LI-FI Technology

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Abstract: **Li-Fi stands for Light Fidelity. The technology is very new and was proposed by the German physicist Harald Haas in 2011 TED (Technology, Entertainment, Design) Global Talk on Visible Light Communication (VLC). Li-Fi is a wireless optical networking technology that uses light emitting diodes (LEDs) for transmission of data. The term Li-Fi refers to visible light communication (VLC) technology that uses light as medium to deliver high-speed communication in a manner similar to Wi-Fi and complies with the IEEE standard IEEE 802.15.7. The IEEE 802.15.7 is a high-speed, bidirectional and fully networked wireless communication technology based standard similar to Wi-Fi's IEEE 802.11. This paper focuses on Li-Fi, its applications, features and comparison with existing technologies like Wi-Fi etc. Wi-Fi is of major use for general wireless coverage within building, whereas Li-Fi is ideal for high density wireless data coverage in confined area and especially useful for applications in areas where radio interference issues are of concern, so the two technologies can be considered complimentary. Li-Fi provides better bandwidth, efficiency, connectivity and security than Wi-Fi and has already achieved high speeds larger than 1 Gbps under the laboratory conditions. By leveraging the low-cost nature of LEDs and lighting units, there are lots of opportunities to exploit this medium. Li-Fi is the transfer of data through light by taking fiber out of fiber optics and sending data through LED light bulb.**

Keywords: **LI-FI, WI-FI, Visible Light Communication, Radio Spectrum.**

INTRODUCTION

In today's world of overcrowded (data communication), Li- Fi is a new and efficient way of wireless communication. Li- Fi uses LED lights to transmit data. The Transmission of data is done wirelessly. The current wireless networks that connect us to the Internet becomes very slow when many devices are connected. Also with the increase in the number of devices, which uses the Internet, the availability of fixed bandwidth makes it much more difficult to enjoy high data transfer rates and to connect a secure network. Radio waves are just a small part of the electromagnetic spectrum available for data transfer. Li-Fi has got a much broader spectrum for transmission of data compared to conventional methods of wireless communications that are done on radio waves. The basic idea behind this technology is that the data can be transferred through LED light by varying light intensities faster than the human eyes can't detect. This technology uses a part of the electromagnetic spectrum that is still not generally utilized- The Visible Spectrum, instead of Gigahertz radio waves for transferring of data.

The idea of Li-Fi was introduced for the first time by a German physicist Harald Hass in the TED (Technology, Entertainment, and Design) Global talk on Visible Light Communication (VLC) in July 2011, by introducing it as "data through illumination". He used a table lamp with an LED bulb to transmit a video of a blooming flower that was then projected onto a screen. In simple terms, Li-Fi can be thought of as a light-based Wi-Fi i.e. instead of radio waves it uses light to transmit data. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. By adding new and unutilized bandwidth of visible light to the currently available radio waves for data transfer, Li-Fi can play a major role in relieving the heavy loads which the current wireless system is facing. Thus it may offer additional frequency band of the order of 400 THz compared to that available in RF communication which is about 300 GHz. Also, as the Li-Fi uses the visible spectrum, it will help alleviate concerns that the electromagnetic waves coming with Wi-Fi could adversely affect our health. By Communication through visible light, Li-Fi technology has the possibility to change how we access the Internet, stream videos, receive emails and much more. Security would not be an issue as data can't be accessed in the absence of light. As a result, it can be used in high security military areas where RF communication is prone to eavesdropping.

1. PURPOSE

The working of Li-Fi is very simple. There is a light emitter on one end i.e. an LED transmitter, and a photo detector (light sensor) on the other. The data input to the LED transmitter is encoded in to the light (technically referred to as Visible Light Communication) by varying the rate at which the LEDs turns 'on' and 'off' to achieve different strings of 1s and 0s. The on off activity of the LED transmitter which seems to be invisible (The LED intensity is modulated so fast that human eye cannot notice it, so the light of the LED appears constant to humans), enables data transmission in light form in accordance with the incoming binary codes: switching ON a LED is a logical '1', switching it OFF is a logical '0'. By varying the rate at which the LEDs turns on and off, information can be encoded in the light to different combinations of 1s and 0s.In a typical setup, the transmitter (LED) is connected to the data network (Internet through the modem) and the receiver (photo detector/light plasma state at the bulb's center. And this controlled plasma in turn will produce an intense source of light. All of these subassemblies are contained in an aluminum enclosure

1.   1EXISTING SYSTEM

Light Fidelity (Li-Fi) technology is a wireless communication system based on the use of visible light between the violet (800 THz) and red (400 THz). Unlike Wi-Fi which uses the radio part of the electromagnetic spectrum, Li-Fi uses the optical spectrum i.e.

Visible light part of the electromagnetic spectrum. The principle of Li-Fi is based on sending data by amplitude modulation of the light source in a well-defined and standardized way. LEDs can be switched on and off faster than the human eyes can detect since the operating speed of LEDs is less than 1 microsecond. This invisible switching activity enables data transmission using binary codes. If the LED is on, a digital signal '1' is transmitted and if the LED is off, a digital signal '0' is transmitted. Also these LEDs can be turned on and off very quickly which gives us a very nice opportunity for transmitting data through LED lights, because there are no interfering light frequencies like that of the radio frequencies in Wi-Fi. Li-Fi is thought to be 80% more efficient, which means it can reach speeds of up to 1Gbps and even beyond. Li-Fi differs from fibre optic because the Li-Fi protocol layers are suitable for wireless communication over short distances (up to 10 meters).This puts Li-Fi in a unique way of extremely fast and efficient wireless communication over short distances.

