National Conference on
"Role of Engineers in Nation Building" organized by VIVA Institute of Technology, Mumbai
(6th and 7th March 2020)
International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2020]

Li-Fi Technology

Nikhil Chiplunkar[1], Prof.Pradnya Mhatre[2]

[1]Department of Computer Applications,University of Mumbai
Viva School of MCA,Shirgaon,Virar(East)
Email: nikhilchiplunkar123@gmail.com
[2]Department of Computer Applications,University of Mumbai
Viva School of MCA,Shirgaon,Virar(East)
Email: pradnyamhatre@vivamca.org

Abstract — *This paper introduced the concept of Li-Fi which is used for data transfer. Li-Fi stands for Light Fidelity. Li-Fi is the term some have used to label the fast and inexpensive wireless communication system which is the optical version of Wi-Fi(Wireless Fidelity) technology. The Li-Fi technology can transfer the data through LEDs. It is a high security wireless communication system, compared to Wi-Fi. Li-Fi is designed to use LED light bulbs similar to those currently in use many energy-conscious homes and offices. However, Li-Fi bulbs are equipped with a chip that modulates the light imperceptibly for optical data transmission.*

A Li-Fi enabled device converts the beam of light into an electrical signal. The signal is then transformed back into actual data. These days, with the fast development of remote interchanges the issue of utilizing range effectively has turned out to be more commanding. Plentiful arrangements have been proposed to measure this issue; one of these arrangements is the use of noticeable light frequencies to send information. These frequencies are as of now free and unused. Light loyalty is another short range optical remote correspondence innovation which gives the availability inside a nearby system, by utilizing Light-Emitting Diodes (LEDs) to transmit information trusting upon light brightening properties.

Keywords — LED Bulbs, LED Diodes, Li-Fi technology, Visible Light communication (VLC), Wi-Fi.

I.INTRODUCTION

Now a day's Wi-Fi is widely used in all the public areas like home, small restaurants, hotels, airports. Due to this radio frequency is being blocked day by day, at the same time use of wireless data is increasing as time goes on every year. Everyone is interested to use wireless data but the ability (to hold or do something) is going down. Wireless radio frequencies are getting higher, difficulties are increasing and RF interferences continue to grow. In order to overcome this problem in future, light - fidelity (Li-Fi) technology came into reality since 2011. Li-Fi is a wireless communication system in which light is used as a sinusoidal signal instead of traditional radio frequency as in Wi-Fi. Li-Fi is a technology that uses light sending out diodes to transmit data wirelessly. Visible light communication (VLC) uses fast pulses of light to transmit information wirelessly that cannot be noticed by human eye. The aim of paper is to focus on Li-Fi technology over Wi-Fi technology and challenges. [1]

At the time of using internet whether it is own or stealing from other, one has probably gotten unfulfilled because slow speed of the internet when more devices are connected to a same router. Due to increasing number of internet users, Radio Spectrum is crowded and blocked but the demand for wireless data double each year. Dr. Harald Haas has come up with a solution for those he calls "Data through lighting up/education", Simply-Fi. Li-Fi is nothing but Wi-Fi using light. Li- Fi is now part of the VLC as is used using white LED light bulbs. Data transmission occurs from this LED bulb by changing the current at very high speeds which undetectable by the human eye. Li-Fi is a data move from one place to another way of doing things that uses light for data move from one place to another This way Li-Fi provides very high data rates. In addition, Li-Fi is very

International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2020]

secure as light cannot penetrate through the walls. Li-Fi uses visible light spectrum, this way it is known as visible light communication (VLC). Visible light is uncontrolled unlike radio frequency spectrum. Because of this, it is cost effective. Here we developed application module of Li-Fi technology, which transmits data through LED bulbs and receive by using photodiode. [2]

