APPENDIX 1

NAVIGATION SYSTEM USING LIGHT FIDELITY TECHNOLOGY

A PROJECT REPORT

Submitted by

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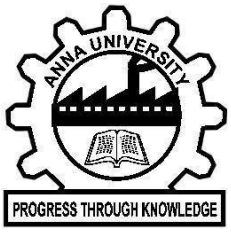
in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING



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JUNE 2022

APPENDIX 2

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BONAFIDE CERTIFICATE

Certified that this project report "**Navigation System Using Light Fidelity Technology**" is the bonafide work of "**MOHAMED YOOSUF I, GUNALAN S, BHARATWAJ M, SURIYA R**" who carried out the project work under my supervision.

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ACKNOWLEDGEMENT

First and foremost, we thank God for an abundance of grace and countless blessings in making this work a great success.

We also express our sincere gratitude to our Head of the Department **Dr. M. MEENAKSHI,** Professor, Department of Electronics & Communication Engineering for her enthusiastic encouragement and support throughout the project.

We present our sincere thanks and gratitude to our project guide, **Dr M.A.BHAGYAVENI**, Professor, Department of Electronics and Communication Engineering for his whole hearted support, patience, valuable guidance, technical expertise and encouragement in our project.

We thank all the teaching and non-teaching staff of Department of Electronics and Communication Engineering, for their kind help and co-operation during the course of our project.

Last but not the least, we would not have made this project without the support from our beloved family and friends

ABSTRACT

An emerging technology Li-Fi, or light fidelity is a bidirectional and fully networked wireless communications medium which uses light from light-emitting diodes (LEDs) and provides transmission of data through illumination by sending data through a LED light bulb that varies in intensity faster than the human eye can follow.

It works by switching bulbs on and off within nanoseconds. This project explores the use of Li-Fi in roads and thereby achieving a smart navigation system.

The transmitter and receiver sections contain Arduino nano which is programmed by using Arduino IDE. High intensity LEDs of Lamp-posts are used as the transmitter section for delivering high-speed data to moving vehicles. Further, in the vechicle's receiver section, solar panel is used to detect the signal generated by the LEDs. Solar panel can also be used as energy source for other purposes.

According to the received signal the information of present location, further diversions are displayed on the LCD installed at the receiver. Audio module is also included to enhance the driver's attention. The aim of designing this system is to provide easy access for navigation. So, here led is used for both illumination and navigation.

திட்டப்பணிசக்கம்

வளர்ந்து வரும் தொழில்நுட்பமான Li-Fi, அல்லது ஒளி நம்பகத்தன்மை இருதரப்பு மற்றும் முழுமையாக உள்ளது ஒளியிலிருந்து ஒளியைப் பயன்படுத்தும் பிணைய வயர்லெஸ் தகவல் தொடர்பு ஊடகம்-உமிழும் டையோட்கள் (எல்இடிகள்) மற்றும் எல்இடி லைட் பல்ப் மூலம் தரவை அனுப்புவதன் மூலம் வெளிச்சம் மூலம் தரவு பரிமாற்றத்தை வழங்குகிறது, இது மனிதக் கண் பின்பற்றுவதை விட வேகமாக மாறுபடும் நானோ வினாடிகளில் பல்புகளை ஆன் மற்றும் ஆஃப் செய்வதன் மூலம் இது செயல்படுகிறது. இந்தத் திட்டம் சாலைகளில் லை-ஃபை பயன்படுத்துவதையும் அதன் மூலம் ஸ்மார்ட் நேவிகேஷன் சிஸ்டத்தை அடைவதையும் ஆராய்கிறது. டிரான்ஸ்மிட்டர் மற்றும் ரிசீவர் பிரிவுகளில் Arduino நானோ உள்ளது, இது Arduino IDE ஐப் பயன்படுத்தி நிரல் செய்யப்படுகிறது. நகரும் வாகனங்களுக்கு அதிவேகத் தரவை வழங்குவதற்கான டிரான்ஸ்மிட்டர் பிரிவாக விளக்குத் தூண்களின் உயர் தீவிரம் கொண்ட LEDகள் பயன்படுத்தப்படுகின்றன. மேலும், வாகனத்தின் ரிசீவர் பிரிவில், எல்.ஈ.டி மூலம் உருவாக்கப்படும் சிக்னலைக் கண்டறிய சோலார் பேனல் பயன்படுத்தப்படுகிறது. பெறப்பட்ட சமிக்ஞையின் படி தற்போதைய இடம், மேலும் திசைதிருப்பல் பற்றிய தகவல் ரிசீவரில் நிறுவப்பட்ட எல்சிடியில் காட்டப்படும். இந்த அமைப்பை வடிவமைப்பதன் நோக்கம் வழிசெலுத்தலுக்கு எளிதான அணுகலை வழங்குவதாகும்.

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CHAPTER 1

INTRODUCTION

It is quite often that traveller travelling to remote areas find it difficult to get onto the right path. The problem grows up during night, due to lack of visibility, nonfunctioning of GPS since not everywhere on the road we find the mobile networks which can be used for navigation. At that time if there is another means which can provide the traveller with the right pathway and location, it will surely reduce the panic and encourage more travellers to take the road trip. Thus to tackle with this problem, we propose to install Li-Fi in the streetlights. Li-Fi (light fidelity technology) is the recent technology that emerged in the Field of wireless communication. It is transmission of data using visible light by sending data through LED bulbs that switches faster than the human eye can detect. Li-Fi is wireless communication which is an improvised technology of Wi-Fi but it is different in every aspect such as data transmission rates, security, high frequency and bandwidth, etc.Nowadays, everyone wants most of the things based on wireless technologies. It includes the use of radio waves for communication like Bluetooth & Wi-Fi and also the new emerging technology Li-Fi. The Li-Fi technology uses LEDs for data transmission.As soon as a vehicle comes in the range of the visible light of these poles, it transmits the data to that vehicle. The available information gets displayed on the LCD installed with receiver in the vehicle.This Li-Fi based highway navigation system where the LEDs that are used in streetlights for

illumination purpose will also be providing the travellers with the information of the present location and all the divergence ahead. This project has a very wide scope in near future as it can help setup outdoor as well as indoor navigation system. The main idea of our paper is to create a navigation system for roads to create automatic navigation for the travellers using Li-Fi technology.

LIGHT-FIDELITY (LI-FI):

Li-Fi (short for light fidelity)is wirelesscommunication technology, which utilizes light to transmit dataand position between devices. The term was first introducedby Harald Haas during a 2011 TED Global talk in Edinburgh. In technical terms, Li-Fi is a light communication system that is capable of transmitting data at high speeds over the visible light, ultraviolet, and infrared spectrums. In its present state, only LED lamps can be used for the transmission of visible light.

In terms of its end use, the technology is similar to Wi-Fi - the key technical difference being that Wi-Fi uses radio frequency to transmit data. Using light to transmit data allows Li-Fi to offer several advantages, most notably a wider bandwidth channel, the ability to safely function in areas otherwise susceptible to electromagnetic interference (e.g. aircraft cabins, hospitals, military), and offering higher transmission speeds. The technology

is actively being developed by several organizations across theglobe.

Li-Fi stands for Light Fidelity and is a Visible Light Communications (VLC) system which runs wireless communications that travel at very high speeds. For Li-Fi, the light bulb is essentially the router. It uses common household LED light bulbs to enable data transfer, boasting speeds of up to 224 gigabits per second.

