AUDIO AND DATA TRANSFER THROUGH LiFi TECHNOLOGY

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Submitted to the department of Electronics & Communication Engineering

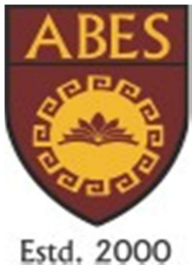
in partial fulfilment of the requirements

for the degree of

Bachelor of Technology

in

Electronics & Communication Engineering



ABES Engineering College, Ghaziabad

Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh Lucknow

May, 2023

DECLARATION

We hereby declare that this submission is our own work that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that project report entitled **"Audio and Data Transfer through LiFi Technology"** which is submitted by **Apurv Kumar, Mohd Anas, and Anshita Yadav** in partial fulfillment of the requirement for the award of degree B.Tech. in Department of Electronics and Communication Engineering of Dr. A.P.J. Abdul Kalam, Technical University, is a record of the candidates' own work carried out by them under my supervision. The matter embodied in this thesis is original and has not been submitted for the award of any other degree.

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We also do not like to miss the opportunity to acknowledge the contribution of all faculty members of the department for their kind assistance and cooperation during the development of our project. Last but not the least, we acknowledge our friends for their contribution in the completion of the project.

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ABSTRACT

The project resembles a remote-controlled device that can control multiple electrical appliances simultaneously. Using the remote, the date, time, and year of the devices' switching can be pre-set. This can also repeat the operation for up to one hundred years. A password that can be changed to protect privacy can safeguard the entire operation. This project uses the Dallas real-time clock (RTC) chip DS12887 and the Atmel AT89C52 to remotely control and program the switching operation of electrical devices. The devices canbe turned on and off at specific times each day and every month. The microcontroller can be customized for gadget control utilizing an ordinary Philips television controller. We can remotely control the operation of devices using this circuitry.

A microcontroller, long- distance communication system, and sensing technology were utilized in the construction of this system. The operational security of an organization's devices is improved as a result of this project. There are a number of issues with these current technologies, including data insecurity, increased power consumption, and increased costs. As a result, there is a significant demand for new technology that can address all of these issues. VLC is a promising new alternative. Li-Fi has a number ten thousand times greater than the spectrum of no particulate radiation to operate in the sunlight. Instead of traditional radio waves, it transmits using electromagnetic radiation. Because of this, it is used in places where radio waves cannot be used. Due to its extremely high speed (ranging from Light (at speeds ranging from 3 to 108 meters per second) is also a source for high-speed communication needs.

Occasionally, the light is aligned, but the sun's rays are deflected by changes in the atmosphere. Information rates of Multiple Gigabits per Second could also be transmitted over a short distance with VLC's 300 THz bandwidth. Here, a prototype of a VLC that transmits data at a significantly higher rate and over a significantly greater distance is being developed. This prototype demonstrates the audio transmission capabilities of VLC.A real-time audio broadcast prototype employing commercial LED bulbs is demonstrated in this study.

According to the findings of the experiments, it is possible to transmit real-time audio over a distance of up to 2 feet with the right arrangement of LED sources and effects that improve concentration. The lighting model's construction and simulation in the real worlddemonstrate the close connection between the illumination source's layout and distribution.

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1. V - Voltage
2. I - Current
3. R- Resistor
4. v- Velocity

LIST OF ABBREVATIONS

1. Fig - Figure
2. LiFi - Light Fidelity
3. IDE -Integrated Development Environment
4. IOT - Internet of Things
5. VLC -Visible Light Communication
6. NLC -Noticeable light correspondence
7. ICSP -In-circuit serial programming
8. ISD - International Subscriber Dialing
9. Rx - Receiver
10. Tx - Transmitter
11. ARS - Analog Read Signal

CHAPTER 1
INTRODUCTION

1.1 AUDIO AND DATA TRANSFER THROUGH LIFI

In the modern era, there has been a significant demand for data accessibility. We genuinely want to interface with the web. The requirement for internet access has increased in importance because of the emergence of numerous Machine learning (ML), cloud computing, artificial intelligence (AI), and the internet of things (IOT) are examples of modern technologies among others. The issue is getting even worse because of RF interference. Light Fidelity (Li-Fi) utilizes the apparent light range that isn't being utilized by utilizing Light Transmitting Diodes (LEDs) as light sources. Second, visible light is limited to the radio frequency that is used the most frequently in wireless communication because light waves cannot pass through obstacles. However, the technology has a lot of room for improvement, and Li-Fi technology can overcome the limitations. To put it another way, a single data point can be sent. In the compression of radio waves. With some limits, light communication may convey data. The technology has a lot of room for improvement, and Li-Fi technology can overcome its limitations. This growing significance has been a significant factor in the worldwide demand for LEDs.

As an alternative method of data transfer, VLC is a brand-new technology that provides increased data rates and security. LED-based lights are currently primarily used for both indoor and outdoor lighting; Due to its high switching speed, low energy consumption, and green vision, this can be used for data transfer in addition to IR-based lights. Consequently, this system makes it easier to communicate effectively via audio and video in the setting. White LEDs produce visible light for the purpose of data transfer and are also used to transmit audio signals recorded by the voice board to the receiver's speaker. A photo detector that receives data from the transmitter and transmits it to the control unit to receive the transmitted input signal serves as the system's receiver. The output was checked by the speaker. In the next generation of the internet, it is anticipated that light will transport data. The radio frequency spectrum, on the other

hand, that these methods use is extremely scarce. These currently available technologies have several drawbacks, including their high cost, data insecurity, and high-power consumption. As a result, we urgently require technology that can overcome all the shortcomings of current technologies. Light is the medium by which this upcoming technology transmits information. It communicates using visible light rather than radio waves. To put it another way, a single data point can be sent. There have been significant advancements in Li-Fi technology despite its extensive global implementation and development. The benefits of driven correspondences, especially in short-range correspondences incorporate a more extended life expectancy, further developed proficiency, minimal expense, and low support. Companies in developed nations like Japan, the United States, China, and others frequently employ them.

In addition, demand for LEDs and Li-Fi technology has steadily increased. Data is transmitted using leds in LiFi technology. It is derived from optical wireless communication technology that uses LED light to transmit information at a rapid rate. The Led is turned off and on very quickly for visible light communication, which is invisible to the human eye. The LiFi LED emitter maintains an intensity that is high enough to facilitate easy communication while remaining low enough to be invisible to the human eye. The LiFi LED emitter maintains a sufficiently low intensity to be indistinct to the human eye while remaining high enough to make communication simple. The light is very safe from hacking because it cannot penetrate the walls. However, this limits the range as well. This is useful in environments prone to electromagnetic interference, such as hospitals, nuclear power plants, and aircraft. This is advantageous in environments that are particularly susceptible to electromagnetic interference, such as aircraft, nuclear power plants, and hospitals. While LiFi uses visible light, both WiFi and LiFi The electromagnetic spectrum is used to transfer data. and WiFi uses radio waves. Li-Fi has virtually no capacity limitations. While WiFi and LiFi both use radio waves to send data, LiFi uses visible light. The electromagnetic range is utilized by WiFi. Li-Fi has virtually no capacity limitations. The visible light spectrum is 10,000 times smaller than the radio frequency spectrum. The light signals are received by the receiver through wireless channels. In order to recover the message, the optical signals are converted by the detector in the receiver. Physical space can be

used to protect LiFi signals because light cannot pass through the walls. The receiver's detector converts the optical signals so that the message can be recovered. Because walls prevent light from passing through them, LiFi signals can be protected in physical space. As an alternative method of data transfer, VLC is a brand-new technology that provides increased data rates and security.

LED-based lights are currently primarily used for both indoor and outdoor lighting; Due to its high switching speed, low energy consumption, and green vision, this can be used for data transfer in addition to IR-based lights. Consequently, this system makes it easier to communicate effectively via audio and video in the setting. White LEDs produce visible light for the purpose of data transfer and are also used to transmit audio signals recorded by the voice board to the receiver's speaker. A photo detector that receives data from the transmitter and transmits it to the control unit in order to receive the transmitted input signal serves as the system's receiver. The output was checked by the speaker.

In the next generation of the internet, it is anticipated that light will transport data. The radio frequency spectrum, on the other hand, that these methods use is extremely scarce. These currently available technologies have a number of drawbacks, including their high cost, data insecurity, and high power consumption. As a result, we urgently require a technology that can overcome all of the shortcomings of current technologies. Light is the medium by which this upcoming technology transmits information. It communicates using radio waves rather than visible light. It can therefore be used in areas where radio waves are ineffective. Additionally, a person sitting in a different room cannot hack the data because light is restricted to a single room. This upcoming technology's most appealing feature is that it transmits data 10,000 times faster than Wi-Fi. We are using the ISD 1820 module to record a variety of audio files for our project. The IC's built-in microphone is used to record the audio or voice that needs to be recorded in the ISD module. Various switches are used to store the various audio files. Through ISD module, the audio file is transmitted serially to the Li-Fi transmitter module by way of the PIC 16F877A microcontroller. When the transmitter module's LED blinks, the audio file is sent. A Representation of sound is an audio signal. Frequencies in the audio range of 20 to 20000Hz are used in audio signals. The mechanism by which audio signals are

routed and processed is known as an audio transmission system. The audio signal was transmitted via microphones, and the signal was routed to a single channel of output. While microphones will transmit and process audio signals, the light in this article will transmit data. The LI-FI refers for 'Light-Fidelity'. Harald Hass, a German physicist, invented the phrase LI-FI.

This is the next generation of the internet, in which data is sent using light as a medium. LI-FI is a novel and productive sort of remote Light-based correspondence. Light-based information transmission is the new and compelling technique for remote correspondence known as LI-FI.

It is the same light that we use in our homes and offices, but with a few tweaks, it can send data to all of our internet-connected devices. To transfer audio data, VISIBLE LIGHT COMMUNICATION (VLC) is employed, and LI-FI (Light Fidelity) technology has been developed. LI-FI is one- of-a-kind method of sending data across small distances in a quick and effective manner. The standardization of data transmission via the AM of the sunlight source is the LI-FI operating principle. We can transfer data at speeds more than 10 Gbps with this method, and its operational frequency ranges from 400THz to 800THz. It is a part of the IEEE standard IEEE 802.15.7. Wireless LI-FI technology in the future might attain data speed of up to 100Gbps. WI-FI is now used around the world; but, because of its speed and security, LI-FI will supplant WI-FI in the future years. With the aid of the electromagnetic spectrum, high-speed data transfer utilizing LI-FI may be described. Because visible light has a frequency in the range of 430THz to 770 THz on the electromagnetic spectrum, a high number of bits may be sent over this bandwidth.

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LI-FI is a new and proficient remote correspondence innovation that sends information utilizing light.LI-FI is a new and proficient remote correspondence innovation that sends information utilizing light. To move sound information, Noticeable LIGHT Correspondence (VLC) is utilized, and LI-FI (Light Devotion) innovation has been created. LI-FI is one- of-a-kind method of sending data across small distances in a quick and effective manner. The operating principle of LI-FI is to communicate data in a standardized manner using the AMof the sunlight source. We can transfer data at speeds more than 10 Gbps with this method, and its operational frequency ranges from 400THz to 800THz. It is a part of the IEEE standard IEEE 802.15.7. Wireless LI-FI technology in the future might attain data speed of up to 100Gbps. WI-FI is now used around the world; but, because of its speed and security, LI-FI will supplant WI-FI in the future years.

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1.2 VISIBLE LIGHT COMMUNICATION

The rapid transmission of data via visible light is made possible by a wireless method known as visible light communication (VLC). This information is communicated by balancing the force of light emitted by a light source. A photodiode device receives the signal and converts it into readable and easily digestible forms for end users. A remote strategy known as visible light correspondence (VLC) makes use of light produced by LEDs to transmit structured, adaptable, and quick data, similar to Wi-Fi, which is why it was given the name Li-Fi. It can be used in conjunction with radio-frequency (RF) or cellular network communication or on its own. Professor Harald Haas of the University of Edinburgh came up with the idea for the technology, which involves turning on and off LEDs at a high frequency in a matter of nanoseconds. In 2011, Haas demonstrated the technology at a TED Global talk. Later, he helped found Pure LiFi, a Li-Fi OEM for LED manufacturers. VLC is thought to be a solution to the problem of limited RF bandwidth because the spectrum of visible light is 10,000 times larger than the spectrum

of radio frequencies. Industry is competitive because it has produced very high data transmission rates. However the sign can't enter obstacles, for example, walls, an immediate view isn't needed insofar as lengthy because of the way different surfaces reflect light. The vehicle lighting must be ON in order for the sign to communicate, but it can be turned down to very low levels. The fact that transmission does not result in electromagnetic interference gives VLC an advantage over Wi-Fi. There are numerous applications, but significant lighting producers Sharpness Brands, GE, and Philips have shown specific interest in one. All in all, gigantic box retail. Lighting has long been referred to as the "silent salesperson" in retail because it makes it easier to find your way around and can be used to draw customers to important products. In order to enhance the shopping experience and increase value, VLC introduces a novel method for connecting retailers and their customers.

In 2012, more than 60% of mobile shoppers used smartphones in stores, and 85% of shoppers used native apps or websites of retailers during shopping trips, according to Deloitte Consulting LLP.

The LED luminaires Acuity, GE, and Philips' solutions offer a way to communicate with customers who are using mobile phones or camera-enabled tablets loaded with an app, appealing to a market that is already ready. The store's luminaires can communicate with customers in two primary ways using VLC. First, VLC offers indoor GPS-like location-positioning capabilities that make it possible to find your way.I t is possible to direct shoppers who have specific items on their shopping lists directly to them. Second, the owner can provide customers with specific information. Coupons, recipes, and other information can be sent to shoppers' smartphones as they pass a product section in an aisle. Philips' "associated lighting framework," shown recently at EuroShop and LIGHTFAIR, comprises Driven luminaires in a thick organization that gives brightening while likewise working as a situating lattice. Each luminaire can be identified and its position can be communicated to an app on a customer's smart device. "The beauty of the system is that retailers do not have to invest in additional infrastructure to house, power, and support location beacons for indoor positioning," states Philips' Gerben van der Lugt."“Because they are everywhere in the store, the light

fixtures themselves can convey this information. Transmission Power Restrictions: In RF correspondences, the electric transmission power can't be expanded past an endorsed level as it presents serious wellbeing dangers for the human body. Spectrum under control: More radio frequencies cannot be used because of the restriction on radio waves.

Additionally, radio spectrum use is regulated. Prohibited in Dangerous Areas: Because it impairs the performance of precision instruments, hospitals and space stations cannot use the radio wave. The use of visible light communications makes it simple to solve the aforementioned radio wave issues. Using visible light communications, all of these issues can be resolved. This can be attributed to the technology's health-friendly operation, high data rates, high transmission power, and lower implementation costs.

1.3 PROBLEM STATEMENT

With the rising interest for quicker and more solid information move, Li-Fi innovation has arisen as a promising arrangement that utilizations light waves rather than radio waves to communicate information. However, the use of Li-Fi for audio and data transfer poses several challenges that need to be addressed. One of the main challenges is the limited coverage area of Li-Fi, which can be a hindrance in large or complex environments.

The line-of-sight requirement for Li-Fi transmission also limits its effectiveness in situations where there are obstacles between the transmitter and receiver. Another challenge is the need for a clear and uninterrupted line of sight between the transmitter and receiver. This means that the use of Li-Fi for audio and data transfer may be affected by factors such as shadows, reflections, and interference from other light sources, making it less reliable than traditional Wi-Fi or wired connections. Additionally, the availability of Li-Fi-enabled devices is currently limited, which may hinder the adoption of this technology for audio and data transfer. Addressing these challenges will be crucial to the successful implementation of Li-Fi technology for audio and data transfer, and will require ongoing research and development.

Power consumption: Since Li-Fi requires light to transmit data, it can consume a lot of power. This can be a significant challenge in situations where battery-powered devices are used, as the constant use of Li-Fi for data transfer can drain the battery quickly.

Security: Li-Fi signals can be intercepted by malicious parties, which poses a security threat to the data being transmitted. This can be mitigated by using encryption, but it requires additional hardware and software to be implemented.

Compatibility: Li-Fi technology is not yet widely adopted and not all devices are compatible with it. This limits its usefulness in situations where multiple devices need to communicate with each other.

Standardization: Li-Fi technology is still in its early stages and there are no established standards for its use in audio and data transfer. This makes it difficult for manufacturers to produce devices that are compatible with each other and can communicate seamlessly.

Cost: The cost of implementing Li-Fi technology can be high, which can make it unaffordable for many users. This is because the technology is still in the early stages of development and the production volume is low, which drives up the cost.

1.4 OBJECTIVE

The target of the proposed work is framed as underneath:

1. To plan and execute a model module of Li-Fi (noticeable light correspondence).
2. to use light as a carrier to send and receive data and audio.