In the data communication system there is a need of higher data rate and secure mean of (how easy something is to get to, use, or understand). So to deal with this needed thing the technology is exploring day by day to overcome the need of stream less communication. In this development, the (people who work to find information) have come with many technologies like Bluetooth, infrared and many more .This development leads the German physicist--Harald Haas to found new data transmission way of doing things named as Li-Fi i.e Light Fidelity which uses the visible light as a medium for data transmission. [3]As the light is part of our day to day life, there is no paucity of light in our homes, streets, working area, etc. so it can be used (in a way that produces a lot with very little waste) both as a light source and as a data transmitting medium.In order to overcome this problem in the future, Professor Harald Haas, an expert in optical wireless communications, proposes in 2011 a brilliant and related solution by using light to transmit data, he (showed/shown or proved) how an Light-Sending out Diodes (LED) bulb prepared with signal processing technology could stream a high-definition video to a computer and he showed that one watt LED light bulb would be enough to provide net connectivity to four computers.This new technology is known as Light-Fidelity (Li-Fi) which is created by Professor Harald Haas. It is a short range wireless communication system based onlight lighting up from LED, and use the visible light as a signal carrier instead of traditional RF carrier as in Wi-Fi.

II. WORKING OF Li-Fi

The working of Li-Fi is very simple. There is a light on one end i.e an LED transmitter, and a photo detector (light sensor) on the other. The data input to the LED transmitter is (translated/put into secret code) in to the light (technically referred to as Visible Light Communication) by changing the flickering rate at which the LEDs flicker 'on' and 'off' to create different strings of 1s and 0s. The on off activity of the LED transmitter which seems to be invisible (The LED strength is controlled/adjusted so quickly that human eye cannot (see aware of), so the light of the LED appears constant to humans), enables data transmission in light form (going along with/obeying) the incoming binary codes: switching ON a LED is a logical '1', switching it OFF is a logical '0'. In a typical setup, the transmitter (LED) is linked to the data network (Internet through the modem) and the receiver (photo detector/light sensor) on the receiving end receives the data as light signal and changes secret code into understandable information, which is then displayed on the device connected to the receiver. The receiver records a binary '1' when the transmitter is ON and a binary '0' when the transmitter is OFF. This way flashing the LED many times or using an organized row of LEDs will eventually provide data rates in the range of hundreds of Mbps. Hence all that is needed/demanded, is some or an organized row of LEDs and a controller that controls/encodes data into those LEDs. All one has to do is to change/differ the rate at which the LEDs flicker depending upon the data input to LEDs.[5] Further data rate improvements can be made in this method, by using organized row of the LEDs for parallel data transmission, or using mixtures of red , green and blue LEDs to change the light's frequency, with each frequency (translating/putting into secret code) a different data channel. LiFi is high-speed (going in both directions) networked and mobile communication of data using light. LiFi contains/makes up of multiple light bulbs that form a wireless network.

LED bulbs are devices, which means that the brightness of the light flowing through them can be changed at very high speeds. This allows us to send a signal by controlling/adjusting the light at different rates. The signal can then be received by a detector, which understands/explains the changes in light strength (the signal) as data. The strength controlling/adjusting cannot be seen by the human eye, and so communication is just as very smooth as other radio systems, allowing the users to be connected where there is Li-Fi enabled light. Using this way of doing things, data can be transmitted from a LED light bulb at high speeds. [6]

International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2020]