Li-Fi vs OTHER EXISTING TECHNOLOGIES:

Feature	**Li-Fi**	**Wi-Max**	**Wi-Fi**	**Zigbee**	**Bluetooth**
1. IEEE Standard	802.15.7	802.16	802.11	802.15.4	802.15.1
2. Range	100 M	30-100m	40km	10-300m	10m
3. Data Rate	1-3.5 Gbps	54-250 Mbps	11-54 Mbps	250kbps	780kbps
4. Band Width	100 Times OfTera HZ.	2-11Ghz	2.4 -5ghz	868/915mhz2.4 Ghz.	2.4 Ghz.
5.NetworkTopology	Point-To-Point	Point To-Multi Point	Point-To- Point	Peer-To-Peer	Point-To-Point
6.TechnologyUsed	Light Fidelity	Microwave	Rf	Rf	Ism Band
7. Security	High	Medium	Medium	Medium	Low
8. Coverage	Indoor	Outdoor	Indoor	Indoor	Indoor

Table 1.1 Li-Fi vs Other Technologies

After reviewing all technologies, we found:

1. Li-Fi transmits data using the spectrum of visible light, achieved a new breakthrough, well suited for high density wireless data than Wi-Fi, coverage range is10m in bounded area and confines radio interference issues, free band that does not need license is used and canal so be used in places that do not allow radio frequency accessible to 1G.

2. Wi-Max, this technology aims to provide telecommunications service over long distances and connectivity between multiple locations without the use of cables. More applications that use this technology are mobile phones and service access to the Internet's global network. The expansion of this technology has led to the evolution of digital phone technology IP Telephony, which depends mainly on the domestic and international networks, but is very costly than Wi-Fi.

3. Wi-Fi is a local area wireless technology, which allows an electronic device to reciprocate dataor hook up to the internet using 2.4 GHz UHF and 5 GHz SHF radio waves. It depends on (IEEE)802.11 standards. It is better for common wireless coverage within buildings, Point to point network topology. It transmits data by RF as the data transfer medium, was developed to be used for mobile processing devices, such as clients, in LANs, but is now increasingly used for further services, including Internet, video gaming, and basic connectivity of consumer electronics such as televisions and DVD.

4. ZigBee networking technology works for long periods without the need for providing electrical energy between short periods. Consumes low power. As well as specially designed for uses that need to provide a high degree of service, so there is a direct replacement in the event of a hardware failure. However, it has a low data transfer but is enough to transfer the value of the sensors. Uses different frequencies as ranked in countries such as 902
MHz and 868 MHz and can be proceed in mesh (peer-to-peer) sites

larger than is possible with Bluetooth. Compliant cellular devices are required to transmit in ranges of 10-75 m.

5. Wireless Bluetooth technology is Radio communications designed to transmit data over short distances from one meter to meter and consumes small amounts of energy, this technique is used heavily in data transfer between mobile devices and in the peripheral accessories for PC. It Permits users to hook up a variety of computing and connection devices so easily, without having to purchase additional or proprietary wires.

As we know that light is a voluntarily accessible form of energy so most of the portion of EM spectrum can be covered by it. Spectrum ofvisible light is 10000 times more than the spectrum of radio wave. Li- Fi data bits can be transmitted in parallel which brings about the expanding efficiency. Light is available in every part of the world which makes each individual to work on the internet in airplanes. It is possible to get more than 10Gbps, theoretically permit a top-quality motion picture to be downloaded in 30sec. This leads to the fast and easy communication. Due to the use of LEDs in Li-Fi its cost is well- organized. The principle point of interest of Li-Fi is that its datatransfer capacity is 10,000 more than the Wi-Fi.

1.1 LITERATURE SURVEY

S.NO	AUTHOR NAME	TITLE	CONTENTS WE HAVE TAKEN FOR OUR PROJECT
1	M.THANIGAVEL M .TECH CSE DEPT VOL. 2 ISSUE 10, OCTOBER - 2013	LIFI TECHNOLOGY USING WIRELESS COMMUNICATION	COMPARED THE LIFI WITH OTHER WIRELESS TECHNOLOGIES AND LEARNED THE WORKING OF LIFI
2	MAIDEEN ABDHULKADER JEYLANI,ACHUTHAN B,ARUN KUMAR B,CHIRAGSUN RL (2021)	UNDERWATER WIRELESS COMMUNICATION USING LI-FI	LEARNT ABOUT THE TRANSMITTER SECTION
3	D. SINGH, A. SOOD, G. THAKUR, N. ARORA AND A. KUMAR (2017)	DESIGN AND IMPLEMENTATION OF WIRELESS COMMUNICATION SYSTEM FOR TOLL COLLECTION USING LIFI	UNDERSTANDING THE USAGE OF COMPONENTS
4	PROF ROMA JAIN, PALLAVIKALE, VIDYA KANDEKAR, PRATIKSHA KADAM(2016)	WIRELESS DATA COMMUNICATION USING LI-FI TECHNOLOGY	LEARNT ABOUT THE FEATURES, ADVANTAGES, SCOPES AND CHALLENGES
5	DIVYA KIRAN XALXO1 ,V. MURALIDHARAN(2018)	SUBAQUATIC MESSAGE TRANSMISSION USING LI-FI	LEARNT ABOUT THE SECURITY OF THE LIFI SYSTEM. SO THE HACKING OF THE SYSTEM HAS LESS CHANCE. LIFI CAN BE MORE EFFECTIVE THAN THE OTHER SYSTEMS LIKE THE ACOUSTIC WAVE COMMUNICATION AND ULTRASONIC WAVE COMMUNICATION.

Table 1.2 LITERATURE SURVEY

1.2 OVERVIEW OF THE REPORT

i. Chapter 2 deals with detailing the design and components.

ii. Chapter 3 deals with the overall workflow of the project.

iii. Chapter 4 deals with briefing the implementation of the project.

iv. Results and Conclusion are given in Chapter 5.

v. Reference are given in Chapter 6.

CHAPTER 2

DESIGN AND COMPONENTS

2.1 SYSTEM MODEL

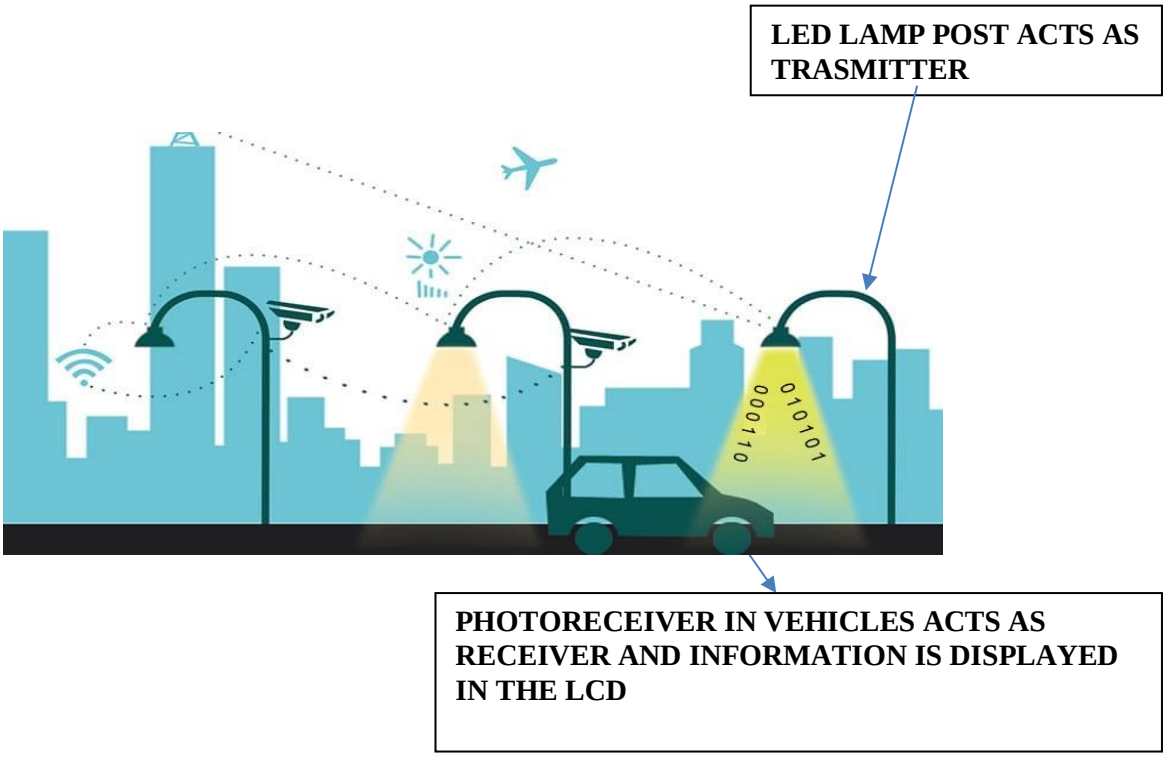

Figure 2.1 System Model

The Li-Fi technology uses LED Lamp-posts for data transmission. As soon as a vehicle comes in the range of the visible light of these poles, it transmits the data to that vehicle. The available information gets displayed on the LCD installed with receiver in the vehicle.

