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Review on multibeneficial applications using light fidelity

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Abstract **- Now a days, wireless communications has become fundamental to our lives and we transmit a lot of data every day. The main way we transmit wireless data is by using electromagnetic waves, in particular radio waves. There is an emerging wireless communication with a promising future and which can be a complement of radio waves i.e. Li-Fi. This paper describes the importance of the Li-Fi technology and the areas where it can be advantageous. Li-Fi also called as Light Fidelity is a new technology that uses light source i.e. light emitting diodes that can be used for high speed communication. It is a better alternative as compared to Wi-Fi technology. It is a technology based on the principle of VLC technology. It is a safer, greener and cheaper technology as it does not have any radio waves or any other type of waves. This technology provides better capacity, security, and availability as compared to Wi-Fi.**

Keywords—Li-Fi(Light-Fidelity), Wi-Fi(Wireless-Fidelity), LED(Light Emitting Diode), VLC(Visible Light Communication), Wireless technology.

I. INTRODUCTION

Li-Fi can be rightly regarded as a light based Wi-Fi. The difference is that instead of Wi-Fi modems, transceiver-fitted LEDs lamps are used which can light a room as well as transmit and receive information. This technology uses a part of the electromagnetic spectrum that is still not greatly utilized, from the infrared through visible light and down to the ultraviolet spectrum providing a wide range of frequencies and wavelengths. Light is in fact a source of life and practically has no ill-effects. Thus li-fi proves to be the most developed technology without any sort of pollution or harms. A flickering light can unexpectedly be a great boon communication. 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 LEDs intensity is modulated so rapidly that human eyes cannot notice, so the output appears constant. Moreover, parallel data transmission using arrays of LEDs, where each LEDS transmit a different data stream is possible. Efforts are being made by using mixtures of red, green and blue LEDs to alter the light's frequency, with each frequency encoding a different data channel which is capable of transmitting of data of about 100-500 Mb/s. Presently we are utilizing the Wi-Fi services within the campus and around the 10-100 meter distances to connect our P.C's, Laptops, palmtops and P.C. notes etc. The challenges faced by Wi-Fi in today's time are Capacity, Availability, Efficiency and Security.

These drawbacks have motivated the scientists to develop a better technology which has come in the form of Li-Fi. This term was first used by Hass in 2011 in TED Global talk on visible light communication. "At the heart of this technology is a new generation of high brightness light-emitting diodes", says Harald Hass from the University of Edinburgh, UK. Later in 2012, the technology was demonstrated at the Consumer Electronics show in Las Vegas using a pair of Casio smart phones to exchange data using li

Light of varying intensity given off from their screens, detectable at a distance of up to ten metres. Then a number of companies made efforts to overcome the drawbacks of radio waves communication by forming consortiums which believe that it is possible to achieve a data rate of more than 10 Gbps.

II. LITERATURE SURVEY

Li-Fi Integrated to Power-lines for Smart Illumination cum Communication paper describes about Li-Fi is a new technology for short range wireless technology to provide connectivity within localized network environment. This technology provides a THz visible light communication (VLC) which sends the data by flashing the light at speeds undetectable to human eyes. The LED lights used in Li-Fi are cheap, durable, and secure and provide good performance. VLC is free of any health concerns, as it uses eco-friendly green technology rather than microwaves, which can cause harm to human body. If PLC is combined with VLC, there would be more benefit and the use of Li-Fi for

wireless connection to devices by a simple plug-and-play technique.

The VLC systems use LED to send data by flashing light at speeds undetected to human eyes. LEDs are more advantageous than the existing fluorescent tubes. The visible light occupies unregulated and unlicensed THz spectrum since it does not cause or suffer from any electromagnetic interference, whereas interference is common using Wi-Fi or any other RF systems. VLC is free from any health concerns, as it uses eco-friendly green technology rather than microwaves, which can cause harm to human body.

There are 4 parts in the hybrid system. They are layer framework, composition of integrated system, channel model and modulation scheme. The layer framework is divided into PHY layer and MAC layer. The Li-Fi is built on composition of VLC and PLC. PLC transmitter excludes amplification and driving circuitry is added to the LED transmitter parts. The signal that comes through the power-line is received through the exclusive PLC module chip and is converted into signal form by a transconductance (TCA) amplifier. The power line channel does not represent an AWGN, but it includes a superposition of five noise types:

1. Colored background noise

2. Narrowband noise

3. Periodic impulsive noise asynchronous to the main frequency

4. Periodic impulsive noise synchronous to the main frequency

5. Asynchronous impulsive noise.

The modulation scheme used is 16QAM.

A survey on Transmission of data through illumination - Li-Fi paper talks about Wi-Fi is the most used technology by everyone, but there is an emerging technology Li-Fi, which refers to apparent light communication systems that uses light from light-emitting diodes (LEDs) as a standard to deliver mobile, networked, high-speed communication in a similar manner as Wi-Fi. Visible light communications (VLC) indicates by switching bulbs on and off within nanoseconds, which is too rapid for the human eye to notice. Although Li-Fi bulbs would have to be kept on to transmit data, the bulbs could be dimmed to the point that they were not visible to humans and yet still functional. Direct line of sight is not necessary for Li-Fi to send signal and light reflected off of the walls can accomplish 70 Mbps. There are approximately 19 billion bulbs worldwide, which just need to be replaced with LED so that it would allow data transmission. The data transmission in Li-Fi is done by turning the LED blubs on-off so fast that it cannot be detected by human eyes. Switching on and LED is a logical '1', switching it off is a logical '0'. A light sensitive device receives the signal and converts it back into original data. Li-Fi is fast and cheap as compared to Wi-Fi. Speed and security is a major concern while transmitting data. Data transmitted through Wi-Fi are susceptible to hackers as it penetrates through walls easily. Li-Fi on the other hand do not penetrate walls and so provides more security. The main component of Li-Fi communication is the white LED, which acts as a communication source and a silicon photodiode which shows good response to visible light. A data rate of greater than 100Mbps is possible by the high speed LEDs.

