A Review Paper on Li-Fi

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Abstract— Li-Fi stands for Light-Fidelity. Li-Fi technology, proposed by the German physicist—Harald Haas, provides transmission of data through illumination by sending data from an LED light bulb that varies in intensity faster than the human eye can track. This paper focuses on developing a Li-Fi based system and analyzes its performance with respect to existing technology. Wi-Fi is for general wireless coverage within buildings, whereas Li-Fi is ideal for high density wireless data coverage in small area and for relieving radio interference issues. Li-Fi provides better bandwidth, efficiency, availability and security more than Wi-Fi and has already achieved blisteringly high speed in the lab.

Key words: Li-Fi, Wi-Fi, high-brightness LED

I. INTRODUCTION

Transfer of 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 number of devices, usage of the internet increases, the fixed bandwidth available makes it more and more difficult to take advantage of high data transfer rates and connect to a secure network. But, radio waves are just a small part of the bandwidth available for data transfer. A solution to this problem is by the use of Li-Fi. Li-Fi stands for Light-Fidelity. 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 by a German physicist, Harald Hass. The word Li-Fi was first used by Haas in his TED Global talk on the topic of Visible Light Communication.

II. CONSTRUCTION

Li-Fi is a fast and cheap optical version of Wi-Fi. VLC is a data communication medium, where the visible light is in between 400 THz (780 nm) and 800 THz (375 nm) as optical carrier in data transmission and illumination. It uses fast pulses of light to transfer information wirelessly. The main parts of Li-Fi system are as follows: a) a high brightness white LED is acting as transmission source. b) A silicon photodiode with good response to visible light as the receiving light. LEDs can be switched on and off to generate digital strings of different combination of 1s and 0s. To generate a new data stream, data may be encoded in the light by varying the flickering rate of the LED. The LEDs is used as a sender or source, by the help of the modulation of the LED light with the data signal. The LED output reflects as a constant to the human eye because of the fast flickering rate of the LED. Communication rate greater than 100 Mbps is possible by using high speed LEDs used with various multiplexing techniques. VLC data rate can be increased by parallel data transmission with the help of an array of LEDs where each LED transmits a different data stream. The Li-Fi emitter system consists of 4 primary components : a) Bulb b) RF power amplifier circuit (PA) c) Printed circuit board (PCB) d) Enclosure The PCB operates the electrical inputs and outputs of the lamp and houses the microcontroller used to operate various lamp functions. A RF (radio-frequency) signal is generated by the solid-state PA and is guided by an electric field about the bulb. The high concentration of energy in the electric field vaporizes the contents of the bulb to a state at the bulb‘s center; this controlled plasma generates an intense source of light. All of these subparts are contained in an aluminum enclosure.

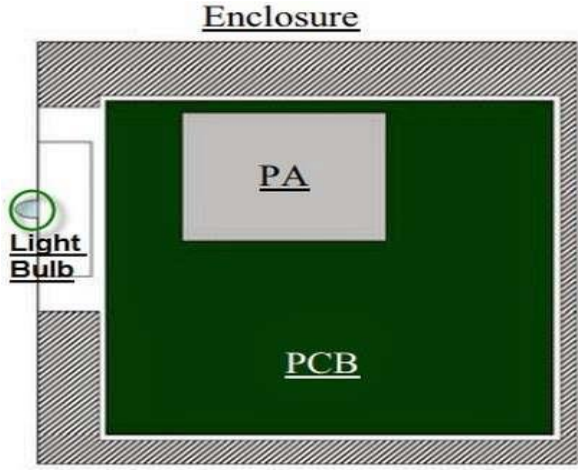

Fig. 1: Block diagram of lifi assembles

III. WORKING

A new generation of light-emitting diodes forms the core part of light fidelity technology. The logic is very simple. If the LED is on, a digital 1 is transferred. If the LED is off, a digital 0 is transferred. These high brightness LEDs can turn on and off very rapidly which gives us a very nice opportunities for transmitting data through light.

The working of Li-Fi is very easy. There is a light emitter on one end, for example, an LED, and a photo detector on the other. The photo detector takes a binary one when the LED is on; and a binary zero if the LED is off. To form a message, flash the LED many times or use an array of LEDs to obtain data rates in the range of megabits per second.

The data is encoded in the light by varying the fluctuating rate at which the LEDs flicker on and off to generate several strings of 1s and 0s.The LED intensity is modulated so quickly that human eye cannot notice, so the light of the LED appears constant to humans.

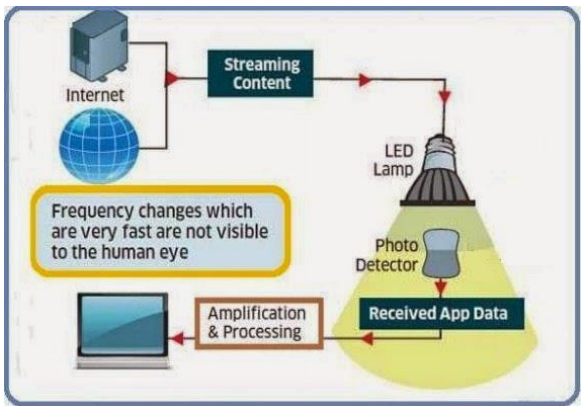

Fig. 1: Block diagram of lifi

IV. APPLICATIONS

Some of the future applications of Li-Fi are as follows:

A. Education systems:

Li-Fi is the modern technology that can provide fastest speed internet access. Such that it can replace Wi-Fi at educational hubs and at offices so that all the people can make use of Li-Fi with the same speed intended in an area.

B. Medical Applications:

Operation theatres (OTs) do not allow Wi-Fi due to radiation concerns. Use of Wi-Fi at hospitals interferes with the mobile and pc which blocks the signals for monitoring equipments. So, can be harmful to the patient's health. To overcome this and to make OT tech savvy Li-Fi can be used for access of internet .This can even be beneficial for robotic surgeries.

C. Cheaper Internet in Aircrafts:

The passengers travelling in airplanes get access to low speed internet at a very high rate. Also Wi-Fi cannot be used because it may interfere with the navigational systems of the pilots. In airplanes Li-Fi is used for data transfer. Li-Fi can easily provide high speed internet via every light source like overhead reading bulb, etc. present inside the airplane.

D. Disaster management:

Li-Fi can be used as a powerful source of communication in times of disaster such as earthquake. The average people may not know the protocols during such calamities. Subway stations and tunnels are the common dead zones for most emergency contacts, have no obstruction for Li-Fi.

E. Traffic management:

In traffic control signals Li-Fi can be used which will connect with the LED lights of the cars which can help in managing the traffic in a good manner and the accident rates can be decreased. Also, LED car lights can alert drivers when other vehicles are too close.

V. CONCLUSION

There are lots of possibilities to be gouged upon in this field of technology. If it becomes justifiably marketed then every bulb can be used similar to a Wi-Fi hotspot to send data. By virtue of this we can ameliorate to a greener, cleaner, safer and a good future. The theme of Li-Fi is to attract a lot of eye-balls as it offers a genuine and very efficient alternative to radio based wireless. It has a good chance to replace the traditional Wi-Fi because as an ever growing population is using wireless internet, the airwaves are becoming clogged, making it more difficult to fetch a reliable, high-speed signal. This concept promises to solve issues like shortage of radio-frequency bandwidth and comes with the disadvantages of Wi-Fi. Li-Fi is the emerging and growing technology acting as threat for various other developing and already invented technologies. Thus the future applications of the Li-Fi can be guessed and preceded to different platforms and various walks of human life.

VI. REFERENCES

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