A STUDY OF THE TECHNOLOGY OF LI-FI*

BY

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ABSTRACT

Li-fi is a future based data transfer technology in which a light emmiting diode is used to transfer all data. It is the vital component and acts as an reciever . Li-fi or Light Fidelity was invented by Professor Harald Hass of university of Edinburgh (Harald Hass, 2016). It is basically 5G technology of visible light communication system which utilizes light emitting diodes as a medium of high speed communication in similar manner as Wi- Fi.Nowadays every technology requires a high communication and data transfer speed the li-fi is one of that bias.

KEYWORDS

LI-FI, WI-FI, data transfer, 5g, Light Emmiting Diode.

I.INTRODUCTION

Li-fi (light fidelity) may be a bidirectional wireless system that transmits data via LED or infrared . It was first unveiled in 2011 and, unlike wifi, which uses frequency , Li-fi technology only needs a light-weight source with a chip to transmit an online signal through light waves. This is a unprecedented advance over today's wireless networks. Li-fi multiplies the speed and bandwidth of wi-fi, 3G and 4G. The latter have a limited capacity and become saturated when the amount of users surfing increases, causing them to crash, reducing speeds and even interrupting the connection. With Li-fi, however, its band frequency of 200,000 GHz, versus the utmost 5 GHz of the wifi, is

100 times faster and may transmit far more information per second. A 2017 study by the University of Eindhoven obtained a download rate of

42.8 Gbit/s with infrared with a radius of two .5 metres, when the simplest wifi would barely reach 300 Mbit/s.

II. BASIC PRINCIPLE AND DESIGN OF LI-FI

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This idea works very simply, if the led is on then logic “1” are going to be transmitted and if the led is off then logic “0” are going to be transmitted also, LEDs are often switched on and off very quickly which adds onto another advantage. We can easily transfer our powerful data even with just help of simple visible light.

Architecture consists of variety of LED bulbs or lamps including many wireless devices like Mobile Phones, Laptops. The following factors should be taken into concern while designing Li-Fi:

1.Presence of light.

2.Line of sight (LOS).

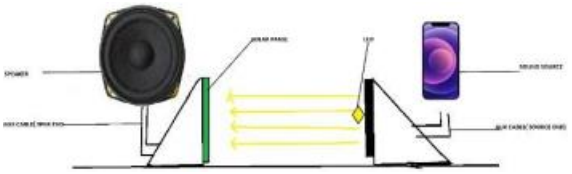
3.For better performance use fluorescent light and LED.

4.

A photo detector received data.

III.METHODLOGY of Li-fi:

On basis of previously based research we made a working model on Li-fi which uses a simple data transfers of music from mobile phone to the speaker using Li-fi. So, basically we will explain with the help of figure.



.fig.1

In our experiment we have done data transmission through lifi technology. In this we have tried to transmit audio signal over lifi. We have to take an aux cable or instead we can use headphone also with a sound box. Byu cutting the aux cable into two equal parts we get wires inside the cable .We have to connect the wire to solar panel and another aux cable wire connected with LED .Connect one end of resistor with LED and another with battery clip .After making all the connections of the devices we get a circuit .After plugging 1 end of aux cable in our mobile phones we get the LED glow. Fixing all the connections to cardboard, we connect another aux cable to a sound box. We get to see the music played in a sound box when we place the solar panel in front of our glowing LED .When solar panel is placed in front of glowing LED the data from mobile is transferred to solar panel through modulated light .As LED light used as signal source between 2 end systems .The '1' and '0' are the flashes of LED of 'on' and 'off' respectively ,which modulates the input signals of transmitter.The receiver part which is

solar panel catches these binary stream of '1' and '0' using a photodiode and amplifies the signal to produce the output.

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MATERIALS USED:

1) Aux cable 2)LED

3)20 ohm resistor

4)9 volt battery

5)solar panel

6)audio amplifier(speaker)

I)AUX cable:

They are single wire that lets you experience stereo sound effect without the hassle of managing multiple cables. They are better at providing superior sound quality using these cables by which the sound or audio may be listened more fluently. We have used it to transfer the sound waves to the amplifier.

Fig :2

II)LED :- Light emitting diode (LED) is a semiconductor device which emits light when electric current is through it .LED is an advanced device

,became more efficient and less expensive and it is easily used .Also been a PN junction diode it responds quickly to emit light when activated and to stop emitting the light when deactivated.Inour model of li- fi this is the most important device used to transmit sound waves from the mobile phone. The voltage is upto 1v to 1.5v as the LED of 1v can generate sufficient voltage and power to transmit audio signals

Fig:3

III)9 V battery :-

It is either disposable or rechargeable. It can also power up many devices.But in our case we have used disposable. After some readings we have used 9v batteryAs 12 v battery can blast an LED.

Fig :4

IV)20 ohm resistor:-

The resistor in electronic circuits is to limit current flow, to adjust signal levels and to terminate transmission lines among other user. They also act to lower voltage levels within the circuit. As in parallel circuit,20 ohm resistor equals the current flow. The LED is attached directly to the resistor. 20 ohm is sufficient to protect 1.5v LED from burns. It will not be seen from the top as we have directly attached in a socket.

V)Solar panel:

Solar panel is a photo reciever which converts direct sun light into electrical energy (D.C).Its energy is stored into battery and used lateron. But in our mode we are using it as a reciever of LED signals..

