

# Li-Fi Based Home/Office Computerization System

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**Abstract** - In the present era, Wi-Fi is the most trending domain. As internet users almost double every year, there is an enormous load on radio spectrum that leads to congestion. To get better bandwidth, efficiency and speed, a new technology Li-Fi has evolved. Li-Fi stands for Light Fidelity. It is a bidirectional and wireless mode of communication using light. It uses the unused visible spectrum and reduces the load on radio spectrum. Li-Fi can be simply put to be Wi-Fi but instead of radio waves light is used as a medium. Here, data is transmitted using light whose intensity varies faster than human eye to capture. Instead of using modems, Li-Fi uses LED bulbs with transceiver. Data transmission in Li-Fi is about 100 times faster than Wi-Fi. Here, in this paper we explore the need for Li-Fi in home/office automation.

**Key Words:** Audio Jack, DTMF Encoder, Power LED, Microcontroller AT89C51, LCD Display, Pre-Amplifier, Power Amplifier, Modulator, Keyboard, Device controller.

## 1.INTRODUCTION

Light Fidelity (Li-Fi) is future technology which replaces the Wi-Fi. Because Li-Fi overcomes disadvantages of Wi-Fi like Data Transfer speed of Li-Fi is more than 1Gbps while in Wi-Fi it is about 150 Mbps. Li-Fi uses light as a carrier but Wi-Fi uses radio Spectrum. In Li-Fi Visible light Spectrum has 10,000 broad spectrums in comparison of radio frequency. Operating Frequency in Li-Fi is Hundreds of TeraHz where as in Wi-Fi it is 2.4 GHz. Li-Fi is Cheaper than Wi-Fi because free band doesn't need license and it uses light. Li-Fi is a bidirectional, high speed and fully networked wireless communication technology similar to Wi-Fi. This term was developed by Harald Haas and is a form of visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication (Wi-Fi or Cellular network), or even a replacement in contexts of data broadcasting. It is so far measured to be about 100 times faster than some Wi-Fi implementations, reaching speeds of 224 gigabits per second. Li-Fi technology in the audio transmission is must faster and secured communication. In Li-Fi based Home/Office automation we can control number of devices using Android application, embedded controller plays important role for switching the device. In future this technology can be used in industry automation for controlling various machineries and robotics. Nowadays approximately 5 million mobile phones are transmitted higher than 600 terabytes of data in every month and currently there are 1.4 billion base station available that inherent more energy and there should be less than 5

percent of efficiency, this all explains that usage of wireless has been achieved maximum utility.

## 1.1 Aim and Objectives

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 thoughts 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.

## 1.2 Requisite

Li-Fi using visible light instead of gigahertz radio waves. Nowadays approximately 5 million mobile phones are transmitted higher than 600 terabytes of data in every month and currently there are 1.4 billion base station available that inherent more energy and there should be less than 5 percent of efficiency, this all explains that usage of wireless has been achieved maximum utility. It is free of wires and there will be no box installed as Wi-Fi. The binary numbers should be transmitted into light pulse. It can be through tiny LED bulbs on and off a million of times per second. The explorers of data transmission through blinking of LED which translates up to 10 Gbps with the help of wireless internet. These gain come at a five-fold transits currently offering fiber optics, Luminous router is used to get the maximum gain of this technology, that have the capacity to emit the binary signals. Li-Fi is not visible to eye so it won't ever replace Wi-Fi, but it could overcome it nicely. It will be very easy in our house where every light will act as a wireless network bridge, instead of trying to find the perfect Wi-Fi router. A Construction of Li-Fi System Compared to Wi-Fi, Li-Fi is a cheap and fast optical technology. Visible Light Communication (VLC) is the basis for Li-Fi. VLC is a data communication media, which depends on visible light between 400 THz (780 nm) - 800 THz (375 nm). It acts as an optical carrier for data transmission and illumination which uses fast signals of light for transmission without wires.