2.2 BLOCK DIAGRAM:

TRANSMITTER SECTION:

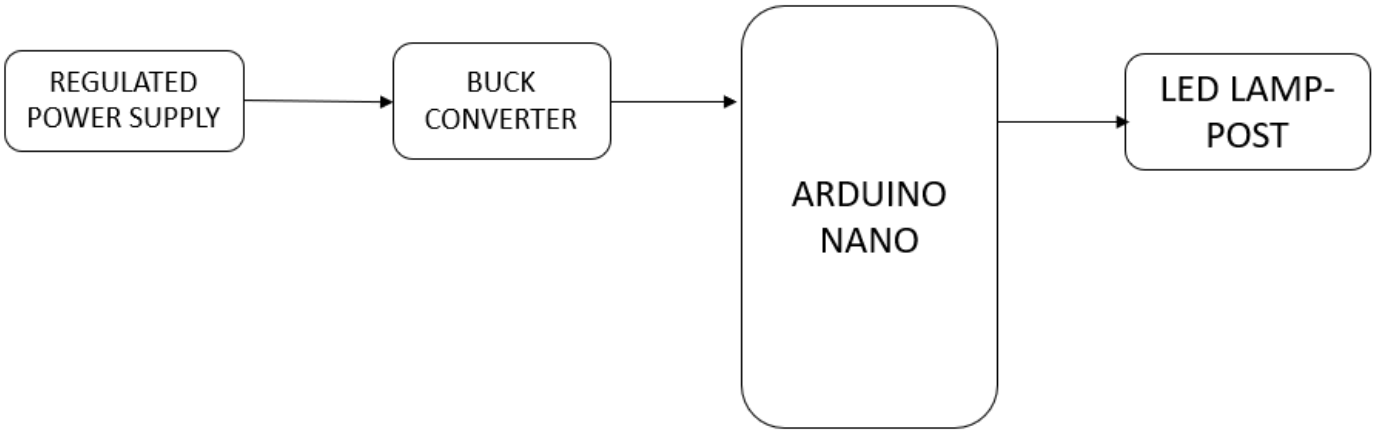

Figure 2.2.1 Transmitter section layout block diagram

External power supply is given as 12V that voltage is fed to buck convertor. Here,Buck convertor acts as a regulator which alters the 12v from external supply to 5V which is given to arduino .Because Arduino Nano maximum voltage is 5v.The data which is given to LED lamp post are programmed by Arduino IDE. Normal bipolar junction transistor couldn't sustain the high voltage ,moreover it burns and cause the damage of the circuit. In order to sustain the high voltage,Darlington tip 122 transistor has been used which acts as a switch. In tip 122, collector and emitter is shorted and it acts a wire when digital 1 is transferred through wire to make the LED glow.Similarly, In Tip 122 , collector and emitter is opened and it acts as a open circuit when digital 0 is transferred through open circuit it makes the LED off that means it won't glow.

RECEIVER SECTION:

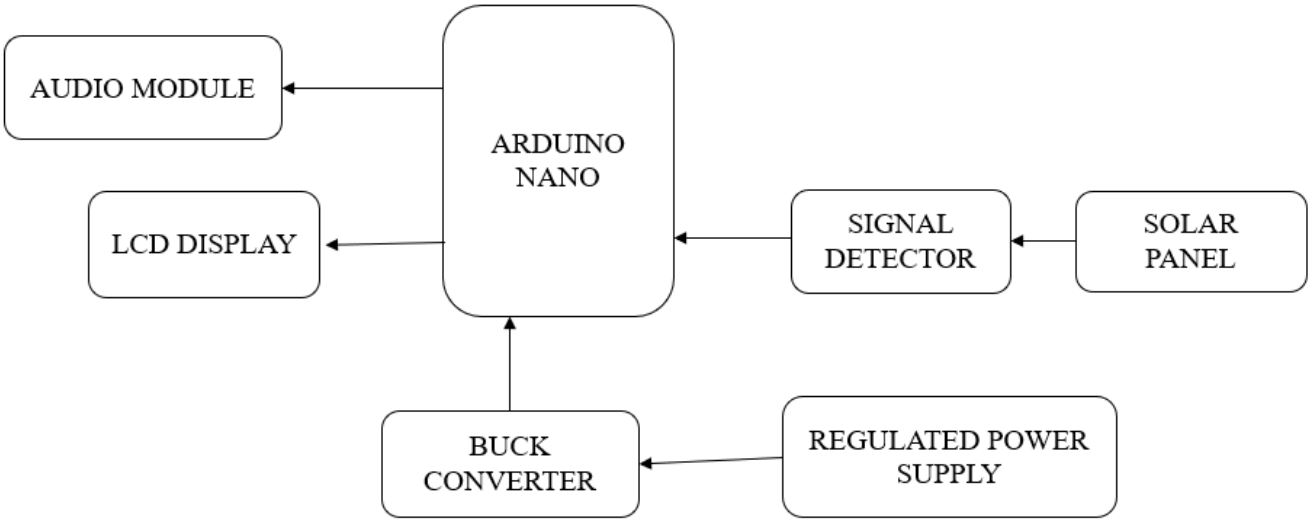

Figure 2.2.2 Receiver section layout block diagram

From LED lamp post,data are received using solar panel It acts as photoreceiver.Here three Lamp posts are used in order to display the present locations and further diversions**.** External power supply of 12 v is given to buck convertor which alters the input voltage as 5v that is the operating voltage for the Arduino. Arduino operating frequency range is 16MHz Arduino is programmed by Arduino IDE.To get the accurate results,resistances have been used.Solar panel receives the light from the lamp post and converts it into electrical signal.It is sent to the IC.here IC acts a comparator.. V+ is the voltage that is captured by Solar cell .V- is said to be reference voltage . reference voltage is set by potentiometer .We measured the v+ value as 4.73 V. when the detected voltage from photoreceiver is greater than the reference voltage (3.73V) that is fixed in the comparator,the output of the comparator will be digital 1 and send it to the Arduino.

when the detected voltage from photoreceiver is less than the reference voltage,the output of the comparator will be digital 0 and send it to the Arduino. Then the Arduino is connected to the lcd in order to display the data. Incase traveller is travelling in high traffic areas or very narrow road ,if he looks the display board, traveller may loss the attention of the driving and it may lead to accident .So audio module(DF mini mp3) is added to hear the present location and further diversions.

