

# A Review on Li-Fi Technology

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**Abstract**—Li-Fi technology invented in Wireless communication to provide the connectivity within network environment. Li-Fi is light-fidelity. It is introduced by German Physicist Herald Haas. It works on principal that data transmit through illumination by LED light bulb that having the intensity faster than the human eye can follow just like infrared remote controls but with more power. D-LIGHT which is invented by HAAS produce data rates faster than 10 megabits per second producing a faster average broadband connection. LED has wide area of application It can use the lighting capability to transmit the data from one to another. Wi-Fi technology solve some bottleneck of data transmission with LI-FI. Here we explore the future scope of this new technology for using visible light as the carrier in data transmission and networking.

**Keywords**— LED, Li-Fi Technology, Wi-Fi Technology, Data Transmission, Visible Light.

## I. INTRODUCTION

Li-Fi include frequencies and wavelengths range, from the infrared through visible and down to the ultraviolet spectrum. LI-FI uses gigabits class communication speeds for short, medium and long ranges and directional data transfer using line-of-sight, reflections. A German Physicist Herald Haas concluded from invention that data transmitted at the range of 500Mbps with all kind of light spectrum like white light, infrared. In today's world usage of wireless data is increasing exponentially every year in almost of sector like paying guest rooms, colleges home, cafes, airport etc. Due to this radio frequency is getting blocked day by day, at the same time.

## II. WORKING PRINCIPLE

This communication scheme is transmission of 'Data through illumination'. If very high speed current passed through LED which vary the intensity and with ON-OFF activities of LED data transmitted using binary codes. When the LED is ON, logically it represents the '1' is transmitted and when the LED is OFF, logically it represents the '0' is transmitted. This method called Visible Light communication (VLC) and used to rapid pulses of light to transmit data".

The Li-Fi architecture is comprises numbers of LED bulbs and many wireless devices such as mobile phones, laptops, PC's, Internet based devices, some server devices etc. [10].

The important factors for designin Li-Fi as following

- 1.Line of Sight
- 2.Representation of Light
- 3.LED & the better performance use fluorescent light



Fig.1 Maintaining the Integrity of the Specifications

As a figure shows the contents must have proper integration with server and Internet network, so that it is easily possible to work efficiently.

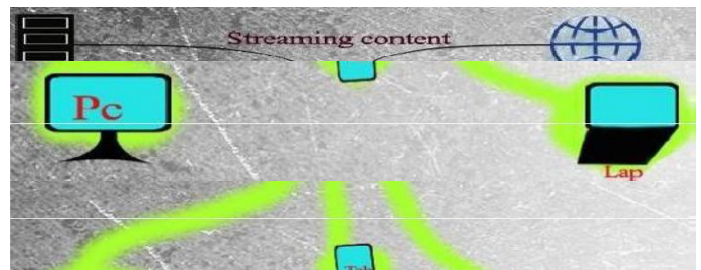


Fig 2. Architecture of Li-Fi

## III. WORKING OF LI-FI

Li-Fi is working on Simple System [15, 16]. On this system, light emitter on one end, for example, an LED, and a photo detector on the other. The photo detector detect a binary one when the LED is on; and a binary zero if the LED is off. To build up a message, flash the LED numerous times or use an array of LEDs of perhaps a few different colors, to obtain data rates in the range of hundreds of megabits per second.



Fig3 Block diagram of LI-FI

Light-emitting diodes can be switched on and off with speed faster than the human eye can detect, causing the light source to appear on continuously, even though it is in fact 'flickering'. The on-off activity of the bulb which is invisible enables data transmission using binary codes: switching on an LED is a logical '1', switching it off is a logical '0'. By

varying the rate at which the LEDs switches on and off, information can be encoded in the light to different combinations of 1's and 0's [9, 16]. The data can be encoded in the light by varying the switching rate at which the LEDs flicker on and off to get different combination of 1s and 0s. In LED Intensity modulation so rapid that human eye cannot notice, so the light of the LED appears constant to humans [15].

