

## LIFI (Light Fidelity) BASED SMART COMMUNICATION SYSTEM

V. DAMIN DOORI<sup>1</sup>, C. DHIBAKAR<sup>2</sup>, S. NANDHAKUMAR<sup>3</sup>,  
V. PRABHAKARAN<sup>4</sup>, S. SIVAKRUBAKARAN<sup>5</sup>

<sup>1</sup>(Assistant Professor, EEE, Anna University, Coimbatore, India)

<sup>2</sup>(Student, EEE, Anna University, Coimbatore, India)

<sup>3</sup>(Student, EEE, Anna University, Coimbatore, India)

<sup>4</sup>(Student, EEE, Anna University, Coimbatore, India)

<sup>5</sup>(Student, EEE, Anna University, Coimbatore, India)

**Abstract:** Nowadays, wireless communications has become more important in communication process. The main way to transmit wireless data is by using electromagnetic waves i.e. radio waves. However, radio waves can support fewer bandwidth because of solid spectrum availability. Elucidation to this is data transmission using Visible Light Communication (VLC). Wi-Fi contracts with wireless coverage within premises, whereas Li-Fi is picture-perfect for high neatness wireless data usage in defined area and for mitigating radio interference issues. In Li-Fi ultimately we focus to transmitting multimedia data between two terminals using LED's. Li-Fi is a transmission of data through illumination, in which data can be sent through a LED light bulb that varies in intensity faster than human eye can follow. In daily life we are using lights for providing light and not only for that purpose. But, it also for communication process. VLC is emerging as the new technique of data transmission method for short-range communication applications. In this paper we implement and characterize two prototype stereo audio streaming methods and data transmission methods employing VLC. An software architecture is developed to process and stream data. The software architecture is bridged with a hardware section, which facilitates free-space VLC channel, over a Universal Serial Bus (USB) to serial interface.

**Keywords:** LIFI, VLC, LED, DMT, RS232, PLC..

### 1. Introduction

Wireless communication schemes like Wi-Fi specially uses radio/micro wave frequencies for data transmission, primarily because of the possibility of high sensitivity receivers and ability to provide broad coverage at low frequencies and high frequency line of sight communication. But, radio frequency can support only a finite bandwidth due to cramped spectrum availability. The idea behind this communication scheme is transmission of 'Data through illumination'. The intensity of the LEDs is varied by blinking the current passed through them at very high speeds. This ON-OFF activity of LED lights facilitate data transmission using binary codes i.e., when the LED is ON, logical '1' is data communicated and when the LED is OFF, logical '0' voice is communicated. With increasing obligation for wireless data, lack of radio spectrum and issues with hazardous electromagnetic pollution, Li-Fi emerges as a new greener, healthier and cheaper substitute to Wi-Fi. Wireless systems and to overcome the confined amount of radio based wireless spectrum available by attaining a completely different part of the electromagnetic spectrum. The consortium believes is potential to achieve more than 10 gbps. Li-Fi also used in profound areas without causing interference. However, the light waves used cannot diffuse through walls. White LED's are used for indoor wireless networks for communication. These equipment should have capacity of wireless optical communication. The medium of communication is visible light. The communication throughout the whole room is delivered by high power lighting equipment. This is often easy to install and low in terms of cost.

### 2. Existing System

Wi-Fi and Bluetooth are two prominent short range wireless technologies used by a multiplicity of wireless applications today. However these methods exploit scarce radio frequency spectrum. Other drawbacks of these methods include requirement of special equipment, high power consumption and high cost. Secured data transmission is not available here, even though, wps key encryption can be provided, it can also be hacked in many ways. It also provides damage to your health as its radio wave transmission. Interference of signals is also a major concern.

### 3. Proposed System

VLC is emerging as the new technique of data transmission method for short-range communication applications. . VLC employs a light source as the transmitter and a light detector as the receiver to altercation data. Data is encoded using on-off keying (OOK). The proposed system will overcome these disadvantages of existing system. Such has, no interference on radio frequency signals as this communication totally depends on light. It is based on a simple technique of illumination communication. Moreover data speed of this LIFI is extremely fast when compared to other means of communication. Since the communication is based on visible light which is the most used part in electromagnetic spectrum for communication. As, data transmitted through light.

