IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Wireless Data Transfer Using Li-Fi Technology Using Arduino Uno And GSM Module

Smt. K. Rojamani, Assistant Professor, Krishna University, Machilipatnam
M. Meghana, R. Dhanarjana, G. Syam Kumar, J. Vyshnavi
Students of UG, Krishna University, Machilipatnam

Abstract:

The project proposes a novel method of data communication using Li-Fi technology. The proposed systemutilizes the Android mobile phone's flashlight to transmit data in Morse code, which is then received by an Arduino Uno board usingan LDR sensor. The received data is then displayed on an LCD screen, and also sent as an SMS notification using a GSM module. The proposed system offers an alternative to traditional communication methods that rely on radio waves, such as Wi-Fi and Bluetooth. The system is cost-effective, secure, and offers a high-speed data transmission rate. The Arduino Unoboard uses an LDR sensor to receive the modulated light signal and decode the Morse code. The received data is then displayed on an LCD screen, which can be used to display messages or other relevant information. Additionally, the systemcan also send an SMS notification using a GSM module, which canbe useful for sending alerts or notifications to the user.

Key Words: Li-Fi, Wi- Fi, VLC (Visible light communication), LED (Light emitting diode), Arduino uno, GSM Module

Introduction

In today's world, communication has become an essential part of our daily lives. With the advancement of technology, various communication methods have been developed, including Wi-Fi, Bluetooth, and cellular networks. However, these methods of communication have their limitations, including cost, security, and speed. Toovercome these limitations, a new technology called Li-Fi has been introduced which uses light to transmit data.

Li-Fi (Light Fidelity) technology uses visible light to transmit data at high speeds, offering a secure and cost-effective method of communication. The technology uses light-emitting diodes (LEDs) to transmit data, which canbe modulated to encode the data. The modulated light signals are then received by a photo detector, which decodesthe signal and converts it back into data.

In this project, we propose a novel method of data communication using Li-Fi technology. The proposed system utilizes an Android mobile phone's flashlight to transmit data in Morse code, which is then received by an Arduino Uno board using an LDR sensor. The received data is then displayed on an LCD screen.

The proposed system offers a low-cost and secure method of data communication, which can be used for a variety of applications, including home automation, security systems, and data transmission in remote areas. The system can be easily implemented using readily available components and can be customized to meet specific requirements.

The project aims to showcase the capabilities of Li-Fi technology and its potential for use in various applications. The project will also provide an opportunity for students and enthusiasts to explore the technology and develop their own applications using Li-Fi.

Proposed System

The proposed system utilizes Li-Fi technology to transmit data between devices using light. The system consists of an Android mobile phone, an Arduino Uno board, an LDR sensor, an LCD screen, and a GSM module. The data transmission process begins with the Android mobile phone's flashlight, which is used to transmit data in Morse code. The flashlight is modulated to encode the data, which is then transmitted as lightsignals. The modulated light signals are received by the LDR sensor connected to the Arduino Uno board, which decodes the signal and converts it back into data. The received data is then displayed on the LCD screen, providing a visual representation of the transmitted data.

The proposed system's working can be summarized as follows:

Arduino platform; for a comparison with previous version.

Fig. 3.2: Arduino board

The user enters the data to be transmitted on the Android mobile phone.

The mobile phone's flashlight is used to transmit the data in Morse code, which is modulated to encode thedata.

The modulated light signals are received by the LDR sensor connected to the Arduino Uno board, whichdecodes the signal and converts it back into data.

The received data is displayed on the LCD screen connected to the Arduino Uno board.

The proposed system offers a low-cost and secure method of data communication, which can be used for avariety of applications, including home automation, security systems, and data transmission in remote areas.

The system can be easily implemented using readily available components and can be customized to meetspecific requirements.

