

Survey of LiFi and WiFi Technologies

¹ J.Nithya, ² N.Iswariya, ³ P.Sathyasutha, ⁴ M.S.Sabari

^{1,3} Assistant Professor, Gnanamani College of Engineering

^{2,4} Assistant Professor, Gnanamani College of Technology

Abstract - Communication is the process of sharing a message between devices by neither wire nor wireless. To reduce complexity of extending wired communication recently people are using wireless with the help of radio waves. The radio waves are dangerous to use which creates a problem to the user who are using signal frequency as much as possible. To overcome the problem, introduced Li-Fi technology to provide more secure of human nature and data. This is harmless data transmission at high speed using light source.

Keywords - *Li-Fi, MAC, VLC, PCB*

1. Introduction

Humans are connected together to sharing data, interaction, knowledge updating and social activities and entertainment. Interested to transmit data with low bandwidth and cost with high efficiency. It was developed by German physicist Harald Haas, sending through light bulbs. It is also referred as sending data through illumination.

Visible Light Communication (VLC) is medium to transmit data, which using light between range of 400 THz to 800 THz. Li-Fi has following parts are,

1. Bulb
2. Power amplifier circuit
3. Printed Circuit Board (PCB)
4. Enclosure

LED is ON digital signal 1 is transmitted, when LED is OFF the digital signal 0 is transmitted. To provide the security of message between sender and receiver. Data should be converted into another form. The process of conversion of original format into unsupported format is encoding. Reconstruction of original message is decoding.

1.1 Communication Types

1.1.1 Wired Communication

Here we are discussing, how data is transmitting in wired communication, the system are connected through wires. For example telephone network, cable television. It using twisted copper pair coaxial based system. Coaxial was replaced with point to point links connected by Ethernet repeater or switches. It gives 48 bit MAC (Medium Access Control) address which is used to specify both SA (Source Address) and DA (Destination Address) of data where it is moving in wire cable. It support broadcast transmission medium.

Disadvantages

1. Difficult to setup
2. More expensive
3. Time consuming
4. Not feasible

1.1.2 Wireless

Communication or transmission of information over a distance without requires wires or cables. Information sends through air by using electromagnetic waves like radio waves, infrared, satellite etc. Wireless router serves as the communication hub. It needs to be secured with passwords for security purpose in order not to be accessed by others.

Radio waves transmission is used radio circuits, complex receivers and antennas, but the light waves transmission uses direct modulation method which is simple and similar to those used in remote control units.

Advantages:

1. Ease of integration and convenience.

2. Mobility.
3. Expandability

Disadvantages:

1. Security problem.
2. Range-insufficient for larger structure.

Few of the Wireless devices are,

1. Bluetooth
2. ZigBee
3. WiFi
4. LiFi

1.1.2. Bluetooth

It uses radio waves range between 15 to 50 feet. Using low power signal to send a data between paired devices.

Here, We have two types of data sharing between the devices

1. Piconet
2. Scatternet

1.1.4 ZigBee

Communication of data with simple structure like sensors. Uses low power and long battery life to save money in order to extend utilization of battery.

Gives flexibility with more reliable.

A wireless device plays a vital role in voice and internet communication:

1.1.5 WiFi

A WiFi(Wireless Fidelity) using radio waves to transfer signal (data in term of 0's & 1's). In this, communication has been established by using wireless adapter to create hotspots and wireless routers are connected to the network and allow users to access internet services.

1.1.6 LiFi

Li-Fi means light fidelity, here fidelity refers faithful output. It works under Visible Light Communication (VLC) system. VLC is the combination of illumination and communication. Any type of information or messages can be sent using a light signal that is visible to humans and this idea is considered to be VLC. Li-Fi is used to define high speed VLC in applications. The current is passed to an LED's and the photons are emitted from LED's which is called as visible light.

Li-Fi and Wi-Fi are similar but it have small difference that is Li-Fi uses light for transmission but the Wi-Fi uses radio waves for transmission.

The Li-Fi technology introduced by Harald Haas, he used this technology in his TED Global Talk on Visible Light Communication (VLC).

