International Journal of Advances in Engineering and Management (IJAEM)
Volume 2, Issue 7, pp: 268-270 www.ijaem.net ISSN: 2395-5252

Li-Fi Technology

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Date of Submission: 25-09-2020 Date of Acceptance: 05-10-2020

ABSTRACT — Li-FI stands for Light Fidelity. The technology is very new and was proposed by the German physicist Harald Hass in 2011. Li-Fi provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than human eye can be follow.

What if we can use waves other than Radio waves to surf the internet? Radio wave seems to be fully exploited and other spectrum needed to be explored. In this direction, Dr Harold Haas, a German physicist proposed an idea called "Data through Illumination" in which he used fiber optics to send data through LED light bulb. The idea is similar as of infrared remote controlsbut far more powerful.

D-Light can produce data rates faster than 10 mega bits per second, which is far quicker than average broadband connection. Hence a future can be envisioned having light as transmitting medium to our laptops, smart phones and tablets. And security would be a snap- if you can't see the light, you can't access the data.

Wi-Fi can be replaced by Li-Fi. Wi-Fi is useful for general wireless coverage within buildings while Li-Fi is ideal for high density wireless data in coverage in confined areas where there are no obstacles. Li-Fi is wireless optical networking which provides better bandwidth, efficiency, availability and security than Wi-Fi.

KeyWords—Li-Fi,VLC(visible light communication)

I. INTRODUCTION

Li-Fi is a visible light communication technology, developed by the team of scientists including professor Haas at the University of Edinburg and deals with transfer of data through illumination by taking fiber out of optics by sending data through a LED light bulb that varies in the intensity faster than a human eye. Li Fi is a part of visible light communication (VLC) PAN IEEE 802.15.7 standard. It can be very easily explained as, if the LED is ON, you are transmitting the data means you transmit a digital 1 ; and if the LED is OFF you transmit a digital 0, or simply no data transfer happens. As one can switch them on and off very frequently one can transmit data easily because the LEDs intensity is modulated so rapidly that human eye cannot notice, so the output in form of light appears constant and hence offering Till now it was implemented through white LED bulbs only but teams at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission by using multiple LEDs or array of LEDs, where each LED transmits a different stream of data. Mixtures of red, blue, green LEDs are also used by some groups to encode different data channels by altering the light frequencies. In simple terms we can consider it to be a light based Wi-Fi which has achieved blistering high speed in the labs at Heinrich Hertz institute in Berlin, Germany of around 500 megabytes per second using a standard white-light

LED. So quiet obviously, modems would be replaced by transceiver fitted LED lamps which can serve both in purposes of lightening the room as well as transmitting the data.

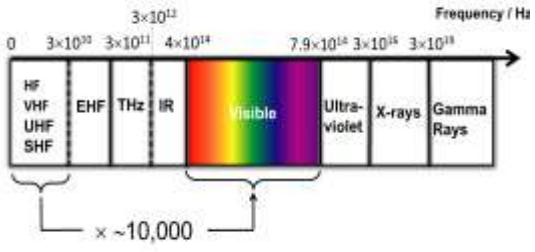

Fig. Electromagnetic Spectrum

II. HAROLD HAAS AND HIS WORK

As it is stated, professor Haas has meanwhile showed that the spectrum has got enough capacity to hold data and is yet has 10,000 times more availability as an infrastructure, globally. There lies a great potential in this technology to change everything that we used for accessing the data today over internet, or streaming videos receiving mail etc. Simply if you are receiving the light means you are connected and if you block it off you are simply offline. The data could be received in familiar forms of ways like visible light, infrared or ultraviolet and thus future possibilities are many.

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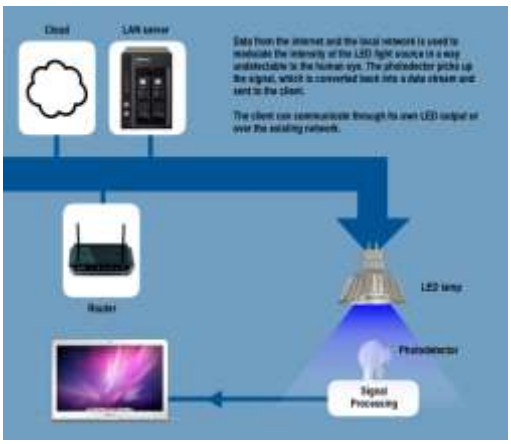

III. GENESIS OF LI-FI

At TED global demonstration by Haas, where he achieved 10 mbps transfer rate increasing it further to 123 mbps after a month, he successfully demonstrated it by blocking the light source to block the video content received by the projector. Depleting bandwidths and faster data rates are major factors leading to further exploration of this utilitarian technique.

