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Data Transfer Using Lifi

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Abstract

Wireless-fidelity (Wi-Fi) and Bluetooth are examples of current wireless communication technologies that utilize the radio waves as primary source for data transport. Despite the widespread use of these technologies, there is a pressing need to investigate new methods for transmitting data wirelessly and efficiently. The reason for this is due to the band of radio frequency (RF) present limits, which has overpopulation and disturbance signals from other RF applications. More research work has been done to prove that visible light may be used as a wireless source for data transport in order to investigate alternatives. As a result, a German physicist named Harald Haas presented a new technology called light-fidelity (Li-Fi). This is a wireless technology that uses visible light instead of the radio wave as a communication medium. The scientific community has recently been drawn to Li-Fi technology. Wireless technology has advanced to the point that it is now necessary to send large amounts of data on a daily basis. Electromagnetic waves, or radio waves, are the most common technique of transmitting data wirelessly. Due to limited spectrum availability and encroachment, radio waves can only support a lower bandwidth. Data transmission via visible light communication is one solution to this problem (VLC). Wi-Fi is used to provide wireless coverage within a building, but Li-Fi is ideal for providing high-density wireless data coverage in a confined area while reducing radio interference. We use LEDs at the transmitter end and photo detectors at the receiver end to send multimedia data between two terminals utilising Li-Fi.

Keywords: *Light Fidelity, Wireless, Radio Interference,Bluetooth*

I. INTRODUCTION

Every one of us uses smart gadgets with various technologies in today's smart world, and one of the most significant actions performed by all of these devices and technologies is the wireless transfer of data. The primary way for exchanging information is through radio waves (electromagnetic). Radio waves have long been utilized for wireless communication and are widely employed around the world. Due to better propagation speed, BW, throughput, and low power needs, RF bands outperform their acoustic equivalents.Because of the limited spectrum accessibility, RF waves can help with low data transfer capacity (bandwidth). Visible Light Communication (VLC) is one of the more viable alternatives for large-scale data transmission (VLC). The phrase "visible light communication" (VLC) refers to an optical communication system that sends data wirelessly by modulating light which is visible to our eyes. Optical communication provides an advantage since it overcomes RF limitations like noise reduction and increased throughput (Mbps to Gbps range).Li-Fi (Light Fidelity) is a new data transfer technology that uses the optical spectrum.Traditional Wi-Fi (Wireless Fidelity) is designed to handle wide areas, whereas Li-Fi is ideal for providing highly compact wireless coverage in small spaces and reducing RF interference. Li-Fi focuses on transmitting multimedia data using an LED-photodiode pair. This light fidelity (Li-Fi) communication environment has a number of advantages over auditory communication, including reduced complexity, increased data transmission rate, and low power usage. Harald Hass, a German scientist, coined the term "data through illumination" to describe Li-Fi during a TED (Technology, Entertainment, Design) Global talk on light Communication (VLC) in July

2011. Li-Fi has the potential to alleviate the current wireless system's excessive loads. Furthermore, because Li-Fi employs the colour spectrum, it will assist to allay fears that Wi-electromagnetic Fi's radiation may harm our health. Visible light communication can discover the service area simply. Because light is obscured by any object in Li-Fi, higher levels of security are frequently attained, whereas in Wi-Fi, new technologies must be employed for increased security. As a result, Li-Fi is frequently used in high-security military sites where RF communication can be intercepted.

1.1 Working of LiFi

The notion of Visible Light Communication underpins Li-Fi. Figure 1 depicts the Li-Fi technology's basic operation. Many light bulbs are used to make a wireless network. This network emits a stream of photons when an electrical energy is applied to it. As LED bulbs acts as a semiconductor devices, their maximum intensity may be changed at extremely fast speeds. Thus by the method modulating the light at various rates, we can transmit a signal. The detector which receives the signal demodulate the light intensity changes into data. The intensity modulation is not visible to ours eye, in the same time the communication is very smooth and fast when compared to various radio systems, allows users to connect wherever LiFi enabled light is available. Data may be sent from an LED light bulb at rapid speeds using this technology.

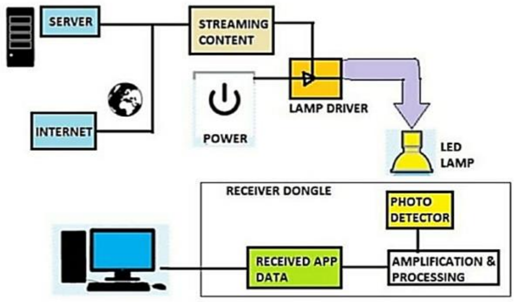


Fig. 1:Working of Li-Fi technology

1.2 LiFi over WiFi

Table 1: Comparison between Li-Fi and Wi-Fi

PARAMETER	Wireless Fidelity	Light Fidelity
Spectrum	RF	Visible Light
Data Transfer Rate	(100Mbps-1Gbps)	More than 1Gbps
Cost	High	Low
Availability	Low	More
Bandwidth	Limited	Unlimited
Power consumption	High	Low
Operation	Using LED bulbs, Li-Fi transports data via light.	Wi-Fi utilizes radio waves to transport data with Wi-Fi router.

Interference	There are no interference difficulties like there are with radio frequency waves.	Interference from neighbouring access points will be a concern (routers)
Technology	IrDA-compliant devices are currently available.	Devices that comply with the WLAN 802.11a/b/g/n/ac/ad standard
Applications	aircraft, submarine excursions, hospital operating rooms, offices, and homes.	With the support of Wi-Fi hotspots, it is used to browse the internet.
Advantages	There is less interference, it can flow through sea water, and it works in dense areas.	Due to more interference, it cannot flow through the water, and it only operates in a less dense area.
Privacy	Because light is prevented by barriers in Li-Fi, data transfer will be more secure.	Because the RF signal in Wi-Fi cannot be blocked by walls, measures must be used to ensure safe data flow.
Frequency of operation	ten thousand times the frequency spectrum of the radio	2.4 GHz, 4.9 GHz and 5 GHz
Volume of data	Suited best for highly congested medium	Due to interference difficulties, it is necessary to work in a less congested setting.
Length of coverage	Approximately 10 m	Range is approximately 32 m (WLAN 802.11b/11g), but it varies depending on transmit strength and antenna type.
Parts of the system	The Li-Fi system will consist of a light driver, an LED bulb (lamp), and a photo detector.	Subscriber devices treated as stations, and routers are required to be installed.

A comparison of both fidelity types are tabulated in Table 1. Wi-Fi transmits data using radio waves, which generate dangerous radiation linked to health problems. The visible light region's frequency is higher than that of radio waves, implying that the visible region will have a larger bandwidth. We can download more info at once if we have more bandwidth. If our Internet Service Provider (ISP) offers a 250Mbps subscription, for example, our bandwidth will be 250Mbps. Because the data transmission will take place right in front of our eyes.

