

LI-FI Technology – The Future Technology In Wireless Communication

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Abstract – Li-Fi stands for Light-Fidelity. Current era many people are using internet to accomplish their task through wired or wireless network. As number of users get increased in wireless speed decreases proportionally. Though Wi-Fi gives us speed up to 150mbps as per IEEE 802.11n, it is still insufficient to accommodate number of users. To remedy this limitation of Wi-Fi, we are introducing concept of Li-Fi. Li-Fi technology, proposed by the German physicist—Harald 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.

Keywords-

LI-FI, WI-FI, Visible Light Communication, Radio Spectrum

INTRODUCTION

Li-Fi is a VLC, visible light communication technology, developed by the team of scientists including professor Haas at the University of Edinburg and deals with transfer of data through illumination by taking fiber out of optics by sending data through a LED light bulb that varies in the intensity faster than a human eye can follow.

Li-Fi, as coined by Prof. Harald Haas during his TED Global talk, is bidirectional, high speed and fully networked wireless communications similar to Wi-Fi. Li-Fi is a subset of optical wireless communications

(OWC) and can be a complement to RF communication (Wi-Fi or Cellular network).

Light Fidelity is a new wireless communication technology which enables a wireless data transmission through LED light. Light Fidelity is based on a unique ability of solid state lighting systems to create a binary code of 1s and 0s with a LED flickering that is invisible for human eyes. Data can be received by electronic devices with photodiode within area of light visibility. This means that everywhere where LEDs are used, lighting bulbs can bring not only The light but wireless Connection at the same time.

The figure-1 shows the environment with the LI-FI technology where light bulbs are used as a data communication medium to PC, Laptop, Tablet and PDA as it all have photo detector connected to it as receiver.

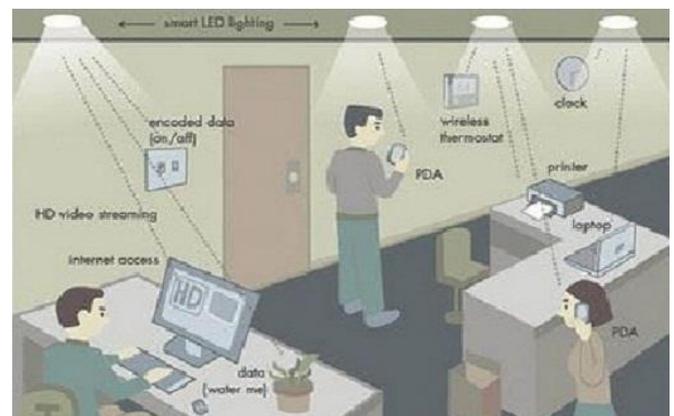


Figure 1: Environment with LI FI Technology

WORKING PROCESS OF LI-FI

Light Fidelity is typically implemented using white LED light bulbs at the downlink transmitter. These devices are normally used for illumination only by applying a constant current. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. This very property of optical current is used in Light Fidelity setup. The operational procedure is very simple-, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. Hence all that is required is some LEDs and a controller that code data into those LEDs. All one has to do is to vary the rate which the LED's flicker depending upon the data we want to encode.

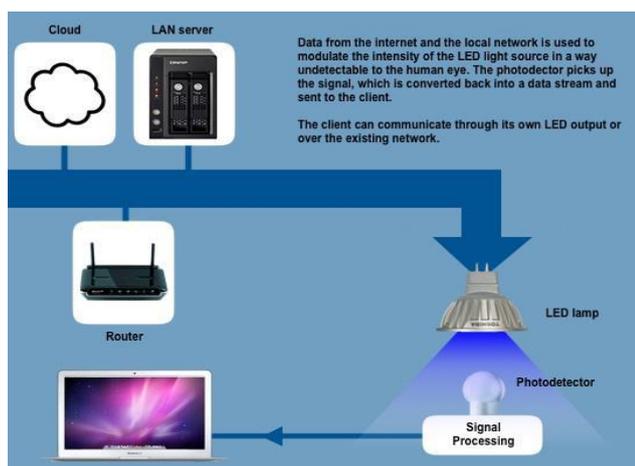


Figure2: Working Process of Li-Fi Technology

ADVANTAGES OF LI-FI

Education systems: Li-Fi is the latest technology that can provide fastest speed internet access. So, it can replace Wi-Fi at educational institutions and at companies so that all the people can make use of Li-Fi with the same speed intended in a particular area.



