Development of Optical Wireless Communication for Indoor Environment

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1. ABSTRACT-

The increasing demand for wireless communication has led to the development of various wireless technologies. One such technology is optical wireless communication (OWC), which uses light to transmit data. This project aims to develop an OWC system for indoor environments, which can provide high-speed, reliable, and secure communication. The system will use visible light communication (VLC) technology, which uses visible light to transmit data. The project will involve the design and development of an OWC system, which will include a transmitter, receiver, and communication protocol. This technology envisions a future where data for laptops, smart phones, and tablets will be transmitted in an economic and eco-friendly medium of light in room.

Keywords- Optical Wireless Communication(OWC), Visible Light Communication(VLC), Indoor Communication Systems, Wireless Data Transmission.

2. INTRODUCTION-

Data transfer is the key to the communication. We have many ways to transmit information from one place to another. OWC is the concept involving high data transfer through the highly available light sources like LEDs. OWC is high speed, bidirectional, and fully networked wireless communication of data using light. OWC constitutes of several light bulbs that form a wireless network.

3. LITERATURE SURVEY –

- **"Indoor Optical Wireless Communication" by S.S.Rao (2022):**

  This review provides an overview of indoor OWC, discussing the key technologies such as VLC & LIFI, challenges, and applications such as Indoor communication, smart homes, and IoT. [1]

- **"Optical Wireless Communication for Indoor Environments" by A.K.Singh (2021):**

  This survey provides a comprehensive overview of OWC for indoor environments, discussing the key technologies such as VLC & LIFI, challenges of Interference, multipath fading, and mobility, and applications such as Indoor communication, smart homes.[2]

- **"Optical Wireless Communication Systems for Indoor Environments" by Y.Wang (2022):**

  This survey provides an overview of OWC systems for indoor environments, discussing the key technologies, challenges, applications and future directions such as Integration with other technologies, security, and mobility.[3]

- **"Indoor Optical Wireless Communication: Challenges and Opportunities" by M.A.El-Sayed (2023):**

  This survey provides an overview of the challenges and opportunities of indoor OWC, discussing the key technologies, challenges, applications and Future directions such as Research and development, standardization, and commercialization.[4]

- **"Indoor Optical Wireless Communication: Challenges and Opportunities" by A.M.Rahman (2022):**

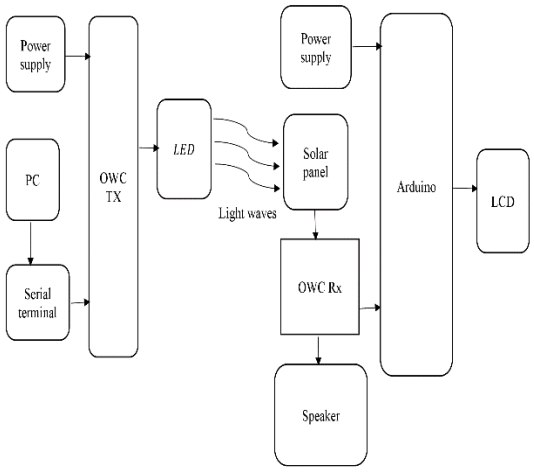
  This survey provides an overview of the challenges and opportunities of indoor OWC, discussing

the key technologies, challenges, and applications.[5]

- **"Optical Wireless Communication for Indoor Environments" by N.Kumar (2022):**

This review provides a comprehensive overview of OWC for indoor environments, discussing the key technologies, challenges, and applications.[6]

BLOCK DIAGRAM



Block diagram of OWC technology

Power Supply: Provides the required voltage for all the components and ensures stable operation of the entire circuit.

Serial Terminal (PC): PC is used as an input device to send data. The serial terminal allows data monitoring, troubleshooting, and debugging and helps in testing the Optical communication process by sending text or audio data to be transmitted.

OWC Transmitter: In this transmitter section we are using diodes, capacitors, resistors, and switches to connect the transfer the data and audio from serial terminal to LED.