Block Diagram

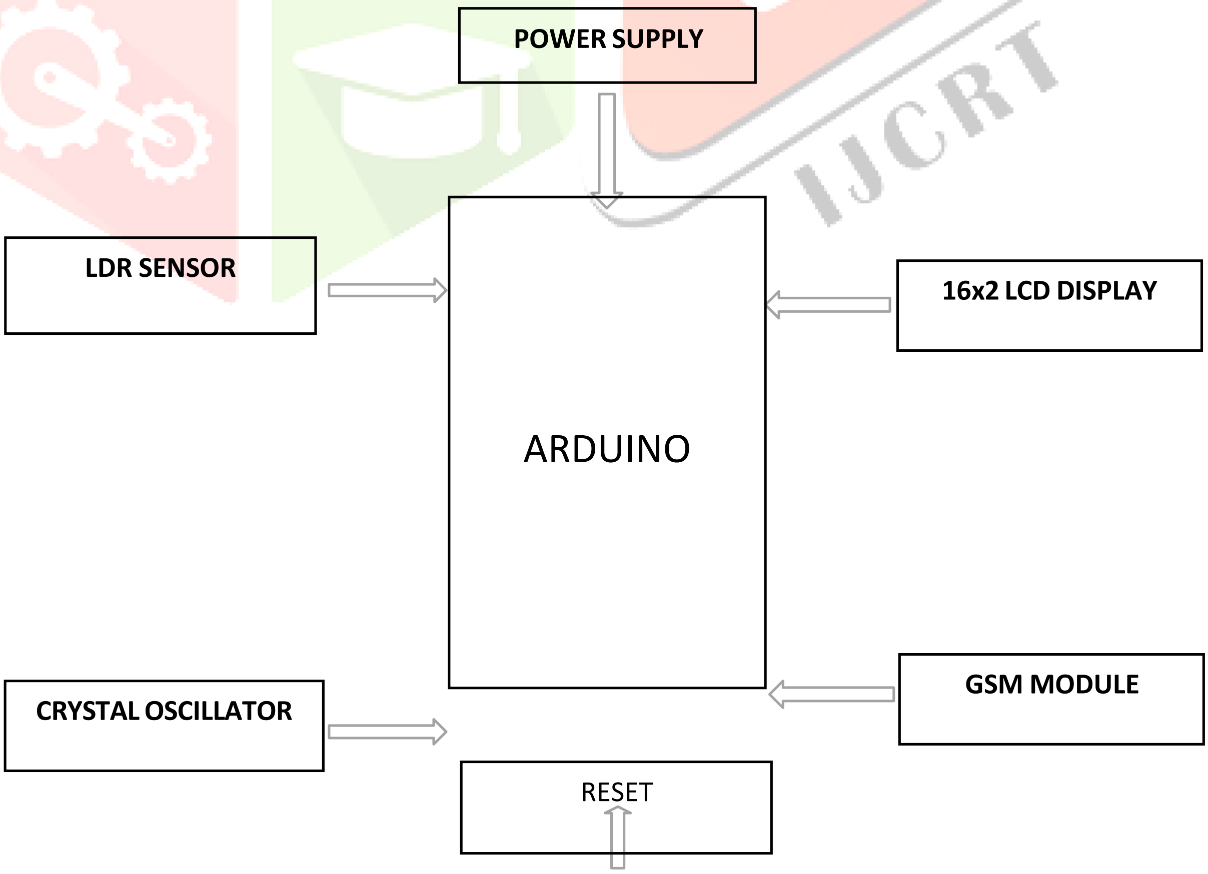


Fig 3.1: Block diagram of proposed system

Working Technology of Li-Fi

The Li-Fi system employs a light source such as an LED (Light-EmittingDiode) bulb. LEDs can be modulated at high speeds, allowing them to transmit data.

