

Light-Fidelity: A Reconnaissance of Future Technology

Lakshmi Addepalli

UG

Department of Computer Engineering
Vivekananda Education Society Institute of Technology
lakshi.ana@gmail.com

Gowri Addepalli

UG

Department of Computer Engineering
Vivekananda Education Society Institute of Technology
gauriaddepalli@gmail.com

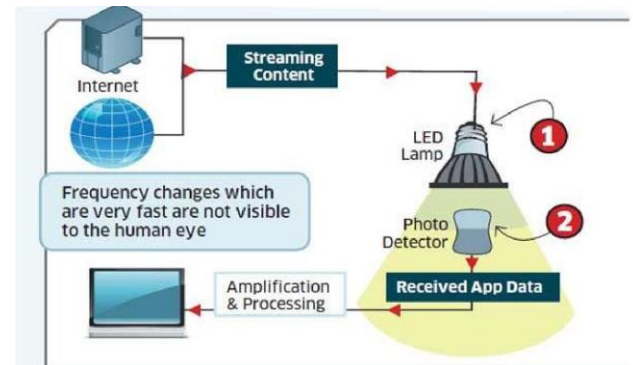
Abstract— As on date internet has made the revolution in the world .Whether you are using internet in a coffee shop, offices or at home, speed of the internet is becoming a major issue. Today everyone thrusts for getting right information at the right time and right place, which, requires fast internet connectivity, technology and large spectrum of channels. Present paper reflects the Future of Communication (LI-FI) which may affect all lives. This latest Technology LI-FI or light fidelity refers to 5g visible light communication systems and describes transmission of “data through illumination” taking the fibre out of fibre optic by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. It can be used as a medium to deliver networked, mobile, high-speed communication in a similar manner as Wi-Fi. Lighting reaches nearly everywhere, so communications can ride along for nearly free. It a technology that may be as fast as 500MBPS (30GBPS per minute) an alternative, cost effective and more robust and useful than Wi-Fi. Li-Fi envisions a future where data for laptops, smart phones, and tablets is transmitted through the light in a room. And security would be snap – if you can’t see the light, you can’t access the data. Li-Fi could lead to the internet of things, which is everything electronic being connected to the internet, with the LED lights on the electronics being used as internet access points. The Visible light communication (VLC) is surely the future of Internet.

Index Terms— LI-FI, WI-FI, LED, VLC

Introduction

What if, all lights in your rooms will communicate each other and creates a bridge of wireless networks to provide internet access? Li-Fi or optical Wi-Fi, Li-Fi Technology is the milestone in the history of Wireless Communication. This brilliant idea was first showcased by Harald Haas from University of Edinburgh, UK, in his TED Global talk on VLC. He explained, it very simple, if the LED is on, you transmit digital 1; if it’s off you transmit a 0. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data quickly, efficiently and accurate without any external hindrances

LI-FI can be used to extend wireless networks at your home, office or university for data transfer at 10 Gbps, “on the move” data transfer rate at 100 Mbps, home wireless data network with local cloud & server. In figure shows how the internet will connect to the laptop using Li-Fi.



Li-Fi can be used in areas where there’s extensive RF Noise is generally prohibited (hospitals, airplanes). This is a digital system that translates the classic binary language of zeroes and ones in light pulses off or on, respectively, through tiny light bulbs led able and off millions of times per second, The pioneers of data transmission through say enlightenment through blinking of LEDs can create wireless Internet access with data transmission speeds of close to 500 megabits per second (Mbps). These benefits come at a fivefold transits currently offering fiber optic lines, to benefit from this technology requires a luminous router (which can adhere cheaply and easily into any conventional electric bulb) which is capable of emitting the binary signal. Moreover, the pulses are captured by few light receptors are required, and are installed on all types of connected devices , from computers to tablets , to phones, televisions or appliances, Matter experts make clear that light pulses are imperceptible to the human eye , without causing damage or discomfort of any kind. In addition, any lamp, lamp or flashlight can become a hotspot.

I.LI-FI TECHNOLOGY AT A GLANCE

The LED bulb will hold a microchip that will do the job of processing the data. The light intensity can be manipulated to send data by tiny changes in amplitude. This technology uses visible spectrum of light, a part of the electromagnetic spectrum that is still not greatly utilized.

In fact the technology transfers thousands of streams of data simultaneously, in parallel, in higher speed with the help of special modulation using unique signal processing technology.



II. DATA TRANSMISSION USING LI-FI

Li-Fi (Light Fidelity) is a fast and cheap optical version of Wi-Fi, the technology of which is based on Visible Light Communication (VLC). VLC is a data communication medium, which uses visible light between 400 THz (780 nm) and 800 THz (375 nm) as optical carrier for data transmission and illumination. It uses fast pulses of light to transmit information wirelessly. The main component of this communication system is a high brightness white LED, which acts as a communication source and a silicon photodiode which shows good response to visible wavelength region serving as the receiving element. LED can be switched on and off to generate digital strings of 1s and 0s. Data can be encoded in the light to generate a new data stream by varying the flickering rate of the LED. To be clearer, by modulating the LED light with the data signal, the LED illumination can be used as a communication source. As the flickering rate is so fast, the LED output appears constant to the human eye. A data rate of greater than 100 Mbps is possible by using high speed LEDs with appropriate multiplexing techniques. VLC data rate can be increased by parallel data transmission using LED arrays where each LED transmits a different data stream. There are reasons to prefer LED as the light source in VLC while a lot of other illumination devices like fluorescent lamp, incandescent bulb etc. are available.

