

# Performance Improvement Using Light Fidelity Network

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**Abstract:** Light Fidelity (Li-Fi) is an Optical wireless communication (OWC) technology, which uses light from light emitting diodes(LEDs) as a medium to deliver network, mobile, high-speed communication in a similar manner to Wi-Fi. Li-Fi can be simply position to remain Wi-Fi but in its place of radio waves light is used as a medium. Now, data is transmit using light whose amount varies faster than human eye to capture. In its place of using modems, Li-Fi uses LED bulbs with transceiver. Data transmission in Li-Fi is about 100 times faster than Wi-Fi. OFDM stands and 4QAM,16 QAM ,32QAM,64QAM has been reported. BER v/s SNR curves are simulated to improve their performance using light fidelity network.

**IndexTerms - Li-Fi, Simulink, OFDM, QPSK, 4QAM, 16QAM, 32QAM, 64QAM.**

## I. INTRODUCTION

Li-Fi (Light Fidelity) is a high speed, wireless communication using visible light communication. It is follows the category of optical wireless communications. Data transmission takes place through LED bulbs whose intensity varies. Based on this variation, communication occurs digitally.

The word Li-Fi was first invented by Harald Haas at the University of Edinburgh in the 2011. This technology consumes huge applications where the use of Wi-Fi is limited area. It also takes out the adverse health effects of using electromagnetic waves. Without light is seen, data can't be hacked and so data transmission is secure. Data communication is typically in terms of Giga bytes per second.

## II. VISIBLE LIGHT COMMUNICATION

Visible light communication range and signal is a part of electromagnetic ranges that the human eye can see. Its wavelength ranges from 390-700nm. The range of visible light communicate is continuous and has seven colors. Using visible light is less unsafe for high-power applications because humans can perceive it and to protect their eyes from damage.

- Gamma rays can't be used as they could be Dangerous.
- X-rays have similar health issues.
- Ultraviolet light is good for place without People, but otherwise dangerous for the human body.
  - Infrared, due to high safety regulation, can Only be used with low power.

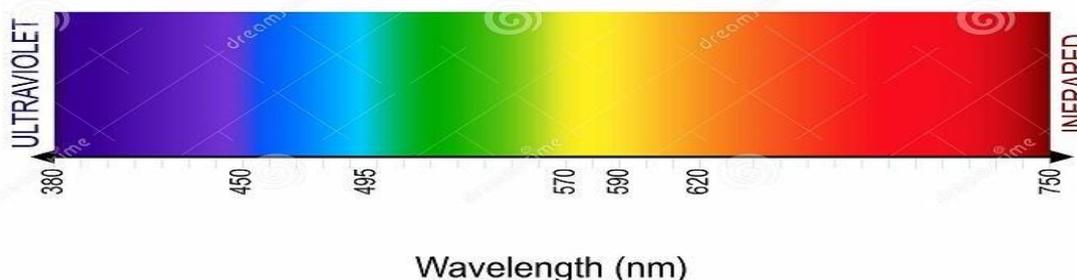


Fig 1:- Visible Light Communication

## III. Features of Li-Fi

Li-Fi deals a number of important benefits over Wi-Fi but is inherently a complementary technology.

### 1. Capacity:

Bandwidth: It is 10,000 more than RF spectrum the unlicensed and free use.

Data intensity: Li-Fi can achieve about 1000 times the data intensity of Wi-Fi because Visible light communication can be light illumination area whereas RF tends to spread out and cause interferences.

### 2. Efficiency:

Cost: Li-Fi is use to light through the information directly to the point to point array, office and building connected

to each other and cost are very less require to light fidelity.

Energy: The light illumination is already efficient and the data transmission requires the additional power.

#### IV. Problems of Wi-Fi

Wi-Fi uses radio waves, but using radio waves has lots of problems.

1. The Wi-Fi speed is low as compared with Li-Fi technology.
2. There are some areas where radio waves are not available means it is banned for these waves. For example in petrochemical plants, in aero planes.
3. This is not secured waves so some people misuse it because of the bad intention.
4. It consumes high cost such as required base station and cooling process of it.
5. In the cellular communication has limited bandwidth also it required large amount of energy for the base stations.

