INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 3 - V7I3-1820)
Available online at: https://www.ijariit.com

Li-Fi Technology

Ganesh S. Girgani
gganesh.648@gmail.com
Mumbai Education Trust, Mumbai, Maharashtra

ABSTRACT

We all have been using Wifi technology extensively for data in our day to day life, this paper presents how Li-fi technology will enhance user experience with its capability of providing a secure and as well as higher data access rate. A Lifi is a wireless technology and its a type of Visible Light Communication (VLC) which makes use of LED lights for data transmission

Keywords— *Visible Light Communication, Lifi, Harald Haas, LED*

1. INTRODUCTION

After spending almost two decades of research on wireless communications and Visible Light Communication (VLC) by German Prof. Harald Haas has introduced Light Fidelity (LiFi) technology for the first time at TED Talk Global 2011, wherein he has shown a impressive demo of how light source can be utilized not only for illumination but also for transmitting high speed data efficiently and in a secure manner.

Fig. 1: Prof. Harald Hass (Father of Li-Fi)

Unlike Wifi which uses radio waves for transmission of data. Li-Fi uses visible light sources (LED's) which is mostly harmless in nature for transmitting data. But when it comes to covering distance light can cover less distance compared to radio waves, therefore Wi-fi has more capacity in terms of covering the distance compared to Li-Fi technology. A Li-Fi technology can cover approximately 10meters, whereas a Wi-Fi can cover up to a distance of 32meters.

Apart from long life, energy efficient, reliability LED lights also have a special capability of modulating rapidly (i.e switching on and off at a high speed) which a standard incandescent or CFL bulbs are not capable of modulating so rapidly and Prof. Harald had utilized this special capability of LED's in LiFi communication wherein it sends 0 when a LED bulb is OFF and 1 when it is ON.

2. WHY Li-Fi ?

Currently, everyone are using internet through wifi in an indoor environment which uses radio frequency. In a year, there has been 60% increase in usage of wireless data. With such high usage of radio frequency they will slowly become saturated and can lead to spectrum crunch. Spectrum crunch means that there has been insufficient wireless frequency which cannot be supported or managed with the increasing number of consumer devices.

This can be a biggest challenge for wireless networks as this would have a negative impact in the speed of accessing internet. In a futuristic way, Wi-fi will not be able to cope up with the demand of data. This can be one of the major reasons why we need to evolve and change the way of accessing data.

As data security has been a major concern for almost every individual this Li-Fi technology brings such high security in data transmission. As we all agree light cannot penetrate through walls, which means data will be transmitted only within a room i.e. no one on the other side of the room would not be able to read that data.

Fig. 2: Security of Li-Fi Technology

3. HOW Li-Fi WORKS ?

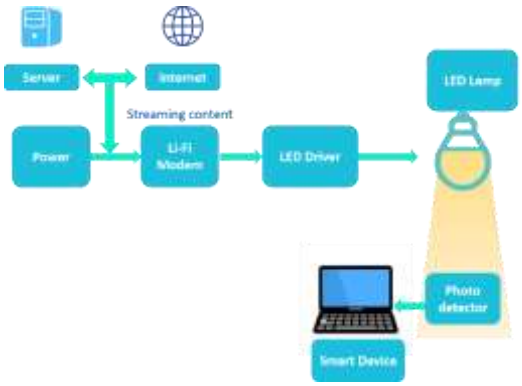

Fig. 3: Working and components of Li-Fi Technology

Components involved in Li-Fi Technology

- **Internet / Server:** This will act as a source of data to be streamed or transmitted on a smart device or output device.
- **Power**: This will be required for providing power supply to the LED Lamp
- **Li-Fi Modem**: It modulates the incoming data stream, this modulated data is sent to LED driver
- **LED Driver:** This helps us in switching power ON/OFF based on the modulated data which was tranferrred from Li-Fi modem.
- **LED Lamp:** This component is actually responsible for transferring data to the photo detector.
- **Photo Detector:** Photo detector contains a photo diode. It helps in converting the optical received data back to electrical signal.
- **IR Transmitter:** Unlike WiFi, Li-Fi technology is capable of bi-directional communication and thats the reason we have IR transmitter which is used to transmit the uplink data back to the LED source. This will be at the receiver end.
- **Smart Device:** This can be considered as an output device where the actual data will be streamed or transferred.

For example, if you want to stream a HD video then connect to proper source of HD video (Internet or Server) once the HD video is available on Internet or Server, this streaming content i.e. HD video will sent to Modem, on receiving the incoming data to modem, it modulates the data and passes the modulated data to LED driver, now LED drivers flickers the led light source i.e. switching it ON/OFF based on the modulated data at a rapid speed almost at a speed of millions times per second then this cannot be seen by a human eyes, Once the led lamp is illuminated at the receiver end photo detector will receive the optical data this optical data is converted back to electrical section and sent to the smart device where our actual HD video gets streamed.