1.3. Advantages of LiFi

Li-Fi has many advantages in comparison to the other technologies that we have today. Some of them are:

- Greater speed
- Security
- Availability
- Cheaper
- Complexity

1.4. Disadvantages of LiFi

The disadvantages of Li-Fi are as follows:

- Li-Fi cannot be accessed beyond the illumination range of light (it cannot be accessed behind a wall).
- Due to interference by the other sources of light, there will be noise.
- If some external disturbance comes in between the receiver and transmitter, Li-Fi doesn't work.
- Li-Fi only works in the direct line of sight (since light travels in a straight line).
- If a mirror or a reflecting device comes in front of the transmitter, the data could be diverted and thus another user can access the data.

*1.5 **Applications of LiFi***

Li-Fi will play more important role in the following applications:

- Data transfer in phones
- Airplane
- Underwater applications
- Traffic
- Outdoor access

II. SYSTEM OVERVIEW

The proposed methodology is shown by a block diagram in Figure 1.2. The transmitter converts data into light using modulation. Due to the relatively linear relationship maintained between light weight intensity and current, an LED is most ideal component for this application. The fundamental concept is to vary the LED's brightness, so that the brightness corresponds to the symbol transmitted. The Microcontroller ports aren't able to deliver enough current to generate fast strong sunlight intensity. This difficult can be resolved with usage of a transistor as a switch, allowing a larger current to be changed more quickly. The incoming light is converted into current employing a photodiode.

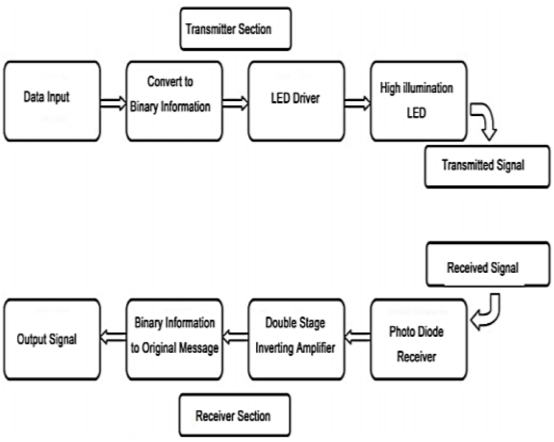


Fig. 2 : Proposed Methodology

The Microcontroller is unable to apply a voltage greater than 5V to a digital signal. The receiver's circuitry must convert the signal to voltage before amplifying and comparing it. Automatic gain controller (AGC) is preferred in place of a variable resistor to avoid the variation in the signal. By amplifying or decreasing the input voltage, this component changes it to a desired output value. Before reaching the microcontroller, the signal is checked with an Op-Amp comparator to confirm that it is digital and stable. The most extensively used encoding method is employed in this project. On-off keying technique is used to decode the data. The logic value ‘0’ corresponds to LOW, and the logic value ‘1’ corresponds to HIGH. This implies that the LED turned out to communicate a 0 and on to communicate a one in the case of VLC. For a coherent receiver, error probability of a high bit are represented using PeS and PeM. These bits are treated as a coffee bit and a coffee bit which is then treated as high bit, is given by the below quation

$$\mathrm{PeS} = \mathrm{PeM} = \frac{1}{2\mathrm{erfc}(\frac{\sqrt{\mathrm{Eb}}}{4\mathrm{Na}})} \qquad (1)$$

where the energy-to-noise spectral density ratio is Eb/Na, and the complementary error function is erfc (.).

2.1 Factors affecting the Modulation in VLC

Dimming and flickering are two important elements to consider when designing a modulation scheme for VLC.

(a) Different activities necessitate different levels of illumination, such as the thirty to hundred lux required for regular light based activities in public spaces. Due to non-linearity relationship between measured and perceived light, an equation is given by:

Perceived Light (%) =100 × Measured Light (%)100 (2)

(b) Modulated light's brightness should be adjusted in such a way that no human-perceivable fluctuations occur. To avoid adverse impacts, IEEE 802.15.7 recommends shuttling rate should be less than two hundred Hz.

III. HARDWARE SETUP

3.1 Resistors

Resistors are used in electronic circuits to provide a specific level of resistance. Resistor gives a certain quantity of electrical resistance rather than to generate usable heat. Resistors are used in circuits to provide a specific amount of resistance. Resistors are made up of metal wire or carbon, and they keep a constant resistance value under a variety of conditions. When compared with lamps, they do not let out light, but they give out heat due to electric power generated in the circuit.

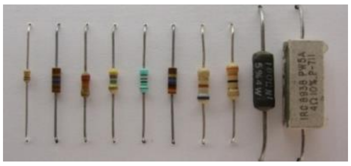


Fig. 3 : Resistors

3.2 Capacitors

Capacitor acts similar to a battery in storing electricity. Figure 4 shows a number of different capacitors. Chemical processes on one of the battery's terminals produce electrons, while chemical reactions takes place in the remaining terminal absorb them. On comparing Capacitor with a battery, we can observe that capacitor is very less complicated than a battery as it does not produce electrons. Non-conducting material is provided between the two terminals is known as the dielectric. Dielectrics can be made using any non-conductive material. In actual applications, however, particular materials are used. However, in real applications, particular materials are used to best suit the capacitor's function.

Fig 4 :Capacitors

3.3 Operational Amplifier

An op-amp is a voltage electronic equipment with additives that embrace resistors associate degreed capacitors connected among its output and enter terminals. These remarks additives decide the amplifier' final feature or "operation," and also the special remarks topologies, whether or not or not resistive, capacitive, or both, allow the amplifier to execute a intensive kind of operations, incomes it the name "Operational Amplifier." The signal for an operational amplifier is visible in

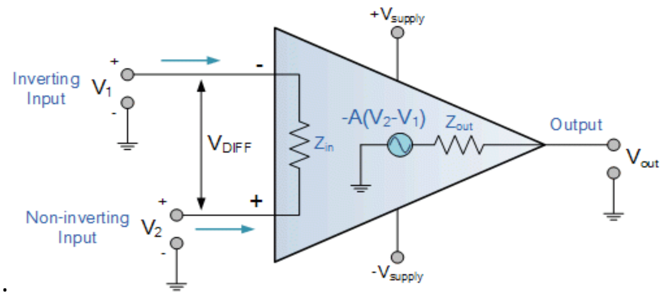


Fig 5 : Operational Amplifier

3.4 Light Emitting Diode(LED)

LED emits light when an electric current is sent through it. Light is produced when current-carrying particles (also known as electrons and holes) collide within a semiconductor material. Since light is generated within the solid semiconductor material, LEDs are classified as solid-state devices. Figure 6 shows the circuit diagram as well as the multiple components of an LED. Organic LEDs (OLEDs) are a type of solid-state lighting that differs from those that use heated filaments (incandescent and tungsten halogen lamps) or gas discharge lamps (fluorescent lamps). Within the LED's semiconductor substance, electrons and holes are confined in energy bands. The distance between the bands determines the energy of the photons (light particles) produced by the LED (i.e. the bandgap). The photon energy determines the wavelength of emitted light, and consequently its colour. Varying semiconductor materials with different bandgaps colour light differently.

