Secure Data Transfer in Personal Area Network

Shiv Kumar[1], Shrawan kumar shrama[2], Awanit kumar[3]
[1]Computer Science & Engineering, Mewar University, Gangrar, Chittorgargh-312901, India.
Shivkumar004@gmail.com
[2]Computer Science & Engineering, Mewar University, Gangrar, Chittorgargh-312901, India.
shrawansharma7070@gmail.com
[3]Computer Science & Engineering, Mewar University, Gangrar, Chittorgargh-312901, India.
itsawanitkumar@gmail.com

ABSTRACT : *Now a d'ays everyone using net in their home or in small office or we can say within a small area. The problem is transfer data from one node to other node in a room or in a hall with minimum costing and minimum maintenance. But we have to save energy also. There are several techniques or method to transfer data in a small premise like Wi-Fi, Bluetooth, Li-Fi and quantum physics. According to our requirement security means privacy, integrity, timeliness and non repudiation. While costing is most important for small organization also. Implementation and maintenance of Wi-Fi is more costly then Li-Fi. Li-Fi is more secure then Wi-Fi because data is transfer from one node to another is done using light. It is cost effective also because we have not to use additional light to light the room or office. Its maintenance is also very easy. So, we can say that LI-Fi is better than Wi-Fi in terms of costing, privacy and maintenance.*

Keywords - Li-fi, Wi-Fi, LED, optical wireless communication, wireless network, Spectrum ,visible light

I. INTRODUCTION

Li-Fi (Light Fidelity) is a technology which is similar to Wi-Fi but more advanced and secure than Wi-Fi. Li-Fi and Wi-Fi both uses electromagnetic spectrum for data transmission, whereas Wi-Fionly uses radio waves, which can be harmful for human beings. The transmission of the data takes place through the light emitting diodes (LED's). In modern times, it is will be known as the optimized version of Wi-Fi. In simple terms, Li-Fi can be thought of as a light-based Wi-Fi. Which uses light instead of radio waves to transmit information. And instead of Wi-Fi modems, Li-Fi would use transceiver-fitted LED lamps that can light a room as well as transmit and receive information.

Li-Fi was suggested by Dr.Harald Haas, (University of Edinburgh in the UK,) who began his research in this field in 2004 promoted this technology in July 2011 TED Global talk. Teams at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission using arrays of LEDs where each LED transmits a different data stream. Li-Fi can be thought of as a light-based Wi-Fi without any wireless device (Router, Wi-Fi modem) Li-Fi uses transceiver-fitted led lamp which can receive information in secure way [1]. Li-Fi is designed to use LED light bulbs similar to those currently in use in many energy-conscious homes and offices. However, Li-Fi bulbs are outfitted with a chip that modulates the light imperceptibly for optical data transmission. Li-Fi data is transmitted by the LED bulbs and received by photoreceptors.

Wi-Fi is a popular wireless networking technology. Wi-Fi stands for "wireless fidelity". By using this technology we can exchange the information between two or more devices. Wi-Fi has been developed for mobile computing devices, such has laptops, but it is now extensively using for mobile applications and consumer electronics like televisions, DVD players and digital cameras. There should be two possibilities in communicating with the Wi-Fi connection that may be through access point to the client connection or client to client connection. Wi-Fi is a one type of wireless technology. It is commonly

called as wireless LAN (local area network). Wi-Fi allows local area networks to operate without cable and wiring. It is making popular choice for home and business networks. A computer's wireless adaptor transfers the data into a radio signal and transfers the data into antenna for users [2].