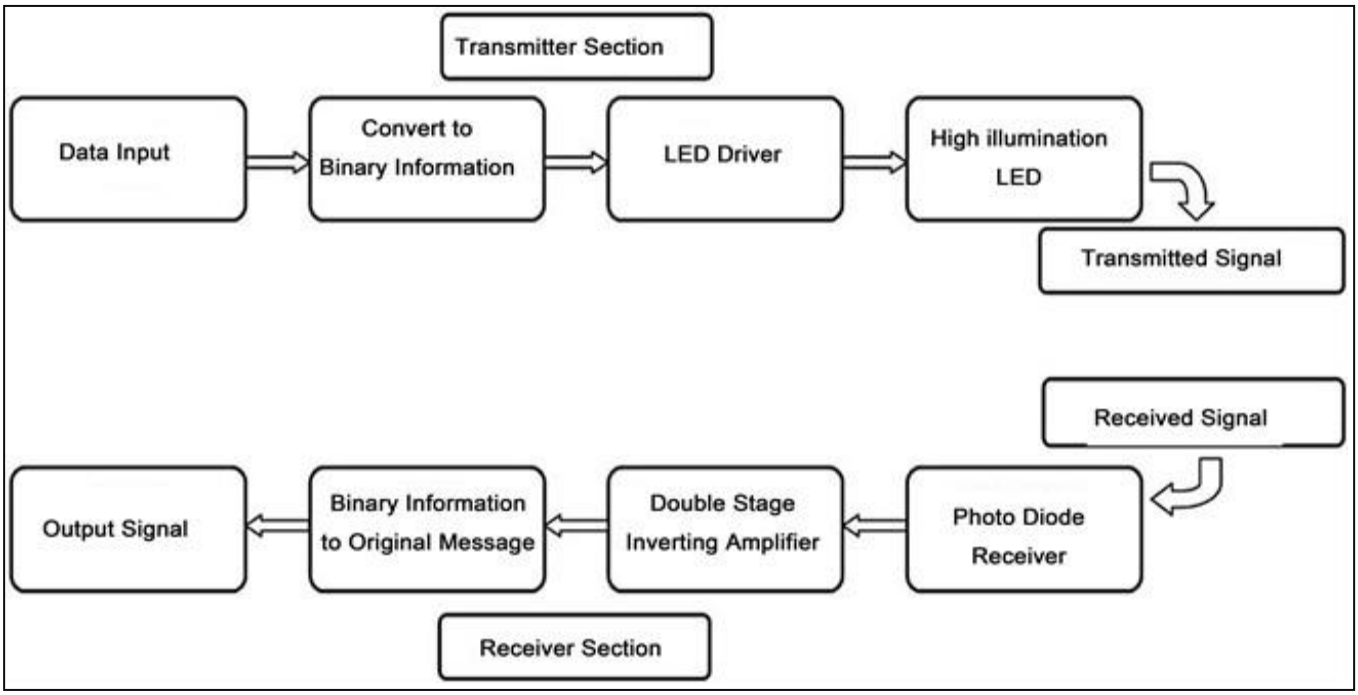

FIGURE 1: Block diagram of working of Li-Fi system

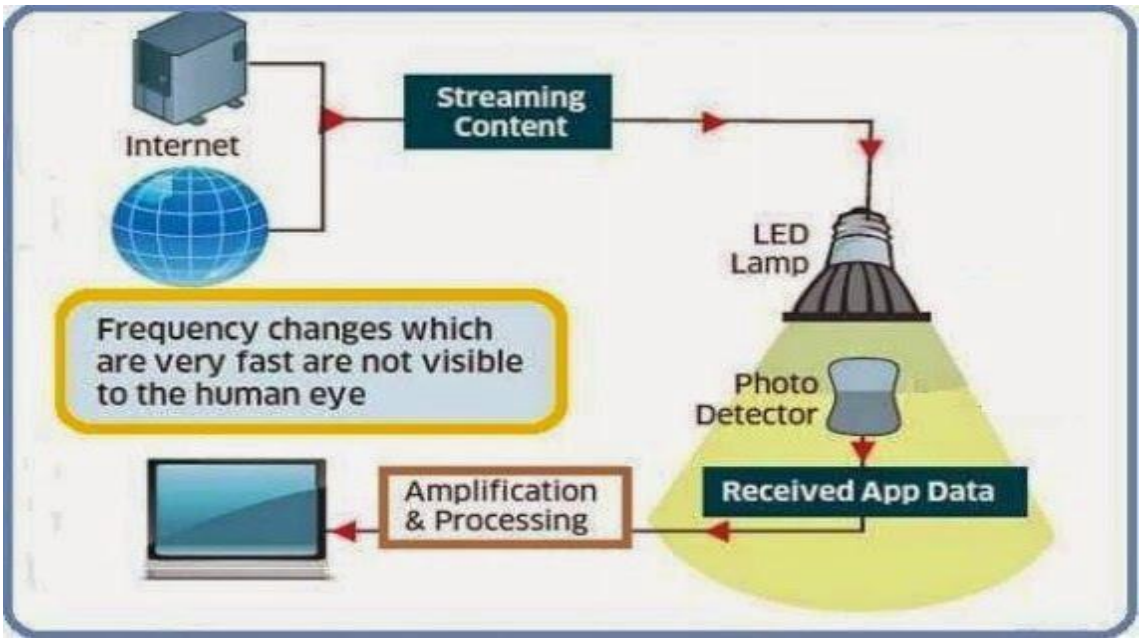

FIGURE 2: Flow diagram for Li-Fi subsystem

International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2020]