2.3 SCHEMATIC DIAGRAM:

2.3.1 TRANSMITTER SECTION:

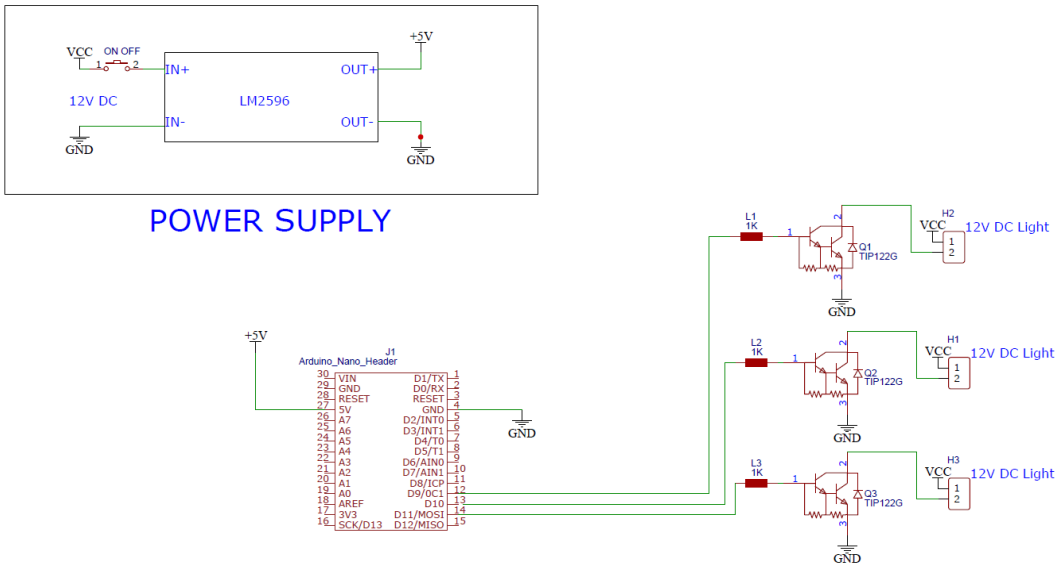

Figure 2.3.1 Transmitter section layout- **Schematic diagram**

2.3.2 RECEIVER SECTION:

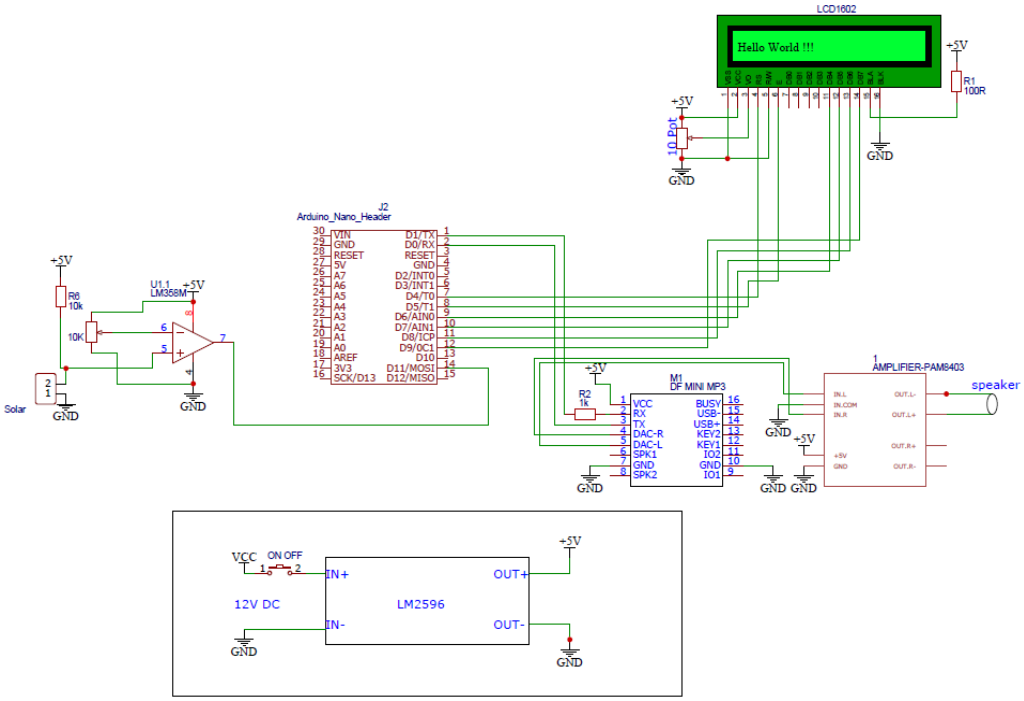

Figure 2.3.2 Receiver section layout- **Schematic diagram**

2.4 HARDWARE DESCRIPTIONS:

ARDUINO MICRO-CONTROLLER:

INTRODUCTION TO ARDUINO:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

WHY ARDUINO?

The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. It isused to build low-cost scientific instruments, to get started with programming and robotics. Arduino is a key tool to learn new things.

There are many other microcontrollers and microcontroller platforms available for physical computing and offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers someadvantage over other systems:

- **Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms.
- **Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- **Simple, clear programming environment** - The Arduino Software (IDE) is easy-to-use, yet flexible enough for users to take advantage of as well. It is conveniently based on the Processing programming environment, so learning to program in that environment will be familiar with how the Arduino IDE works.

- **Open source and extensible software** - The Arduino software is published as opensource tools, available for extension by programmers. The language can be expanded through C++ libraries, the technical details are, however, based on AVR C programming language. Similarly, AVR-C code can be directly added into Arduino programs.
- **Open source and extensible hardware** - The plans of the Arduino boards are published under a Creative Commons license, so the module can be extended and improved.

ARDUINO NANO:

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

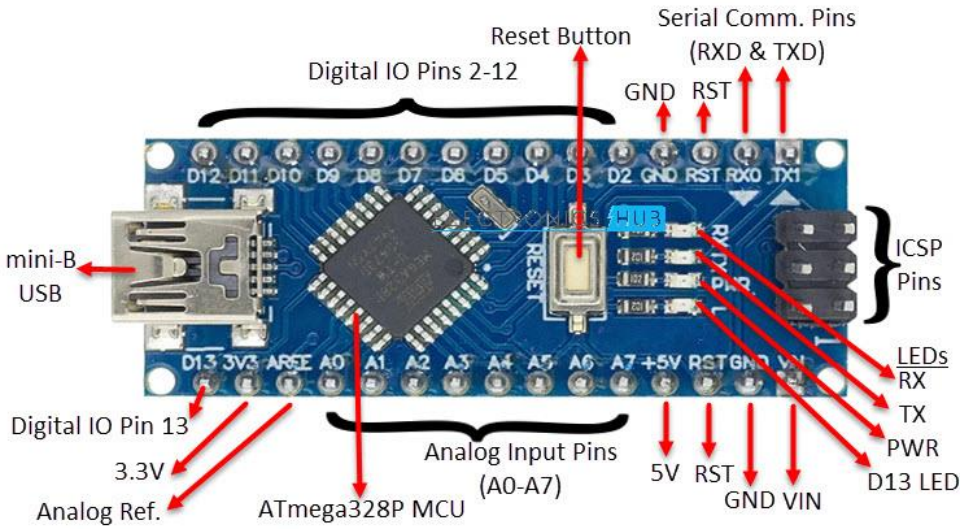

Figure 2.4.1 Arduino NANO board pin layout

TECHNICAL SPECIFICATIONS:

Flash Memory	32 KB (ATmega328) of which 2 KB used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz
Power consumption	19 mA
PCB size	18 x 45 mm
Weight	7 g
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	40 mA

Table 2.1 ARDUINO NANO SPECIFICATION

HARDWARE:

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative commons license where layout and production files of the hardware are also available.

The Arduino board is equipped with an RS-232 serial interface (upper left) and an Atmel ATmega8 microcontroller chip (black, lower right); the 14 digital I/O pins are at the top, the 6 analog input pins at the lower right, and the power connector at the lower left.

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino NANO is the optiboot-bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implementedusing USB-to-serial adapter chips.

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits, providing 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino-

compatible boards can be connected with male header pins on the underside of the board that can plug into solderless breadboards.

PROGRAMMING:

The Arduino NANO can be programmed with the (Arduino Software (IDE)).The ATmega328 on the Arduino Nano comes preprogrammed with a boot loader that allows to upload new code to it without the use of an external hardware programmer.

LIQUID CRYSTAL DISPLAY:

LCD screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is considerably basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlikein seven segments).

