



# International Journal of Innovative Research in Computer and Communication Engineering

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## Li-Fi Technology: Emerging trend of Data Transmission

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**ABSTRACT:** Nowadays most of the communication through the network between two nodes is done by the unguided medium. According to IEEE 802.11 standard Wi-Fi gives us speed up to 150 Mbps. As the number of devices and the number of users increases day by day, we need to find out a better option than Wi-Fi. A German Physicist Harald Hass introduced a new concept of Light-Fidelity (Li-Fi). He demonstrated how LED bulbs send data just by illumination at TED Talk. Li-Fi uses visible light to transmit data. Which he calls D-LIGHT can produce data rates faster than 10 Mbps, which is faster than average broadband connection.

**KEYWORDS:** Light-Fidelity (Li-Fi), Light Emitting Diode (LED), data transmission, visible light communication, wireless communication.

### I. INTRODUCTION

Harald Hass introduced the concept of visible light communication and Li-Fi at TED Global Talk. He is the Chairman of Mobile Communications at the University of Edinburgh and co-founder of pureLiFi.

Wi-Fi uses radio waves for transmission while Li-Fi uses visible light. Optical Wireless Communication (OWC) is achieved by switching LEDs on and off at very high rate. Although they could be dimmed below human visibility while still emitting enough light to carry data. Li-Fi provides data rates over 224 Gb/s which is much more faster than a broadband connection. The light waves have less penetration power so, they cannot penetrate through walls or any solid objects which make it suitable for shorter range. If there is no Line of sight connection, then also by reflection from walls and other objects we can achieve 70 Mb/s. [1]

### II. RELATED WORK

In [2] author demonstrates working of Li-Fi. He demonstrates how the transmission is possible through visible light. In [3] authors point out the key difference between Li-Fi and Wi-Fi. They have mentioned that Li-Fi does not cause any harm to the human body whereas Wi-Fi which uses Radio waves is harmful. They have also explained the various application of Li-Fi. Very high data transfer rates have been achieved using Li-Fi. Researchers at the University of Oxford have achieved a speed of 224 Gbps using Li-Fi.

### III. WORKING OF LIFI

The working of Li-Fi Technology is very simple. Li-Fi uses a light source at the sender end like a LED and photodetector (light sensor) at the receiver end. When LEDs starts glowing, the photodetector detects the fluctuations in the light. It gets binary-1 for on LEDs otherwise gets binary-0. By flashing LEDs frequently at a high rate, it builds a certain message and the photodetector detects the message. [3]

After detecting the message by the photodetector, the receiver converts it back into a digital signal by digital signal processing. Now the message which was carried away by visible light waves is in the form of digital data. The working of Li-Fi can be demonstrated by Figure 1. [2]

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You may think that the presence of other light sources will interfere LiFi communication. But if you have understood the working of LiFi, you may know that it works by detecting the fluctuations in light signal (i.e. by the change from 0 to 1 or 1 to 0). So any surrounding light source which has a constant light illumination will not affect the LiFi communication until it has a very high intensity.

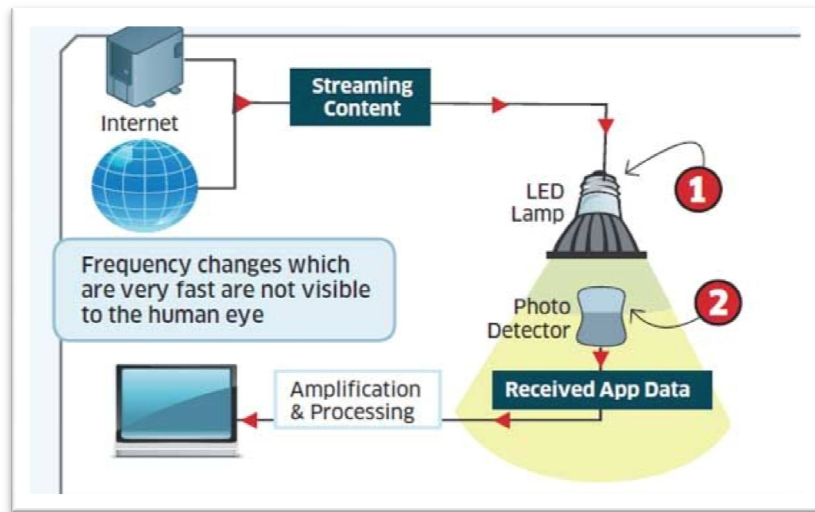


Figure 1 Working of Li-Fi [3].

