Li-Fi Technology

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ABSTRACT:-

Whether you're using wireless internet in a coffee shop, stealing it from the guy next door, or competing for bandwidth at a conference, you've probably gotten frustrated at the slow speedsyou face when more than one device is tapped into the network.

As more and more people and their many devices access wireless internet, clogged airwaves are going to make it increasingly difficult to latch onto a reliable signal. But radio waves are just one part of the spectrum that can carry our data. What if we could use other waves to surf the internet?

One German physicist,DR. Harald Haas, has come up with a solution he calls "Data Through Illumination"—taking the fiber out of fiber optics by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. It's the same idea behind infrared remote controls, but far more powerful. Haas says his invention, which he calls D-Light, can produce data rates faster than 10 megabits per second, which is speedier than your average broadband connection. He envisions a future where data for laptops, smartphones, and tablets is transmitted through the light in a room. And security would be a snap—if you can't see the light, you can't access the data.

Li-Fi is a VLC, visible light communication,

Technology developed by a team of scientists including Dr Gordon Povey, Prof. Harald Haas and Dr Mostafa Afgani at the University of Edinburgh. The term Li-Fi was coined by Prof. Haas when he amazed people by streaming high-definition video from a standard LED lamp, at TED Global in July 2011. Li-Fi is now part of the Visible Light Communications (VLC) PAN IEEE 802.15.7 standard. "Li-Fi is typically implemented using white LED light bulbs. These devices are normally used for illumination by applying a constant current through the LED. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds.

Unseen by the human eye, this variation is used to carry high-speed data," says Dr Povey, , Product Manager of the University of Edinburgh's Li-Fi Program 'D-Light Project'.

In simple terms, Li-Fi can be thought of as a light- based Wi-Fi. That is, it uses light instead of radio waves to transmit information. And instead of Wi- Fi modems, Li-Fi would use transceiver-fitted LED lamps that can light a room as well as transmit and receive information. Since simple light bulbs are used, there can technically be any number of access points.

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 eyes cannot notice, so the output appears constant.

INTRODUCTION:-

Li-Fi stands for 'Light Fidelity'.

It is a VLC(Visible Light Communication), technology developed by team of scientists including Dr. Gorden Povey, Prof. Harald Hass and Dr. Mostafa Afgani at University of Edinburgh

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1.DESIGN OF LI-FI TECHNOLOGY

Li-Fi architecture consists of number of LED bulbs or lamps including many wireless devices such as mobile phones, laptops. Main objective is to built a prototype using the shelf electronic devices, and establish a successful link for transmission of digital data and provide a working of li-fi system. The following factors should be taken into consideration while design of Li-Fi:

1) Presence of light
2) For better performance use LED or fluorescent light
3) Line of Sight(LoS)

2.IMPLEMENTATION OF LI-FI

Li-Fi is typically implemented using white LED light bulbs at the downlink transmitter. These devices are normally used for illumination only 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. The operational procedure is very simple-, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. Hence all that is required is some LEDs and a controller that code data into those LEDs. All one has to do is to vary the rate at which the LED's flicker depending upon the data we want to encode.

Further enhancements can be made in this method, like using an array of LEDs for parallel data transmission, or using mixtures of red, green and blue LEDs to alter the light's frequency with each frequency encoding a different data channel. Such advancements promise a theoretical speed of 10 Gbps – meaning one can download a full high- definition film in just 30 seconds.

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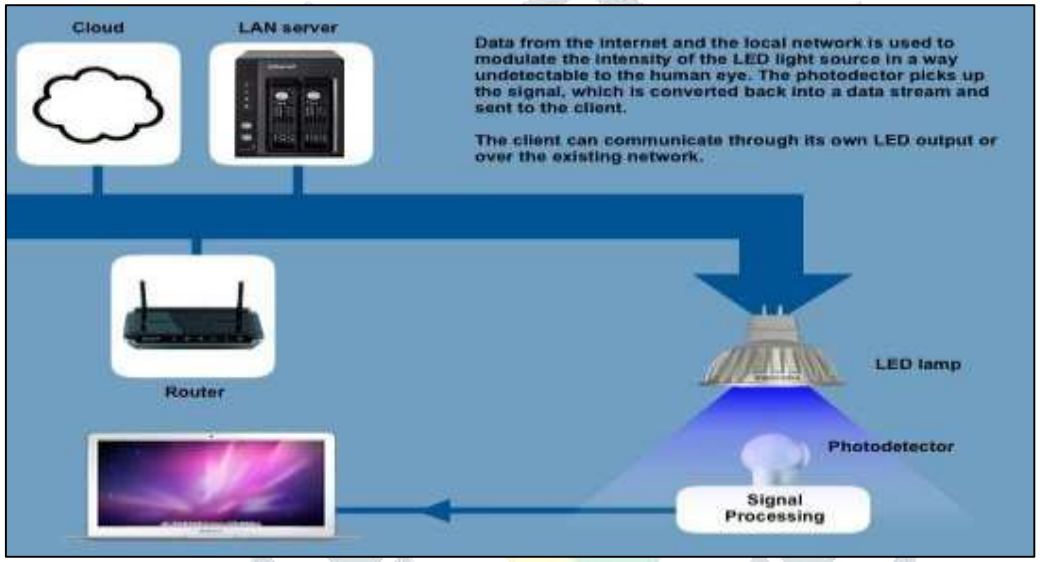
Li-Fi is the term have been used to label the fast and cheap wireless communication system, which is the optical version of Wi – Fi .