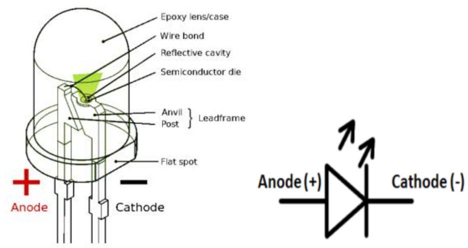
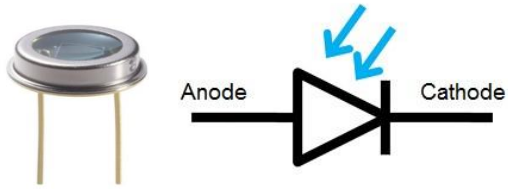


Fig 6 :LED

3.5 Photodiode

Light energy is converted into voltage or current by this sort of light sensor. A photodiode is a semi-conducting device with a PN junction. Between the p (positive) and n (negative) layers is a layer of intrinsic material. The photo diode uses light energy as an input to generate electric current. This gadget is referred to as a photodetector, photo sensor, or light detector. Some of the most common photodiode materials include silicon, germanium, indium gallium arsenide phosphate, and indium gallium arsenide. On the inside of a photodiode, there are optical filters, a lens, and a surface area. The reaction time increases as the photodiode's surface area increases. On this gadget, there are two terminals. The anode is the shorter of the two terminals, while the cathode is the shorter. The



photodiode signal can be seen in Fig. 7.

Fig 7:Photodiode

The photodiode works in reverse bias mode. As seen in Figure 8, reverse voltages are represented on the X axis in volts, while reverse current is plotted on the Y axis in microampere. Reverse current is unaffected by reverse voltage. When there is no light illumination, the reverse current is almost nil. The smallest amount of current that exists is known as dark current. The reverse current rises in a linear pattern as the light intensity rises.

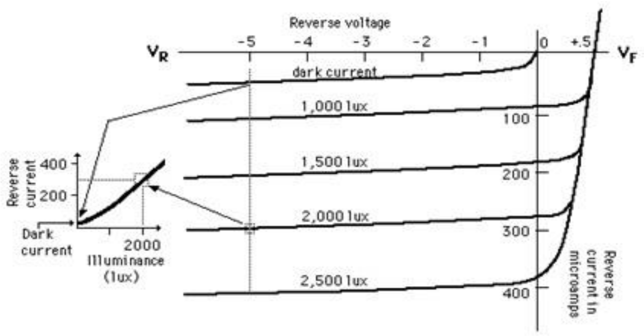


Fig 8: VI Characteristics of Photodiode

3.6 Keypad Module - 4x4

One GPIO pin is required when connecting a single key to the microcontroller. However, if we want to connect many keys, such as 9, 12, or 16, all of the microcontroller's GPIO pins may be used. We can utilise a matrix keypad to conserve GPIO pins on the microcontroller. A matrix keypad consists of rows and columns of keys. For example, if we want to connect 16 keys to a microcontroller, we'll need 16 GPIO pins; however, if we use a matrix 4x4 keypad, we'll just need 8 GPIO pins. In a matrix of rows and columns, keyboards are arranged. A row and a column establish touch when a key is pressed; otherwise, there is no connection between them. Figure 9 depicts 4x4 matrix keypad.

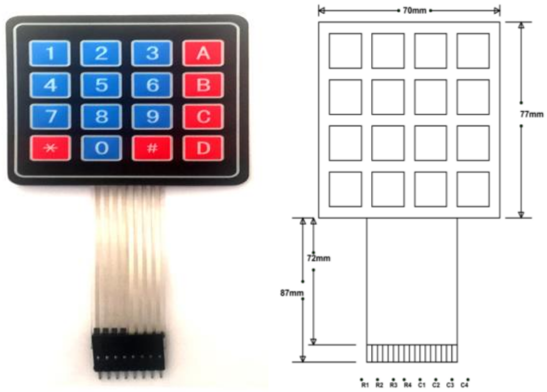


Fig. 9:4x4 Keypad module

3.7 LCD DISPLAY – 16x2

The term "liquid crystal display" (LCD) refers to a display built of liquid crystals. It's a form of electronic display module that can be found in a variety of circuits and devices, including phones, calculators, computers, and television sets. Figure 10 shows a 16x2 LCD display. The main benefits of using this module are its low cost, ease of programming, and the ability to display unique characters, special effects, and even animations with no limitations. The following are some of the characteristics of this LCD:

• It features two rows, each with a 16-character output capability.

• This LCD's operating voltage is 4.7V-5.3V; the current consumption is 1mA with no backlight; each letter can be generated with a 588 pixel box; the alphanumeric LCDs alphabets and numerals can be made with a 588 pixel box;

• It operates in four-bit and eight-bit modes.

• It has a blue and green backlight and displays some user-generated characters.

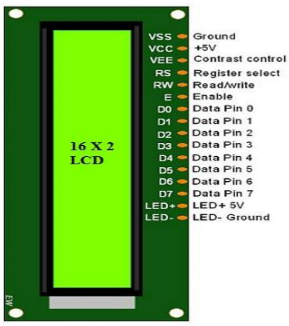


Fig. 10 :Pin diagram of 16x2 LCD display

3.8 Microcontroller - Atmega16

Atmega16 microcontroller is Atmel's Advanced Virtual RISC machine. It has high performance architecture. Figure 11 depicts the PIN diagram of a 40-pin microcontroller. It's a computer featuring a CPU, RAM, ROM, EEPROM, Timers, Counters, ADC, and four 8-bit ports (ports A, B, C, and D). For added performance, each port contains 8 input and output pins.

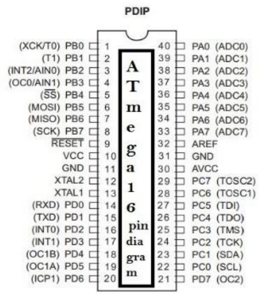


Fig 11 :PIN diagram of ATmega16

IV. SOFTWARE RESULTS

This section gives the software results for text, audio and image transfer using LI-FI.

4.1 Audio Transfer done in Multisim

An analog circuit was designed to transfer audio input in multisim. The transmitter part consists of a power amplifier which is used to amplify the weak signal followed by a non-inverting amplifier with LED. The receiver part consist of photo diode with the amplifier circuit to remove the noise and to strengthen the signal. The circuit diagram of the transmitter and receiver implemented is shown in Figure 12 and 13 .A voice recodingwas given as audio input to the circuit. The output is shown via a signal analyzer. From the simulation it was observed that environmental noise was added in the output. So, there is a need for the enhancement of the circuit design to reduce the noise.