## 2. TECHNIQUE

Transceiver is a Block that act as a transmitter and receiver at the same time. This transceiver consists of LED to transmit the light and photodiode to receive the light. Amplifier is embedded to strength the power of light received from the photodiode. The modem is used to modulate and demodulate the signal. The signal that comes from the photodiode is analog and it converts into digital in the modem. While the signal that ready to transmit, the digital signal convert into analog signal in the modem and sent by LED. The driver before the LED operates to drive the current of the LED in order to get the flickering. The flickering is functioning the LED for data transmission, if LED is ON then it transmits digital '1' and if OFF, it transmits digital '0'[4][5].

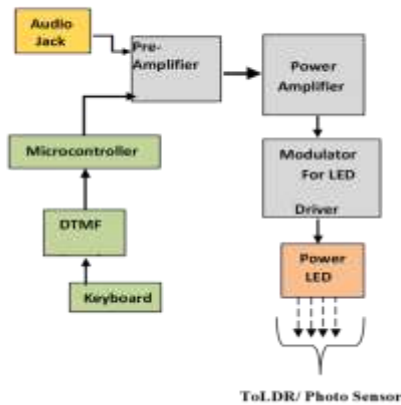


Fig-1: Block diagram of Transmitter

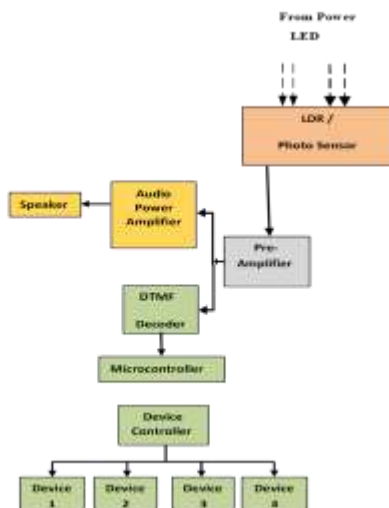


Fig-2: Block diagram of Receiver

The Li-Fi system consists of mainly two parts, the transmitter and the receiver. LED light is used as signal source between two end systems. Data is carried by the modulated light from the LED. The microprocessor unit

(MPU) system modulates and demodulates data at transmitter and receiver ends respectively. The transmitter part modulates the input signal with the required time period and transmits the data in the form of 1's and 0's using a LED bulb. These 1's and 0's are nothing but the flashes of the bulb. The receiver part catches these flashes using a photodiode and amplifies the signal to produce the output. Li-Fi is implemented using white LED light bulbs at downlink transmitter. An array of LEDs can also be used for parallel data transmission and different colored LEDs to alter the LED frequency so that data are encrypted for different frequency.

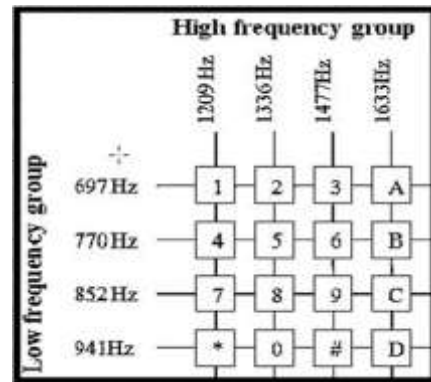


Fig-3: 4x4 Key Matrix.

Above figure No. 5.5 indicates the 4x4 key matrix key boards, used to generate the DTMF code combinations. It contains 16 keys. The key combination can send the particular frequency to switch ON or OFF the Device. According to these key combinations the particular devices are switched ON or OFF.

Table -1: Conditions for working

Sr. No.	Parameter	Observations
1)	Max. Length of Communication between Transmitter & Receiver.	5 Meters
2)	Response time of relay after key pressed.	10ms

## 3. CONCLUSIONS

The most of the dependent upon 'the cloud' or our own 'media services' to store all of our files, including movies, photos, audio and video devices, games, the more and most bandwidth and speed should be needed to access this data. Therefore RF-based technologies such as today's Wi-Fi are not the optimal way. In addition, Wi-Fi may not be the most efficient way to provide new desired capabilities such as precision indoor positioning and gesture recognition. The optical wireless technologies, sometimes called visible light communication (VLC), and more recently referred to as Li-Fi. On the other hand, offer an entirely new paradigm in wireless technologies in the terms of communication speed, usability and flexibility, reliability. VLC is the possible solution to the global wireless spectrum shortage. Li-Fi technology is a fast and cheap optical version of Wi-Fi.

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