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The future of wireless communication LI-FI(Light-Fidelity)

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ABSTRACT

As per the growing demands of wireless there is enormous new technologies participating to make sophisticated environment for an end user. To serve this increasing number and size of wireless communication the German scientist- Harald Hass proposed a "LI-FI technology". LI-FI provides transmission of data through illumination y sending data through an LED bulb. Light Emitting Diodes(LED s) are used in different areas of everyday life. The advantages of this device is that in addition to their lightning capabilities and now it will be used for communication by sending data through an LED light bulb that varies in intensity faster than human can follow. WI-FI is great for general wireless coverage within buildings, whereas LI-FI is ideal for high density wireless data coverage in confined area and relieving radio interference issues.

1.INTRODUCTION

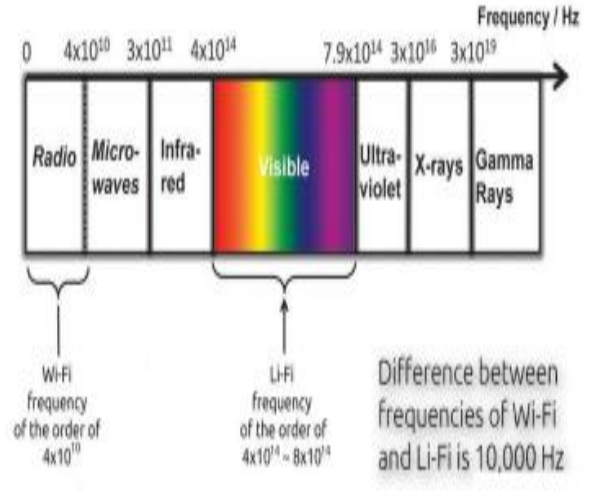
LI-FI stands for Light-Fidelity. The term LI-FI refers to visible light communication (VLC) technology that uses light as medium to deliver high speed communication in a manner similar to WI-FI. This idea was first introduced by German physicist Professor Herald Hass in his TED Global talk on Visible Light Communication. According to Hass, the light which he referred to as D-Light can be used to produce data rates higher than 10MBps which is much faster than our average broadband connection

This brilliant idea works very simple, if the LED is on, we transmit digital 1; if its off we transmit 0 which will be very fast and it may gives nice opportunities for transmitting data.

In order to handle more users and data traffic, several solutions has been proposed. They can be classified in three groups

1. Improve spectrum utilization
2. Establishing Heterogeneous Networks (Het Net) with smal cells to reuse bandwidth.
3. Identify new spectrum with larger band. Basically the goal of LI-FI is not to replace radio frequency, but rather to complement it.

The VLC data communication uses light between 400THz (780nm) to 800THz(375nm) as optical carrier or data transmission and illumination.



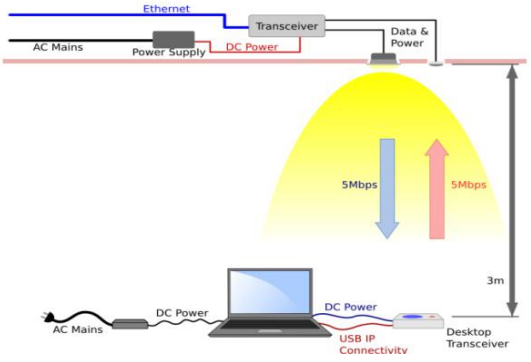
The LI-FI emitter consists of 4 primary sub-assemblies:

a. Bulb
b. RF power amplifier circuit(PA)
c. Printed Circuit Board(PCB)
d. Enclosure

2.WORKING PRINCIPLE

The working of LI-FI is very simple. There is light emitter on one end and photo detector on other end. The photo detector sensors senses and registers binary 1 when the LED is on; and binary 0 if LED is off. To build up a message, flash the LED numerous times or use an array of LEDs of perhaps of few different colors at different wavelengths, to obtain data rates in the range of hundreds of Mbps.

The data can be encoded in the light by varying the



flickering rate at which the LED glows. LEDs can be made switch on or off faster than the human eye can detect causing light source to be on continuously even though it is flickering.

