

# Li-Fi (Light Fidelity) - An Advancement For Future Wireless Communication

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## Abstract

With the advancement of technology and in this digital age wireless communication has reached a new level. Internet being now a basic necessity for living, thus the want for faster and more reliable internet has increased over time, as more and more people with their many devices access wireless internet. German physicist Harald Haas has come up with a solution called “data through photons”, which takes the fiber out of the technology of fiber optics and by sending data through LED light bulb with varying intensity faster than we human can follow. The infrared remote has the same idea band but this is far more powerful. Haas calls this D-LIGHT, which is capable of producing data rates as fast as up to 10 gigabytes per second; currently more than 250 times faster than the fastest broadband connection. The future holds where would be transmitted using light in a room and security would not be a snap as “as you can't see it, thus can't hack it”.

## Keywords

VLC, Wi-Fi, LiFi (Light Fidelity), LED (Light emitted diode).

## I. Introduction:

The Information Age, also commonly known as the Computer Age or Digital Age. Today is the period in human history which is characterized by the shift from traditional industry to an economy based on the information computerization. The internet is the center of attention and has spawned industries to emerge as a global cultural phenomenon. LiFi is transmission of data through illumination using LED light bulbs, this term is used to label fast and cheap communication system which is an advanced version of Wi-Fi or say it the optical version of Wi-Fi. When switched the LED on digital 1 is transmitted and when it's off digital 0, thus can be switched on and off very quickly. It is also possible to encode data in light by varying the rate at which the LEDs flicker to produce different strings of 0s and 1s. The intensity is modulated so fast that the human eye can't notice thus the output appearing constant. More advancement could drastically increase the VLC data rate.

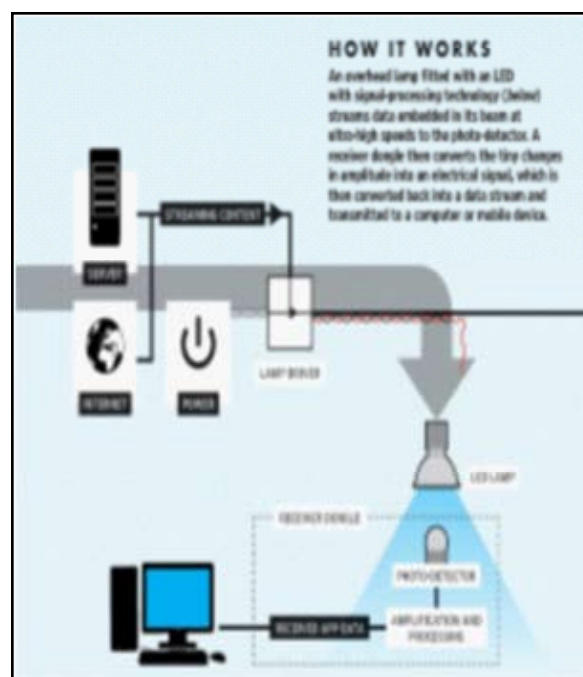
In the near future, the wireless technology is being replaced by a drift from Wi-Fi to LiFi technologies due to the disadvantages offered by Wi-Fi over the innumerable advantages proposed by LiFi. While Wi-Fi is predicated on the availability of a microwave signal, LiFi has the ability to turn any lamp into a network connection operating at much higher frequencies. LiFi also offers more privacy than Wi-Fi.

## II. Working

The working of a Li-Fi is very simple if a LED is on you just transmit 1 and if it is 0 is being transmitted, thus these LEDs can be switched on and off very quickly thus allowing us to transmit data. So all we require is some LEDs and a controller and code data into the LEDs. All we need to do is just adjust the intensity and vary the rate at which the LED flickers which indeed depends on the data we want to transmit. Modifications and advancement of technologies may bring other changes to this raw technology like using different mixtures of LEDs or an array arrangement and many more. By using different color LED and altering the frequency as every frequency would encode different channel of data. This kind of advancement promise a speed of up to 10Gbps

i.e. downloading a full HD video in just 30 seconds. This high speed is not the only reason which gives this technology a future in coming it is also the fact that it just uses light to transmit data and could be used safely in hospitals, aircrafts and other public domains. Since Wi-Fi completely fails underwater this technology doesn't. Radio waves could be easily replaced by the new method of transmitting signals called Li-Fi.

