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A Study on emerging Li-Fi Technology and its Applications

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Abstract: *Li-Fi is abbreviated as Light Fidelity. Li-Fi technology was proposed by a German physicist named Harald Haas. The light emitting diodes present in this technology transfers the data through wireless communication. It is a vital feature of the telecommunication system using light as a medium replacing the traditional radio frequencies i.e. Li-Fi uses light-based signals instead of radio waves to receive and transmit data substituting Wi-Fi modems. This existing paper reflects the destiny of communication (Li-Fi) which might impact the lives of individuals by playing a predominant role in accessing the net. The paper also emphasizes on consistency of the type of setup and application, advantages of light fidelity is the capability of LED light bulbs to offer together, the illumination and intercommunication bridge consistently. Simultaneously, this characteristic feature intends to work faster than human eye. Li-Fi technology is an epitome for high density wireless coverage data for releasing radio interface issue, high data transfer and bond with the secure network.*

Keywords: *Wi-Fi (Wireless Fidelity), LED (Light Emitting Diode), RF (Radio Frequency), UV (Ultraviolet) Light.*

I. INTRODUCTION

The global interconnectivity of networks - Internet plays a vast role in a common man's life. Currently, Wi-Fi and hotspots are in demand. The Li-Fi structure at present acts as a transmission system that allows the requirements of semiconductor diodes such as a LED which equips the data transfer at a higher and genuine rate as compared to the data transfer in Wi-Fi.

Li-Fi is a bidirectional high speed telecommunication system and mobile communication of information system in which radiance is used as carrier wave, an alternative of fixed radio frequency as in WI-FI. Light obedience which makes certain that computer technology implementing light emitting diodes to pass data wirelessly. A stream of photons is ejected from the bulb when an electric current is applied to a LED. LED bulbs are a semiconductor device, which means that the illumination of the light flowing through them can be altered at enormous speeds. The signal can then be established by a detector which understands the variations in light intensity (the signal) as data. Visible light communication (VLC) is an electronic transmission of data in an alternative form which uses visible light.

This paper ensures on light constancy (obedience) technology that prevail over WI-FI technology and VLC technology.

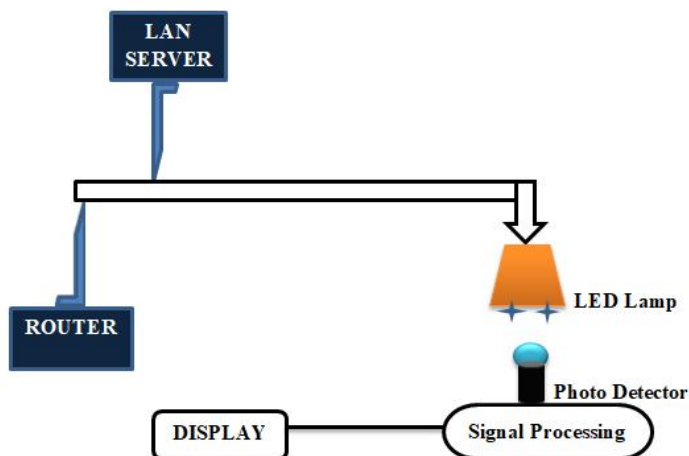
II. LI-FI ARCHITECTURE

Architecture of Li-Fi contains number of LED bulbs or lamps that form a wireless network, multiple wireless devices such as PDA, Mobile Phones and laptops.

Important factors we should consider while designing Li-Fi as following:

- A. Presence of Light
- B. Line of Sight(Los)
- C. Use fluorescent light & LED (For better performance)

An overhead lamp fitted with an LED with signal- processing technology streams data embedded in its beam embedded in its beam at ultra-high speeds to the photo-detector. A receiver dongle then converts the tiny changes in amplitude into an electrical signal, which is then converted back into a data stream and transmitted to a computer or mobile device.



III. WORKING PROCESS OF Li-Fi

A. Basic Working of a Li-Fi

Li-Fi is radically applied using white LED bulbs at the downlink transmitter. These equivalents are usually used for radiance only by using a constant current. However, by quick and precise variations of the current, the visual output can be made to differ at extremely high speeds.

The characteristic of Visual current is used in the setup of LI-FI.