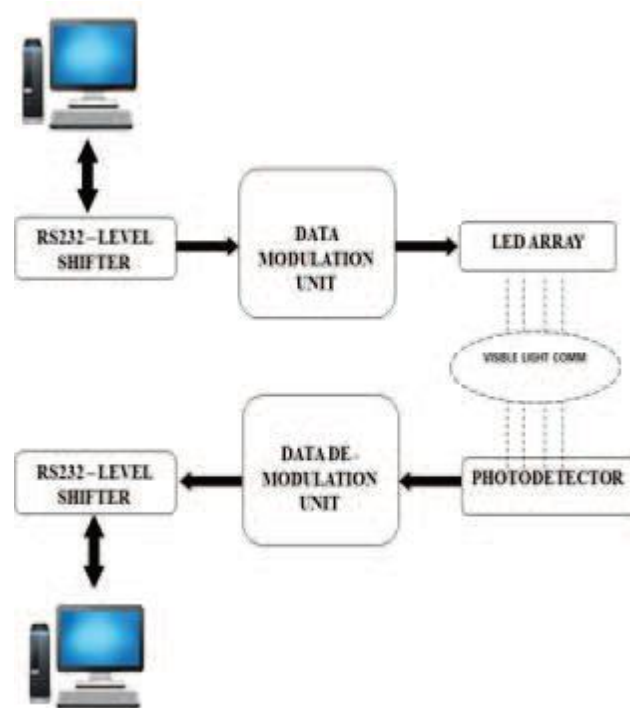


Fig.1.0. Block Diagram OF Proposed System

In this paper, the implementation and analysis of two stereo audio transmitting methods referred to as Pulse Code Modulation (PCM) streaming and MP3 streaming over VLC are presented. Audio streaming is a core component in home entertainment. The communication architecture instigated is composed of software and hardware subsections. Hardware components are instigated using off the shelf, low cost components Light Emitting Diodes (LEDs) as the transmitter, photodiodes as the receiver and a universal serial bus (USB) module as the interface between the hardware and software subsystems. The software subsystem produces a transmission-ready binary data stream from audio files and the hardware subsection transmits the binary stream over a free space VLC link. .

### 4. TRANSMITTER

In transmitter part the data is said to be communicated by transmitting an data from pc via data modulation unit and through LED array. Data can be converted to digital signals of 0s and 1s in data modulation unit and provides series of pulses such that image can be converted into digital signals of binary bits. Data gets designated from series of stored data and is then designated and transmitted successfully. Once the data is transmitted it reaches receiver side through visible light communication scheme. The goal of transmitter part is to transmit image.

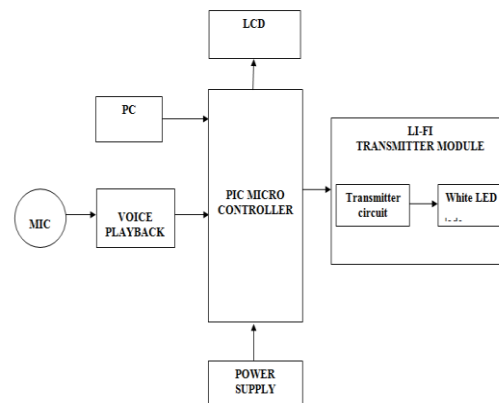


Fig.2.0. Block diagram of Transmitter

## 5. Receiver

The goal of receiving part is to receive the data that is transmitted from the transmitter successfully. The goal of receiving part is to receive the data that is transmitted from the transmitter part successfully.