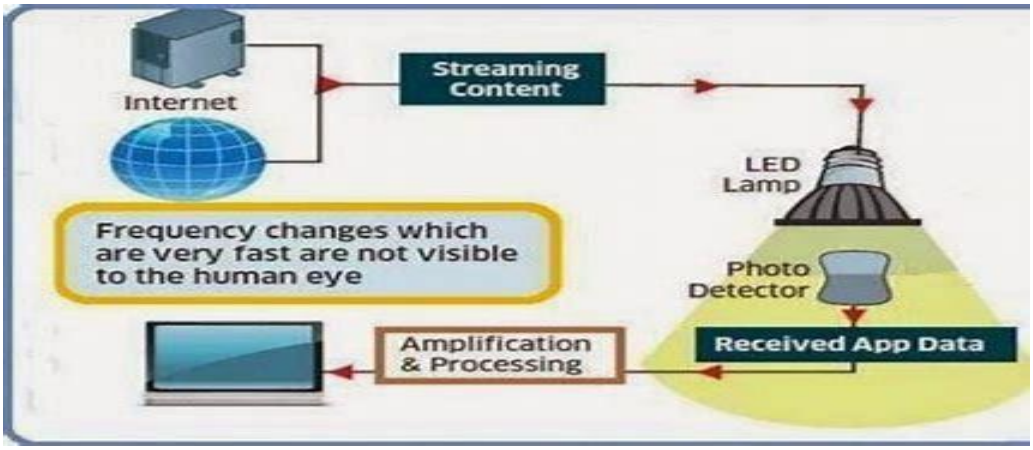


Fig. working of Li-Fi

The data to be transmitted is converted into binary code (0s and 1s), similar to other digital communication systems. This encoding process is typically performed using modulation techniques like intensity modulation or orthogonal frequency-division multiplexing (OFDM).

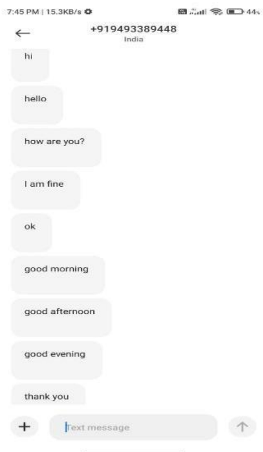
The encoded data is sent to the LED bulb, which acts as a transmitter. The intensity of the light emitted by the LED is adjusted rapidly to represent the binary data. When the LED is on, it represents a "1," and when it is off, it represents a "0."

On the receiving end, a photodetector is used to capture the changes in light intensity. This device could be a specialized photodiode or a smartphone camera, as most cameras can detect light variations.

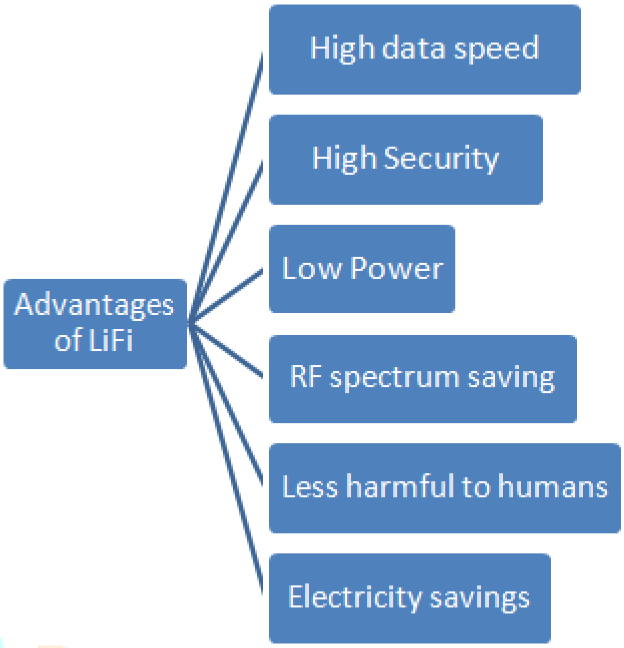
The received light signals are converted back into binary data by the receiver using similar modulation techniques as employed in the transmitter. This process decodes the light signals and retrieves the original information.

Once the data is decoded, it can be processed by the receiving device, such as a computer or smartphone. The Li-Fi receiver communicates with the connected device through a wired or wireless connection to complete the data transfer.

Results:



Benefits or advantages of Li-Fi Technology



Limitations of Li-Fi Technology

Line of Sight and Range: Li-Fi requires a direct line of sight between the transmitter and receiver. Any obstruction, suchas walls, furniture, or human bodies, can block the light signal and disrupt communication. This limitation restricts the range and coverage area of Li-Fi compared to Wi-Fi, which can penetrate through obstacles.

