

# Li-Fi Technology

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## Abstract

Due to migration of data from local storage to cloud number of Wi-Fi users are increased. On wireless network numbers of users get increased and the speed get reduced uniformly. As per IEEE 802.11n Wi-Fi provide us speed up to 150-160 Mbps. It is still deficient to accommodate desired no of users. To remedy this restriction, we are presenting the idea of Li-Fi. As per German scientist Harald Haas -Transmitting data through a light-emitting diode light bulb that varies in intensity quicker than the human eyes can follow it. Haas says his discovery, which is called as D-LIGHT, able to make data rates quicker than 10 Mbps, which is speedier than the placed for typical broadband. As we know twentieth century is an epoch of internet. Where so many communications take place over the internet. Wi-Fi is most ordinarily used in the present century for establishing connection with the internet. In Wi-Fi the speed of data transferring and the amount of users can use, are restricted. Our project is about visible light is a high speed, duplex and absolutely networked sections of communication. Where light comes in use as a medium for sending the messages. As we know the speed of the light is approximately  $3 \times 10^8$  m/s which is going to act as a medium that will offer the incredible speed for data transmissions. Not only speed however also the protection in a closed surroundings will increase with the use of Li-Fi. Our project aims at ascertaining the use of Li-Fi also branded as Optical wireless communication.

**Keywords: Light Fidelity (Li-Fi), illumination, (D-LIGHT), Wireless-Fidelity (Wi-Fi), light Emitting Diode (LED)**

## I. INTRODUCTION

Li-Fi or light Fidelity is a bidirectional; high speed and fully networked subsections of visible light communications (VLC). Where instead of radio frequency (300 GHz-3Kz) visible light come use for communication; waves that carry more data. Therefore Li-Fi is an active and coming technology which has the ability to provide huge bandwidth. As the transmission of data over radio waves strategies its limits, a new medium endowments itself. We all have the knowledge about the custom of Wi-Fi is 2.4-5 GHz RF for the delivery of wireless statistics, for the accessing of web or data. Due to limited bandwidth i.e. 50-100 Mbps it enable to plot area outside the bandwidth. This is nice tie up with speed of internet then also it is less capable in exchange of big amount of data such as data files, films, software, games. The speed and the bandwidth are directly related in communication medium. Thus Radio wave frequencies based technologies are hard to implement. Wi-Fi is not able to serve the desire delivery in gesture recognition and positioning. For reducing such type of problems there is one alternate solution is present, known as Li-Fi (light Fidelity). This is also called as visible light communication and informally known as optical wireless technology, which serves intense variation of speed, reliability, suppleness and usefulness. Li-Fi is transmission {of knowledge |of information |of data} over light using the fibre out of fibre optics by directing data through a light-emitting diode light bulbs which varies in intensity quicker than the human eye can track. Li-Fi is the word that comes in use for labelling the fast and low-cost wireless communication system of optical version of Wi-Fi. Encoding of is possible data in the light by changing the amount at that the LEDs flicker on and off to deliver totally diverse strings of 0s and 1s. Intensity of light emitting diode is controlled hence quickly human eye is unable to notice, therefore the output seems continuous. A lot of subtle methods and techniques that might intensely increase visible communication rate. Li-Fi is quick 2 method communication that uses visible light rather than radio frequency waves for carrying data. The number of information being carried over the visible light is way quite the oftenest waves therefore giving us more bandwidth on the market for mistreatment. Machine data typically refers to combinations of 0's and 1's. Therefore transmitting streams of 0's and 1's means transmitting data or information and if its 2 ways that it becomes communication. There should be a unique way to represent 0's and 1's that by mistreatment light-weight is OFF and ON severally. If we've a singular thanks to represent 0's and 1's we are able to care for machine knowledge.

## II. EXISTING SYSTEMS

Presently Wi-Fi is the most often used wireless technology for transmission of data and connection to the internet. Wi-Fi has its own issues of safety as the person sitting in different area who isn't visible to us too can access data if the essential security measures don't seem to be detected.

