

Li-Fi Technology

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Abstract: Nowadays almost all the peoples are using internet to accomplish their task through wired or wireless network. As number of users are increases in using wireless network , speed decreases . Though Wi-Fi gives us speed up to 150mbps as per IEEE 802.11n, which is not sufficient to accommodate number of desired users. To remedy this limitation of Wi-Fi, we are introducing the new concept of Li-Fi technology. Li-Fi stands for the Light Fidelity. As per german physicist Harald Haas :data in the form of illumination taking the fibber out of fiber optic by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. It's the same idea behind infrared remote controls but far more powerful. Haas says his invention, which he calls D-LIGHT, can produce data rates faster than 10 megabits per second, which is faster than your average broadband connection.

Keywords— Wireless-Fidelity(Wi-Fi), Light-Fidelity (Li-Fi), Light Emitting Diode (LED),Visible Light Communication (VLC).

INTRODUCTION:

Li-Fi having a various range of frequencies and wavelengths, from the infrared through visible and down to the ultraviolet spectrum. It includes sub-gigabit and gigabit-class communication speeds for short, medium and long ranges, unidirectional and bidirectional data transfer using line-of-sight, reflections and many more. It is not limited to LED or laser technologies or to a particular receiving technique. Li-Fi is a framework for all of these providing new capabilities to current and future services, applications and end users. This idea was first showcased by Harald Haas from University of Edinburgh, UK, in his TED Global talk on VLC. He explained, 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.[2]

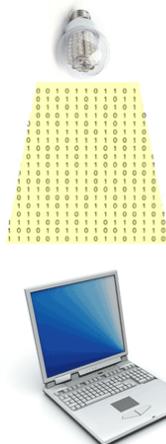


Figure 1 Data Trasmission in Li-Fi

Li-Fi basically known as “**LIGHT FEDILITY**” is an outcome of twenty first century. The basic idea behind this technology is that the data can be transmitted through LED light whose intensity varies even faster than the human eye. As the transmission of the data takes place through the light emitting diodes (LED's) the amount is comparatively small .In modern times, it is called as the optimized version of WI-FI .The advantageous thing is the wireless communication which decreases the cost enormously. [10]HARALD HASS, who is considered to be the father of Li-fi , says that the heart of this technology lies in the intensity and the potential of the light emitting diodes. The major reason which lead the modern man through this invention is that the confinement of Wi-Fi to comparatively small distance. As there are more and more devices coming up day-by-day the signals are being clogged up due to heavy traffic, there arised a need for an error free transmission technology. And the solution to this problem was the Li-fi technology.[4] It has been designed in such a way that it overcomes the disadvantages that occurs during the usage of wi-fi. In general,Li- fi works even under water thereby causing a great benefit to the military operations.

Li-Fi is the term some have used to label the fast and cheap wireless communication system, which is the optical version of Wi-Fi. Li-Fi uses visible light instead of Gigahertz radio waves for data transfer.[6]

Li-Fi can play a major role in relieving the heavy loads which the current wireless systems face since it adds a new and unutilized bandwidth of visible light to the currently available radio waves for data transfer. Thus it offers much larger frequency band (300 THz) compared to that available in RF communications (300GHz). Also, more data coming through the visible spectrum could help alleviate concerns that the electromagnetic waves that come with Wi-Fi could adversely affect our health.

WORKING OF LI-FI

- Li-Fi is implemented using white LED light bulbs at downlink transmitter.
- By fast variations of the current, optical output can be made to vary at extremely high speeds.
- An overhead lamp fitted with an LED with signal processing technology streams data embedded in its beam at ultra high speeds to the photodiodes.
- A receiver dongle then converts the tiny changes in amplitude into an electrical signal, which is then converted back into a data stream & transmitted to a computer or mobile device.[9]

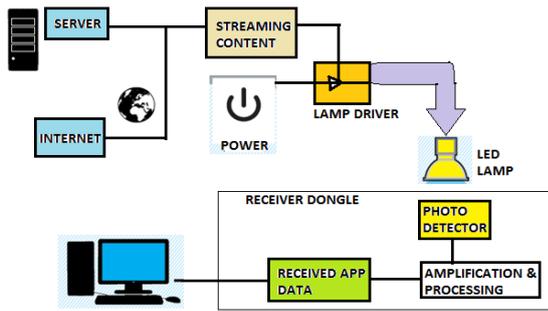


Figure 2: Working of Li-Fi.