Figure 14 shows the input audio signal shown via a signal analyser. Figure 15 and 16 shows the output of the transmitter and receiver circuit. As there is some error obtained at the receiver end, some modulation in the circuit must be done to get the exact result.

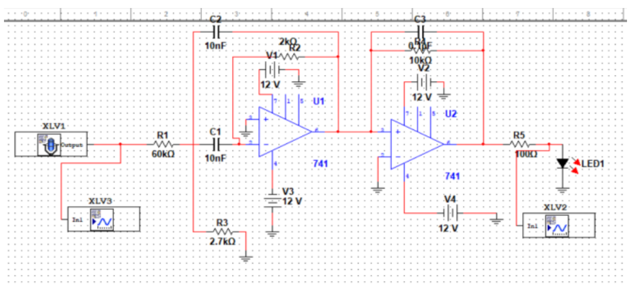


Fig 12: Circuit diagram of Transmitter

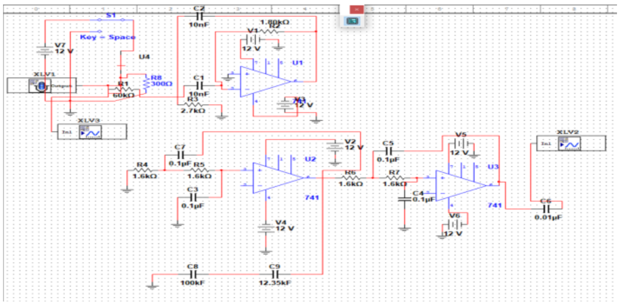


Fig 13: Circuit diagram of receiver

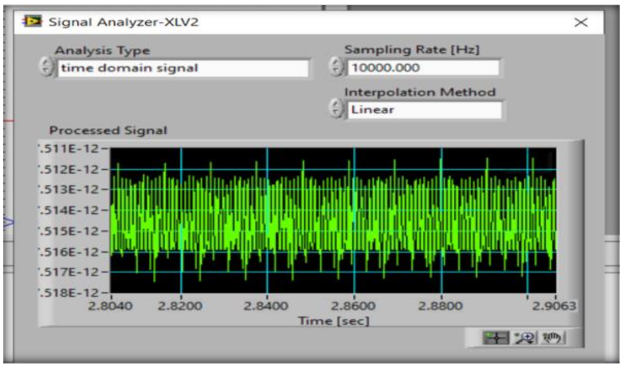


Fig 14: Input

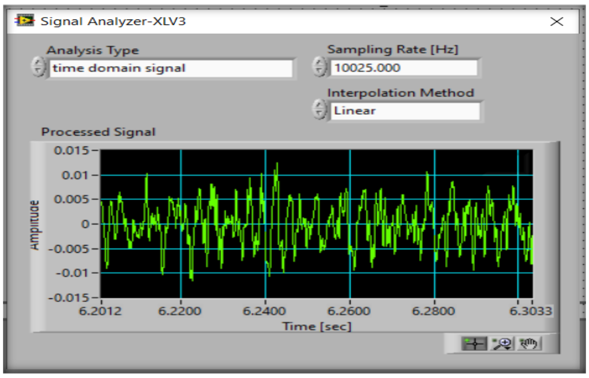


Fig 15. Simulation output of Transmitter

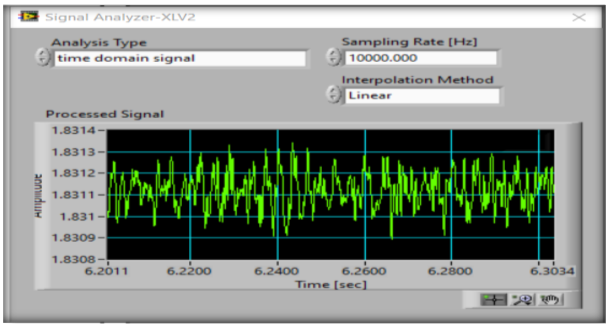


Fig 16. Simulation output of Receiver

4.2 Audio Transfer done in Simulink

A circuit with modulation was designed to reduce the noise. The circuit was built in simulink. The circuit consist of transmitter and receiver part with the frequency modulation. An input signal of 10 KHz was given as input, which is given to the integrator and multiplier followed by a 16 bit ADC to convert the analog signal to digital. The series of bits was given as an input to the LED. The photo diode in the receiver part receives these series of pulses from the LED and is given to the amplifier followed by a DAC to convert the digital signal to analog. Here P to S simulink converter is used for physical environment signal to simulink environment signal conversion and S to P converter is used for converting simulink environment signal to physical environment signal .Figure 17 shows the Circuit diagram of transmitter and receiver that was implemented.

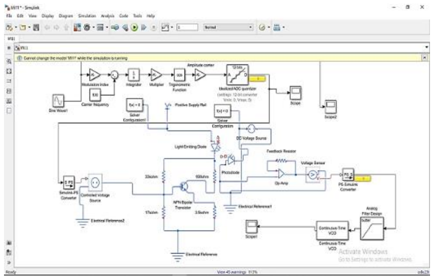


Fig 17. Circuit diagram of Transmitter and Receiver with Frequency Modulation

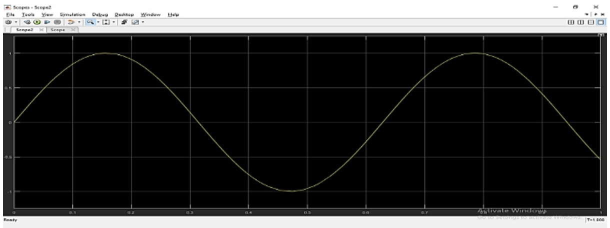


Fig 18 :Input signal

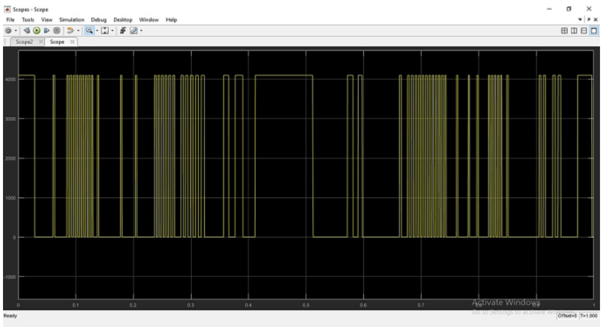


Fig 19: Output bits

Figure 18 shows the input signal of frequency 10 KHz which was given as input and Figure 19 shows the output from the 16 bit ADC. The final output is shown in Figure 20.Fig 19: Output of the transmitter

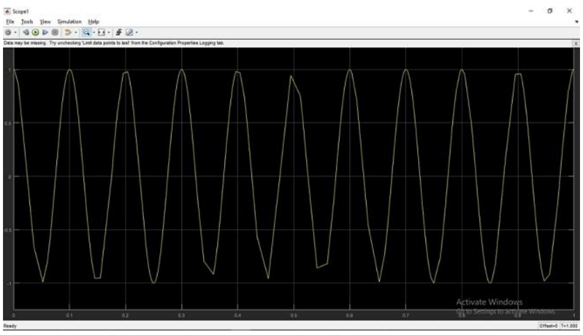


Fig 20: Output of the Receiver

4.3 Text Transfer done in Proteus

A transmitter and receiver circuit using Atmega16 microcontroller was built in proteus. Here the input was given using a 4x4 keypad and the output was displayed in a 16x2 LCD. An embedded C code was written. On the transmitter side, the microcontroller was coded to convert each key input to a pulse with unique frequency to make the LED blink. On the receiver end , a photodiode was used to detect the light from the LED and from the frequency of the pulses obtained the value of the key was displayed in the 16x2 LCD.Figure 21 shows the Circuit diagram of the transmitter and receiver .