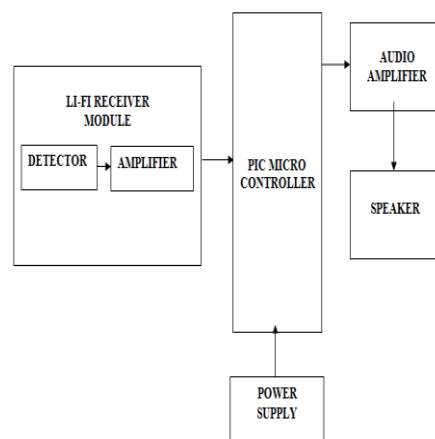


Fig.3.0. Block diagram of Receiver

### 5.1 Circuit Diagram of Transmitter

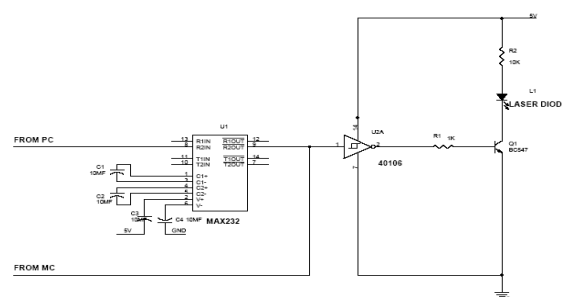


Fig.4.0 Circuit diagram of Transmitter

The data whose has to transmit given from PC or microcontroller. If the data is from the PC, the transmitter section is interfaced with PC through the level logic converter MAX 232. The MAX 232 is used to convert the +12v and -12v pulse to 0v and 5v pulse then given to hex inverter 40106. If data is from the microcontroller, it is directly given to hex inverter input. When 5v is given to base of the switching transistor BC 547, the transistor is conducting and it closed the collector and emitter terminal. Now the LED is

conducting, so data is transmitted as the light medium. When 0v is given, the transistor and LED is turned off. Hence the binary data 0, 1 are transmitted through light medium.

## 5.2 Circuit Diagram of Receiver

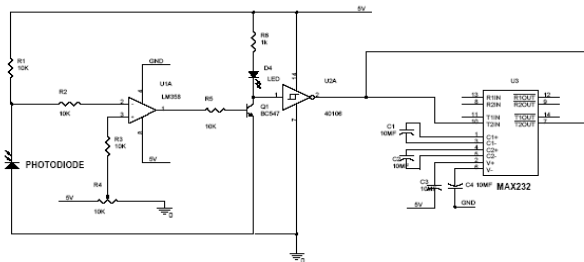


Fig.5.0. Circuit diagram of Receiver

This circuit is deliberate to receive the data from the LED transmitter side. In this circuit the photo diode is used as receiving device. The data are transmitted in as light medium. The light rays are fallen on the photo diode. When light ray falls on the photo diode, the diode is conducting and became short circuit. When there are no light rays, the diode became open circuit. The photo diode is connected in series with resistor and constructs the voltage divider. This grouping is allied to inverting input terminal of the comparator. The comparator is fabricated with LM 741 operational amplifier. In the comparator circuit the reference voltage is given to non-inverting input terminal. When photo diode is conducting, the comparator non-inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +12V. This voltage is given to base of the transistor Q1. Hence the transistor is conducting. Here the transistor is act as switch so the collector and emitter will be closed. The output is taken from collector terminal. Now the output is zero which is given to hex inverter 40106. When there are no light rays, the photo diode is open circuit. The inverting input voltage is grander than non-inverting input. Now the comparator output is -12V so the transistor is cutoff region. The 5v is given to hex inverter 40106 IC. Then the final output data is directly given to microcontroller. If the output data has to give to PC we essential level logic converter RS-232 which converts the TTL input to PC acceptable format (+12V to -12V).

## 6. Working

The output of a LED may be a continuous constant-amplitude output (known as CW or continuous wave); or pulsed, by using the performances of Q-switching, model-locking, or gain-switching. In many applications of pulsed LED's, one aims to payment as much energy as possible at a given place in as short time as conceivable. Some LED's and vibronic solid-state LED can produce light over a far-reaching range of wavelengths; this property makes them suitable for engendering extremely short pulses of light, on the order of a few femtoseconds ( $10^{-15}$  s). The peak power of pulsed laser can achieve  $10^{12}$  Watts.

## 7. Serial Communication

The serial communication is used, to transfer to a device located many meters. In serial communication, the data is sent one bit at a time, in which the data is sent a byte or more at a time. The ARM has serial communication proficiency built into it, thereby making apparent fast data transfer using only a few wires. It provides the data in byte-sized chunks, When microprocessor interconnects with the outside world, The ARM transfers and receives data serially at many baud rates. The baud rate in the ARM is programmable. This is done with the help of timer 1.

