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Secure Li-Fi Enabled Communication and Tactical Networks

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ABSTRACT

Light Fidelity (Li-Fi) is a Visible Light Communication (VLC) based technology that makes light as a media of communication replacing cable wire communication. Li-Fi is Evolve to overcome the rated speed in Wi-Fi. In tactical environments, it is used for effective communication and for Sharing Confidential Information. Li-Fi technology offers unique advantages in these scenarios, enabling fast and secure information exchange among persons, vehicles, and command centers. Li-Fi's low latency and high bandwidth capabilities facilitate real-time data transmission, which improves situational awareness and supports swift decision-making processes.

Key Words: Internet of Things, Photo Diode, Wi-Fi, LI-FI, VLC,Audio,LED.

1. INTRODUCTION

In an increasingly connected world where data security is paramount, the emergence of Li-Fi technology has opened up new avenues for secure and high-speed communication. Li-Fi, or light fidelity, leverages visible light communication (VLC) to transmit data, offering several advantages over traditional wireless technologies.

This revolutionary technology utilizes LED lights to transmit data, providing faster data transfer rates, reduced interference, and enhanced security. This project delves into the realm of secure Li-Fi-enabled communication, exploring its potential applications across various industries such as healthcare, finance, and defense. By harnessing the power of light to transmit data, we aim to not only enhance the speed and reliability of communication but also fortify the security measures in place. This research will investigate the encryption protocols, authentication methods, and hardware requirements necessary to establish a robust and secure Li-Fi communication system. As we delve into the intricacies of Li-Fi technology, we endeavor to pave the way for a safer and more efficient future in data transmission and communication.

2. LITERATURE REVIEW

Li-Fi technology emerged as a revolutionary advancement in wireless communication, offering connectivity within network environments. Coined from "light-fidelity," it was pioneered by German physicist Herald Haas. Li-Fi operates on the principle of transmitting data through LED light bulbs at intensities imperceptible to the human eye, akin to infrared remote controls but with heightened efficacy. Haas's invention, D-LIGHT, achieves data rates exceeding 10 megabits per second, resulting in significantly faster broadband connections on average. The versatility of LEDs enables their application not only in illumination but also in data transmission, expanding their utility across various domains. By leveraging visible light as a medium for data transmission and networking, Li-Fi presents a promising solution to overcome the limitations of traditional Wi-Fi technology.

3. PROPOSED SYSTEM

Our proposed system for text transfer through Li-Fi (Light Fidelity) involves using LED light bulbs to transmit data encoded in light pulses. In this system, text data would be converted into binary code and modulated onto the intensity of the light emitted by the LED bulbs.

The goal of our project is to develop a simple wireless communication through visible LED light. our project Li-Fi utilizes light-emitting diodes (LEDs) to transmit data by modulating light intensity at high speeds. This technology offers several advantages, including higher data rates, increased security(as light cannot penetrate through walls)and reduced electromagnetic interference. we have used NodeMCU, which is based on the ESP8266 microcontroller and is programmed to modulate and transmit data through an LED for text transmission. By encoding text data into light intensity variations and transmitting it using an LED connected to NodeMCU, text transmission via Li-Fi is achieved.Our

project Li-Fi has the potential to revolutionize communication systems by enabling high-speed audio and text transmission through light, enhancing connectivity in various environments such as homes, offices, and public spaces.

4. COMPONENTS NEEDED FOR IMPLEMENTATION

4.1 LED Bulbs:

Light-emitting diode (LED) bulbs serve as the primary transmitters in LiFi systems. These bulbs emit light that carries the data signal encoded in its intensity variations.

4.2 Photodetectors:

Photodetectors or photoreceivers are used to receive the modulated light signals and convert them back into electrical signals for decoding.

4.3 Modulation/Demodulation Circuitry:

Modulation and demodulation circuitry are required to encode data onto the light signal (modulation) and extract the data from the received light signal (demodulation).