Li-Fi transmits data at high speed with the use of light source. Li-Fi uses the suitable light source which have Light Emitting Diodes (LED'S) because it can ON and OFF in fraction of seconds. So that the human eye can not able to detect that ON and OFF activity of LED'S. Therefore the changes in light intensity is transmitted and converted as electrical signal using photo detector and it is converted as a stream of binary data. Switching ON an LED is binary 1 and OFF is binary 0.

How li-fi sends data

The visible light spectrum is 10,000 times larger than the radio waves we use for wi-fi today. Information can be encoded in light pulses, just like in traditional TV remote controls.

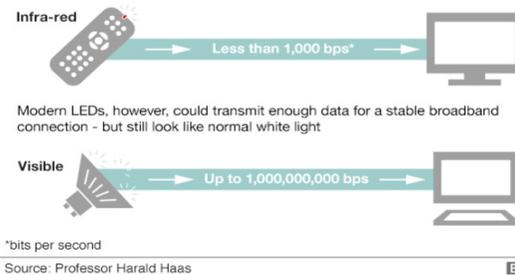


Fig 1.1 Working of LiFi

2. Comparative Study of WiFi Vs LiFi

Li-Fi uses light source as transmission medium but Wi-Fi uses radio waves as transmission medium. Li-Fi maximum speed is 10 Gb/s but Wi-Fi has lesser speed than Li-Fi that is 1 percentage of Li-Fi speed that is 1 Gb/s.

Wi-Fi stands for Wireless Fidelity. It connects devices in wireless mode. Wi-Fi has different standards such as IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac. Wi-Fi uses different network topologies those are AP based topology, peer to peer topology, point to multi point bridge topology etc.

Li-Fi is also known as light based Wi-Fi. It uses visible part of electromagnetic spectrum. Li-Fi is a optical wireless network communication system. In Li-Fi, the internet can be accessed through light source. If the light is turn ON, then get access to the wireless visible optical network everywhere in the presence of light source. So if you are under light source means you can access the internet through this source.

In Li-Fi, the light source of LED bulbs cannot penetrate through walls, so the Li-Fi signals available only within the room itself. Therefore the Li-Fi covers limited range of

areas. Wi-Fi signal range connects within the Local Area Network like college campus, office, hospital etc.

3. Features of LiFi

Li-Fi features mainly focused on four parameters which include capacity, efficiency, safety, security.

3.1 Capacity:

Capacity includes the features like bandwidth, data density, high speed and planning.

3.1.1 Bandwidth

Li-Fi can break the bandwidth barrier which is suffered by existing wireless systems. Li-Fi uses the light source area of the electromagnetic spectrum 10,000 times more than RF of the electromagnetic spectrum.

3.1.2 Data density

Li-Fi has the tight illumination, Hence in this more amount of data can be stored. It has capable of 1000 times more than data density than Wi-Fi.

3.1.3 High speed

Because of tight illumination it does not cause any interference often, so it has low interference. Due to this low interference speed of the Li-Fi technology is more and it provides high data rates.

3.1.4 Planning

Planning in capacity is quite simple and it also provides good signal strength.

3.2 Efficiency

3.2.1 Low cost:

Radio technology requires more number of components but the Li-Fi technology requires less number of components so Li-Fi has low cost.

3.2.2 Energy

Compare to radio waves, light waves are more efficient and the transmission of data requires negligible additional power.

3.2.3 Environment

Radio technology cannot support in some places, for example transmission of RF spectrum in underground

water is not possible but the Li-Fi can propagate through water so it is adaptable for every environment.

3.3 Safety

Light waves are non hazardous so this technology is safe and health free.

3.4 Security

3.4.1 Containment

Light waves which are transmitted from LED bulbs are not penetrates through wall. So it is difficult to theft data from Li-Fi signals. It eliminates the risk of signal leakage.

3.4.2 Control

In this light waves user can see, where the data is moving. So there is no need for extra security.

3.5 Availability

If the light source is in available condition then there is also the internet is available. Wherever you use lights, there will be an option to connect internet.

4. Limitations

1. Light waves are not penetrating through walls and objects.
2. Light waves are works continuously without any interruption. Suppose the other lights from sun, normal bulbs, can interrupt the transmission of light waves then the communication will be affected.
3. VLC systems installation cost is very high.

