

Light-Fidelity (Li-Fi) Revelation and How Radio Waves Can Help Li-Fi Technology Limitation

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Abstract: Nowadays almost all the peoples are using internet to accomplish their task through wired or wireless network. As number of users are increases in using wireless network , speed decreases . Though Wi-Fi gives us speed up to 150Mbps as per IEEE 802.11n, which is not sufficient to accommodate number of desired users. To remedy this limitation of Wi-Fi, we are introducing the new concept of Li-Fi technology. Li-Fi stands for the Light Fidelity.

Thus radio waves can help Li-Fi technology to overcome its few shortcomings in the following 2 ways:

- 1) It allows the data to penetrate through walls.
- 2) There is no requirement of continuous line-of-sight as is required in Li-Fi

Keywords: Li-Fi construction, Li-Fi applications , Li-Fi advantages ,Li-Fi limitation , Proposed system.

I. Introduction

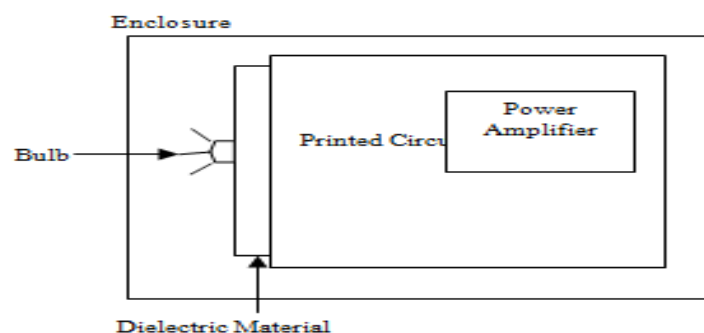
Li-Fi is a new technology which uses visible light for communication instead of radio waves. It refers to 5G Visible Light Communication systems using Light Emitting Diodes as a medium to high-speed communication in a similar manner as Wi-Fi [3]. It can help to conserve a large amount of electricity by transmitting data through light bulbs and other such lighting equipments. It can be used in aircrafts without causing any kind of interference. Li-Fi uses light as a carrier as opposed to traditional use of radio waves as in Wi-Fi and this means that it cannot penetrate walls, which the radio waves are able to. It is typically implemented using white LED bulbs at the downlink transmitter [2]. By varying the current through the LED at a very high speed, we can vary the output at very high speeds. This is the principle of the Li-Fi. The working of the Li-Fi is itself very simple—if the LED is ON, the signal transmitted is a digital 1 whereas if it is off, the signal transmitted is a digital 0. By varying the rate at which the LEDs flicker, we can encode various data and transmit it.

Li-Fi is no longer a concept or an idea but a proven technology, albeit still at its infancy. Already, several experts in the field of communication have attested that Li-Fi technology would soon become a standard adjunct to Wi-Fi. That is, until its inherent limitations could be overcome. Since it is light-based, its major drawback is that it won't be able to penetrate solid objects such as walls. Though it could also mean privacy for the personal user, it also questions its use for large-scale delivery of data transmissions

II. Summary Of Li-Fi Construction

Li-Fi □ offers an integrated light source that is straightforward to integrate into a projector In this example Li-Fi □ consists of 5 primary sub-assemblies:

- □ Printed circuit board (PCB)
- □ RF power amplifier (PA)
- □ Bulb
- □ Optics
- □ Enclosure



III. Applications of Li-Fi.

Some of the applications are discussed below:

- (a) Education System:** Li-Fi can replace Wi-Fi in educational institutions and provide faster internet speeds. All the people can make use of the same speed as has been designated.
- (b) Medical Applications:** Wi-Fi is not allowed operation theaters because they can interfere with medical equipments. Moreover, their radiations pose risks for patients. Li-Fi uses light and hence can be used in place of Wi-Fi
- (c) Internet access in aircrafts:** The use of Wi-Fi is prohibited inside airplanes because they can interfere with the navigational systems of the plane. The users get access to very low speed internet at high rates. Thus, Li-Fi is a safe alternative to Wi-Fi in aircrafts since it uses light and can provide faster internet access.
- (d) Underwater applications:**
Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. But the tether used in ROVs is not long enough to allow them to explore larger areas. If their wires were replaced with light — say from a submerged, high powered lamp — then they would be much freer to explore. They could also use their headlamps to communicate with each other, processing data autonomously and sending their findings periodically back to the surface [4]. Li-Fi can even work underwater where Wi-Fi fails completely, thereby throwing open endless opportunities for military operations
- (e) Disaster Management:** In times of natural calamities such earthquakes, Li-Fi can be used as a powerful means of communication since it uses light which unlike RF is not obstructed by walls or other such things.
- (f) Radio broadcast:** A large amount of power is required by radio masts in order to broadcast and this makes them quite inefficient. LEDs on the other hand require very low power to

IV. Advantages Of Li-Fi

- □*Capacity:* Visible light spectrum is 10000 times bigger than RF spectrum. It is predicted that will we run out of the RF spectrum *Capacity:* Visible light spectrum is 10000 times bigger than RF spectrum. It is predicted that will we run out of the RF spectrum by 2020.
- □*Security:* Light cannot penetrate walls, but radio waves can, thus security is higher in using Li-Fi.
- □*Efficiency:* The 1 million radio masts base stations consume a lot of energy, which indeed is used to cool the base stations and not to transmit radio waves. These base stations have poor efficiency up to only 5%.Whereas Li-Fi uses the 2.4 billion led lamps which offers a much higher efficiency.
- □*Transmission of data:* Wi-Fi transmits data serially and Li-Fi transmits thousands of data streams parallelly thus offering higher speed [5].
- □*Infrastructure:* It is already existing. Inexpensive devices, mostly powered by LED, so it is cost effective, compared to base stations.

