International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 5 Issue: 2

ISSN: 2454-4248
05 – 08

Light Fedility (Li-Fi) - An Emerging Era of Wireless Data Communication and its Applications

T. Venkat Narayana Rao[1] , Cheruku Priyanka [2], Bhukya Prabhavathi [3]

Professor[1], Student[2, 3], Department of C.S.E, SNIST
Sreenidhi Institute of Science and Technology
Yamnampet,Hyderabad, T.S,India.

Abstract:- These days, internet has turned out to be major demand that people are in seek of Wi-Fi hotspots (internet providers). Li-Fi offers transmission of information through visible by transferring information via an LED light bulb that diverges in concentration quicker than individual eye can go after. The term Li-Fi states to VLC(visible light communication) technology that utilizes as standard to carry speedy interaction in a way comparable to Wi-Fi. Li-Fi supplies superior efficiency, security, bandwidth and availability than Wi-Fi. This paper offer a brief summary on Li-Fi technology, its applications, potential and advantages.

*****

I. Introduction

Li-Fi is abbreviated as light fidelity. It was introduced by Prof. Harald Haas for the first time at Ted Global Talk on July 2011. Li-Fi is done based on visual light communication (VLC) using Light Emitting Diodes (LEDs). It is wireless optical networking. It transmits the data at high speeds over infrared radiation, visible light spectrum, and ultraviolet radiation. The bulbs used in Li-Fi are provided with a fragment that changes the light for data transmission [1].

II. Working of LI-FI

Li-Fi is a VLC (**visible light communications**) structure and the rate of this system is extremely high. Li-Fi uses common LEDs to allow the information to transfer and increase the speed till 224 Gigabits/sec. The data transversal of this technology can be done through illumination [4]. The important strategies of this system are the bright LEDs. The action of LEDs allows a kind of data transmission in the form of binary codes. But the individual eye cannot identify this change & the bulb shows a constant intensity.

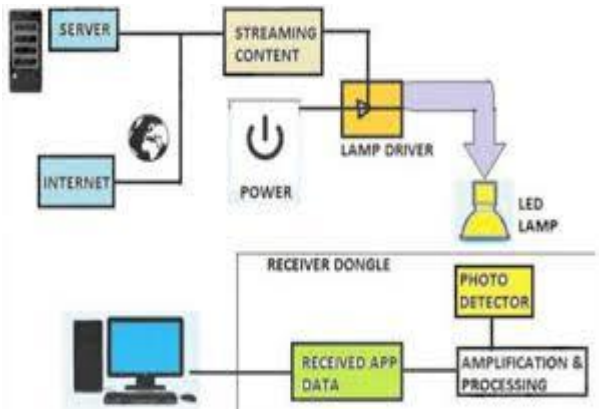

Figure 1: Working of LED in Li-Fi technology

Li-Fi works on the Infrared technology in Googlebox. The input is adjusted into a binary code and the code is then telecasted through infrared light waves by the remote's sensor devices. Later the light waves are received by the TVs infrared detector, which decodes the light and performs the designed action. In case of Li-Fi, the LED bulbs broadcast the data by changing the light waves whereas a photo detector on the radiotelephone or workstation pick those light waves and changes them[5].The LED bulbs will hold a microprocessor that will do the work of processing the information. The power of the light can be utilized to send the information by minute changes in amplitude. Figure 1 shows the working principle of the Li-Fi system, for statistics channeling; it can be done by single or multiple LEDs. On the recipient side, there is a photo detector, which transfigures this light into electric signals and that signals are given to the device connected to it. Current regulator and stage shifter circuits are used on twain sides to transmute or support voltage intensity among source and target as shown in Figure.

Existence with Li-Fi will have theatrical growth in the usage of LEDs for illumination that gives the chance to include Li-Fi technology into a surplus of LED surroundings. For example any illumination appliances like ceiling lights, car lights, and street lights are used as a hotspot (internet provider) which assists us to lessen the cost of structural design for a hotspot as shown in Figure 2. This technology is mainly appropriate for several popular internet implementations; i.e. downloading videos, music, and games in just a few minutes with the aid of Li-Fi. Figure 2 shows the environment with the Li-Fi technology where light bulbs are used as a data transmission intermediate to the local computer, processor, and smart gadgets as they have photo sensor linked to it as a receiver[11].