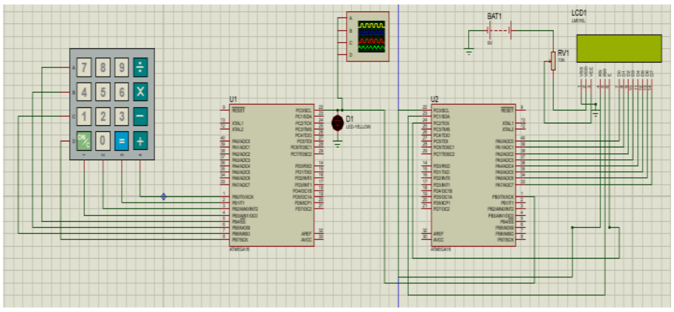


Fig 21: Circuit diagram in Proteus for text transfer

Figure 22 and 23 shows the output when the keys 9 and 3 was pressed in the keypad, respectively. The output of the oscilloscope shown in Figure 24 and 25 shows the pulses of different frequencies generated for different input values.

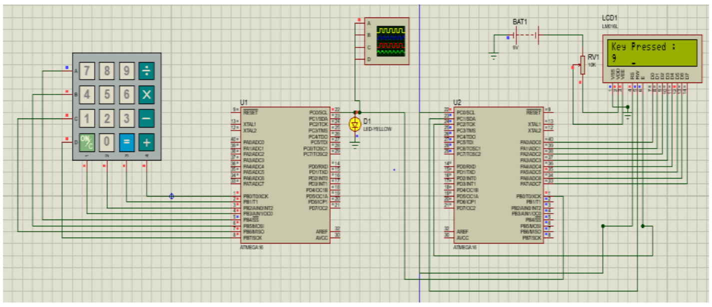


Fig 22 :Output when key 9 was pressed

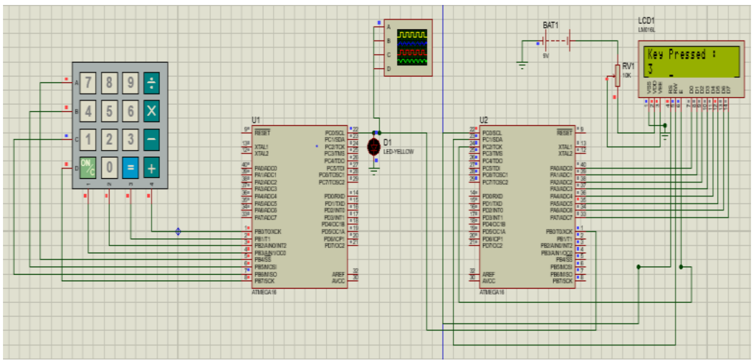


Fig 23 :Output when key 3 was pressed

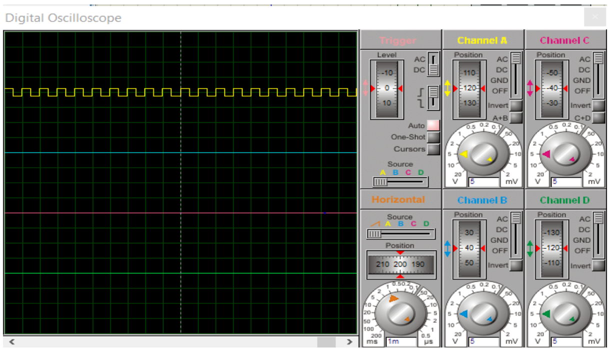


Fig 24:Transmitter output when key 9 was pressed

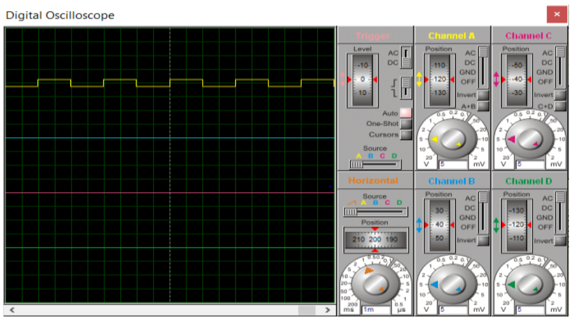


Fig 25:Transmitter output when key 3 was pressed

4.4 Audio Transfer done in Proteus

A circuit in proteus was designed for audio transfer. The concept is same as text transfer .In addition to that a power amplifier in the transmitter and receiver side was added to strengthen the weak signal. An audio signal of the word "hello" was given as input. The code was written for data transfer done through USART and for ADC and DAC in the transmitter and receiver side respectively. Figure 26 shows the hardware setup connection, Figure 27 shows the input given to the circuit and the output is shown in Figure 28 and 29. From this simulation it can be observed that wireless data communication with a simple circuit can be done without any error.