Light Accessibility: Li-Fi relies on the presence of light to transmit data. In environments where there is no or limited natural or artificial light, such as underground areas or enclosed spaces without light sources, Li-Fi may not function or provide reliable connectivity.

Sensitivity to Interference: Li-Fi communication is susceptible to interference from external light sources. Strong ambient light, including sunlight, can disrupt the light signals used for data transmission, leading to a degradation in performance or even complete loss of connectivity.

Mobility and Flexibility: Li-Fi technology is currently more suitable for stationary or slow-moving devices due to the line-of-sight requirement. If a device moves out of the range or loses direct visibility of the light source, the connection islost. This makes it less suitable for applications involving high mobility, such as smartphones or fast-moving vehicles.

Scalability and Infrastructure: Implementing Li-Fi requires the installation of LED bulbs or compatible light fixtures with modulation capabilities. Retrofitting existing infrastructure or deploying Li-Fi on a large scale may require significant investments and changes in lighting infrastructure.

Cost: Currently, the cost of Li-Fi technology, including the specialized LED bulbs and receivers, can be higher compared to traditional Wi-Fi equipment. As the technology matures and adoption increases, the cost may reduce, but initially, it could pose a barrier to widespread implementation.

Standardization: Li-Fi technology is still in its early stages, and there is a need for standardized protocols and specifications to ensure compatibility and interoperability between different Li-Fi devices and systems. Lack ofstandardization may hinder its adoption and widespread use.

Applications of Li-Fi Technology

High-Speed Internet Access: Li-Fi can provide extremely high-speed internet access, enabling faster downloads, streaming, and data transfer. It could be used in homes, offices, and public spaces where high bandwidth is required.

Indoor Positioning and Navigation: Li-Fi can be used for indoor positioning and navigation systems. By utilizing the visible light signals emitted by LED bulbs, Li-Fi can help determine the exact location of devices within a building, enabling precise indoor navigation and location-based services.

Secure Communications: Li-Fi offers enhanced security compared to traditional Wi-Fi, as light signals do not penetrate through walls and are less prone to interception. This makes Li-Fi suitable for applications that require secure data transmission, such as military operations, banking, and healthcare.

Underwater Communication: Unlike radio waves, light waves can travel through water without significant degradation.Li-Fi has the potential to enable high-speed communication underwater, facilitating applications like underwater exploration, oceanic research, and underwater robotics.

Automotive Applications: Li-Fi can be used in intelligent transportation systems and vehicles. It can provide high-speed connectivity between vehicles, enabling data exchange for real-time traffic updates, vehicle-to-vehicle communication, and vehicle-to-infrastructure communication.

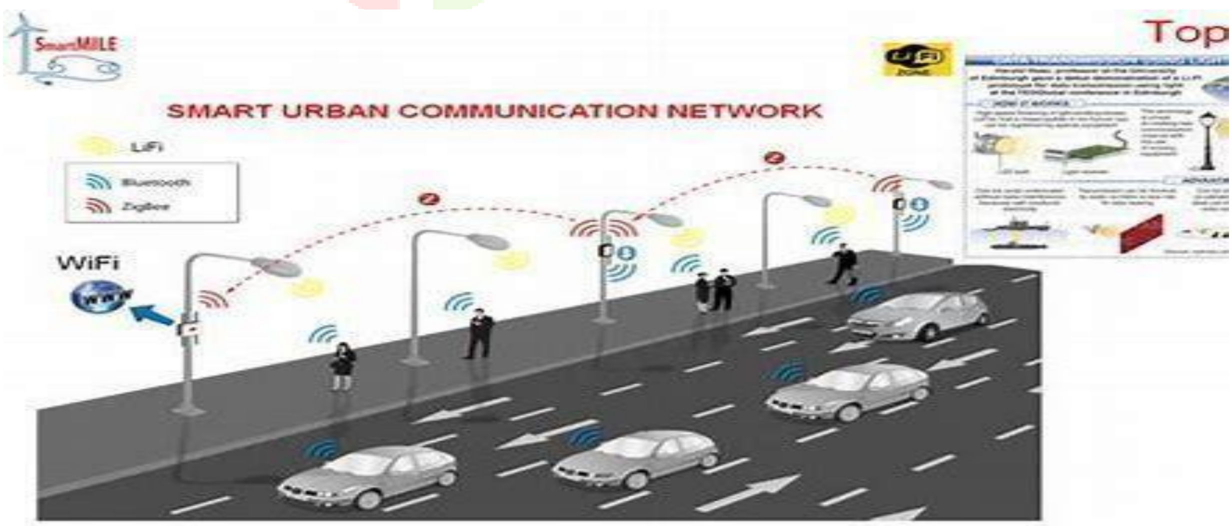
Healthcare and Medical Environments: Li-Fi can be deployed in hospitals and medical facilities to provide secure and interference-free communication. It can support data transfer for medical devices, enable telemedicine applications, and maintain a sterile environment where radio waves could interfere with sensitive medical equipment.