A novel method for transmitting data is visible light. A photosensitive detector then picks up the data sent in Li-Fi by altering the intensity of the light. and converted into an electronic signal by demodulating the light. The way this modulation is done makes it hard for the human eye to see. VLC comprises a light source as a beneficiary and a transmitter simultaneously. The amplifier circuits amplify this electrical signal before feeding it into the power LED. The LED's light signal changes in response to the voice signal's intensity. Stronger the voice, the sparkle of the Drove will be more. An electrical signal proportional to the light signal will be generated by the Avalanche photo detector at the receiver side A demodulator circuit processes this electrical signal before feeding it to a speaker, which in turn produces the audio signal that was at the transmitter side's input.

1.5 SYSTEM DESIGN

1.5.1 BLOCK DIAGRAM OF TRANSMITTER AND RECEIVER

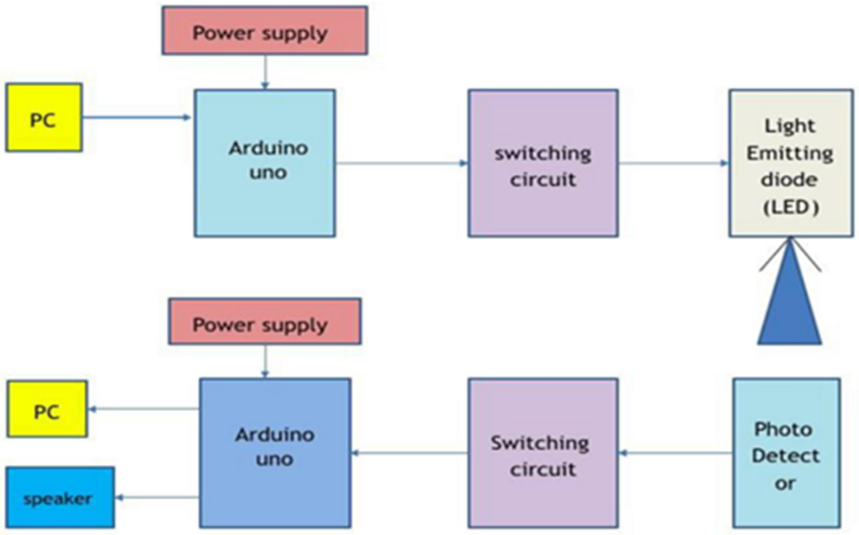


Fig 1:-Block Diagram Of Transmitter And Receiver

1.5.2 BLOCK DIAGRAM OF PROPOSED SYSTEM

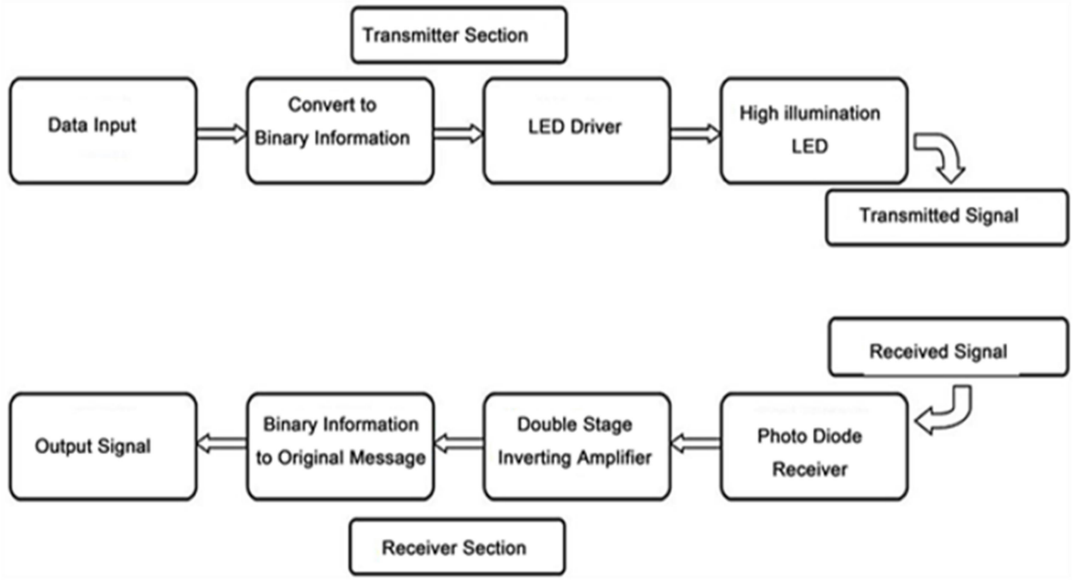


Fig 2:- Block Diagram Of Proposed System

1.5.3 HARDWARE REQUIREMENTS

1. Arduino
2. Laser Light
3. Amplifier Circuit
4. Regulated Power Supply
5. ISD 1820Voice Recording Module
6. Solar Pannel
7. 3.5 mm Audio Jack
8. Speaker

1.5.4 SOFTWARE REQUIREMENT

1. Arduino Id
2. Embedded C & C++ Programing

1.6 HARDWARE DESCRIPTION

1.6.1 Arduino

Arduino is an electronics project-building platform that is open-source. The two parts that make up Arduino are a computer-based piece of software known as an IDE (Integrated Development Environment) and a physical programmable circuit board, which is also known as a microcontroller.

The software is used to write and upload computer code to the physical board.19 . People who are just getting started in the field of electronics are increasingly turning to the Arduino platform. Unlike most previous programmable circuit boards, the Arduino does not require a separate piece of hardware known as a programmer to load new code onto the board.; instead, you can use a USB cable to do so. Additionally, the Arduino IDE employs a simplified C++ implementation to simplify programming.

At long last, Arduino gives a standard structure factor that sorts out the microcontroller's capabilities into a more straight forward bundle.

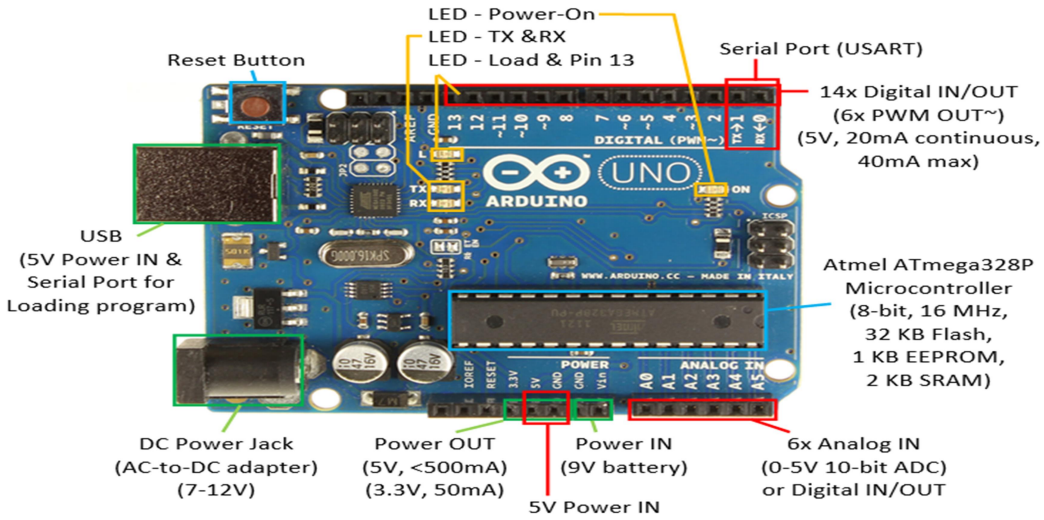


Fig 3:- Arduino

The Uno, one of the most widely used sheets in the Arduino family, is a fantastic option for beginners. Later on in the tutorial, we'll talk about what's inside and what it can do. Arduino has been the brains of thousands of projects over its long history, from common objects to sophisticated logical instruments. A global community of makers, including students, hobbyists, artists, programmers, and professionals, have gathered around this open-source platform.

They have contributed a tremendous amount of knowledge that can be of great assistance to novices and experts alike. Arduino, a simple tool for quick prototyping intended for students with no prior experience in electronics or programming, was developed at the Ivrea Interaction Design Institute. The Arduino board began to adapt to new requirements and challenges when it contacted a larger audience, ranging from basic 8-bit sheets to items for IoT applications, wearables, 3D printing, and implanted conditions. Users can build their own Arduino boards and eventually modify them to meet their specific requirements due to the open-source nature of all of them. The software is open-source as well, and users all over the world are contributing to its development. Arduino Pin Chart:- A run of the mill illustration of The Arduino Uno board is available. The ATmega328 is a microcontroller with 28 pins.

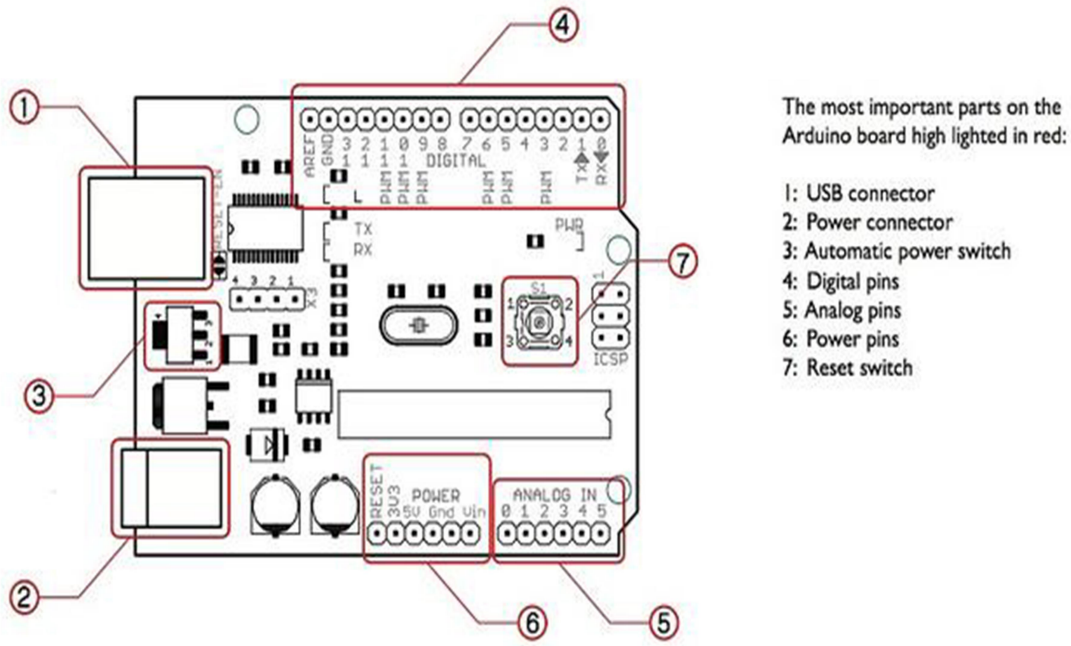


Fig 4:- Pin Diagram

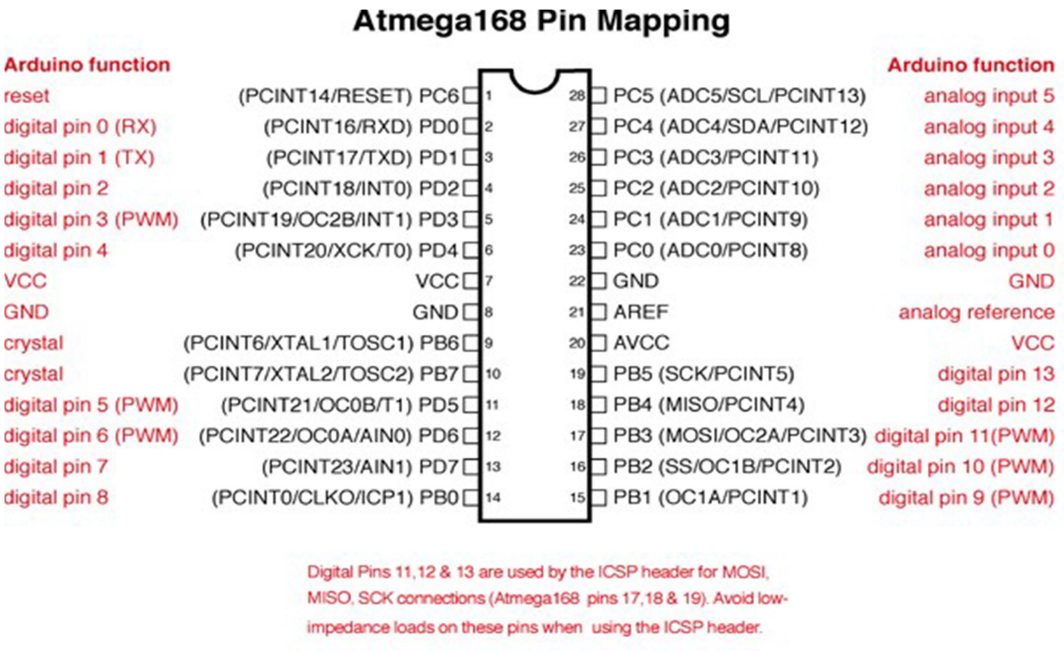


Fig 5:- Arduino Pin Mapping Diagram

Six of the 14 digital input/output pins on the Arduino Uno can be used as PWM outputs. It also has a reset button, six analog inputs, a 16 MHz crystal oscillator, a power jack, an ICSP header, and a USB connection. Through a USB connection, it can be powered by the computer or by an external source like a battery or adapter. It is able to function on a supply of 7 to 12V and can receive power from the outside via the pin Vin or by providing a voltage reference via the IORef pin. It has 14 advanced inputs and yield sticks that each draw or draw 40 mA of current. Pins 0 and 1, which function independently as Rx and Tx for sequential correspondence, pins 2 and 3, which are external interrupts, pins 3,5, 6, 9, 11, which provide a pwm result, and pin 13, which is associated with Driven, all have distinct capabilities. The resolution of each of its six analog input/output pins is ten bits. It resets the microcontroller when it reaches low and provides analog input references. The processor in Arduino essentially employs the Harvard architecture, in which program data and code share a separate memory. It has two recollections: both the program memory and the data memory The code is stored in the flash program memory, while the data are stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code, of which 0.5 KB are used for the bootloader and operates at a clock speed of 16 MHz. Additionally, it has 1 KB of EEPROM and 2 KB of SRAM.

Arduino Architecture

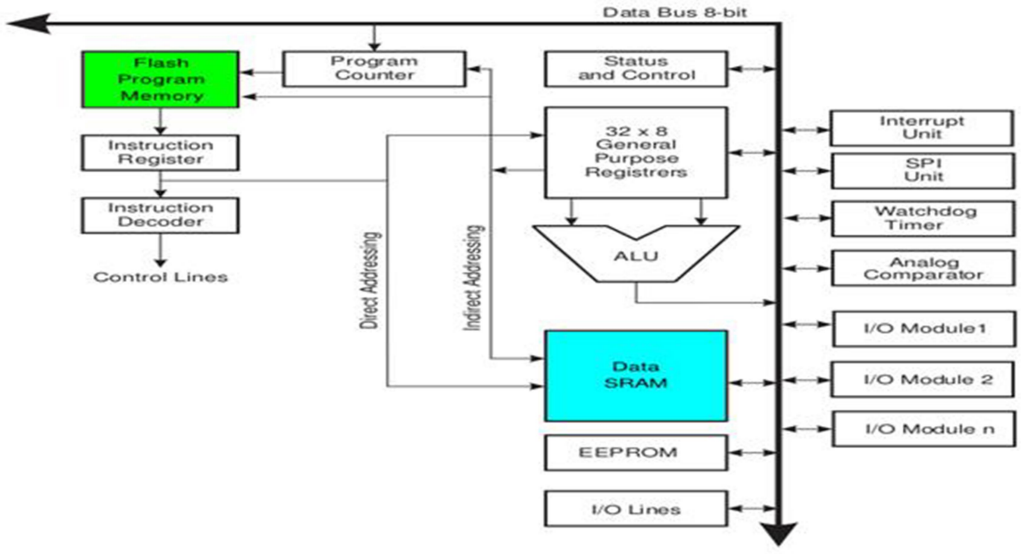


Fig 6 :- Arduino Architecture

Application

1. Xoscillo, an open-source oscilloscope.
2. A MIDI controller that resembles the Monome is the Arduinome.
3. A trip computer that makes use of the on-board diagnostics is called OBDuino. interface found in the majority of contemporary automobiles.
4. Ardupilot, drone programming and equipment.
5. Gameduino, an Arduino safeguard to make retro 2D computer games.
6. ArduinoPhone, a phone that you can make yourself.
7. Water quality testing platform.
8. Stepper motor-based automatic titration system with an Arduino.
9. low-cost virtual reality application data glove.
10. Bovine milk adulteration is detected by an impedance sensor system.
11. Homofaciens made their own CNC with Arduino and DC motors and close-loop control.
12. DC motor control using Arduino and H-Bridge.