VISIBLE LIGHT COMMUNICATION

1. Li-Fi is a faster and cheaper version of Wi-Fi, which is based on visible light communication (VLC). [5]
2. The visible light communication is a data communication technique using visible light between 400 THz and 800 THz as an optical carrier for data transmission.[6]

WHY VLC ?

- Gamma rays, X-rays, Ultraviolet rays are harmful for the human body.
- Infrared rays are also dangerous, due to eye safety regulation, and can only be used with low power.
- Radio waves are expensive and they are less secure.

HENCE WE ARE LEFT WITH ONLY THE VISIBLE - LIGHT SPECTRUM which is not harmful for humans.[3]

APPLICATIONS:

There is a wide necessity for data transfer and by the end of the day every field involves the use of technologies. One such technology is Li-Fi which can have its applications extended in areas where the Wi-Fi technology lack its presence like medical technology, powerplants and various other areas where Li-Fi proved its excellence of the undersea awesomeness.

At present its applications are beyond imagination but still if to think about few then they are :

- Can be used in the places where it is difficult to lay the optical fiber like hospitals. In operation theatre LiFi can be used for modern medical instruments.
- In traffic signals LiFi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased.
- Thousand and millions of street lamps can be transferred to LiFi lamps to transfer data.
- In aircraft LiFi can be used for data transmission.
- It can be used in petroleum or chemical plants where other transmission or frequencies could be hazardous.[8]

Sl.No	Parameters	Light Fidelity	Wireless Fidelity
1	Speed for data transfer	Faster transfer speed (>1 Gbps)	Data Transfer speed (150 Mbps)
2	Medium through which data transfers occurs	Used Light as a carrier	Used Radio spectrum
3	Spectrum Range	Visible light spectrum has 10,000 time broad spectrum in comparison to radio frequency	Radio frequency spectrum range is less than visible light spectrum.
4	Cost	Cheaper than Wi-Fi because free band doesn't need license and it use light.	Expensive in comparison to Li-Fi because its uses radio spectrum.
5	Network topology	Point to point	Point to point
6	Operating frequency	Hundreds of Tera Hz (THz)	2.4 GHz

Table 1 Comparison of Li-Fi & Wi-Fi

CONCLUSION:

Li-Fi is the upcoming and on growing technology acting as competent for various other developing and already invented technologies. Since light is a major source for transmission in this technology it is very advantageous and implementable in various fields that can't be done with the Wi-Fi and other technologies. Hence the future applications of the Li-Fi can be predicted and extended to different platforms like education fields, medical field, industrial areas and many other fields. The possibilities are numerous and can be explored further. If this technology 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 towards the cleaner, Greener, Safer and Brighter future.

REFERENCES:

- 1) [Http://en.wikipedia.org/wiki/li-fi](http://en.wikipedia.org/wiki/li-fi)
- 2) [Http://www.scribd.com/doc/88377913/synopsis-on-lifi-the-latest-technology-in-wireless-communication](http://www.scribd.com/doc/88377913/synopsis-on-lifi-the-latest-technology-in-wireless-communication)
- 3) [Http://www.scribd.com/doc/88340668/seminar-report-on-lifi](http://www.scribd.com/doc/88340668/seminar-report-on-lifi)
- 4) Cisco visual networking index, "global mobile data traffic forecast update, 2012-2017," white paper,cisco (feb. 2013).
- 5) Tsonev, d., sinanović, s., and haas, h., "novel unipolar orthogonal frequency division multiplexing(u-ofdm) for optical wireless," in [proc. Of the vehicular technology conference (vtc spring)], ieee,ieee, yokohama, japan (may 6-9 2012).
- 6) Khalid, a. M., cossu, g., corsini, r., choudhury, p., and ciaramella, e., "1-gb/s transmission over
- 7) A phosphorescent white led by using rate-adaptive discrete multitone modulation," ieee photonics
- 8) Armstrong, j. And lowery, a., "power efficient optical ofdm," electronics letters 42, 370-372 (mar. 16,2006).
- 9) Lee, s. C. J., randel, s., breyer, f., and koonen, a. M. J., "pam-dmt for intensity-modulated and direct-detection optical communication systems," ieee photonics technology letters 21, 1749-1751 (dec. 2009).
- 10) Fernando, n., hong, y., and viterbo, e., "flip-ofdm for optical wireless communications," in [informationtheory workshop (itw)], 5-9, ieee, ieee, paraty, brazil (oct., 16-20 2011).
- 11) Asadzadeh, k., farid, a., and hranilovic, s., "spectrally factorized optical ofdm," in [12th canadian workshop on information theory (cwit 2011)], 102-105, ieee (may 17-20 2011).