## 8. Arm Microcontroller

The ARM7TDMI core is the supreme extensively used 32-bit embedded RISC microprocessor solution. Speed critical control signals are pipelined to grant system control functions to exploit the fast-burst access modes supported by many memory technologies. The ARMv4 ISA which adds upkeep for the 16-bit Thumb instruction set. A 128-bit wide memory interface enables 32-bit code effecting at the maximum clock rate. For critical code size applications, the 16-bit Thumb substitute mode reduces code by more than 30% with minimal performance penalty. As LED lights should OFF and ON to transmit data. its not visible to our human eye. So fast switching should be compulsory for efficient transmission of 0s and 1s. this is made by pulse width modulation technique.

### 8.1 USB to TTL

As data can be transmitted between two devices a serial port cable should be there for serial communication. Recommended Standard 232(RS232) is used for this type of communication where data can be transmitted bit by bit over long distances. This is widely used communication for data transmission.

### 8.2 Visible Light Communication(VLC)

Digital data of 1s and 0s are approved by unconventional switching of LED bulb lights through visible light communication. Data from LED light array are transmitted through visible light which is then captured by photo detector and this diode converts light signals into electrical signals which is then demodulated by data demodulation unit and is filtered to get prerequisite appropriate output on the receiver side of personal computer (PC). The final voltage signal should correspond to the received light pulses which are then decoded in the final decoder block, thus extracting the digital data.

## 9. Introduction to PIC

The microcontroller that has been recycled for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS(complementary metal oxide semiconductor) that uses isolated bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC mishmash is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

### 9.1 PIC (16F877)

Various microcontrollers offer dissimilar kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Encoding and Obliterating are other features of PIC 16F877.

## 10. Power Supply

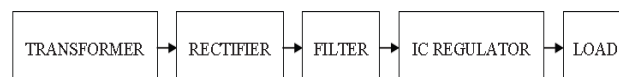


Fig.6.0.Block diagram of Power supply

The ac voltage, typically 220V rms, is connected to a transformer, which provides that ac voltage down to the level of the anticipated dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage fluctuates. This voltage regulation is habitually obtained using one of the popular voltage regulator IC units.

## 11. Conclusion

This technology is still under research and surely it will be a breakthrough in communication. It assures data speed of 100gbps which is entirely greater than radio waves. In this paper transmission of data is done through this Li-Fi technology. The scope of this Li-Fi was ultimately greater. The goal of this paper is Li-Fi provides secured, low cost, easy data transmission and provides reliable communication. It can also be used in industrial, medical, military applications. Li-Fi is still in its beginning stages, but improvements are being made rapidly, and soon this technology will be able to be used in our daily lives. It is intended that this research will provide the starting steps for further study. In spite of the research problems it is our belief that the VLC system will become one of the most promising technologies for the future generation in optical wireless communication.

### **References**

- [1]. “A Visible Light Communication System for Indoor Application” Amrutha.S, Ansu Mathew, Rajasree.R, Swathy Sugathan; Aravind.S, International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 12, June 2014.
- [2]. AbhishekKurup, VipinTiwari, Selvanathiya (2014), ‘Implementation And Demonstration Of Li-Fi Technology’, International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
- [3]. Akshata m sonnad (2013), ‘Led Recent Advancements In Li-Fi Technology’, International Journal of Electrical, Electronics and Data Communication, ISSN: 2320-2084 Volume- 1.10, Dec-2013.
- [4]. AnuragSarkar (2015), ‘Li-Fi Technology: Data Transmission through Visible Light’, International Journal of Advance Research in Computer Science and Management Studies Volume 3, Issue 6, June 2015.
- [5]. Amrutha.S, Ansu Mathew, Rajasree.R, SwathySugathan; Aravind.S (2014), ‘A Visible Light Communication System for Indoor Application’, International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 12, June 2014
- [6]. Alif Shah (2014), ‘Novel Architecture for Future Li-Fi Wireless Technology’, International Journal of Engineering Research & Technology (IJERT). Vol. 2 Issues 11, November – 2014.
- [7]. Cossu.G, Khalid A.M, Choudhury.P, Corsini.R, Ciaramella.E(2012), ‘Long Distance Indoor High Speed Visible Light Communication System Based on RGB LEDs’, IEEE Transactions on networks.
- [8]. DilukshanKarunatilaka, FahadZafar, VineethaKalavally,(2015), ‘LED Based Indoor Visible Light Communications: State of the Art’, Ieee Communication Surveys & Tutorials, Vol. 17, No. 3, Third Quarter 2015.