

LIFI- Emerging Technology



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Abstract: LIFI (Light Fidelity) is a relatively new technology that is expected to compete with WIFI in the coming years. Visible Light Communication (VLC) with Light Emitting Diodes (LEDs) is the foundation of this technology (LEDs). It is used to send data packets via a light-based medium. The current state of LIFI and the issues it faces are presented in this study.

Keywords: LED-Light Emitting Diodes, OWC- Optical Wireless Communication, RF- Radio Frequency, TED-Technology, Entertainment, and Design, VLC- Visible Light Communication

I. INTRODUCTION

In all areas, wireless communication and technologies have taken over the planet. One of the growing technologies among them is LiFi. Every industry relies on data as a building block, necessitating secure and quick transfers from one device to another, especially since the medium is accessible at all times. The development of this technology began in 2011. Prof Harald Haas of the University of Edinburgh invented the term LIFI (Light Fidelity) at a TED Global Talk in July 2011, earning him the title of "Father of LIFI." Professor Haas' topic of debate was Visible Light Communication, and as a result, a new technology was born, which is now known as LIFI. This was discovered in response to the challenges caused by radio frequency limitations (RF). To bring LIFI to market, the author founded a private company named 'Pure Visible Light Communication.' The company is an original equipment manufacturer (OEM) that is set up to commercialize LIFI devices for integration with current LED lights [1]. The professor anticipates a future in which data for gadgets is conveyed in a more secure manner using light [2]. It is an Optical Wireless Communication (OWC) system that can be used in conjunction with radio frequency communication. As detailed in depth in, this technology allows us to communicate and transmit data at rapid speeds at a low cost [3]. This technique is based on Visible Light Communication and aims to provide high-speed, secure, bi-directional, and completely networked wireless communication. [4]

II. LIFI

LIFI, or Light Fidelity, is a light-based wireless communication system. LEDs may switch on and off at a rate of several million times per second. The eye cannot see this modulation since it occurs at a rate of more than 10 million times per second. LIFI will expand the breadth of study and application in all domains in the future. Communication is an important component of everyone's life since it allows them to exchange information across devices connected to a wired or wireless network. The major purpose of LiFi, it is emphasized, is to complement radio frequency rather than to replace it. [5]. LIFI stands for light-based WiFi, which transmits data using light waves rather than radio waves. Instead of WiFi modems, it employs transceiver-equipped LED lamps that can both light up a room and broadcast and receive data as shown in Figure-1. LIFI is predicted to be ten times less expensive than current technology. It's an exciting new technology that promises to be 1000x faster in all places and at all times. But, like everything else, LIFI has advantages and disadvantages. The disadvantages include a limited range, inadequate dependability, and hefty installation costs. [6][7]

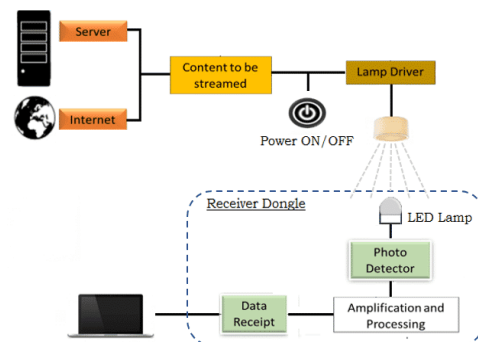


Figure 1: Block Diagram for LIFI

III. WORKING OF LIFI

LIFI's operation is based on a system in which light is used as a data transmission channel. In LiFi technology, the source of this medium (light) is an LED lamp driven by a lamp driver, which is then directly connected to the internet. Digital data is transmitted by the blinking of LEDs. This communication approach is known as 'data transfer through illumination.' By adjusting the current fed through the LEDs at extremely rapid speeds, the intensity of the LEDs may be changed. This, on the other hand, will display the ON-OFF activities of LED lights and allow data communication using binary codes. When the LED is turned on, it represents the number '1' being broadcast, and when it is turned off, it represents the number '0' being transmitted. VLC is a form of data transmission that employs rapid light pulses. [3]

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The light driver can control the amount of flickering to speed up or slow down data transfer. A photosensitive device called a photo detector receives the data-contained light emitted by the LED, analyses it, and amplifies it. Processing entails transforming light signals into digital signals, completing the communication process as shown in the Figure-2.[8]

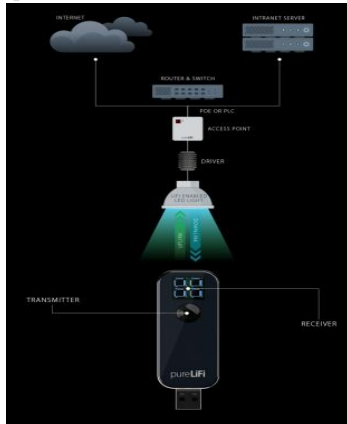


Figure 2: Working of LiFi

IV. LIFI VS WIFI

When it comes to WiFi and LiFi, it's tough to compare the two because each has its own set of benefits and drawbacks. That is why, in order to look at these pieces of technology in a new light, a fresh mindset is required. A common misperception concerning LiFi systems is that they were designed to completely replace WiFi. [10] Putting light on the basic features as follows-

- Frequency of operation-

LiFi: 10 thousand times frequency spectrum of the radio
 WiFi: 2.4GHz, 4.9GHz and 5GHz

- Data density-

LiFi: Works in high dense environment
 WiFi: Works in less dense environment due to interference related issues

- Coverage distance-

LiFi: About 10 meters
 WiFi: About 32 meters (WLAN 802.11b/11g), varies based on transmit power and antenna type

- System Components-

LiFi: uses LED bulbs and Light Signals to transfer and receive data.