5. Application of Li-Fi

5.1 Traffic lights

LED bulbs are used in car's headlights, cack lights so using this light waves can passed information between cars. This type of communication can prevent accidents.

5.2 Airlines

The communication media is the main problem while we are travelling in airways, because this communication

takes place using radio waves. To resolve this we use Li-Fi.

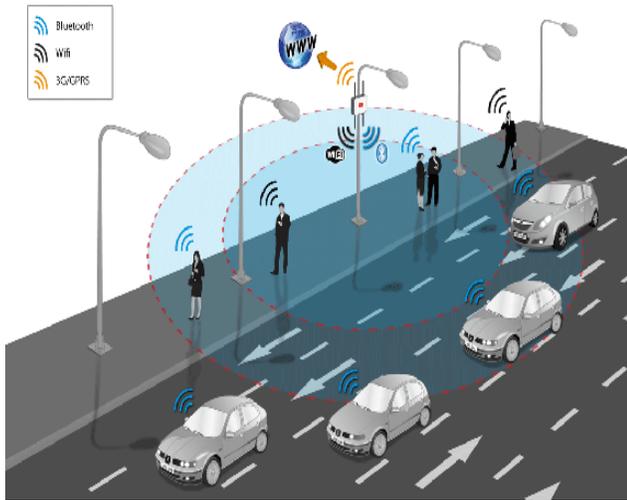


Fig 1.2 Traffic light signaling

Li-Fi provides speed of internet to each member who seating under the light.

5.3 Industries

Light waves are safer than radio waves. So it can be used in plants like petrochemical plants, nuclear power plants and also in petrol pumps.

5.4 Under ocean:

Wireless Fidelity cannot work in under water but the light waves are penetrating through water so it can be used for military/navigation.

5.5 Street lights

Every street in the world having minimum number of street lamps. Each of these will be provided the internet access.

5.6 Hospitals

Wi-Fi is not allowed to use in operating rooms but the Li-Fi overcomes these problems and used in hospitals.

Advantages:

1. More secure from hacking than WiFi

2. Cheaper than WiFi
3. Data transfer rate reached 10Gbits/s
4. Data transmission speed is high and easy to transfer.
5. It is Simple to use and Implement

Disadvantages:

1. Limitations in locations.
2. Signal range is limited because it cannot propagate through walls.
3. If other signals can interrupt light waves, then the communication may be disconnected.
4. The new structure need to build for Li-Fi.

LiFi	WiFi
Light Fidelity	Wireless Fidelity
Transmission of data using LED light.	Transmission of data using radio waves with WiFi router
Applications like airlines, undersea explorations, hospitals	It is Used in internet browsing with the help of wifi hotspots
In LiFi, light is blocked by the walls	In WiFi, RF signal cannot be blocked by the walls
Signal coverage about 10 meters	Coverage distance about 32 meters
Li-Fi has low implementation and maintenance costs.	Global Accessibility and ease of Communication

6. Conclusion

This paper describes the process of WiFi and analyzed the drawback of using radio waves. Here we have been identified a new idea to send data with high security using light communication. This is not currently implemented anywhere in real application except in high secure area.

References

- [1] Akshit Agarwal & Deepali Jhanji, ' comparative study : li- fi v/s wi-fi', International Journal of Research & Development in Technology and Management Science – Kailash Volume - 21| Issue 1 | ISBN - 978-1-63102-445-0 | March 2014

- [2] JyotiRani, Prerna Chauhan, "Li-Fi(Light Fidelity)The future tec-hnology in Wireless communicate-on", International Journal of App-plied Engineering Research, ISSN 0973-4562 Vol-7 March-2015.
- [3] Rahul R. Sharma,Raunak, Akshay Sanganal, "Li-Fi Technology Transmission of data through light", International.Journal of Computer Technology &Applications, Vol5,Jan-14.
- [4] P.Kuppusamy,S.Muthuraj,S.Gopinath "Survey and challenges of Li-Fi with comparison of Wi-Fi",Wireless Communications, Signal Processing and Networking (WiSPNET)23-25 Mar-2016
- [5] <http://en.wikipedia.org/wiki/Li-Fi>