

Li-Fi Technology: Transmission of data through light

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Abstract

In the era of data communication internet is a necessity. Internet is a backbone of the data communication industry. Transmission of the data is one of the most important day to day activities in the fast growing world. Now a days the whole world is using internet to accomplish their task through wired or wireless network. The current wireless networks that connect us to the Internet are very slow when multiple devices are connected. Also with the increase in the number of devices which access the Internet, the availability of fixed bandwidth makes it much more difficult to enjoy high data transfer rates and to connect a secure network. When the number of users are increase using wireless network, the speed of network get decreases Though Wi-Fi gives us speed up to 150mbps as per IEEE 802.11, which is not sufficient to welcomes number of desired users. To remedy this limitation of Wi-Fi, the new concept is introduced, Li-Fi technology. Li-Fi stands for the Light Fidelity. Li-Fi technology, suggested by the German physicist—Harald Haas, provides transmission of data through lighting by sending data from an LED light bulb that varies in intensity faster than the human eye can track. This paper focus on the Li-Fi Technology. Li-Fi is the one which provides better bandwidth, efficiency, better availability and security more than Wi-Fi and has already achieved blisteringly high speed in the lab.

Keyword: Visible Light Communication, Li-Fi, LED, Wi-Fi

1.INTRODUCTION

Li-Fi having a various range of frequencies and wavelengths, from the infrared through visible and

down to the ultraviolet spectrum. Moving data from one place to another is one of the most important activities. The current wireless networks that link us to the internet are very slow when multiple devices are connected. As the numbers of devices, usage of the internet enlarge, the fixed bandwidth available makes it more and more difficult to take advantage of high data transfer rates. But, radio waves are just a small part of the bandwidth available for data transfer. Problem can be solved by using Li-Fi. Li-Fi is transmission of data by taking the fiber out of fiber optics by sending data through an LED bulb which varies in intensity faster than the human eye can follow. Li-Fi is the term some have used to label the fast wireless communication system, which is the optical version of Wi-Fi. Li-Fi uses visible light instead of radio waves having bandwidth in GHz for data transfer. The idea of Li-Fi was introduced for the first time by a German physicist Harald Haas in the TED (Technology, Entertainment, Design) Global talk on Visible Light Communication (VLC) in July 2011, by referring to it as "data through illumination". He used a table lamp with an LED bulb to transmit a video of a blooming flower that was then projected onto a screen. In simple terms, Li-Fi can be thought of as a light-based Wi-Fi i.e. instead of radio waves it uses light to transmit data. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. By adding new and unutilized bandwidth of visible light to the currently available radio waves for data transfer, LiFi can play a major role in relieving the heavy loads which the current wireless system is facing. Thus it may offer additional frequency band of the order of 400 THz compared to that available in RF communication which is about 300 GHz. Also, as the Li-Fi uses the visible spectrum, it will help alleviate concerns that the electromagnetic waves coming with Wi-Fi could adversely affect our health. HARALD HASS, who is considered as the father of the Li-fi, says that the heart of this technology lies in the intensity and the potential of the light emitting diodes. The main reason

come out which lead the modern man through this invention is that the confinement of Wi-Fi is because of its small distance. As there are more and more devices coming up day-by-day the signals are being obstruct up due to heavy traffic, there arised a need for an error free transmission technology. And the answer to this problem is Li-fi technology. It can works even under water which causes a great benefit to the military operations. It provides much larger frequency band up to (300 THz) compared to that available in RF communications (300GHz).

2. WORKING OF LI-FI

Li-Fi is a Visible Light Communications (VLC) system for data transmission. A simple VLC system has two qualifying components: 1) at least one device with a photodiode able to receive light signals and 2) a light source equipped with a signal processing unit. A VLC light source could comprise of a fluorescent or light emitting diode (LED) bulb. Since a robust Li-Fi system requires extremely high rates of light output, LED bulbs are most ideal for implementing Li-Fi. LED is a semiconductor light source, which implies that LED light bulbs can amplify light intensity and switch rapidly. Therefore, LED cells can modulate thousands of signals without the human eye ever noticing. In turn, the changes in light intensity from the LED light source are interpreted and converted as electrical current by the receiving photodiode device. Once the electronic signal is demodulated, it is converted into a continuous stream of binary data comprising of audio, video, web, and application information to be consumed by any Internet-enabled device. There is ample room for growing innovation in Li-Fi technology. Like conventional broadband and Wi-Fi, Li-Fi can also function as a bidirectional communication system. By interchanging visible light and infrared light from a photo detector, a mobile device connected to that photo detector can send data back to the light source for uplink. Also, multi-colored RGB (Red/Green/Blue) LED's at retina size could be engineered to send and receive a wider range of signals than single-colored phosphor-coated white LED's.