4.5 Signal Processing Unit:

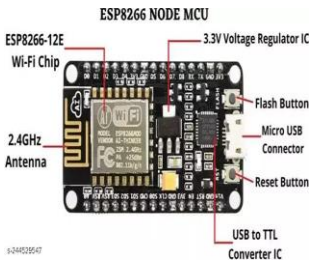
A signal processing unit is responsible for processing and decoding the electrical signals received from the photodetectors, extracting the transmitted data, and converting it into usable audio or text format.

4.6 Audio/Text Output Device:

Once the data is decoded, it can be outputted in the form of audio (speakers) or text (display screens) to be perceived by users.

4.7 Power supply:

A power supply is an apparatus that delivers electric power to an electrical load. Batteries serve as a common source of power to operate various devices.



4.8 NodeMCU:

Which is based on the ESP8266 microcontroller is programmed to modulate and transmit data through an LED. By encoding text data into light intensity variations and transmitting it using an LED connected to NodeMCU, text transmission via Li-Fi is achieved.

These components work together to enable the transmission of text and audio data using LiFi technology works 10 times faster than wifi.

5. RESULT

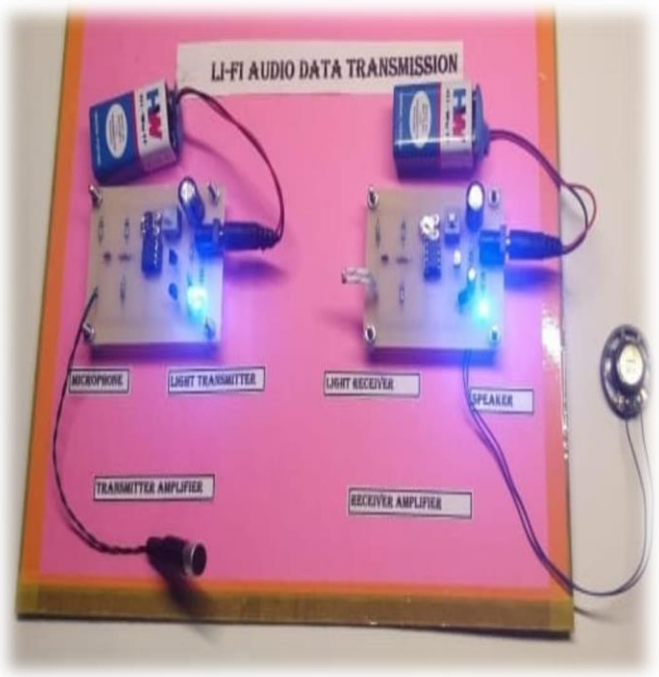


Figure-1. Audio Transmission using LI-FI

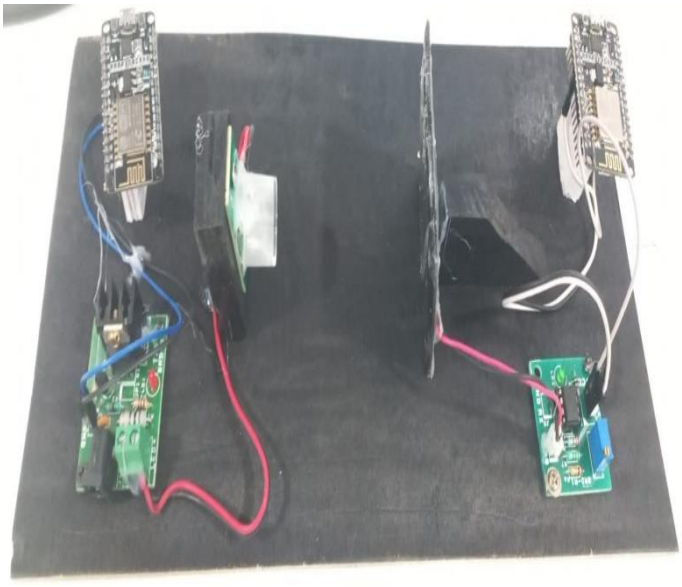


Figure-2. Text Transmission using LI-FI

6. CONCLUSION

Our project Li-Fi text and audio transmission using Node MCU represents a promising frontier in wireless communication, offering fast, secure, and versatile connectivity solutions for the future.

