LI-FI Has Just Been Tested In The Real World And It Is 100 Times Faster Than WI-FI

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Abstract: Light Fidelity refers to Visible Light Communication systems using light-emitting diodes as a medium to high-speed communication in a similar manner as WI-FI. Now a days where internet has become a major demand, people are in a search for WI-FI hotspots. LI-FI is New Life of data communication is a better alternative to WI-FI in wireless communication. This paper proposes a survey on LI-FI Technology and analyzes its performance with respect to existing technology. The concept of LI-FI is data communication on fast flickering of light which is not detected by human eye but it is focused on photo detector which converts the on-off state into binary digital data. It has gained a huge popularity in two years of its invention. Such technology has brought not only greener but safer and cheaper future of communication.

Index Terms: Light Fidelity (LI-FI), Light Emitting Diode (LED), Radio Frequency (RF), Technology Entertainment Design (TED), Visible light communication (VLC).

1 INTRODUCTION OF LI-FI TECHNOLOGY

HARALD HAAS, a professor at the University of Edinburgh who began his research in the field in 2004, gave a debut demonstration of what he called a LI-FI prototype at the TED Global conference in Edinburgh on 12th July 2011. He used a table lamp with an LED bulb to transmit a video of blooming flowers that was then projected onto a screen behind him. During the event he periodically blocked the light from lamp to prove that the lamp was indeed the source of incoming data. . 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 show in Figure 1. At TED Global, Haas demonstrated a data rate of transmission of around 10Mbps comparable to a fairly good UK broadband connection. Two months later he achieved 123Mbps. Researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabytes per second using a standard white-light LED. Haas has set up a spin-off firm to sell a consumer VLC transmitter that is due for launch next year. It is capable of transmitting data at 100 MB/s - faster than most UK broadband connections.

***Figure 1**. LI-FI Technology*

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2 CONSTRUCTION AND WORKING OF LI-FI

A VLC light source could comprise of a light emitting diode bulb. Since a robust LI-FI system requires extremely high rates of light output, LED bulbs are most ideal for implementing LI-FI. LED is a semiconductor light source, which implies that LED light bulbs can amplify light intensity and switch rapidly. Therefore, LED cells can modulate thousands of signals without the human eye ever noticing. In turn, the changes in light intensity from the LED light source are interpreted and converted as electrical current by the receiving photodiode device. Once the electronic signal is demodulated, it is converted into a continuous stream of binary data comprising of audio, video, web, and application information to be consumed by any Internet-enabled device. The photo detector registers a binary one when the LED bulb is on; and a binary zero if the LED bulb is off. There is ample room for growing innovation in LI-FI technology. Like conventional broadband and WI-FI, LI-FI can also function as a bidirectional communication system. By interchanging visible light and infrared light from a photo detector, a mobile device connected to that photo detector can send data back to the light source for uplink. Also, multi – colored RGB (Red/Green/Blue) LED's at retina size could be engineered to send and receive a wider range of signals than single-colored phosphor-coated white LED's. Figure 2 shows the construction and working of LI-FI.

***Figure 2.** Construction of LI-FI Works*

The light has a transmission capacity far superior to radio waves and with the progress of LED's technology, there will be potentially tens or hundreds of light-emitting inside the houses, the cars, the roads, anywhere Figure 3. Shows room is connected to LI-FI. There are already ongoing researches that are developing LED's thousand times smaller, and with a thousand times the speed of switching.

Billboards in the streets, panels, everything can transmit information.