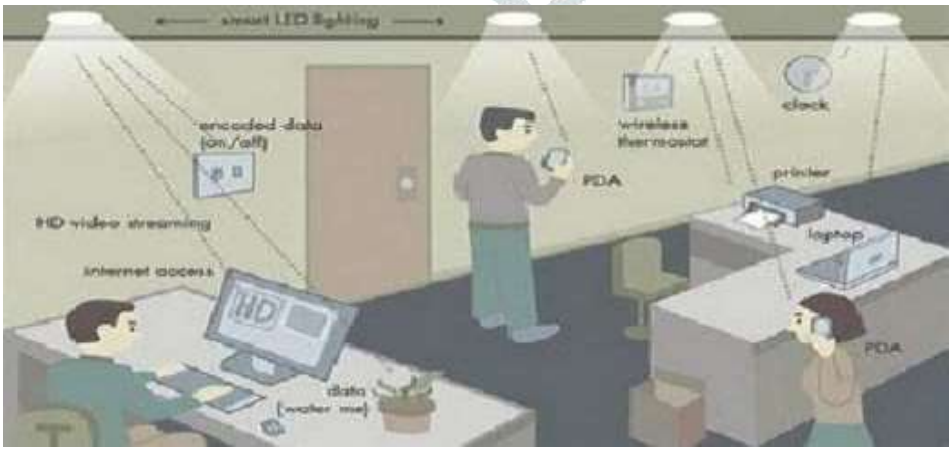
Li-Fi is light based Wi-Fi that is, it uses light instead of radio waves to transmit information



To further get a grasp of Li-Fi consider an IR remote. It sends a single data stream of bits at the rate of 10,000-20,000 bps.

Now replace the IR LED with a Light Box containing a large LED array.

This system is capable of sending thousands of such streams at very fast rate.



Light is inherently safe and can be used in places where radio frequency communication is often deemed problematic, such as in aircraft cabins or hospitals.

So visible light communication not only has the potential to solve the problem of lack of spectrum space, but can also enable novel application.

The visible light spectrum is unused, it's not regulated, and can be used for communication at very high speeds.

Li-Fi technology is implemented using white LED bulbs. The LED are used only on applying a constant current to them. Optical current is used in Li-Fi technology setup.

Its operation is very simple, if LED is on then logic is 1 and if LED is off then logic is '0'.The data speed is marked upto 10gbps.

Using RGB technology the researchers have marked the speed upto 100gbps. One can download a full High-Definition film in just 30 seconds.

3. ADVANTAGES OF LI-FI:-

0. Efficient: It works on visible light technology.. Since home and offices have LED bulbs for lightning purposes.so that same light can be used for transmission of data. Hence it is efficient in terms of cost and energy.

1. Availability: The presence of light is everywhere in the surrounding. Meaning is that the high speed transmission could be available everywhere.

2. Security: Since light cannot pass through the opaque structures, so LI-Fi technology is used within a room and cannot be breached by other users or other buildings.

4. DISADVANTAGES OF LI-FI:-

1) Internet cannot be used without a light source. This could limit the locations.
2) One of the biggest drawbacks is the interception of signal outdoors. Other sources might interfere with the signals.
3) Whole new infrastructure of Li-Fi need to be constructed.

5. APPLICATIONS:-

Mobile Connectivity: mobile phones, tablets, and other devices can be connected directly using LI-Fi. It gives the highest data rate and also provide security.

Underwater Communication: To use radio frequency in underwater communication can be impractical due to strong signal absorption in water. Li-Fi provides an undue advantage in this case.

Industrial Plants: Li-Fi is a safe alternative as compared to radio waves as in radio waves the electromagnetic interference takes place in environments such as mines and petrochemical plants.

6. FEATURES:-

Bandwidth: The visible light spectrum is plentiful, much more than RF and also is free to use Data Density:. Li-Fi can achieve 1000 times the data density of Wi-Fi, as visible light can be well contained in the light illumination but in case of RF it suffers from interference.

High Speed: A very high speed of data access can be achieved from Li-Fi as it is free from interference and also is having a very large bandwidth.

CONCLUSIONS:-

With the ongoing increase in the cellular networks, the newest technology of Li-Fi has proven to be a milestone in communication systems.

It uses the visible spectrum of light which is far better than the RF as it is prone to interference. With the use of LEDs the information can be transmitted at very high rates with just the simple turning on and off of the LEDs.

This technology is not only free to use but also provides a safe and secure access.

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