LED: LED stands for light emitting diode which is used to convert the electrical energy into light waves to transmit. The LED intensity varies according to the data, which carries the information. This modulated light is sent to the OWC receiver.

OWC Receiver: In this receiver section we are using diodes, capacitors, resistors, and switches to connect the received the data and audio from solar panel.

Solar panel: Solar panel is used to convert the light waves into electrical signals. This electrical signals can not be given directly to the Arduino board so, we are using the amplifier.

Amplifier: Solar panels produce a varying voltage and current output depending on the amount of sunlight they receive. The output voltage and current may not be sufficient to power the Arduino board directly. An amplifier can help boost the voltage and current output of the solar panel to a level that's suitable for the Arduino board.

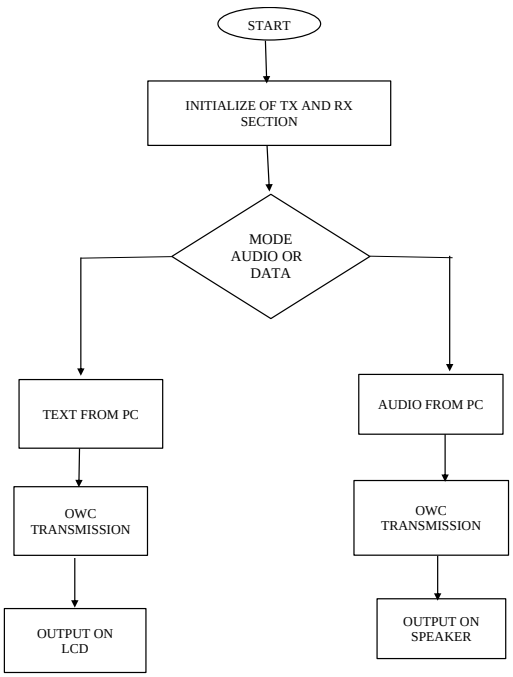
Power Supply: Provides the required voltage (typically 5V to 12V) for the Arduino and other components and ensures stable operation of the entire circuit.

Arduino Uno: Acts as the central controller of the system. Processes the transmitted and received data. Interfaces with the OWC receiver (RX), LCD, PC, and speaker. Controls the flow of information in the system.

Speaker: Used at the receiver end to convert the received audio signal into sound.

LCD Display: Displays received data or system status. Can be used to show text messages, system parameters, or debugging information.

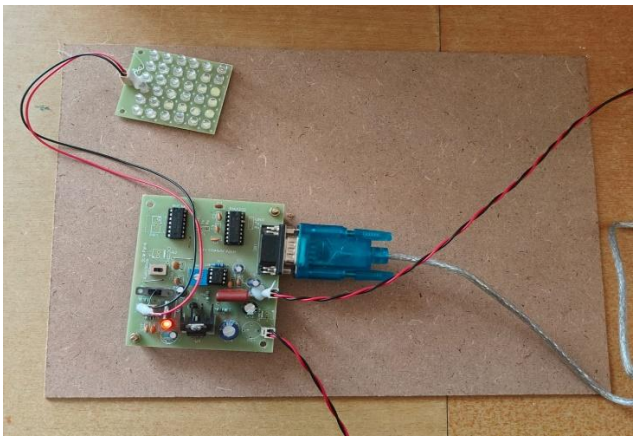
4. FLOW CHART :



