

**LIGHT FIDELITY: THE GREEN WI-FI**

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**ABSTRACT**

Light fidelity (Li-Fi) also known as Green Wi-Fi is a new and emerging technology, which is very popular among researchers and scholars. As internet is become a major need of people in this digital era, people are in search of Wi-Fi and hotspots. Li-Fi is the 5G technology which uses the Light Emitting Diodes for data communication through Wi-Fi. It is beneficial for wireless coverage inside a building however Li-Fi is best for high density data coverage within restricted region than the Wi-Fi. This technology provide the relive from radio interferences issues. In this paper we have discussed this new technology with reference to its various aspects like history, design, working and challenges but our main focus is to comparison of Li-Fi with existing technology. The undertaken study is useful for researchers, scholars and academicians.

**Keywords:** LIGHT FIDELITY, Li-Fi, Wi-Fi, Green Wi-Fi, Light Emitting Diodes, 5G Technology

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**1. INTRODUCTION**

Now a day's internet connectivity is a major issue for which the current era people are very concerned. Everyone wants to be connected with globe where ever he/she is. Like Wi-Fi hotspots in restaurants or any public place, Li-Fi is mainly named as light fidelity which is still in developing phase the main philosophy behind this technology is to transfer our data more faster than any other technology, as a large number of devices access the internet simultaneously,



therefore the existing network which connect us to internet provides less speed. With the limitation of fixed available bandwidth, it becomes cumbersome for these networks to provide high data rates and secured network [1]]. Li-Fi transmits the data by the use of LED bulbs and allows us to transfer data even faster than the response of human eyes, in this technology the data transmission is provided through LEDs, Li-Fi is centered on Visible Light Communication technology which allows us to transfer data through the source of light within the assigned range. Li-Fi is a technology which will enhance our data transmission experience and will also replace Wi-Fi technology in future, It provides large frequency band up to (300 THz) compared to RF communications provides band up to (300GHz)[2] also be beneficiary for doctors and medical students during their trials and operations because it is also radiation free so doctors and students will be able to access data connectivity in operation theaters which will help them to get connected with their seniors through video calls in order to avoid any mistake. It can also be used in aircrafts and in areas near nuclear plant without causing any harm/interference. Researchers are also claiming that it will be more[3] cheaper and beneficent than Wi-Fi which will save many bucks of customers which they usually spend on buying routers, switches and cables in order to install Wi-Fi device but in Li-Fi all they need to have is lamp driver which will be connected with led bulbs in order to make it work as data transmission device. There is no doubt that it wouldn't be successful in the market but according to researchers it will take up some time to be available in the market to users, As per researchers they are still working on Li-Fi technology to make it outperform Wi-Fi[4]. The researchers think that the speed of 10gbps can be achieved later (near future), if this would be possible then high resolution Movies would take very less time to download. Dr. Haas claims that by providing ordinary LED bulbs with an installed microchips .In this paper we have discussed this new technology with reference to its various aspects like history, design, working and challenges but our main focus is to comparison of Li-Fi with existing technology. The undertaken study is useful for researchers, scholars and academicians.[5]Figure No-1 shows the visual form of Li-Fi.



**Fig.1.** Concept of Li-Fi

## 2. HISTORY OF LIFI

This concept was first discovered by German physicist Prof. Dr. Harald Hass professor from university of Edinburgh, the word Li-Fi first used in TED Global talk on the topic of Visible Light Communication on 12 July 2011, This technology is introduced in 1990's in Korea, Germany, Japan and so on where they discovered LED's could be wireless spectrum available. The association believes that it is likely to get more than 10Gbps speed by using optical wireless technology also known as Li-Fi. It is more secure than Wi-Fi, which can receive data within transmitted cone-shaped tool of light signals. [6]Haas said: "My greatest vision is that light bulbs will become broadband communications equipment, so that the light bulb is not only able to provide lighting and also become a more necessary tool." [6].