### III. WORKING

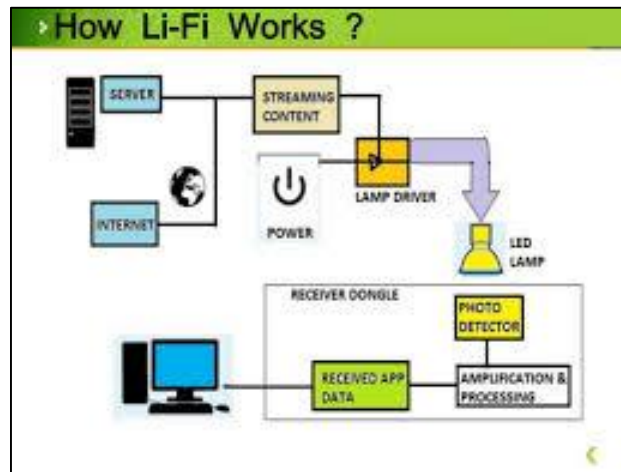


Fig. 1: Working of Li-Fi Technology

The above given FIG (1) demonstrates the working of Li-Fi technology. The information that's to be sent for instance through internet is being given to the light-emitting diode Lamp. When device shows ikon Detector which make the connection with light emitting diode it takes the data from the sender. Fundamentally building of it consists of bulbs which derives in daily use with a computer chip. This technology permits to transfer wireless information through a light-emitting diode light detector and bulb. By turning lights on and off i.e. flickering at a very great speeds the light-emitting diode bulbs able to send high bandwidth wireless information. However transmitting, data is converted into pulses {of light} which is focused at a photo detector or light detector that picks up little fluctuations in light intensity and period. This light signal is then transformed back into data formats for getting output from a computer. Prof Haas Harald, inventor of this technology claims the advantage of this medium of communication is that, visible light has 10,000 times the spectrum of radio frequencies allowing quicker data with far greater capacities in a single data stream. This medium can be made accessible anywhere that light bulbs can be established and also the only infrastructure essential are regular bulb sockets fitted with the changed light-emitting diode lamp and the photo detector or light detector to scan the information. No other massive infrastructure need to be fashioned to roll out this machinery.

#### A. Future Scope

Li-Fi can be seen as interchanging the current Wi-Fi technology. Along with the speed Li-Fi also offer security measures. As non-transparent obstacles cannot make use of Li-Fi and therefore data transmission happens only among the devices or users visible to human eye. However this issue can be overcome through the use of Li-Fi connectors that regenerate the light waves and match the synchronization.

#### B. Problems in Wi-Fi

These are the problems with radio waves:

##### 1) Capacity

For communication purpose use of Radio waves are found to be limited and also it's costly. With the coming advanced technologies alike 3G, 4G and so on are going to come in use for communication. Due to restricted bandwidth implementation of them will be difficult.

##### 2) Efficiency

1.4 million cellular radio base stations are present currently which burns energy in immense quantity. Bigger part of energy consumed by the bottom station at the place of broadcasting. For this type of base stations effectiveness is around 5-6%.

##### 3) Availability

Availability is concerned in massive radio waves. Mobile phones are prohibited in aircrafts and in organic compound plants and gasoline stations.

##### 4) Security

Radio waves can go through wall. So anybody with bad intention can misuse it. so the security can be harmed.

#### C. Advantages of Li-Fi

Li-Fi technology supports the data transmission through LED or any type of light bulbs no matter what spectrum they provide. That is why it can occupy in the range of the ultraviolet, invisible or the visible spectrum portion. Communication speed and the downloading of music, games and so on happens within no time.

And it also removes the disadvantageous part occurs in Wi-Fi:

### 1) Capacity

Radio waves have 1000 times lesser wide range of bandwidth than visible light. In the current era the apparatus related to the visible light implementation are present so the capacity can be increased easily.