#### 3.1 Related Work

1. The author described this report possesses statistics approximately the visible light communication the use of Li-Fi technology. This modern-day generation Li-Fi describes transmission of "records via illumination" taking the fiber out of fiber optical by way of sending records through a controlled light bulb that varies in intensity quicker than the human eye can observe. Discuss of this paper on a Visible Light Communication (Li-Fi) performed work done by Kartik Wate.

2. The author described Li-Fi is a label for wireless-communication structures using light as a service rather than traditional radio frequencies, as in wireless. Li-Fi has the benefit of being able to be used in touchy regions along with in aircraft without inflicting interference. Discuss of this paper on a The New Era of Transmission and Communication Technology: Li-Fi (Light Fidelity) LED & TED Based Approach performed work done by Ravi Prakash.

3. The author defined the short boom in devices utilization and application developments has brought on many researchers to appearance past wireless. The opportunity of the usage of visible light for brief variety verbal exchange is explored with the aid of many researchers. Discuss of this paper on a Performance Analysis of Visible Light Communication System for Free Space Optical Communication Link performed work done by Shamsudheen P.

4. The term Li-Fi refers to visible light communication (VLC) technology that makes use of light as a medium to deliver excessive velocity communication in a way just like wireless. Discuss this paper on a Li-Fi—The Future Technology in Wireless Communication performed work done by Hemalata Chavan.

5. The author defined Li-Fi is the time period some has used to label the fast and reasonably-priced Wi-Fi communication tool, i.e. The optical model of wireless. In this paper on Wireless Communication tends to Smart Technology Li-Fi and its comparison with Wi-Fi performed work done by H.A. Hadi.

6. The author defined this era is quality for high density wireless facts communication in restricted area and to overcome radio intervention trouble. In this paper on a Li-Fi – A Revolution in the field Of Wireless-Communication performed work done by Parth Vora.

7. The author defined optical wireless communication is emerging as a potential wireless networking alternative made possible with the promising developments in the physical layer transmission. In this paper on A Novel Network Architecture for Indoor Optical Wireless Communication performed work done by Sampath Edirisinghe.

8. The author defined develops a novel cross-layer design framework for dynamic multiple access selection (DMAS) in intelligent Li-Fi APs. The developed framework runs at Li-Fi attocell system level and can be configured to cater for various system. In this paper on a Dynamic Multiple Access Configuration in Intelligent Attocellular Access Points performed work done by Hanna Abumarshoud.

#### 3.2 Li-Fi Network

In light-Fidelity might be a wireless communication expertise, that is uses light to communicate information then situation among procedures.

Now this real-world passé Li-Fi is a light communication method that is skilled and transferring data at great quickness finished the visible light communication (VLC). On dealings of its completion users, the expertise are related to Wireless Fidelity the key procedural transformation existence that Wireless Fidelity uses to radio rate to communicate information. The area is struck by number of light fixtures, which deliver light for radiance. Every graceful is focused through a Li-Fi modem before a Li-Fi chip and, then, similarly works as per a visual improper location otherwise access point (AP). The optical wireless network positions are related to the core network by great rapidity backhaul networks. The light fixtures additionally have an included electromagnetic sensor to acquire indicators since the stations. The revealing light illuminations are controlled at in elevation amounts.

The resultant great radio rate of recurrence flickers which remain abundant developed than the recharge amount of a

Laptop display are not evident to resident of the area influence as fine as records dismiss to each light fixture using a quantity of dissimilar methods.

