

Communication through Li-Fi (Light Fidelity)

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Abstract: *Now-a-days, internet has become a major people demand are in search of Wi-Fi hot spots. Li-fi or Light Fidelity was created by Professor Harald Haas of university of Edinburgh. This can be the latest technology in present day communication system which it's make to use LEDs, Light Emitting Diodes that helps in the transmission of data much more faster than the data that can transmitted through Wi-Fi. It is fundamentally a 5G technology of transmission by using light communication system which utilizes LED as a medium of fast communication in similar manner as Wi-Fi, because the light speed is equal 300 thousands kilometer per second.*

Keywords: Light Fidelity, Transmission, Wi-Fi, VLC, LED, spectrum, receiver, illumination, frequency, lamp

1. Introduction

Li-Fi is a VLC, visible light communication technology, manufactured by the team of experts including professor Haas at the University of Edinburg and deals with copy of data through light by taking fiber out of optics by mailing data through a LED lamp that varies in the intensity faster than an eye can follow. Dr Haas amazed people by streaming HD online video from a standard LED lamp, at TED Global in July 2011 and thereby coined the term Li-Fi. Li-Fi has become part of visible light communication (VLC) PAN IEEE 802.15.7 standard. That can be very easily explained as, if the LED is ON, you are transmitting the data means you transmit a digital 1; of course, if the LED is OFF you transmit a digital 0, or null, or simply no data happens. As one can switch them on and off very frequently anybody can transmit data easily because the LEDs intensity is modulated so rapidly that human eye can not seen, so the output in light form looks as regular thus offering everlasting connectivity. More effectiveness in the transmission techniques can further improve the data rates

through VLC. Till now it was implemented through white LED floodlights only but teams at the University of Oxford and the University of Edinburgh are centering on parallel data transmission by using many LEDs or array of LEDs, where each LED transmits a different sort of stream of data. Mixtures of red, blue, green LEDs are also employed by some groupings to encode different data channels by altering the light frequencies. In simple conditions we can ponder over it to be a light based Wi-Fi which has achieved blistering broadband in the labs at Heinrich Hertz institute in Munich, Germany of around five-hundred megabytes per second by using a standard white-light LED. As a result quiet obviously, modems would be replaced by transceiver fitted LED lamps which can serve both in purposes of lightening the room as well as transmitting the data. The technology runs on the part of an electromagnetic spectrum and was demonstrated at 2012 consumer electronics show in Las Vegas whereby a pair of Cisco smart phone was used to exchange data using light of varying intensity from their screens. Figure (1) describes the Li-Fi technology.

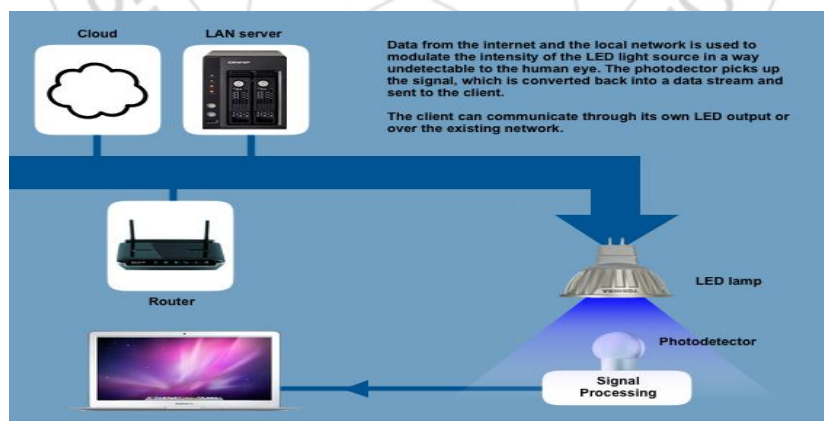


Figure 1: Li-Fi Technology

Professor Haas experiment

Professor Haas has showed the spectrum has capacity to hold enough data and more availability 1000 times for an infrastructure. Generally there is a great anticipating in this technology to change anything that we used for evaluating the data today over internet, or streaming videos, acquiring emails etc [4]. Simply if you are obtaining the light means you are communicated and if you turn it off you are simply just out of service. The data could be received in familiar

varieties of waves like visible light, infrared or ultraviolet and many future possibilities.