 ISSN: 2454-4248
05 – 08

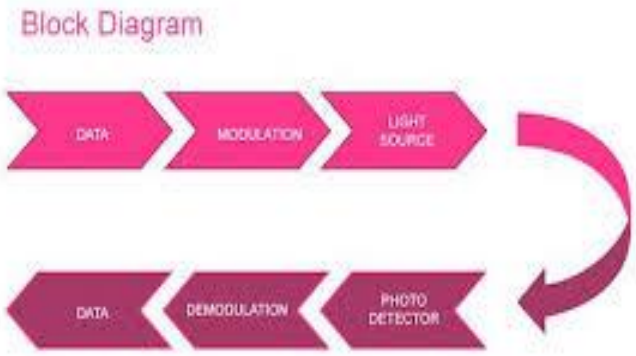

Figure 2: Block diagram data transmission

2.1 Why VLC?

VLC is a visual transmission technology that uses the observable illumination rays, these rays situate between [400-800] THz, as the visual carriers the information for broadcasting by illumination. It uses fast pulses of light, which cannot be detected by the human eye to transmit data. It includes the use of the visible light of the electromagnetic range to broadcast information. The VLC consistency process is performed within IEEE wireless unique area network running groups. One of VLC‟s characteristics is providing broad bandwidth as demonstrated in Figure 3. It is evident that the procedure in the optical part of spectrum guarantees 10,000 times greater bandwidth in contrast to usage of the RF number within the locality of visible illumination and RF prevalence at electromagnetic spectrum. As seen in the previous paragraph, VLC is a communication method which consists of transmitter, a receiver and a messaging guide[6].

2.2 The main components of VLC systems

- High-intensity Light-Emitting Diodes (LEDs) or any light initiator, which acts as a source.
- A silicon photodiode has the role of a detector and it shows a good reaction to a visible wavelength.
- Usually, employed for some required circuits like a dynamic circuit and a receiving route. The driving circuit contains a direct circuit and output period to alter the data and make it ready for sending and the receiving route which consists of a filter to choose the required group, the ampLi-Fication phase is to provide the necessary sign also to the noise ratio in order to extract the signal.

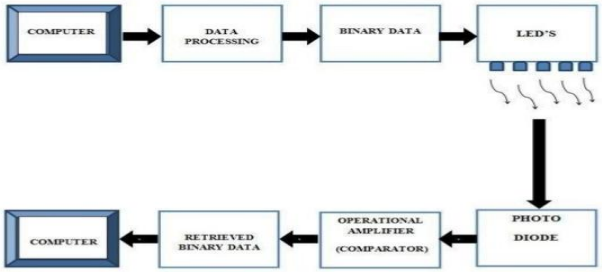

Figure 3: Block diagram of a VLC system

III. Comparison of WIFI and LI-FI

The following table I is the comparison about WiFi and Li-Fi based on several characteristics as listed[2][3].

Table 1. Comparison of WIFI and LI-FI

CHARACTERISTICS	WI-FI	LI-FI
Abbreviation	Wireless Fedility	Light Fedility
Range	100 meters	Based on LEDs
Cost	Lower	Expensive
Operating Frequency	Hundreds of Tera Hz	2.4GHz
Security	Low	High
Speed	150Mbps	About 1Gbps
Network Topology	Point-to-Point	Point-to-Point

Figure 4: comparison of Li-Fi and Wi-Fi

IV. LI-FI Applications

4.1 Security

The Figure 5 exhibits inbuilt security ascendancies of using a light source for wireless communications that let organizations to improve security for their wireless systems considerably. The capability to strictly describe the communication part of a Li-Fi access point permits the exact splitting of the office atmosphere[7]. Furthermore, technology needs trademarked hardware earlier than anyone can access the network.