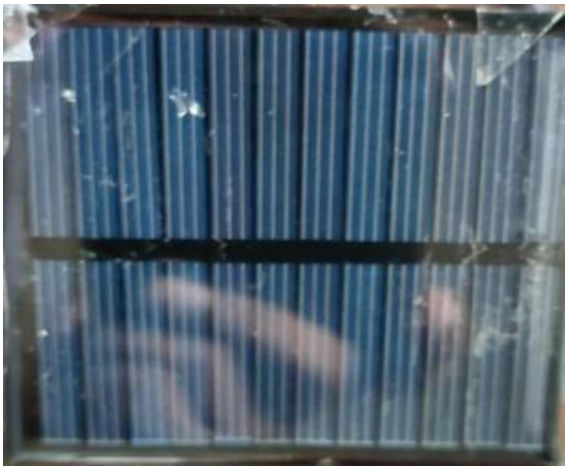

Fig :5

VI)Audio amplifier

Audio amplifier basically used to amplify the signals or to increase amplitude and frequency of t he audio signals. We are also using same feature for amplifying audio signala as the signals are not much effective.

Fig :6

IV)Contrievence of li-fi. (Nischay, 2017)

Li-Fi is typically implments using white LED light bulbs in reference with photo receiver. The LEDs are used for illumination only on applying a continuing current to them. However, by fast and subtle variations of the present , the optical output are often made to vary at extremely high speeds. This very property of optical current is employed in Li-Fi technology setup. The data is processed in binary for it means 0,1. which means that the 1= on, 2= off. The LED flickers very fast that a normal human eye cant even catch it and render. Hence the photo diode uses it and convert it into meaningful data. It is so fast that a person can play any high definition game at ultra graphics with upto 10mb/s link speed.

In figure a internet connection is connected to the lamp driver. A switch with lamp driver and LED lamp also connected to the present lamp driver through fiber optic cable. Now a receiving device, photo detector is employed for receive signal then to perform further processing, this

device is then connected to PC's or Laptop's LAN port. On one end all the info are going to be streamed to a lamp driver when the LED is switched on the microchip converts the digital data or the logic data in light form. The light detector receives the sunshine signal then convert it again into the first digital form

V)Why only visible light?

Just take a look at light specteum-

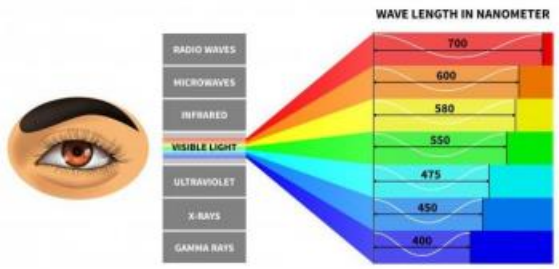

Fig. :7

we can now point as (pyle, 1991)

1.Radio waves

2.Micro waves

3.Infrared

4.Visible light

5.Ultraviolet

6.X- rays

7.Gamma rays.

- Radio waves can penetrate through walls which create safety and privacy issues.
- Microwaves can't be use as mode for communication.
- Infrared waves can create eye problem if operated at high frequency.
- Gamma rays can be proved more harmful for body
- Ultraviolet is perfect only if there are less human.Otherwise its bit harmful.
- X-rays have also same issues of human penetration.
- We only remain with visible light. This is the only light which can only used for our safe, secure and reliable communication without any safety issues and harm to human.

VI)Comparision of wi-fi over Li-fi (pyle, 1991)

Wi-Fi is great for general wireless coverage within buildings, and Li-Fi is ideal for high-density wireless data coverage in confined area and for relieving radio interference issues, so the two technologies can be considered complimentary

Fiedility	Speed	Data density
Wireless		
Wi-fi	150mbps	**
irDAO	4mbps	*
Bluetooth	5mbps	***
Li-fi	2Gbps	*****

**Citation[International Journal of Computer Science and Mobile Computing a Monthly Journal of Computer Science and Information Technology]

VII)Future Scope and challenges. (Harald Hass, 2016)

As the future demands the needs of li-fi we will find a nice path for development of li-fi as a wireless technology for easily accessible for people.

Paris is one of the country implemented with li-fi the offices, hospitals, retail stores, public street lighting as well as metro station at L Defense, and Curtius museum in Liege in 2012.

The challenges we can face are infrastructure and literature among all aspects, Li-Fi will probably not completely replace Wi-Fi, as it has shown some negative results in outdoor ranges where sunlight is avail. Although it has given a high performance in transfer rate.

VIII]APPLICATIONS (Nischay, 2017)

Spectrum Relief:

With the rise of telephone users, the available bandwidth is insufficient and may cause over loaded condition. This problem are often solved by Li-Fi which uses the color spectrum for communication.

Mobile Connectivity: Various devices like Laptops, Mobile Phones, Tablets and other devices are often interconnected directly by using Li-Fi. It gives very high data rates and also provide security.

Hazardous Environments:

Li-Fi may be a safe alternative as compared to radio waves as in radio waves the electromagnetic interference takes place in environments like mines and petrochemical plants.

Underwater Communication:

To use frequency in underwater communication are often impractical thanks to strong signal absorption in water. Li-Fi provides an undue advantage in this case.

VI)CONCLUSION:

As we even when the science has achived many more today still some contries and small states cant even afford the internet as the contries have made internet very expensive. In oman 22 rial is the price of internet only 1.5gb/day. If in reference to India it is upto 22 rs only. Thus, in consideration of Li-fi it is still expensive. The only way to overcome Is to make Li-fi a moderate using feature in future.Hereby we conclude that li-fi is tested very speedy and always reliable to us.

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