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position,

controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is used in the project. The 16×2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

16X2 LCD PINOUT DIAGRAM:

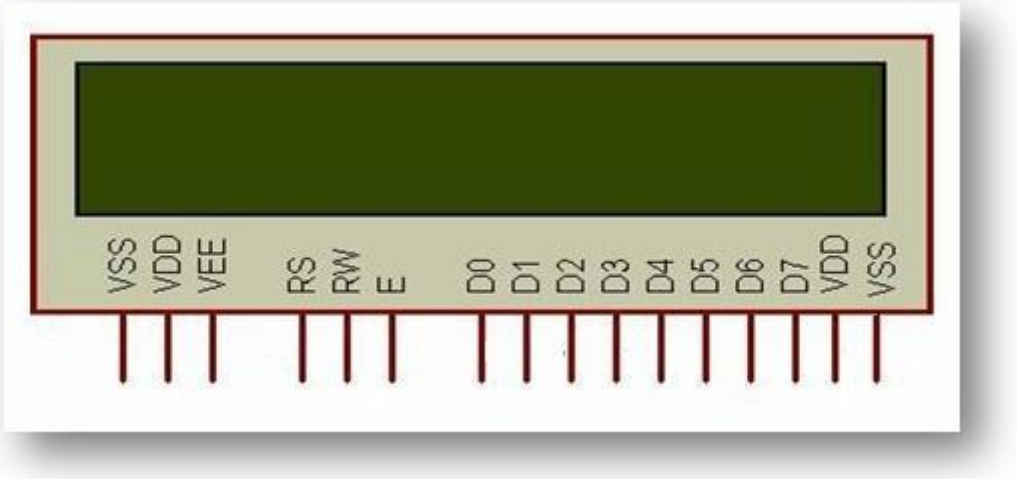

Figure 2.4.2 16X2 LCD pinout diagram

PIN NO.	FUNCTION	NAME
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	VCC
3	Contrast adjustment; the best way is to use a variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.	Vo / VEE
4	Selects command register when low, and data register whenhigh	RS (RegisterSelect)
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction andEN(enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction we make it high en=1 for some milliseconds. After this we again make it ground that is, en=0.	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight VCC (5V)	Led+
16	Backlight Ground (0V)	Led-

TABLE 2.2 LCD PINS

RS (REGISTER SELECT):

A 16X2 LCD has two registers, namely, command and data. The register select is used to switch from one register to other. RS=0 for command register, whereas RS=1 for data register.

COMMAND REGISTER**:**

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. Processing for commands happens in the command register.

DATA REGISTER**:**

The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. When we send data to LCD it goes to the data register and is processed there. When RS=1, data register is selected.

BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarmdevices, timers, and confirmation of user input such as a mouse click or keystroke.

Figure 2.2.3 Buzzer

1. MAGNETIC TRANSDUCER:

Magnetic transducers contain a magnetic circuit consisting of a iron core with a wound coil and a yoke plate, a permanent magnet and a vibrating diaphragm with a movable iron piece. The diaphragm is slightly pulled towards the top of the core by the magnet's magnetic field. When a positive AC signal is applied, the current flowing through the excitation coil produces a fluctuating magnetic field, which causes the diaphragm to vibrate up and down, thus vibratingair. Resonance amplifies vibration through resonator consisting ofsound hole(s) and cavity and produces a loud sound.

2. MAGNETIC BUZZER (SOUNDER):

Buzzers like the TMB-series are magnetic audible signal devices with built-in oscillating circuits. The construction combines an oscillation circuit unit with a detection coil, a drive coil and a magnetic transducer. Transistors, resistors, diodes and other small devices act as circuit devices for driving sound generators. With the application of voltage, current flows to the drive coil on primary side and to the detection coil on the secondary side. The amplification circuit, including the transistor and the feedback circuit, causes vibration. The oscillation current excites the coil and the unit generates an AC magnetic field corresponding to an oscillation frequency. This AC magnetic field magnetizes the yoke comprising the magnetic circuit. The oscillation from the intermittent magnetization prompts the vibration diaphragm to vibrate up anddown, generating buzzer sounds through the resonator.

LM2596-BUCK CONVERTER:

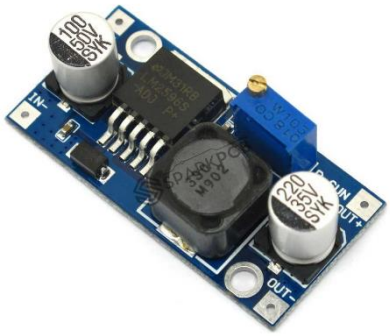

Figure 2.4.4 LM 2596 BUCK CONVERTER

The LM2596 regulator is monolithic integrated circuit ideally suited for easy and convenient design of a step−down switching regulator (buck converter). It is capable of driving a 3.0 A load with excellent line and load regulation.

This device is available in adjustable output
version and it is internally compensated to minimize the number of external components to simplify the power supply design.Since LM2596 converter is a switch−mode power supply, its efficiency is significantly higher in comparison with popular three−terminal linear regulators, especially with higher input voltages. The LM2596 operates at a switching frequency of 150 kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Available in a standard 5−lead TO−220 package with several different lead bend options, and D2PAK surface mount package.

The other features include a guaranteed 4% tolerance on output voltage within specified input voltages and output load conditions, and 15% on the oscillator frequency. External shutdown is included, featuring 80 A (typical) standby current. Self protection features include switch cycle−by−cycle current limit for the output switch, as well as thermal shutdown for complete protection under fault conditions.

Features:

• Adjustable Output Voltage Range 1.23 V − 37 V
• Guaranteed 3.0 A Output Load Current
• Wide Input Voltage Range up to 40 V
• 150 kHz Fixed Frequency Internal Oscillator
• TTL Shutdown Capability
• Low Power Standby Mode, type 80 A
• Thermal Shutdown and Current Limit Protection
• Internal Loop Compensation
• Moisture Sensitivity Level (MSL) Equals 1
• Pb−Free Packages are Available Applications
• Simple High−Efficiency Step−Down (Buck) Regulator
• Efficient Pre−Regulator for Linear Regulators
• On−Card Switching Regulators
• Positive to Negative Converter (Buck−Boost)
• Negative Step−Up Converters
• Power Supply for Battery Chargers

TIP122-DARLINGTON TRANSISTOR:

Figure 2.4.5 TIP122-DARLINGTON TRANSISTOR

The TIP122 is a Darlington pair NPN transistor. It functions like a normal NPN transistor, but since it has a Darlington pair inside it has a good collector current rating of about 5A and a gain of about 1000. It can also withstand about 100V across its collector- Emitter hence can be used to drive heavy loads.

Features:

- Darlington medium-power NPN Transistor
- High DC Current Gain (hFE), typically 1000
- Continuous Collector current (IC) is 5A
- Collector-Emitter voltage (VCE) is 100 V
- Collector-Base voltage (VCB) is 100V
- Emitter Base Voltage (VBE) is 5V
- Base Current(IB) is 120mA

12V LED:

Figure 2.4.6 12 V LED

The “Light Emitting Diode” or LED as it is more commonly called, is basically just a specialised type of diode as they have very similar electrical characteristics to a PN junction diode.

This means that an LED will pass current in its forward direction but block the flow of current in the reverse direction.

Light emitting diodes are made from a very thin layer of fairly heavily doped semiconductor material and depending on the semiconductor material used and the amount of doping, when forward biased an LED will emit a coloured light at a particular spectral wavelength.

SOLAR PANEL:

Figure 2.4.7 SOLAR PANEL

1. Light hits the solar panels, and creates an electric field.
2. The electricity generated flows to the edge of the panel, and into a conductive wire

SPECIFICATIONS:

- Operating Voltage: 5V (With voltage regulator module)
- Open-circuit Voltage: 7.2V
- Operating Current: 1A(MAX)
- Short circuit current: 1.1A
- Maximum power: 6W
- Material: Monocrystalline Silicon Flexible Lamination
- Wire length: 1m

DF MINI MP3:

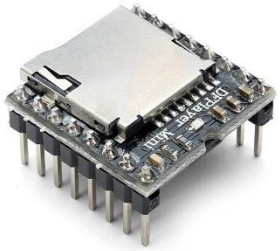

Figure 2.4.8 DF MINI MP3

The DFPlayer Mini is a small and low-cost MP3 module player with a simplified output directly to the speaker.

The DFPlayer mini standalone can be used as a stand-alone module with an attached battery, speaker, and push buttons or used in combination with an Arduino NANO or any other with RX/TX capabilities.