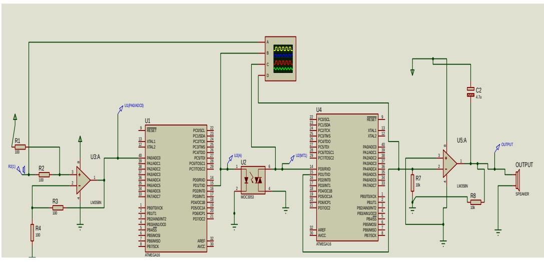


Fig 26: Circuit diagram in Proteus for audio transfer

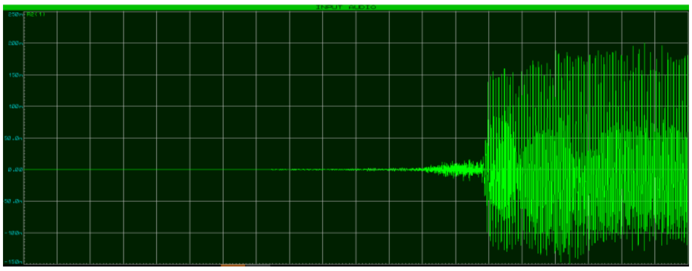


Fig 27:Input audio

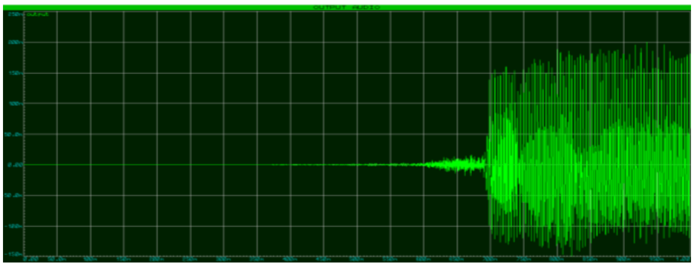


Fig 28 :Output audio

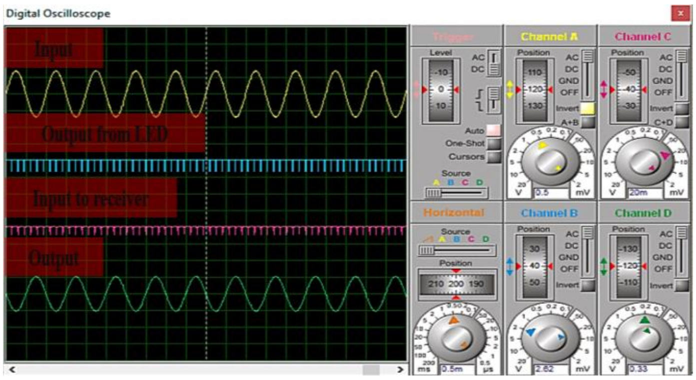


Fig 29: Oscilloscope output for 1 KHZ Sine wave input

4.5 Image Transfer done in Matlab

Image transmission was done in MATLAB using OOK(On-Off Keying) Modulation. The input 3-channel image(Red-Green-Blue) and it gets converted to a grayscale image are shown in Figure 30 a & b respectively. A grayscale (or graylevel) image is simply one in which the only colors are shades of grey. The reason for differentiating such images from any other sort of colour image is that less information needs to be provided for each pixel. Then OOK modulation is done on this binary data.A noise is added to this signal and the signal is transmitted. The input and output of OOK modulation is shown in Figure 31. On the receiver end, the received signal is demodulated to a series of pulse. The pulses are then converted into pixels(2D) and the output image is obtained as shown in Figure 32.The Bit Error Rate(BER) Vs Signal to Noise Ratio(SNR) graph was plotted and is shown in Figure 33.

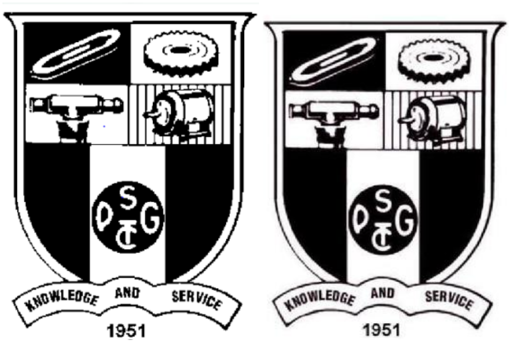


Fig 30:Input Image and Grayscale Image

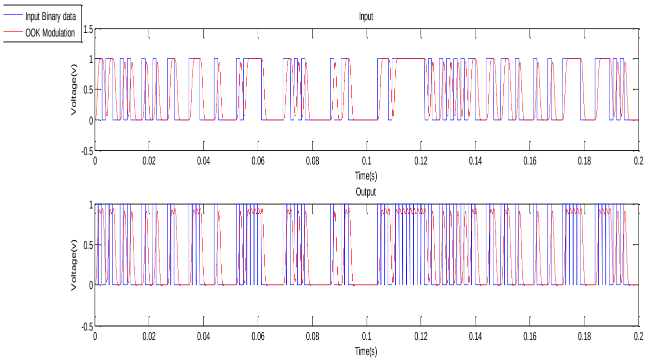


Fig31:Input and output signal of OOK modulation

Fig32 :Output Image

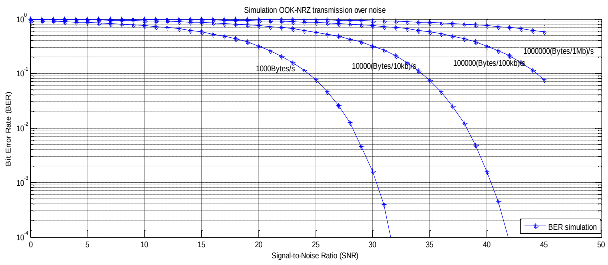


Fig33:Bit Error Rate(BER) Vs Signal to Noise Ratio(SNR) graph

4.6 Comparison between Wi-Fi and Li-Fi

The circuit diagram of both Wi-Fi(shown in Figure 34 and 35) and Li-Fi(shown in Figure 36) was implemented in Multisim.A sine as shown in Figure 36 was given as input. The outputs obtained from the Wi-Fi and Li-Fi transmitter and receiver is shown in Figure 37, 38, 39 and 40 respectively. The calculation of power and frequency of both Wi-Fi and Li-Fi was done and the results were compared.