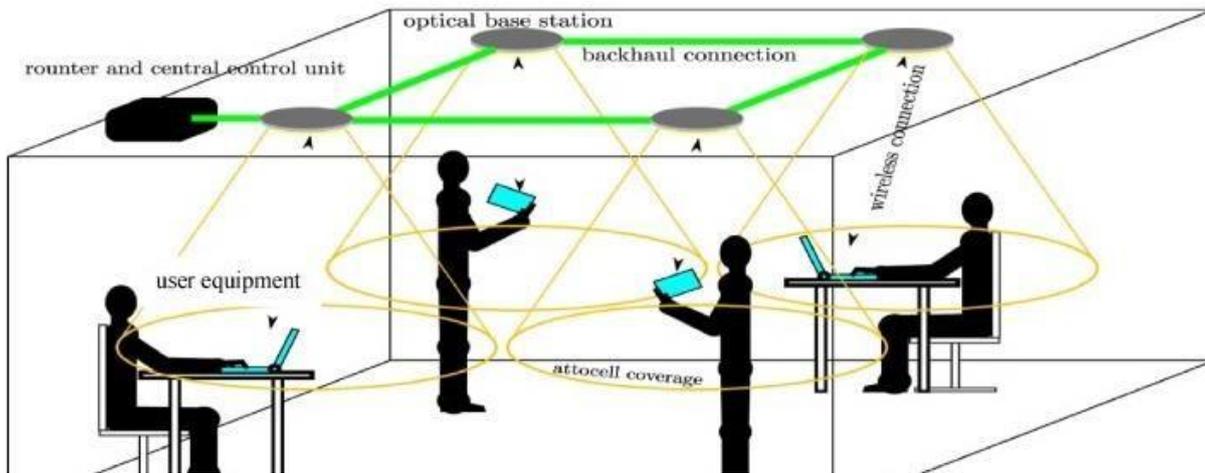


Fig 2 :-Li-Fi Network

### 3.3 How Li-Fi Work

The running on li-fi era is simply simple. A light supply at a few concludes like a led and the picture detector are the other stop. As swiftly as, led starts blooming, photo detector on other give up will stumble on light and get a binary 1 in any other case binary 0. Seen light is a records conversation intermediate, which uses seen mild among four hundred THz (780 nm) and 800 THz (375 nm) as optical service for information transmission and illumination. It usages rapid pulses of light to transmit records. Wi-Fi.

The principle mechanisms of this communiqué machine are

- 1) an excessive brightness white led, which acts as a communication supply and
- 2) a silicon photodiode which suggests desirable response to seen wavelength location serving because the receiving element.

Li-fi is usually applied the usage of white led light bulbs on the downlink transmitter. Those devices are usually used for illumination simplest by way of making use of a consistent present day. However, via speedy and subtle variations of the present day, the optical output may be made to differ at extremely high speeds. This very belongings of optical cutting-edge is used in li- fi setup. The operational manner is very simple: if the led is on, you transmit a virtual 1, if it's off you transmit a zero. The leds may be switched on and rancid very quickly, which offers first-rate possibilities for transmitting data. So what you require at all are some leds and a controller that code facts into the ones leds. We ought to simply vary the charge at which the led's flicker relying upon the data we need to encode. In addition enhancements may be made in this method, like the use of an array of leds for parallel records transmission, or using mixtures of pink, green and blue leds to regulate the mild's frequency with every frequency encoding an exclusive information channel. Such improvements promise a theoretical speed of 10 gbps- meaning you can download a complete excessive-definition movie in only 30 seconds.

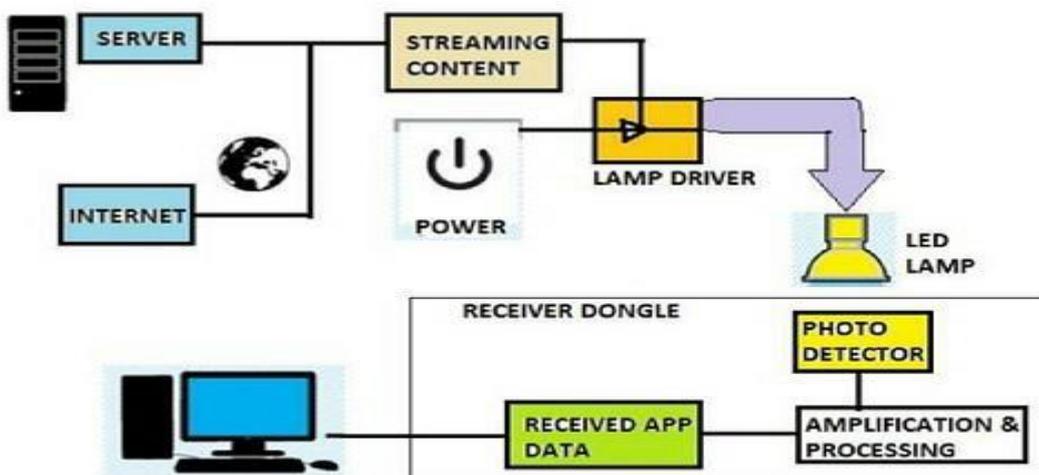


Fig 3:- Li-Fi Works

## I. RESEARCH METHODOLOGY

The methodology of Li-Fi uses visible light for sending data, it is necessary to modulate the data into a signal which can be transmitted. These signals consist of light pulses. Some of the common modulation techniques used in Li-Fi is discussed below:

### 3.1 Modulation Technique

In the digital modulation techniques generally used for Li-Fi are summarized, and some special issues and requirements are discussed. In principle, Li-Fi also relies on electromagnetic radiation for information transmission. There are two Modulation Technique Single carrier modulations and other of Multi-carrier Modulation. In this paper uses of Li-Fi are Multi-carrier Modulation Technique

### 3.2 OFDM

Orthogonal frequency-division multiplexing (OFDM) is a modulation technique of encoding digital data on multiple carrier frequencies. This remains a new method to communication in which an added element is added to square 2D amplitude/phase modulation (APM) techniques such as quadrature amplitude modulation (QAM) and pulses shift keying (PSK). Not like the modern OFDM modulation technique, the Sub-carrier Index Modulation Orthogonal frequency-division multiplexing technique splits the serial bit stream into two bit sub-streams of the same length. The important knowledge is to use the sub-carrier index to convey information to the receiver. The Orthogonally allows for efficient Modulator and demodulator implementing using the FFT algorithm on receiver side and other sender side the time computer the IFFT or FFT transform has to take the time for each side

### 3.3 QAM

In this digital modulation processes connected intimate of analog modulation approaches extensively used in modern communication to transmit information.as a QAM is a Data transmission as a 16QAM, another transfer to 64QAM, 64QAM to 256QAM.It is higher data rate can be achieved but at the cost of the margin many data migrate between the difference order of QAM, 16QAM,32QAM etc. dependent upon link condition. Then a QAM order increase so the increase so distance between the differences and there is a higher possibility of data error being introduced. There are shown constellation diagram of QAM.

### 3.4 QPSK

In the QPSK it is based on BPSK is conversion of digital bits into a series of digit stream it convert them into bit pair. These decrease the data bits. The decrease the data bits rate half which allow space for other users Thus in QPSK, the carrier undergoes four changes in phase. Each phase conversion can represent two binary bits of data. The idea of this method is that the carrier can transmit two bits of data instead of one, so the bandwidth of the transmission has effectively doubled. If a digital signal is used as the input to a straight frequency modulator, the output will consist of a sine wave containing two distinct frequencies.

### 3.5 Channel Model

Additive White Gaussian Noise (AWGN) is the information random radio noise characterized by a wide incidence range with regards to a signal in a communications channel. Average Signal-to-Noise Ratio (SNR). In this paper optical wireless communication system uses the AWGN channel model in which the only impairment to communication is a linear addition of wideband or white noise with a constant spectral density and a Gaussian distribution of amplitude the influence of Signal-to-noise ratio (SNR) of communication signal and channel coding on the Bit-Error Rate Performance is performed using prototype. Relative position of transmitter with respect to receiver on the improve performance in optical wireless communication.

### 3.6 Comparison Wi-Fi and Li-Fi

Parameter	Li-Fi	Wi-Fi
Speed	1-3.5 Gbps	54-250 Mbps
Range	10 Meters	20-100 Meters
IEEE Standards	802.15.7	802.11b
Spectrum Range	100000 times than Wi-Fi	Radio spectrum Range
Network Topology	Point To Point	Point To Multipoint
Data Transfer Medium	Used light as a carrier	Use radio spectrum
Frequency Band	100 times of Tera Hz	2.4 GHz

## IV. RESULTS AND DISCUSSION

The image is given as the input to the OFDM Modulation technique from communication Model where the Radio Frequency based OFDM system and optical communication based OFDM system combined in a hybrid Model. Before transmitting the image the type of network is to be choosing by the user .The model asks the Bellow said configuration details based upon the network to be transmitted. Then it generates the results for the image that is given as input based on the selected modulation technique and transmit to output of demodulate the image as combine QPSK and 4QAM,32QAM,64QAM modulation technique such as FFT and IFFT. All the experiments are carried out using MATLAB R2017b.The optical communication there improve network performance by using OFDM Modulation technique in Light Fidelity.