It supports MP3 and WMV hardware decoding. It supports sampling rate of 8KHz,11.025KHz, 12KHz,1 6KHz, 22.05KHz, 24KHz, 32KHz, 44.1KHz, 48KHz.

It can support up to 32GB micro SD card. It supports up to 100 folders, each folder can be assigned up to 1000 songs.

It has 6 different levels of equalizer; and 30 levels of volume adjust control. It can operate from 3.2V to 5V.

PAM-8403 AMPLIFIER:

Figure 2.4.9 PAM-8403 AMPLIFIER

The PAM8403 is a 2-channel, 3W, class-D audio amplifier module that features low harmonic distortion and high efficiency. It offers low THD+N, allowing it to achieve high-quality sound reproduction. Operating voltage for this module range from 2.5 V to 5.5 V, making it ideal for adding the audio capability to your MP3 and MP4 player projects.

SPECIFICATIONS:

- 2 channels 3 W PAM8403 audio amplifier
- Output Power: 3 W + 3 W (at 4 ohm)
- Working Voltage: 2.5 to 5.5 V
- Board Size: 24 x 15 mm
- High amplification efficiency 85%
- Unique without LC filter class D digital power board
- Can use computer USB power supply directly

SOFTWARE DESCRIPTIONS:

ARDUINO SOFTWARE (IDE):

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

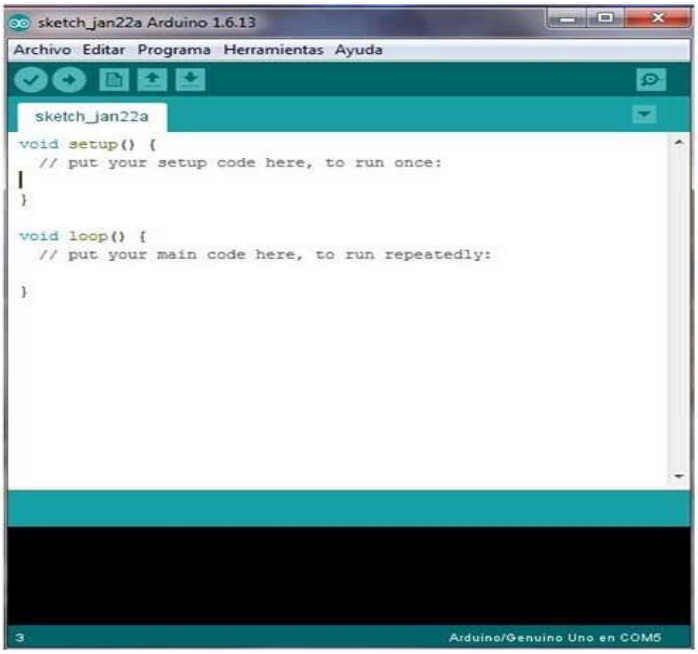

Figure 2.4.10 Arduino IDE Sketch

CHAPTER 3

PROPOSED METHODOLOGY

3.1 WORKING

Recently, the visible light communication (VLC) is considered as a future emerging technology in the telecommunication and lighting industry, as defined in the IEEE 802.15.7 standard.

Visible light communication is a new way of wireless communication using visible light. Typical transmitters used for visible light communication are visible light LEDs and receiver essentially accommodates a photo- detector to receive light signals and a signal processing element to convert the data into 'stream-able' content.

We present a new application of communicating real time data of Navigation information of remote areas which will be made possible by visible light communication technology.

Considering the efficient utilization of energy in a visible light communication (VLC) system, it is safe to say that data transmission is presented in this project at the expense of low power consumption while satisfying lighting and communication requirements.

White LEDs offer advantageous properties such as high brightness, reliability, lower power consumption and long lifetime. The biggest potential application for white LEDs will be general illumination and

lighting. Indoor wireless optical Communication systems employing white LED lighting have been proposed. In this paper, easy wiring system for optical communication is proposed.

The system emitsvisible light from LED lighting which is modulated according to the transmitted messages. Hence, data is fed into an LED light bulb (with signal processing technology), it then sends data (embedded in its beam) at rapid speeds to the photo-detector (photodiode).

An LED light bulb is a semiconductor light source meaning that the constant current of electricity supplied to an LED light bulb can be dipped and dimmed, up and down at extremely high speeds, without being visible to the human eye.

The tiny changes in the rapid dimming of LED bulb is converted by the 'receiver' into electrical signal.The signal is then converted back into a binary data stream that we would recognize as the text message

CHAPTER 4

IMPLEMENTATION

4.1 HARDWARE IMPLEMENTATION:

This is a prototype for Navigation system using Light-Fidelity technology.

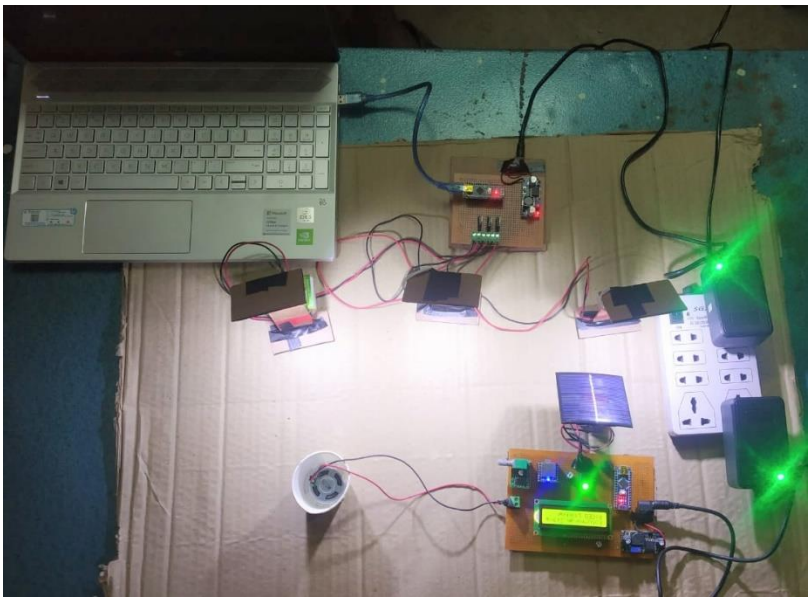

Figure 4.1.1 Experimental setup

We use ARDUINO NANO microcontroller which acts as brain of the system, because the entire system program instruction stored in it.

a. The circuit connections are made and the Arduino is switched on by using a regulated power supply and Buck convertor (LM2596).

b Regulated power supply of 12 v is given to buck convertor which alters the input voltage as 5v that is the operating voltage for the

Arduino. Arduino is programmed by Arduino IDE . Resistance can be selected by experiment to get the best results Darlington tip 122 transistor is to sustain high voltage and it acts as a switch. The LED will glow if digital input is 1. The LED won't glow if digital input is 0 .

c. From external power supply,12v is given and it is sent to Arduino.solar panel receives the light from the lamp post and converts it into electrical signal.It is sent to the comparator.

d. when the detected voltage from photoreceiver is greater than the reference voltage (3.73V) that is fixed in the comparator,the output of the comparator will be digital 1 and send it to the Arduino.

e. when the detected voltage from photoreceiver is less than the reference voltage,the output of the comparator will be digital 0 and send it to the Arduino.

f. Then the Arduino is connected to the lcd in order to display the data.suppose traveller is travelling in high traffic areas,if he looks the display board,it may deviate the concentration of the traveller and it may lead to accident.so audio module(DF mini mp3) is added to hear the present location and further diversions.