II. PRINCIPLE OF LI-FI

Li-Fi technology based on the use of visible light between the blue (670 THZ) and red (480THZ). It uses the optical spectrum; the principle is based on the sending data by amplitude modulation of light sources generated by LEDs. LED turns on and off at very high speed and is not visible to human beings. This ribbon of on and off signals interpreted to create binary streams of 0 and 1. When the LED is ON, logical '1' is transmitted and when the LED is OFF, logical '0' is transmitted.[3] This method of using rapid pulses of light to transmit data is called Visible Light Communication (VLC). Li-Fi light emits plasma by coupling radio-frequency energy into an electrode-less quartz bulb. The RF (radio-frequency) energy is created and amplified by an RF circuit which is driven by a Solid-State Power Amplifier. The following three steps shown below is the process of light generation in Light Fidelity system [4]:

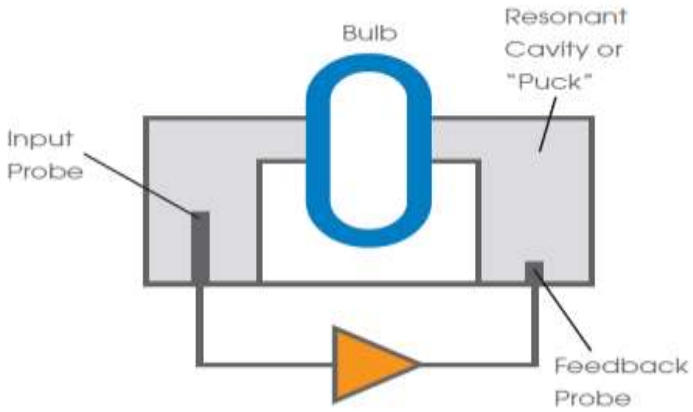

Fig 1:Principle of Li-Fi Technology

The principle of the wireless network is based on use of radio waves and exchange of data resembles communication with the radio:

1. The wireless adapter transforms the information into radio signal and transmits it to the air through antenna;
2. Wireless router receives and performs inverse transformation of the signal. Further the information is sent to the internet by cable;
3. The same process is performed for receiving the information. After receiving the information from the internet the router transforms it into radio signal and sends through antenna to the wireless adapter.
4. Wi-Fi receivers and transmitters applicable the networks resemble the devices used in cell phones and portable duplex radios. They receive and transmit radio waves and also convert the digital signal into radio waves and vice versa. The difference between the Wi-Fi devices and the similar devices is that they use 2.4 GHz or 5 GHz which is much higher and allows sending more data.[5]

III. WORKING OF LI-FI & WI-FI

The working of Li-Fi engineering is basic. In the figure 1 shown how the binary data are captured by few light receptors are required, and are installed on all types of connected devices from computer to tablets, to phone, television and other appliances. Make sure that light pulses are imperceptible to the human eyes, without causing harm or discomfort of any types. The Advantages is that any lamp or flashlight can become a hotspot. A light is required on one end (An LED), and a photo-detector (Light sensor) on the other. When LED is on, the photo-detector registers a binary one; otherwise its binary is Zero. Flash the LED more times and it build up a

message, which uses an array of LEDs and few different Colors, and quickly use will deal with data rates in the range of hundreds or megabits per second, this is accomplished by the flickering of LED light bulbs to create binary code (On= 1 and Off= 0).

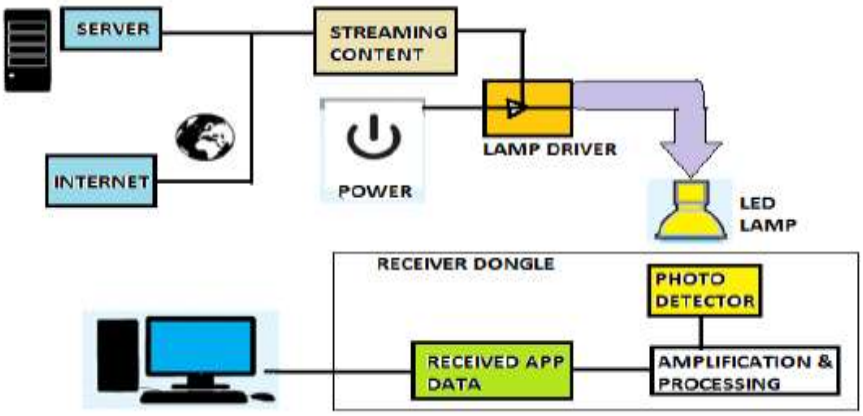

Fig 2: Working of LI-Fi Communication

And this is done at higher rate than human eyes can detect it, as more LEDs ii lamp, the more data it can process [6].

