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Li-Fi: Life of Possibilities

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Abstract-- The field of technology is something that never stops growing; it is a perpetually progressive field that simply does not stop. When it comes to connectivity, the science and technology has processed greatly. With all these advancements in communication technology, we can easily communicate with someone who may be far away from us.
While the Wi-Fi Technology has helped individuals greatly, at times, issues regarding congestion come up as a result of which, people have been looking forward to new innovations in the communication field and exactly such an innovation is on its way. Li-Fi technology is a new technology that transmits signals as light instead of radio waves.
In simple terms, Li-Fi can be thought of as a light-based Wi-Fi. 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.
Keywords: Wireless-Fidelity (Wi-Fi), Light-Fidelity (Li-Fi), Light Emitting Diode (LED), Visible light Communication (VLC)

I. INTRODUCTION

The radio spectrum is highly congested and the demand for wireless data is making this much worse. Demand for wireless information doubles every year but the available capacity cannot sustain this growth. Radio waves are replaced by light waves in a new method of data transmission which is being called Li-Fi. The concept of Li-Fi is currently attracting a great idea of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless.

LED illumination can be used as communication source at very high speed. LED lights can be switched off and on quicker than we can understand. This off-on motion can be used to represent 0's and 1's-in alternative words, digital data. A sequence of such variations can cause a flow of data. This, or transmission by a lot of advanced modulation schemes like Orthogonal Frequency Division Multiplexing (OFDM), is that the technological basis of visible light communication or wireless optical communication.

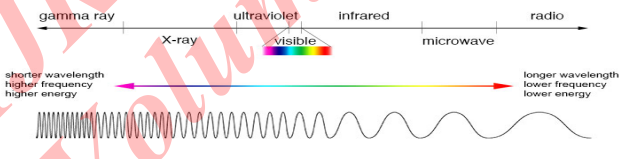

Fig.1 ELECTROMAGNETIC SPECTRUM

WHY ONLY VLC…

- Gamma rays can't be used because it could be dangerous to use.
- X-rays can cause many health issues.
- Ultraviolet rays are good to use but dangerous for human beings.
- Infrared can cause eye diseases so, used with low power.

We left with the only visible-light spectrum which is safe to use.

II. LI-FI CONSTRUCTION

- The Li-Fi product consists of four primary sub-assemblies:
- Bulb
- RF power amplifier circuit (PA)
- Printed circuit board (PCB)
- Enclosure
-
- The Printed Circuit Board (PCB) used to control the electrical inputs and outputs of the lamps.
- The microcontroller used to manage different functions of lamp.
- An RF (Radio Frequency) signal is generated by the solid-state PA and is guided into an electrical field vaporizes the

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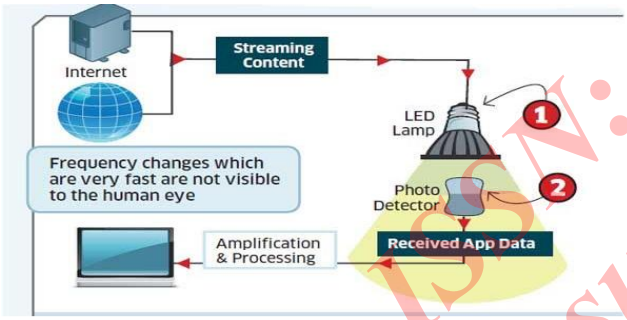
contents of the bulb to a plasma state at the bulb's center; this controlled plasma generates an extreme source of light.

- All of these sub-assemblies are bounded in an aluminum enclosure.
- The design and construction of the Li-Fi light source enable efficiency, long stable life, and full spectrum intensity that is digitally controlled and easy to use.

2.1How Li-Fi Works?

- This brilliant idea was first demonstrated by Herald Hass from University of Edinburgh, UK
- The functioning of recent Li-Fi technology is simply easy. You may have a light source at one end like a LED lamp and a photo detector (Light Sensor) on the other end.