Fig. 4: PureLiFi Dongle

4. ADVANTAGES Of Li-Fi TECHNOLOGY

Capacity: As Wi-fi uses radio frequency and with the increase in the amount wireless data usage on a yearly soon radio frequency would become saturated which will lead to spectrum crunch. But as Li-Fi uses visible light in the electromagnetic spectrum we have 10,000 more spectrum compared to radio frequency.

Speed: Li-fi provides a lightning speed of data transfer rate. It can transfer at 100Gbps and max upto 224Gbps. This is almost 100 times faster when compared to Wi-Fi technology which can only provide a maximum speed of 100Mbps. With the emerging increase of Internet of Things (IoT) devices it will be very inefficient to handle these many devices interacting at a same place.

Note: Faster data transfer rate is achievable by Lifi, but if the internet speed provided is slow then its insignificance will be unchanged

Security: Wifi which uses radio waves which in turn have a capability of penetrating through walls and these can be intercepted or can network can be used by an unauthorized user or a person with a bad intensions, but with Lifi it is not possible for the unauthorized user to access or intercept which makes Li-fi technology secure.

Efficient: In Li-fi technology we make use of LED's for data transmission i.e. data is getting transmitted through light and LED's are highly energy efficient, long lasting cheaper and durable. With usage of Li-f technology, we are not required to have a wifi router or amplifiers which will reduce or eliminate extra cost and even pureLifi (a biggest VLC company which is also co-founded by Prof. Harald Haas) are developing solar cells which will act as a photo detector for enabling both wireless charging and accessing internet both at a same time

Bi-Directional: Lifi technology has a capability of sending back the data from the client to the source LED i.e. uplink. This will give a truly wireless internet browsing experience. This can be enabled by using infra-red light.

5. APPLICATIONS OF Li-Fi Technology

Hospitals: As Li-Fi uses light spectrum there will be no interfere with other radio frequency devices. Lifi can be used safely in different hospital applications for eg. Corridors, patient rooms, waiting rooms etc. Wherein it will remove interference issues between smartphones and hospital wifi's and enable a light communication network.

Lifi can be used for movement of patients report, real time monitoring and all this without any wires. Lifi can easily enable patients to connect to internet by staying at bed so that patients can access there mailbox, news, or play games as this also help in passing the time during there stay. Lifi enables collecting data from any other device which is lifi enabled.

Fig. 5: Application of Lifi in Hospitals

Under water: Unlike Wifi which uses radio waves and that gets absorbed by water. Li - Fi technology as enabled usage of data under water. As light has a capability of penetrating deep under water

This will help under water divers and vehicles to communicate with each other for changing ways

Traffic Management: Li-fi can be used to manage traffic more efficiently and can help commuters for live updates for example if there is any road construction work going on or there has been a accident on a route, with lifi technology it is capable of recommending or notifying the user on that route to take a diversion to avoid traffic. With IoT in place it is very much possible 2 vehicles can communicate with each other with the use of lifi signals

Fig. 6: Traffic management using Lifi Technology

6. LIMITATIONS OF Li-Fi TECHNOLOGY

Range Limitation: Li-Fi has a range limitations that is we need to work effectively within a closed spaces, this can be over come by placing the lights tactically such that it covers scope of Lifi or we need to have multiple light source to over come range limitations

Infrastructure: As Lifi technology is in trial phase its major drawback is infrastructure even if there is large scale of infrastructure available there is lack of implementation of this technology in a large scale. It will take more time before lifi technology can be enjoyed by general public. Most of the current infrastructure are built for accomadating radio frequency now it would be very tedious and costly to replace current infrastructure and go with new technology.

Limited Compability: As Li-fi technology is still a new technology it will be difficult to find the compatible devices for connecting and communicating but as the usage increases this limitations will also reduce in a very short span of time

7. CONCLUSIONS

With emerging increase in usage of wireless data adapting to Lifi technology will help us further in enhancing and have a better experience. Applications of Li-fi technology are really beyond our imaginations. But adapting to this technology will give a boost to many sectors. As we have been comparing Li-fi technology with Wifi technology where in both had there advantages and disadvantages. Therefore I would like to conclude that Li-fi can neither be considered as a substitute nor it can completely replace Wi-fi technology. So Li-fi can be considered as a complementary technology which aims in improving performance of the existing technology.

8. REFERENCES

[1] https://lifi.co/
[2] https://www.iberdrola.com/innovation/lifi-technology
[3] https://www.iberdrola.com/innovation/lifi-technology
[4] https://www.ted.com/talks/harald_haas_wireless_data_from_every_light_bulb?language=en#t-561565
[5] https://www.youtube.com/watch?v=Cd8G9d-Begs&t=105s
[6] https://www.youtube.com/watch?v=Cd8G9d-Begs&t=105s
[7] https://purelifi.com/