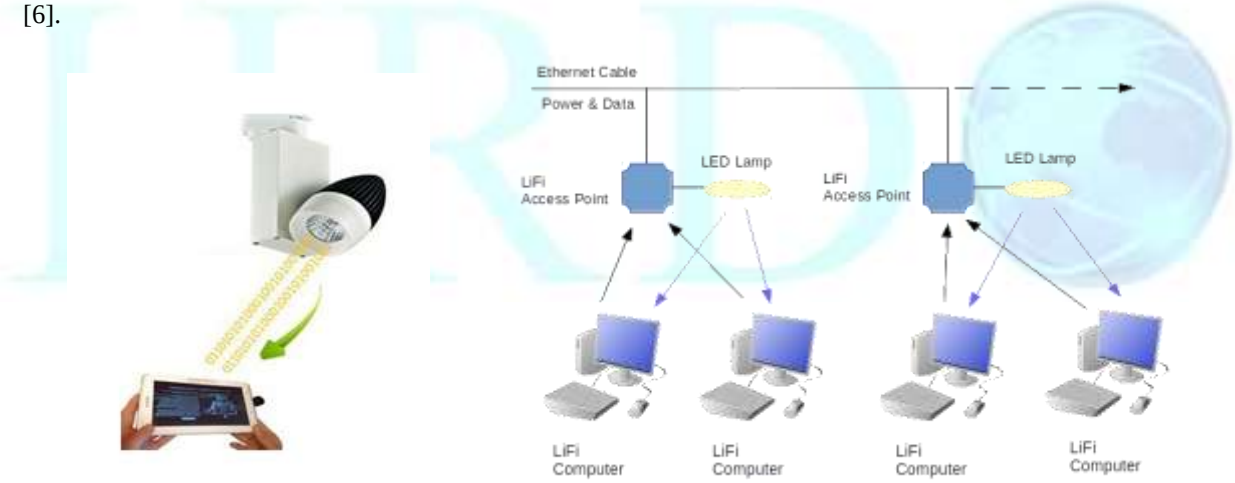

Fig 3 : Connection between LED and computer

The Figure 3 shows brief connection of internet with LED and information retrieved on the computer. One LED transfers data at a slower rate, so millions of LEDs with one micron size are installed in the bulb. The reduction of size of LEDs does not decrease its capability to transfer data or intensity on the opposite it increases the efficiency of one light bulb to transmit the data at an unexpectedly higher rates. Further these micro-LEDs are ultimately just pixels-and at one micron, these LEDs, would be a lot smaller than those in your smart phone's retina display.

Wi-Fi Working:

The wireless network is operating three essential elements that are radio signals, antenna and router. The radio waves are keys which make the Wi-Fi networking possible. The computers and cell phones are ready with Wi-Fi cards. Wi-Fi compatibility has been using a new creation to constituent within the ground connected with community network. The actual broadcast is connected with in sequence in fact it is completed by way of stereo system surf as well as the worth of wires with monitor to classification prone. Wi-Fi allows the person in order

to get access to web any place in the actual provided area. You can now generate a system within Resorts, library, schools, colleges, campus, personal institutes, as well as espresso stores as well as on the open public spot to help to make your company much more lucrative as well as interact with their own customer whenever. Wi-Fi compatibility can make surf with stare to company using their inspiring cable television much a smaller amount force down. The radio signals are transmitted from antennas and routers that signals are picked up by Wi-Fi receivers, such has computers and cell phones that are ready with Wi-Fi cards. Whenever the computer receives the signals with in the range of 100-150 feet for router it connect the device immediately. The range of the Wi-Fi is depends upon the environment, indoor or outdoor ranges. The Wi-Fi cards will read the signals and create an internet connection between user and network. The speed of the device using Wi-Fi connection increases as the computer gets closer to the main source and speed is decreases computer gets further away[7].

