

Light - fidelity: for high data rate communication

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Abstract— ‘internet’ since last five years we are coming across this word more frequently almost everywhere we are having internet as the cost of usage is getting lower the users of internet is increasing tremendously. As this is used for communication it might be either wired or wireless, as the mobility became a serious factor to be considered wireless has more demand over wired communication. Increase in the users is leading to the decrease in speed gradually. Despite that wifi is providing us with speed of 150mbps according to IEEE 802.11 we are still facing problem in accommodating many users so in order to come up with solution concept of Li-fi came into existing. According to harnald haas a germen phycist ‘ data though illusion’- using the fiber from the fiber optics and transmitting the information using an LED light bulb which can varies intensities faster than the human eye. It is the same idea small band behind infrared which is far more powerful. Haas says that D-LIGHT his invention can transfer data faster than 10 megabytes per second faster than the normal broadband connection.

Index Terms—Wireless- Fidelity (Wi-Fi), Light- Fidelity (Li-Fi), Light emitting diode (LED), Line of sight (LOS), Visible light communication (VLC).

I. INTRODUCTION

Lifi embraces wide range of frequencies and wavelength between infrared and ultraviolet spectrum through visible light. Lifi incorporate sub-gigabit and gigabit-class communication speeds for short, medium and long ranges, it can transfer data both unidirectional and bidirectional and this tender by using line of sight or diffuse links, reflections and much more. This exceptionally talented idea was first formulated by Herald Haas from, university of Edinburgh, UK, in this TED global talk on VCL. He explained “very simple, if the LED is on, transmit digit 1 ; if it’s off , transmit digit 0. The LED’s can be switched on and off very quickly, which gives nice opportunities for transmission of data”.



Figure 1: Data through light

II. APPLICATIONS

The applications of Li-fi and varied reverberation of its key features, such as directional lighting, intrinsic security, high data rate capability, energy efficiency and signal blocking by walls and because of other features Li-Fi has many applications, few among them are,

A. underwater communication

as the sea water is filled with salt radio waves can easily be absorbed which leaves us with short distance communication, but light can penetrate for long distance, therefore Li-Fi can enable communication from driver to driver, driver to mini- submarine, driver to drilling rig etc.,

B. Dense urban environment

as light cannot travel from wall therefore somebody outside the room will not be able to intercept with wireless transmission so, with light we would be able to transmit data more securely.

C. Connectivity

“Internet of everything” our houses are already have installed many lighting. By simply replacing those lights with LED we can enable Li-Fi connectivity not only with devices such as television, computers and Hi-Fi, but also connecting ordinary domestic appliances, such as fridges, washing machines, microwaves and vacuums.

D. EMI sensitivity environment

as in the aircraft these are many radio equipments there are chances of interference of electromagnetic waves because of the electronic gadgets usage. But by using Li-Fi technology EMI interference is completely eliminated.

E. Cost

instead of running around of miles lengthen cables , the LED powered Li-Fi connection can be used easily and connect the devices directly to destination. Using point to point array we can connect buildings near by which in turn reduces with the burden of cables.

F. Traffic updates

Now a days using Li-Fi technology light from the traffic lights gives the information about the traffic updates in which the GPS receives the information directly from the news broadcasting.

III. EXISTING WIRELESS SYSTEMS

Generally wireless communication can be broke down into three categories:

- Short range wireless communication which can communicate devices with the range of few centimeters to several meters. Examples Bluetooth, infrared, zigbee.
- Medium range wireless communication which signal can travel up to 100 meters and so. Examples Li-Fi, Wi-Fi.
- Wide area wireless communication in which the communication can be done from several kilometers to several thousand kilometer. Examples cellular and satellite communications.

a) Bluetooth:

Bluetooth is a type of wireless communication used to transmit data at high speed using radio waves standard protocol for short range radio communication between many different types of devices mobiles, entertainment system and other electronics; the devices should be approximately 10 meters of distance typical data rate is around 2mbps, operates in 2.45GHz frequency band. Every device using Bluetooth has a small microchip that can send data segments in a typical set up one device operates as master and one are more devices like slave. Master uses link manager software to identify other Bluetooth devices to create links with them to be able to send and receive data. It uses a spread- spectrum frequency hopping technology which means it uses multiple frequency at same time limit interference while using multiple devices don not need a direct line of sight as the signal do not carry very far devices need to be within approximately 10 meters. This works great to make calls through audio system in your car or to play music through wireless speaker but it doesn't work well to connect multiple computers in an office. It is also widely used to establish a wireless connection between a computer and various peripheral devices.

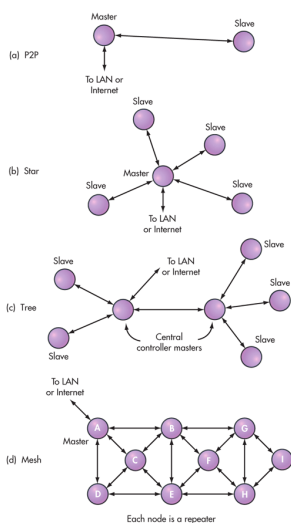


Figure 2: Bluetooth Topology

b) Infrared:

Electromagnetic radiation with wavelength that are just beyond those is visible light. IR wave length is from 700 nanometer to 1 millimeter with the frequency range of 430THz to 800GHz. It is used in thermal sensing detectors, used in short range wireless communication. it is mainly used in remote applications.

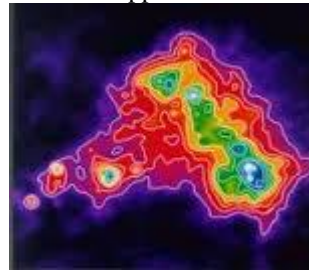


Figure 3: Thermal Sensing using IR

c) Zigbee:

Zigbee is a specification for a suite of high level communication protocols. Used to create PAN built from small, low power digital radios. It limits the transmission distance from 10 -100 meters range. Zigbee has a defined bit rate of 250Kbps, which is developed by zigbee alliances formed by 150 companies and standardized n 2003. IEEE standardization is IEEE 802.15.4 with a operating frequency of 868MHz to 250GHz. zigbee devices can transmit data over long distance passing data through a mesh network of intermediate devices to teach more distant one more over than a Bluetooth or an Wi-Fi.

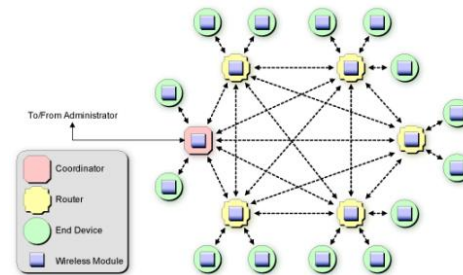


Figure 4: Zigbee Topology

d) Wi-Fi:

According to institute of electrical and electronics engineering (IEEE) 802.11 standard, Wi-Fi is a wireless local area network (WLAN) used to connect electronic devices in a medium range. Range of Wi-Fi is up to 100 meters, frequency ranges from 2.4GHz to 5GHz which carries more data and a data rate up to 10Mbps. First version of Wi-Fi is 802.11b which has 2.4GHz frequency and has a data rate of 11Mbps, this is most slowest and least expensive Wi-Fi. Later on it is developed to 802.11g this is version it has the data rate of about 52Mbps and it the faster it's version, this is again developed to 802.11awith 54Mbps data rate and 5GHz frequency. Latest version of Wi-Fi is 802.11n with 140 Mbps and operates at a frequency of 2.4 and 5GHZ this uses multiple data stream at a same channel where as a, b and c are single data stream.

Wi-Fi card is used in order to establish a wireless connection using Wi-Fi technology. These cards have a standard features on most of the laptops and mobile phones newer cards are compatible with all the different current version of 802.11 standard.