1.6.2 LASER LIGHT

A laser is a device that uses optical amplification to produce a coherent light beam. Gas lasers, fiber lasers, solid state lasers, variety lasers, diode lasers, and excimer lasers are just a few of the many types of lasers. A fundamental set of components is shared by all of these laser types. Laser light is typically delivered in the form of a laser beam, which has moderate beam divergence and propagates predominantly in a clearly defined direction. The spatial coherence of such a laser beam is high, sometimes extremely high. This implies that the electric fields at various areas across a pillar profile waver with an inflexible stage relationship. A laser beam's high focusability and the fact that it can be focused to very small spots are both due to precisely this coherence, which explains why it can travel over long distances without spreading much in the transverse directions.

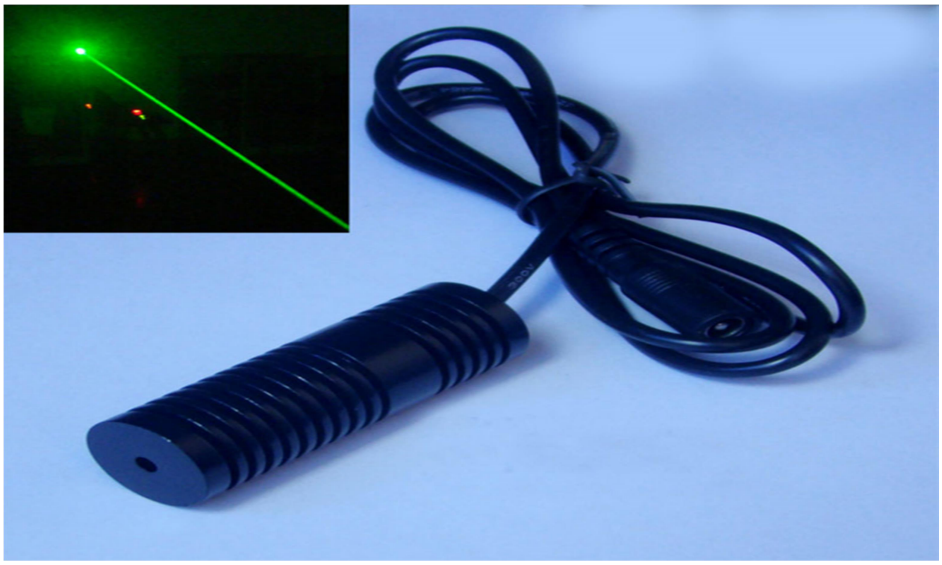


Fig 7:- Laser Light

Lasers increment the power of light as well as produce light. Through stimulated radiation emission, which raises the intensity of radiation, lasers produce light. In addition to visible light, some lasers also produce ultraviolet or infrared rays. Lasers are not the same as traditional light sources. Traditional light sources like the sun, electric bulb, and incandescent lamp do not possess certain properties that lasers do. It also addresses nonlinear and quantum optics, laser applications, and the physics of laser beam propagation, particularly that of Gaussian beams. Additionally, a laser is a device that focuses light in a specific direction to increase its intensity. Lasers increment the power of light as well as produce light. Through stimulated radiation emission, which raises the intensity of radiation, lasers produce light Some lasers produce ultraviolet or infrared rays in addition to visible light.

Lasers are not the same as traditional light sources. Traditional light sources like the sun, electric bulb, and incandescent lamp do not possess certain properties that lasers do.

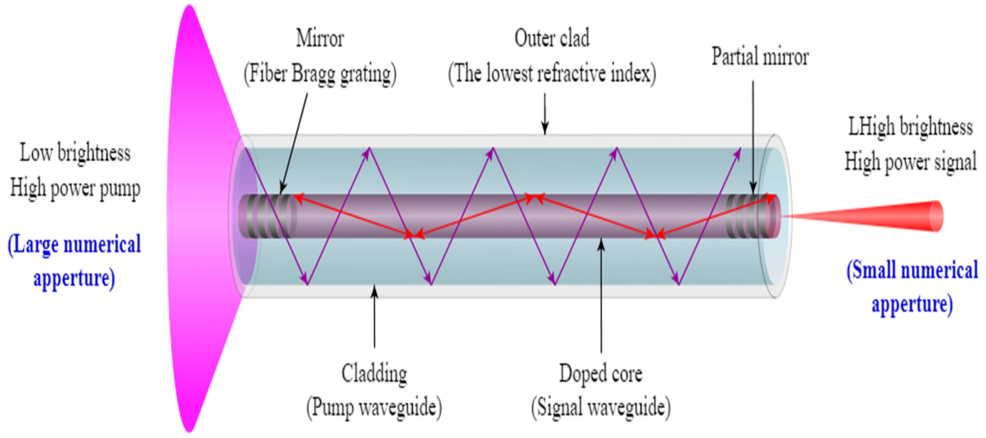


Fig 8 :- Laser Schematic Digram

Application

1. Optical Communication and Storage
2. Laser Machining and Cutting
3. Military and Defense Applications
4. Medical Applications
5. Biomedical Imaging and Superresolution
6. Lasers in Communication
7. Lasers in science and technology
8. Lasers in Industries

1.6.3 AMPLIFIER CIRCUIT

A fundamental power amplifier that is made to generate an output signal with a high strength value from an input signal of low strength. The various domains in which an electrical signal is converted to an acoustic signal make use of this amplification technique. Audio amplifiers are the name given to this kind of amplifier. The audio amplifier is present at both the input and output of any circuit that processes audio signals. For instance, on the off chance that a mouthpiece gets a sound wave input signal it needs a pre-intensification of the sign prior to handling it further and comparable prior to conveying an electrical message to a speaker it should be enhanced.

The working of the intensifier isn't on a solitary stage. There are a number of steps involved in this amplification of the audio signals. In light of the standards of the corridor, foundation, and the impedance esteem the enhancement of the signs happens.

The power created at the result of these intensifiers relies on its utility. Any microphone can be used to apply the input signal, which moves the majority and minority carriers toward the transistor as it reaches it. If the transistor is of the n-p-n type, the supply connections should be designed to reduce the width of the depletion region, indicating that the transistor should be operating in fully conducting mode. Multiple transistors can be incorporated into the amplifier design. The signal reaches its destination thanks to these carrier movements.

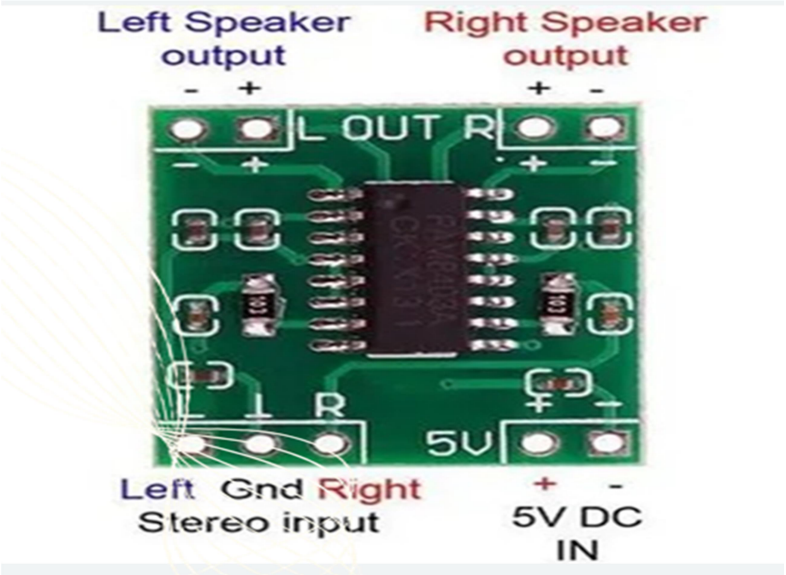


Fig 9:- Amplifier Circuit

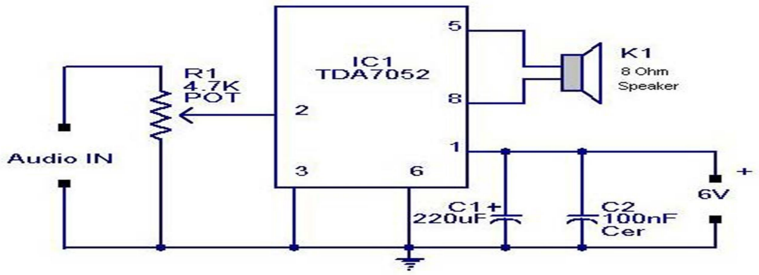


Fig 10:-Audio Amplifier Circuit Diagra

Applications

1. These amplifiers are utilized the most frequently in the sound systems.
2. These amplifiers are incorporated into a variety of music-related instruments.
3. These amplifiers are utilized in the transmission of radio signals.
4. The sign transmission for significant distance correspondence is the most enhancer that is used.
5. Audio amplification is required for the signals to be transmitted wirelessly.

1.6.4 REGULATED POWER SUPPLY

An electronic circuit that maintains a constant DC voltage is called a regulated power supply. Across the load terminals despite changes in the load. As a result, a regulated power supply's primary function is to convert AC power into constant DC power. The managed power supply is in some cases likewise called a straight power supply.

Even if the input power changes, the regulated power supply makes sure that the output power at the load terminals stays the same. The regulated power supply generates constant DC power from an input of AC power. A directed power supply is essentially an inserted circuit consisting of different blocks.

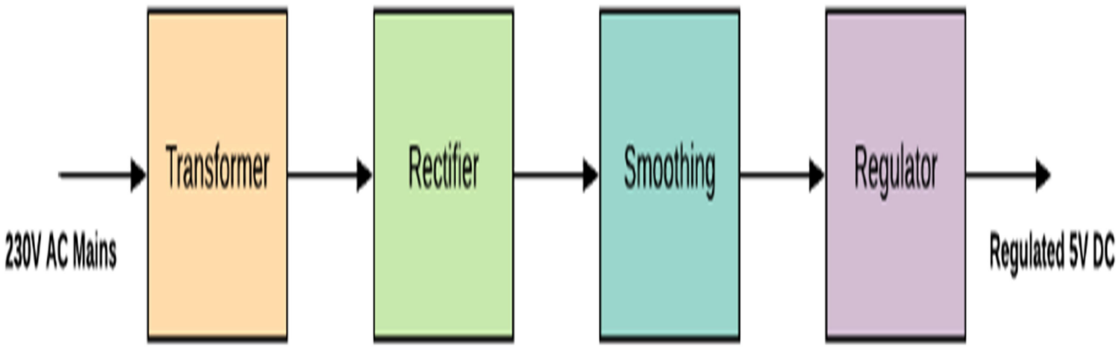


Fig 11:- Block Diagram of Regulated Power Supply

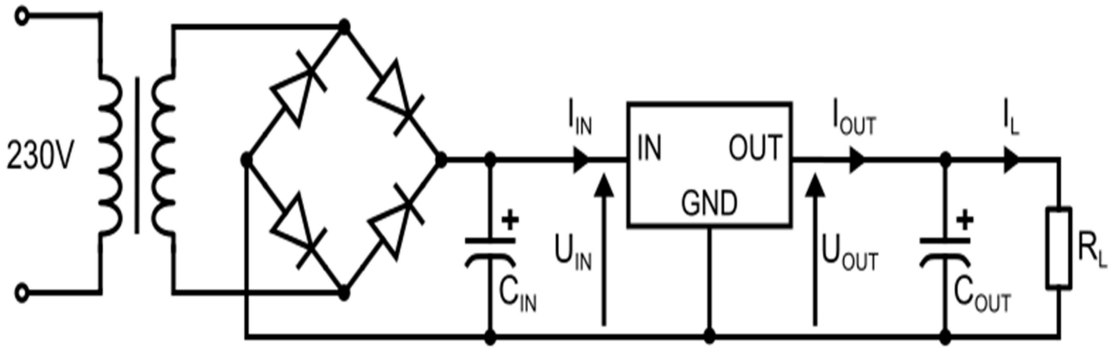


Fig 12:- Regulated Power Supply Circuit Diagram

Components Value Table

S.No	Components	Value	Qty
1	Diode	1N4001	1
2	IC	7805	1
3	Capacitor	100uF, 0.1uf	1.1
4	Power Supply	5V	

Application

1. Electronic devices: the device remains stable and consistent, regardless of changes in the input voltage.

2. Regulated power supplies are frequently are used in devices like computers, televisions, and mobile phone so ensure that the voltage supplied to
3. Industrial automation: Regulated power supplies are used in industrial automation systems to provide power to sensors, actuators, and other devices. They help ensure that the voltage supplied to these devices remains stable and within the required range, which is critical for the safe and efficient operation of industrial equipment.

4. Medical equipment: Regulated power supplies are used in medical equipment such as MRI machines and heart monitors to ensure that the voltage supplied to these
5. devices is stable and within the required range. This is critical for accurate diagnosis and treatment of medical conditions.
6. Automotive industry: Regulated power supplies are used in automotive applications to provide power to electronic systems such as sensors, controllers, and displays. They help ensure that the voltage supplied to these systems remains stable and within the required range, which is essential for the safe and reliable operation of vehicles.

1.6.5 ISD 1820 VOICE RECORDING MODULE

The compact Voice Recorder and Playback module ISD1820 is capable of multi-segment recording. The client can change the on-board resistor to record for 8 to 20 seconds for each application, which is a significant amount. With embedded Flash memory, this Voice Recorder/Playback module can record and erase data for up to 100,000 times. A microphone is built right into the board, and any 8 ohm speaker can be connected.Your recording are saved even without power because of the non-unstable capacity on the ISD1820.This module utilizes the ISD1820 voice record and playback IC to record a solitary voice message of as long as 10 seconds long.The specialized analog flash memory in which the recorded message is stored will keep the message stored even when power is removed.

Fig 13:- ISD 1820 Voice Recording Module

This module is very simple to use, and you can directly control it with a microcontroller like an Arduino, STM32, ChipKit, or another. You can easily control record, playback, repeat, and other functions from these. The record duration and sampling frequency, which can range from 8 to 20 seconds (4 to 12 kHz), must be selected with an external resistor. If you want to change the record duration. By default, our Voice Record Module uses a short cap to connect a 100k resistor. So the default record length is 10s. On the off chance that the module perceives the HIGH sign on the pin, the device starts the playback cycle. Playback cycles continue until either the end of the memory space or an End-of-Message (EOM) marker is reached. The device shuts down and enters standby mode automatically when the playback cycle is finished.

Pin Description of ISD1820 Recorder/Playback Module

Pin Name	Description
VCC	DC 2.4-5.5V
GND	Ground
FT	FeedThrough: The Microphone can drive the speaker directly in this mode.
REC/REC (Button)	The REC input is a HIGH record signal that is active.. When REC is set to HIGH, the module begins recording. This pin should stay HIGH as long as necessary. When it comes to playback (PLAYLorPLAYE) signals, REC takes precedence.
P-E/PLAY-E (Button)	Playback of the Active Edge: When a HIGH-going transition is found, it continues until either the memory space ends or the End-of-Message (EOM) marker.
P-L/PLAY-L (Button)	Playback, Level-activated: A playback cycle begins when the level of this input pin moves from LOW to HIGH.

SPI	Amplifiers with impedances as low as 8 benefit immediately from the drive provided by the SP+ and SP pins.
MIC	In the microphone: The on-chip pre-amplifier receives signals from the microphone input.

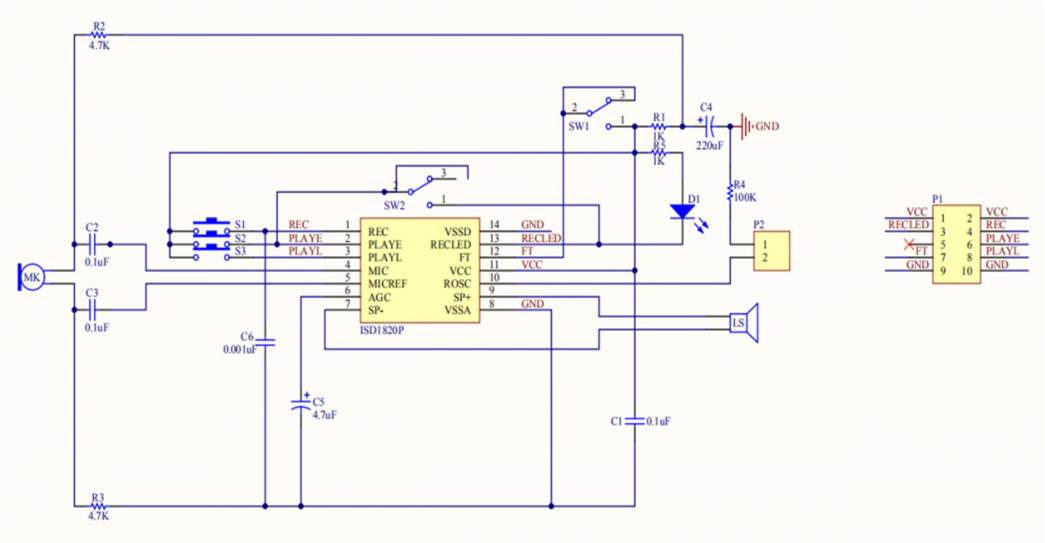


Fig 14:- ISD 182 Recording Module Schematic Diagram

Features

1. Record and playback as long as 10 seconds of sound.
2. MCU and pushbutton control
3. Edge or level enacted playback
4. Built-in microphone
5. On-chip 8 ohm speaker driver
6. With a change in the resistor, Up to 20 seconds can be added or removed from the duration and sample rate.
7. Auto power down mode
8. 2.6-5V operation

Applications

1. Circuits for DIY that need to playback and record messages with sound.
2. Message recording Applications.
3. Speech Controlled Device.
4. Voice Recorder
5. Microcontroller based audio playback
6. Sound recorder

1.6.6 SPEAKER

One of the most common output devices are speakers, which are connected to a computer to produce sound. A few speakers are intended to interface with any sort of sound framework, while some can be connected exclusively with PCs. With the PC speaker, the PC's sound card makes a sign that is utilized to deliver sound. The fundamental objective of speakers is to offer sound outcomes for the crowd. The speaker, which is a transducer, transforms the electromagnetic waves into sound waves.