LI-FI technology uses semiconductor device LED light bulb that rapidly develops binary signals which can be manipulated to send data by tiny changes in amplitude. Using this innovative technology 10000 to 20000 bits per second of data can be transmitted simultaneously in parallel using a unique signal processing technology and special modulation. The light used to transmit the data is called D- light by Harald Hass, the inventor of LI-FI.

In future data for laptops, Smartphone's and tablets can be transmitted through the light in a room by using LI-FI.

III. COMPARISON BETWEEN WI-FI AND LI-FI

Characteristic	Wi-Fi	Li-Fi
Frequency	2.4 GHz to 5 GHz	No frequency for light
Standard	IEEE 802.11	IEEE 802.15
Range	100 meters	Base on LED light
Primary application	Wireless local area networking	Wireless local area networking
Data transfer rate	11 Mbps	>1Gbps
Power consumption	Medium	LOW
Cost	Medium	high
Security	Its medium secure	Its high secure
Primary devices	Notebook computers, desktop computers, servers, TV, Latest Wi-Fi mobiles.	Mobile phones, office and industrial automatic devices, notebook computers, desktop computers, servers computers, TV and latest upcoming devices with Li-Fi
Primary users	Corporate campus users, homes and others public places	Traveling employees, home users, others public places, office and industrial workers,
Usage location	Within range of WLAN infrastructure, usually inside a Building	Where ever light is available, it may a public place, home, office and road etc
Development started	1990	2011

IV. APPLICATION OF LI-FI

1. High speed, as high as 500mbps or 30GB per minute
2. Li- Fi uses light rather than radio frequency signals
3. VLC could be used safely in aircraft.
4. Integrated into medical devices and in hospitals as this technology does not deal with radio waves, so it can easily be used in such places where Bluetooth, infrared, Wi-Fi and internet are banned. In this way, it will be most helpful transferring medium for us.
5. Under water in sea Wi-Fi does not work there.
6. There are around 19 billion bulbs worldwide, they just need to be replaced with LED ones that transmit data. We reckon VLC is at a factor of ten, cheaper than WI-FI.
7. Security is another benefit, he points out, since light does not penetrate through walls.

8. In streets for traffic control. Cars have LED based headlights, LED based backlights, and Car can communicate each other and prevent accidents in the way that they exchange Information. Traffic light can communicate to the car and so on.
9. By implementing the Technology worldwide every street lamp would be a free access point.
10. Li-Fi may solve issues such as the shortage of radio frequency bandwidth.

V. VALUES OF LI-FI

- A free band that does not need license.
- High instalment cost but very low maintenance cost.
- Cheaper than Wi-Fi.
- Theoretical speed up to 1 GB per second: Less time & energy consumption.
- No more monthly broadband bills.
- Lower electricity costs.
- Longevity of LED bulb: saves money.
- Light doesn't penetrate through walls: secured access.

VI. LIMITATIONS OF LI-FI

- The main problem is that light can't pass through objects, so if the receiver is inadvertently blocked in any way, then the signal will immediately cut out. —**If the light signal is blocked**, or when you need to use your device to send information — you have to seamlessly switch back over to radio waves.
- Reliability and network coverage are the major issues to be considered by the companies while providing VLC services. **Interference from external light sources** like sun light, normal bulbs; and opaque materials in the path of transmission will cause interruption in the communication.
- High installation cost of the VLC systems can be complemented by large-scale implementation of VLC though Adopting VLC technology will reduce further operating costs like electricity charges, maintenance charges etc.

- We still need Wi-Fi we still need radio frequency cellular systems. We can't have a light bulb that provides data to a high-speed moving object or to provide data in a **remote area** where there are trees and walls and obstacles behind.

VII. CONCLUSION

With the development of the technology, and its application for the industrial use, it 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. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, on one way, it can transmit the data at higher rate and on the other it is very cheap as compared with WI-FI .The airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radiofrequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight. Hence implementing LI-FI can bring a enormous change in efficiency, security and speed in the cyber world.

REFERENCES

- [1] www.lificonsortium.org
- [2] <http://beyondweblogs.com/what-is-li-fi-is-this-replacing-Wi-Fi/>
- [3] <http://en.wikipedia.org/wiki/Li-Fi>
- [4] [Technopits.blogspot.com/technology/cgap.org /2012/01/11/a-li-fi-world/](http://Technopits.blogspot.com/technology/cgap.org/2012/01/11/a-li-fi-world/)
- [5] Li-Fi – Internet at the Speed of Light, by Ian Lim, the gadgeteer, dated 29 August 2011.
- [6] "Visible-light communication: Tripping the light fantastic: A fast and cheap optical version of Wi-Fi is coming". *The Economist*. 28 January 2012. Retrieved 22 October 2013.
- [7] Haas, Harald (July 2011). "Wireless data from every light bulb". *TED Global*. Edinburgh, Scotland.