### 3. RELATED WORK

Lots of research has been done in this field by various researchers since Last two decades. Whereas [7] discussed the Scope and challenges of Li-Fi whereas [8] [14] gives the comparison of Li-Fi with various other technologies such as Wi-Fi [9] [10] illustrated the future of Wi-Fi.

### 4. DESIGN OF LI-FI

Li-Fi design includes a more than one LED's comprising numerous other assets like Laptops, PDA's and cell phone. The facts which are focused while designing Li-Fi:

1. Presence of light.
2. Line Of Sight.
3. Fluorescent light and LED.
4. Photo sensor received data

### 5. WORKING OF LI-FI

Working of Li-Fi is very simple, It is mainly rely on digital data transmission, which is not detected by human eye. The LED's can be switched (off or on) very fast through which we transmit the data by the help of light. [2]

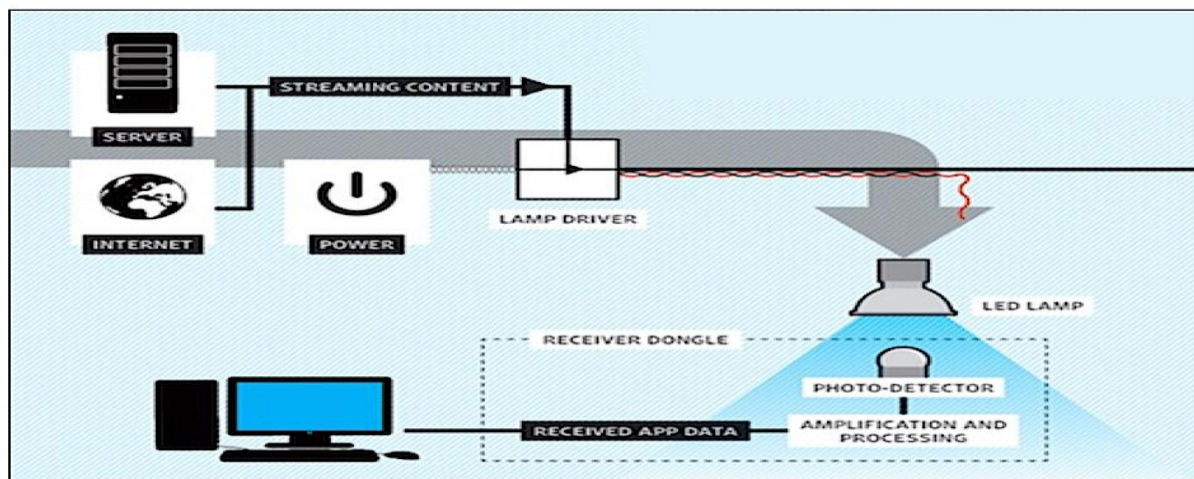


Fig.2. Working of Li-Fi

## **6. REPLACEMENT FOR OTHER TECHNOLOGIES**

As we know this technology uses light source to transfer data which is very useful for places where we are not allowed to use devices like Bluetooth, Infrared, and wi-fi etc. Li-Fi is a only solution available right now.

It has various benefits, i.e., very large spectrum of operation instead of the visible range of high color fidelity, electromagnetic spectrum, highly secured than Wi-Fi, Manageable terminal, and many more.

So, according to researchers Li-Fi is better than existing technologies and can be utilized in the fields where other technologies may flop.

## **7. ADVANTAGES**

There are various advantages of Li-Fi like as [11] [13] It operates on Visible Light Spectrum having ten thousand times more spectrum bandwidth than current RF band, Visible Light Spectrum is a free spectrum, there is no license process enabled for that by TROI. That means free of license cost, Visible Light Spectrum uses the Attocell, which not only recovers the enclosed coverage but it is also able to improve the capability of RF wireless networks., Attocell helps and being the bridge between RF and VLC Li-Fi Sub networks. It has high Installment cost but low maintenance cost. Li-Fi uses the LED bulbs which is Cheaper than Wi-Fi. Less time & energy Consumption Lower electricity Charges. Theoretical speed of 1.3 Gbps by using the different color LEDs we can achieve the more speed of 10 Gbps. Longevity of LED bulb saves money, More Expose of VLC spectrum won't cause any health problems. It provides secured access because of light penetration restriction through wall. LiFi can be used as remote signal under water Ocean where RF will not work. It can be used in Petrochemical plants where the RF usage is not secure, Can be used in Hospitals where RF signals cannot be used and Can be used in Auto Driven Cars to avoid the traffic / accident collisions. It is also beneficial in Streets to control the traffic signals also to form the Li-Fi Wi-Fi Network.