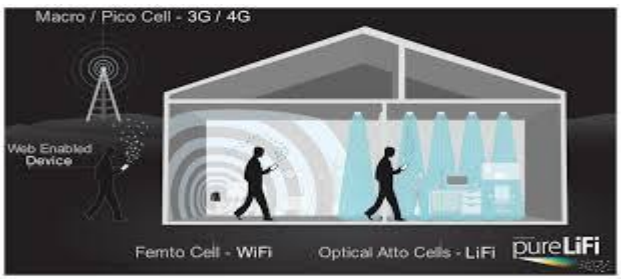

Figure 5: Security with Li-Fi

 ISSN: 2454-4248
05 – 08

4.2 Smart Lighting

Wherever there is lighting framework there be capable of a wireless Li-Fi communication system. That Li-Fi system can provide extra value providing upgraded planning and control. In a Li-Fi system, every Li-Fi access point has a distinctive Internet Protocol address (IP address) permitting facility[4] [8].

4.3 Hospitals and Healthcare

Li-Fi provides a never done or known before a chance for integration in hospitals and healthcare services. Li-Fi don't discharge radio-frequency interference and for that reason does not mess around with medical tools, nor is it messed around with by MRI (Magnetic Resonance Imaging) scanners as shown in figure 6.

Figure 6: implementation of Li-Fi for MRI scanners

4.4 Enterprise Wireless Solutions

Li-Fi system for everyday work, discussion streaming remote desktops along with video, can provide a better user experience with the assurance of robust precautions. The property of maintaining a direction of light transmission can successfully lessen interference in closely occupied offices. Wireless discharging to Li-Fi delivers spectrum for joining additional devices as shown in Figure 7.

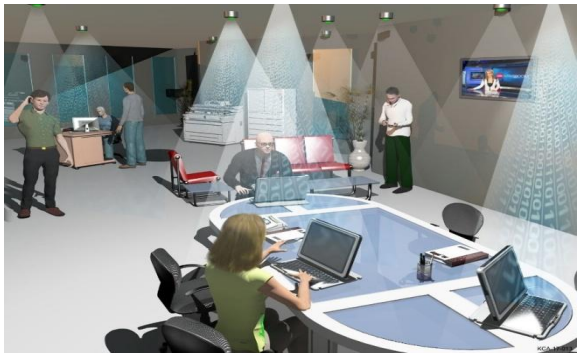

Figure 7: **Li-Fi implementation in enterprise environment**

4.5 Smart Transport

Li-Fi cannot just offer dependable, high speed and secure wireless communications for a beneficiary of transport; Li-Fi can also facilitate vehicle to vehicle interactions as shown in Figure 8. Also, LED (Light Emitting Diode) Vehicle lights can aware the drivers as soon as other vehicles are too near [8][10].

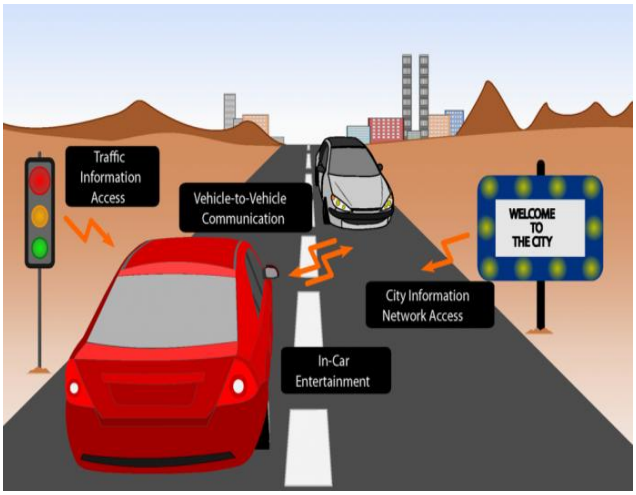

Figure 8: **implementation of Li-Fi for vehicles**

4.6 Smart Cities

Figure 9 depicts that Li-Fi can allow the recognition of reliable smart cities. Lights used in buildings, streets, transportation can communicate without wires. Li-Fi can relieve public wireless congestion as a discharging ability for broadcasting frequencies [6].

