

Multimedia Communication Using Efficient Lighting Source

Nikhil. D. Sangale¹, Dr. Dhananjay K. Singh²Department of Electronics and Telecommunication, Sinhgad Institute of Technology Lonavala, Maharashtra, India¹Department of Electronics and Telecommunication, Sinhgad Institute of Technology Lonavala, Maharashtra, India²

ABSTRACT: Now a day, many researchers are working on the development of light-emitting diode (LED) lighting system. The LED has two great advantages i.e. lower power consumption and a longer life-time compared to other lighting systems for e.g. fluorescent lamp system. Li-Fi stands for Light-Fidelity. Li-Fi technology, proposed by the German physicist—Harald Haas, provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. This paper focuses on developing a Li-Fi based system for multimedia communication with respect to existing technology. Data transfer is kind of process to transfer the data between two objects. Recently data transfer is done through wire and further wireless, which results problem like data losing, data hacking and also cause health hazards to the children by emission of waves in wireless communication. In Li-Fi technology, led is used to transfer data and many receiver can access data at the same time. The objective is to produce lesser data lose and eco-friendly system. In this paper we outline the basic components in these systems, review the state of the art and discuss some of the challenges and possibilities for this new wireless transmission technique.

KEYWORDS: Multimedia communication, Li-Fi Light-Fidelity. .

I. INTRODUCTION

Currently there is rapid development in the field of data transmission. This technique results problem like data hacking and data loss. Hence the transfer of data through light is decided. Communication is most important day-to-day activities for that transfer of data from one place to another are necessary. In the current wireless networks system radio waves are just a small part of the spectrum available for data transfer. A solution to this problem is by the use of Li-Fi. Li-Fi environment used LED for light a room as well as transmit and receive information or data. Data can be in any form like it's in text, audio or video the proposed solution compatible with all multimedia files.

We all know that LED has very important property that its intensity can be modulated at very high speed, it can be switched ON-OFF at such a high speed to give different strings of 1s and 0s that even human eye can't detect, Li-Fi used this fundamental property. Using Li-Fi technique we transfer data through light to many of the receivers. Hence the same data will received by all receiver at same time. Visible Light Communication (VLC) is a data communication technology that uses a visible light source as a signal transmitter, the air as a transmission medium or channel and a signal receiving device. Generally, the transmitters are Light Emitting Diodes (LEDs) while the principal device of the receiver is a photo detector, usually a photodiode. By using VLC in short distance applications, we can supplement radio waves achieving high data rates and a larger bandwidth.

II. CONSTRUCTION

A high brightness white LED is the main component of this communication system, which acts as a communication source and a silicon photodiode which shows good response to visible wavelength region. LED can generate digital strings of 1s and 0s when it being switched on and off respectively. Data can be encoded in the light to generate a new

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data stream by varying the flickering rate of the LED (as shown in Fig. 1). This system works on switching LED on and off within nanoseconds which could transmits data.

The VLC (visible light communication) is 10,000 times larger as compare to radio frequency. LI-Fi replaces gigahertz radio waves with visible light. Hence area like aircraft cabins, hospitals and nuclear power plant which are electromagnetically sensitive, at that area we can transfer data without electromagnetic interference using Li-Fi.

