

COMMUNICATION THROUGH LI-FI WIRELESS TECHNOLOGY

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ABSTRACT : Li-Fi technology is one of the future technologies in wireless communication sector. This term is used to describe visible light communication technology applied to high speed wireless communication. This technology transfer data through wireless. As we are communicating we expect that data should be transferred securely and fastly. Li-Fi is a bidirectional with a very high speed and is a fully networked communication which is open source. This paper investigates communication through Li-Fi using LED as a source over Wi-Fi. Data transmission takes place from this LED bulb by varying the current at extremely high speeds which undetectable by the human eye.

KEY WORDS : LED (Light emitted diode), Wi-Fi, VLC

1.INTRODUCTION:

Li-Fi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb that varies in intensity faster than the human eye can follow. Li-Fi is the term some have used to label the fast and cheap wireless-communication system, which is the optical version of Wi-Fi. The term was first used in this context by Harald Haas in his TED Global talk on Visible Light Communication. "At the heart of this technology is a new generation of high brightness light-emitting diodes", you transmit a digital 1, if it's off you transmit a 0,"Haas says, "They can be switched on and off very quickly, which gives nice opportunities for transmitted data. "It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant. More sophisticated techniques could dramatically increase VLC data rate. For parallel data transmission using array of LEDs, where each LED transmits a different data stream. Other group are using mixtures of red, green and blue LEDs to alter the light frequency encoding a different data channel Li-Fi.

The idea behind Li-fi is implemented by using white LED light bulbs at the downlink Transmitter. For illumination, a constant current is applied to LEDs. The optical output can be made to vary at very high speeds, by fast variations of the input current. It works as, when the LED is on then the logic "1" is transmitted and when the LED is off then the logic 0 is given. LED's flickering occurs at a very fast rate and which is not visible to the human eye. In this method much advancement could be possible by use of an array of LEDs for parallel data transmission.

2.IMPLEMENTATION OF LI-FI

These types of advancements promises a speed of 10Gbps – that is one can download a full HD film in just 30 seconds. Internet connection switch and LED lamp are all connected to the lamp driver through optical fiber cable. Photo detector receives the signal and performs further operations. Detector is further connected to PC's, Laptops or LAN port. When the LED is ON, the conversion of the digital data into the light form is done by microchip. On receiving the light signal the Light detector converts it again into the original digital form.

WORKING OF Li-Fi:

Dr. Harald Haas in his TED Global Talk (2011) on Visible Light Communications proposed a technology in order to overcome the radio spectrum congestion.

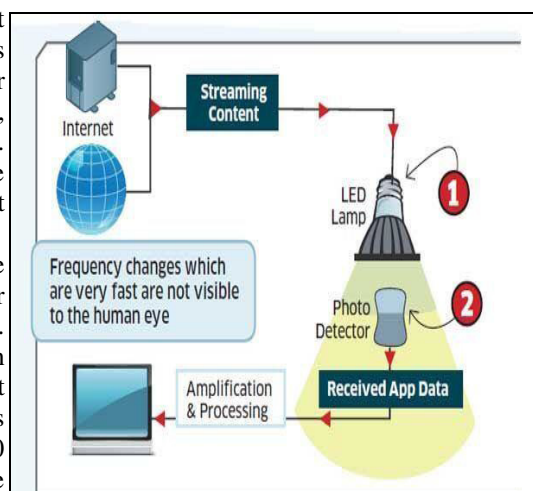


Fig1: working of li-fi

In this Dr. Haas demonstrated his invention called D-Light, which he also referred to as “data through illumination”. The technique behind D-Light was to transfer data at speeds exceeding 10 Mbps using light waves from an ordinary table lamp to a nearby computer. This technology known as Light Fidelity or Li-Fi stands for the data transmission through visible light and is therefore considered as an optical version of Wireless Fidelity or Wi-Fi. Li-Fi is usually implemented using LED lights at the transmitter end. Normally, LED light bulbs are used as a source of illumination by applying a constant current. However, by varying the current too fast LED light bulb’s output can be made to fluctuate at extremely high speeds. If the LED is switched on then the data transmitted is a digital one and if the LED is switched off, then the data transmitted is zero. This high speed fluctuation of the LED light will be undetectable to the human eye, appearing as if the LED is constantly lit. Further variations can be made to this setup by using an array of LEDs for parallel data transmission, or using a combination of red, green and blue LEDs and altering each light’s frequency for encoding a different data channel. Such variations can promise transfer of data at a speed of 10Gbps or more. The key advantage of using Li-Fi technology is increased security, as light cannot penetrate walls. Since visible light is the carrier, Li-Fi sources are intolerant to noises and disturbances. The use of LED light bulbs could mean that every street lamp could be a potential access point. One of the disadvantages of this technology would be that Li-Fi only works in Line of Sight (LOS) .