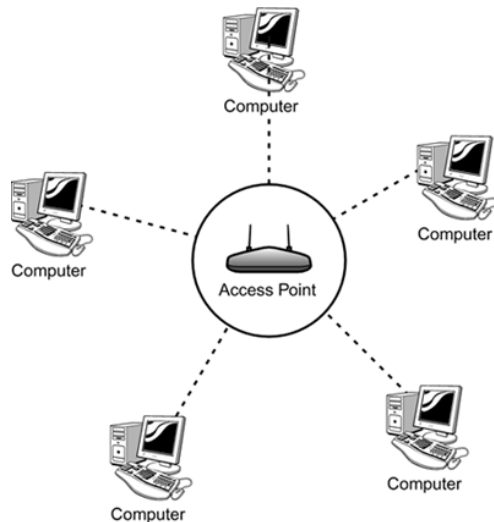


Figure 5: Wi-Fi Topology

IV. PROPOSED METHOD FOR MEDIUM RANGE COMMUNICATION

Li-Fi:

In wireless medium range type of communication Li-Fi is the best method. Li-Fi is a light based communication technology where data rate is high. In this method data is delivered and received in a high- speed and bidirectional network with frequency band of 430-790THz and wavelength is from 390-700nanometers.

Li-Fi uses the visible light portion in the electromagnetic spectrum for communication purpose. Where the data is transmitted by modulating the intensity of light based and electro signal using LED and which is sensed by photo detectors and the light is converted based into electric form. Li-Fi is bracted of optical wireless communication (OWC), which includes infrared, ultraviolet and visible light.

Design of Li-Fi:

While designing a Li-Fi few key factors have to be mainly consider they are:-

- 1.presence of light
- 2.line of sight (LOS)

Its architecture mainly consists of LED bulbs and many wireless devices connected.



Figure 6: Design of Li-Fi

Construction of Li-Fi:

We use Li-Fi for fast communication through light which is operated by simple process when the LED is ON it transmits 1 if it is OFF it transmits 0. So accordingly we need

controls that code data into those LED's. only thing is to vary the rate at which LED has to flicker according to the coded data. We can enhance the technique by using array of LED's for parallel data transmission. Parallel data transmission means enabling sequential connectors from one set of light to next set of light through networking session.

Working of Li-Fi:

Li-Fi mainly works based on two key factors they are :

1. light emission
2. Light absorption.

The data that needs to be transmitted is in electrical form and it is converted to optical or light from using light emitting diodes LED's by modulating intensities.

The modulated light was absorbed or detected by the receiver which was in line of sight (LOS). Here photo detector devices like photo resistive devices observe the modulated light and convert to original transmitted electric pulses.

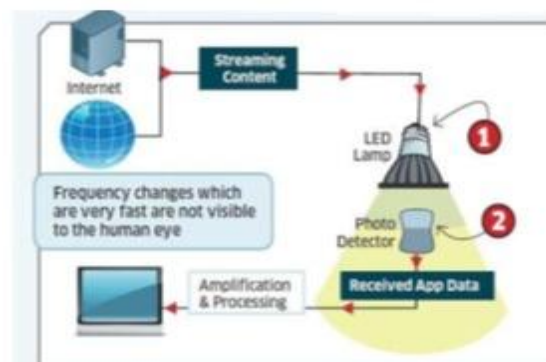


Figure 7: Working of Li-Fi

Comparison with various technologies:

Method	Data rate
Wi-Fi	150Mbps
Bluetooth	3 Gbps
Li-Fi	10 Gbps

V. CONCLUSION

Li-Fi can be a well renowned wireless technology .Though it was not able to replace traditional wireless systems, it can enhance the multiple users application system and purposeful high rate data transmission .They place a major role to overcome the security problems and confining the network area.

VI. REFERENCES

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