- As soon as, LED lamp starts illuminating, photo detector or light sensor on other end will detect light and get a binary ONE otherwise binary ZERO. Flashing a LED certain times will build up a message to transmit. Illumination of light is



detected by the photo detector or light sensor and it will receive a message.

- Light Emitting Diodes are often switched ON and OFF faster than the human eye will observe, causing the light source to appear to be ON continuously.
- The researchers used a micro-LED light bulb to transmit 3.5Gbit/s via each of the three primary colors - red, green, blue - that form up white light.
- This means over 10Gbit/s is feasible.

III. ADVANTAGES OF LI-FI

- Evenly spaced LED transmitters could provide much more localized and consistent internet connectivity throughout buildings.
- Mostly powered by LEDs, so it is cost efficient.
- It is possible to gain more than 10Gbps, allowing a high definition movie to be downloaded in 30 sec.
- Every Li-Fi light unit can convey up to 10 times more information than a Wi-Fi Hot Spot.
- A frequencies band completely free and unlicensed worldwide.
- Ability of multi-user communication.
- Exchange your files safely.
- Transmission of data is fast and easy.
- Its main advantage is its bandwidth. It is 10,000 times than the radio waves.

IV. APPLICATION AREA OF LI-FI

Li-Fi technology is still in its early period of existence. However some areas where is seems perfectly applicable are:

4.1 Medical Technology

For a long time, medical science has lagged behind the rest of the wireless world. Operation room does not allow Wi-Fi over radiation concerns. It is difficult to lay optical fibers in operation theatre. While Wi-Fi is in place in many hospitals, interference from mobile phones and computers can block signals from monitoring equipment.

Li-Fi solves such problems: light are not only allowed in operating rooms, but tend to be thepermanent appliance in the room. It can be used for modern medical equipment.

4.2 Traffic Lights

Traffic lights can communicate with car and with each other.

Cars having LED-based headlights and backlights can communicate with each other and prevent accidents by exchanging information.

4.3 Free Hotspot

Hotspot is limited region in which some amount of device can access the internet connectivity.

As there are millions of street lamps deployed around the world .Each of these street lamps could be a free access point.

4.4 On ocean Beds

Li-Fi can be used underwater where Wi-Fi fails completely. It provides endless opportunities for military/navigation operations.

4.5 Intrinsically safe environment

Visible light is safer than radio spectrum hence it can be used in places where radio waves can't be used such as petrochemical plants, airplanes.

V. CHALLENGES

1. Light can't pass through objects.
2. Interferences from external sources like Sun light, normal bulbs, and opaque materials in the path of transmission will cause interruption in communication.
3. Cost of installation of VLC systems is very high.
4. An important challenge facing Li-Fi is: how the receiving device will transmit data back to transmitter.

VI.COMPARISON BETWEEN WI-FI AND LI-FI

VII.CONCLUSION

Parameter	Li-Fi	Wi-Fi
Speed	***	***
Range	*	**
Data density	***	*
Security	***	**
Reliability	**	**
Power available	***	*
Transmit/receive power	***	**
Ecological impact	*	**
Device-to-device connectivity	***	***
Obstacle interference	***	*
Bill of materials	***	**
Market maturity	*	***

* low ** medium *** high

Li-Fi has the potential to be faster, safer and cheaper than conventional Wi-Fi technology. In more ways than one, it looks like the future of wireless communication.

Thanks to the Li-Fi technology, the 14 billion lamps in the world can become gradually green mobile internet masts that will allow replying to the spectacular increasing demand of mobile connectivity. Also, this can enable reducing the electromagnetic pollution generated by the many radio emission solutions developed until now. We will merely stand under any sort of light and surf the web as the connection made in case of any light presence.

It's hard to predict how a technology will develop over time, but it's safe to say that a combination of Li-Fi and Wi-Fi will bring the best of both worlds to the internet.