The devices, which can be as simple or sophisticated as a computer or sound recorder, transmit sound to speakers. The analog speaker's sole purpose is to convert analog electromagnetic waves into sound waves. The analog sound waves are made, but first digital speakers turn the digital input into an analog signal before the sound waves are made. The sound that speakers produce is characterized by its amplitude and frequency. The sound's pitch, or height or depth, is determined by frequency. For example, a low pitch guitar or kick drum creates low sound waves, while a soprano vocalist's voice produces sounds in the high-recurrence range.

The capability of the speaker system determines the sound quality and clarity; It can be the best way to determine audio quality if it can accurately reproduce sound frequencies. The lodging, a cone, a magnet, and iron is utilized to make speakers; They function by converting mechanical energy into electrical energy. The mechanical energy is used to compress air and transform the motion into sound energy or pressure level. An electric current flows through a wire coil and creates an electric field whenever a device provides electrical input to the speakers.

Additionally, it interacts with the speakers' attached magnetic field. At the point when the speaker gets electrical contribution from a gadget, the voice curl is connected to move this way and that. The motion of going back and forth causes the outer cone, which we hear as sound, to vibrate.

Fig 15:- Speaker

Applications

1. Multimedia devices: 5-volt speakers are also used in multimedia devices such as DVD players, gaming consoles, and portable media players. They can provide high-quality audio output in a compact form factor.
2. Smart home devices: 5-volt speakers can be used in smart home devices such as voice assistants and smart speakers. They can provide high-quality audio output in a small and compact form factor.
3. Automotive applications: 5-volt speakers are used in automotive applications such as car audio systems, GPS devices, and dashboard displays. They are ideal for use in these kinds of applications due to their small size and low power consumption.

1.6.7 AUDIO JACK

The 3.5mm headphone jack is the audio plug of choice in the industry. Connecting stereo headphones to your smartphone or "piping" audio from your phone to an external amplifier in your home or car are the most common uses. Subject to the quantity of connector rings, earphones can likewise incorporate a mouthpiece. Nowadays, smartphones, computers, and laptops all use the 3.5mm audio jack size.

Additionally, for projects that plug into headphone jacks, the 3.5mm audio jack is a useful component for hobbyists. There are various kinds of 3.5mm sound jack accessible with various applications like TS, TRS, and TRRS, yet the most widely recognized that we find in day to day existence is TRS and TRRS.

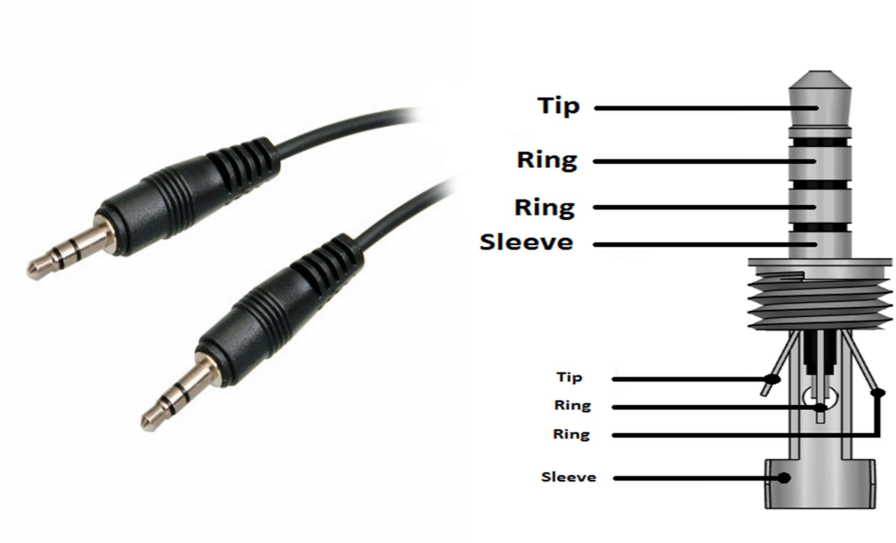


Fig 16:- 3.5mm Audio Jack & Pinout

Features

1. Switching: Some audio jacks are designed with a switch that allows the device to detect when an audio plug is inserted or removed. This can be used to automatically switch between speakers and headphones or to mute the audio when headphones are unplugged.
2. Mono or Stereo: Audio jacks can be designed for mono or stereo use. Mono jacks have one signal channel, while stereo jacks have two signal channels. Stereo jacks are typically used for headphones and speakers, while mono jacks are used for microphones and other audio input devices.
3. Switching: Some audio jacks are designed with a switch that allows the device to detect when an audio plug is inserted or removed. This can be used to automatically switch between speakers and headphones or to mute the audio when headphones are unplugged.

Applications

1. Headphones and earphones: Audio jacks are commonly used to connect headphones and earphones to electronic devices such as smartphones, laptops, and music players. The audio jack provides a stable and reliable connection for audio output, allowing users to enjoy high-quality sound without the need for additional equipment.
2. Microphones: Audio jacks can be used to connect microphones to electronic devices such as laptops, smartphones, and cameras. The audio jack provides a stable and reliable connection for audio input, allowing users to capture high-quality sound for voice recordings, video conferencing, and other applications.
3. Musical instruments: Audio jacks are commonly used in musical instruments such as electric guitars, bass guitars, and keyboards. They provide a stable and reliable connection for audio output, allowing musicians to connect their instruments to amplifiers, mixers, and other equipment.

1.6.8 RESISTORS

According to Ohm's law, a resistor is an electronic component with two terminals that is designed to produce a voltage drop between its terminals proportional to the current in opposition to an electric current: V = IR Resistors are found in electronic circuits and electrical networks. Most of electronic gadgets contain them on a large scale. Resistors can be made of a wide variety of compounds and films as well as resistance wire, which is wire made of high nickel and chrome. The ability to dissipate power and resistance are the primary properties of resistors. The value below which power dispersal restricts the maximum allowed current stream or, more specifically, the voltage at which the cutoff is applied to the resistor's materials as planned are additional characteristics. Other characteristics include the temperature coefficient, commotion, and basic obstruction. Resistors can be incorporated into integrated, hybrid, printed, and printed circuits. Size, actually huge enough not to overheat while disseminating their power. A resistor is a circuit component with two terminals. When a voltage V is applied across the resistor's terminals, the higher value of R further "stands up to" the progression of current I, which is provided by high-resistivity combination, such as inductance. This is

known as the consistent of proportionality. less effectively than its actual dimensions; It is designed that way.

Fig 17:- Resistors

The majority of electronic hardware contains resistors, which are standard components of electrical systems and electronic circuits. As well as opposition wire (wire made of a high-obstruction combination like nickel-chrome), different mixtures and movies can be utilized to make down to earth resistors. Resistors can be incorporated into integrated circuits, particularly analog devices, as well as hybrid and printed circuits. The opposition of a resistor shows its electrical usefulness: Most commercial resistors have a range of more than 9 significant degrees. When specifying that resistance in an electronic design, it may be necessary to take into account the application's manufacturing tolerance of the selected resistor. In some accuracy applications, the obstruction's temperature coefficient may likewise be a worry. Additionally, useful resistors have a maximum power rating that should be higher than the expected power distribution of that resistor in a particular circuit: This is primarily of concern in applications involving power electronics. Resistors with higher power ratings are physically larger and may require heat sinking. The rated maximum working voltage of the resistor must sometimes be considered in high voltage circuits. The series inductance of a pragmatic resistor makes its way of behaving withdraw from ohms regulation; Smaller resistance values may play a significant role in some high-frequency applications. A resistor's noise characteristics may be an issue in a pre- or amplifier with low noise.

The technology used to make the resistor has a major impact on the temperature coefficient, excess noise, and unwanted inductance. Most of the time, there is no separate specification for each family of resistors made with a particular technology. A group of discrete resistors is likewise recognized by its structure factor, which is connected with the size of the gadget and the place of its leads (or terminals), which are essential to the genuine creation of the circuits that utilize them.

The ohm sign is The SI unit for electrical opposition is), and its name comes from Georg Simon Ohm. A volt for every ampere is comparable to an ohm. Because resistors are manufactured and specified for a very long time, the derived units of milliohm (m = 103.3), kilohm (k = 103), and megohm (M = 106) are also common range of values. Conductance G = 1/R, which is measured in Siemens(SIunit) units, also known as a mho, is the opposite of resistance R.As a result, a Siemens is equivalent to an ohm: Despite the fact that the term "conductance" is frequently employed in circuit analysis, the actual resistance (in ohms) of resistors is always specified rather than their conductance.

Features

1. Value of Resistance: The most crucial aspect of a resistor is its resistance value. It is estimated in ohms (Ω) and decides how much current that will move through the resistor for a given voltage. From fractions of an ohm to millions of ohms, resistors come in a wide range of values.
2. Power Level: The power rating of a resistor is the greatest measure of force it can securely disperse without being harmed. This is commonly estimated in watts (W) and relies upon the size and development of the resistor.

Applications

1. Division of Voltage: When voltage is divided into smaller values that can be used in other parts of the circuit, resistors are frequently used in voltage divider circuits.
2. Timing: When controlling the timing of events in a circuit, resistors are used in timing circuits like RC circuits.

3. Sensing of Temperature: Because their resistance changes with temperature, resistors can be utilized as temperature sensors. They are frequently utilized in temperature control and measurement circuits.

1.6.9 CAPACITORS

A capacitor or condenser is a passive electronic component made up of two conductors separated by a dielectric.When a voltage potential difference exists between the conductors,an electric field is accessible in the dielectric.Between the plates, this field creates a mechanical force and stores energy. The effect is strongest between conductors that are wide, flat, parallel, and narrowly spaced apart. The capacitance, which is estimated in farads, is the one steady worth that characterizes an optimal capacitor.TThis is the ratio of each conductor's potential difference to its electric charge. A small amount of spillage flow eventually passes through the dielectric that separates the plates. A capacitor (previously known as a condenser) is a gadget for putting away electric charge. Practical capacitors come in many different shapes and sizes, be that as it may, they all have no less than two guides isolated by a nonconductor.For instance, the metal foils that make up capacitors in electrical systems are separated by an insulating film layer.

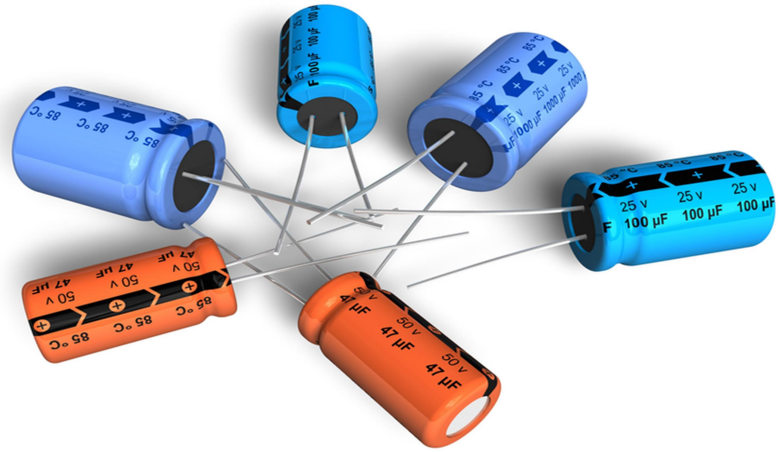


Fig 18:- Capacitors

Capacitors are broadly utilized in electronic circuits in channel organizations that prevent direct current from flowing while allowing alternative current to pass, for smoothing the result of force supplies, in the thunderous circuits that tune radios to specific frequencies and for the overwhelming majority different purposes. A capacitor is a detached electronic gadget comprised of two transmitters isolated by a separator or dielectric. A static electric field forms in the dielectric at the point when there is an expected contrast (voltage) between the guides.This field creates a mechanical force between the conductors and stores energy.An ideal capacitor is portrayed by a lone reliable worth, capacitance, assessed in farads.This is the proportion of every conveyor's electric charge to their possible distinction.

Features

1. Capacitance: The most crucial property of a capacitor is its capacitance. It is expressed as the amount of electrical charge that can be stored in the capacitor for a given voltage and is measured in farads (F). From picofarads (pF) to farads (F), capacitors are available in a wide range of capacitance values.
2. Voltage Rating : A capacitor's voltage rating indicates the highest voltage it can safely withstand without failing. In applications where high voltage spikes or surges are possible, this is a crucial factor to take into account.
3. Tolerance: The degree to which a capacitor's actual capacitance value may differ from its nominal value is known as its tolerance. This is communicated as a rate and shows the accuracy with which the capacitor is fabricated. Low tolerance capacitors are more precise but also more costly.

Applications

1. Energy Capacity: Electrical energy is frequently stored by means of capacitors, such as in electronic flashlights and flash cameras. They can also be used to store energy from ambient sources like solar or thermal in energy harvesting circuits.
2. Combining and Separating: Capacitors are utilized in coupling and decoupling circuits to permit the section of AC signals while obstructing DC signals.

Capacitors are used to reduce noise in decoupling circuits by providing a low impedance path for high-frequency signals.

3. Tuning and Resonance : Tuned circuits, such as radio and television receivers, use capacitors to tune to a particular frequency. Additionally, they are utilized in oscillators and filters, which are resonant circuits.

CHAPTER 2
LITERATURE REVIEW

2.1 Literature Survey

A) Noof Al Abdulsalam et al; in their paper[1], title “Plan and Execution of a Vehicle to Vehicle Correspondence Framework Utilizing Li-Fi Innovation" introduced the underlying plans and consequences of a vehicle-to-vehicle correspondence limited-scale model framework utilizing light loyalty (Li-Fi) innovation, another innovation that was created over the most recent couple of years, which actually needs more examinations on its supportability for open air vehicular organizations. Communication between vehicles has proven to be the most efficient method for reducing vehicle accidents. This paper focuses primarily on the use Utilizing light-emitting diode (LED) bulbs as an optical wireless medium for signal propagation and as a means of connectivity, LED bulbs transmit data through the spectrum of light.. Truth be told, the utilization of Driven disposes of the need of complicated remote organizations and conventions. Experimental findings and numerical simulations performed with the Proteus package are also presented, and they are found to be quite consistent.

B) Hind Bangui et al; in their paper[2], titled “The Smart City concept is gaining popularity because it incorporates a variety of technologies into public spaces to meet the requirements of citizens. Brilliant Versatile Advancements for the City Representing things to come was introduced. However, the smart city paradigm's success is directly linked to the treatment and management of the large amount of real-time data that can currently be most effectively approached with the assistance of cloud platforms. In this paper, they talk about the most encouraging portable cloud and information transmission advances that are intended to make the city "smarter" and more affordable for customers.As a result, they also talk about Li-Fi as a future method for sending information through light that can make correspondence in a brilliant city even better and ensure that citizens have wireless connectivity that meets their needs.

C) Nikshep K N, Sowmya G et al; in their paper[3], title ”TIn the presentation "Voice and Data Communication Using Li-Fi," the process of data communication via visible light on the transmitter side uses the Keypad as the input signal. The DTMF Encoder

receives the sign from the microcontroller, which generates two results from the keypad. For each key pressed, the encoder will produce one tone and one frequency, which are amplified and fed into the power LED by the amplifier circuits. The ward resistor will receive the light signal at the beneficiary sidelight and generate an electrical signal that is related to it. A demodulator circuit (DTMF Decoder) processes this electrical signal. The output of the decoder is fed to a microcontroller, which then activates the load that corresponds to the pressed key. Voice serves as the input signal during voice communication on the transmitter side using visible light.Through a condenser or microphone, this signal is transformed into an electrical signal that is amplified by the amplifier circuits and fed into the power LED. The LED's light signal changes in response to the voice signal's intensity; A light-dependent resistor on the receiver side will take in the light sign and produce an electrical sign that is relative to it. A demodulator circuit processes this electrical signal before feeding it to a speaker, which in turn produces the audio signal that was at the transmitter side's input.