4.2 SOFTWARE IMPLEMENTATION:

TRANSMITTER SECTION:

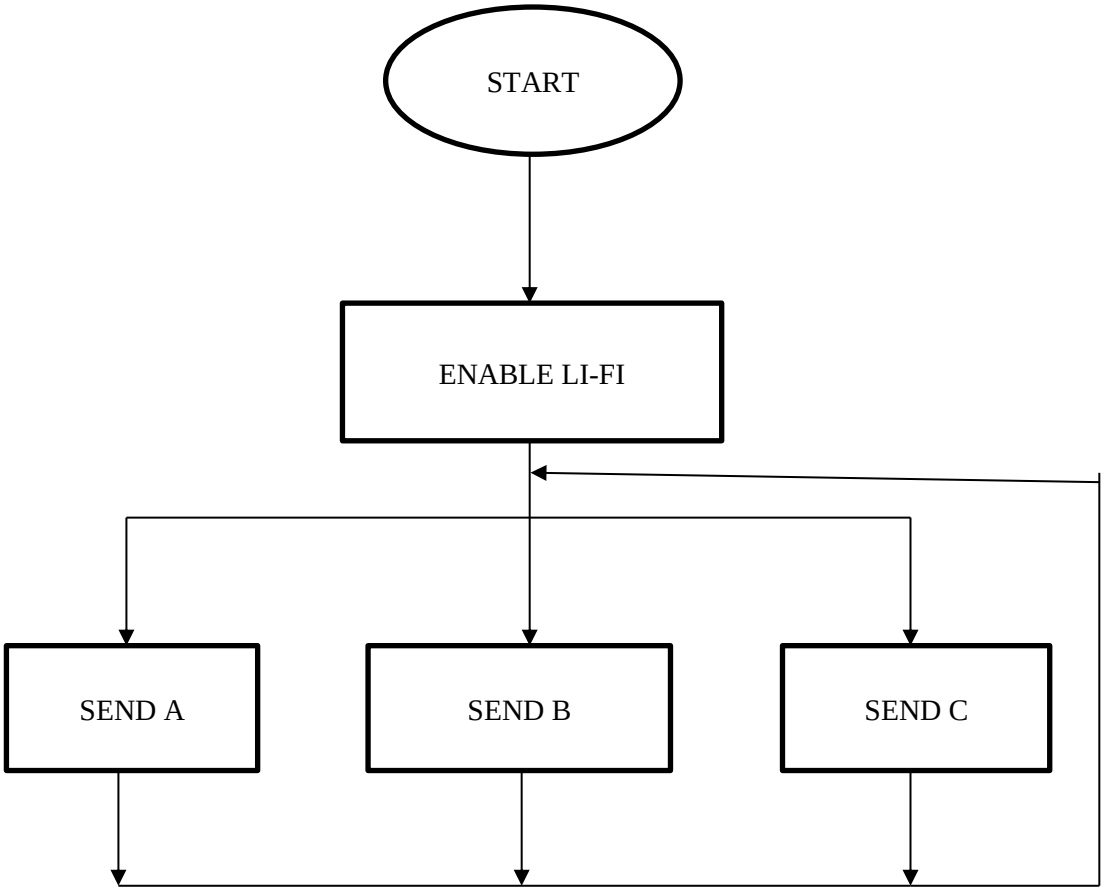

Figure 4.2.1 Transmitter Section

RECEIVER SECTION:

