LI-FI (Light Fidelity) Technology and Its Future in India

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ABSTRACT
LI-FI technology i.e Light Fidelity technology is a wireless communication. Prof. Harald Haas is the founder of Li-Fi technology. Li-Fi provides transmission of data through LED light.. Li-Fi term refers to visible light communication (VLC) and subset of optical wireless communication. He started a research in 2003 as he saw the upcoming spectrum crunch. Prof. Harald Haas also gave a TED talk on this topic of LI-FI in 2011. He says the solution for this is sending data through LED light which is very fast. LED light is electronic device. Harald Haas calls it as D-LIGHT, which produce data rate faster than 10 megabits per second, which has more speed than average broadband connection. This is the concept where Wi-Fi is replaced by Li-Fi. All data's from laptops, cell phones, are transmitted through light, and when there is no light you can't access data.

General Terms
Wi-Fi, LED, VLC

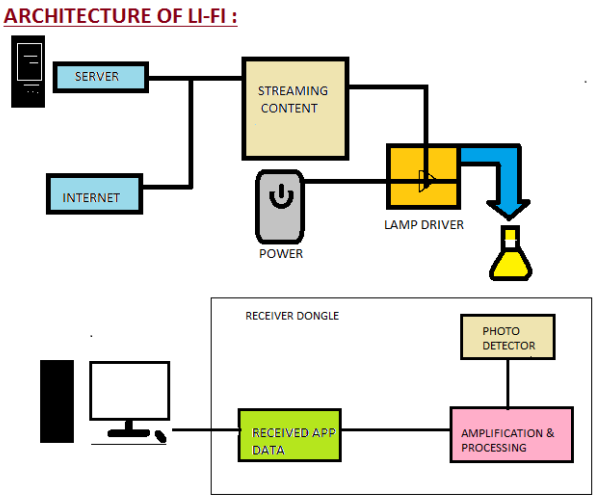
1. INTRODUCTION
LI-FI transmits data through LED lights. Its intensity is faster.Li-Fi is similar to WiFi. Li-Fi is a fully networked wireless communication technology. It is also cheap and is a fast wireless communication system. It can turn on and off very easily and quickly. Some industry and companies promote the high speed optical wireless system. The optical version of Wi-Fi is Li-Fi where Wi-Fi uses radio waves and Li-Fi uses Light waves. As wireless communication has become utility in our day to day life like water and electricity, it is a part of optical wireless communication technology which carries more information and has solution to RF-bandwidth limitations. The issues this technology has:

- Capacity.
- Efficiency.
- Availability.
- Security.

Part of electromagnetic spectrum is light. Electromagnetic spectrum has Radio-Waves, Infrared, Visible, Ultra-Violet, X-rays, and Gamma rays. The Li-Fi market is protected to have a compound annual growth rate of 82% from 2013 to 2018 and to be worth over $6 billion per year by 2018.Li-Fi is such a free band which is licence free that is why it cost less than Wi-Fi. Thousands of data can be transferred simultaneously at high speed. Li-Fi is an important concept of Internet of things (IOT) where everything is connected to internet.

2. WORKING PRINCIPLE OF LI-FI
Li-Fi is implemented using LED bulbs. Optical current is used in Li-Fi setup. Light act as a medium from Light Emitting Diodes (LED) to deliver networked mobile, high speed. When the LED light is on, it transmits digital 1, and when off it transmit 0.i.e when the light is on data can be accessed and when it is off data can't be accessed. It is very easy to switch on and off. Visible light communication (VLC) works by switching the current to the LEDs off and on very quickly to be noticed by the human eye.To transmit data continuously Li-Fi LEDs should be kept on.

In future in this method more enhancement can be made by using array of LEDs. Li-Fi technology is a fully networked technology. The current which is supplied to LED bulbs can be up and down with very high speed. The changes when occurred in short time dimming of LED light are converted into electrical signal by the 'receiver'. The electrical signal is converted back into binary data which recognizes as applications that run on internet like audio, web or video. Li-Fi works like infrared technology in television. The inputs turn into binary code and transmitted via infrared light waves which are received by the TV's infrared sensor which decodes light and performs action. Both Wi-Fi and Li-Fi transmit data over the electromagnetic spectrum. The visible light spectrum is two times larger than the entire radio frequency spectrum. Li-Fi method is use of specialized LED driver chips. This entire process happens very fast that human eyes may not even detect it easily.