IV. ARCHITECTURE

Li-Fi architecture consists numbers of Led bulbs or lamps.

Important factors to be consider while designing Li-Fi as following:

1. Presence of Light (Light generated by LEDs)
2. Line of Sight (Los)
3. For better performance use fluorescent light & LED

As shown in figure 4 streaming content must have proper integration with server & internet network, so that it is easily possible to work efficiently. [8]

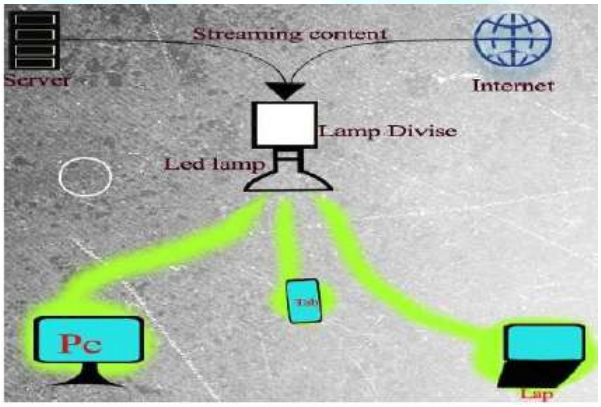

Fig 4: Architcture of Li-Fi

Architecture of Wi-Fi :

Wi-Fi architecture consists numbers of devices to accessing a wi-fi network
Important factors to be consider while designing Wi-Fi as following:
1 Stations
2 Basic service set
3 Extended service set
4 Distribution system

The figure 5 is show the Architecture of Wi-Fi network [9]

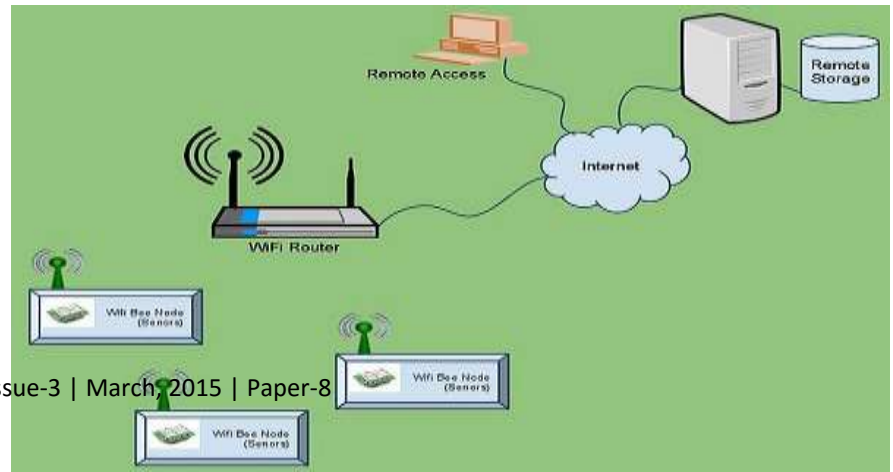

Fig 5:Working Architecture of Wi-Fi

V. IMPLEMENTATION

Li-Fi can be implemented using LED light bulbs at the downlink transmitter. These devices are normally used for illumination only by applying a constant current. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. This very property of optical current is used in Li-Fi setup. The operational procedure is very simple, if the LED is on, you transmit a digital 1, if it's off you transmit a 0[10]. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. Hence all that is required is some LEDs and a controller that code data into those LEDs. All one has to do is to vary the rate at which the LED's flicker depending upon the data we want to encode. Further enhancements can be made in this method, like using an array of LEDs for parallel data transmission, or using mixtures of red, green and blue LEDs to alter the light's frequency with each frequency encoding a different data channel. Such advancements promise a theoretical speed of 10Gbps – meaning one can download a full high-definition film in just 30 seconds [11].