Li-Fi technology utilizes visible light for data transmission, providing a secure and high-speed alternative to traditional radio frequency-based systems.

ESP8266 microcontroller offers a versatile platform for implementing Li-Fi text transmission applications, it requires less cost, ease of programming, and built-in Wi-Fi capabilities. Li-Fi holds promise as a high-speed, secure wireless communication technology with applications in various industries

7. BENEFITS OF LI-FI

7.1 Efficiency:

Energy consumption can be minimized with the use of LED illumination which is already available in homes, offices, malls etc. for lighting purpose. Therefore, data transmission consumes minimal additional power, rendering it highly efficient both in terms of cost and energy utilization.

7.2 High speed:

A combination of low interference, high bandwidths, and high-intensity output, helps Li-Fi provide high data rates of 1Gbps or even beyond.

7.3 Availability:

The ubiquity of light sources ensures that availability is not an issue for Li-Fi technology. Internet access can be enabled wherever there is a light source present. Light bulbs, commonly found in homes, offices, shops, malls, and even aircraft, can serve as conduits for data transmission.

7.4 Affordability:

Li-Fi technology offers cost advantages as it requires fewer components for operation and consumes minimal additional power for data transmission.

7.5 Security:

A key benefit of Li-Fi is its heightened security. Because light cannot penetrate opaque structures, Li-Fi internet access is restricted to users within a defined area. This characteristic prevents unauthorized interception and misuse of data outside the designated operational zone, ensuring robust security for Li-Fi networks.

8. FUTURE WORK

8.1 Video Transmission:

Through specialized software installed on the receiving PC, video data is routed to the Li-Fi module for transmission via light to the photodetector. The receiving PC then processes this data, resulting in the transmission of high-quality video content via Li-Fi technology. Future developments in Li-Fi are anticipated to prioritize enhancements in data transfer speeds, reliability, and network coverage

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8.2 Image Transmission:

The binary data representing the image is modulated onto the intensity of the light emitted by an LED. Different modulation techniques, such as on-off keying (OOK) or pulse amplitude modulation (PAM), can be used for this purpose. Finally, the decoded image is displayed on a screen or monitor for viewing by the user.

To achieve these image and video transmissions we need to use 2 Arduinos One is on the transmitter side and the other is on the receiver side.

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REFERENCES

1. R. GowriShankaran, Dr. J. Selvakumar, “Visible Light Communication Using Li-Fi”, International Journal for Research in Applied Science & Engineering Technology, Volume No 6, Issue VI, (2018),2321-9653.
2. A.Vinnarasi, S.T.Aarthy, “Transmission of Data, Audio Signal and Text Using Li-Fi”, International Journal of Pure and Applied Mathematics, Volume 117 No.17, Special Issue, (2017),179-186.
3. Anwesha Chakraborty, Trina Dutta, Sushmita, Mondal, Dr. AsokeNath,” Latest Advancement in Light Fidelity (Li-Fi) Technology” International Journal of Advance Research in Computer Science and

Management Studies Volume No 5, Issue11, (2017),47-53 .

4. Pavas Goswami, Manoj Shukla, "Design of Li-Fi Transceiver", Wireless Engineering and Technology Volume No 3, Issue 8, (2017),71-86 .
5. Remya Ramesh, Sariga Raj, "Li-Fi in Defense And Security", International Journal of Current Engineering and Scientific Research Volume No 4, Issue 10, (2017), 25-31.
6. Hikmatyarsyah, Sasono Rahardjo and Juliati Junde, "Light Fidelity (Li-Fi): Security and Market Sector", Proceeding 7th International Conference on Photonics, Optics and Laser Technology Volume No 2, Issue 7, (2019),154-162.
7. Alif Asyraaf, Hafiz Helmi, Muhammed Akram, Alya Sahira, Zubir, "Li-Fi Security Issue and Challenges" Volume No 9, Issue 2,(2019),1-10 .