WiFi: uses Routers and Radio Frequency

V. BENEFITS OF LIFI

- Speed & Bandwidth-

In mobile devices, LIFI can give multiple gbps speeds. This next-generation technology will push wireless technology to new heights, allowing for unimaginable bandwidth.

- Reliability-

LiFi offers increased stability, allowing for interference-free connections and 1000 times the data density, resulting in a much improved user experience.

- Low Latency-

LiFi now has a three-fold lower latency than WiFi and potentially revolutionize innovation, automation, and applications like AR and VR.

- Security-

In a physical location, light can be contained and secured. Because LiFi provides exact localization for asset monitoring and user authentication, it gives you more control.

WiFi signals can readily pass through solid walls, however when utilizing LIFI, data packets transit safely and LiFi signals cannot pass through solid walls because light cannot pass through solids.

- Localization-

Because LiFi is fully networked, each LiFi equipped lamp has its own IP address; complex geofencing can be easily implemented in a LiFi network.

- Interference Free-

A wide range of equipment, including cordless phones, microwaves, and neighboring WiFi networks, can cause RF interference. Because LiFi signals are defined by the area of illumination, interference is considerably easier to prevent and even eliminate. This implies LiFi can be utilized in RF-sensitive areas like hospitals, power plants, and aero planes.

- Cost of Operation-

LiFi is more expensive to set up than WiFi, but it is significantly less expensive to operate in the long run.

- Availability-

Every light source has the ability to connect to the internet. Street lights, building lights, and transportation lighting will all be able to communicate wirelessly in the near future, when the technology is already available to the general public, and you will be able to access the internet wherever you are. [Figure-3]

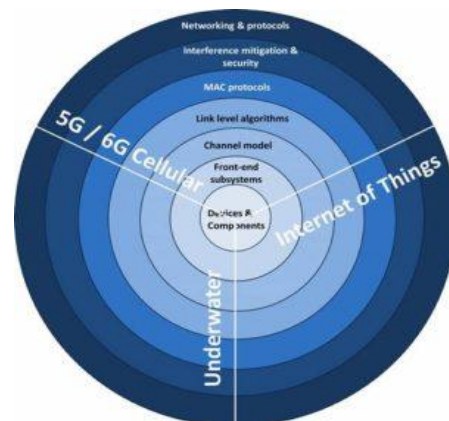


Figure 3: Benefits

VI. CHALLENGES FACED BY LIFI

Despite the fact that LiFi is an amazing technology with a wide range of applications in practically all areas, it nevertheless faces significant obstacles in the real world.

- To use LiFi, you must be in close contact to LiFi LEDs. Natural light, sunshine, or electrical light can cause data transmission to be disrupted in particular places.

- Data transmission and speed can be hampered by opaque barriers on paths.

- It is not suitable for usage in an outside area, as is the case with RF signals. This is due to interference from adjacent light sources and other optical sources. Furthermore, if used outside, it can be intercepted by undesirable people.

- As a security reason, According to [11] a threat like eavesdropping can happen in LiFi. It occurs when there is a space between the floor and the door, allowing light to pass through. A leak can also be caused by a crack in the inside floor or shielded windows.
- LiFi is a technology that functions well in an indoor infrastructure but not in an outdoor environment. LiFi coverage in the outdoor area must be established in order for the connection quality to be satisfactory. [12]
- Despite its ease of installation, the LiFi system necessitates a completely new infrastructure. This will increase the cost of LiFi internet access for businesses and individuals.
- Despite the fact that it consumes little power, lights must be turned on at all times of the day and night in order to use LiFi internet services. Because the internet is so important these days, this system will squander more energy than any other internet system.
- LiFi is a very new technology that has yet to be developed for widespread use.

VII. CONCLUSION

This research looks into what LIFI technology is all about. This revolutionary technology has the potential to revolutionize wireless communication. LIFI has evolved into a ubiquitous system technology with revolutionary networking capabilities for universal application, allowing for high-speed internet connections on a number of device platforms. If LIFI can be made to work, every bulb can be used as a replacement for WIFI hotspots. Although LIFI technology does not employ radio frequencies, it is a safer, greener, and less expensive alternative. When compared to Wi-Fi, LIFI technology provides consumers with superior security, capacity, and availability.

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