

A BRIEF STUDY OF LI-FI TECHNOLOGY : A REVIEW

Jagdeep Singh
Assistant Professor
Department of Computer Science
JC DAV College, dasuya

Abstract

Wired or wireless network of internet has been in vogue to carry on our work. Network speed is clearly related to the number of users, it degrades with the increase of users. The Wi-fi speed upto 150 mbps fails to meet the need of users. To counter it Li-fi is introduced. The same idea called D-LIGHT also used in infrared remote controls produces the data rates faster than average broadband connections. Li-fi the Light Fidelity, as coined by German physicist Harald Hss transmits data through illumination. This paper discuss will Li-fi system in detail. Wi-Fi provides connectivity within the buildings, whereas Li-fi is used for coverage in captive area. Li-fi is better than Wi-Fi in efficiency, availability and security. Li-fi can be used for public internet access through street lamps and auto piloted cars. Hass visualizes the working of phones and laptops through light in the room.

Introduction

When it comes to multiple connections, the internet runs very slow because of fixed bandwidth. Li-fi can come to the rescue of this problem. It is fast and cheap wireless communication and is the optical version of Wi-fi. Li-fi uses light and relieves load by adding unutilized bandwidth of visible light to the currently available radio waves for data transfer.

Construction of Li-fi System

Fast and inexpensive version of Wi-fi, Li-fi is based on VLC, data communication medium. Light between 400 THz and 800 THz is used for data transmission to transmit information wirelessly.

Li-fi consists of following components

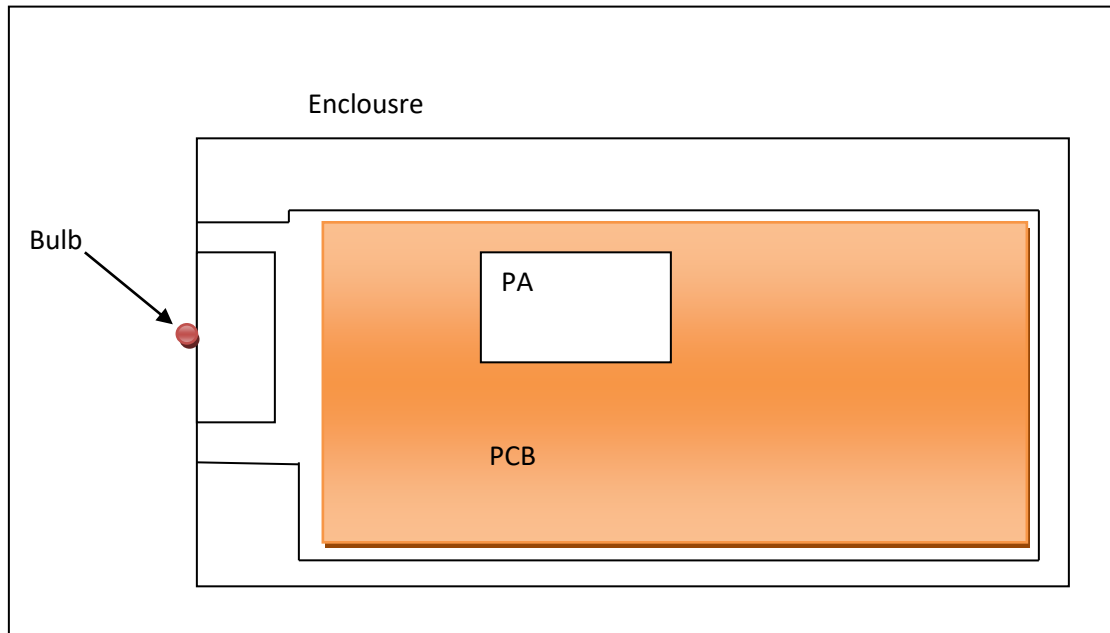
- a) White LED
- b) A silicon photodiode

To attain 100 Mbps communication rate, high speed LED's are used with multiplexing techniques.

Li-fi emitter system has four parts:

- a) Bulb
- b) RF power amplifier circuit (PA)
- c) Printed circuit board (PCB)
- d) Enclosure

PA generates the radio frequency, while the PCB controls the electrical inputs and outputs. The signal thus generated guides into an electric field about the bulb as explained in the following figure.