D) Rajan Sagotra, Reena Aggarwal et al; in their paper[4] titled “Visible Light Communication “ presented, With the invention of LED (Light Emitting Diode), the idea of victimization as a form of communication has come back to the forefront. White Light Emitting Diodes (LEDs) are used in VLC. These LEDs transmit information by flashing light at speeds that are invisible to the human eye.Now, the light they use in their way of life can be used for more than just providing light; it can also be used for communication. This technology is being developed through extensive research for business use in a variety of areas, such as web access and vehicle-to-road communication using traffic signal lights.Based on their literature review, it became clear that more work needed to be done to make it possible to plan a new model that would work with the current infrastructure for indoor applications.

E) Junjie Liu et al ;in their paper[5], titled “Survey of Wireless Based Indoor Localization Technologies” presented, There is a growing demand for localization-based services (LBS). he fundamental foundation of LBS is the acquisition of physical location. Despite its widespread use for outdoor localization, GPS does not perform well inside due to the obstruction of signals by ceiling and walls. Numerous methods have been developed to achieve high accuracy in indoor localization. The vision based

confinement includes camera and compact PC vision advances that increment the worth. Each localization prediction's error will be added up in an accelerometer-based localization. To begin,They compare the wireless technologies utilized in recent localization research. The remote advancements are partitioned by the distance of inclusion. When used for indoor localization, their distinct characteristics, such as their frequency band and recognition, ensure their distinctiveness. The mathematical methods used in wireless based localization are then explained. Only a technique based on proximity can provide an information about a connection or link that is supported by the location. Triangulation can be acclimated to ensure point or distance data recover fron the client region received signals from three or more assistance stations.Fingerprint assumes that every purpose has a completely different signal property; the location is typically determined by comparing it to radio-maps that have already been constructed. The paper concludes with a summary of four trends in wireless-based indoor localization research.Multiple mathematical methods can be used to reduce error and improve accuracy.

F) Shivaji Kulkarni et al; in their paper[6] titled “A Survey on Li-Fi Technology" provided a succinct analysis of Li-Fi, a novel technology for data communication, and the advantages it offers over other technologies.

G) P. Kuppusamy et al; in their paper[7] titled “A survey on Li-Fi technology and Wi-Fi technology in commercial and industrial settings was presented in "Survey and Li-Fi's Obstacles, Compared to Wi-Fi."Based on radio waves in the spectrum, Wi-Fi works. These waves signal sensitive areas and are extremely harmful to sick people. As a result, It couldn't be used in places like scan centers, air lines, and hospitals, for example. To conquer these constraints, Li-Fi is the innovation that is created to work in such conditions. TThe study of Li-Fi innovation, working standards, challenges, and applications with a correlation to Wi-Fi innovation is presented in this paper.The relative review additionally introduced the highlights of the two advances. Using a light source, the observations demonstrate that Li-Fi transmits data at high speed in a non-harmful manner.

H) R. Bhavya and R. Lokesh M., (2016), in their paper[8] A Survey of Li-Fi Technology The design of Li-Fi, another remote innovation that attempts to give network inside a specific organization climate, was the subject of an investigation. Through the transmission of data through an LED, LiFi Technology provides us with a method for data transfer. The intensity of this LED changes so rapidly that it is impossible for the human eye to follow it. There is no question that there is a splendid future for such an innovation that utilizes VLC innovation. The possibility of "Each and every bulb can be utilized as a hotspot for the Web" i.e., like an area of interest to communicate remote information. With a clear vision of a cleaner, greener, safer, and brighter future, this concept also encourages us toward a brighter future. Their goal and approach is basically the same as our objectives of this venture.

I) Shilpi Mishra, Implementation of A Simple Li-Fi Based System in their paper[9] - This study focuses primarily on the transmission of text, audio, and video using Li-Fi technology.The use of a PCB necessitates a transmitter that is comparatively more complicated for this procedure. The LED's light intensity can be controlled and altered using this. As a result, this study proves to be a more advanced version of the current project, which merely demonstrates text data transmission. Additionally, RGB LEDs (red, green, and blue) are incorporated to increase data transmission speed. The majority of the time, using a photo-transistor rather than an LDR increases the efficiency of receiver design.

J) G Madhuri, K Anjali and R Sakthi Prabha, In their paper [10], they show tThe transmission of information, sound, and text signals utilizing Li-fi innovation exhaustively. We notice the use of handsets which are associated with the two laptops between which correspondence happens. Here, we discuss the advantages of using LEDs in the transmitter system, which include LEDs that are better for the environment, perform better, have a more adaptable design, and have a longer lifespan.

K) Rekha R1, Priyadarshini in their paper [11] implemented a Data and audio communication system based on Li-Fi. The system's signals are directed to the comparator, where they are compared to the reference voltage. Binary high means thatThe reference voltage is lower than the voltage that was received.. Binary low is when the received voltage is lower than the reference voltage. Either from the Data are

entered via serial communication or the Hex Keypad. A microcontroller converts this signal into binary 0s or 1, which are fed to the LED driver for turning on and off the light. Input data make up these light signals. These signs are communicated towards the beneficiary. The LCD Display also displays the input data for verification.

L) A. Gayathri, S. Mohanapriya et al; in their paper[12] has fostered a Plan and Execution of MPVLC Li-Fi Model for Start to finish Remote Information Transmission. There are two ways to calculate the codes needed to put the model into action during the transmission process. Shell script is one method for interacting with the MPVLC Li-Fi model's hardware system.The mixed media data is sent and received in a further manner as a 0 and 1 bit of data.The MCU system employs the shell script method so that it can handle transmission progress between source and destination port lines. The code for reading information from the MCU device via the receiver end port point is developed using the MATLAB tool. Following a connected recurrence investigation, the encoded information is changed over into the first data at the recipient end point.

CHAPTER 3
METHODOLOGY

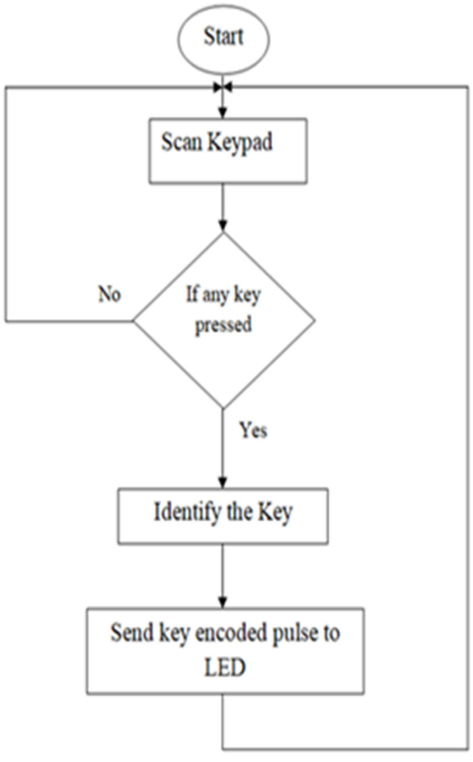
3.1 METHODOLOGY

When putting Li-Fi into action at the downlink transmitter, which is capable of transmitting data from the source, white LED lights are typically used. Commonly, these gadgets are just utilized for consistent current light. However, the optically produced output can be made to vary at extremely high speeds through rapid and substantial current changes. In Li-Fi setup, this very optical current property is used. Switches or microphone audio data can be applied to the input data. Python is used to convert the audio data into binary and applies it to the led driver.In This, The square waveform that is applied to the transistor Bc547 is used as a led driver. If the led is on, you send a digital 1 I.E. high, and if it is off, you send a 0 I.E. low. This is the straightforward operational procedure.

Text, images, videos, and audio signals can all be sent using Li-Fi. And also it can be used to provide internet access. The transmission of two types of data is the primary focus of this paper: text and audio waves Topologies, as well as there are many different features and variations of the data that are being sent from various setups.Audio signals have been sent from one source to one output (SISO), multiple sources to multiple outputs (MIMO), and one source to one output (MISO). Using an arrangement of Arduino boards, a L.E.D., and a Silicon photo-diode, we were able to transmit text between two users. Utilizing modulation techniques like OFDM, In the future, Li-Fi may even be used to provide internet access.Combining Li-Fi and Wi-Fi results in a setup that is ideal because the drawbacks of Li-Fi are covered up by device handoffs to Wi-Fi.

Using LiFi technology, the analog audio or data signal must first be converted into a digital signal that can be transmitted. An analog-to-digital converter (ADC) for audio signals and a digital signal processing unit for data signals can be used to accomplish this.A modulator circuit is used to transform the digital audio or data signal into a light signal. To encode the digital signal onto the light signal, this circuit alters the intensity of the light source.After that, a light source like an LED is used to transmit the

modulated light signal. Most of the time, the LED is modulated at a high frequency, usually in the tens or hundreds of megahertz range.A photodetector receives the modulated light signal and transforms it back into a digital signal. Most of the time, the photodetector is a phototransistor or high-speed photodiode that is sensitive to the modulation frequency of the light signal.The original audio or data signal is then recovered by demodulating the digital signal. This should be possible utilizing a demodulator circuit that separates the balancing signal from the got light sign. The advanced sign is then decoded to recuperate the first sound or information signal.The reconstructed audio or data signal can be processed, filtered, or amplified in the final step of signal processing to improve its quality.Generally speaking, the system for executing sound and information move utilizing LiFi innovation includes changing over the simple sound or information signal into a computerized signal, balancing it onto a light sign, communicating the light sign through a light source, getting the light sign utilizing a photodetector, demodulating and deciphering the advanced sign, and handling the remade sound or information signal.



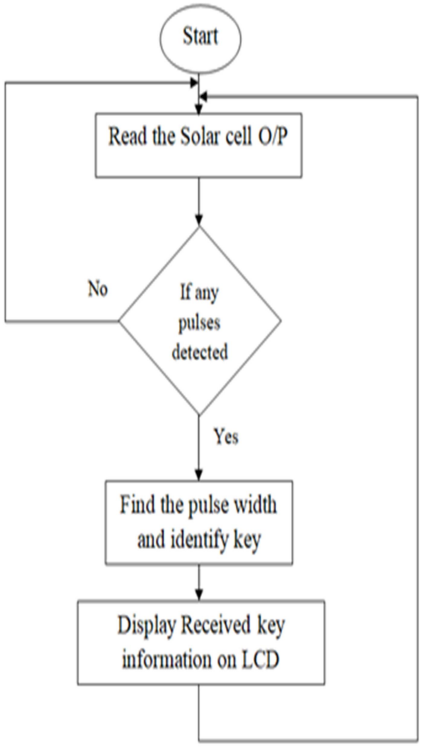


Fig 19:- Transmitter Flow Diagram Fig 20 :- Receiver Flow Diagram

Visible light is a novel method for transmitting data. Data is sent in Li-Fi by adjusting the brightness of the light, which is picked up by a photosensitive detector. In VLC, a light source transmits and a detector receives information. The LED will glow brighter the louder the voice. The solar panel-detected incoming light is interpreted by the receiver section, which then transforms it into a sound signal that can be heard with the help of a Speaker.As a result, this method becomes more sophisticated to Li-Fi's use of multiple LEDs and multiple data streams at a given time.

This method enables faster data communication by transmitting more information.A Li-Fi trans-receiver's fundamental operation.It transmits an electrical signal to an LED driver from an input device.The photodiode receives this electrical signal in the form of light as binary data.After that, the light signal is recognized by the receiver, and the data that is sent to the output device is decoded. In our project, laser light is used to send audio and data to the solar panel for audio signal transmission, the positive end of the laser is connected to a 5 volt supply;An audio device's aux cable is connected to the laser's ground end;The signal's amplitude changes are send to the solar panel, and the solar panel's output is connected to an amplifier circuit that is connected to the speaker for the purpose of transmitting data, the laser sourceconnects the text to the Arduino Uno microcontroller data is converted into digital output for the solar panel in the forms of 1 and 0.On the receiving side, the analog pin of the Arduino uno is connected to the solar panel's analog output.If the value exceeds the defined threshold, an Arduino threshold value is set for the analog signal is set to 1 and if it is less than the defined threshold it is set to 0.After The data is decoded into text when it is received.

Additionally, it is displayed on an LCD or serial monitor.A mobile device sends the audio signal to the transmitter, and an array of LEDs send the analog signal.The one shown in Figure effectively alters the amount of sunlight that is emitted.Utilizing the various light intensities, the photodiode records the signals., the pre-amplified speaker amplifies the signals received by the solar battery through the unsteady junction rectifier array and then emits sound waves that the speaker can detect.Figure illustrates how this is demonstrated.

A transmitter unit that converts and modulates the audio or data signal into a light signal, a receiver unit that detects and decodes the light signal, a LiFi link that connects the two units, a power supply that supplies the power required to operate the system, and a user interface that provides feedback to the user are all components of the proposed system for audio and data transfer using LiFi technology. This system can make it possible to transfer audio and data over light waves at a high speed and in a secure way, making it a dependable and effective communication option for a variety of applications.

CHAPTER 4
AUDIO AND DATA TRANSFER THROUGH LIFI TECHNOLOGY

4.1 AUDIO & TEXT SEGMENT

4.1.1 AUDIO TRANSMISSION

A mobile device sends the audio signal to the transmitter, and an array of LEDs send the analog signal.The one shown in Figure 1 effectively alters the amount of sunlight that is emitted.Utilizing the various light intensities, the photodiode records the signals.As a result, the pre-amplified speaker amplifies the signals received by the solar battery through the unsteady junction rectifier array and then emits sound waves that the speaker can detect.Figure 1 illustrates how this is demonstrated.

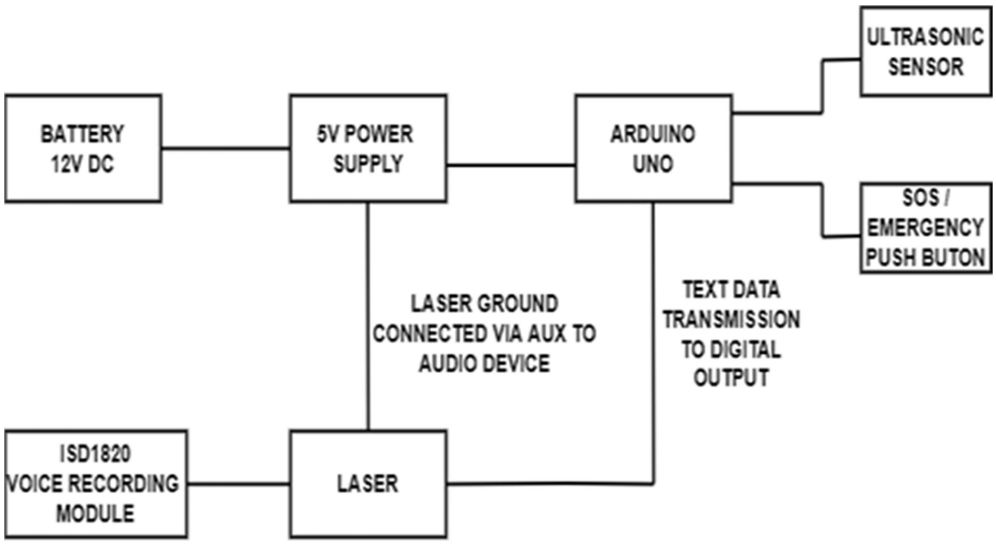


Fig 21 : Audio & Text Transmission

The audio signal was sent through the 3.5 mm jack from the phone at the transmitter end, transforming into an analog signal from the digital signal. Before being sent to the LED array connected to the breadboard, this analog signal is amplified. The LED array is also supplied with a power supply. The LED array and the 3.5 mm jack are both connected to a 9V battery, which provides this power.A photodetector-functioning solar panel captures this variation in light intensity. The received signal is sent to the speaker that has been pre-amplified. and records all variations. Using the same concept, an analog phone signal was substituted for text-to-speech software. A text that has been entered into the program is read out by the software. This audio signal, which came from reading the text aloud, was recorded on a solar panel and sent through the LED array fluctuation that was mentioned earlier. This was heard through a speaker that had already been amplified.

4.1.2 TEXT TRANSMISSION

In accordance with the user's requirements in the transmitter section, the Arduino IDE handles the initial text input from the laptop.This message is transmitted to the led by means of an The microcontroller Arduino Nano. In the section for receivers, a photo transistor and a photo receiver diode are connected.An Arduino Nano microcontroller and laptop are connected to this via a USB to serial port converter.Diagram 2 shows how this is demonstrated.To keep the issue ready for transmission the text is initially typed onto a device such as a laptop, mobile phone, or other deviceThe work on the transmittal side will then conform to the text that needs to be transferred.

In the figure above the text is sent to the small controller on the transmitter side.In order to move forward with any process the text is coded during a type.After the code has been prepared it will be sent to the convertor where the coded text is converted to light type.When the light is placed in the rangeThe receiver side receives the data next.After that, the coded text is decoded and sent to the receiver's output.Therefore the output is obtained at the source and is available at the receiver.