Data Transmission through Li-Fi:

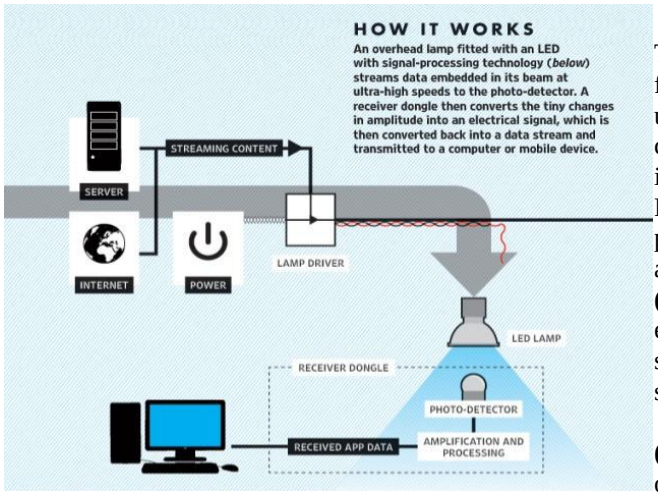
1. VLC can be used safely in aircrafts.
2. Integrated into medical devices and in hospitals as this technology does not deal with radio waves, so it can easily be used in such places where Bluetooth, infrared, Wi-Fi and internet are banned.
3. As light does not penetrate walls it provides better security.
4. Wi-Fi does not work under water, which is possible using Li-Fi.
5. Every street lamp would be a free access points for this technology.
6. This technology will solve the issue of shortage of radio frequency bandwidth.

III. WORKING OF LI-FI

The working principle of li-fi was first proposed by Harald Haas from University of Edinburgh, UK, in his TED global talk on VLC. The working principle of li-fi is very simple, it is based on the transmission of digital data 0's and 1's. The logic is, if the LED is OFF, digital 0 is transmitted and if the LED is ON, digital 1 is transmitted, which can't be detected by human eye. The LED's can be switched ON and OFF very quickly by which we can transmit data with the help of light.

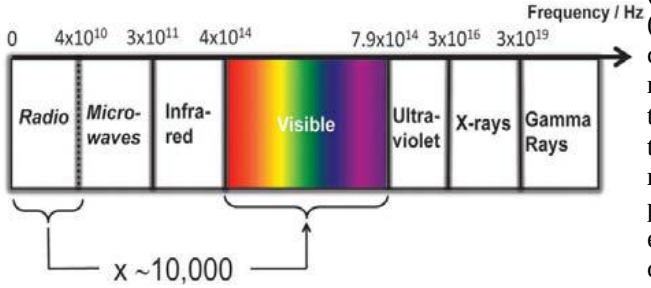
Generally white LED bulbs are used for implementing the concept of li-fi which is used for

illumination by applying a constant current. However, the light output can be made to vary at extremely high speeds by fast variations of the current. To build up a message we are flashing the LEDs numerous times. In order to obtain data rates in the range of hundreds of mega bytes per seconds we can use array of LEDs which also helps us for parallel data transmission or we can also use combination of three basic colours LEDs red, green, blue to alter the frequency of light. The VLC (Visible Light Communication) uses visible light between 400 THz (780 nm) and 800 THz (375 nm) as the optical carrier for data transmission and for illumination.



IV. ADVANTAGES OF LI-FI

Li-fi technology is based on the light sources like LED for the transmission of data. With the help of all kinds of light we can transfer the data, no matter what the part of the spectrum they belong. . That is, the light can belong to the invisible, ultraviolet or the visible part of the spectrum. Also, the speed of the communication is more than sufficient for downloading movies, games, music and all in very less time.



Capacity:-The bandwidth of light is 1000 times wider than the bandwidth of radio waves. As the equipment's are already available and the light sources are already installed so, it has got better capacity.

Efficiency:-LED light consumes less energy and are highly efficient.

Cheaper:-As the cost of the LED is less and it consumes less electricity so it is cheaper.

Availability:-As light sources are present everywhere so availability is not an issue. There are billions of light bulbs worldwide, they just need to be replaced with LEDs for proper transmission of data.

Security:-As light waves cannot penetrate through walls so, they cannot be intercepted or misused. They provide secure access.

Free band:-It makes use of free band that doesn't need any licensing.

High speed:-It provides theoretical speed of one giga byte per second.

V. APPLICATIONS OF LI-FI

The LI-FI system finds a variety of uses in many fields from access to internet by the general public using street lamps to auto-pilot cars which communicate through their headlights. Moreover, in areas such as medicine and aircrafts where WI-FI cannot be used, LI-FI is an alternative which can provide faster data access rates. Some of the applications are discussed below:

(a) Education System: LI-FI can replace WI-FI in educational institutions and provide faster internet speed. All the people can make use of the same speed as has been designated.

(b) Medical Applications: WI-FI is not allowed in operation theatres because they can interfere with medical equipment's. 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 application: 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. 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 operate and this means that LI-FI also uses very little power.

VI. CONCLUSIONS

Li-Fi is an emerging technology and has vast application. If this technology can be put into practical use, every bulb can be used like a Wi-Fi hotspot to transmit wireless data. This concept can be used to solve issues such as shortage of radio frequency bandwidth. Thus, this technology provides numerous benefits. By using this technology we can proceed towards a greener, safer and cleaner future. It is an advanced approach that will make our lives more technology driven in the near future.

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