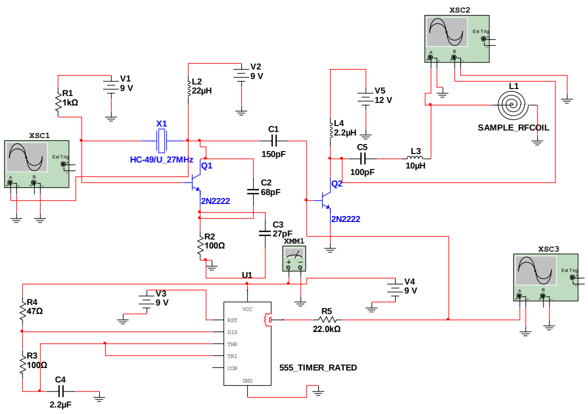


Fig 34 :Circuit diagram of Wi-Fi transmitter

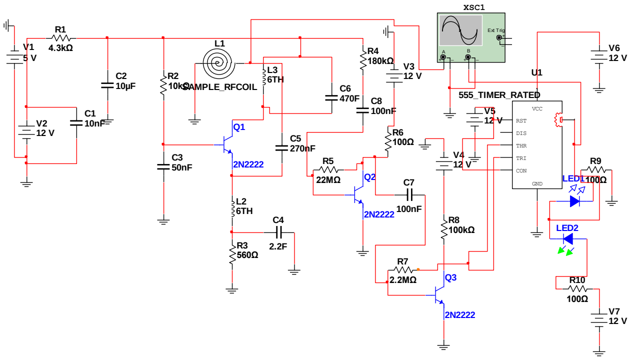


Fig 35 :Circuit diagram of Wireless Fidelty Receiver

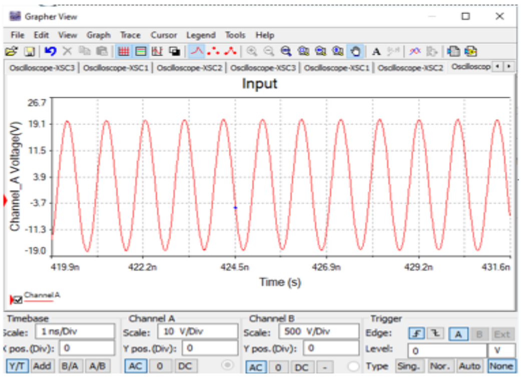


Fig 36 :Input Signal

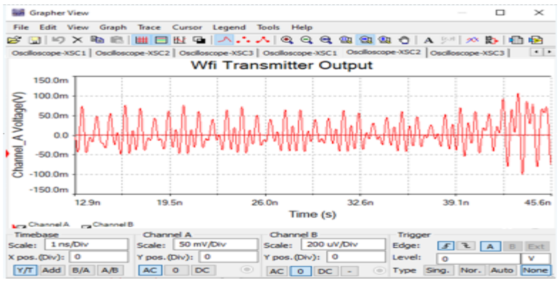


Fig 37:Wireless Fidelity transmitter's output

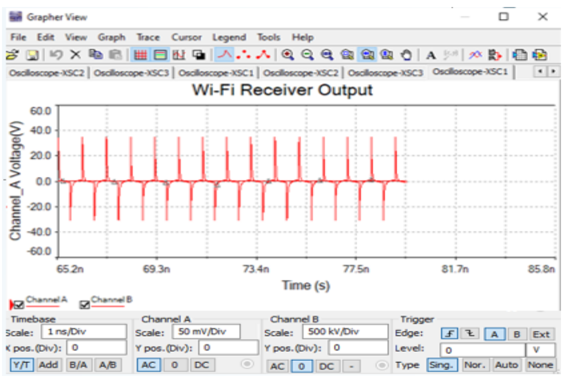


Fig 38:Wireless Fidelity at Receiver

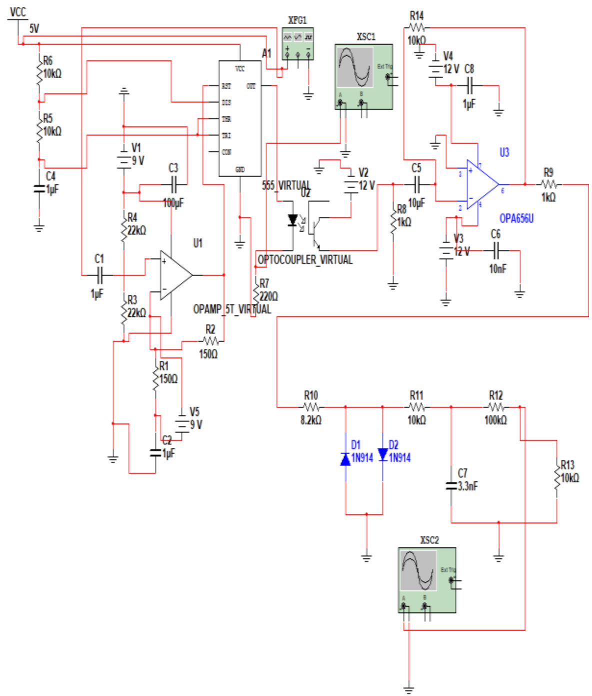


Fig 39: Circuit diagram of Li-Fitransceiver

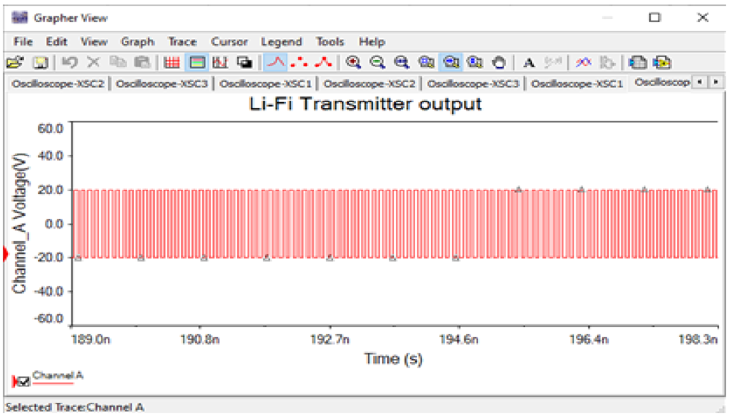


Fig 40: Light fidelity transmitter output

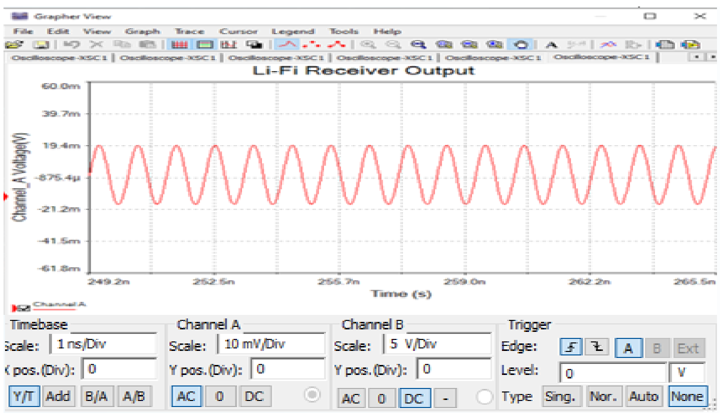


Fig 41:Light Fidelity receiver output

4.6.1 Calculation of Power

P = V * I (2)

Where P stands for power ,V for Volt and I for Current .

For Power P1 = V1* I1 ,

Total power P= P1 + P2 + P3 + P4 + P5 + P6 + P7 ………… + Pn (3)

Here, P = P1 + P2 + P3 + P4 + P5 + P6 + P7 + P8 (4)

- To calculate power for Light Fidelity:

  $P = 1216.057*10^{-9} + 111.764*10^{-9} + 1838.729*10^{-9} + 571.295*10^{-9} + 22.165*10^{-9} + 4.512*10^{-9} + 2516.692*10^{-9} + 56.366*10^{-9}$

  $P = 6393.946*10^{-9}$ W

- To calculate power for Wireless Fidelity:

  $P = \mathbf{337.6562}*10^{-9} + 988.1605*10^{-9} + 5446*10^{-9} + 231.466*10^{-9} + 16.76*10^{-9} + 5.242*10^{-9} + 3100.265*10^{-9} + 751.94*10^{-9} + 1.515*10^{-9}$

  $P = 10879.958*10^{-9}$ W

From the calculation done, it is observed that the power consumed by the circuits of Li-Fi is much less than compares to Wi-Fi.