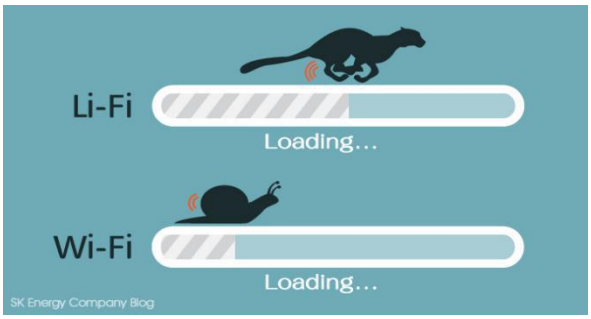
By varying the rate which the LEDs flicker on and off, information can be encoded I the light with different combinations of 0s and 1s. This method is also known as Visible Light Communication(VLC) technology.

3.COMPARISON BETWEEN LI-FI and WI-FI

LI-FI is the name given to describe visible light communication technology applied to obtain high speed wireless communication system.In LI-FI the information is carried out by the help of optical sources(visible light).

Whereas the term WI-FI is abbreviated as Wireless-Fidelity in which the information is carried out on an electric field.

Parameter	LI-FI	WI-FI
Routing Devices	LEDs	Access Points
Cost	Less	High
Security	High	Low
Developing Year	2011	1999
Network Topology	Point to Point	Point to Multipoint
Speed	1-3.5Gbps	54-250Mbps
Data Transfer Medium	Light as carrier	Radio Spectrum
Frequency Band	100 times of Tera Hz	2.4 GHz



4.Advantages of LI-FI

It is similar to the Wifi except that it uses Light waves instead of Radio waves. Wifi is great for general wireless coverage while **Lifi** is ideal for high density coverage in a confined region. It is believed that the technology can yield a speed more than 10 Gbps, allowing a HD film to be downloaded within 30 seconds.

The key benefits are:

Enhanced wireless infrastructures by providing an additional layer of small cells (‘attocells’);
The avoidance of the radio frequency spectrum crunch (10,000 times more capacity);
Enabling very high peak data rates (10 Gbps)
The enabling of the Internet-of-Things (100 times more devices)
Significantly enhanced secure wireless communication (reduced interception of signals)
Enhanced energy-efficiency by combining data communication and illumination (100 times energy reduction)
Complete elimination of health concerns.

5.APPLICATIONS OF LI-FI

Li-Fi applications are varied as a result of its key features, such as directional lighting, energy efficiency, intrinsic security, high data rate capability, signal blocking by walls and integrated networking capability.

Some of the various applications of LI-FI are:

i. Security:-In a meeting room environment, the access area of each channel is the width of the light pool, and can be accessed by multiple users. Each user can receive higher data rates than would be the case for an equivalent Wi-Fi channel.

ii. Dense urban environments:-Dense by their nature tend to have complete artificial lighting coverage. This lighting infrastructure can provide always available high data rate access for users as they move through that environment.

iii. Cellular communication:-In external urban environments, the use of Li-Fi enabled street lamps would provide a network of internet access points. In cellular communication, the distance between radio base stations has come down to about 200-500 metres.

iv. EMI sensitive environments:-

Exhibits in museums and galleries are illuminated with specific lighting. Li-Fi enabled lighting can provide localised information within that light. This means that a visitor’s camera or mobile phone can be used to download further information regarding the object being viewed from the light that illuminates the

exhibit.

Fig. 1: Working Principle of LI-FI Technology

Fig. 2: Multiple Li-Fi APs in a room

6.LIMITATIONS OF LI-FI

I. Internet cannot be used without a light source. This could limit the locations and situations in which Li-Fi could be used.
II. Because it uses visible light, and light cannot penetrate walls, the signal's range is limited by physical barriers.
III. Other sources of light may interfere with the signal. One of the biggest potential drawbacks is the interception of signals outdoors. Sunlight will interfere the signals, resulting in interrupted Internet.

7. SCOPE AND CHALLENGE

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, since with this enhanced technology, a growing number of people and their many devices access wireless internet, on one way, transmit data at higher rates and on the other it is very cheap as compared with Wi-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.

8.CONCLUSION

The world of lighting companies experiences a true revolution with the development of LED lighting devices with reduced energy consumption and a longer lifetime

Wi-Fi is great for general wireless coverage within buildings and LI-FI is ideal for high density wireless data coverage in confined area and for relieving radio interference issues, so the two technologies can be considered complimentary.

With so many feathers in its cap, Li-Fi has one natural shortcoming. Since light cannot penetrate opaque obstacles, this can prove to be an obvious limitation to the technology's usage. Nevertheless, given the terrific data rates and use in multiple fields Li-Fi is definitely the road ahead in wireless communication.

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