

## LiFi (Light Fidelity)

### Summary

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**LiFi (light fidelity) is a bidirectional wireless system that transmits data via LED or infrared light.** It was first unveiled in 2011 and, unlike Wi-Fi, which uses radio frequency (30 Hz to 300 GHz). LiFi technology only needs a light source with a chip to transmit an internet signal through light waves. Another big advantage of LiFi is that the usage of light allows LiFi connections to occur almost instantaneously because light travels at extremely fast speeds. This results in faster transmission of data and faster internet connections about 100 times faster than speeds achievable by Wi-Fi.

This is an extraordinary advance over today's wireless networks. **LiFi multiplies the speed and bandwidth of wifi, 3G and 4G.** The latter have a limited capacity and become saturated when the number of users surfing increases, causing them to crash, reducing speeds and even interrupting the connection.



Figure 1: Data transmission by modulating the intensity of light

With LiFi, however, its band frequency of 200,000 GHz, versus the maximum 5 GHz of the wifi, is 100 times faster and can transmit much more information per second. A 2017 study by the University of Eindhoven obtained a **download rate of 42.8 Gbit/s with infrared light with a radius of 2.5 metres**, when the best wifi would barely reach 300 Mbit/s.

## Li-Fi Technology

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Professor Harald Haas authored term. Light Fidelity is modern wireless communication technology that empowers remote transmission of data using LED light. Light Fidelity depends on novel ability of solid-state lighting systems to create 1s and 0s binary code with human-imperceptible LED illumination.

Information may be obtained within vicinity of visible light by means of electronic gadgets with photo-diode. 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 location 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.

## LiFi History

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Professor Harald Haas, of University of Edinburgh, UK, is regarded as founding father of Li-Fi. The term Visible Radiation Communication (VLC) embodies any use of visible radiation portion of electromagnetic spectrum for data transmission.

D-Light project was sponsored at Center for Digital Communications in Edinburgh from January 2010 until January 2012. Haas introduced this breakthrough in his 2011 TED Global talk, and helped advertise it. Li-Fi consortium, formed by Fraunhofer IPMS, Germany, IBSSEN Telecom, Norway, Supreme Architecture, Israel / US, and TriLumina, USA, is planning to upgrade and advance different Optical Wireless Communication (OWC) technologies. Li-Fi technology was demonstrated at the 2012 Consumer Electronics Show in Las Vegas, employing pair of Casio smartphones to trade the data utilizing light of varying intensities emitted from their displays, noticeable up to 10 meters away.

## Working of LiFi

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Light Fidelity technology is wireless communication device focused mainly on use of visible light between violet (800 THz) and red (four hundred THz).

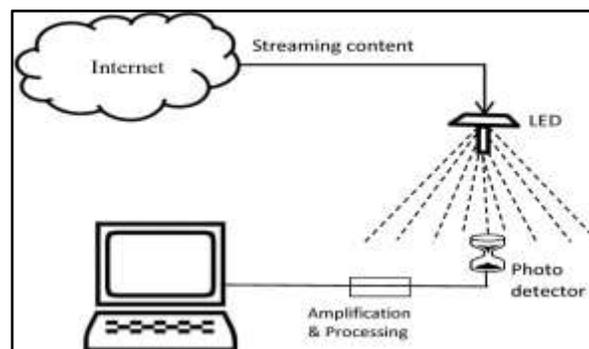
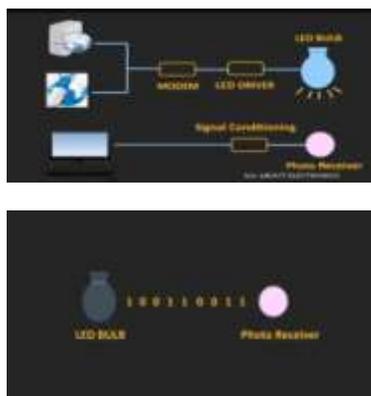


Figure 2: Working of LiFi

Li-Fi is based solely on propagation of information in defined and uniform fashion via amplitude modulation of light supply. There is LED transmitter (light emitting) on one end and photo detector (light sensor) on other. Li-Fi operates very simple and fast. The data input to 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 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 rate at which LEDs flicker on and off to different combinations of 1s and 0s.

## **Advantages:**

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- **Proficiency**

Energy utility can be minimised with use of LED illumination which are now accessible in home, workplaces and Mall and so on for lighting reasons. Consequently transmission of information requiring 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 small additional capacity for data transmission.

- **Availability**

Disponibility is not issue as light sources are available all over place. Along these lines, lights are can be utilized as model 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 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.

## **Limitations**

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The availability of light source is necessary for internet access. This could restrict areas and situations where Li-Fi might be used.

- To trade data it requires close or immaculate line of sight.
- Light waves cannot 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

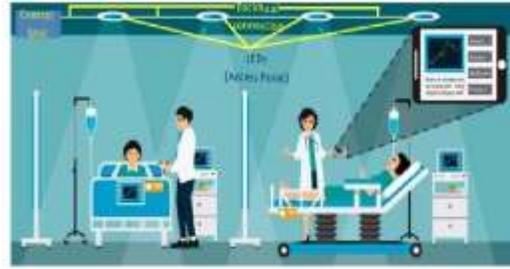


Fig. 4- Design of a Li-Fi architecture within the hospital [9].

- **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.