Overview of Wireless Communication Technologies (Wi-Fi and Li-Fi)

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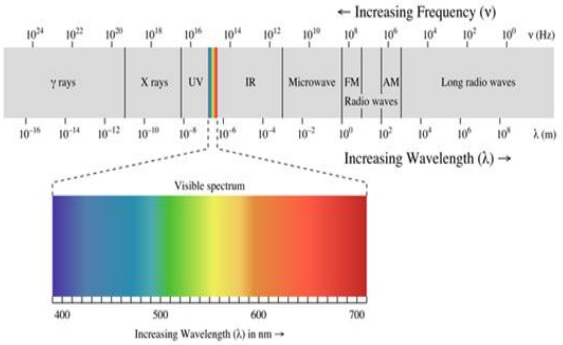
***Abstract*- As we all know in today's era technology is very essential part of our lives. There are various forms of technologies which we are using in our day to day life. For example: Wi-Fi, Biometric Systems, Video Conferencing, Apps for Education, Machinery in industries and Agriculture and many more. One such emerging technology is Li-Fi which is competent of Wi-Fi . Both this technology uses wireless communication. Since each and everything has its pros and cons. Therefore, this paper gives an overview of the advantages, disadvantages and applications of both these technologies i.e., Wi-Fi and Li-Fi.**

Index Terms- Wireless Communication, Wi-Fi, Li-Fi, visible spectrum.

I. INTRODUCTION

Now a days every institution, industries, businesses etc. wants to access the required information in time and at their place. To make it possible the speed of internet required is also fast. In today's time nothing is possible without internet whether it is IoT or 5th generation of cellular systems. Since all the technologies require fast internet connectivity, therefore, many times many issues occur related to the speed of internet because the frequency which we are using is not sufficient to serve the whole population with internet access. Hence frequency above 10 GHz should be used for fast internet connectivity. We all know that there are various wireless communication systems which we are using today in our day to day life such as Wi-Fi. One can easily get connected to this wireless communication without making use of wires. It is a wireless networking technology used to provide internet connections via radio waves. That radio waves are used for propagation of messages or signals from sender to receiver [1].



Visible Light Communication (VLC) as the name suggests is a technology used to transmit or receive data using the visible light between 400 to 800 THz i.e., visible spectrum. It uses normal bulbs or lamps to transmit signals [2].

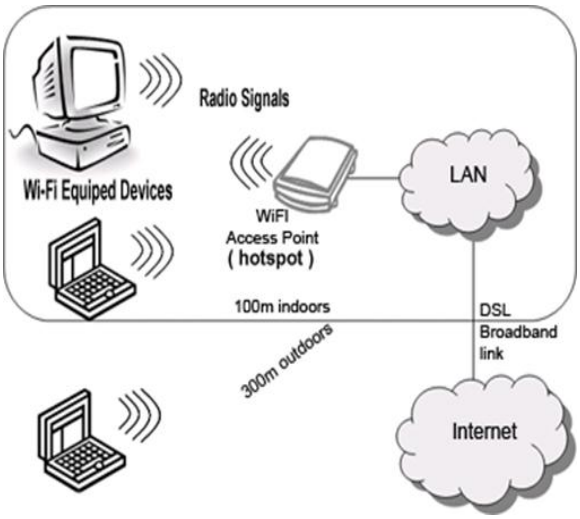
Li-Fi comes under this technology of using visible light for transmitting of signals using higher frequencies in visible spectrum. It is classified as NM wave communication. It is safer and faster method of transmission. It was discovered by Prof. Harald Haas and had named it as "data through illumination" [3].

The paper is divided into following sections:- Section II, what is Wi-Fi, its advantages, disadvantages and applications are discussed. Section III, what is Li-Fi, its advantages, disadvantages and applications are discussed. Section IV, difference between Li-Fi and Wi-Fi is discussed. Sections V, challenges for Li-Fi are discussed. At last conclusions are given in Section VI.

II. Wi-Fi

Wi-Fi is something that makes use of radio waves having frequency below 10 GHz to propagate signals from sender to receiver. In today's time no one has left untouched by this technology. Each one of us make use of this technology either at home or at office. All of us are dependent on this technology for our everyday work, no matter what the place is. It

could be school, institution, office etc. More than nine billion Wi-Fi devices are in use in today's date. It is a trademark of the Wi-Fi Alliance. Two main components are required to establish wireless connection that are:- access point and wireless network adapters. Through access points signals are broadcasted and wireless network adapters present in devices are responsible to detect, catch those signals and also to connect with them. Generally, the signals transmitted by Wi-Fi are in the frequency between 2.5 to 5 GHz. Hot zone are the interconnected area of hotspots and network access points.



Advantages:-

- Wi-Fi is very convenient to use. Anyone can connect to it at any place and at any time.
- Just turning on the Wi-Fi will enable user to connect with the network.
- Using Wi-Fi internet can be accessed at any place.
- More than one device can be added to the network using Wi-Fi.
- Using Wi-Fi files uploaded on the drive or server can be accessed easily at any place.
- It is cost efficient i.e., cost required for cables in wired communication is reduced here.
- One can connect to the network irrespective of his/her position or place.

