# Li-Fi - Wireless in Field of Data Communication

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**Abstract –** The brand new member of wireless data transmission family is Li-Fi which uses the concept of flickering light faster than human's eye capacity for data transmission. As we recognize the speed of light o a lot more than existing wi-fi data transmission. The technique can be used to acquire the speed of fiber optics in wireless communication technique. The Foremost problem is protection because visible (visible light) is more at ease then invisible (radio waves).The usage of light is preferred t because of radio/microwave/ Infrared strategies have reached the restrict same as silicon age is over and we are looking for broader variety i.e. nanotechnology.

The concept of Li-Fi came out from the thoughts of Dr. Harald Haas who has been operating in this area from 2004 and subsequently in 2011 he confirmed by sending video by using LED light lamp at speed of 10 Mb/s.

**Index Terms –** LED (Lightemitting diode) , VLC (Visible Light Communication).

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## 1.Introduction

In this digital generation, we are living in portable and high-speed global communication. So we need better spectrum for wi-fi data exchange due to the fact current is attaining to limit. Researchers are using light Spectrum variety between 400 THz to 800 THz or (780 nm) to (375 nm) as for transmission of statistics due to the fact that is untouched but. we will gain information charge of more than 1 GB/s using Li-Fi in place of 54-600 megabits consistent with seconds (Mbps) of wireless that is the most for these days high Definition digital world [2]. The sending and receiving are

easy as we use transceiver-equipped LED lamps for each purposes with normal lightning room property but in wi-fi we use modems for only data transmission. The main purpose to pick out light is because of harmless biological and environment effect and extensively to be had as an infrastructure, globally. This method uses traditional the binary technique of 0 and 1 of data transmission by way of manipulating the light depth which is past the human functionality to peer.



**Figure 1: Dr. Harald Haas**

Groups at the University of Edinburgh and Oxford University is focusing on parallel data transmission the use of parallel formation of LEDs, in which individual LED acts as an unbiased independent data source. Other teams are the usage of coloration scheme of a PC system that is RGB LEDs via which we can be blended these shades to make any shade of seen spectrum to get one-of-a-kind frequency of visible light, with every frequency encoding a one of a kind data channel we will get [1].

The table shows comparison between current and future wireless technologies:

| Technology | Data Rate | Reach | Security | Market Maturity |
|---|---|---|---|---|
| Wireless (current) | | | | |
| Wi-Fi-IEEE(802.11n) | 150Mb/s | Excellent | Good | Adopted |
| Bluetooth | 3Mb/s | Good | Good | Adopted |
| IRDA | 4Mb/s | Good | Good | Outdated |

| Wireless (future) | | | | |
|---|---|---|---|---|
| WiGig | 7Gb/s | Excellent | Good | Not Fully Adopted |
| Giga-IR | 1Gb/s | Good | Good | Not Fully Adopted |
| Li-Fi | >1Gb/s | Excellent (As long as we see light) | Excellent | Not Fully Adopted |

**Table 1 : Comparisons between Current and Future Wireless Transmission technologies**



**Figure 2: Visible Light Communication**

## 2. ARCHITECTURE OF VISIBLE LIGHT

## COMMUNICATION SYSTEM(Simplified)

The Li-Fi emitter system is made up from four primary parts:

- Bulb
- Radio Frequency power amplifier circuit (Power Amplifier)
- Printed circuit board (PCB)
- Enclosure

The PCB controls the electric alerts of the lamp and microcontroller is used to govern the feature of a lamp. A Radio-Frequency sign is generated via energy Amplifier and ship into an electric powered subject approximately the bulb. That changes the state of contents of the bulb to a plasma state to the bulb's middle area; This generates a strong source of light.
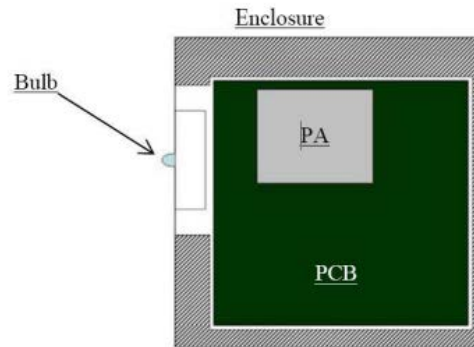