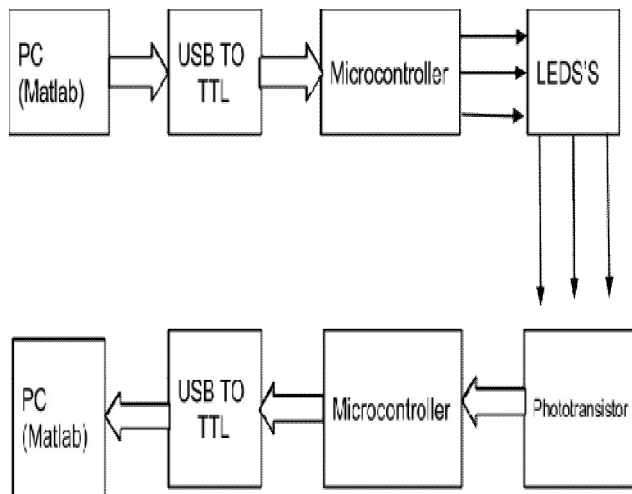


Fig. 1 - Block Diagram of System

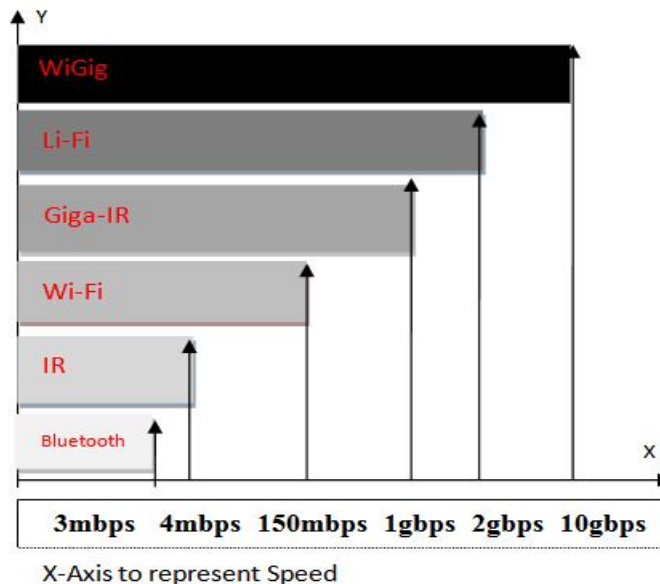


Fig 2

Due to the fast flickering rate of the LED, output appears constant to the human eye. Theoretical Communication rate greater than 100 Mbps or in Gbps is possible by using high speed LEDs (as shown in Fig. 2). VLC data rate can be increased by parallel data transmission using an array of LEDs where each LED transmits a different data stream.

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III. WORKING PRINCIPAL

A new generation of high bright light-emitting diodes plays very important role in light fidelity technology. The logic is very simple. If the LED is on, a digital 1 is transmitted. If the LED is off, a digital 0 is transmitted. These high brightness LEDs can be switched on and off very quickly through which data transmit through light.

The working of Li-Fi is very simple. There is a light emitter on one end, for example, an LED, and a photo detector (light sensor) on the other. The photo detector registers a binary one when the LED is on; and a binary zero if the LED is off. To build up a message, flash the LED numerous times or use an array of LEDs of perhaps a few different colors, to obtain data rates in the range of hundreds of megabits per second.

The data can be encoded in the light by varying the flickering rate at which the LEDs flicker on and off to generate different strings of 1s and 0s. The LED intensity is modulated so rapidly that human eye cannot notice, so the light of the LED appears constant to humans.

Many other sophisticated techniques can be used to dramatically increase Visible Light Communication data rate. Team at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission using array of LEDs, where each LED transmits a different data stream. Other groups are using mixtures of red, green and blue LEDs to alter the light frequency encoding a different data channel.

Light-emitting diodes (commonly referred to as LEDs and found in traffic and street lights, car brake lights, remote control units and countless other applications) can be switched on and off faster than the human eye can detect, causing the light source to appear to be on continuously, even though it is in fact 'flickering'. The on-off activity of the bulb which seems to be invisible enables data transmission using binary codes: switching on an LED is a logical '1', switching it off is a logical '0'. By varying the rate at which the LEDs flicker on and off, information can be encoded in the light to different combinations of 1s and 0s. This method of using rapid pulses of light to transmit information wirelessly is technically referred to as Visible Light Communication (VLC), though it is popularly called as Li-Fi because it can compete with its radio-based rival Wi-Fi. Figure 3 shows a Li-Fi system connecting devices.

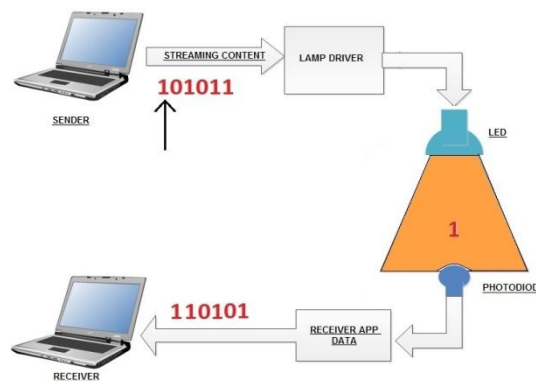


Fig 3 – Li-Fi system connecting devices

IV. COMPARISON BETWEEN LI-FI & WI-FI

Table- I shows a comparison of transfer speed of various wireless technologies. Table I shows a comparison of various technologies that are used for connecting to the end user. Wi-Fi currently offers high data rates. The IEEE 802.11.n in most implementations provides up to 150Mbit/s although practically, very less speed is received.

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Table - 1

Technology	Speed
Wi-Fi – IEEE 802.11n	150 Mbps
Bluetooth	3 Mbps
IrDA	4 Mbps
Li-Fi	>1 Gbps

V. ADVANTAGES OF LI-FI

Li-Fi technology is based on LEDs for the transfer of data. The transfer of the data can be with the help of all kinds of light. Also, the speed of the communication is more than sufficient for downloading movies, games, music and all in very less time.

- Capacity:** Light has 10000 times wider bandwidth than radio waves.
- Efficiency:** Data transmission using Li-Fi is very cheap. LED lights consume less energy and are highly efficient.
- Availability:** Availability of LEDs is not an issue. There are billions of light bulbs worldwide; they just need to be replaced with LEDs for proper transmission of data.
- Security:** Light waves do not penetrate through walls.

VI. DISADVANTAGES OF LI-FI

- The artificial light cannot penetrate into walls and other opaque materials which radio waves can do.
- Also, another disadvantage is that it only works in direct line of sight.