Disadvantages:-

- One of the major disadvantage of Wi-Fi is its speed. At every place high speed internet cannot be accessed by everyone.
- As radio waves loses its intensity while passing through the obstacles in between. Hence the strength of signals transmitted gets reduced. Therefore, upto a certain distance the connection cane be maintained.
- Another important aspect is security of data which is being sent through network. Hence proper encryption methods should be used for encrypting the data.
- Another disadvantage of Wi-Fi to humans and all living creatures is the radiations caused by it.
- Also, the cost of implementation of Wi-Fi is more than the wired connection.

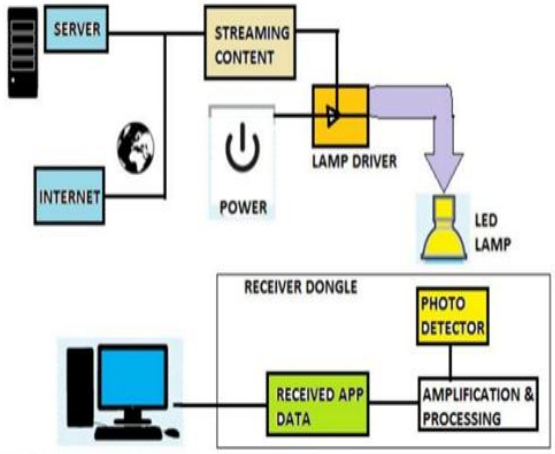
Applications: -

- Wi-Fi routers can be installed at home to connect to network easily with the devices present at home.
- Files and photos can be shared easily within the home.
- Connecting printers and devices through Wi-Fi enables the user to get prints easily.
- Since it is wireless hence there is no mess of wires in the house or in the office.
- Used in public places to attract the customers.
- Two devices can easily be connected to each other whether it is laptops or mobile phones.
- Now a days it is used in campus of almost all the institutions so that students can easily connect to the network.
- Also, by using Wi-Fi the wireless speaker and mobile phone can be connected inside the car. So that the driver can make use of both the devices easily.

III. Li-Fi

Li-Fi is a new technology coming into the frame in the past few years, which make use of higher frequencies in visible spectrum for transmission of data [5][6]. This technology has been discovered by Prof. Harald Haas, and named it as "data through illumination" [4]. It works same as infrared rays used in remote controls but it is more powerful. It reduces the loss of communication, getting hacked by a hacker. And also provides high speed internet connectivity without having any limitation of time or place. It uses LEDs (Light Emitting Diodes) for wireless communication and the speed achieved using single LED is around 3 Gbps [8]. Since now a days almost everywhere LEDs are used hence it

becomes easy to use them for communication. And one major advantage of using LEDs are their lifetime and energy efficiency. Data can be transmitted by switching LED on or off for the inputs 1 and 0[7].



Advantages: -

- One of the major advantage of Li-Fi is its speed. It is almost 100 times faster than Wi-Fi.
- The consumption of power and cost is efficient in case of Li-Fi since LEDs are used for transmission of data.
- Since LEDs are available almost everywhere hence data can be transmitted easily.
- Since visible spectrum is used by Li-Fi which cannot cross opaque objects hence loss of data or other such attacks are reduced.

Disadvantages: -

- The setup required for Li-Fi is not currently available in large amount.
- All the devices should be upgraded to make use of Li-Fi which is difficult.
- The cost required for R&D of Li-Fi is huge.
- Li-Fi signals can be interfered from sunlight, normal light used in home or offices etc.
- Due to the fact that Li-Fi signals cannot penetrate opaque objects therefore the range of Li-Fi becomes limited.

Applications: -

- Since data cannot penetrate walls hence it can be used by military so that hackers cannot hack any information.
- Under water also Li-Fi can be used because visible light penetrates the water whereas radio waves gets absorbed by the water.
- Accidents on the road can be reduced by sending signals from head lights or tail lights to the vehicle whether it is infront or at the back of the vehicle.

IV. DIFFERENCE BETWEEN Wi-Fi and Li-Fi

- Wi-Fi stands for Wireless Fidelity and Li-Fi stands for Light Fidelity.
- Wi-Fi was invented in 1991 by NCR Corporation and Li-Fi was invented in 2011 by Prof. Harald Haas.
- Wi-Fi uses radio waves for transmitting signals whereas Li-FI uses LEDs for transmission.
- The speed of transmission of data in Wi-Fi ranges from 150Mbps to 2Gbps. On the other hand, speed of Li-Fi is around 1Gbps.
- Distance covered by Wi-Fi signals is about 32 meters whereas by Li-FI signals is 10 meters.
- Components used in Wi-Fi are access points and routers whereas in Li-Fi LED bulbs and photodiodes are used.

V. CHALLENGES FOR Li-Fi

- Since light travels in a straight line therefore, to achieve high speed LED bulb should be at the top of head, which is not possible everytime.
- For each device separate emitter and receivers are required to be installed. Due to which cost of installation increases.
- Li-Fi uses visible light for transmission and hence it could be interfered by other lights such as sunlight, due to which intensity of light is disturbed. Therefore, it cannot be used in home and offices easily.

VI. CONCLUSION

We all know how important role the internet plays in our lives. We cannot live even one day without internet. Since the population is increasing, the devices accessing the network is also increasing. Due to which the airwaves are getting chocked and the possibility of receiving high speed signals is also reduced. To overcome this situation, a technology is invented after many years of research called as Li-Fi. Li-Fi uses LEDs for transmitting data. After practical

implementation of Li-Fi, each LED will act as a hotspot for transmitting data. The only challenge for Li-Fi is that the travelling path of light is straight line. Otherwise, it is one of the best technologies ever invented.

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