

Li-Fi Technology: A New Revolution in Wireless Technology

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Abstract

The communication plays a very important role in our modern life. The peoples always require accurate information at any place with a very high speed internet. The peoples prefer wireless network instead of wired network for fast communication. In last few years researchers have developed some new wireless technology. Li-fi is a new wireless technology which provides better efficiency, bandwidth, availability and security with very high speed connectivity. This paper present LI-FI technology and study with other wireless communication technologies.

1. Introduction

Today, there are many tools and technologies for communication. We can communicate with each other either using wired network or wireless network. LI-FI is one of the fastest growing technologies among them [1-2]. German scientist Harald Hass invented Li-Fi technology. The Li-Fi technology is also called as visible light technology as it based on visible light. In Wi-Fi technology radio waves are used. The Li-Fi uses light instead of radio waves to transfer data at very high speed [1, 3].

Li-Fi plays major role to minimize the heavy load which this problem facing by current wireless systems. By using this technology, we can produce at the rate of higher than 10 megabits per second which is much faster than our average broadband connection [4].

2. Literature Survey

Harald Haas name the term Li-Fi and presented Li-Fi in his 2011 TED Global talk by showing demonstration of an LED light bulb to transmit a video with the speed more than 10 mega bits per second. He succeeded to building an 800 mega bits per second active wireless network by using some simple red, blue, green and white LED light bulbs [3].

He demonstrated Light fidelity for the first time, a method of Visible light communication (VLC) technology. Li-Fi technology gives new circumstances of accessing the internet, receive emails and much more. Research into this VLC has been conducted in 2003, mainly in England, America, Germany, Korea and Japan. Demonstrations have shown that VLC is faster, safer and cheaper than other forms of wireless internet [6].

Herald Hass clarified that the heart of this technology is light emitting diode. The main components of Li-Fi system are

- 1.) High brightness white LED which acts as transmission source.
 - 2.) Silicon photodiode which act as the receiving element.
- Figure 1 shows block diagram of Li-Fi technology.

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To implement Li-Fi technology, the researchers have used white LED light bulbs. To make Li-Fi works, constant current is required. Light emitting diodes can be switched on and off faster since their operating speed is less than 1 μ s, that the human eye can detect. When the LED is on, it transmit a digital '1', when it's off it transmit a '0'. As they can be switched on and off very quickly, it gives nice opportunities for transmitted data [5].

3. World Survey

Journal of China Universities of Posts and Telecommunications, the illumination of the receiving surface for different distances between the LED transmitter and photodiode receiver was tested. The researchers found that with the increase in communication distance, the illumination sharply reduced.

The Wireless World Research Forum (WWRF), discovered that performance of receiver element need not be considered for bandwidths up to 100MHz. To increase data rates, performance of LEDs must be enhanced [4].

Researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabits per second using a standard white-light LED.

Researchers at the University of Strathclyde in Scotland have started the task of bringing high-speed Li-Fi technology to market [8].

Li-Fi Consortium was formed in October 2011 by a group of companies and industry groups to raise high-speed optical wireless systems and to overcome the limited amount of radio based wireless spectrum. According to the Li- Fi Consortium, it is possible to achieve more than 10 Gigabits per second of speed [6].

4. India Survey

Indians scientists currently working for Lifi technology. Railways Minister declares that Wi-Fi facilities would be provided at over 400 railway stations. Ministry of railway presenting the Railway Budget for fiscal 2015-16 in Parliament, He explained that the budget is for speedier railway. There will be satellite railway terminals in major cities and Wi-Fi facility will be provided in 400 stations.

According to Indian Railway budget 2015-16, all station will be having Wi-Fi hotspot. All station differ in length of station, number of platform on a station so there may be use of many routers or internet access points, but by using Li-Fi

concept it can reduce the router quantity and also it can have common access point for each station[7].

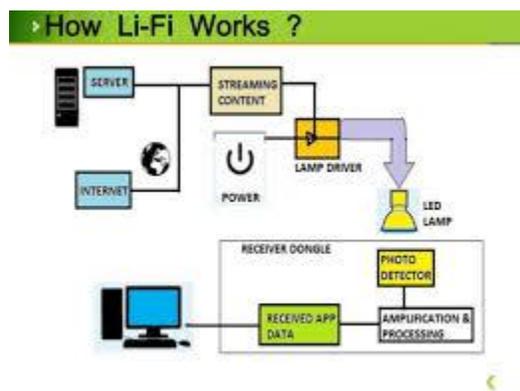


Fig 1 Architecture of Li-Fi Technology

Table 1: Comparison of Li-Fi vs Wi-Fi vs Bluetooth Technologies:

Characteristics	Li-Fi	Wi-Fi	Bluetooth
Frequency	No frequency for light	2.4 GHz - 5 GHz	2.4 GHz
Range	Based on LED light falling	100 meters	10 meters
Data transfer speed	800 Kbps	11 Mbps	> 1Gbps
Cost	Low	Medium	Low
Security	High secure	Medium secure	Less secure
Operating band	Visible light band	Radio frequency band	Industrial, scientific and medical radio band
invention year	2011	1990	1998

5. Application

There are numerous applications of this technology:

1. Education systems: Li-Fi is the latest technology that can provide fastest speed internet access. So, it can replace Wi-Fi at educational institutions [4].
2. Health technologies: The Wi-Fi technology emits radio waves which are very harmful for the patients and the radio waves may interpret the medical instruments. Thus we can use internet in operating rooms by Li-Fi technology [2].
3. Underwater Communication: By using Wi-Fi technology, it is not possible to communicate through water as radio waves are quickly absorbed in water. But light can penetrate for large distances. Therefore, Li-Fi can be used for underwater communication [4].
4. Traffic management: In traffic signals by using Li-Fi technology, the LED lights of the cars can communicate with each other which can help in managing the traffic in a better manner. So the chances of accidents may reduced [2].

5. Challenges

1. Li-Fi requires line of sight.

2. Receiving device would not be shift in indoors.
3. A major challenge is how the receiving device will transmit data back to transmitter.
4. Visible light can't penetrate through brick walls.
5. We become dependent on the light sources for internet access. If the light sources break, we lose access to the internet [3].

6. Conclusions

Lifi is upcoming and fastest growing technology. Now days, the world is moving towards the digital space. So by using Lifi technology, the internet data for laptops, tablets and smart phones can be transmitted through light in room. Lifi technology increases the speed of data transfer and it can be used in many banned places. If this technology used in practically, each and every bulb can be used something like WiFi hotspot to transmit high speed wireless data. So we can move towards cleaner, safer and brighter future.

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