

Li-Fi technology (Optical Communication) compare with other Technologies

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Abstract - Li-Fi is a Light Fidelity, it transmits data through an LED light bulb at varies in intensity faster than human eye. Here, we developing a Li-Fi based system and analyzes its performance with previous or existing technology. Wi-Fi is general wireless coverage within buildings, whereas Li-Fi is ideal for high density wireless data coverage in confined area and for relieved from radio interference. Li-Fi is better bandwidth, efficiency, availability and security than existing technology and also high speed, low cost of LED's and lighting units there are many opportunities in this medium. Public access internet through street lamps to auto-piloted cars, communicate through their headlights, where data for laptops, smart phones and tablets will transmitted through light in a room. Harald Haas a German Physicist says his invention, which he calls D-Light, produce data rates as fast as upto 10Giga Bytes per second. Li-Fi is 1000 times greater than Wi-Fi. Visible Light Communication (VLC) is a kind of method used for Li-Fi technology. VLC used for fast pulsation. So, utilization becomes more and work gets finishes at a low rate. So, we can say this is best technology. In security, visible light is unable to penetrate the wall, Li-Fi technology safer and cheaper future for communication and great role in communication field.

Keywords- Li-Fi technology, Wi-Fi, Gi-Fi, Bluetooth, Visible Light Communication (VLC), LED Bulbs.

INTRODUCTION

Li-Fi stands for LIGHT FIDELITY. Nowadays internet has become a major role of those people search for Wi-Fi hotspots. So, Li-Fi has new life for data communication is better alternative to Wi-Fi in wireless communication. Li-Fi is that light weight cannot tolerate objects, consequently if receiver is unknowingly blocked in any manner. To overcome this we are using many existing techniques. Here for Li-Fi technology we use VLC (Visible Light Communication).



Li-Fi bulb

(i)Visible Light Communication (VLC):

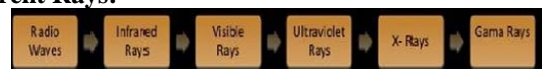
Visible light used in which Li-Fi provides wireless covered and enclosed contact. It is a best technique. This is used for fast pulsation. So utilization becomes more and work gets

finishes at a low rate. So, we can say this is best technology.

Current wireless networks are slow because multiple devices are connected. High data rates transfer are difficult because of fixed bandwidth between radio waves are just a small part of the spectrum available for data transfer. Solution for this we use Li-Fi data's transfer through LED light bulb that varies in intensity faster than the human eye can follow. Harald Haas a German Physicist says his invention, which he calls D-Light, which is 250 times faster or speedier than broadband connection. He also said that it transmit of data through illumination. It offers much larger frequency band 300THZ compared to available in RF Communication is 300GHZ. By using LED (Light Emitting Diode) bulbs where data for laptops, tablets, smart phones transmitted through light in a room. As a result it used in high security for military utilization. When switched the LED On digital is 1 it transmitted and when it's Off digital is 0, On and Off is done very quickly. It is also possible to encode data in light by varying data rate at which LEDs flicker to produce different strings 0s and 1s. Intensity is modulated as fast as that human eye can't notice thus the output appearing constant, this is the advantage to increase the VLC data rate.

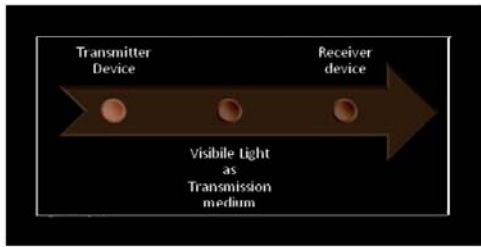
VLC is used to label fast and cheap communication system which is an advanced version of Wi-Fi or say it's an optimal version of Wi-Fi. In future, all Wi-Fi are replaced by Li-Fi, because Li-Fi has ability to turn, any lamp gives a network connection operating at much higher frequency. It also offers more privacy than Wi-Fi. Optical wireless communication networks are going to be introduced in the market as complementary technologies for Wi-Fi, Bluetooth, Wi-Max, etc. It provides high speed and secure communication. With the bandwidth dome caused by increased data usage, network providers are turning to alternatives to relieve internet traffic.

Different Rays:



Gamma rays cannot use as they are dangerous-ray similarto health issues. Ultra violet light good for place without human being, but dangerous for human body. Infra-Red due to eye safety regulation can only be with low power. Radio Waves penetrate through walls so arises security issues. Hence, finally choose an only the visible "light spectrum".

Working Principles



Transmitter Device:

Light emitter on one end. High brightness white LED which acts as transmission source.