Light emitting diodes know as LED are found everywhere in traffic lights, cars, remote, lamps literally everywhere, these ELDs can be switched on and off quickly so that a human eye can't detect its flickering and use this invisible activity to transmit data using binary code, when a LED is on it ia a logical 1 and for off it is a logical 0. Data can therefore be encoded by changing the rate at which it blinks thus giving different strings. This method Is rather known as Visible Light Communication (VLC), this could be used to bring an advancement to the basic Wi-Fi to Li-Fi.



**III. Comparison Between Li-Fi & Wi-Fi:**

Table 1 : Comparison between current and future wireless technology

Technology	Speed	Data density
Wireless (current)		
Wi-Fi - IEEE 802.11n	150 Mbps	*
Bluetooth	3 Mbps	*
IrDA	4 Mbps	***
Wireless (future)		
WiGig	2 Gbps	**
Giga-IR	1 Gbps	***
Li-Fi	>1Gbps	****

Table above depicts the wireless technologies available today for transmitting data like Bluetooth, IrDA and Wi-Fi. As per the present scenario Wi-Fi is the sole which offers high data rates. Thus Li-Fi could be considered much superior than all the technologies present.

**IV. Advantages Of Li-Fi Over Wi-Fi:**

- There are myriad advantages that LiFi has over Wi-Fi.
- i. While Wi-Fi is predicated on the availability of a microwave signal, LiFi can hypothetically turn any lamp into a network connection. LiFi operates at frequencies much higher than Wi-Fi.
  - ii. One of the biggest advantages of LiFi is that it can be used in areas with a lot of RF noise or where RF noise is prohibited, such as hospitals and airplanes.
  - iii. LiFi also offers more privacy and security than WiFi because the signal is easily obscured by opaque materials and light does not penetrate through walls.
  - iv. LiFi can be used in places where it is difficult to lay optical fibres as in operation theatres.
  - v. Li-Fi has high speeds, provides communications as high as 500 Mbps or 30GB per minute, so it can easily be used in such places where Bluetooth, infrared, Wi-Fi and internet are banned. In this way, it will be the most helpful transferring medium.
  - vi. Li-Fi is a free band that does not need licence. Hence it is cheaper than Wi-Fi.

**V. Challenges For Li-Fi:**

Since LiFi requires line-of-sight, when set up outdoors the apparatus would need to deal with ever changing conditions. Indoors, one would not be able to shift the stationery receiving device. A major challenge facing LiFi is how the receiving device will transmit back to the transmitter. On the other hand light does have a few other obvious drawbacks as visible light cannot penetrate through most walls and is easily blocked by somebody simply walking in front of the LED source.

**VI. Applications Of Li-Fi Technology:**

- i. Integrated into medical devices and in hospitals as it can easily be used in such places where Bluetooth, infrared, Wi-Fi and internet are banned.
- I. Under water in sea where Wi-Fi does not work at all.
- II. In aircraft, the overhead lights can be used for data transmission. It can be used in petroleum or chemical plants where other transmission or frequencies could be hazardous.
- III. There are around 14 billion bulbs worldwide, they just need to be replaced with LED ones that transmit data as we reckon VLC at a factor of ten, cheaper than WI-FI.
- IV. In streets for traffic control. Cars have LED based headlights, LED based backlights, and Cars can communicate with each other and prevent accidents in the way that they exchange such information.
- V. Traffic light can communicate to the cars and so on.
- VI. By implementing this technology worldwide every street lamp would be a free access point.
- VII. Li-Fi may solve issues such as the shortage of radio frequency bandwidth.

**VII. Conclusion:**

The future holds the real answer as the possibilities are huge and if this technology is brought into practice every light emitting diodes would be like a Wi-Fi device and transmitting signals, this will lead towards a better, safer, cleaner, greener world. This concept attracts a great deals of research as increasing number of devices are using the wireless network, airwaves are said to be clogged making it difficult to be reliable high speed data transmitting signal. This may greatly solve the problem and allow internet to places where traditional wireless signals are banned such as aircraft. One of the problem to tackle is that it would only work for direct line of sight.

**VIII. Acknowledgement:**

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