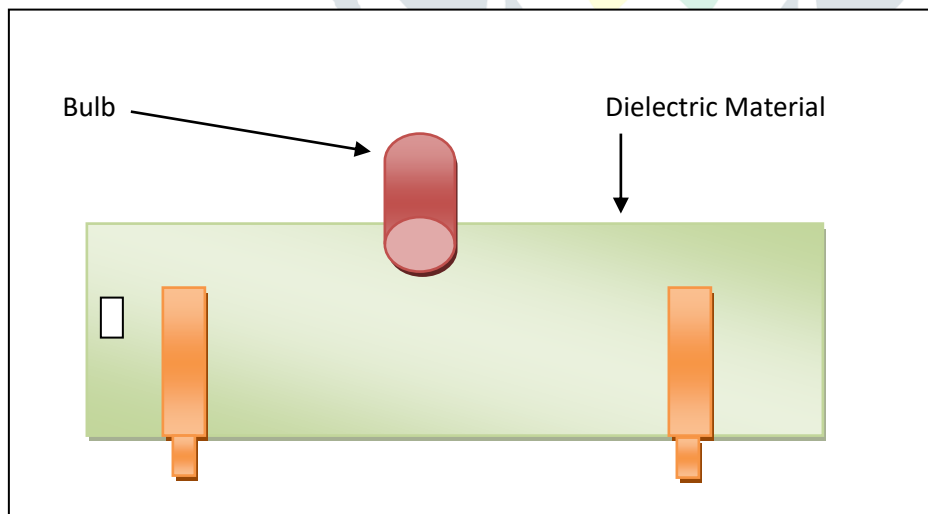


Block Diagram of Li-fi Assemblies

Working of Li-fi

Light fidelity is born of high brightness light emitting diodes. In switched on LED, a digital 1 is transmitted. In an off one a digital 0 is transmitted. Li-fi has light emitter on one end and a light sensor on the other. Binary one is registered on switched on LED and binary zero on the off. To ascertain data rates LED is flashed many times.

The block diagram of Li-fi is shown in figure



Recent Advancements in Li-fi

Researchers at the Heinrich Hertz Institute in Berlin, Germany reached data rates of over 500 megabytes per sec by using a standard white light LED. In Las Vegas, this technique was demonstrated with casio smart phones. The light of varying intensity from the screens was detected at a distance of about 10 meters.

In October 2011, a Lifi consortium was formed. It promoted high speed optical wireless system. It also enables to achieve 10 Gbps of speed which allows an HD film to be downloaded in 30 seconds.

Comparison between Li-fi and Wi-fi

Li-fi is visible light communication technique used to obtain high speed wireless communication. The name is derived by virtue of its similarities to Wi-fi.

Wi-fi works for wireless coverage within building, Li-fi works inside a confined area for radio interference issues.

Problems in Wi-fi

- a) Capability : Wireless data transmitted through radio-waves is limited and expensive with a limited band width.
- b) Efficiency : around 1.4 million cellular radio bases consume huge amount of energy leaving the efficiency to 5% only.
- c) Availability : Mobiles can not be used everywhere especially in aero planes, at petrochemical plants and at petrol pumps.
- d) Security : Radio waves that are penetrative even through walls can be misused.

Advantages of Li-fi

Li-fi is based on LED's and other light sources for data transmission. The speed too can download movies in lesser time.

- a) Capacity : Light has 10000 times wider band width than radio waves. Li-fi equipments are easily available.
- b) Efficiency : Cheap data transmission with less consumable energy.
- c) Availability : Since light sources are present everywhere therefore availability is not an issue.
- d) Security : It is non penetrative therefore safe to use.

Disadvantages of Li-fi

In open air Li-fi can be slow and non handy because artificial light cannot be penetrative like the radio waves. Secondly, Li-fi works only in direct line of sight.

Application of Li-fi

Since Li-fi uses just light it could be convenient to use Li-fi at planes where Wi-fi cannot make its access. With the help of Li-fi internet can be accessed at any public place.

Some of its future uses can be in

- a) Education System : Fast speed can replace Wi-fi at educational institutes and companies.
- b) Medical Applications : Operation theatres do not allow Wi-fi due to radiation concerns. Hence use of Wi-fi at hospitals is prohibited. Li-fi can be tech savvy in such places.
- c) Cheaper internet in Aircrafts : Wi-fi may interfere with the navigational system, so it is not readily used in aircrafts. Li-fi can provide high speed internet with light sources.
- d) Underwater Usage : Underwater vehicles feels it difficult to operate as cables can tether remotely operated vehicles. Light from the head lamps can solve this issue as it involves no risk.
- e) Disaster Management : In earthquakes and hurricanes, Li-fi can work obstruction free.
- f) Use in Sensitive areas : Wi-fi, especially in power plants can be hazardous as it can leads to radiations. Li-fi can offer safe connectivity there.
- g) Traffic Management : Li-fi usage connection with LED light of cars can manage traffic efficiently.
- h) Replacement : Li-fi do not use radio waves, so it can replace Bluetooth, infrared and Wi-fi in banned places.

Conclusion :

If rightfully marketed, Li-fi can overcome Wi-fi hotspots for wireless data transmission. This can ensure a clear and safer environment. Li-fi has the capacity to replace jammed radio waves. Shortage of radio waves frequency bandwidth can also be tackled with Wi-fi. Hence Li-fi, if extended to various platforms can make human life easy and risk free.

References:

1. <https://iopscience.iop.org/article/10.1088/1757-899X/325/1/012013/pdf>
2. <https://iopscience.iop.org/article/10.1088/1757-899X/325/1/012013>
3. <http://tec.gov.in/pdf/Studypaper/lifi%20study%20paper%20-%20approved.pdf>
4. <https://www.lifitn.com/blog/2018/8/30/5-applications-of-li-fi-technology>
5. Jyoti Rani, Prerna Chauhan, Ritika Tripathi, —Li-Fi (Light Fidelity)-The future technology In Wireless communication, International Journal of Applied Engineering Research, ISSN 0973-4562 Vol.7 No.11 (2012).
6. Richard Gilliard, Luxim Corporation, —The lifi® lamp high efficiency high brightness light emitting plasma with long life and excellent color quality.
7. Richard P. Gilliard, Marc DeVincentis, Abdeslam Hafidi, Daniel O'Hare, and Gregg Hollingsworth, —Operation of the LiFi Light Emitting Plasma in Resonant Cavity.
8. Visilink, —Visible Light Communication Technology for Near-Ubiquitous Networking White Paper, January 2012.