EasyChair Preprint

№ 2469

A Review Paper on Li-Fi (Light Fidelity) Technology

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January 27, 2020

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ABSTRACT

Now a day's while we connected to internet, the speed of internet is depends upon the signal strength that has been shown in 2G, 3G, 4G each generation is defined as a set of telephone network standards, which detail the technological implementation of a particular mobile system. The speed increases and the technology used to achieve that speed also changes. For eg, 2G offers 64 Kbps and is based on GSM, 3G offers 144 KBPS to 2 MBPS whereas 4G offers 100 MBPS To 1 GBPS and is based on LTE technology.

The aim of wireless communication is to provide high quality, reliable communication just like wired communication (optical fiber). Li-Fi stand for "light fidelity" is refers to 5G means it can produce data rates faster than 10 megabits per second. Ever one wants faster internet and security this new technology makes its possible and proposes a new era of wireless communication. This new technology save natural resource and make our planet green and healthy. its cheaper as compare others wireless technology.

KEYWORDS

LI-FI, WI-FI, LED, Visible Light Communication.

1. INTRODUCTION

Today's scenario wireless communication is widely used in all the public sector Wi-Fi network uses radio frequency for its operation in the 2.4 GHz or 5.8 GHz bands. The Wi-Fi technology is bases on WLAN as defined in IEEE 802.11 series standards which include 11a, 11n, 11ac and 11ax. The standard defines PHY and MAC layer specifications. Wi-Fi Security is to combat this consideration wireless networks may choose to utilize some of the various encryption technologies available. Some of the more commonly utilized encryption methods, however, are known to have weaknesses that a dedicated adversary can compromise. The range of the typical range of a common 802.11g network with standard equipment is on the order of tens of meters. While sufficient for a typical home, it will be insufficient in a larger structure. To obtain additional range, repeaters or additional access points will have to be purchased. Cost for these items can add up quickly. The speed on most wireless networks (typically 1-54 Mbps) is far slower than even the slowest common wired networks (100 Mbps up to several Gbps) the throughput of wired network might be necessary.

2. Li-Fi (short for light fidelity)

Is wireless communication technology, which utilizes light to transmit data and position between devices. The term was first introduced by Harald Haas during a 2011 TEDGlobl talk in Edinburgh. He is a person who introduced this marvelous technology it's totally work on light fidelity by using LED light we can transfer data from one device to another show in fig 1.1