V. Limitations Of Li-Fi

Li-Fi technology is not without drawbacks. As there is inability of light to penetrate solid surfaces, so transmitter and receiver need to be aligned in order to establish a peer to peer connection. Service Providers while providing VLC services has to consider major issues like reliability and availability of system. Companies also need to consider how to maintain coverage area of network. The communication can be restricted due to the Interferences coming from different sources for example sun light, normal bulbs and any non-transparent materials in the path of transmission. VLC system has high Initial Installation cost but when it is implemented at large scale area it can accommodate us by its less operating cost like electricity bills ,less operational staff and limited maintenance charges as compare to RF system.

VI. Proposed System

a) Components

-Harmonic oscillator

The harmonic oscillator produces a sinusoidal output. The basic form of a harmonic oscillator is an electronic amplifier with the output attached to a narrow-band electronic filter, and the output of the filter attached to the input of the amplifier. When the power supply to the amplifier is first switched on, the amplifier's output consists only of noise. The noise travels around the loop, being filtered and re-amplified until it increasingly resembles the desired signal.

-Modulator

Adds useful information to the carrier wave There are two main ways to add this information. The first, called amplitude modulation or AM, makes slight increases or decreases to the intensity of the carrier

wave. The second, called frequency modulation or FM, makes slight increases or decreases the frequency of the carrier wave.

- Amplifier:

Amplifies the modulated carrier wave to increase its power. The more powerful the amplifier, the more powerful will be the broadcast.

-Antenna:

Converts the amplified signal to radio waves.

-Wireless Adaptors:

A high-speed wireless network card that is used to access a network that is pre-installed in most of the computers, laptops and mobiles.

-End User:

End User can be any number of user using laptop, computer and mobile.

b) Working of the Proposed System

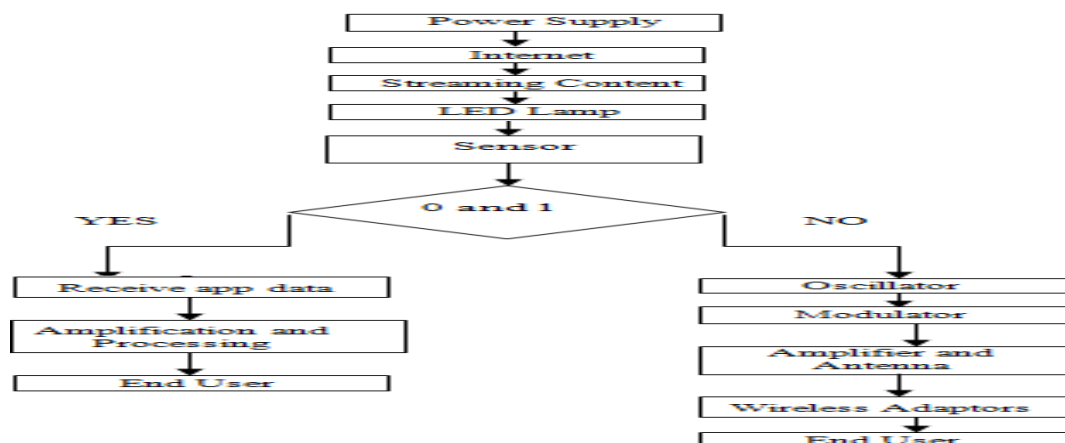
The following are the steps designed for Proposed System:

- 1)The first and most important thing needed for the system to work is Power Supply.
- 2)Internet connection is made and streaming of the content is done accordingly.
- 3)LED Lamp glows with the help of power supply and there is continuous transfer of 0 and 1 and when there is no obstacle the sensor receives 0 and 1. But if there is an obstacle the sensor receives only 0 signal.

4)Now, if there is continuous transfer of 0 and 1 signals the

system works as a Li-Fi which has the following steps:

- a)Receiving the application data coming from the LED Lamp through sensor.
- b)Performing Amplification and Processing.
- c) Delivering the data to the end user.



Flow Chart showing Proposed System

5) But, if there is only 0 signal coming from the sensor that means there is some kind of obstacle which may be wall or anything which does not allow light to transfer the system generates radio waves in the following manner:

- a) Oscillator which oscillates the current coming from the power supply into alternating current.
- b) Modulator which adds the information in the wave.
- c) Amplifier which increases the power of the transferring wave.
- d) Antenna which converts the amplified waves into radio wave
- e) Wireless Adaptors are the receivers which receives the radio waves.

- f) Finally, the data is delivered to the end user.
- g) this way, the data can be transmitted through walls without causing any problem to the user.

VII. Conclusion

Li-Fi technology thus holds the solution to various shortcomings of radio based wireless communication systems. It has a wide range of application green environment, as it uses Visible Light Communication for transmission of data, which is harmless and available everywhere. Thus if the idea and technology of Harald Hass are put to practical use, every LED bulb can be used as a Li-Fi hotspot for transmitting and receiving wireless data. applications. It also supports

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