IV. HOW IT WORKS

It is implemented by using a light bulb at the downlink transmitter. Normally the light bulb glows at a constant current supply however fast and subtle variations in current can be made to produce the optical outputs since it just uses the light, hence can be easily applied in aircrafts or hospitals or any such area where radio frequency communication is often problematic. The operation procedure is very simple-, if the LED is on you transmit a digital 1, if it is off you transmit 0.LED can be switched on and off very quickly hence nice opportunities to transmit data. The more LEDs in your lamp, the more data it can process. To further get an clear idea of what is said above let us consider a IR remote which sends data stream at rate of 10000-20000 bps. Now replace the IR LED with a light box containing a large LED array which is capable of sending thousands of such streams at very fast rate. LEDs are found in traffic and street lights, car brake lights, remote control units and countless other applications. So visible light communication not only solves the problem related to lack of spectrum space but also enable novel application because this spectrum is unused and not regulated thus can be used for communication at very high speeds. This method of using rapid pulses of light to transmit information wirelessly, technically referred to as visible light communication (VLC) has a potential to compete with Wi-Fi and hence inspired the characterization of Li-Fi.

V. COMPARISON BETWEEN LI-FI AND WI-FI

LI-FI as discussed, is a term used to describe visible light communication technology applied to high speed wireless communication. It acquired this name due to the similarity to WI-FI, only using light instead of radio. WI-FI is great for general wireless coverage within buildings and LI-FI is ideal for high density wireless data coverage in confined area and for relieving radio interference issues, so the two technologies can be considered complimentary.

Technology	Speed
Wi-Fi	150 Mbps
Bluetooth	3 Mbps
Li-Fi	>1Gbps

VI. APPLICATIONS ON LI-FI

Health technologies

operating rooms did not allowed Wi-Fi over radiation concerns, and there was also a whole lack of dedicated spectrum. Also if Wi-Fi is implemented in many hospitals, interference from cell phones and computers can block signals from monitoring equipment. Thus Li-Fi solves both problems: lights are not only allowed in operating rooms, but tend to be the most intended fixtures in the room. And, as mentioned by Haas in his TED Talk**,** Li-Fi has 10,000 times the spectrum of Wi-Fi, so we can't delegate red light to priority medical data.

Power Plants

Wi-Fi and many other radiation or radio waves are bad for sensitive areas like those of power plant inter-connected data systems to monitor things like demand, grid integrity and core temperature. Proper monitoring can save huge benefits in terms of energy and economy obviously. Li-Fi could offer safe, abundant connectivity for all areas of these sensitive locations. This would be cost effective as well as would improve upon the current implementations solutions.

Under sea working

Underwater Rovers, also called toys of treasure seekers, operate from long cables that supply their power and allow them to receive signals from their pilots above. ROVs work efficiently until unless they got stuck somewhere or if the search area is huge.

Various Other Areas

Can be used effectively in the places where it is difficult to lay the optical fiber cables especially the atomic power plant inter-connected data systems to

monitor things like demand, grid integrity and core temperature. Proper monitoring can save huge benefits in terms of energy and economy obviously. Li-Fi could offer safe, abundant connectivity for all areas of these sensitive locations. This would be cost effective as well as would improve upon the current implementations solutions.

Learning

Lecture Halls Can Be Fun. Okay, well maybe not fun, but better. A few teachers tell me to download lecture notes from their blog in my time. Half the time I wished I already had the notes with me so that I could follow along as the lecture progressed. Imagine how interactive the classroom could be with real-time interconnectivity between 500 devices

VII.ADVANTAGES

- High speed connectivity of the rate of 500mbps.
- Li- Fi uses light rather than radio frequency signals.
- Integrated into medical devices and in hospitals as this technology doesn't
- deal with radio waves, so it can easily be used in all such places where
- Bluetooth, infrared, Wi-Fi and internet are broadly in use.
- Under water in sea Wi-Fi does not work at all but light can be used and hence
- Under sea explorations are good to go now with much ease.
- Security is a side benefit of using light for data transfer as it does not penetrate
- through walls.
- On highways for traffic control applications like where Cars can have LED
- based headlights, LED based backlights, and they can communicate with each
- other and prevent accidents.
- Using this Technology worldwide every street lamp would be a free data access point

VIII. ISSUES

- Light pollution
- Line of sight transmission
- The network topology is point to point
- Limitedrange of communication.

IX. CONCLUSION

Possibilities for future utilization are abundant. Every light bulb can be converted into li-fi signal receptor to transfer data and we could proceed toward the cleaner, safer, greener and brighter future. Aswe know that the airways are getting clogged day by day Li-fi can offer a genuine and very efficient alternative. Li-Fi is enabled by advanced digital transmission technologies. Optical cell networks based on Li-Fi are the link between future energy efficient illumination and cellular communications. They can also harness unregulated, unused and vast amount of electromagnetic spectrum and can even enable ever smaller cells without the need for new infrastructure. The issues of shortage of radio frequency can be tackled easily with only limitation being that it works in direct line of sight of light. There are no dead ends to technology and science. Now both light and radio waves can be used simultaneously to transfer data and signals.

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