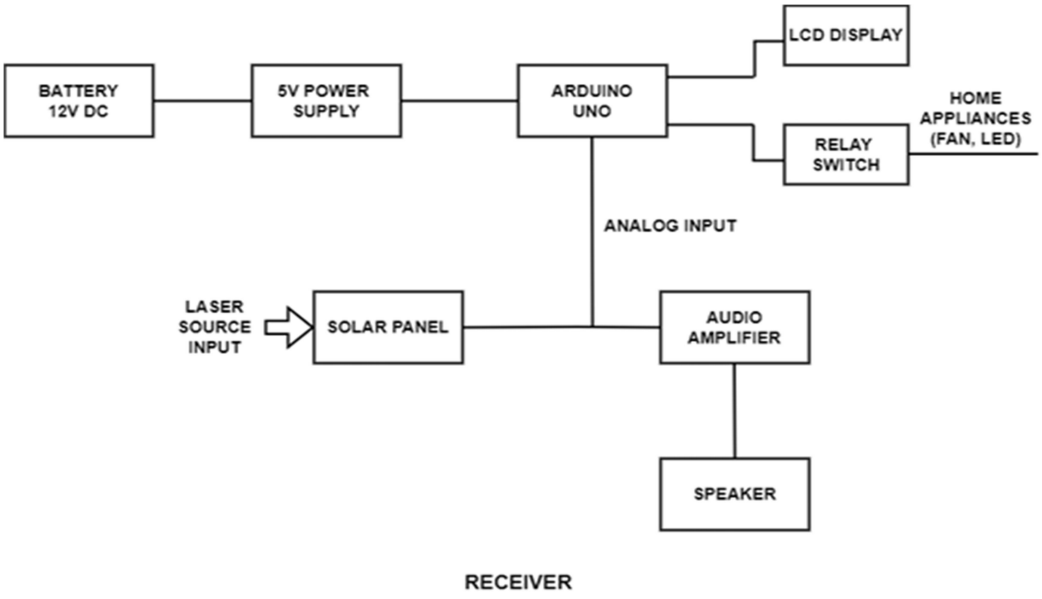


Fig 22:- Audio & Text Receiver

The text transmission segment consists of three parts. The first is that the Arduino sends text to itself. Second, sending text between two Arduinos via infrared. Thirdly, text communication between two Arduinos via VLC.The transmission of data through LEDs is the fundamental principle of Li-Fi. When used as a light source, LED bulbs can transmit data through visible light at constant current. LED flickering has an impact on the transmission speed as well as the flow of data. When data is transmitted, this LED turns on, and when zero is transmitted, it turns off. Variable light frequencies encode the data and strings of one and zero turn the LEDs ON and OFF, respectively.A Li-Fi trans-receiver's fundamental operation.It transmits an electrical signal to an LED driver from an input device.The photodiode receives this electrical signal in the form of light as binary data.After that, the light signal is recognized by the receiver, and the data that is sent to the output device is decoded.In our project, laser light is used to send audio and data to the solar panel.For audio signal transmission, the positive end of the laser is connected to a 5 volt supply;An audio device's aux cable is connected to the laser's ground end;The signal's amplitude changes are sent to the solar panel, and the solar panel's output is connected to an amplifier circuit that is connected to the speaker.For the purpose of transmitting data, the laser The Arduino Uno microcontroller is connected to the source.The text data is then converted into digital output for the solar

panel in the forms 1 and 0. On the receiving side, the analog pin of the Arduino uno is connected to the solar panel's analog output.If the value exceeds the defined threshold, an Arduino threshold value is set for the analog signal is set to 1 and if it is less than the defined threshold it is set to 0.After The data is decoded into text when it is received, and itis shown on a chronic screen or LCD show.

4.2 HARDWARE IMPLEMENTATION & CIRCUIT DIAGRAM

4.2.1 TRANSMITTER SECTION

For Audio signal transmission , the positive end of laser is connected to 5v supply , ground of laser is connected to aux cable to audio device , the signal amplitude fluctuation are transmitted to solar panel , the solar panel output is connected to amplifier circuit i.e connected to speaker. At the sending end, Arduino-1 is used to convert the alphanumeric characters into 8 bit ASCII code. For the code, we have to do the following: Take the characters as input and Convert the characters into ASCII code of which the start bit is 1 The delay is set 10ms between two consecutive bits Set the delay of 100ms between two consecutive Bytes. Then Upload the code.The phone's The digital music file is transferred here to the audio jack via the built-in digital to analog converter.The audio jack is connected in series in the transmitter circuit, which is powered by a power supply circuit.It will send data through the LEDs if a song starts, but because the speaker circuit hasn't been connected yet, it can't tell if it's being sent because the LEDs change too quickly for the eye to see.

The technology for wireless communication known as Light Fidelity (LiFi) transmits data using either visible, ultraviolet, or infrared light. Light waves are used to transmit data in LiFi, in contrast to Wi-Fi and other conventional wireless communication technologies. There are a few parts that work together to send information using light waves in the LiFi transmitter segment. The LiFi transmitter portion normally includes a Drove (Light Exuding Diode), a driver circuit, a sign dealing with the unit, and a point of convergence or diffuser. The LED produces a specific wavelength range of light that can be modulated to carry digital data. The driver circuit is accountable for controlling

the Driven and balancing the light sign as per the communicated information. The computerized data must be encoded by the sign handling unit into a format that can be conveyed via the controlled light sign. On-Off Keying (OOK), Pulse Width Modulation (PWM), and other modulation techniques Frequency Shift Keying (FSK) can form the basis for the encoding process. The focal point, otherwise called a diffuser, spreads the light sign over a huge region to make it more straightforward for the recipient segment to get it. Contingent upon the necessities of the application, the focal point can likewise be utilized to shine the light sign in a particular heading or region. The LiFi transmitter section uses a lens or diffuser, an LED, a driver circuit, a signal processing unit, and light waves to send data. Computerized information is changed into tweaked light signals and communicated in a particular frequency range by the transmitter segment. The receiver section converts the modulated light signals into digital data.

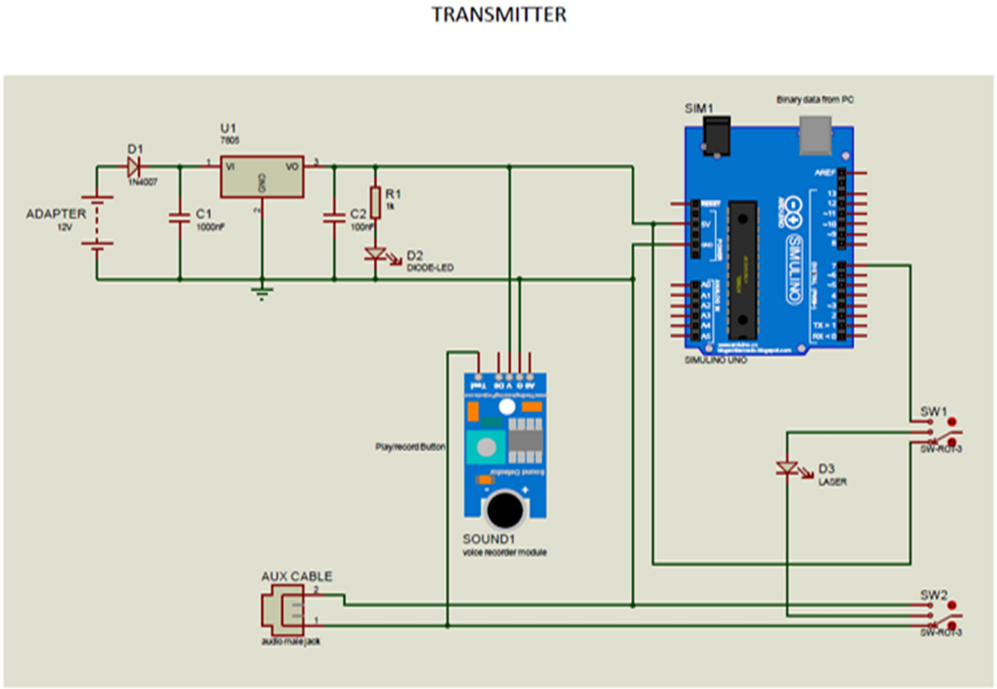


Fig 23:- Transmitter Circuit Diagram

For high-speed and dependable data transmission, the LED used in the LiFi transmitter section must be chosen carefully. For LiFi applications, LEDs with a high modulation bandwidth, low flicker, and stable color temperature are preferred.Digital information is

encoded into the light signal by LiFi using a variety of modulation methods. The most common method is OOK, in which binary data are represented by turning on and off a light at a predetermined frequency. In some applications, additional modulation techniques like PWM and FSK are utilized.The signal handling unit in the LiFi transmitter segment is answerable for encoding the computerized information into the light sign. The functions of modulation and encoding are typically carried out by a digital signal processor (DSP) or microcontroller that make up the signal processing unit.The driver circuit is in charge of controlling the LED and modulating the light signal in accordance with the transmitted data. A power amplifier and a modulation circuit are typically part of the driver circuit.The LiFi transmitter section uses a lens or diffuser to spread or focus the light signal.

4.2.2 RECEIVER SECTION

For Data transmission laser source is connected to Arduino uno microcontroller , the text data is converted to digital output in 1 , 0 forms to the solar panel . At the receiving side solar panel the analog output of Arduino uno , then the output character data is taken out via serial monitor. Laser light is sent to the solar panel and the solar panel now receives the data. The solar panel is connected with the A0 pin and ground. After checking the value of the solar panel using built in “AnalogReadSignal " both when there is no light on the laser, and when there is light on the laser. We then set the THRESHOLD Value for the solar panel by examining the value from “AnalogReadSignal". In setup, we consider the solarpin A0 as input and fix the Serial.begin to 9600. Then we take the reading from the solar pin. If the Reading from the solarpin is greater than the threshold, then we consider it to be ‘1’, otherwise it is considered as ‘0’. These binary bits are stored in an array.

The speaker circuit consists of the solar cell and operator. It collects using the solar cell as a receiver to receive the song data sent by the LEDs (this could also be done with any photodiode or photoresistor).The signal is then processed by the amplified speaker.You can listen to the music that is transferred through the LED because of this.The LED's light signal is converted into an electric signal (current) by the photodiode. This current is then turned into a voltage by the comparator, which is then used to demodulate the

signal using a 16 KHz RC filter. To verify the data reception and operation of The LED light is covered by a plate in our reception scheme.Our success can solely be attributed to the success of our circuit test because this test produced no results.

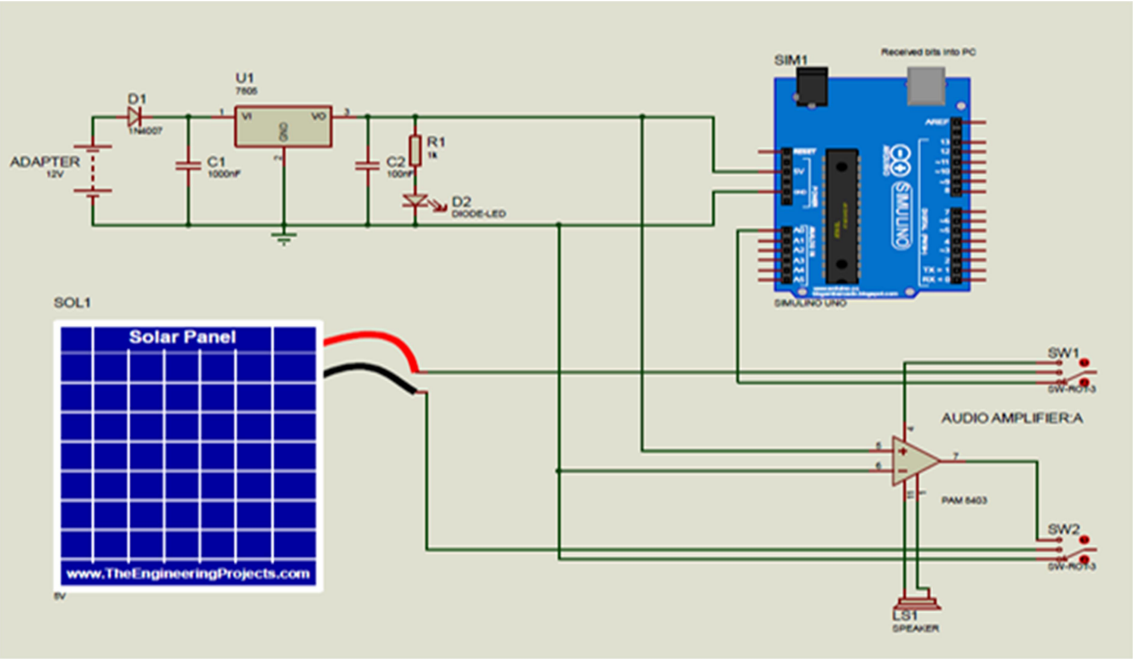


Fig 24:- Receiver Circuit Diagram

Photodetector: A device that converts light energy into electrical energy is called a photodetector. A photodetectoris used to detect the modulated light signal sent by the LiFi transmitter section in the LiFi receiver section.A photodiode, which is capable of converting light signals with high speed and precision, is the photodetector that is utilized the most frequently in LiFi applications.The photodetector's electrical signal is amplified through the use of the amplifier. The signal processing unit then processes the amplified signal.Processing unit for signals: The photodetector and amplifier's electrical signals need to be processed by the signal processing unit.

Demodulation and decoding are typically carried out by a digital signal processor (DSP) or microcontroller that are part of the signal processing unit. The sign handling unit extricates the computerized information from the tweaked light sign and sets it up for interpreting.The digital data that is extracted by the signal processing unit is decoded by the decoder. The decoder translates the advanced information into its unique

arrangement, which can be additionally handled or shown. Typically, the modulation method utilized by the transmitter section serves as the foundation for the decoding process.Due to noise, interference, or other factors, the received data may be corrupted or lost in some instances. To guarantee accurate and dependable data transfer, error correction techniques are used to identify and correct these errors.In general, the LiFi receiver section is crucial in making it possible for wireless data to be transferred through light at a high speed and with confidence. To accurately detect and decode the modulated light signal, the receiver section must be designed and optimized with care to achieve high sensitivity and low noise.The responsiveness of the photodetector is basic for recognizing powerless light signals and accomplishing high information move rates. Utilizing a high-quality photodetector and optimizing the receiver circuitry can raise the sensitivity.

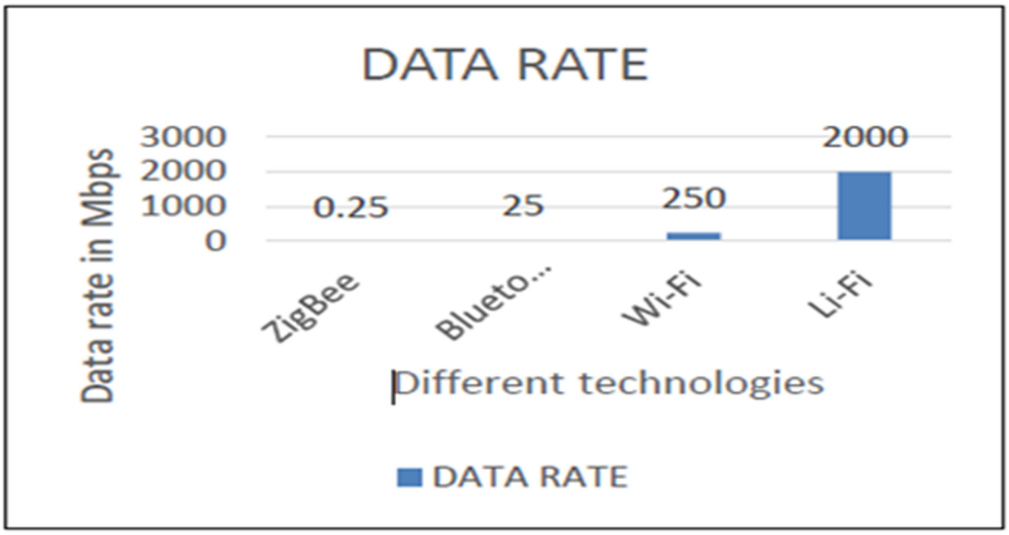


Fig 25:- An examination of the data rates of various wireless Communication technologies in comparison

4.3 WORKING

The Laser communication system works in a similar way to fiber optic links, but the beam travels through free space instead of through wires. A laser communication (LC) system sends and receives serial data over the air using a laser beam.The whole system consists of 3 parts. (1) Transmitter end, (2) Receiver end, (3) Transmission medium.

(1) Transmitter End: The transmitter consists of a PC with a keyboard and an Arduino. The input is given through the keyboard (example: AbCdE). The Arduino (1) converts the text into 8 bit binary. A UART must add sync and parity bits to the data packet on the transmit side before sending it through the transmission line with a laser beam at the right time.

(2) Transmission medium: The transmission medium is nothing but air. After transmitting, the information containing the laser travels through the air and incident upon the solar panel of the receiver.