### 4.1 Performance Metrics

In this work the two major metrics are consider. They are Peak Signal-to-Noise Ratio (PSNR), and Bit-Error-Ratio (BER).

**Signal-to-Noise Ratio:**-is a work term for the ratio among the determined potential influence of signal and the power corrupting noise that affects the fidelity of its representation.

**Bit Error rate:-** The BER is the amount of bit error per unit time. In noise ratio channels BER is frequently as a purpose of the controlled carrier-to-noise ratio measure denoted  $E_b/N_0$ .

### Evolution Result

#### Figures

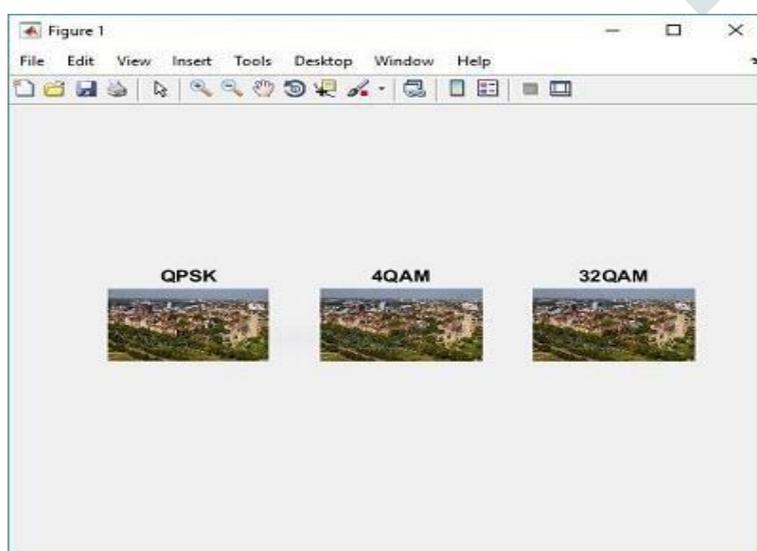


Fig 1: Output image of OFDM with 4QAM,32QAM Design

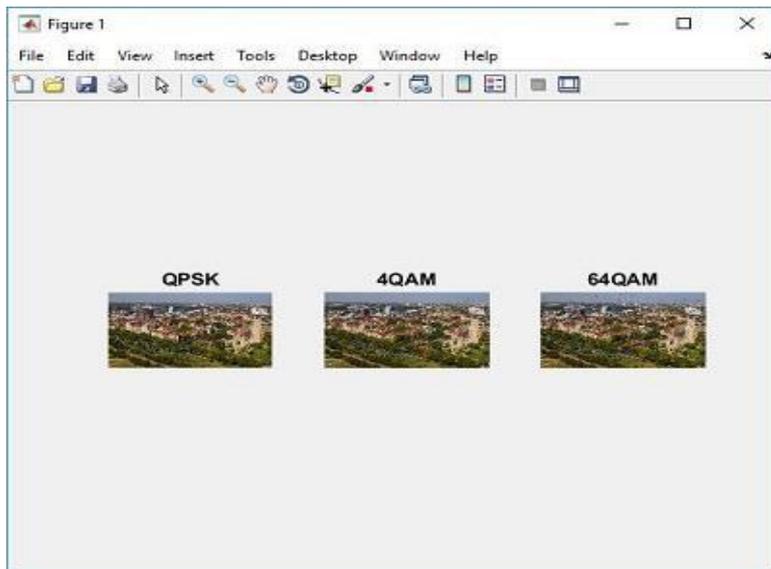


Fig 1: Output image of OFDM with 4QAM,64QAM Design

## Tables Test Configuration

### Parameter and performance calculation

Image Size	250*250
IFFT Size	16
Number of carrier	4
Modulation Method	QPSK,QAM
Peak Power Clipping	10dB
SNR	20dB

## V. ACKNOWLEDGMENT

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