VLC:

Visible Light Communication is a data communication medium. VLC uses visible light between 400 THZ (780nm) and 800THZ (375nm) as optical carrier for data transmission and illumination.

Receiver Device:

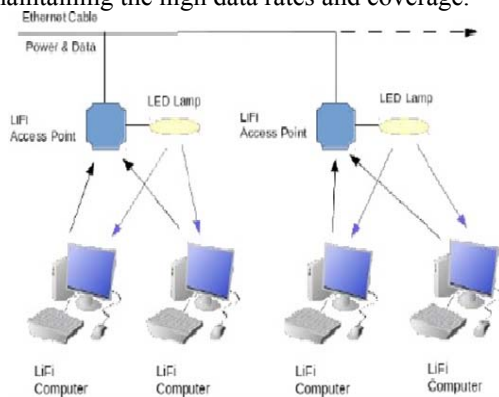
Light sensitive device (a photo detector on other end) receives the signal and converts it back to original data by using VLC.



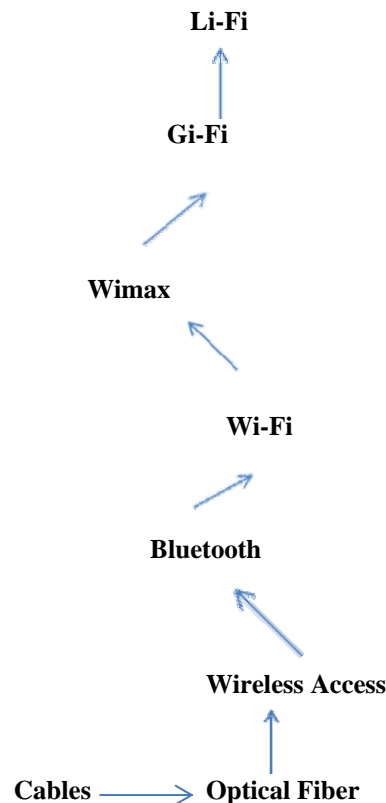
In Li-Fi technology, we used VLC (Visible Light Communication) method. By this method, fast pulse of light to transmit information wirelessly technically called Visible Light Communication. And also by this technique, data rate can be increased use an array of LEDs like parallel data transmission, or using different colors of LEDs to alter the light frequency with each frequency encode a different data channel. Li-Fi operating speed is less than 1µs. We just vary the rate, which LEDs flicker depend upon data to transmit. This invisible On-Off activity is a kind of data transmission using binary codes. A light sensitive device (a photo detector) receives the signal and converts it back to original data by using VLC. LED output appears constant to human eye by virtue of fast flickering rate of LED. VLC uses visible light between 400 THZ(780nm) and 800THZ(375nm) as optical carrier for data transmission and illumination.

Two main components of Li-Fi technology has (i) a high brightness white LED which acts as transmission source and (ii) a silicon photodiode with good response to visible light as the receiving element. Li-Fi is designed to use LED light bulbs similar transmission medium to those currently in many energy-conscious homes and offices. However, Li-Fi bulbs are out fitted with a chip that modulates the light invisibly for optical data transmission. It transmits by LED bulbs and receives by Photoreceptors. VLC tools are fluorescent lamps i.e. ordinary bulbs, not any special communication devices to transmit signals. For receiving

signals specially designed electronic devices generally containing a photodiode receive signals from light sources. Especially, Avalanche Photodiode for sensitive reception, image sensor for image acquisition and data reception. The distance in which VLC can be expected to be reasonably used ranges up to about 10 meters. This kind of advancement promise a speed of up to 10Gbps i.e. downloading a full HD video in just 30 seconds. By transmitting data at speeds above 1Gbps and record distances of 10 metres at a fraction of the power of typical LED bulbs, we continue to make the technological leaps and bounds that make Li-Fi a technology that could transform the way we use the Internet in the near future. The transmission was carried out using micro LED lights and required less than 0.5W of power, only ten per cent of the usual power consumption of a 10W LED bulb. This proves the point that lights can be dimmed down while maintaining the high data rates and coverage.



Comparisons of various technologies with Li-Fi:



Li-Fi and Wi-Fi:

Li-Fi technology used to describe VLC technology, applied to high speed wireless communication, its name is similar to Wi-Fi, only using light instead of radio. Li-Fi is ideal for high density wireless data coverage inside a confined area or room and relieving radio interference problems and Wi-Fi is great for general wireless coverage within buildings. Efficiency for both to transmit data is Wi-Fi only operational upto 5% efficiency; on the other hand Li-Fi LEDs are high efficient and energy consumption. Security, an issue if you can't see the light you can't access the data in Li-Fi which radio waves which can penetrate through walls makes it disposed to break the security protocol. Light is easily accessible as compared to Wi-Fi. Li-Fi is free band that does not need license. Hence, it is cheaper than Wi-Fi.