**Figure 3: Li-Fi emitter system**

All of these components are contained in an aluminum enclosure[8].The construction of lightning gadget consists of a bulb in adielectric cloth. That (dielectric material) serves two functions: It acts as a waveguide for the RF power transmitted by the PA and it also acts as an electric powered area concentrator that focuses energy to warmness the material in the bulb to illuminate. [9]
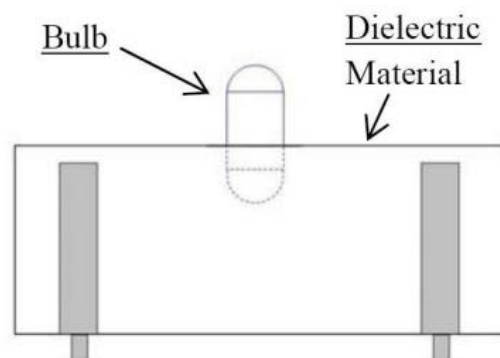


**Figure 3: Lightning System**

## 3.WORKING OF VISIBLE LIGHT

## COMMUNICATION

Today the most widely used communication is fiber optic and wifi. Development in wifi has now led to wireless communication using light.The basic components required for transmission are:

• **Source of light ( like LED, used here). •  Silicon photo diode act as receiving element.**

The LED's can be switched on and off (1/0) in a very fast manner ,such that its beyond the human eye reaction rate, which  transmits strings of logical 0 and 1 (data in  binary code). So  we require some LEDs that provides source of light along with  a controller that convert data suitable for sending through LEDs( preferably in the form of Binary Code). Then the flickering rate of LED is adjusted depending upon the data stream  to send.

A data rate of more than 100 Mbps can be achieved by using series of LEDs . An  LED lamp with signal processing technology act as a source, streams data embedded in its beam at ultra-high speeds to the light detector (receiver). A converter connected to the detector that converts the changes in amplitude into an electrical signals. The signals are then converted from  analog to digital and then transmitted to the device.

The below picture depicts the working:
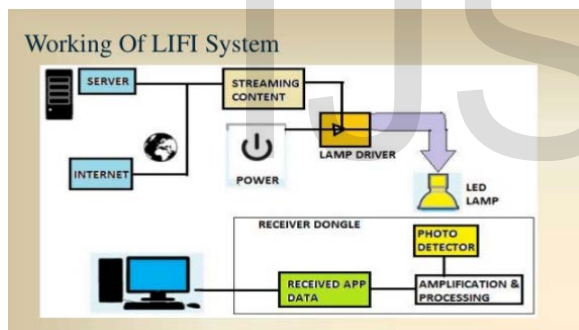


## 4.APPLICATION OF LI-FI

### 4.1Medical Field

Radio waves are harmful  and also can make distrupt important  equipment  in  hospitals.  Here  Li-Fi Technology  acts  as  a  solution,  it  has  a  larger spectrum than Wi-Fi , is harmless and can work efficiently with existing Light source.

### 4.2. Aviation Field

While travelling in flight we often switch off or put our phones in flight mode since the radio wave may interfere with the planes radio waves. Here LI-FI can be used for communication ,this can be done by using the reading lamps or a personal photo device.

### \4.3.Nuclear Industry

LI-FI comes in handy in nuclear plants or research station ,since the radio waves may react with the elements. LI-FI is a safe technique since it uses visible  light  which  does  not  react  with    most elements.

### 4.4. Security

Radio waves pose some security issues whereas , if light is visible then the risk is low. So Li-Fi is more secure than any other   wireless technology because we know the destination .

### 4.5 Office

We  usually  need  speed  for  data  transmission  in institutions  and  offices.  LI-FI  provides  larger bandwidth which makes its data transmission  rate higher than WI-FI.

### 5.CONCLUSION

We can use existing lightning infrastructure only replacing ordinary bulb with Li-Fi enabled LEDs enabling each light source as a WI-FI hotspot. The population is increasing drastically, so there will be a day when the requirement for larger bandwidth and transmission rate are in huge demand.  Visible light has far more spectrum space than spectrum of Wi-Fi. So we can use Li-Fi in each and every scenario . One of the disadvantages is that it only works in direct line of sight.

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