Internet of Things (IoT): Li-Fi can play a role in IoT networks, where numerous devices need to communicate with each other. Its high bandwidth and low interference characteristics can support the connectivity requirements of IoT devices, facilitating smart homes, smart cities, and industrial IoT applications.

Energy-Efficient Lighting Systems: Since LED bulbs are used as the light source in Li-Fi, they can serve a dual purpose by providing both illumination and data transmission. This can lead to energy-efficient lighting systems that also offer wireless communication capabilities.

Future Scope

As light is everywhere and free to use, there is a great scope for the use and evolution of LiFi technology. If this technology becomes mature, each Li-Fi bulb can be used to transmit wireless data. As the Li-Fi technology becomes popular, it will Lead to a cleaner, greener, safe communications and have a bright future and environment.



r

The concept of Li-Fi is deriving many people as it is free (require no license) and faster means of data transfer. If it evolves faster, people will use this At Present, LBS (location Based Service) or Broadcast are commercially available. The next step could be a Li-Fi WLANfor B2B market with high added value on specific business cases and could grow towards mass market. In the long term, the Li-Fi could become an alternative solution to radio for wireless high data rate room connectivity and new adapted service, such as augmented or virtual reality

Conclusion:

In conclusion, the proposed system utilizes Li-Fi technology to transmit data between devices using light, offering a low-cost and secure method of communication. The system consists of an Android mobile phone, an Arduino Uno board, an LDR sensor, an LCD screen, GSM Module. The system's working involves transmitting data in Morse code using the mobile phone's flashlight, which is modulated to encode the data. The modulated light signals are received by the LDR sensor connected to the Arduino Uno board, which decodes the signal and converts it back into data. The received data is then displayed on the LCD screen and sent as an SMS notification using the GSM module.

References:

1. Haas, H. (2018). Li-Fi is a paradigm-shifting 5G technology. Reviews in Physics, 3, 26-31.
2. Ramadhani, E., & Mahardika, G. P. (2018, March). The technology of Li-Fi: A brief introduction. In IOPconference series: materials science and engineering (Vol. 325, No. 1, p. 012013). IOP Publishing.
3. Wu, X., Soltani, M. D., Zhou, L., Safari, M., & Haas, H. (2021). Hybrid Li-Fi and WiFi networks: A survey.IEEE Communications Surveys & Tutorials, 23(2), 1398-1420.
4. http://www.academia.edu/6996573/CSE_Study_Paper_on_._LiFi_Technology_The_latest_technology_in_wireless
5. http://www.ijsrp.org/research-paper-0416/ijsrp-p5275.pdf 14
6. http://www.academia.edu/6770592/Light_Fidelity_LI-FI_-A_Comprehensive_Study_ 15.
7. http://www.ijser.org/researchpaper/A-Study-on-LiFi-Light-Fidelity-Technology.pdf
8. http://www.internationaljournalssrg.