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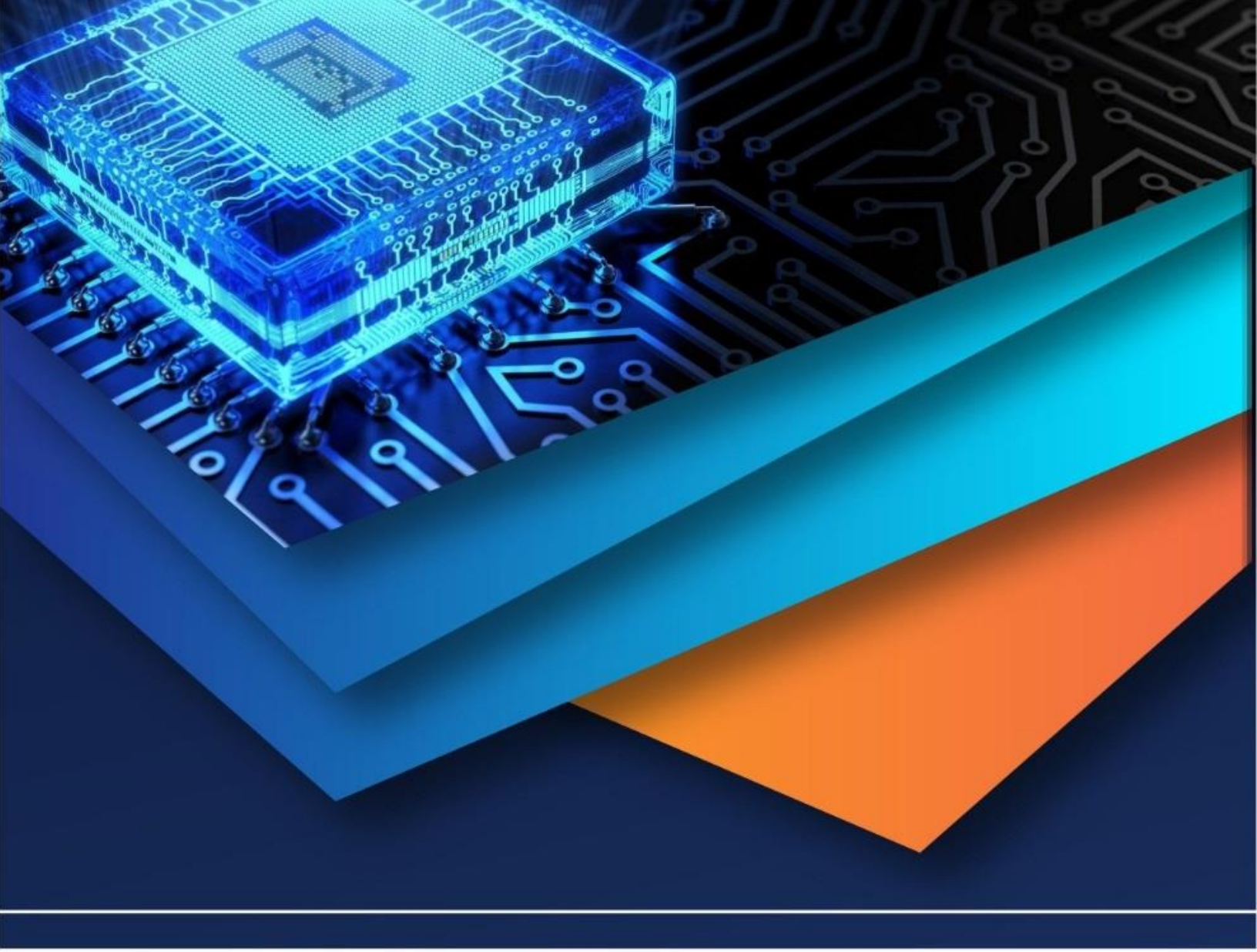

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