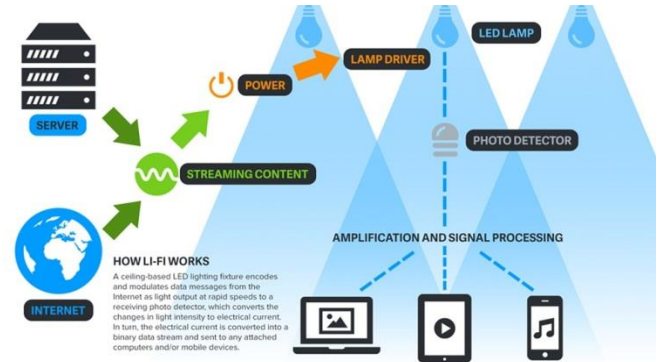


Figure Working of Li-Fi

3. APPLICATION OF LI_FI

The applications of Li-Fi are limitless. It is a technology that will extend the capabilities of Wi-Fi communication even beyond our imagination. Where there is an LED light, there can be data. Some of the most common applications of Li-Fi are summarized below:

3.1 .The Military

Unlike Wi-Fi, Li-Fi is confined to a small range. As light does not penetrate walls, data transmitted over Li-Fi can be limited to a small area such as a tent. This makes Li-Fi great for use by the military even in remote locations as the data can't be intercepted by outside hackers. Moreover, no complex wiring infrastructure is needed for li-fi, where there is light, there is li-fi. BT has already begun testing Li-Fi for military bases.

3.2. Traffic Lights

Li-Fi can be used to provide drivers with traffic and weather updates as they wait at the traffic lights. This also eliminates the problem of getting critical traffic updates to drivers who are already on the road.

3.3 .Underwater Communications

Traditional Wi-Fi cannot be used underwater because radio waves get absorbed by the water. Li-Fi, on the other hand, uses light for data transmission. Visible light can penetrate deep into the water and therefore it can be used for underwater communication potentially changing the way underwater vehicles and divers communicate with each other.

3.4. *Augmented Reality*

Augmented reality is being used in institutions such as museums to enhance the customer experience. However, like many other services that are dependent upon Wi-Fi, the experience can be slow and sluggish as the number of people connected on the network increases. Li-Fi can easily solve this problem by providing each exhibit with its own data stream using a Led Powered light bulb. Moreover, Li-Fi enabled lighting can also provide localized information within that light. Li-Fi will enable the customers to not only enjoy an uninterrupted AR experience at the museum, but it will also empower them to download information about that exhibit using the light that illuminates the exhibit.

3.5. *Dense Urban Environments*

Most urban environments are completely illuminated by artificial light. This existing infrastructure of lights can be used to provide high-speed data access to users at all times. For instance, users waiting on a hotel corridor can have access to high-speed downloads facilitated by Li-Fi. Not only that, all the rooms in the hotel can get localized Li-Fi access giving them no interference and extremely high-speed data access.

3.6. *Safety Environment*

The use of cell-phones is prohibited in places having high-risk explosive environments. Transmission of data using Li-Fi will simplify data encryption and configuration in such environments. Using Li-Fi new modes of securing such environments from potential hazards may also be developed. The possibilities are endless.

Li-Fi is a powerful technology that can have revolutionary implications in the world of IT. Many companies have already started using Li-Fi to provide ground-breaking connectivity solutions to not only their employees but also their customers. Li-Fi is a secure, faster and safer alternative to wireless data transmission using radio-waves. It is already being used in more than 20 countries across the globe. The number is expected to grow significantly as more and more applications of Li-Fi are discovered and developed.

References ought to be included in the finish of the paper, and its equivalent citation will be included the order of their appearance in the content. Authors ought to guarantee that each reference in the content shows up in the rundown of references and the other way around. Demonstrate references by Clark et al., 1962 or Deal and Grove, 2009 or Fachinger, 2006 in the content. The genuine Authors can be alluded to, however, the reference citation(s) should dependably be given. A few cases of how your references ought to be recorded are given the finish of this layout in the 'References' segment, which will enable you to amass your reference list as indicated [2, 5] by the right organization and text dimension.

4. **LIMITATION OF LI-FI**

Although Li-Fi can offer many advantages there are some limitations are:

Special Hardware Needs:-It needs specialized hardware for implementation which isn't currently available on a large scale.

Technological Advancements:-The current technology must be upgraded in order for Li-Fi to be implemented on a large scale and for common public to use it.

Cost Factor:-Since the technology is new, there has been a huge amount invested in its R&D and hence Li-Fi is very expensive.

Uplink Issues:-Li-Fi has demonstrated extremely high downlink speeds. There has never been any mention regarding the uplink and any clarity on how it is being implemented.

Interference:-Li-Fi signals are prone to interference from everyday lightings such as sunlight, common household lighting etc. due to the use of visible light for its transmission.

Limited Range:-The range of Li-Fi is limited by two major factors: Dispersion of light and inability of light to penetrate optically opaque objects (like walls of a room).

Use of Wi-Fi:-The widespread use of Wi-Fi is a major factor preventing the use of Li-Fi. The limitations of Li-Fi

makes it a difficult task to replace conventional Wi-Fi networks.

5.CONCLUSION

The possibilities are numerous and can be explored further. If this technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal.

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