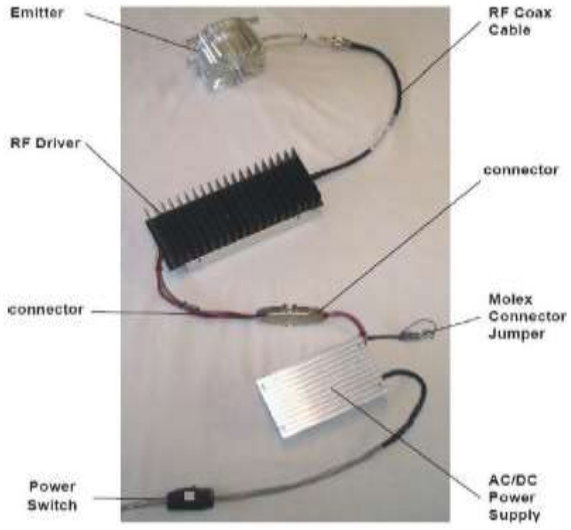

Fig 6 : IMPLEMENTATION: LI-FI

Emitter Assembly: Mechanical assembly containing a ceramic resonator and a quartz bulb. Ceramic resonator channels the RF (radio-frequency) energy into the bulb resulting in a powerful light emitting plasma. The bulb contains halides needed to generate the plasma.

RF Driver: An RF (radio-frequency) signal is generated by the solid-state Power Amplifier Driver and is guided into an electric field about the bulb. The RF driver also contains controls circuit for digital and analog lighting controls [12].

Li-Fi System: System consisting of an emitter assembly and RF driver connected by an RF cable. [13]

Power Supply: This is the main power supply that can converts AC power into DC power. LiFi system requires at least 28 volt DC input.[12]

Fixture: The end lighting system that contains the LIFI system, light shaping components, power supply, and heat sinks.

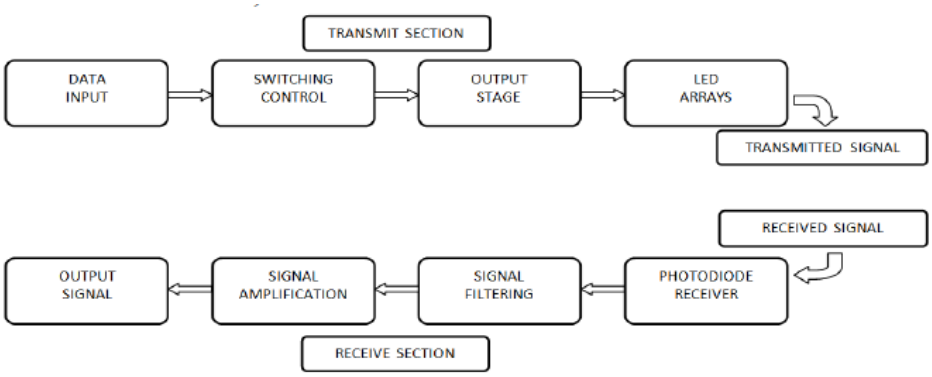

Figure 7: Li-Fi System Block Diagram

This technology is best for personal use as well as commercial example (personal use at home along with other family members in a family and cyber cafe). This will reduce the requirement of Wi-Fi-modem and other appliances. Let us suppose a family of four members who uses internet service, for them a single LED lighting a room will work as a router. So it is necessary that LED should be present in everywhere there they can utilize the service. Benefit of this Li-Fi is proper connectivity will be shared to every person of the family and outsider will be bared for the service.[14]

IMPLEMENTATION OF WIFI: Vision's wireless systems connect to your PCs without the hassle of cables. With a well established history in wireless communications and converged voice and data networking, Vision delivers wireless Local Area Networks (wLANs) solutions suited to every environment from the simplest applications to offices, schools, campuses and metropolitan wireless networks. Vision delivers highly secure, high-bandwidth, long-range communication to public spaces and security-sensitive applications that [15]

VI. SECURITY ISSUE

6.1 Security in Li-Fi

- Signals do not penetrate walls. Thus any person from outside the room cannot access the service.
- Data may be directed from one device to another and the user can see where the data is going; there is no need for additional security such as pairing for RF interconnections such as Bluetooth.