2. Li-Fi Architecture

Li-Fi architecture includes a number of LED bulbs or lamps including many wireless terminals such as Mobile Cell phones, Laptops and PDA. The design of Li-Fi should be have following factors:

- 1) Presence of light.
- 2) Line of sight (LOS).
- 3) Fluorescent light and LED.
- 4) Photo detector (receiver).

This requirement is some LEDs and a controller that will use to code of data into those LED switch.

3. Li-Fi Implementation

Li-Fi is typically implemented using white LED floodlight as downlink transmitter. The used LEDs for illumination only applying a regular current to them. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. This property of optical current is utilized in Li-Fi technology. Its procedure is very easy as when the LED is on then logic „1“ is transmitted and when LED is off then logic „0“ is transmitted. This so happens at an extremely fast rate flickering of LED which is not visible to the human eye.

Further improvements can be made in this technique, like using an array of LEDs for parallel data transmission or using mixtures of red, green and blue (RGB) LEDs to alter the light's frequency with each frequency encoding a different data channel. Such advancements assurance a theoretical speed of 10Gbps, meaning one can download a full high definition film in a few seconds. Implementation of Li-Fi given in the figure (2). Figure (2) describe how an internet connection is linked to the lamp driver. A switch with lamp driver and LED lamp also linked to the lamp driver through fiber optic cable. Now an obtaining device, photo detector is utilized for receive signal and then to perform further processing, this device is then connected to PC's, Laptop's or LAN port. On one end all the data will be streamed to a lamp driver when the LED is turned on the microchip is converting the digital data to logic data in light form. The light detector receives light signal and then converting again to the original digital form. Hence we can retrieve the information by utilizing a simple circuitry of Li-Fi.

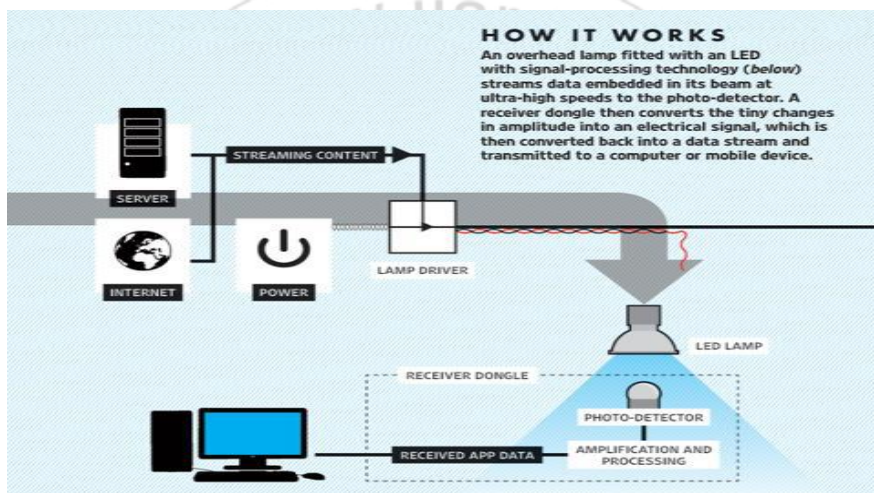


Figure 2: Li-Fi Implementation

4. Communication Through Illumination

Previously the radio waves were used however they were expensive and less secure. Infrared, can only be used with low power as for the sake of eye safety. Gamma rays are not able to be used because is dangerous. Ultraviolet light is good for place which is free from humans otherwise can be very injurious to the human.

Since visible light has not effects for human, it can be safe to use and is also having a greater bandwidth. Visible light communication (VLC) is a data communication medium, which uses visible optical light in the range of 400THz to 800THz as optic carrier for data transmission and illumination. In figure (3) describe the visible and invisible spectrum.