4.6.2 Calculation of Frequency Loss

- For wireless fidelity :

  T=Total no. of division * base time (5)

  For input :

  T= 1 * 1ns

  f =1/ (1 *1ns) = 1000MHz

  For output:

  T = 1.5* 1ns

  f =1/ (1.5 *1ns) = 666.67MHz

  Calculation of percentage of frequency loss,

  Input = 1000 MHz , Output = 666.67 MHz

  Loss of frequency, F loss = 1000 – 666.67 = 333.33 Hz

  % of floss = (333.33/1000)*100= 33.33%

- For light fidelity :

  For input :

  T=1 * 1ns

  f =1/ (1 *1ns) = 1000 MHz

  For output :

  T=1.2 * 1ns , f =1/ (1.2 *1ns) = 833.33MHz

  Calculation of percentage of frequency loss ,

  Input = 1000MHz ,Output = 833.33MHz

  Loss of frequency, F loss = 1000 – 833.33 =166.67 Hz

  % of frequency loss = (166.67/1000)*100 = 16.66%

From the calculation done , it is proved that the frequency loss in Wi-Fi is greater than compared to Li-Fi.

4.7 SNR Distribution in aroom

The SNR(Signal to Noise Ratio) for Visible Light Communication in a room was calculated in matlab. From the simulation output it is observed that, the data transfer has been in good range when

SNR is of 40dB with the power emitted from the led is above 1000W .Below that the signal was not received properly as there is some data loss due to the amount of light emission that is insignificant for that input. A solution to reduce this data loss is by increasing the sensitivity of photodiode.Figure 42, 43, 44 and 45 shows the SNR plot for various values of power emitted by the LED.When the power emitted by the LED is 10W, 100W , 1000W and 10000W , the SNR is found to be -2.451 , 7.551 , 27.55 and 47.55 respectively .

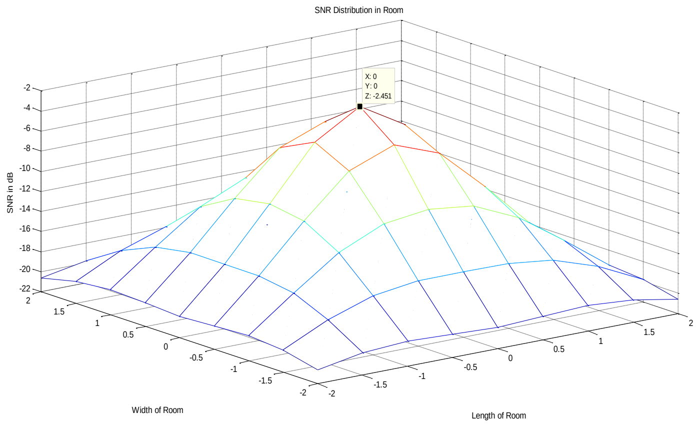


Fig 42 :SNR plot when Power Emitted by LED is 10W

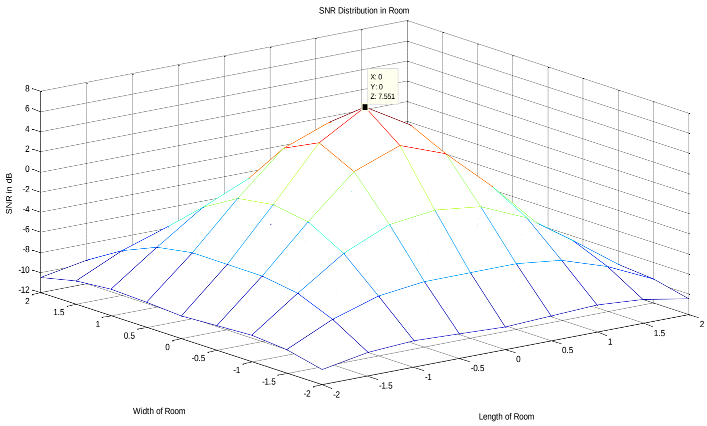


Fig 43 :SNR plot when Power Emitted by LED is 100W

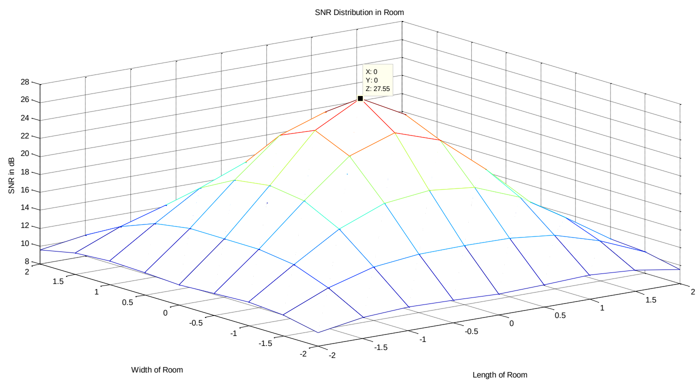


Fig 44:SNR plot when Power Emitted by LED is 1000W

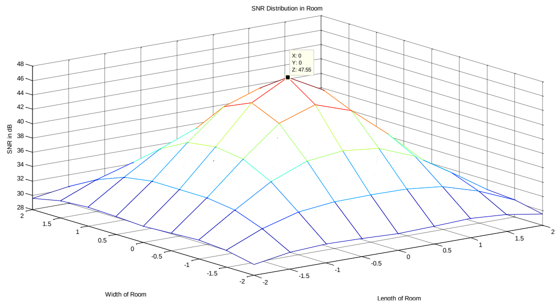


Fig 45:SNR plot when Power Emitted by LED is 10000W

V. CONCLUSION

Li-Fi is a type of mobile wireless technology that transmits data using light rather than radio waves. In software (MATLAB, Proteus, Multisim), data transport using Li-Fi has been implemented. It was created with the goal of facilitating wireless communication in restricted areas. High bandwidth, ease of use, efficiency, and safety are just a few of the advantages of LiFi technology. Li-Fi is 250 times faster than Wi-Fi, which communicates by radio waves. The power consumption and frequency loss in the Li-Fi system are significantly lower than in the Wi-Fi system, according to the calculations. Li-Fi, visible light ID systems, hospital robotics, underwater communication, and traffic communication systems are all possible applications of VLC. VLC has become a popular study topic as a result of all of these applications. This technology has a lot of potential that can be explored further. Every Li-Fi bulb might be utilised as a Wi-Fi hotspot to broadcast wireless data if this technology is put into practise, opening the way for a cleaner, greener, safer, and brighter future.Triplet Li-Fi will pique people's interest since it could provide a genuine and cost-effective alternative to radio-based wireless communication. The airways are becoming increasingly crowded as the number of people using smart appliances grows, making it increasingly difficult to acquire a stable and high-speed signal. Li-Fi may be able to address these concerns while also allowing access to the internet in places where standard radio-based wireless is prohibited, such as aeroplanes and hospitals.This technology might also be developed into a T-LiFi Hub, which is a novel feature in laptops that allows hard drives or mobile devices to directly access data from the laptop. One drawback is that it only works in direct line of sight. This is a serious issue that this technology must address through future research and development.

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