Li-Fi consumes light from LEDs, instead of radio waves as in the case of Wi-Fi, to send information in the form of binary data. Let us simplify this a little - Li-Fi works much like the infrared technology in your television. Infrared works on a simple way of thinking/basic truth/rule: a command is given (e.g. "change channel" when you press a button on your remote control) and that input is turned into binary code. The code is then transmitted via infrared light waves by your remote's sensor, and the light waves are received by your TV's infrared sensor, which (changes secret code into understandable language) the light and (does/completes) the meant action. In case of Li-Fi , LED bulbs transmit the data by controlling/adjusting the light waves while a photodetector on your phone or laptop picks up those light waves.

Li-Fi is creating a lot of buzz since Li-Fi technology has (not very long ago) made its way to live trials based on solutions from the Estonian startup, Velmenni. The company has taken advantage of the new technology to design a smart lighting solution for commercial and industrial conditions. Velmenni has also showed/told about that its pilot program is now providing Internet access with speeds up to 1GBps to its clients in different businesses, including office-based structures. In lab conditions even higher radio frequencies/abilities have been received (the fastest recorded speed was 224 Gbps). In short, LED bulbs at any place can provide you with 100 times (more than Wi-Fi speed) faster internet with this technology.[7]

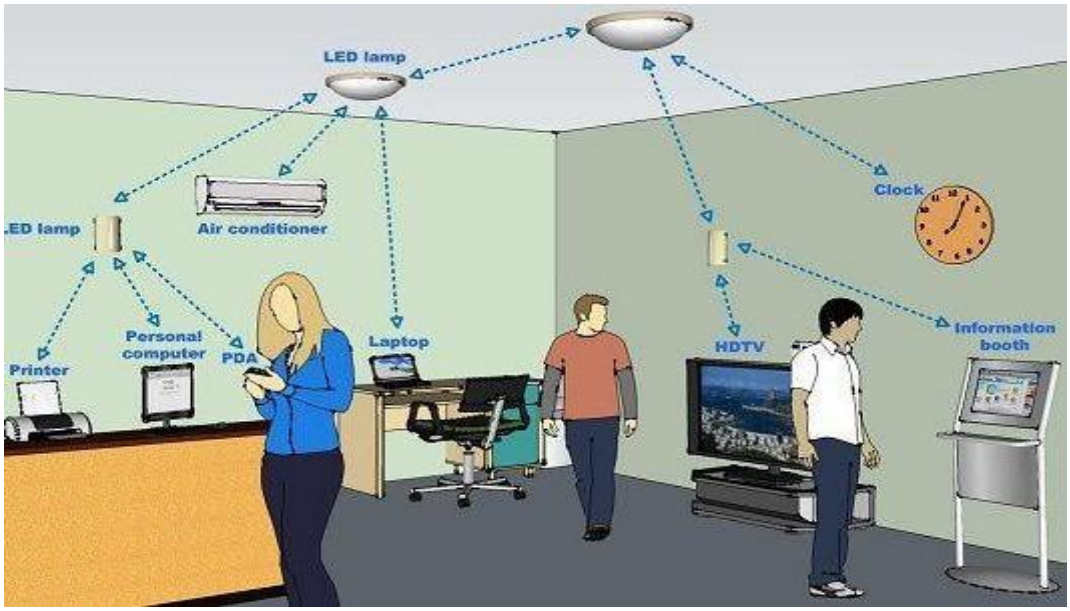

FIGURE 3: Li-Fi system connecting devices in a office

International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2020]

TABLE 1
COMPARE BETWEEN LI-FI AND WI-FI

Sr.No.	LI-FI	WI-FI
01.	Li-Fi is through data transfer in light medium.	Wi-Fi is through data in radio waves.
02.	A range of 10,000 times more than radio waves.	Short frequency range of 2.4GHz to 5GHz
03.	Cannot penetrate through walls.	Can penetrate through walls.
04.	Interference is fewer as it can pass through salty sea water, works in densy region.	Interference is more as it can not pass through salty sea water, works in densy region.
05.	In Li-Fi, light is choked by the walls and hence will provide more secure data transfer.	In Wi-Fi ,radio frequency signal can not be blocked by the walls and hence need to employ techniques to achieve secure data transfer.