6.2 Security in Wi-Fi

- Wi-Fi security issues (can be intercepted outside the building) so any one can easily access the service
- Directing data from one device to another security line pairing device password or confirmation password may be required.

VII. COMPARISON

Comparison between Li-Fi and Wi-Fi are shown below in the table:

S. No.	Parameters	Wireless Technologies	
		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 uses 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	2.4 GHz

Table 1: COMPARISON BETWEEN Li-Fi VS Wi-Fi

VIII. CONCLUSIONS

In this way we can say that Li-Fi is more secure than Wi-Fi and also its speed is higher than Wi-Fi. Not only this it is more secure than Wi-Fi. So, for personal area network Li-Fi should be used instead of Li-Fi..

IX. ACKNOWLEDGMENTS

Foremost, I would like to express my sincere gratitude to my advisor **Shiv Kumar** and **Awanit Kumar** for the continuous support of my study, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this paper. I could not have imagined having a better advisor and mentor for this paper.

Besides my advisor, I would like to thank the rest of my Friends and well wisher: **Rahul bhatia**, for their encouragement, insightful comments, and hard questions. Last but not the least; I would like to thank my brother **Nand Lal Sharma** and my beloved **Neelam Sharma** supporting me spiritually throughout my life.

X. REFERENCES

[1] Harald Haas, 'Wireless data from every light bulb', TED Global, Edinburgh, July 2011.
[2] http://www.elprocus.com/how-does-wifi-work/
[3] Akshata m sonnad, anjana gopan, sailakshmi n r, divya s, ambika r "recent advancements in li-fi technology" bmsit, International Journal of Electrical, Electronics and Data Communication, ISSN: 2320-2084 Volume-1, Issue-10, Dec-2013
[4] LiFi® STA 41 01,"Data and Reliability Package", September 24, 2010
[5] http://mim.ge/text_open.php?id=2
[6] http://en.wikipedia.org/wiki/Li-Fi
[7] http://www.elprocus.com/how-does-wifi-work/
[8] http://purevlc.co.uk/what_is_li-fi/applicationsof_vlc/
[9] http://beyondweblogs.com/what-is-li-fi-is-this-replacing- Wi-Fi/
[10] Technopits.blogspot.comtechnology.cgap.org /2012/01/11/a-li-fi-world/
[11] http://en.wikipedia.org/wiki/Li-Fi

[12] Visible Light Communication (VLC)/Li-Fi Technology Market worth $6,138.02 Million - 2018, New International, 13 November 2013.
[13] Li-Fi beats Wi-Fi with 1GB wireless speeds over pulsing LEDs, gear burn, 13 January 2013, Jacques Coetzee.
[14] http://www.visiontechnologiesinc.net/commercial-solutions-and-services/wireless-design-implementation-and-support.html
[15] http://purevlc.co.uk/what_is_li-fi/applicationsof_vlc/

Author Profile

Shiv Kumar received the M. Tech. degree in Computer Science and Engineering from Mewar University Chittorgargh in 2012. During 2007-2013, he stayed in Canon India Private limited Center of Excellence center and India Software Center Noida and Gurgaon of India. He knows with Mewar University, Chittorgargh, India.

Shrawan Kumar Sharma is currently pursuing masters degree program {M.Tech} in Computer science and engineering in Mewar University, India. His research interest includes soft computing, Mobile computing, DBMS, Network Security, Graphic programming, Fuzzy and Data Mining and etc.

Awanit Kumar is currently pursuing masters degree program {M.Tech} in Computer science and engineering in Mewar University, India. His research interest includes DBMS, Computer Network, programming, Artificial intelligence and data processing and etc.