Figure3: Li-Fi used in Educational System

Medical Applications: Operation theatres (OTs) do not allow Wi-Fi due to radiation concerns. Usage of Wi-Fi at hospitals interferes with the mobile and pc which blocks the signals for monitoring equipments. So, it may be hazardous to the patient's health. To overcome this and to make OT tech savvy Li-Fi can be used to accessing internet and to control medical equipments. This can even be beneficial for robotic surgeries and other automated procedures.



Figure4: Li-Fi used in Medical

Cheaper Internet in Aircrafts: The passengers travelling in aircrafts get access to low speed internet at a very high rate. Also Wi-Fi is not used because it may interfere with the navigational systems of the pilots. In aircrafts Li-Fi can be used for data transmission. Li-Fi can easily provide high speed internet via every light source such as overhead reading bulb, etc. present inside the air plane.



Figure5: Li-Fi used in aircraft



Figure6: Li-Fi used in Traffic Management

Disaster management: Li-Fi can be used as a powerful means of communication in times of disaster such as earthquake or hurricanes. The average people may not know the protocols during such disasters. Subway stations and tunnels, common dead zones for most emergency communications, pose no obstruction for Li-Fi. Also, for normal periods, Li-Fi bulbs could provide cheap high-speed Web access to every street corner.

Applications in sensitive areas: Power plants need fast, inter-connected data systems so that demand, grid integrity and core temperature (in case of nuclear power plants) can be monitored. Wi-Fi and many other radiation types are bad for sensitive areas surrounding the power plants. Li-Fi could offer safe, abundant connectivity for all areas of these sensitive locations. This can save money as compared to the currently implemented solutions. Also, the pressure on a power plants own reserves could be lessened. Li-Fi can also be used in petroleum or chemical plants where other transmission or frequencies could be hazardous.

Traffic management: In traffic signals Li-Fi can be used which will communicate with the LED lights of the cars which can help in managing the traffic in a better manner and the accident number can be decreased. Also, LED car lights can alert drivers when other vehicles are too close.

Underwater applications: Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. But the tether used in ROVs is not long enough to allow them to explore larger areas. If their wires were replaced with light — say from a submerged, high powered lamp — then they would be much freer to explore. They could also use their headlamps to communicate with each other, processing data autonomously and sending their findings periodically back to the surface. LI-FI can even work underwater where Wi-Fi fails completely, thereby throwing open endless opportunities for military operations.

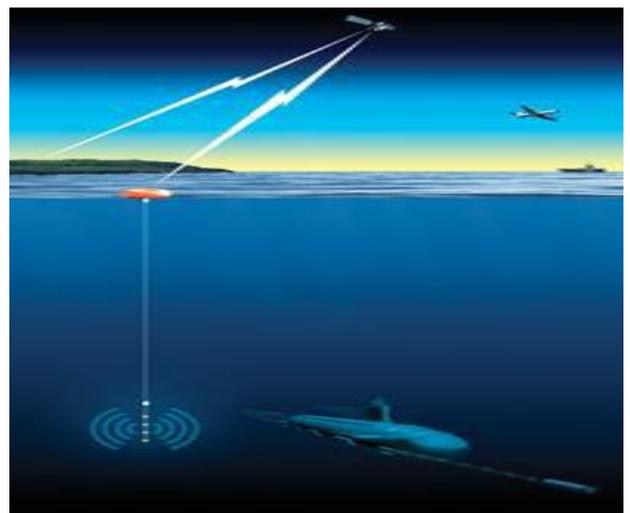


Figure7: Li-Fi used in Underwater applications

ADVANTAGES OF LI-FI OVER WI-FI

- Light Fidelity uses light rather than radio frequency signals so are intolerant to disturbances.
- VLC could be used safely in aircraft without

affecting airlines signals.

