LIFI TECHNOLOGY

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Abstract —**Li-Fi stands for Light-Fidelity. Li-Fi technology, proposed by the German physicist—Herald Haas, provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. This paper focuses on developing a Li-Fi based system and analyses its performance with respect to existing technology. 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 for relieving radio interference issues. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi and has already achieved blisteringly high speed in the lab. By leveraging the low-cost nature of LEDs and lighting units there are many opportunities to exploit this medium, from public internet access through street lamps to auto-piloted cars that communicate through their headlights. Haas envisions a future where data for laptops, smart phones, and tablets will be transmitted through the light in a room.**

I. INTRODUCTION

Transfer of data from one place to another is one of the most important day-to-day activities. The current wireless network the connect us to the internet when multiple devices are connected. As the no. of devices that access the internet increases, the fix bandwidth available make it more and more difficult to enjoy high data transfer rates and connects to a secure network. But, radio waves are just a small part of the spectrum available for data transfer.

A solution to this problem is Li-Fi. Li-Fi stands for Light-Fidelity. Li-Fi is transmission of data through illumination by taking the fiber out of fiber optic by sending data through a LED light bulb that varies intensity faster than the human eye can follow.

Li-Fi is a term which provides us cheap wireless data transmission, which is optical version of Wi-Fi. Li-Fi uses visible light instead of radio waves for data transferring.

The idea of Li-Fi was introduced by a German physicist, Herald Hass, which he also referred to as —data through illumination. The term Li-fi was used by Hass in his TED Global Talk on visible light Communication. According to Hass, the light, which he referred to D-light, can be used to produce data rates higher than 10 megabits per second which is much more faster than our broadband connection.

Li-Fi can play a major role in reliving loads which the current wireless system face it add a new unutilized bandwidth of visible light to the currently available radio waves for data transfer. Thus it offer much larger frequency band (300 THz) compared to that available in RF communication (300GHz). Also, more data coming through the visible spectrum could help alleviate concern that the electromagnetic waves that come with Wi-Fi adversely affect our health.

Fig. 1. Li-Fi bulb

Li-Fi can be the technology for the future where data for laptops, smart phones, and tablets will be

transmitted through the light in a room. Security would not be an issue because if you can‘t see the light, you can‘t access the data. As a result, it can be used in high security military areas where RF communication is prone to eavesdropping.

II. CONSTRUCTION OF LI-FI SYSTEM

Li-Fi is a fast and cheap optical version Wi-Fi. It is basically work on visible light communication(VLC). VLC is a data communication medium, which uses visible light between 400THz (780 nm) and 800 THz (375 nm) as optical carriers transferring and illumination. It uses fast pulses of light to transmit information wirelessly. The main components of Li-Fi system are as follows:

- A high brightness white LED which acts as a transmission source.
- A silicon photodiode with good response to visible light as receiving element.

LEDs can be switched on or off to generate digital strings of different combination of 1s and 0s. To produce a new data stream, data can be encoded in the light by alter the glimmering rate of the LED. The LEDs can be used as sender or origin, by regulating the LED light with the data signal.

Communication rate higher than 100 mbps is feasible by using high speed LEDs with the help of complicated techniques. VLC data rate can be increased side by side data transference using an array of LEDs where each LED transfers a dissimilar data stream. The Li-Fi emitters consist of 4 first subassemblies:

- Bulb
- RF Power Amplifier Circuit (PA)
- Printed Circuit Board (PCB)
- Enclosure

The PCB controls the electrical inputs and outputs of the lamp and houses the microcontroller used to manage dissimilar lamp task. A RF signals are created by solid state PA and is lead into an electric field about the bulb. The high concentration of energy in the electric field volatize the content of the bulb to a plasma state at the bulb centre this controlled plasma create an extreme source of light. All of these subassemblies are contained in an aluminum enclosure.

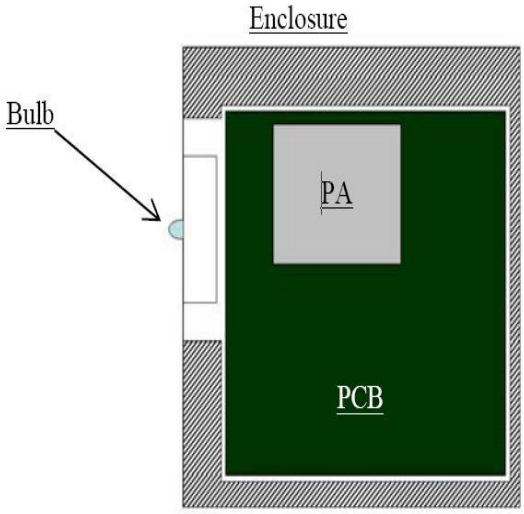

fig2Block diagram of Li-Fi sub-assemblies

The bulb sub-assembly is the heart of Li-Fi emitter. It consists of sealed bulb which is embedded in a dielectric material. This design is more reliable than conventional light source that insert degradable electrode into the bulb. The dielectric material serves two purposes. It act as a wave guide for RF energy transmitted by the PA . It also acts as an electric field concentrator that focuses energy in the bulb. The energy from the electric field rapidly heats the material in the bulb to a plasma state that emits light of high intensity and full spectrum. Figure 3 shows the bulb sub-assembly.

There are various inherent advantages of this approach which includes high brightness, excellent colour quality and high luminous efficacy of the emitter – in the range of 150 lumens per watt or greater. The structure is mechanically robust without typical degradation and failure mechanisms associated with tungsten electrodes and glass to metal seals, resulting in useful lamp life of 30,000+ hours. In addition, the unique combination of high temperature plasma and digitally controlled solid state electronics results in an economically produced

family of lamps scalable in packages from 3,000 to over 100,000 lumens.