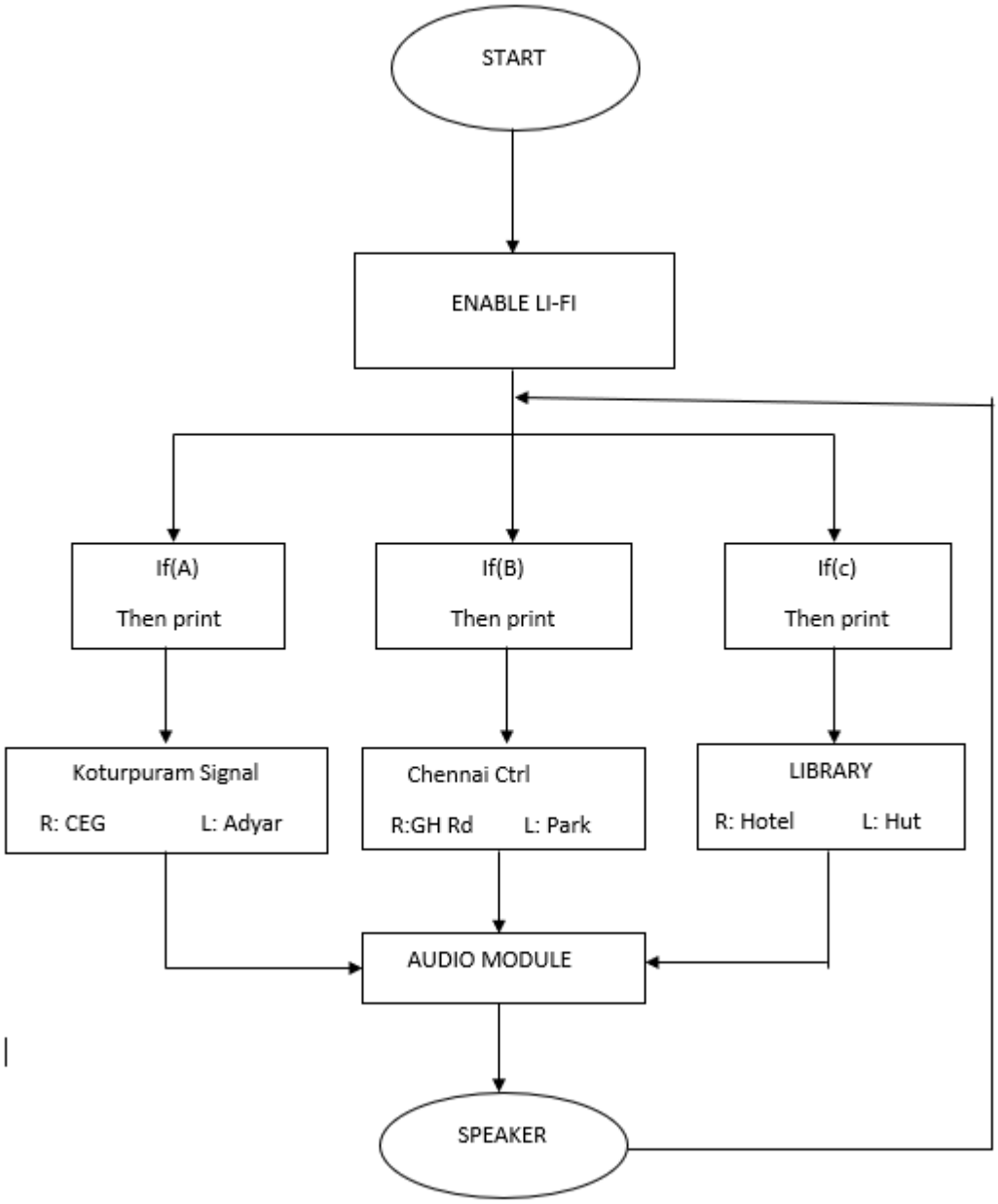

Figure 4.2.2 Receiver Section

CHAPTER 5

RESULTS AND CONCLUSIONS

5.1 RESULTS:

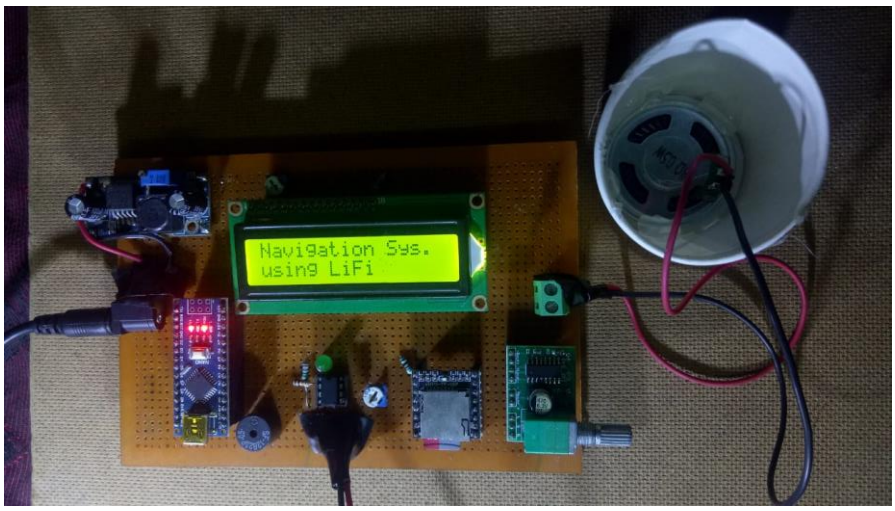

Figure 5.1.1 Transmitting message "Navigation system using LIFI

1)Displaying the present location and further diversions of the traveller

Figure 5.1.2 Present location and further diversions in lamp post 1

Figure 5.1.3 Present location and further diversions in lamp post 2

Figure 5.1.4 Present location and further diversions in lamp post 3

Figure 5.1.5 Real time data transferring from lamp post 1

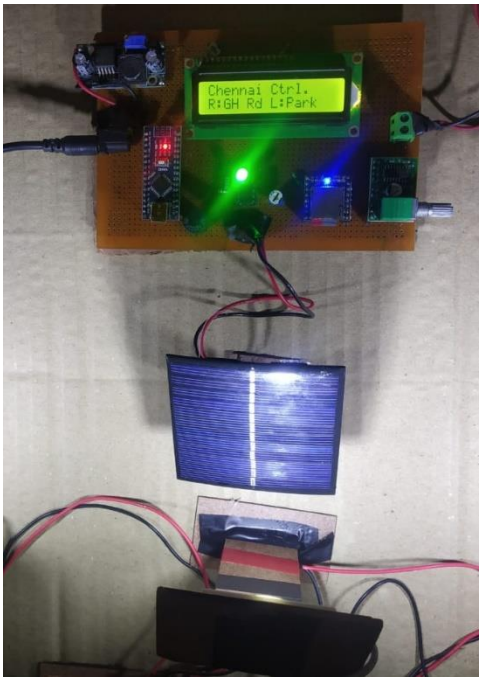

Figure 5.1.6 Real time data transferring from lamp post 2

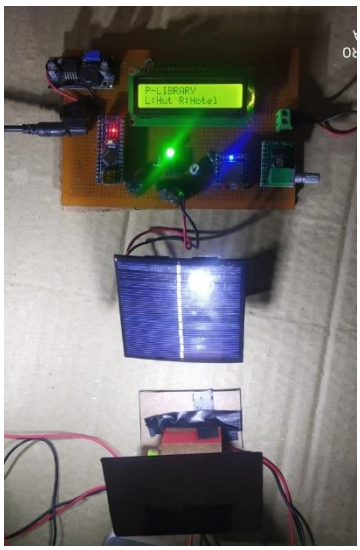

Figure 5.1.7 Real time data transferring from lamp post 3

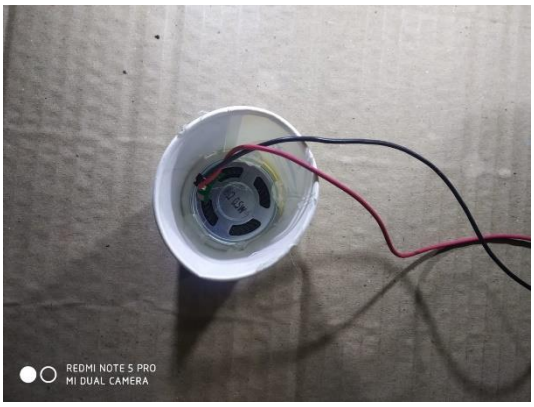

Figure 5.1.8 Audio Feedback using Speaker

.

5.2 CONCLUSION:

The Li-Fi technology is now developed into a ubiquitous system technology with innovative networking capabilities for universal application to provide a variety of device platforms for high-speed internet communications. Li-fi transmits data using the spectrum of visible light, has achieved a new breakthrough, well suited for high density wireless data. Its coverage range is 10m in bounded area. It is

used in places that do not allow radio frequency accessible like aircraft and hospitals and Internet anywhere, speed up to 1Gbps. Li- Fi based communications could offer much greater mobility.so it is much effective way to install it in the roads for navigation purpose. Hence the lamp posts are used for both illumination and navigation.

5.3 FUTURE WORK

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 highspeed 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 Li-Fi 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.

ANNEXURE:

The following codes were used to implement the Navigation system using 'Li-Fi' written in **Arduino IDE**.

Transmitter block code:

```
#include <SoftwareSerial.h>
SoftwareSerial LSerial1(2, 10);
SoftwareSerial LSerial2(3, 11);
SoftwareSerial LSerial3(4, 12);
void setup()
{
  delay(1000);
  Serial.begin(9600);
  Serial.println("Lifi Tx");
  LSerial1.begin(400);
  LSerial2.begin(400);
  LSerial3.begin(400);
}
void loop()
{
  LSerial1.print("A");
  LSerial2.print("B");
  LSerial3.print("C");
  delay(5000);
}
```

Receiver Block Code:

```
//#include <DFRobotDFPlayerMini.h>
#include "DFRobotDFPlayerMini.h"
#include <SoftwareSerial.h>
//SoftwareSerial GSerial(11,12);
SoftwareSerial DFSerial(2,3);
#include <LiquidCrystal.h>
LiquidCrystal lcd(4,5,6,7,8,9);
int buzzer=13;
DFRobotDFPlayerMini myDFPlayer;
unsigned long previousMillis=0;
char rec=0;
void setup()
{
  lcd.begin(16, 2);
  lcd.setCursor(0, 0);
  lcd.print("Navigation Sys.");
  lcd.setCursor(0, 1);
  lcd.print("using LiFi");
  pinMode(buzzer, OUTPUT);
  digitalWrite(buzzer, LOW);
  Serial.begin(400);
```

```
  //GSerial.begin(400);
  DFSerial.begin(9600);
  //Serial.println("Lifi Rx");
  delay(2000);
  if (!myDFPlayer.begin(DFSerial))
  {
     while(1)
     {
       digitalWrite(buzzer,
HIGH);delay(200);digitalWrite(buzzer
LOW);delay(200);
     }
  }
myDFPlayer.setTimeOut(500);
myDFPlayer.volume(30);  //Set
volume value. From 0 to 30
myDFPlayer.outputDevice(DFPLAYE
R_DEVICE_SD);
    myDFPlayer.playFolder(1,1);
    lcd.clear();
    previousMillis = millis();
}
void loop()
{
```

```
if(millis() - previousMillis > 5000)
  {
    rec = 0;
    lcd.clear();
  }
  if(Serial.available() != 0)
  {
    rec = Serial.read();
    if(rec=='A')
    {

digitalWrite(buzzer,HIGH);delay(100);
digitalWrite(buzzer, LOW);
      lcd.clear();
      lcd.setCursor(0,0);
      lcd.print("Koturpuram Signal");
      lcd.setCursor(0, 1);
      lcd.print("R:CEG L:Adyar");
     myDFPlayer.playFolder(1,2);
      delay(3000);
      previousMillis = millis();
      rec = 0;
      lcd.clear();
```

```
    }
    if(rec=='B')
    {
      digitalWrite(buzzer,
HIGH);delay(100);digitalWrite(buzzer,
LOW);
      lcd.clear();
      lcd.setCursor(0,0);
      lcd.print("Chennai Ctrl.");
      lcd.setCursor(0, 1);
      lcd.print("R:GH Rd L:Park");
      myDFPlayer.playFolder(1,3);
      delay(3000);
      previousMillis = millis();
      rec = 0;
      lcd.clear();
    }
    if(rec=='C')
    {
      digitalWrite(buzzer,
HIGH);delay(100);digitalWrite(buzzer,
LOW);
      lcd.clear();
      lcd.setCursor(0,0);
```

```
      lcd.print("P-LIBRARY");
      lcd.setCursor(0, 1);
      lcd.print("L:Hut R:Hotel");
      myDFPlayer.playFolder(1,4);
      delay(3000);
      previousMillis = millis();
      rec = 0;
      lcd.clear();
    }
  }
}
```

CHAPTER 6

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