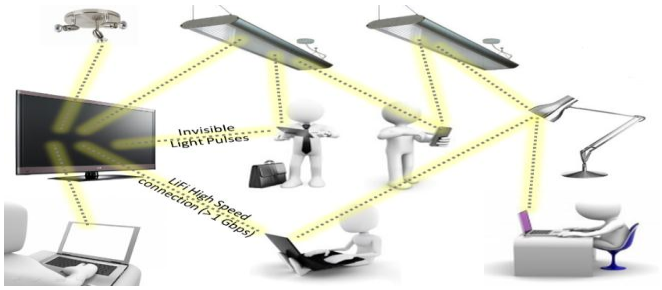

Figure 3. *LI-FI environment*

3 LI-FI VERSES WI-FI

LI-FI signals cannot pass through walls, so in order to enjoy full connectivity, capable LED bulbs will need to be placed throughout the home. Not to mention, LI-FI requires the light bulb is on at all times to provide connectivity, meaning that the lights will need to be on during the day. What's more, where there is a lack of light bulbs, there is a lack of LI-FI internet so LI-FI does take a hit when it comes to public WI-FI networks. On January 4, 2016 they announced that an extension of standard Wi-Fi is coming and it's called WI-FI HALOW. This new project claims to double the range of connectivity while using less power. Due to this, Wi-Fi HALOW is reportedly perfect for battery powered devices such as smart watches, smartphones and lends itself to Internet of Things devices such as sensors and smart applications. But it's not all doom and gloom! Due to its impressive speeds, LI-FI could make a huge impact on the internet of things too, with data transferred at much higher levels with even more devices able to connect to one another. What's more, due to its shorter range, LI-FI is more secure than WI-FI and it's reported that embedded light beams reflected off a surface could still achieve 70 megabits per second. Difference between LI-FI and WI-FI shows in the Table 1.

S. No.	Parameters	Wireless Technologies	
		Light Fidelity	**Wireless Fidelity**
1.	Speed for data transfer	Transfer speed(>1 Gbps)	Data Transfer speed(150 Mbps)
2.	Medium through which data transfers occurs	Used Light as a carrier	Radio frequency spectrum range is less than lighter spectrum
3.	Spectrum Range	Visible light spectrum has 10,000 time broad spectrum in comparison to radio frequency	Radio frequency spectrum range is less than visible light spectrum.
4.	Cost	Cheaper than spectrum has 10,000 time broad spectrum in comparison to radio frequency.	Expensive in comparison to Li-Fi because its uses radio spectrum.
5.	Network topology	Point to point	Point to point
6.	Operating frequency	Hundreds of TERA Hz	2.4 GHz

Table 1*.Difference between LI-FI and WI-FI*

4 ADVANTAGES

- WI-FI is great for general wireless coverage while LI-FI is ideal for high density coverage in a confined region.
- LI-FI is believed that the technology can yield a speed more than 10Gbps, allowing a HD film to be downloaded within 30 seconds.

5 DISADVANTAGES

- LI-FI light waves cannot penetrate walls.
- In 2012, this technology was demonstrated and it was detectable up to a distance of 10 meter.

6 APPLICATION OF LI-FI

6.1 Smart Lighting

Any private or public lighting including street lamps can be used to provide LI-FI hotspots and the same communications and sensor infrastructure can be used to monitor and control lighting and data.

6.2 Hospital & Healthcare

LI-FI emits no electromagnetic interference and so does not interfere with medical instruments, nor is it interfered with by MRI scanners.

6.3 Underwater Communications

Due to strong signal absorption in water, RF use is impractical. Acoustic waves have extremely low bandwidth and disturb marine life. LI-FI provides a solution for short-range communications.

6.4 Vehicles & Transportation

LED headlights and tail-lights are being introduced. Street lamps, signage and traffic signals are also moving to LED. This can be used for vehicle-to-vehicle and vehicle-to-roadside communications. This can be applied for road safety and traffic management.

6.5 Radio Frequency Avoidance

Some people claim they are hypersensitive to radio frequencies and are looking for an alternative. LI-FI is a good solution to this problem.

Figure 4. *LI-FI applications*

7 FUTURE IPHONES ON LI-FI TECHNOLOGY

On January 18, 2016 they announced that recent versions of IOS have been found to contain references to LI-FI show in Figure 5, an experimental high-speed wireless networking protocol that uses pulses of light to transmit data and is being marketed as a long-term replacement for WI-FI.

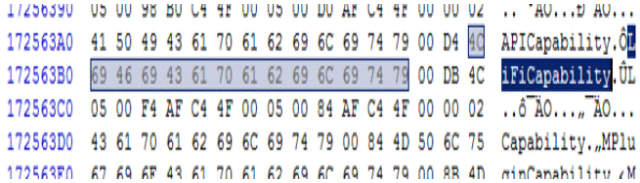

Figure 5. *IPHONES LI-FI Capability*

8 CONCLUSION

From this LI-FI technology, we can see that the LI-FI is an advanced approach on design, having the best ever design of internet by largely reducing the size of device which transfers data, implementation- by means of having more than 1.4 million light bulbs all over the world if replaced by such LEDs can provide feasible access, and last but not the least enormous applications compared to any other networks in various fields which cannot be imagined by on use networks. Although there are some disadvantages, but can be eliminated by careful further research. LI-FI has provided a step forward invention in the world of growing hunger communication, this is safe to all biodiversity including humans and progressing towards a greener, cheaper and brighter future of technologies.

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