### 2) Efficiency

Data transmission using Li-Fi is very cheaper than Wi-Fi. As LED consume less power than any radio base station.

### 3) Availability

Due to presence of light sources all over availability is not a problem. Around 1 billion bulbs are in use all over the world; there is only necessity to replace the bulb with LEDs for better transmission.

### 4) Security

The penetration of light through wall is not possible; so the security level reaches high.

## IV. APPLICATIONS

Li-Fi has so many numerous applications. Such as auto pilot vehicles which interact with each other using their headlights and also accessing internet using light of street lamps.

Li-Fi over comes the limitations of Wi-Fi. Such as in Hospitals, power station. As Li-Fi uses simply light for transmission it can be used in aircrafts, Flying drones and sanatoria which can be interfered with radio waves which is illegal and as we know Wi-Fi works due to radio waves.

Street lamps are usable for transmission of data through light. So that people will have large space for accessing internet.

Coming future will be like this with the great use of Li-Fi:

### A. Security

Security is big issue in a meeting room area. Spreading area of light is limited till walls of room and also it will fall on each user laptop so that users can use the internet with higher data rates and also share information within room only. As fewer number of members are present in room the data will be shared and access within themselves so the security can be maintain.

### B. Compact Urban Atmosphere

Urban areas have their own dense everything covered within lighting as people roam within this surrounding so the people will have high data rate access all over. For illustration, downloading will be done from anywhere else such as hotel lobby or corridor of hotel. Moreover, light can't propagate through walls so secured communication is possible. which gives better wireless communication and no need of using shared spread spectrum.

### C. Cellular Communication

As we know cellular communication requires base station having distance 200-500 meters but instead of using base station we use street lamps for data transmission in urban area which is worth and also gives high data rate with greater bandwidth. There will be no need of installing new base stations full data communication rates are still possible.

### D. EMI Sensitive Environments

On aircraft radio waves are not allowed (Wi-Fi), with use of Li-Fi technology every passengers will be free to use the internet with higher data rate. Li-Fi won't harm or won't create electromagnetic interference. And every passenger will be connected to the internet.

### E. Augmented Reality

Cameras and mobile phones are present in museums exhibitions etc. for information of any object or history of ancient things you can easily use the data transmission for downloading going on through the light of museums or exhibition.

### F. Localized Advertising

Every shop has its on display poster. If it is lighting than this lighting can be used as Li-Fi for broadcasting advertisement of shop. It's menus, offers, coupons, etc.

### G. Underwater Communication

Water absorbs Radio waves. So due to absorption underwater communication is not possible by using Wi-Fi. Here is the option Li-Fi. Light can travel through water. That's why underwater communication is possible with the use of Li-Fi.

### H. Safety Environments

As we know in situations such as bomb spot or explosion hazard environment mobile phones are highly prohibited. For transmitting data Li-Fi will make it easier. And also data network configuration will be simplify. Security will be maintain due to Li-Fi.

### ***I. Intelligent Transportation Systems***

Interaction between vehicles by using the headlights the accidents can be avoid at great level. And also traffic will be less as traffic lights will give information about traffic.

### ***J. Connectivity***

Every home has lighting facilities. Li-Fi will bring connectivity between television and also vacuum cleaner, microwave, landline phones, etc. In short internet can be accessed everywhere.

### ***K. Sensitive Data***

Radio waves are not allowed in hospital area which are harmful for medical machineries and also patients.

So the Li-Fi provide more options for data transmission n can give good deployment as it will be easy to share patients information.

#### ***1) Indoor navigation***

Navigation through urban areas will be easier. It will be easier to find locations due to Li-Fi having higher data rates

## **V. CONCLUSION**

Thus our project demonstrates light can be used as a medium for communication in returning future. As Li-Fi can be realized because the next big step within the world of digital communication and also the internet, there are teams round the globe acting on the Li-Fi technology and creating improvement for the use of Li-Fi publicly available

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