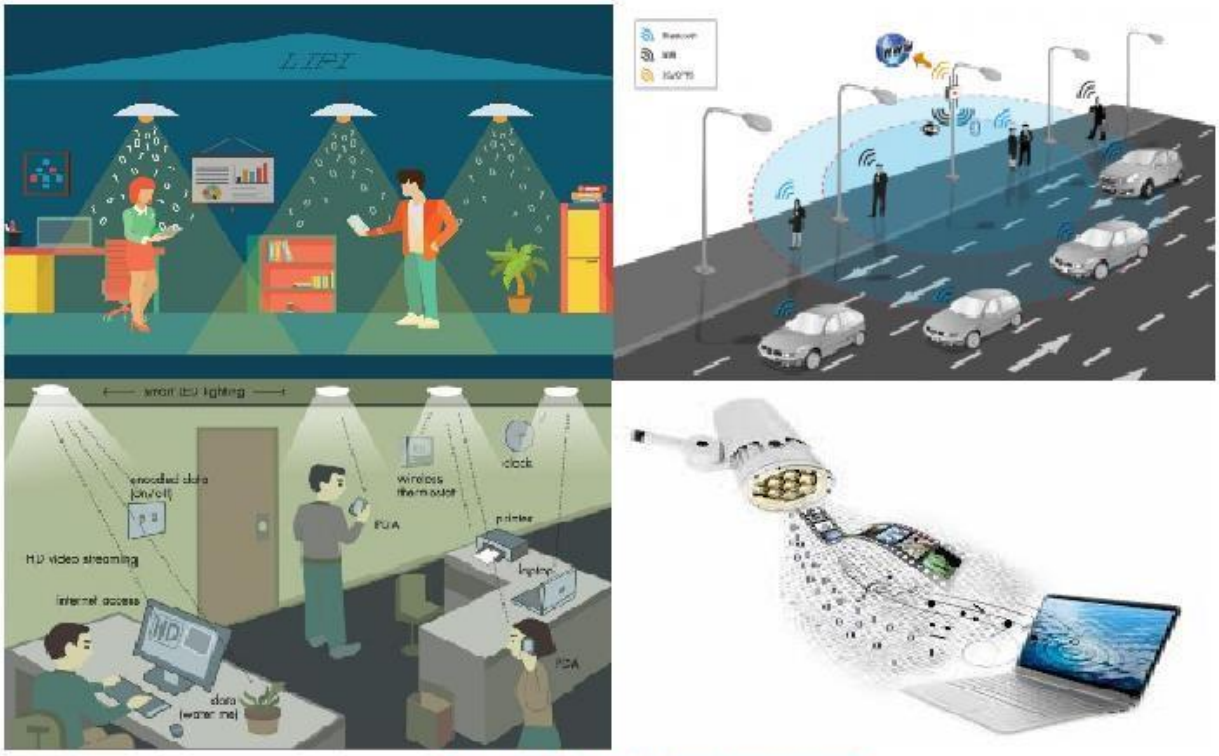

Fig. 1.1 Li- Fi Environment

light fidelity (Li-Fi) technology is a wireless communication system in which light is used as a carries signal instead of traditional radio frequency as in Wi-Fi. Li-Fi is a derivative of optical wireless communications (OWC) technology, which uses light – emitting diodes (LEDs) as a medium to deliver network, mobile, hight – speed communication in a similar manner to Wi-Fi. LED is commonly found throughout traffic and street light, car's, remote controller, home, restaurant, almost every possible place, it transmission of data through illumination, sending data through a LED light that varies in intensity faster than human eye can follow.

Its work very simply, if the LED is on, you transmit a digital 1, if it's off you transmit a digital 0. They can be switched on and off very quickly, which gives nice opportunities for transmitting data show in fig 1.2.

Fig. 1.2 How Li-Fi Works

3. VISUAL LIGHT COMMUNCATION (VLC)

Li-Fi or light fidelity is a high speed, bidirectional and fully networked subsets of visual light communication (VLC). VLC is a data communications variant which uses visible light between 400 and 800 THz (780-375 nm). VLC is a subset of optical wireless communications technologies or LI-FI. VLC operates under the concept of transmission of data via light rays to send and receive message in a given distance. Putting to use LED lighting, VLC can be used as a replacement for radio frequencies in areas it cannot be applied. In addition, VLC has the upper hand over radio frequencies as it offers ultra-fast data transmission and also high bandwidth transmission.

Given that light travels 186,000 miles in a second, communication via this source is virtually instantaneous. This makes VLC the faster means of communication between all means are visible to the human eye. Every form of data can be broken down into single units of ones and zeroes that can be deciphered as low or high signals. To function, VLC requires a receiver (Photo detector), a transmitter (LED's) and channel of communication. A photodiode is a semiconductor device that converts light into an electrical current show in fig 1.3. To transmit signals we can use specially designed electronic device as show in fig 1.4.

