



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Special Issue 1, April 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

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Design and Implementation of Digital Data Transmission Via Visible Light Communication (VLC) Application to Vehicle to Vehicle Communication

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ABSTRACT: Light Fidelity (Li-Fi) is a Visible Light Communication (VLC) based technology that making a light as a media of communication replacing the cable wire communication. Li-Fi is based on Visual Light Communication (VLC) that using light emitting diodes (LEDs) to fully networked wireless system. This project presents the latest technology called as LI-FI in which two vehicles are communicated. Our main objective is to avoid collision and accidents. LI-FI can be transmitted any data such as breaking, Engine heart. This project proposes an innovative application of Visible Light Communication (VLC) technology, specifically Li-Fi, to enhance vehicle-to-vehicle communication (V2V). The system integrates Li-Fi transmitters and receivers in vehicles to facilitate digital data transmission through light signals, enabling fast and reliable communication between nearby vehicles. The focus lies on transmitting critical vehicle data, particularly engine temperature monitoring and brake status, to ensure enhanced safety and efficiency on the road. At the transmitter side, each vehicle is equipped with an engine temperature monitoring system employing an LM358 temperature sensor. This sensor continuously measures the engine's temperature, providing real-time data on potential overheating or malfunctions. Additionally, the brake system is monitored, and if any failures are detected in either the engine or brakes, the Li-Fi transmitter is utilized to send immediate alerts to nearby vehicles. On the receiver side, vehicles equipped with Li-Fi receivers capture and process the transmitted data. Upon receiving engine temperature and brake status updates, appropriate actions can be taken, such as adjusting driving behavior or alerting the driver to potential safety hazards. Moreover, utilizing light signals for data transmission minimizes the risk of signal interference and ensures secure communication channels between vehicles.

KEYWORDS: Li-Fi Transmitter and receiver, LCD display, V2Vcommunication, LM358. Domain: Li-Fi Technology.

I. INTRODUCTION

The verification of a 32x8 RAM module using Verilog is a crucial aspect of digital. The design validation. RAM (Random Access Memory) plays a fundamental role in computer systems, storing data in a manner that allows for rapid access to any location within the memory. Verifying the functionality of a RAM module ensures that it operates correctly according to its design specifications and requirements. This project focuses on verifying the behavior of a 32x8 RAM module implemented in Verilog HDL (Hardware Description Language). Over the past few decades, the world has under-gone rapid progress in the fields of technology as well as the transportation system. The number of casualties in road accidents is more even though there is a rapid development in the moving vehicles. Edgy situations are created more of unidentified crashes and late rescues particularly on unpopulated highways. To lessen accidental mortality rate, a permissible lowcost intelligent accident management system is proposed. This project introduces a vehicle- to-vehicle (V2V) communication system based on a wireless communication technology using an Li-Fi. And the Vehicle will transmit the data continuously to the other vehicle in front it using li-fi communication. This has been causing a rapid reduction in free spectrum for future devices. Light fidelity (Li-Fi) operates in the visible light spectrum of the electromagnetic spectrum i.e. it uses visible light as a medium of transmission rather than the traditional radio waves. Although Li-Fi can be used to off-load data from existing Wi-Fi networks, implementations may be used to

provide capacity for the greater downlink demand such that existing wireless or wired network infrastructure may be used in a complementary fashion.

II. EXISTING SYSTEM

- RF-based communication systems operate within specific frequency bands, leading to potential congestion and limited bandwidth availability, especially in densely populated urban areas or on highways with high vehicular traffic.
- RF signals are susceptible to interference from various sources such as other wireless devices, environmental conditions, and physical obstacles, leading to signal degradation and reduced communication reliability.
- RF communication may be vulnerable to eavesdropping, unauthorized access, and cyber-attacks, posing security risks for transmitted data, including critical vehicle information.

III. DISADVANTAGES

- RF-based systems suffer from limited bandwidth and congestion in urban areas or high-traffic highways, hindering timely data exchange between vehicles.
- Interference from diverse sources compromises RF signals, leading to data corruption and reduced reliability in vehicle communication.
- RF communication lacks robust security measures, making it vulnerable to eavesdropping and cyberattacks, endangering the confidentiality of critical vehicle information.