However, comparing Wi-Fi and Li-Fi technologies, Li-Fi aims to resolve many issues faced by Wi-Fi mainly in terms of capacity, efficiency, availability and security. With over 10,000 times more bandwidth than Radio Spectrum, there is no concern over bandwidth overcrowding in Visible Spectrum. LED light bulbs can be used for both illumination and data transmission which would be less expensive but a highly efficient solution.

Principle of Light Fidelity

The main component of Li-Fi technology is Light Emitting Diodes (LED) light bulbs. Data is encoded in light by operating LED light bulbs at very high speeds using data encoding techniques. The main advantage of using LED light bulbs is that it can produce high brightness and hence provide illumination .

It is needed to transmit data along with LED light bulb. Depending on the data to be transmitted, the rate of switching on and off the LED light bulb can be varied. Usually an array of LED light bulbs is employed to increase the rate of data transmission. The different colored LEDs in the array can be attributed to different data channels .Data source Data, so can either be internet or a web server can be

encoded in LED light bulb and transmitted. Data encoding can be achieved at the transmitting end by flickering the LED light bulbs at very high speeds invisible to the human eye or by varying the light bulb intensity. This light with the encoded data in it is then received at the receiving end by a photo detector. The photo detector detects and decodes the data, amplifies it and sends it to the end receiver which can either be a mobile device or a computer .The lamp driver contains the streamed and encoded data from the internet. The LED light bulb used to transmit the data contains a microchip. This microchip on switching the LED light converts the digital data to light waves which are then transmitted. These transmitted waves are received at the receiving end by a photo detector, which is then amplified, decoded and converted back to its original format. This message is then transmitted to the end receiver which can either be a mobile device or a computer. Working architecture of data transmission using LED light source is explained in Fig 1 above.

COMPARISION BETWEEN Li-Fi & Wi-Fi

LI-FI is a term used to describe visible light communication technology provide to high speed wireless communication. It has given this name due to the same to WI-FI, only using light instead of radio wave. WI-FI is good for area under within buildings, and li-fi is ideal for high density wireless data coverage in small and under a wall area and for solving radio wave issues, so the two technologies can be considered opposite to each other.

Technology	Speed	Data density
Current wireless		
Wi-Fi – IEEE	150 Mbps	*
Bluetooth	3Mbps	*
IrDA4	Mbps	***
Future wireless		
Li-Fi	>1Gbps	***

Table 1.Comparison between current and future wireless

From the table as in current Wi-Fi , Bluetooth, IrDA has only150 mbps of higher data rate .But Li-Fi has higher data speed than the current technology

Application of Li-Fi

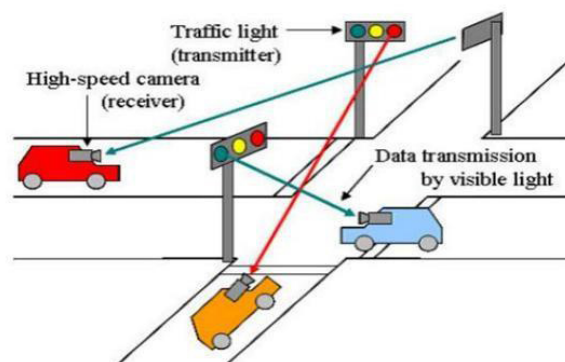


Smarter Power Plants

Wi-Fi and many other radiation types are bad for sensitive areas. Like those surrounding power plants. But power plants need fast, inter connected data systems to monitor things like demand, grid integrity and core temperature. The savings from proper monitoring at a single power plant can add up to hundreds of thousands of rupees. Li-Fi could offer safe, abundant connectivity for all areas of these sensitive locations. Not only would this save money related to currently implemented solutions, but the draw on a power plant's own reserves could be lessened if they haven't yet converted to LED lighting. It can be used in other area also like

1 Hospitals- Li-Fi can be used in modern instrument.

2 In traffic signals Li-Fi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased.



3 In public place like in Colleges, Bus, Bank for large amount of use.

Benefits of Li-Fi:

Higher speeds than Wi-Fi. 10000 times the frequency spectrum of radio. More secure because data cannot be intercepted without a clear line of sight. Eliminates neighboring network interference. Does not create interference in sensitive electronics, making it better for use in environments like hospitals and aircraft

CHALLENGES FOR 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 be shift in indoors. A major challenge is how the receiving device will transmit data back to can't transmitter. Other disadvantage is visible light and is penetrate through brick walls as radio waves easily blocked by somebody simply walking in front of LED source

CONCLUSION AND FUTUER SCOPE

In this technology number of possibilities for addition of development further. If this technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will develop a new cleaner, secure, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless is not allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight.

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