## 8. COMPARISON OF LI-FI WITH WIFI USING VARIOUSPARAMETERS

**Table1.** Comparison of Li-Fi with Wi-Fi

<b>Sr.</b>	<b>Parameters</b>	<b>Wi-Fi</b>	<b>Li-Fi</b>
<b>1</b>	<b>Standards</b>	IEEE802 11	IEEE802.1 5.7
<b>2</b>	<b>Speed</b>	Up to 150 Mbps	>1Gbps
<b>3</b>	<b>Medium to data transfer</b>	2.4 to 5 GHZ	Use light as a carrier
<b>4</b>	<b>Range of spectrum</b>	Radio Frequency range is less	1000 times broader than Radio Frequency spectrum
<b>5</b>	<b>Cost</b>	Medium	Low
<b>6</b>	<b>Security</b>	Medium	High
<b>7</b>	<b>Range</b>	100m	Based on LED
<b>8</b>	<b>Data Density</b>	Low	High
<b>9</b>	<b>Reliability</b>	Medium	Medium
<b>10</b>	<b>Power Available</b>	Low	High
<b>11</b>	<b>Transmit/Receive</b>	Medium	High
<b>12</b>	<b>Ecological Impact</b>	Low	Medium
<b>13</b>	<b>Market Maturity</b>	High	Low

## 9. CHALLENGES OF LIFI

Li-Fi is very efficient technology as compare to Wi-Fi. Wi-Fi is facing few challenges which should be addressed:

1. As we all know that Li-Fi works with the help of light source and to transfer data it requires us to use the device within the shadow of that light.
2. We can easily lose the access of internet if any issue comes to the light source.

3. Sometimes we also have to look for weather conditions whether it is good or not, if you have set up the connection outdoor.
4. Light cannot pass through walls, so if any kind of hard material comes in front of it then it will easily be blocked.
5. The biggest challenge is to transfer the data back to transmitter.

## 10. APPLICATIONS OF Li-Fi

The applications of Li-Fi is given below: [12]

1. Airways: In airways the communication is done through the radio waves due to these waves various problems can occurs in communication media during the travel in airways. Li-Fi is used to cope with such types of problems. As LED lights are already installed in the airplanes by using these LEDs the light and internet can be provided to the passengers without any problem.
2. Green Technology: It is named as green technology because its waves are not harmful to the human body like other technologies. Li-Fi never provides these harmful effects.
3. Mobile Connectivity: There are different mobile device such as Tablets, PDA's , Smart phones, Laptops, which necessitates high security and high data rate for connection in limited range and Li-Fi makes it possible.
4. Underwater Communication: The use of Radio Frequency is unworkable because of solid signal concentration in water. This problem can be solved by the use of Li-Fi.
5. Traffic Management: In traffic signals, LED and the Car light LEDs are interconnected with each other, which can be helpful to manage the traffic and decreases the quantity of accidents.
6. Health Application: In the operation theatres radio waves are not allowed because these waves are harmful for the patients' health. To cope with this Li-Fi is used.

## 11. CONCLUSION

Li-Fi is a new and very competent technology as compared to today's various technologies. This technology is not only less in cost but also provides the secure communications to the users. Li-Fi is still under implementation phase. Researchers and scientists are working to overcome its

challenges to improve its performance. It is beneficial for various other fields such as medical, education, industry and so on. It is also named as green Wi-Fi because its waves are less effective than other existing technologies. All above achievements shows that the Li-Fi is the perfect tool to provide better communication in restricted areas.

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