Bluetooth:

This is the first wireless technology for information interchange over short distances. This technology operates over a range of 2400MHz and 2483.5 MHz, including the guard bands. This technology operates over a range of 10m radius with a data rate of 5Gbps.

WiMax:

WiMax stands for Worldwide interoperability for Microwave access. This technology is capable of transmitting data at a rate of 1Gbps.

Gi-Fi:

Gi-Fi Technology is a Gigabit wireless Fidelity that uses extremely high frequency of 60GHz for the transmission of data, The process of mixing and signal filtering enhances the strength of the signal, with minimal losses in the medium, Just like Bluetooth, this technology uses short-range wireless communication. This feature competes with the contemporary wireless communication technologies; this technology also operates within a range of 10m, just like the Bluetooth technology

Features:

- It save our life in traffic light can communicate to cars, it can help to manage traffic in better manner and accident can be decreased, LED car light can alert drivers when other vehicles are too close. Li-Fi provides cheap high-speed web access to every street corner. So, remain it "if there's light, you're online".
- Li-Fi used powerful communication in times of natural disasters. So many loses and damages due to disaster,

by Li-Fi bulbs provide cheap high speed web access to every street corner.

- Underwater ROV (Remotely Operated Vehicles), operate large cables supply their power and allow them to receive signals. Some inconvenience times, wires were cut by this time high powered lamp (or) light used. They could use their headlamps to communicate with each other. Li-Fi works Underwater where Wi-Fi fails completely.
- In aircraft, passengers get low speed internet, Wi-Fi not used because many interfere with navigation of pilots and switch off our electrical devices because playing around radio waves on airplanes, but Li-Fi easily provide high speed internet via every light source i.e. overhead reading bulb etc., inside the flight.
- Many toys incorporate LED lights and these can be used to enable extremely low-cost communication between interactive toys.
- In medicinal, Operational Theatres not allowed Wi-Fi due to radiation concerns. It also blocks the signals for monitoring equipment's. So, it may be dangerous to patient health, to overcome Li-Fi can used to access internet and control medical equipment. It also benefit for robotic surgeries also.
- In power plants need fast, inter connect systems, grid integrity and core temperature (in nuclear plant) can be monitored. Li-Fi could safe (no radiation) and connectivity for all areas in these sensitive locations.

Recent Applications:

In China, Chi Nan Professor built her own Li-Fi wireless system, that use LED lights to send and receive internet data. The Professor bought ordinary or regular retail parts to create her system.

4-computers under a 1Watt LED light bulb may connect to internet under the principle that light can be used as a carrier instead of traditional radio frequencies.

Drawbacks:

One cannot shift receiving device in case of indoor arrangement of apparatus as light cannot penetrate through walls and it is easily block by somebody simple walk in front of LED source. It works in direct line of sight. Artificial light cannot penetrate into walls and other opaque materials which radio waves can do. The requirement that lights stay on for operation.

Feature	Wireless Transmission				Light Transmission
	Bluetooth	Wi-Fi	WiMax	Gi-Fi	Li-Fi
Full form	-	Wireless Fidelity	Worldwide interoperability for Microwave access	Gigabit wireless Fidelity	Light Fidelity
Data rate	800Kbps	11Mbps	1Gbps	5Gbps	>10 Gbps
Operating range	10 meters	100 meters	50 Kilometers	10 meters	Inside a confined area or a room or 10 metres
Operating frequency	2.4GHz	2.4GHz	2.3 – 3.5 GHz	57-64GHz	400 THZ to 800THZ
Power consumption	5MW	10MW	~5MW	<2MW	10W LED bulb
IEEE tandard	IEEE 802.15	IEEE802.11	IEEE 802.16	IEEE 802.15.3C	IEEE 802.15.7

CONCLUSION:

In future, Li-Fi toward a better, greener, safer and cleaner world. It attracts everyone to utilize the internet using Li-Fi technology, brought into practice every LED would be like a Wi-Fi device and transmitting signals. In this digital age wireless communication has reached a new level. To replace the Wi-Fi, because of increasing population and airwaves are blocked or congested. So, difficult to reliable, high-speed signal. So, it will be expected and extended to different platforms and various walks of human life. Every bulb is replaced by an LED which will act something like a Wi-Fi hotspot to transmit wireless data. As you can't see it, thus can't slave it.

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