Light Fidelity (Li-Fi)

Light Fidelity (Li-Fi) is VLC, visible light communication technology developed by a research team at University of Edinburgh, including Professor Haas. Professor Harald Haas authored the term. Light Fidelity is modern wireless communication technology that empowers remote transmission of data using LED light. Light Fidelity depends on the novel ability of solid-state lighting systems to create 1s and 0s binary code with human-imperceptible LED illumination.

Information may be obtained within the vicinity of visible light by means of electronic gadgets with photo-diodes. This means that light bulbs can bring not only light but wireless connection at same time anywhere where LED's are used. Generally speaking, Wi-Fi plays an efficient role in wireless data coverage within buildings, while using Li-Fi we will provide excellent density data coverage in particular locations without any radio interference issues. Li-Fi provides better latency, performance, accessibility and security than Wi-Fi, and under laboratory conditions has even reached extreme speeds greater than 1 Gbps.

Working of Li-Fi :

Light Fidelity technology is wireless communication device focused mainly on use of visible light between violet (800 THz) and red (four hundred THz). Li-Fi is based solely on propagation of information in defined and uniform fashion via amplitude modulation of light supply. There is an LED transmitter (light emitting) on one end and a photo detector (light sensor) on the other. Li-Fi operates very simple and fast. The data input to the LED transmitter is encoded into light by varying the flickering rate at which binary code (1s and 0s) is generated by LEDs flicker 'on' and 'off'. LED transmitter's on / off operation which seems to be invisible to the human eye as speed of LEDs is less than microsecond. By switching ON LED is logical '1' it makes data transfer according to incoming binary codes, switching OFF is logical '0'. Data can be encoded in

light by varying the rate at which LEDs flicker on and off to different combinations of 1s and 0s.

Advantages :

- **Proficiency** –
  Energy utility can be minimized with use of LED illumination which are now accessible in homes, workplaces and malls and so on for lighting reasons. Consequently transmission of information requires negligible additional power, which makes it efficient in terms of costs as well as energy.
- **Cost** –
  Not only does Li-Fi need fewer components for its service, but it also requires only a small additional capacity for data transmission.
- **Availability** –
  Disponibility is not an issue as light sources are available all over place. Along these lines, lights can be utilized as models for information transmission.
- **Security** –
  One principal advantage of Li-Fi is security. Since light can't go through opaque structures, Li-Fi web is accessible just to clients inside a limited zone and can't be intercepted and misused outside area under operation.
- **High speed** –
  Combination of low interference, high bandwidths and high-intensity output, aids Li-Fi provides high data rates i.e., 1 Gbps or even beyond.

Disadvantages :

- The availability of light sources is necessary for internet access. This could restrict areas and situations where Li-Fi might be used.
- To trade data it requires a close or immaculate line of sight.

- Light waves can not penetrate walls and therefore Li-Fi has much shorter range than Wi-Fi.
- Opaque impediments affect data transmission on pathways.
- Normal light, sunlight, and ordinary electric light can influence information transmission speed.
- High cost of installing the VLC systems.

Applications :

- **In Aircrafts** –
  In air crafts, passengers get high-charges on low-speed internet, but using Li-Fi provides affordable fees for high-speed internet.
- **Health technologies** –
  WI-Fi has been replaced by Li-Fi in many hospitals because use of Wi-Fi in hospitals interferes with mobile devices and computers that block the monitoring equipment signals.
- **Traffic Application** –
  Li-Fi can be used in traffic management, which interacts with LED lights of vehicles such as buses, which can help in dealing with traffic and can regulate accidents by warning other drivers when vehicles are excessively close.
- **Disaster management** –
  Li-Fi can be used as groundbreaking methods of correspondence in the midst of disaster, e.g. seismic tremor or, on other hand, hurricanes as subway stations and passages; common dead zones do not impede Li-Fi.
- **Power Plant application** –
  Li-Fi is progressively safe, with bottomless availability in all regions of the power plant as utilization of Wi-Fi and other radiation sources isn't acceptable.

Difference between LiFi and WiFi

Wi-Fi(wireless fidelity) and **Li-Fi(light fidelity)** are two different technologies that are used *to send and receive data wirelessly*. In the case of Wi-Fi, we use

Routers and Radio Frequency (RF) waves to transmit data, whereas in Li-Fi we use LED bulbs and Light signals to transmit and receive data.

The basic difference between LiFi and WiFi are as follows:

Comparison	Li-Fi	Wi-Fi
Full form	It stands for Light Fidelity.	It stands for Wireless Fidelity.
Invented/Coined	Coined by Prof. Harald Haas in 2011.	By NCR corporation in 1991.
Operation	It transmits data using light by the help of LED bulbs.	It transmits data using radio waves using wifi router.
Technology	Present IrDA compliant devices	WLAN 802.11/b/g/n/ac/d standard compliant devices
Data Transfer Speed	About 1 Gbps	Ranges from 150Mbps to maximum of 2Gbps
Standard	IEEE 802.15.7	IEEE 802.11
Privacy	Light is blocked by the walls hence providing more secure data transfer.	Walls cannot block radio waves so we need to employ more techniques to achieve secure data transfer.
Bandwidth	Availability of unlimited bandwidth.	Availability of limited bandwidth.
Frequency of operation	10, 000 times frequency spectrum of the radio	2.4Ghz, 4.9Ghz and 5Ghz
Coverage Distance	About 10 meters	About 32 meters(vary based on transmit power and antenna type)
Power Consumption	Power Consumption is Low.	Power Consumption is High.
Data density	Work with the high dense environment	Work in a less dense environment due to interference-related issues.

Cost	Low	High
Bare minimum Components used	LED bulb, LED driver and photo detector	Routers, Modems and access points
Merits	Low cost because of VLC technology used which in turn uses highly efficient LED bulbs. Faster transmission speed as light travels at fast speed. Less interference, ability to travel across salt water, and ability to operate in dense areas. Prevents unauthorized access because of the no penetration feature of visible light from the opaque walls.	WiFi eliminated the need for direct physical connections to access local networks and the internet without requiring direct physical connections to servers. Users are granted access from anywhere within range because WiFi connections are wireless. Easy to implement as you need to contact only an Internet Service Provider (ISP) to provide an internet connection and a WiFi Router to give an access point.
Demerits	The infrastructure required to implement LiFi technology on a large enough scale is still essentially nonexistent because it is still an emerging concept. To enable network access, the light source must always	WiFi networks are notoriously insecure. Its lack of security is primarily due to its large signal range. More interference, inability to travel over salt water, and preference for less populated areas. Signals are highly unreliable. This

	be on. It becomes extremely vulnerable to outside interference because it uses light to communicate data. Users are made stationary when using LiFi devices because of the short signal range emitted by light bulbs.	is because of the fact that radio frequencies are still susceptible to numerous external interferences. Due to this much range of connection issues, including weak signals, poor reception, and even connection loss can occur.
Applications	Used in airlines, undersea exploration etc.	Used for internet browsing with the help of Wifi hotspot.
Broadcast	Li-Fi uses visible light with special chips and sensors to broadcast its signal	WIFI uses radio waves to broadcast its signal.