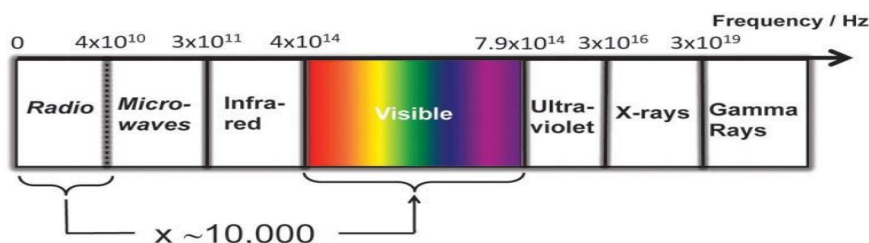


Figure 3: visible and invisible spectrum

LI-FI against WI-FI

LI-FI as talked about is a term used to describe visible light communication technology put on high speed wireless communication. This acquired this name as a result of similarity to Wi-Fi, only using light rather than radio. Wi-Fi

is great for general wireless coverage within buildings and Li-Fi is suitable for very dense Wi-Fi data coverage in enclosed area and for minimizing radio interference issues, therefore the two technologies can be considered complimentary. Table one particular also provides the

current wireless technologies which you can use for transferring data between devices today for example. Wi-Fi, Bluetooth and IrDA. Just Wi-Fi currently offers very high data rates. The IEEE 802.11n in many implementations provides up to 150Mbit/s (in theory the typical can go to 600Mbit/s) although in

5. Applications

Data transmission in these days have wide use, Li-Fi has proved to be more usefully and better than the present technology. There are many fields where Wi-Fi and many technologies have failed but Li-Fi has proved its excellence.

a) Spectrum limitation:

Mobile phone users are increasing and the available bandwidth is insufficient and can lead to over loaded condition with highly cost. This problem can be resolve by Li-Fi which uses the visible spectrum.

b) Mobile Connectivity:

Various terminals such as Laptops, Mobile Phones, Tablets and other terminals can be communicated with each other directly by using Li-Fi. It gives very high data rates and provides more security.

c) Underwater Communication

Radio signals in underwater communication can be impractical due to strong signal absorption in water. Li-Fi resolves this problem because light signal absorption is weak.

6. Li-Fi Future Alternative

This technology doesn't use the radio frequency so it can be alternative for the other technologies like Bluetooth, Infrared and Wi-Fi etc. Li-Fi is a best alternative for previous technologies. It has various benefits such as:

- a) Wide spectrum regarding with electromagnetic spectrum.
- b) High color fidelity.
- c) Protected access.
- d) Easy management.
- e) Instant start up time.

So, in summary Li-Fi technology is more effective than current technology and can be used in those areas where other technologies failed.

7. Features

- **Spectrum :**
The visible light spectrum is abundant more than RF and also it is free to use.
- **Data Density:**
Li-Fi achieves 1000 times Wi-Fi data density, visible light contained in the light illumination but RF it suffers from interference.
- **Speed:**
Li-Fi provides a very high speed of data transfer with zero interference and also great bandwidth.

8. Conclusion

Options for future utilization are abundant. Every light lamp can be converted into Li-Fi signal receptor to transfer data and we could proceed toward the cleaner, safer, greener and

brighter future. As you may know that the airways are becoming back logged day by day Li-Fi may offer a genuine and incredibly efficient alternative. Li-Fi is enabled by advanced digital transmission technologies. Optical cellular networks based on Li-Fi are the link between future energy-efficient illumination and cellular communications. They can also harness unregulated, untouched and vast amount of electromagnetic spectrum and can even permit ever smaller cells with no requirement for new infrastructure. The issues of shortage of radio frequency can be tackled easily with only limitation being that functions in direct line of sight of light. Generally there are no dead terminates to technology and research. Now both light and radio waves can be used together to copy data and signals.

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