

Li-Fi: The Future Wireless Communication Technology

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Abstract- Modern world fully relies on wireless internet and cellular mobile services. Wireless services are now essential part of our life. We can't imagine day without internet. The rate at which data is growing and an increase in demand for data transmission is reason for its importance. The data now transmitted through Wi-Fi using radio waves. Radio waves has got its own limitations like bandwidth, interference etc. This paper aims to demonstrate that Li-Fi, which is emerging branch of optical wireless communication, can provide solution for the same. LED^{'s} are used for the purpose of transmissions. The light is a component used for transmission of data, which is a green solution for the problem. The new technology can transmit data at rate 1000 times more than radio waves. Now you can imagine the advantage of new technology. It is said that you can download film in 30 seconds. Li-Fi by using visible light communication technology can provide faster, efficient and secure communication.

Keywords: Li-Fi, VLC, Wi-Fi, LED.

INTRODUCTION

Li-Fi is a new wireless technology to provide connectivity within localized network environment. It was suggested by Dr. Harald Haas (University of Edinburgh in U.K.) in July 2011 TED Global talk. It uses transceiver fitted lamp which can receive information in secure way. Li-Fi data is transmitted by LED bulbs and received by photoreceptor. LED^{'s} can flicker at higher rate which can't be recognized by necked eye. '0' represents off state, '1' represent on state.

Working Principles: The operation procedure is very simple, if LED is ON you transmit a digital 1, if it is OFF you transmit a 0. The LED's can be switched ON and OFF very quickly as shown below.



Fig1: Data series of 1^{'s} and 0^{'s}

Li-Fi bulbs are out fitted with a chip that modulates the light impressibility for optical data transmission. Li-Fi data is transmitted by LED bulbs and received by photoreceptors. A light sensitive device receives the signals and converts back into original data.

Wireless communication using microwave was best option but it has got its own limitation of limited bandwidth as shown in the below figure2

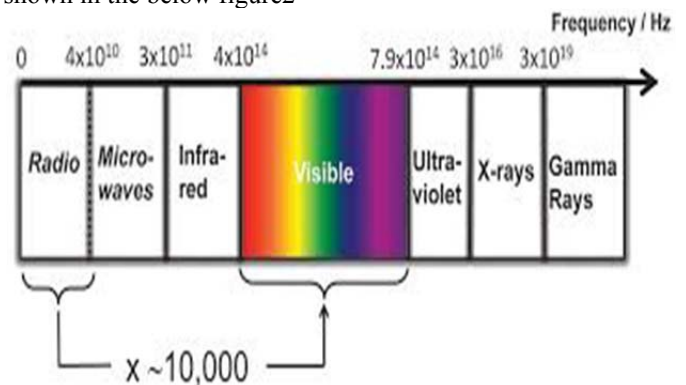


Fig2: Electromagnetic Spectrum

High brightness LED^{'s} are core component of Li-Fi technology. Light emitting diodes can be switched ON and OFF faster since the operating speed of LED is less than μ s, than the human eye can detect causing the light source to be appear continuously. This invisible ON and OFF activity enable a kind of data transmission using binary codes. Switching on and LED is a logical '1', switching OFF is a logical '0'. Encoding of data takes place by varying the rate at which LED speaker ON and OFF to give different strings of 1^{'s} and 0^{'s} as shown in figure1.

Modulation of LED is not recognize by human eye. A photo detector receives the signal and converts it back into original data. Visible light communication is a technology which uses rapid pulse of light to transmit information wirelessly. It is a fast and cheap compare to Wi-Fi. The range of light used for VLC lies b/w 780 nm to 375nm. VLC is a green solution as it uses visible light for its communication. Li-Fi is able to solve the problem of speed and security as vulnerable to hackers as it penetrates two walls easily.

Li-Fi is typically implemented using white LED light bulbs at downlink transmitter. These devices are normally use for

elimination 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 Li-Fi setup. LED^s and a controller that code data into those LED^s is used in combination. Any enhancement can be made in this method like using an array of LED^s for parallel data transmission or using mixture of red, green and blue LED^s to alter the light frequency with each frequency encoding a different data channel.

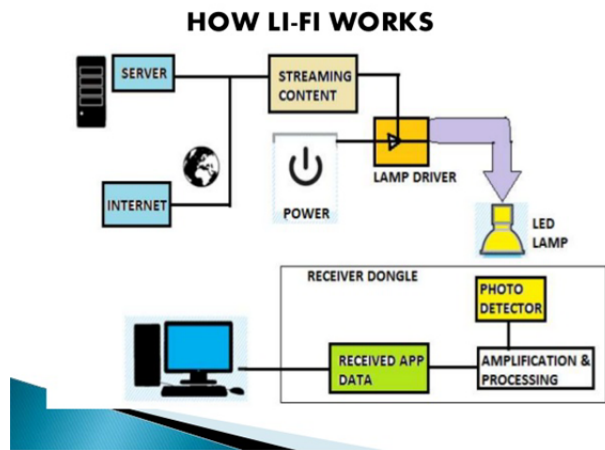


Fig3: Working of Li-Fi

APPLICATIONS:

1. Used in aircraft for communication without affecting airlines signals.
2. Integrated in medical devices and hence used in hospitals, where infrared, Bluetooth and Wi-Fi are banned.
3. Used in street light both as source of light and data.
4. Used in cars as back light to prevent accidents and helpful in traffic control. Traffic light can communicate with car.

COMPARISON OF LI-FI AND WI-FI

Sl.No	Parameter	Li-Fi	Wi-Fi
1	Development year	2011	1999
2	IEEE standard	802.15.7	802.11b
3	Communication	Visible light communication	Radio frequency communication
4	Transmission medium	Visible light waves	Radio waves
5	Carrier	Over optical intensity	Over electric field
6	Cost	less	More
7	Routing device	LED ^s	Access points
8	Availability	Any where	Limited
9	Speed	100Gbps	11Mbps
10	Range	Based on LED illumination	35-140 Mtrs
11	Network topology	Point to Point	Point to Multiple point
12	Interference	No	Interfere
13	Signal to noise ratio	High	Low
14	Security	High	Low

CONCLUSION:

Light is a new technology at its infant stage. It has got waste potential. The main advantage is cleaner and greener technology where mankind will be safe. It is able to solve almost all problems of Wi-Fi like interference, bandwidth, speed, security, cost etc. On-line will become on-light in near future. Scope for future enhancement may be affect of interference from non-LED light sources like sun light or any other light and obviously cost reduction is always a criteria.

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