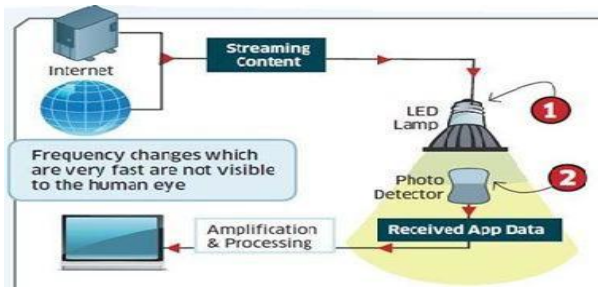


Fig4 Data transmission using LED data stream

The method of using transmit information wirelessly is technically referred to as Visible Light Communication (VLC), though it is popular called as Li-Fi because it can compete with its radio based rival Wi-Fi connection devices within room [19]. Many other sophisticated techniques can be used to dramatically increase VLC data rate. The LED data rate is directly transmits a different data streams [6].

IV. LITERATURE SURVEY

In broad area of Wi-Fi Internet devices, most of the people are using 2.4-5GHz RF to deliver wireless Internet access surrounded our offices, schools, home, and some public places also. We become quite dependent upon these nearly ubiquitous services [7, 15]. While Wi-Fi cover an entire house, school, the bandwidth is limited to 50-100 megabits per seconds (Mbps). It is a mostly current Internet services, but insufficient for moving large data files such as HDTV movies, music libraries and video games. The most of the dependent upon 'the cloud' or our own 'media services' to store all of our files, including audio and video devices, movies, photos, games, the more and most bandwidth and speed should be needed to access this data. Hence RF-based technologies Wi-Fi are not the optimal way. In addition, Wi-Fi may not be the most efficient way to provide new desired capabilities such as gesture recognition and precision indoor positioning. The optical wireless technologies, sometimes called visible light communication (VLC), and more recently referred to as Li-Fi. On the other hand, offer an entirely new paradigm in wireless technologies in communication speed, usability and flexibility, reliability. VLC is the possible solution to the global wireless spectrum storage. Li-Fi technology is a fast and cheap optical version of Wi-Fi. It is a based on Visible Light communication medium using Light between 4000 THZ to 375 THZ as optical carrier for the data illumination. The data is encoded into light to generate data stream by varying the flickering rate, to be clearer, by modulating the LED light with the data signals, it illustrates the communication source [4]. This is a whole new spectrum of possibilities as compared to the radio waves spectrum and is 1000 times more in size radio waves

spectrum. And is 1000 times more in size. Visible light is not injurious to vision and are mandatory part of infrastructure.

V. MODULATION TECHNIQUES FOR VLC & LI-FI

The modulation technique used is digital modulation technique which can work with optical wireless communication using LEDs. Intensity modulation is a basic principle used depending on variation of intensity of light but the information varied. It will show the bi-polar signals like higher order capacity achieving modulation techniques used in radio frequency. Higher order modulation techniques like M-level quadrature amplitude modulation (MQAM) is essential to get data rates that are close to the Shannon capacity limit. The mapping of bi-polar to unipolar performance of signals, in a way that the it out performance existing methods such as direct current optical-orthogonal frequency division multiplexing (DCO-OFDM) and asymmetrically clipped optical-orthogonal frequency division multiplexing (ACO-OFDM). The VLC and Li-Fi system [1, 18], which use the lighting system. The power can be strictly positive. It cannot show negative or complex. It will show the bi-polar signals like higher order capacity achieving modulation techniques used in radio frequency [9], The use of higher order modulation techniques such as M-level quadrature amplitude modulation (MQAM) is essential to achieve data rates that are close to the Shannon capacity limit. The mapping of bi-polar to unipolar performance of signals, in a way that the it out performance existing methods such as direct current optical-orthogonal frequency division multiplexing (DCO-OFDM) and asymmetrically clipped optical-orthogonal frequency division multiplexing (ACO-OFDM). The VLC and Li-Fi system [1, 18], which use the lighting system required high average optical power to provide adequate illumination. It is a high-amplitude signals in higher-order modulation schemes clipped by the peak power constraints of the LED, . It should be lead to high signal distortion. The researchers have developed the Hadamard Coded Modulation (HCM) to achieve low error probabilities in LED-based VLC system needing high average optical powers. This technique uses a fast Walsh-Hadamard Transform (FWHT) to modulate the data which is alternative modulation technique to orthogonal frequency division multiplexing (OFDM).