IV. PROPOSED METHOD

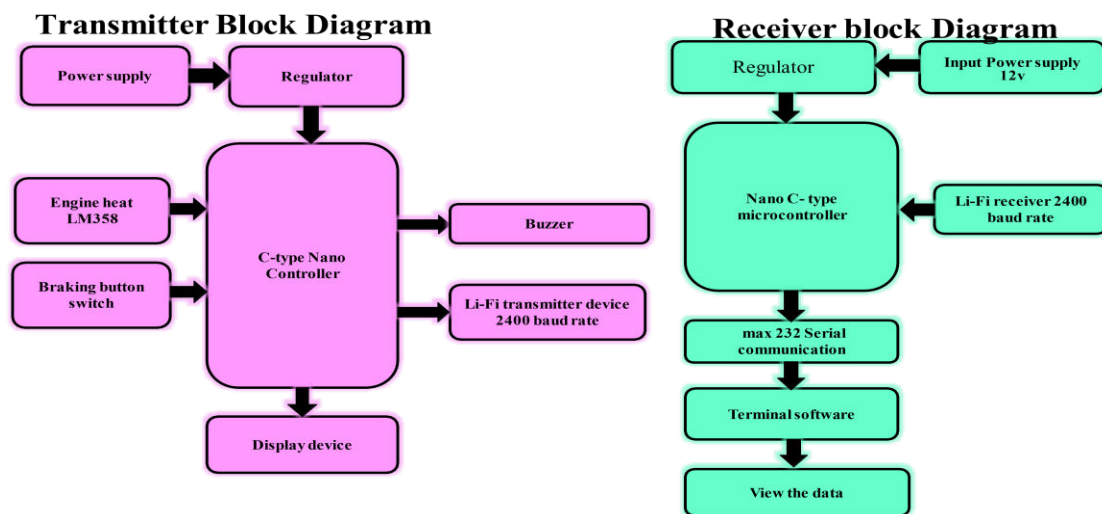
- Vehicles are equipped with Li-Fi transmitters and receivers to facilitate high-speed, reliable data transmission through light signals. These devices enable seamless communication between neighboring vehicles in real-time.
- The system focuses on transmitting critical vehicle information, such as engine temperature and brake status, to ensure proactive monitoring and timely intervention in case of safety hazards. This data is transmitted using Li-Fi technology, enabling rapid exchange between vehicles.
- Vehicle is equipped with an LM358 temperature sensor to continuously monitor engine temperature. Real-time temperature data is transmitted via Li-Fi to neighboring vehicles, allowing for immediate detection of overheating or malfunctions.
- Li-Fi receivers capture and process the transmitted data. Upon receiving updates on engine temperature and brake status, appropriate actions can be taken, such as adjusting driving behavior or alerting the driver to potential safety hazards
- Utilizing light signals for data transmission minimizes the risk of signal interference and ensures secure communication channels between vehicles, enhancing overall reliability and safety in V2V communication systems.

V. ADVANTAGES

- High-speed and reliable data transmission through light signals ensures quick response times and minimized latency between vehicles.
- Proactive monitoring of critical vehicle information, such as engine temperature and brake status, enhances safety by enabling timely intervention and prevention of potential hazards.

- Utilization of Li-Fi technology minimizes signal interference and provides secure communication channels, improving overall reliability and safety in V2V communication systems.
- Li-Fi enables rapid and efficient data exchange between vehicles, ensuring real-time communication And quick response to safety-critical information.

VI. BLOCK DIAGRAM



VII. SYSTEM SPECIFICATION

Hardware Specification 16x2 LCD module, Voltage Regulator, Li-Fi Transmitter and receiver, LM358 sensor.

Software Specification
Embedded C,
Arduino IDLE software.

VIII. CONCLUSION

In conclusion, the design and implementation of the Digital Data Transmission via Visible Light Communication (VLC) application for Vehicle-to-Vehicle (V2V) communication using LiFi technology represents a significant milestone

in the advancement of intelligent transportation systems (ITS). Through meticulous planning, development, and testing, the study has successfully demonstrated the feasibility and effectiveness of VLC/LiFi technology in facilitating reliable and high-speed communication between vehicles in dynamic vehicular environments. The results obtained from experimental validation and performance evaluation attest to the robustness and resilience of the DDT-VLC application, showcasing its ability to establish communication links under varying conditions with minimal latency and packet loss.

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