VII. APPLICATIONS OF LI-FI

There are numerous applications of this technology, from public internet access through street lamps to auto-piloted cars that communicate through their headlights. Applications of Li-Fi can extend in areas where the Wi-Fi technology lacks its presence like medical technology, power plants and various other areas. Since Li-Fi uses just the light, it can be used safely in aircrafts and hospitals where Wi-Fi is banned because they are prone to interfere with the radio waves. Some of the future applications of Li-Fi are as follows:

- Education systems:** Li-Fi is the latest technology that can provide fastest speed internet access. So, it can replace Wi-Fi at educational institutions and at companies because that all the people can make use of Li-Fi.
- Extends our life span:** Operation theatres (OTs) do not allow Wi-Fi due to radiation concerns, it may be hazardous to the patient's health. To overcome this problematic situation Li-Fi can be used to accessing internet and to control medical equipment's.
- Underwater applications:** Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. If their wires were replaced with light or high-powered lamp. They could also use their headlamps to communicate with each other. Li-Fi can even work underwater where Wi-Fi fails completely.
- Traffic management:** In traffic signals Li-Fi can be used in traffic signals which will communicate with the LED lights of the cars which can help in managing the traffic and can be decreased numbers of accident. Also, LED car lights can alert drivers when other vehicles are too close.

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e) **Replacement for others technologies** This technology doesn't deal with radio waves, so it can easily be used in the places where Bluetooth, infrared, WIFI and Internet are banned. In this way, it will be most helpful transferring medium for us. It includes other benefits like:

- A very wide spectrum over visible wave length range.
- Extremely high colour fidelity.
- Instant start time.
- Easy terminal Management.
- Dynamic dark i.e. brightness Modulation of lamp output to enhance video contrast.
- Trouble-free integration into existing light engine platform.

VIII. RESULTS

Figure 4 shows the hardware setup of the proposed work.



Fig 4 – Li-Fi Setup

Figure 5 shows the transmitted signal propagation of light in the proposed work.

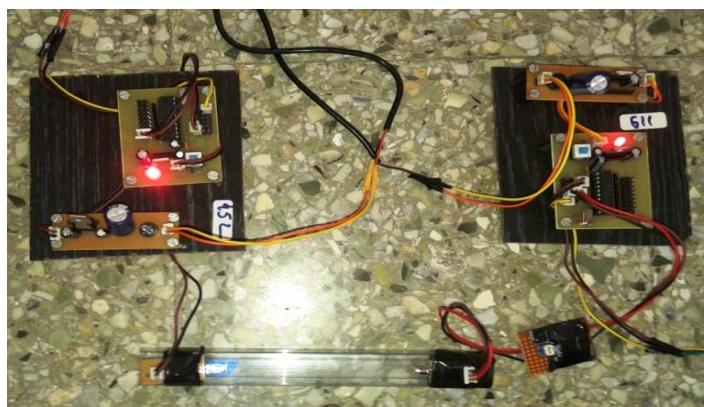


Fig 5 – Li-Fi system connecting devices

Figure 6 shows the Transmitter Software screen shot.

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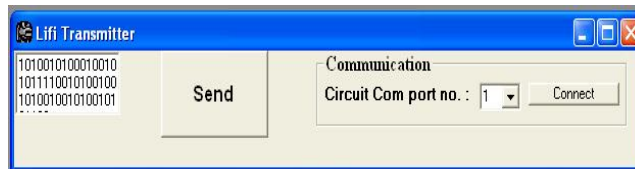


Fig 6 – Li-Fi Transmitter

Figure 7 shows the Receiver Software screen shot.

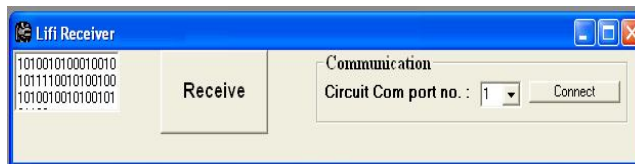


Fig 7 – Li-Fi Receiver

IX. CONCLUSION

Li-Fi is the upcoming and on growing technology acting as competent for various other developing and already invented technologies. If his technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. LED's are majorly used for indoor lighting purposes. Li-Fi gives a new dimension to the very popular LED's as a speed data transmitter. It can be viewed as a replacement to RF communication for short ranges to some extent. The phenomenon of data transfer using Bluetooth, Wi-Fi can be implemented using VLC's. VLC has no health hazards associated with it. A low cost communication system can be set up.

In future, visible light communication can be a replacement to almost all indoor and short range communication purpose. The data rates can be further enhanced by using suitable light sensors. There are a plethora of possibilities to be gouged upon in this field of technology.

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BIOGRAPHY



Mr. Nikhil D. Sangale
Electronics and Telecommunication
Department
Sinhgad Institute of Technology
Lonavala, India.



Dr. D. K. Singh
Electronics and Telecommunication
Department
Sinhgad Institute of Technology
Lonavala, India.