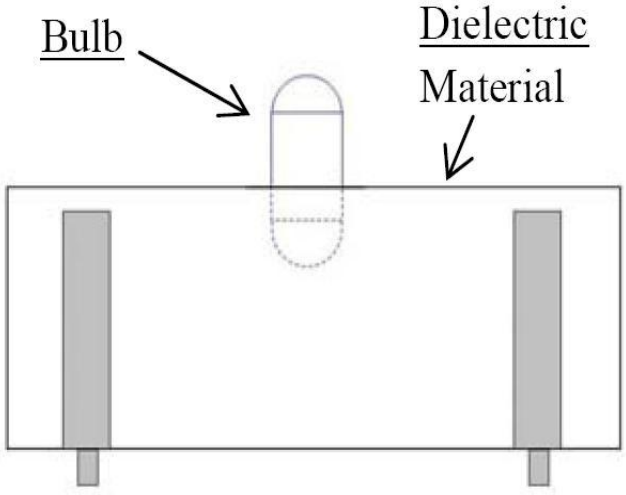

Fig. 3. Bulb sub-assembly

III. WORKING OF LI-FI

A new generation of high brightness light-emitting diodes from the core part of light fidelity technology. If the LED is on, a digital 1 is transmitted. If LED is off then, a digital 0 is transmitted.

The working of Li-Fi is very straight forward. There is a light emitter on one end, for example, an LED and a photo detector (light sensor) on the other. The photo detector registers a binary one when the LED is on; and a binary zero if the LED is off. To build up a message, flash the LED numerous times or use an array of LEDs of perhaps a few different colours, to obtain data rates in the range of hundreds of megabits per second. The block diagram of Li-Fi system is shown in Fig. 4.

The data can be encoded in light varying the shining rate at which the LEDs flickers on or off to generate different string of 0s and 1s.The LED power is modulated so fast that human cannot notice it, so the light of LED appears constant to human.

Light emitting-diode (LEDs) are mostly found in various devices like in traffic lights and street lights, car break lights, remote control and many other countless applications) can be switched on off faster than the human eye can detect, causing the light source to appear continuously, even though it is in fact 'flickering'.

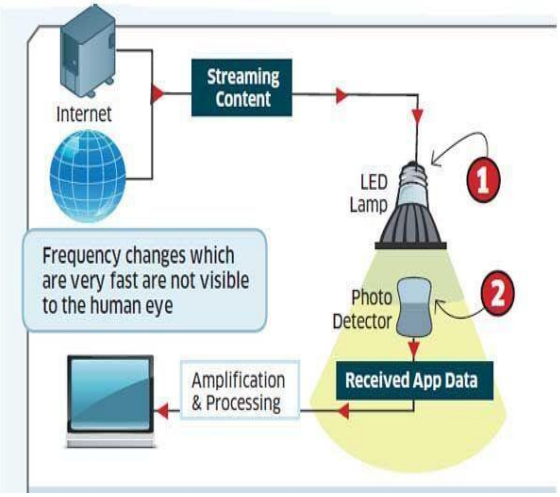

Fig. 4. Block diagram of Li-Fi system

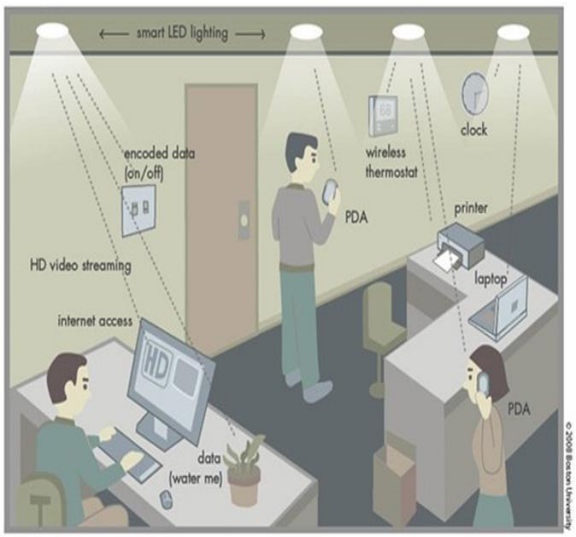

Fig. 5. Li-Fi system connecting devices in a room

CONCLUSION**:**

REFERENCES:

1. [1] Jyoti Rani, PrernaChauhan, RitikaTripathi, ―Li-Fi (Light Fidelity)-The future technology In Wireless communication‖, International Journal of Applied Engineering Research, ISSN 0973-4562 Vol.7 No.11 (2012).
2. [2] Richard Gilliard, Luxim Corporation, ―The lifi® lamp high efficiency high brightness light emitting plasma with long life and excellent color quality‖.
3. [3] Richard P. Gilliard, Marc DeVincentis, AbdeslamHafidi, Daniel O'Hare, and Gregg Hollingsworth, ―Operation of the LiFi Light Emitting Plasma in Resonant Cavity‖.
4. [4] Visilink, ―Visible Light Communication Technology for Near- Ubiquitous Networking‖ White Paper, January 2012.
5. [5] http://edition.cnn.com/2012/09/28/tech/lifi-haas-innovation
6. [6] http://articles.economictimes.indiatimes.com/2013-01-14/news/36331676_1_data-transmission-traffic-signals-visible-lightspectrum
7. [7] http://www.extremetech.com/extreme/147339-micro-led-lifi-whereevery- light-source-in-the-world-is-also-tv-and-provides-gigabit-internetaccess
8. [8] http://www.dvice.com/archives/2012/08/lifi-ten-ways-i.php
9. [9] http://www.good.is/posts/forget-wifi-it-s-lifi-internet-through-lightbulbs
10. [10] http://www.lifi.com/pdfs/techbriefhowlifiworks.pdf
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