III. ADVANTAGES

4.1 Convenience: Convenience is not an issue as light sources are present everywhere. As everywhere there is a light source, there can be Internet. Light bulbs are present everywhere in homes, offices, shops, malls and plane planes, which can be used as a medium for the data transmission.
4.2 Efficiency: Energy consumption can be minimized with the use of LED illumination, which are once misogynist in the home, offices and Mall etc. for lighting purpose. Hence the transmission of data requiring negligible spare power, which makes it very efficient in terms of financing as well as energy.
4.3 Security: One main wholesomeness of Li-Fi is security. Since light cannot pass through opaque structures, Li-Fi internet is misogynist only to the users within a serving zone and cannot be intercepted and misused, outside the zone under operation.
4.4 Upper speed: Combination of low interference, upper bandwidths and high-intensity output, help Li-Fi provide upper data rates i.e. 1 Gbps or plane beyond.
4.5 Cheaper: Li-Fi not only requires fewer components for its working, but moreover uses only a negligible spare power for the data transmission.[11]

IV.CONCLUSION

Li-Fi is the ideal solution for effective data transmission due to its basic building block: Light. Unlimited, fast, safe and cost effective, Li-Fi could possibly be the (person or thing that comes after something else) of Wi-Fi upon further development. Its working centers around the way of thinking/basic truth/rule of changing the electrical signal based on the needed/demanded output. Its applications range from toys to communication and can find uses in critical fields like military and medicine. Further research on Li-Fi is gaining pace in the recent times, which will possibly resolve the many unsolved mysteries of the world.

Although there is still a long way to go to make this technology a commercial success, it promises a great in the field of wireless internet. Many people who are finding information and companies are now working on this idea, which promises to solve the problem of lack of radio spectrum, space and low internet connection speed. By use/military service of this technology, we can move to greener, cleaner, safer communication networks. The very idea of Li-Fi promises to solve issues such as, shortage of radio-frequency radio frequency/ability and eliminates the disadvantages of Radio

International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-5, Issue-3, March- 2020]

communication technologies. Therefore, there is feeling of being completely sure of development of future computer programs of the Li-Fi, which can be extended to raised, flat supporting surfaces, and different walks of human life.

REFERENCES

[1] http://www.ijsrp.org/research-paper-0416/ijsrp-p5275.pdf
[2] http://www.academia.edu/6770592/Light_Fidelity_LI-FI_-A_Comprehensive_Study_
[3] https://www.ijedr.org/papers/IJEDR1601019.pdf
[4] http://www.ijser.org/researchpaper/A-Study-on-LiFi-Light-Fidelity-Technology.pdf
[5] http://visiblelightcomm.com/
[6] http://purelifi.com/what_is_li-fi/how-does-vlc-work/
[7] http://www.lificonsortium.org/tech4.html
[8] http://techyworld.in/lifienhancedmodefuturewirelesscommunicationreview/
[9] https://www.ijcsmc.com/docs/papers/April2014/V3I4201499a9.pdf
[10] https://www.ijedr.org/papers/IJEDR1601019.pdf
[11] http://www.ijser.org/researchpaper/A-Study-on-LiFi-Light-Fidelity-Technology.pdf
[12] http://www.internationaljournalssrg.org/IJECE/2015/Volume2-Issue3/IJECEV2I3P107.pdf
[13] http://whatis.techtarget.com/definition/LiFi
[14] H. Haas. Wireless Data from Every Light Bulb. TED Website, Aug. 2011.
[15] Frank Deicke, Josef Shwartz, Li-Fi: A New Paradigm in Wireless Communication, article in EFY, April 2012