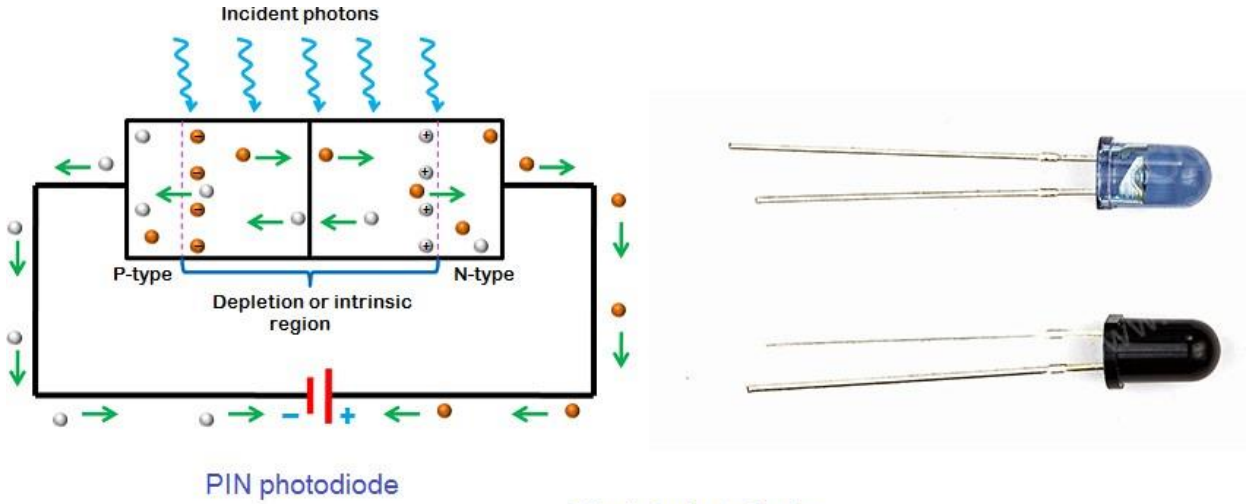

Fig 1.3 photodiode

Fig. 1.4 Tools Used in Visible light communication

VLC uses light emitting diodes (LED) as transmitters, and photo- diodes as receivers. The LED which operates in visible light spectrum serves dual purpose of illumination and communication, making VLC preferred choice in indoors and outdoors wireless communication, this is how a VLC system works :

LED transmits the intensity modulated over the air, and a detector detects the change in the change in the brightness level of that modulated single, to decodes back the signals. We essentially start with an electrical single, convert to optical to signal and send it using an LED, receive the optical signal at receiver, convert it back from optical to electrical. On –Off keying being the most basic technique in On-Off keying, we represent a binary one as LED bulb switched on, binary zero as LED bulb switching off. Since the detector works on the different of brightness level, the constants ambient light is cancelled out. In fig 1.5 shows the wavelength bends of different waves such as Gamma rays, X-rays, UV rays and Visible light.

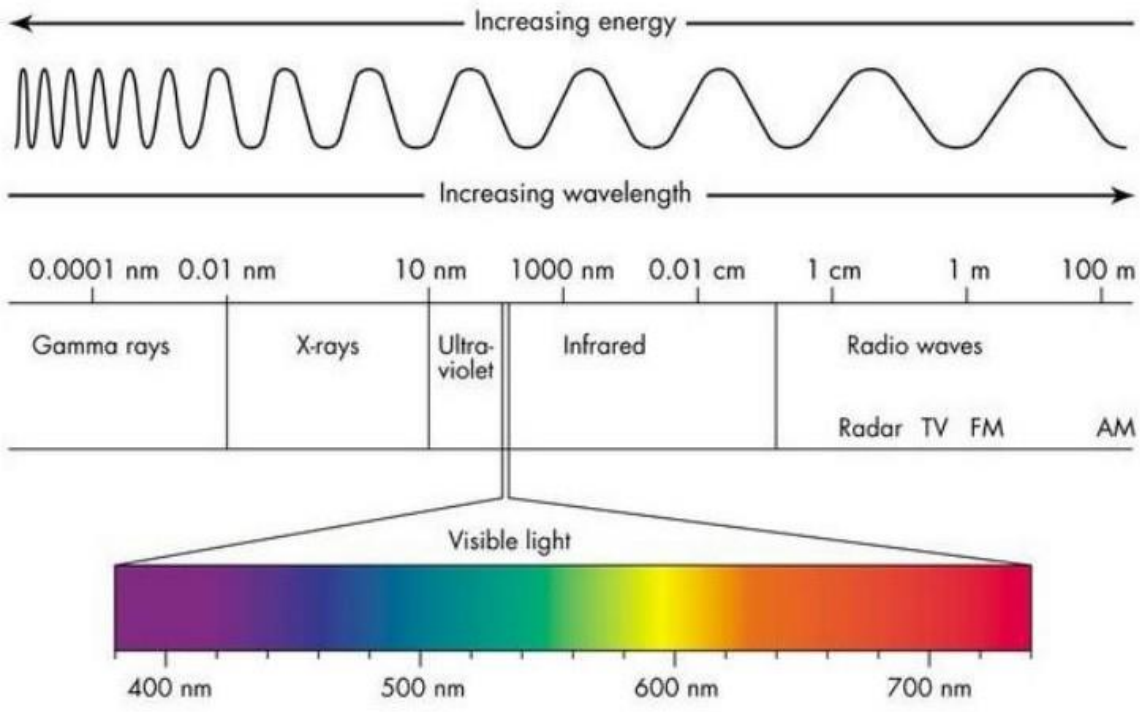

Fig 1.5 EM Spectrum

4. COMPARISON OF VLC, IR AND RF COMMUNICATION TECHNOLOGIES

PROPERTY	VLC	IRB	RFB
Bandwidth	Unlimited, 400-700 nm	Unlimited, 800-1600 nm	Regulated and limited
Electromagnetic interference + hazard	No	No	Yes
Line of sight	Yes	Yes	No
Distance	Short	Short to long (Outdoor)	Short to Long (Outdoor)
Security	Good	Good	Poor
Standards	In progress (IEEE 802.15.7 Task Group)	Well developed for indoor (IrDa). In progress for outdore	Matured