(3) Receiver End: The receiver contains a small solar panel, an Arduino and a PC with a monitor. When the laser beam is incident on the solar panel, it converts the data containing light signal into a current and this current flows through the Arduino (2). This Arduino converts the bits into corresponding alphanumeric characters and the computer monitor shows them. This is our desired output.

At the transmitter end, the audio signal was transmitted via a smartphone, which, through the 3.5 mm jack, transmitted the signal.Both the phone's input audio and the 3.5mm audio jack undergo analog conversion. There are typically three output lines on a 3.5mm audio jack: ground, right, and left . The adverse terminal of the 9V battery is associated with the sound output signals for the left and right.The negative of the LED array that is connected to a breadboard serves as the ground for the 3.5mm jack, and the positive of the 9V array serves as the ground for the resistors that are connected in series with the LED array. Based on the effective voltage difference, The carrier wave produced by the LEDs is effectively manipulated by this circuit. The changes happen quickly and are hard to see with the naked eye. A solar panel that functions as a photo detector, on the other hand, records this variation in light's intensity. It records all of the variations, sends the received signal to an amplifier, which amplifies it, and then sends it as audio to the speaker.The speaker's output is influenced by how far away the solar panel is from the LED arrays. This demonstrates the ability of the LED array's line of

sight to receive data. The solar panel has a harder time detecting all of the light rays that are being emitted because The intensity of the light decreases and the light becomes more dispersed as the distance between the LED and the solar panel increases.

Imagine being able to download a movie from your desk lamp or access the public internet by hovering under a street lamp. A new technology is emerging that has the potential to "show, both literally and metaphorically, how to meet the ever-increasing demand for high-speed wireless connectivity.In a new data transmission technique known as Li-Fi, light waves take the place of radio waves. The ability of light-emitting diodes to switch on and off at speeds faster than the human eye can detect gives the impression that the light source is always on. A light that flickers can be very annoying, but it has turned out to be a good thing because it makes it possible to use light to send data wirelessly.To produce digital strings of one- and zero-digit numbers, LEDs can be turned on and off. Information can be encoded in the light to create another information stream by shifting the gleaming pace of the Drove.

By modulating it with the data signal, the LED illumination can be used as a source of communication to make things clearer. Due to its rapid flickering, the LED output appears constant to the human eye. Utilizing high-speed LEDs and the appropriate multiplexing strategies makes it possible to achieve a data rate greater than 100 Mbps.

VLC information rate can be expanded by equal information transmission utilizing Drove clusters where each Drove communicates an alternate information stream. There are a number of reasons to choose LED over a variety of other illumination devices, such as an incandescent or fluorescent lamp, for the VLC. are accessible. Because it is intrinsically safe, light can be utilized in settings such as airplane cabins or hospitals where radio frequency communication is frequently regarded as problematic.

Thus, not only does visible light communication have the potential to address the issue of limited spectrum space, but it also has the potential to enable novel applications. The spectrum of visible light is not used; It can be used for very fast communication and is

not regulated. Modulating the LEDs into a carrier signal is necessary for the actual transmission of data, such as pictures or audio files, via LEDs. With regards to apparent light correspondence, this transporter signal comprises light heartbeats conveyed in short stretches.

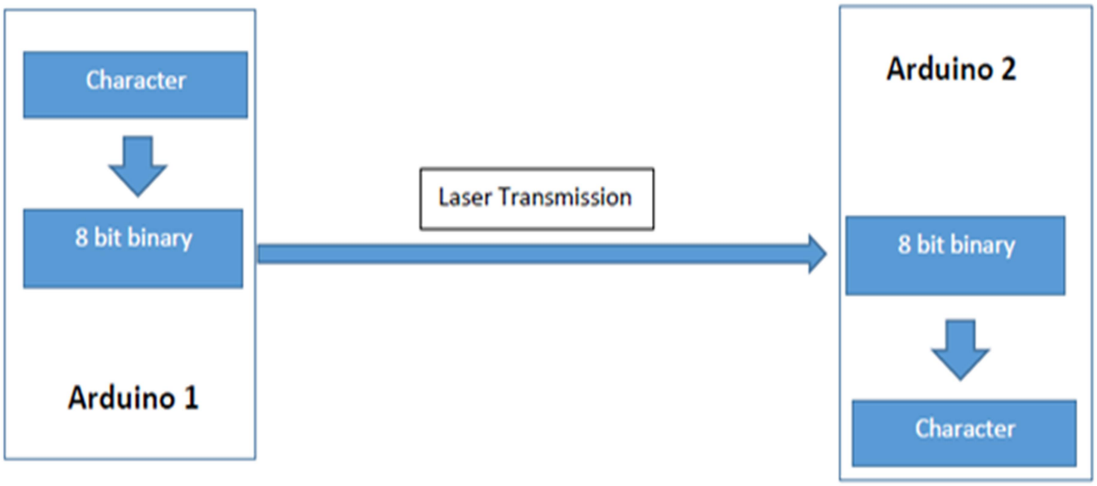


Fig 26:- Diagram of Audio and Data Laser Transmission

The whole cycle is rehashed backward for the return transmission of information from the recipient to the transmitter. For this situation, the sound or information sign to be communicated is first changed over into an electrical sign by the collector hardware, which is then balanced onto a high-recurrence transporter signal utilizing a modulator circuit. The photodetector at the transmitter detects and decodes the modulated electrical signal, which is then used to modulate the LED's light's intensity or color. Generally, sound and information move LiFi frameworks offer a solid and fast option in contrast to customary remote correspondence advancements like Wi-Fi and Bluetooth. They are especially useful in places like hospitals, aircraft, and military facilities where radio frequency interference is a concern.

CHAPTER 5
RESULT AND DISCUSSION

5.1 RESULT

Trans-gathering of the sound and text documents is effectively executed involving Noticeable light as the transporter. The accompanying perceptions are made.

The signal quality deteriorates as the distance between the beneficiary and the transmitter increases.

According to the findings of the experiment, the maximum distance that can be transmitted using a The visible light communication system has a distance of approximately 15 feet for audio and 2 meters for data.

If the angle between the LED's LOS and the receiver changes, the data it receives is affected.

The results obtained for the research work are discussed as follows.

5.1.1 Audio Transmission

We were able to transmit audio, in this case music from a smartphone, by connecting three three-volt For 0.5 feet, LEDs in series with a resistor of 220 ohms. If there are no light interferences from the outside, the music signal can be heard for one foot.A summary of the model is provided in Figures 27 and 28.

Step1: When the audio is received initially through a 3.5mm jack, the LEDs begin to blink.

Step2: When LEDs blink it can send the data to a solar panel in front of them that picks up the changes in light and sends an amplified audio signal to the receiver.

5.1.2 Text Transmission

Using a li-fi module that is a part of the Arduino Nano microcontroller and a sequential to USB converter for text to discourse change, text was sent between two laptops.At a

distance of three feet from the transceiver, the text can be transmitted here up to 100 characters if there is no interference. The model is presented in its entirety in Figure 29.

Step1: An input message is initially entered into the Arduino IDE on the transmitting laptop. The message reads, "Good Morning, Welcome to ABES Engineering College," as shown in Figure 29.

Step2: The "RUNNING" message is displayed on the screen when the Python IDLE program is run on the receiving laptop. We now receive both an audio and text message that reads "Good Morning Welcome to ABES Engineering College " on the screen after the input message has been sent to the transmitter, as is represented in Fig. 31.

5.2 OUTPUTS

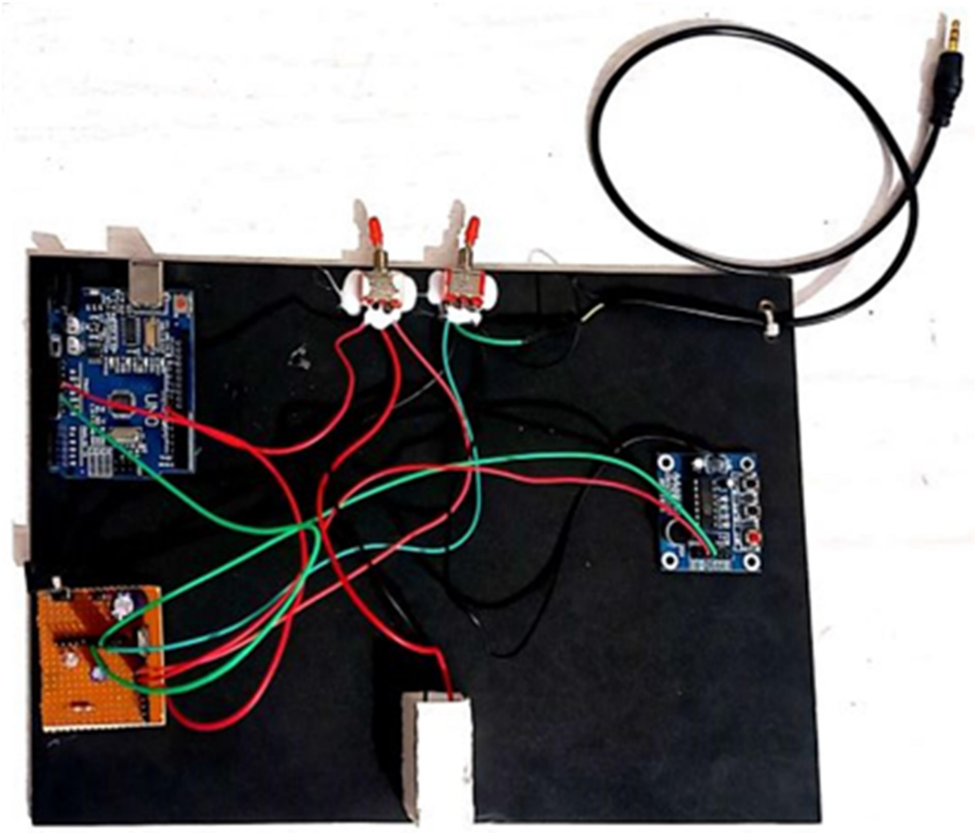


Fig 27:- Transmitter Section Model Overview

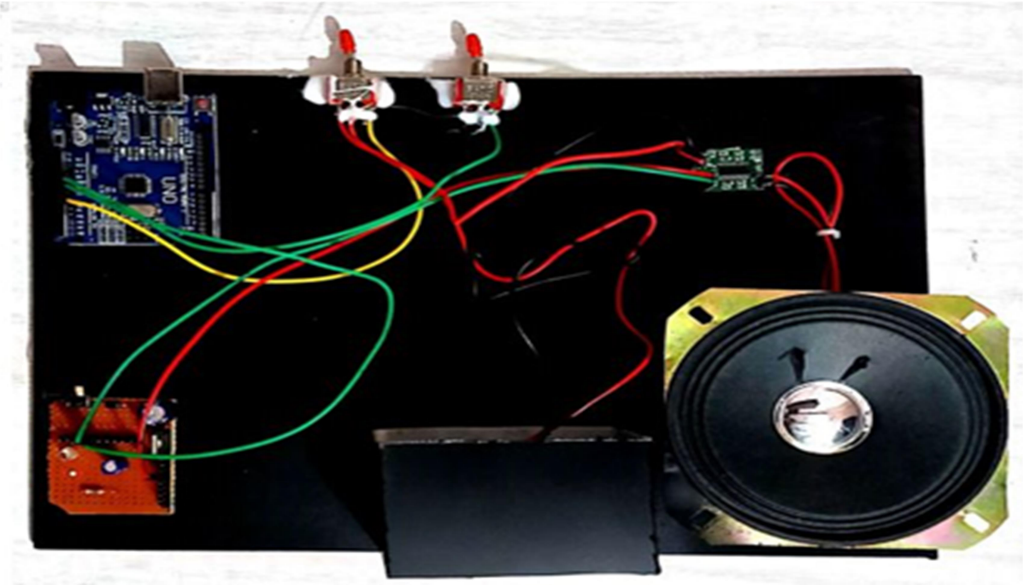


Fig 28:- Receiver Section Model Overview

Fig 29:-Text Transmission Model Overview

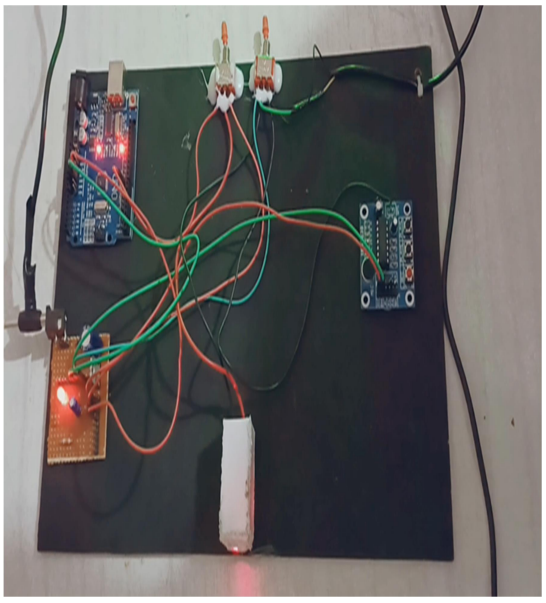


Fig 30:- Working Model Circuit

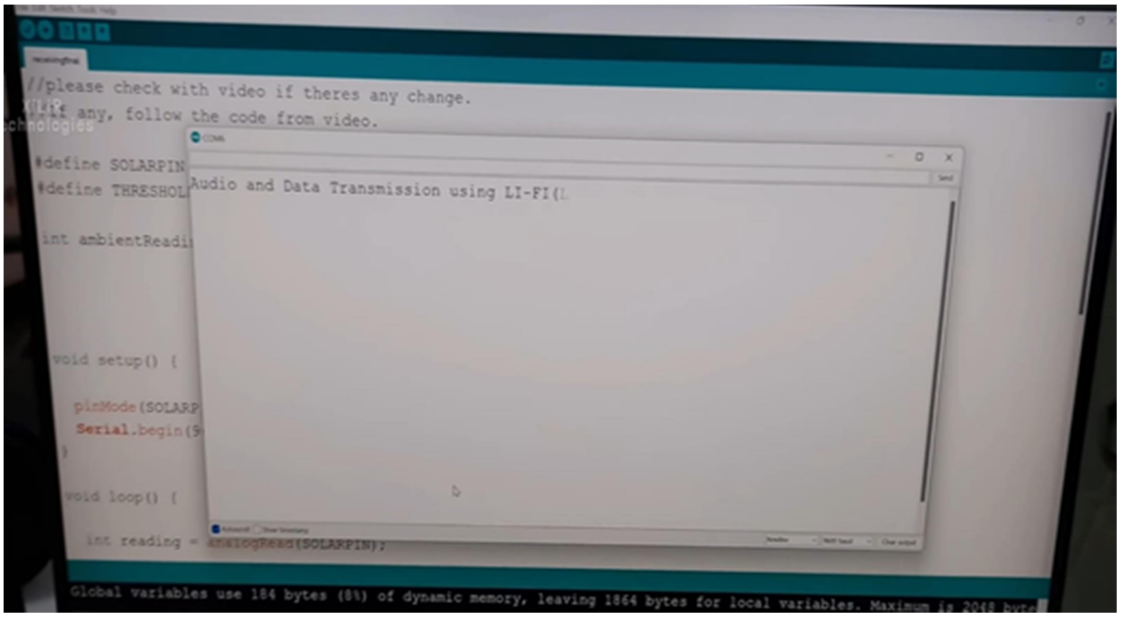


Fig 31:- Message is received by the receiver and played.

5.3 SOFTWARE DESCRIPTION

5.3.1 Arduino IDE tool

Arduino IDE is the software used to prepare the project. It is simple to write code and upload it to the board using the open-source software Arduino (IDE).

The board of the Arduino UNO has a microcontroller that can be programmed and accepts code in the form of bits or codes.

The Arduino IDE is compatible with both C and C++ languages. We used the programming language C for our project, and programs written with the Arduino software are called sketches.

The Arduino Coordinated Improvement Climate (IDE) is a product instrument used to create and transfer code to Arduino microcontroller sheets. Users can write, compile, and upload code to the Arduino board through the graphical user interface (GUI) provided by the IDE.

1. Code supervisor: A code editor with syntax highlighting and auto-completion is part of the Integrated Development Environment (IDE). This makes writing and editing code easier.
2. Compiler: The IDE includes a compiler that can turn Arduino-language code into machine code that can be run on the microcontroller.
3. Uploader: The compiled code can be uploaded to the Arduino board using the USB connection provided by the IDE's uploader.
4. Libraries: The IDE incorporates an assortment of pre-fabricated libraries that can be utilized to broaden the usefulness of the Arduino board. A wide variety of sensors, actuators, and other peripherals are supported by these libraries.
5. Monitor in series: Users can send and receive data between the Arduino board and a computer thanks to the IDE's serial monitor. For code testing and debugging, this is useful.