Figure 9: **implementation of Li-Fi on roads**

4.7 Smart Home and Lifestyle

Li-Fi can facilitate home in simple, secure, robust and dependable wireless communications. Parallel to the enterprise atmosphere Li-Fi can provide wireless discharging and data aggregation [9]. Smart homes can be

 ISSN: 2454-4248
05 – 08

wireless, and users can instinctively understand the best exposure positions by considering the light [5]. No longer will home users need to concern about “man in hub" (man under the locus of Li-Fi) attacks as they can just draw the curtains (of windows) and shut their doorways to lock their Li-Fi networks as in Figure 10.

Figure 10:**implementation of Li-Fi in home environment**

V. Advantages and Disadvantages

5.1 Advantages

It is an Enhanced wireless framework by providing an extra layer of undersized cells (attocells).

It has prevention of the radio frequency spectrum crunch (10,000 times more competence than present)

Empowering very high apex data tariff (10 Gigabytes /sec).

It empowers the Internet-of-Things (100 times more devices)[6].

Extensively improved protected wireless communication (condensed prevention of signals).

It has improved energy-efficiency by merging information communication and explanation (100 times energy lessening).

5.2 Disadvantages

The Internet cannot be used without a light resource. This could limit the loci and positions in which Li-Fi could be used [9]. Because it uses tangible light and light cannot perforate through walls, the signal's area is restricted by objective hurdles.

The starting place of light may hold up with the signal. One of the prime prospective limitations is the prevention of signals outdoors. The signals will be interfered by sunlight. A perfect latest framework for Li-Fi would need to be erected[10][11].

VI. Conclusion

In this paper, we have examined the applicability of Li-Fi technology. With this, one can observe that Li-Fi as an extremely developed approach on design, having the most excellent proposal of internet by principally reducing the dimension of device which transports data execution- by resources of light bulbs substituted by such LEDs. It can offer huge access with vast applications compared to any other networks present in a variety of sectors. Although there are a few flaws, they can be obliterated by cautious additional research and future study. Li-Fi has enhanced a step ahead for progress in the humankind of mounting desire. In expectations, it is the largest part valuable and demanding technology for the VLC and also useful for OFC (Optical Fiber Communication).

References:

[1] Akshata M Sonna, Anjanagopan, Sailakshmi N.R, Divya S, Ambika R, “Recent Advancements in Li-fi Technology” International Journal of Electrical, Electronics and Data Communication, volume-1, issue-10, dec-2013 issued: 2320-2084.

[2] Jithender Singh, Vikash, “A New Era in Wireless Technology using Light-Fidelity” International Journal of Recent Development in Engineering & Technology, Vol-2, June 2014.

[3] Jyoti Rani, Prerna Chauhan, Ritika Tripathi, “Li-Fi (Light Fidelity)-The future technology In Wireless communication‖”, International Journal of Applied Engineering Research, ISSN 0973-4562 Vol.7 No.11 (2012).

[4] Rahul R.Sharma Li-Fi technology Transmission of data through light .

[5] ”Data through Light”, The Institute of Engineers, Technorama Magazine, Volume 62, pp. 41,December 2012.

[6] Dominic O‟Brien, Hoa Le Minha, LubinZeng, GrahameFaulkner and HsiHsir Chou, Kyungwoo Lee, Daekwang Jung,YunJe Oh, Eun Tae Won,”Visible Light Communication:Recent Progress and Challenges”, Wireless World ResearchForum.

[7] MeghaGoyal,DimpleSaproo,AshaBhagashra,” New Epoch of Wireless Communication: Light Fidelity”, International Journalof Innovative Research in Computer and CommunicationEngineering, Vol. 1, Issue 2, April 2013 ISSN (Print):2320-9798, ISSN (Online): 2320– 9801.

[8] Gordon Povey,Top 10 Visible Light Communications applications,March 2011.

[9] Shubham Chtterjee,Shalabh Agarwal,Ashok Nath,”scope and challenges in Light fedility technology in wireless data Communication”,International Journal of Innovative Research in Advanced Engineering(IJIRAE),Issue 6,vol 2,Page 1-9,June 2015.

[10] UllasChandran,Implementation of Li-Fi Technology for Home Automation and Vehicle Communication, 10 April 2016.

[11] Vittal S Saptasagare,Next of WiFi an future technology in wireless networking Li-Fi Using Led Over Internet of Things,march 2014.