2. DRAWBACKS OF EXISTING SYSTEM

• **Less User Friendly:** The existing system is not user friendly because the retrieval of day-to-day activities data/records is very slow and records are not maintained efficiently and effectively.

• **Lengthy time:** Every work is done manually so we cannot generate report in the middle of the session or as per the requirement because it is very time consuming.
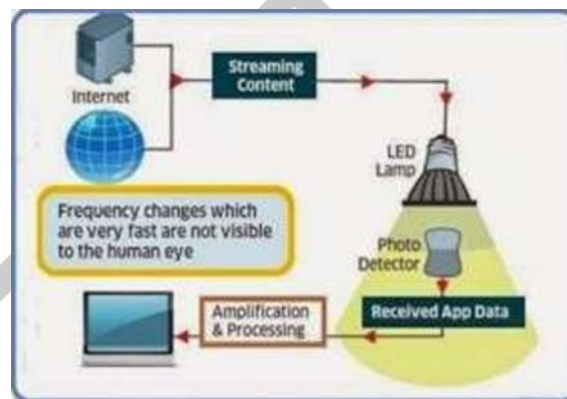
3. SYSTEM ARCHITECTURE

Fig -1: System Architecture Diagram

ADVANTAGES

a) Efficiency: Energy consumption can be minimized with the use of LED illumination which are already available in the home, offices and Mall etc. for lighting purpose. Hence the transmission of data requiring negligible additional power, which makes it very efficient in terms of costs as well as energy.

b) High speed: Combination of low interference and high bandwidth and also high-intensity output, help Li-Fi provide high data rates i.e. 1 gbps or even beyond.

c) Availability: Availability is not an issue as light sources are present everywhere. Wherever there is a light source, there can be Internet. Light bulbs are present almost everywhere – in homes, offices, shops, malls and also in planes, which can be used as a medium for the data transmission. d) Cheaper: Li-Fi not only requires fewer components for its working, but also uses only a negligible additional power for the data transmission.

e) Security: One main advantage of Li-Fi is security. Since light cannot pass through opaque structures, Li-Fi internet is available only to the users within a confined area and cannot be intercepted and misused, outside the area under operation.

f) Li-Fi technology has a great scope in future. The extensive growth in the use of LEDs for illumination indeed provides the opportunity to integrate the technology into a plethora of environments and applications.
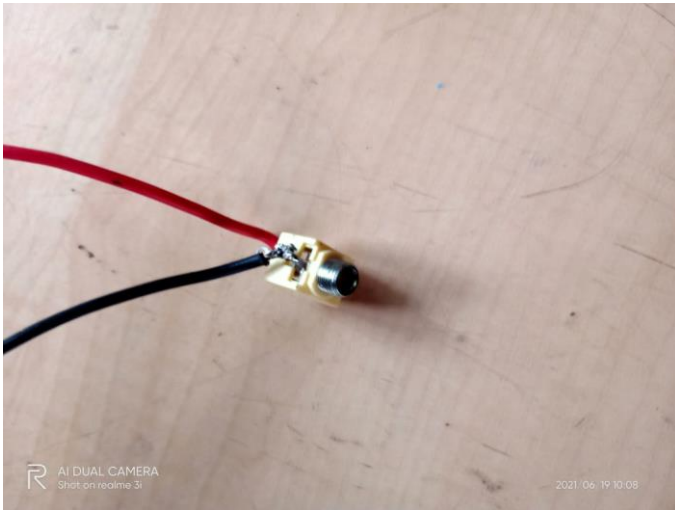
Application

There are numerous applications of Li-Fi technology:-

a) Education systems: Li-Fi is the latest technology that can provide fastest speed for Internet access. So, it can augment/replace Wi-Fi at educational institutions and at companies so that the people there can make use of Li-Fi with the high speed.

b) Cheaper Internet in Aircrafts: The passengers travelling in aircrafts get access to low speed Internet that too at a very high price. Also Wi-Fi is not used because it may interfere with the navigational systems of the pilots. In aircrafts Li-Fi can be used for data transmission. Li-Fi can easily provide high speed Internet through every light source such as reading bulb, etc. present inside the airplane

4.   Snapshots

Light Fidelity (Li-Fi) innovation is a remote correspondence framework dependent on the utilization of noticeable light between the violet (800 THz) and red (400 THz). Not at all like Wi-Fi which utilizes the radio piece of the electromagnetic range, Li-Fi utilizes the optical range for example apparent light Less expensive Internet in Aircrafts: The travelers going in airplanes gain admittance to low speed Internet that too at an exorbitant cost. Likewise Wi-Fi isn't utilized in light of the fact that it might meddle with the navigational frameworks of the pilots. In airplanes Li-Fi can be utilized for information transmission. Li-Fi can without much of a stretch give fast Internet through each light source like understanding bulb, and so on present inside the plane.

5.　　CONCLUSION

Although there's still a long way to make this technology a commercial success, it promises a great potential in the field of wireless internet. A significant number of researchers 15 and companies are currently working on this concept, which promises to solve the problem of lack of radio spectrum, space and low internet connection speed. By deployment of this technology, we can migrate to greener, cleaner, safer communication networks. The very concept of Li-Fi promises to solve issues such as, shortage of radio-frequency bandwidth and eliminates the disadvantages of Radio communication technologies. Li-Fi is the upcoming and growing technology acting as catalyst for various other developing and new inventions/technologies. Therefore, there is certainty of development of future applications of the Li-Fi which can be extended to different platforms and various walks of human life.

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