C and C++ are two of the programming languages supported by the IDE. The IDE's code editor has syntax highlighting, code completion, and error checking features for writing code.Using the IDE, you can compile your code into machine code that can be uploaded to your Arduino board after you have written it. You can also upload your code to the board using a USB cable thanks to the IDE's built-in uploader.You are able to send and receive data between your computer and the Arduino board thanks to the serial monitor that is included in the IDE. This is useful for connecting to sensors and other devices connected to the board and debugging your code.The IDE likewise incorporates a library director that makes it simple to download and introduce extra libraries. Pre-written code for common tasks like controlling motors, reading sensors, and communicating with other devices is provided by these libraries.

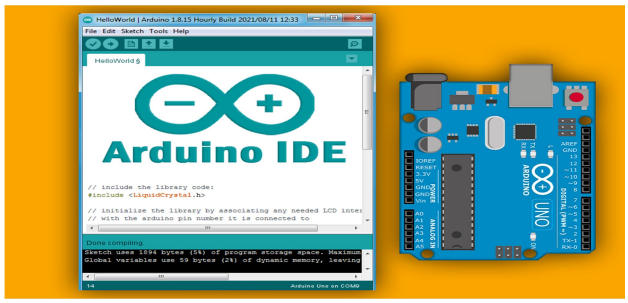


Fig 32:- Arduino IDE Tool

5.3.2 PROTEUS

The difficulty in comprehending the teaching material is what makes traditional electronics experimentation and teaching challenging; the absence of strong connections between courses; the experimental equipment's low use rate; the absence of standard experiment with programming and content; the lack of a suitable teaching platform for MCU software;the absence of extensive tests and inventive trial implies .Preparing large is troublesome quantities of qualified applied abilities. From product concept to design completion, Proteus is a complete development platform. Among its advantages are PCB automatic layout and wiring, single-chip software debugging, accurate hybrid circuit simulation and analysis, intelligent principle layout, and co-simulation of single-chip and peripheral circuits. Labcenter, an English organization and Proteus programming engineer, has been created all over the planet for almost 20 years. In more than 50 nations, it is currently the most effective and cost-effective EDA tool.

EWW CAD REVIEW ROUNDUP deemed it the best EDA tool. In terms of philosophy, continuous model development, and software upgrade, it is ahead of the competition, ensuring top-notch technology. It depicts the structure of the Proteus software product. Proteus is a platform for the complete simulation of embedded system software and hardware design. Proteus ISIS is an intelligent schematic input system. The basic platform combines single-chip microcomputer simulation with pSpice circuit simulation. IIt has analogy circuit simulation, digital circuit simulation, system simulation of a single chip microcomputer and its peripheral circuits, RS232 dynamic simulation, I2C debugger, SPI debugger, keyboard and LCD system simulation, and a variety of virtual instruments like an oscilloscope and logic analyzer signal generator, etc. To get signals on and off the PCB you need either connector components or connecting wires.

Terminal pads with soldered circuit pins are the best way to join wires to a prototype PCB; wires can then be soldered to the pins.. Add the Cushion TERMINAL part from the EEE library to permit wires for the V+, V-and GND supplies. There will be internal nets all over your circuit that you need to measure during testing. Add test points to

these nets (the PADTESTPOINT component).Testpoints will show up on the schematic as little cushions like terminal cushions - you don't anyway have to bind circuit pins onto test directs 60 Toward get signals on and off the PCB you really want either connector parts or interfacing wires.The most effective way to join wires to a model PCB is through terminal cushions which have circuit pins patched - wires can then be fastened to the pins. Add the Cushion TERMINAL part from the EEE library to permit wires for the V+, V-and GND supplies.There will be internal nets all over your circuit that you need to measure during testing. Add test points to these nets (the PADTESTPOINT component).On the schematic, testpoints will appear as small pads similar to terminal pads; however, you are not required to solder circuit pins to test points.For the Third International Conference on Modern Management, Education Technology, and Social Science (MMETSS 2018), the authors created ARES, a high-level PCB wiring editing software. The publishing house is Atlantis Press. This is an open access article under the CC BY-NC grant (http://creativecommons.org/licenses/by-nc/4.0/).

Progresses in Sociology, Training and Humanities Exploration, volume 215 512 [3]. After confirming that the device is packaged correctly, the ISIS-designed schematic diagram can export the network table automatically. 2D tools can be utilized for PCB format and wiring to plan the PCB outline in the board edge side layer, set the wiring procedure, pick a counterfeit or programmed gadget design for wiring, and perform DRC.

Proteus comprises two principal applications: ISIS and ARES from Proteus. The software for circuit design and simulation is Proteus ISIS, while the software for PCB layout is Proteus ARES. Proteus ISIS permits you to plan electronic circuits by putting parts on a virtual breadboard and wiring them together utilizing virtual wires. You can see how your circuit behaves under various conditions by simulating it in real time. You can use a library of components that have already been designed to build your circuits in Proteus ISIS, or you can make your own custom components.

You can move your circuit design from the virtual breadboard to a real PCB with Proteus ARES. The components can be placed on the PCB, the connections between

them can be routed, and the manufacturing files for making the actual board can be generated.

Proteus includes virtual instruments that enable you to measure and monitor the behavior of your circuit in real-time, as well as a variety of debugging tools that assist you in identifying and fixing problems in your circuit, in addition to circuit design and simulation.

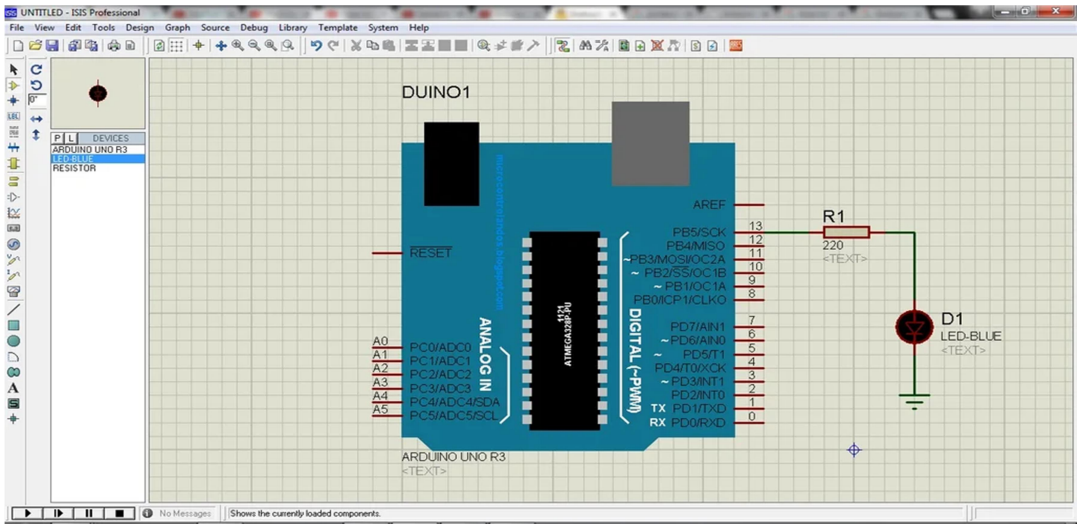


Fig 33:- Proteus Software

CHAPTER 6
CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

With the help of a light source on the transmitter side, we were able to move the voice and text that were recorded at a temperature to the receiver side. The text is displayed precisely, the temperature is accurately detected, and the speaker makes an appropriate sound. This innovation has a tremendously impressive future. In this section, we demonstrate how visible light can be incorporated into a communication system. This system can be used with the infrastructure that is already in place without requiring significant modifications. Visible Communication is a rapidly developing technology in the field of wireless communications because there are a lot of challenges in this field, but there are also benefits that are equal or greater.

Many of the problems we've dealt with for a long time, like power and natural resources, might be solved by using VLC. Despite the fact that the VLC is still in its infancy, the rapid advancements that are being made to this technology stage by stage will soon see it utilized in our everyday lives.One of the most promising and well-known wireless communication technologies is, in our opinion, the VLC system for future generations, despite the research's flaws. Li-Fi is more secure than Wi-Fi because of its shorter range, but Embedded light beams reflected off a surface can still achieve 70 megabits per second, according to reports.Despite having a secure connection, LiFi is constrained and cannot penetrate walls, unlike Wi-Fi. Unsecure radio frequency communication and radio frequency-based wireless communication, both of which can be impacted by electromagnetic field (EMF) interference and pose health risks, were the focus of this project.In this project, an Arduino and Li-Fi Technology-based wireless data transmitter and receiver device was successfully designed and implemented.
Every light bulb can serve as a Wi-Fi hotspot for wireless data transmission if this technology is implemented, and our future will be cleaner, greener, safer, and brighter.

Li-Fi is currently receiving a lot of attention due to the possibility of providing a genuine and highly effective alternative to radio-based wireless. The airwaves are becoming increasingly congested as a result of the increasing number of individuals and devices. using wireless internet, making it increasingly challenging to obtain a fast, dependable signal. This could help with problems like a lack of radio-frequency bandwidth and make the internet possible in places like airplanes and hospitals where traditional radio-based wireless is prohibited. In this paper, a continuous sound transmission model is made with commercial LEDs; It is anticipated that commercial LED lamps will make it possible to transmit information over longer distances. High-quality audio can be transmitted over a one-millimeter distance with the addition of Focusing lens between transmitter and receiver, International Journal of Pure and Applied Mathematics, Special Issue 184.

Transmission errors can be reduced by employing encoding and decoding in the prototype's transmitter and receiver components. By rapidly switching multiple LEDs, the data transmission rate could also be improved. The tests were carried out inside with natural light. LED arrays can provide a greater area of transmission coverage.High data transfer rates, which can reach speeds of up to several gigabits per second, are one of LiFi's main advantages. This is because visible light can carry more data per second than radio waves, which are used in traditional wireless communication technologies.Due to the fact that the data is contained within the physical space of the light and cannot be intercepted by unauthorized devices, LiFi also offers a higher level of security than conventional wireless communication technologies. This makes it ideal for use in conditions where security is a worry, like medical clinics, army bases, and monetary organizations.LiFi has some drawbacks despite its numerous benefits. For instance, it may not be suitable for outdoor communication because it requires a clear line of sight between the transmitter and receiver. It likewise requires specific equipment, like Drove lights with LiFi abilities and photodetectors, which might build the expense of execution.

Overall, LiFi has the potential to change how we send and receive data as well as wireless communication. It is a promising technology for the future because ongoing

research and development are anticipated to result in further improvements in performance, cost-effectiveness, and usability.

6.2 FUTURE SCOPE

Li-Fi is a brand-new technology with a lot of promise. There is a lot of room for research in this area. In this area, a lot of scientists are already doing a lot of research. Li-Fi's future lies in Gi-Fi. Wireless communication that transmits data in excess of one billion bits per second (gigabit) is referred to as "gigabit wireless" or "Gi-Fi." By using Li-Fi, parallelism can save energy. In the not-too-distant future, we might be able to put in place an LED array next to a motorway. This array would help light the road, show the most recent traffic updates, and wirelessly send information from the internet to passengers' laptops, notebooks, and smart phones.In addition, it will permit internet access in areas where internet access is typically prohibited, such as aircraft and operating theaters. Gi-Fi will ultimately be Li-Fi's fate. Wireless communication that transmits data at a rate of more than one billion bits per second (gigabit) is referred to as "gigabit wireless" or "Gi-Fi."

A single integrated circuit (chip)-integrated 60 GHz CMOS transceiver was demonstrated in 2008 by University of Melbourne researchers.Audio and video data can be transferred wirelessly at speeds ofat a cost that is one tenth of that, up to 5 gigabits per second, which is ten times the maximum wireless transfer rate at the moment.The Screen of mobiles, TVs and cylinder lights itself go about as a transmission gadget. On the other hand, mobile phones' cameras can take the place of the photodetector when scanning and retrieving data. LiFi can be used in transparent-screen mobile phones, televisions, desktops, smartcards, and smart guides in the future.

LiFI can also be used in hotels, emergency rooms, exhibition halls, schools, universities, and other locations. LiFi can be used in hospitals, for instance, where electromagnetic rays are extremely harmful. It can likewise be utilized in a hazardous climate like the nuclear energy station and thermal energy station without causing electromagnetic obstruction. LiFi can thus take the place of WiFi.The beginning of a significant shift in wireless technology from RF to optical is signaled by the increasing demand for larger bandwidths, data transmission that is quicker and safer,as well as equipment that is not only environmentally friendly but also clearly human-friendly. Despite the fact that

VLC is still in its infancy, it is a promising technology with numerous applications. VLC is gaining popularity all over the world, and there may soon be a lot of applications in the real world. Lasers, which are significantly more rapid than radio waves, make it possible for this device to transmit data at a rate of approximately 100 gigabits per second (Gbps). High-intensity LEDs or focusing lenses are frequently added to this work in the future to improve communication range. By adding a noise termination circuit to the receiver end, output noise can be reduced.

Using Li-Fi to transfer audio and data in the future will have many different applications. Some possible applications include:

1. Home streaming of audio and video: High-speed, dependable, and secure data transfer is in high demand as smart homes and connected devices grow in popularity. Li-Fi is ideal for applications like in-home media streaming because it can transmit audio and video data from one device to another with very little latency.

2. Remote sound frameworks: Additionally, high-quality audio signals can be wirelessly transmitted with Li-Fi. Wireless audio systems that can transmit high-quality audio with low latency and are immune to interference from other electronic devices may emerge as a result of this.

3. Independent vehicles: Data transfer between autonomous vehicles and other devices, such as traffic lights, road signs, and other vehicles, could be made possible by Li-Fi. Both road safety and efficiency may benefit from this.

4. Applications in medicine: In medical applications where fast and secure data transfer are essential, Li-Fi could be used. For instance, sending clinical information from sensors to clinical experts progressively, empowering quicker conclusion and treatment could be utilized.

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PUBLICATION DETAIL

REVIEW PAPER

Dear Authors,

We Presented and Received Certificate from ICET-2023 (Springer Conference) (International Conference on Inovation in Clean Energy Technologies MANIT Bhopal)

Authors : Apurv Kumar , Mohd Anas , Anshita Yadav , Ranjeeta Yadav

Title : Audio And Data Transfer Through LiFi Technology

ID : ICET 124

http://www.icet2022.org/

RESEARCH PAPER

Dear Authors,

We Submitted research paper in International Conference on Smart Computing and communication (ICSCC Kochi India)-IEEE Conference

Authors : Apurv Kumar , Mohd Anas , Anshita Yadav , Ranjeeta Yadav

Title : Audio And Data Transfer Through LiFi Technology

ID : 135

https://cmt3.research.microsoft.com/ICSCC2023/Submission/Index

APPENDIX

```
Analog Read Signal Code
*/
// the setup routine runs once when you press reset:
void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
}
// the loop routine runs over and over again forever:
void loop() {
  // read the input on analog pin 0:
  int sensorValue = analogRead(A0);
  // print out the value you read:
  Serial.println(sensorValue);
  delay(500);        // delay in between reads for stability
}
SENDING CODE
#define LASERPIN 7
void setup() {
  // put your setup code here, to run once:
  pinMode (LASERPIN, OUTPUT) ;
   char myText[] = " ABES ENGINEERING COLLEGE  ";
 int length = sizeof(myText);
 int ar[50];
 int m;
 int bits[8];
 for (int i =0 ; i<length ; i++ ) {
  ar[i]= int(myText[i]);
 }
  for (int n =0 ; n<length ; n++ ){
```

```
 m=ar[n];
 int z;
 int bin[7];
 int newbin[7];
 for(z=0;z<8;z++){
  bin[z] = m%2;
  m = m /2 ;
 }
 for (int j= 7 ; j>=0 ; j-- ){
  newbin[7-j] = bin[j] ;
 }
  for( int p=0 ; p<8 ; p++ ){
    if (newbin[p] == 1){
     bits[p] = HIGH ;
    }
    if ( newbin[p] == 0){
     bits[p] = LOW ;
    }
 }
 bits[0] = HIGH;

 for (int i = 0; i < 8; i++) {
  digitalWrite(LASERPIN, bits[i]);
  delay(30);
 }
 digitalWrite(LASERPIN, LOW);
 delay(100);
 }
}
void loop() {
```

```
}
```

RECEIVING CODE

```
#define SOLARPIN A0
#define THRESHOLD 400
int ambientReading = 0;
void setup() {
  pinMode(SOLARPIN, INPUT);
  Serial.begin(9600);
}
void loop() {
  int reading = analogRead(SOLARPIN);
  int bits[8];
  //Listening for the start bit
  if (reading > THRESHOLD) {
    for (int i =0; i<8 ; i++) {
      if (analogRead(SOLARPIN) > THRESHOLD) {
        bits[i] = 1 ;
      }
      else {
        bits[i] = 0;
      }
      delay(30);
    }
    int m = 0;
    for (int j =1; j <8; j++) {
    if (bits[j] ==1) {
      m = m + (1<<(7-j));
    }
    }
```

```
    char n=m;
    Serial.print(n);
  }
}
```