## IV. REASONS TO USE VISIBLE LIGHT AS A CARRIER

- The visible light spectrum is 10,000 times larger than radio frequency spectrum.

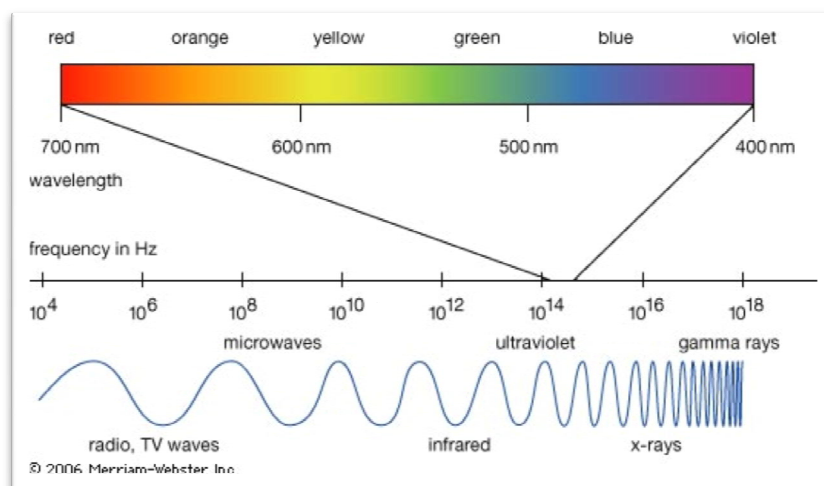


Figure 2 Spectrum of Electromagnetic Waves.

- Li-Fi is a faster and cheaper version of Wi-Fi. Because of low power, communication through radio waves is expensive.[2]
- Visible Light waves have high frequency and short wavelength than radio waves which enable us to transmit data at a high rate than Wi-Fi.



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- Gamma rays, X-rays, and Ultraviolet waves are dangerous to human body due to their radiation property and they have high power.
- Infrared waves are also dangerous for eyes, we use it after applying some sort of filter on to them.
- Hence there is only one option left in Electro-Magnetic Spectrum that is Visible Light which is not harmful to humans.

## V. ADVANTAGES OF USING LIFI

- **Speed:** As discussed above Lifi has 10,000 times the frequency spectrum of radio waves and 1,000 times the data density of WiFi. So, Lifi can achieve a very high speed of around 1Gbits per second.
- **Cost:** It requires very fewer components than radio technology. In addition, we use LED's for LiFi which we already have around us at almost all the places like office, home, street lights, theaters, hospitals, etc. It has been observed that LiFi is around 10 times cheaper than WiFi.
- **Security:** Light signals of LiFi are confined to a very small illumination area and also cannot pass through walls. Hence LiFi communication is safer than other radio technologies.
- **Safety:** LiFi has no known safety or health concerns. Also by using LiFi, other wireless pollution can be reduced.

## VI. APPLICATIONS OF LIFI OVER OTHER TECHNOLOGIES

LiFi can be used at places where other waves like radio waves or sound waves have limitations. LiFi also provides additional features like high data rates and security.

Applications of LiFi include:

- **Cellular Communication:** LiFi can provide higher data rate (especially high downlink) and security in comparison to WiFi for short distances.
- **Hospitals:** LiFi can be integrated into medical devices and can be used in hospitals where WiFi is banned as it emits electromagnetic interferences with medical instruments and MRI Scanners.
- **Aviation:** LiFi can use LED lights which are already deployed in airplanes. Using LEDs for communication can reduce heavy cabling and add flexibility to seating layouts in passenger cabins.
- **Underwater Communications:** Radio waves are quickly absorbed in water and acoustic waves disturb marine life, but LiFi using light signals can be used as an alternative to this problem for short-range underwater communications.
- **Vehicle & Traffic management:** LEDs can be used in head-lights, tail-lights, street lamps, signage and traffic signals for vehicle-to-vehicle and vehicle-to-roadside communications. This can avoid road accidents and make traffic control more intelligent.
- **Hazardous Environments:** LiFi uses light signals for communications, so it can provide a safe alternative to electromagnetic interferences from radio frequency communications in environments such as mines and petrochemical plants.
- **RF Spectrum relief:** Due to excessive usage of radio waves for communication, we may face a shortage of radio-frequency bandwidth. LiFi can be used as an alternative to radio waves for short distance communication.
- **RF Avoidance:** Some people claims that radio frequency used in mobile and WiFi communication can cause brain cancer. So, LiFi is a good solution to this problem.

## VII. CONCLUSION

Li-Fi is the future technology of data transmission. Since it is easy to generate light waves, it is very advantageous and easily implementable in various fields. Hence the future application can be extended to the various field like Traffic



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Management, Medical, Aviation, TeleCommunication etc. By putting this technology in practical use, a single LED can be demonstrated as a hotspot. It is safer and faster as compared to Wi-Fi.

## REFERENCES

- [1] <https://en.wikipedia.org/wiki/Li-Fi>
- [2] Harald Haas. "Harald Haas: Wireless data from every light bulb". [www.ted.com](http://www.ted.com)
- [3] Polshetwar Poonam V., Mr. Saad Siddiqui., "Li-Fi Technology", International Journal of Computer Science and Information Technologies (IJCSIT), Vol. 5, Issue 6, pg. 8031-8032, 2014
- [4] Shubham Chatterjee, Shalabh Agarwal, AsokeNath, "Scope and Challenges in Light Fidelity(LiFi) Technology in Wireless Data Communication", International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163, Vol. 2, Issue 6, 2015
- [5] Akshata M Sonnad, AnjanaGopan, Sailakshmi N R, Divya S, Ambika R, "Recent Advancements In Li-Fi Technology", International Journal of Electrical, Electronics and Data Communication, ISSN: 2320-2084, Vol. 1, Issue 10, pg. 61-63, 2013
- [6] PushpendraVerma, Dr. Jayant Shekhar, Preety, Dr. Amit Asthana, "Light-Fidelity (Li-Fi): Transmission of Data through Light of Future Technology", IJCSMC, Vol. 4, Issue 9, pg.113 – 124, 2015
- [7] Vitthal S Saptasagare, "Next of Wi-Fi an Future Technology in Wireless Networking Li-Fi Using Led Over Internet of Things", International Journal of Emerging Research in Management &Technology ISSN: 2278-9359, Vol.3, Issue 3, pg. 142-147, 2014
- [8] Akanksha R. Shrivastava, "Li-Fi: The Future Bright Technology", National Conference on "Advanced Technologies in Computing and Networking"-ATCON-2015
- [9] Suriya Begum, SiddharthKonar, Ashhar, "Light Fidelity ( Li Fi ) : A Survey", International Journal Of Engineering Sciences & Research Technology, Vol.5, Issue 7, pg.391-402, 2016
- [10] UmalaxmiSawant, ShaileshJadhav, "A Review On Li-Fi Technology", International Journal of Scientific Research Engineering & Technology (IJSRET), ISSN 2278 – 0882, Vol.4, Issue 11, pg.1140-1144, 2015
- [11] Alao O.D., Joshua J.V., Franklyn A.S., Komolafe O., "Light Fidelity (Li-Fi): An Emerging Technology for The Future", IOSR Journal of Mobile Computing & Application (IOSR-JMCA), Vol. 3, Issue 3, pg.18-28, 2016
- [12] EshaJulka, Deepak Kumar, "A Review Paper on Li-Fi Technology", International Journal of Scientific & Engineering Research, Vol. 6, Issue 2, pg. 58-61, 2015
- [13] Rahul R. Sharma, Raunak, AkshaySanganal, "Li-Fi Technology Transmission of data through light", Int.J.Computer Technology & Applications, Vol. 5, Issue 1, pg. 150-154, 2014

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