Services	Illumination + Communications	Communications	Communications
Noise sources	Sun light + other ambient light	Sun light + others ambient lights	All electrical / electronic appliances
Power consumption	Relatively low	Relatively low	Medium
Mobility	Limited	Limited	Good
Coverage	Narrow and wide	Narrow and wide	Mostly wide

5. FEATURE COMPARSION: LiFi Vs WiFi

Feature	LiFi	WiFi
Full Form	Light Fidelity	Wireless Fidelity
Operation	LiFi Transmits data using light with the help of LED bulbs	WiFi transmits data using radio waves with the help of WiFi router.
Interference	Do not have any interference issues similar to radio frequency waves.	Will have interference issues from nearby access points(routers)
Technology	Present IrDA compliant devices	WLAN 802.11a/b/g/n/ac/ad standard compliant devices
Merits(advantages)	Interference is less, can pass through salty sea water, works in densy region	Interference is more, cannot pass through sea water, works in less densy region
Privacy	In LiFi, light is blocked by the walls and hence will provide more secure data transfer	In WiFi, RF signal can not be blocked by the walls and hence need to employ techniques to achieve secure data transfer.
Data transfer speed	About 1 Gbps	WLAN-11n offers 150 Mbps, about 1-2 Gbps can be achieved using WiGig/Giga-IR
Network Topology	Point –To-Point	Point-To-Multi Point
Frequency Band Width	100 times of THz	Its 2.4 GHz

6. Application Of Li-Fi

6.1 Li-Fi And Live Streaming

According to Go-Globe report, 82% of consumers prefer to watch live videos from a brand than posts, 80% brand audience prefer to watch live video from a brand than read a blog and live videos are watched three times longer than videos that are not live anymore. Because of the high speed rates Li-Fi can reach, it can be made available in big shopping malls, sport stadium, street lights, air planes, trains, train station, airports this allows any user to consume rich content media like videos

as well as live streaming from their Smartphone's or there mobiles device nearly anywhere they are like they are exposed to Li-Fi enabled LEDs.

6.2 Li-Fi technology In Hospitals

Li-Fi can be safely used in many hospital application like , in corridors, waiting rooms, which will remove electromagnetic interference issues from smartphones and the use of WiFi in hospitals.

6.3 Li-Fi In The Workplace

Li-Fi will not offer illumination but secure wireless connectivity in workspaces. As well as the networking capability, people will be able to take a Skype video conference call and move from one room to another without that conference call being interrupted.

Philips Lighting's LiFi enabled LED are currently being trialling Li-Fi technology in real-estate company lcade's office in La Defense, Paris.

6.4 Li-Fi In School

The right wireless network is a key component to provide new learning experiences by connecting student and teaching to smart technology, enabling learning application on any mobile device. Li-Fi can also provide seamless network connectivity and security throughout the whole school, from the classroom all the way through to university dorms. Some school have even started trialling Li-Fi technology in classrooms. A school called the hegel-gymnasium in Stuttgart is currebtly testing Li-Fi in classrooms to teach a broad range of subjects from everything to information technology.

6.5 Li-Fi In Retail

Li-Fi can help directing shoppers from the time they enter the shop. It can help them to locate specific products in the store, collect digital coupons, check store promotions, check stock availability of some products on the shelves, engage in store online services through their smart devices and improve their store experience.

6.6 Underwater communication

Radio waves are quickly absorbed in water, preventing underwater radio communications, but light can penetrate for large distances. Therefore, LiFi can enable communication from diver, diver to mini-sub, diver to drilling rig, etc.

7. CONCLUSION

1. Li-Fi is enabled by advanced digital transmission technologies.
2. Li_Fi will enable many new applications.
3. Optical attocell networks based on Li-Fi:Are the glue between future energy efficient illumination and cellular communications.
4. Harness unregulated, unused and vast amount of electromagnetic spectrum.
5. Enable ever smaller cells without the need for new infrastructure.
6. Researcher are developing micron sized LED which are able to flicker on and off around 100 times quicker than larger than LED.

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