□ Integrated into medical devices and in hospitals as this technology doesn't deal with radio waves, so it can easily be used in all such places where Bluetooth, infrared, Wi-Fi and internet are broadly in use.

□ Under water in sea Wi-Fi does not work at all but light can be used and hence undersea explorations are good to go now with much ease.

□ There are billions of bulbs worldwide which just need to be replaced with LED's to transmit data. □ Security is a side benefit of using light for data transfer as it does not penetrate through walls.

□ On highways for traffic control applications like where Cars can have LED based headlights, LED based backlights, and they can communicate with each other and prevent accidents. Using this Technology worldwide every street lamp would be a free data access point.

□ The issues of the shortage of radio frequency bandwidth may be sorted out by Li-Fi.

Problems in Wi-Fi

a) Capacity: Wireless data is transmitted through radio waves which are limited and expensive. It has a limited bandwidth. With the rapidly growing world and development of technologies like 3G, 4G and so on we are running out of spectrum.

b) Efficiency: There are 1.4 million cellular radio base stations that consume massive amount of energy. Most of the energy is used for cooling down the base station instead of transmission. Therefore efficiency of such base stations is only 5%.

c) Availability: Availability of radio waves is a big concern. It is not advisable to use mobile phones in aero planes and at places like petrochemical plants and petrol pumps.

d) Security: Radio waves can penetrate through walls. They can be intercepted. If someone has knowledge and bad intentions, they may misuse it. This causes a major security concern for Wi-Fi.

DISADVANTAGES OF LI-FI

Apart from many advantages over Wi-Fi, Li-Fi technology is facing some problems such as Li-Fi requires line of sight. Receiving device would not be shift in indoors. A major challenge is how the receiving device will transmit data back to transmitter. Visible light can't penetrate through brick walls as radio waves and is easily blocked by somebody simply walking in

front of LED source.

CONCLUSION

Every light bulb can be converted into li-fi signal receptor to transfer data and we could proceed toward the cleaner, safer, greener and brighter future. As we know that the airways are getting clogged day by day Li-Fi can offer a genuine and very efficient alternative. Li-Fi is enabled by

advanced digital transmission technologies. Optical cell networks based on Li-Fi are the link between future energy efficient illumination and cellular communications. They can also harness unregulated, unused and vast amount of electromagnetic spectrum and can even enable ever smaller cells without the need for new infrastructure. the issues of shortage of radio frequency can be tackled easily with only

limitation being that it works in direct line of sight of light. There are no dead ends to technology and science. Now both light and radio waves can be used simultaneously to transfer data and signals.

FUTURE SCOPE

The area of Li-Fi is very broad in the manner of Hospitals, Academics, Airlines and more. Can be used in the places where it is difficult to lay the optical fiber like hospitals. In operation theatre Li-Fi can be used for modern medical instruments. In traffic signals Li-Fi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased. Thousand and millions of street lamps can be transferred to Li-Fi lamps to transfer data. In aircraft Li-Fi can be used for data transmission. It can be used in petroleum or chemical plants where other transmission or frequencies could be Hazardous. Such advancements promise a theoretical speed of 100 Gbps - meaning one can download a full high definition film in just 3 seconds.

REFERENCES

- [1] Harald Haas, „Wireless data from every light bulb”, TED Global, Edinburgh, July 2011.
- [2] <http://www.ripublication.com/ijaer.html>
- [3] <http://en.wikipedia.org/wiki/Li-Fi>
- [4] www.w3schools.com