers, companies can see the benefits of ubiquitous indoor centimeter level accuracy with millisecond updates that Li-Fi is promising.

8.1 Future Scope

Abroad - Li-Fi is creating a lot of buzz since it has recently made its way to live trials based on solutions from the Estonian startup, Velmenni. Here are some instances of its real-life usage.

a) It is being used in commercial and industrial environments in Tallinn, Estonia's capital. Thanks to the smart lighting solutions designed by an Estonian startup called Velmenni. Its pilot program is currently providing Internet access with speeds up to 1GBps to its clients in different industries, including office-based structures.
b) The municipality of Meyrargues, France, are using it to give out navigation information by using the traffic lighting infrastructure already in place. There are many more ways in which Li-Fi can be used. For instance, at places such as hospitals, airports, and so on.

India - With the growing population (1.252 billion) and number of internet users (402 million) in India, we are definitely running out of space. By 2019, it is estimated that the world will be exchanging roughly 35 quintillion bytes of information each month. Since, radio frequencies are already in use and heavily regulated, that data is going to struggle to find a spot in line. Given the situation, Li-Fi will be crucial for India. Li-Fi is still in its nascent stage but the scope for it is limitless.

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