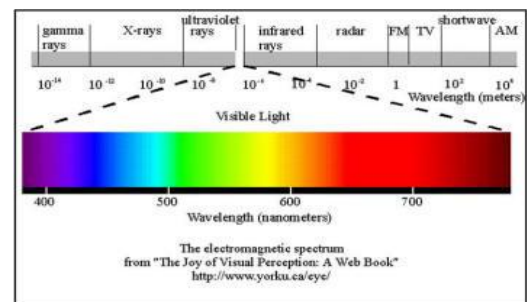


Fig 5 The electro magnetic spectrum

HCM achieves a better performance for high illumination levels as its small peak to average power ratio (PAPR). The HCM power efficiency can be improved by reducing DC part

of the transmitted signals without losing any information. The result so called DC-reduce HCM (DCR-HCM) is well suited to environment requiring dimmer lighting as it transmits signals with lower peak amplitudes compared to HCM, which are thus subject to less nonlinear distortion. HCM to make the resulting signals more resistant against inter-symbol interference (ISI) in dispersive VLC links by using Interleaving [13].

#### VI. APPLICATION OF LI-FI

- a) Li-Fi is cheaper than Wi-Fi.
- b) No License is needed for the Li-Fi.
- c) It can be used in Medical instruments.
- d) It can also use in chemical department.
- e) It can be used in petroleum plants.
- f) It can use Li-Fi in hospital and aircraft.
- g) Millions of street lamps can be transferred to Li-Fi lamps to transfer data.
- h) The Visible light spectrum is a free spectrum band.
  - i) It uses in Education System.
  - J) It uses in Radio broadcast System

#### VII. CONCLUSION

Li-Fi is the upcoming , growing technology acting as competent for various other developing and invented technologies.. The number of people and their devices access wireless Internet, the air waves are becoming gradually more crammed, making it more difficult to get a high-speed signal. This wonderful technology be used practically, then may be in future each and every bulb can be used something like a Wi-Fi hotspot to brighter future. 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 and very efficient alternative to radio-based wireless.

#### REFERENCES

- [1] <http://en.wikipedia.org/wiki/Li-Fi>.
- [2] <http://www.seminarpaper.com/2013/14/seminar-report-on-li-fi-html>
- [3] Akshita M Sonnad, Anjana Gopan, Sailkshmi
- [4] R, Divya S, Ambika R. "Recent Advancements in Li- Fi technology
- [5] Technopits.blogspot.com/technology.cgap.org/2012/01/11/a-li-fi-world/
- [6] Y. P. Singh, "A Comparative and Critical technical Study of the Li-Fi – (A Future Communication) V/S Wi-Fi"
- [7] Vaishli Jadhav, "A study on Li-Fi- Light Fidelity".
- [8] Shilpa Choudhary, Dolly Kumari, Supria Goel, "New Lighting Technology "LI-FI"- A Review".
- [9] Jyoti Rani, Prema Chauhan, Ritika Tripathi, "Li-Fi (Light Fidelity)-The future technology in
- [10] wireless communication". Y. P. Singh, "Analytical study of Wi-Fi".
- [11] Herald Haas, 'Wireless data from every light bulb', TED Global, Edinburgh, July 2011.
- [12] "New Epoch of wireless communication: Light Fidelity" IJIRCCCE, vol 1, issue 2, April 2013.
- [13] "LI-FI" the latest technology in wireless" IJCCE, vol 2 issue 3, July, 2012.
- [14] Dvice.com/archives/2012/08/lifi-ten-ways-i.php
- [15] <http://edition.cnn.com/2012/09/28/tech/lifi-haas-innovation>