3. ADVANTAGES OF LI-FI OVER WI-FI

Li-Fi uses light rather than radio frequency signals. Speed of Li-Fi technology is 224 Gbps. The internet speed is high where you can download games, movies etc quickly by Li-Fi technology. In Li-Fi technology data is transmitted through light so it is beneficial as light is available everywhere like in hospitals, street, malls, Airport etc. So internet can be used everywhere where LED light is present.

VLC could be used safely in aircraft without affecting airlines signal. Li-Fi has the advantage of being useful in electromagnetic sensitive areas. It can be used even in underwater without radio interference as salt conducts electricity. Data's are safe as data can't be leaked because signals cannot be passed through walls. It is safe to use even in planes as it doesn't interfere with radio equipment. As Wi-Fi is placed in many hospitals disturbance of computers and phones block the signals from observing and checking the quality of equipments. where Li-Fi overcomes this problems as light are not only allowed in operating room but also it tend to reflect strong in the room. Even it is planned more than 9.8 Mbps speed in a plane. Li-Fi can be used underwater also with the help of headlamps to communicate with each other. Li-Fi uses visible light communication instead of radio frequency waves which has much wider bandwidth so Li-Fi is wireless.LED based technology solves both the indoor location problems and also high speed data communication.

4. FUTURE OF INDIA

At present there is no research going on in India. Process of testing of Li-Fi is going on in Dubai by telecommunication provider. It is also suggested that Apple may build future iphones with Li-Fi technology. After Li-Fi arrives in India there are chances of company setting up its manufacturing plants in India. There are scopes for job seekers in those plants. With the growing number of internet users in India there is more demand for internet technology. In future it is estimated that the world will be exchanging information each month. As radio frequencies are currently in use and regulated that data is going to struggle to find the spot in line. Given the situation, Li-Fi will be of great importance in India. Li-Fi is still in its coming into existence stage but the scope for it is limitless. It is expected that Li-Fi would be cheaper compared to Wi-Fi. Research have reached data rates of over 10 Gbit/sec which is much faster than typical fast broadband in 2013.As there is increasing use of Wi-Fi the radio frequency is getting blocked slowly, there is an increasing number of people who want to connect to internet. The Li-Fi technology helps us to overcome these problems. There are number of bulbs in India which has to be replaced with LED's to transmit data.By using this technology in India every street lamp would be free data access point. The new Li-Fi technology can be managed easily and it is very simple.

5. CONSTRUCTION OF LI-FI

The Li-Fi products consist of four primary sub assemblies:

- RF power amplifier circuit(PA)
- Printed circuit board(PCB)
- bulb
- Enclosure

The PCB houses the micro controller used and controls the electrical inputs and outputs to manage different loop functions

6. USE OF LI-FI INSTEAD OF WI-FI IN INDIA

There is variety of uses in many fields from access to internet using street lamps was found by Li-Fi technology. Such areas, where Wi-Fi cannot be used such as medicine and aircrafts, the alternate option is Li-Fi which provides faster data access rates. In India Wi-Fi can be replaced with Li-Fi in:

6.1 Education System

Replacement of Wi-Fi with Li-Fi can be done in Education Institute and provide fast internet.

6.2 Medical Application

Wi-Fi is not allowed in operation theatres as interference of medical equipments may occur. Here Li-Fi can be used, as Li-Fi uses Light.

6.3 Internet Access in aircrafts

Use of Wi-Fi is strictly not allowed in planes as interference of navigational system may occur. The alternate option is Li-Fi which is very safe and is very fast.

6.4 Underwater Application

Wi-Fi does not work under water in sea but instead of Wi-Fi, Li-Fi can be used as they wear headlamps which can be used to communicate.

6.5 Disaster Management

There are some situations where natural calamities occur at that time Li-Fi can be used for communication which unlike RF is not obstructed by walls.

6.6 Radio Broadcast

A large amount of power is required by radio masts to overcome these problems. Li-Fi can be used as it requires very less power because Li-Fi uses LED lights.

7 CONCLUSION

In this paper, a survey on Li-Fi technology has been discussed. Li-Fi technology is attracting best deal of interest. The magic of light can put into practical use by making world safer and brighter. If this technology will be used then every bulb can be used as hotspots to send data. Even if there are some disadvantages, but they can be eliminated by being careful in further research. It overcomes the limitation of radio spectrum. Li-Fi has stepped forward invention in the world of growing communication. Li-Fi can solve the problems of wireless communications these days. However, in future it will be beneficial to all the common people as it will make work paper free.

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