B. LED Plays a Vital Role.

The characteristic of Visual current is used in the setup of LI-FI. This operative method is very simple. If the LED is ON, we transfer a digital 1, if it's OFF, we transfer a digital 0. Good chances for transmitting data are available as the LED can be switched ON and OFF very quickly. Hence, all the data is needed is few LED's and a controller that code data into those LED's.


The varying of the rate, at which the LED flickers depending on the data, must be done. Parallel data transmission can be done by using array of LED's or a combination of red, green and blue LED's to modify the radiance frequency with each frequency put into a code, at a different channel. Such upgradation commits a conceptual speed of 10gbps-means a high definition film can be downloaded. Light is generally safe and can be used in places where electromagnetic spectrum is often assumed problematic, such as in Aircraft cabins or hospitals.

So, VLC not only has the ability to solve the problem of lack of spectrum space, but can also permit different applications. VLC spectrum is unused, it's not fixed, and it can be used for communication at very high speeds.

C. Why Use Li-Fi

Where does visible light fit in?

Gamma rays	X-rays	ultraviolet	Visible light	infrared	microwaves	radio waves
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Notice where 'violet' light is?... Next to Ultra violet rays!

Notice where 'red' light is?... Next to Infra red rays!

Gamma rays cannot be used as they are unsafe. X-rays has same health issues. UV-light is fine for place without people; otherwise it is harmful and unsafe. Only people with Low power eye sight can use Infrared rays, due to eye safety regulation. Radio waves have the power to penetrate through the walls and hence they arises security issues.

D. Comparing Li-Fi & Wi-Fi

1) *Prominent features between Wi- Fi and Li- Fi:* The name Li-Fi was derived due to its good similarity to Wi-Fi. Wi-Fi works well for general wireless coverage within buildings, and Li-Fi is used for high density wireless data coverage inside a home-bound area and for improved radio interference issues. A comparison is shown, of transfer speed of various wireless technologies and comparison of various technologies that are used for connecting to the end user.

E. Advantages Of Li-Fi

- 1) Licensed copy is not required
 - a) It is an unrestricted band that does not need a license.
 - 2) Variations in Cost
 - a) High cost for installment but very low cost for maintenance.
 - b) It is cheaper than Wi-Fi.
 - 3) Speed of LI- FI
 - a) The hypothetical speed is up to 1 GB per second
 - b) Less time & energy consumption.
 - c) No more monthly broadband bills.
 - 4) Saves Electricity
 - a) Low electricity costs.
 - b) Length of service of LED bulb saves money.
 - c) Light doesn't penetrate through walls providing secured access.

F. Advanced Usage

- 1) *Enhanced usage of Li- Fi*
 - a) *Underwater applications:* Underwater Remotely Operated Vehicles (ROVs) operate from large cables that supply power to it and allow them to receive signals from their pilots above. But the leash used in ROV's is not long enough to allow them to research larger areas.
 - b) *Air crafts:* The passengers travelling in air crafts have access to low speed internet at a very high rate. Wi-Fi is not used because it might interfere with the navigational systems of the pilots. Li-Fi can be used for data transmission in air crafts. Li-Fi easily provides high speed internet through a light source such as overhead reading bulb, etc present inside the airplane.

IV. FUTURE SCOPE

In the manner of Hospitals, Academics, Airlines and more, the area of Li-fi is very broad.

A. In The Field of Medicine

LI-FI can be used in the places where it is difficult to lay the optical fiber, places like hospitals. Li-Fi can be used for modern medical instruments in operation theatres.

B. Airlines and traffic system

In traffic signals Li-Fi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased. Millions of street lamps can be transferred to Li-Fi lamps in order to transfer data. Li-Fi can be used for data transmission in aircrafts. It can be used in petroleum or chemical plants where other transmission or frequencies could be Hazardous.

V. CONCLUSION

The possibilities are numerous in Li-Fi and can be explored further. The concept of Li-Fi is currently attracting a huge number of people. As there are a growing number of people and their devices accessing wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal.



This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed. Li-Fi is certainly not useless, but it has certain inbuilt limits for the technology.

Li-Fi may not be able to replace conventional radios altogether, but it could speed up the development of wireless television and make it easier.

At present, finding the ideal position for a wireless router is something of a divine art. If the signal could be passed via VLC (Visible Light Communication) from Point A to Point B inside a home, small local routers at both points could create local fields with less chance of overlapping and interfering with each other. Large scale areas that are concentrated with radio signals or that doesn't permit them for security reasons could use Li-Fi as an alternate high-speed wireless network solution.

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