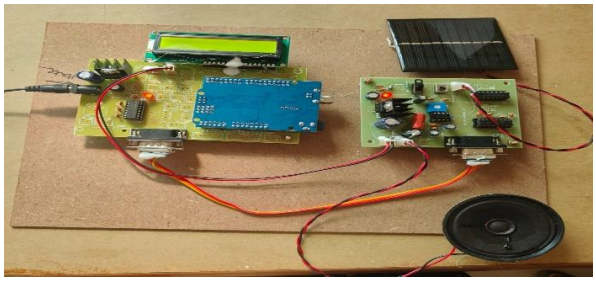
WORKING-Optical Wireless Communication (OWC) is

a simple technology that uses light to transmit data. It consists of an LED transmitter and a photo detector (light sensor) on the receiving end. The LED transmitter encodes data into light by varying is flickering rate, creating different combinations of 1's and 0's. The photo decoder receives the light signal and decodes the information.[7]

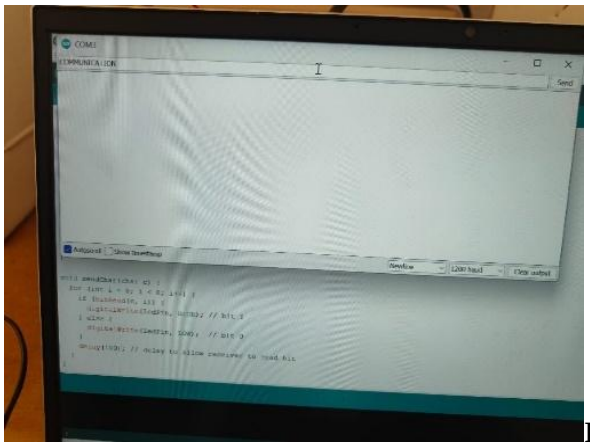
6.RESULT-



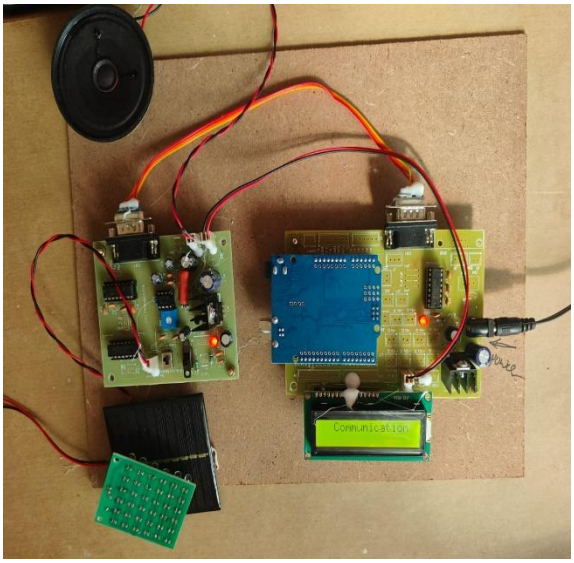
Transmitter section



Receiver Section



Data Input



Data Output

The result of OWC systems is the provision of reliable and secure communication links. The confined nature of OWC signals within the physical space is anticipated to minimize the risk of eavesdropping and interference, ensuring the secure transmission of sensitive information. This makes OWC systems an attractive solution for applications requiring high security, such as financial, military communications, and confidential data exchange.

7. CONCLUSION-

We have been able to transfer the audio signal to the receiver side through the help of laser light source which is present on the transmitter side. A proper audible sound is heard on the speaker. We have successfully transmitted the text signal with Arduino Software and the output is displayed exactly. The future scope of this technology is very bright. The solution of the problem dealing with the integration of visible light with a communication system is demonstrated here. This system can be used with the present infrastructure, without undergoing major changes. Visible Light Communication is a rapidly growing technology in the field of wireless communications. As there are many challenges in this fields but there are equal or more advantages with it as well.

8. FUTURE SCOPE-

OWC is a fast and cheap wireless-communication system. The increasing demand for higher bandwidths, faster and more secure data transmission as well as environmental and undoubtedly human friendly technology heralds the start of a major shift in wireless technology, a shift from RF to optical wireless technologies. The possibilities are numerous and research can provide us with many solutions. This technology can be used to make every LED bulb into a OWC hotspot to transmit data wirelessly and will proceed to give us a safer, faster and a greener network.[8]

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