Vehicle to Vehicle Communication using LI-FI Technology

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ABSTRACT:

Vehicle-to-vehicle communication is a communication method that indirectly relies on network topology. This method is satisfactory and prevents major accidents, making the vehicle safe and secure. The proposed scheme is a car-to-car application and does not require any infrastructure. This project is more powerful because it does not require any infrastructure or network connection. In the realm of smart cities, the implementation of vehicle-to-vehicle (V2V) communication stands out as the most effective strategy for alleviating traffic congestion. Within intelligent transportation systems (ITS), diverse wireless communication techniques facilitate the exchange of information. Given the abundance of vehicles on the roads, occasional accidents ensue. Li-Fi, or Light Fidelity, employs light fidelity technology for swift and dependable transmission and reception of vehicle information, boasting excellent reception capabilities. The utilization of Wi-Fi can pose risks to ecosystems, including flora and fauna, prompting the development of Li-Fi technology. Li-Fi represents a cutting-edge advancement, utilizing components such as Photodiode, Keypad, DC motor, LCD display, Li-Fi transmitters, and receivers. Employing Li-Fi for in-car communication presents a cost-effective means of achieving high data transmission rates and bandwidth performance. This article discusses the automated detection and management of vibration-induced potholes and bumps, with vehicle communication relying on Li-Fi technology. Li-Fi, a wireless technology utilizing light for data transmission, operates a hundred times faster than Wi-Fi. As the leading vehicle decelerates, a message is relayed via Li-Fi, enabling the activation of automatic braking to halt the vehicle on the highway.

1. INTRODUCTION:

As Professor Harald Haas developed in his TED Talk, it is a two-way, high-speed, wireless communication similar to Wi-Fi. Li-Fi is a group of optical wireless communications (OWCs) that

can complement RF communications (Wi-Fi or cellular) or transfer data. Light-emitting diodes (LEDs) are used to power this OWC technology, which allows for high-speed wireless communications that resemble Wi-Fi. Li-Fi can enable the Internet of Things, that is, the connection of all electronic devices to the Internet and the LED lights of electronic devices to work like Li-Fi Internet access [1]. Visible Light Communication (VLC) operates by rapidly switching light on and off within nanoseconds, achieving remarkable speed. This swift modulation remains imperceptible to the human eye [2]. Our daily lives are increasingly influenced by wireless communication. Alternatively, individuals may opt to utilize nearby public facilities for free, contending with numerous others for the limited bandwidth they offer [3]. As these locations gain popularity, obtaining sufficient bandwidth becomes increasingly challenging for users. Moreover, this trend impacts ecosystems, including both flora and fauna. Human communication patterns are deeply intertwined with visual perception. Light serves as the medium for transmitting vast amounts of data at incredible speeds. Within the realm of light-based communication, a wide array of sizes and lengths of light sources are available for selection [4].

There exist around 1.4 million mobile radio wave base stations globally, catering to over 5 billion mobile phones. Mobile devices persist in transmitting more than 600 TB of messages as usual. Currently remote communication uses radio waves. However, the radio cannot be said to be problem-free in terms of performance, accessibility, security and limitations. Many things are required for long distance communication. As innovation progresses and the number of users increases, existing radio waves cannot solve the problem and cause limitations. To solve all the problems, the idea of using LED lights to send messages over long distances came up, called Li-Fi. This is a new innovation that uses LED lights to help send messages quickly [5,6,7]. Again and again very good. Its efficiency and long service life make Li-Fi a great idea. Today powered lamps are often used for personal and empowerment purposes to increase their emitting capacity.

In-vehicle communication isn't tailored for any particular brand or make of vehicle. It's adaptable for use across all vehicle types with minimal adjustments. The system has been designed with the average vehicle user in mind so that it can be used. Speed and security are the main concerns in data transfer. Wi-Fi penetrates walls and is easy for hackers [8]. A LOS is necessary for Li-Fi to be effective as it does not penetrate through walls.

2. Objective:

Create a smart machine that can detect potholes and speed on the road. Use Li-Fi technology to communicate between vehicles to prevent accidents on the road [9,10]. Get adequate information about the car's location using the nearest Android device.

3. Literature Review:

This chapter provides a basic overview of vanet in the cloud. There are also many ways to improve performance and privacy awareness. This type of web development has led to the heavy use of many applications and other service-oriented applications [11]. Processing, alerting and transmitting safety data in human-machine interactive systems. The CASA project (Car Safety App) is a joint project of a French partnership of 5 partners in industry and 1 in education with the aim of creating an application on Android that promotes safe and green driving and ensures the security of data transfer. In this article, we focus on the security and performance of the project. We find that the multimodal data processing of our study is safe and reliable. Security and privacy in sensor networks [12,13]. In this study, we explore the various safety and security challenges faced by sensor networks and then examine strategies that can be used to overcome them. threats. Due to the diversity of threats, we will first present a high-level discussion of countermeasures or solutions and then focus on discussing an example topic. Our Ten Years of Driver Assistance: Review and Overview - This program examines key goals, developments, and future prospects for driver assistance. Mobility is people's desire. Potential improvements to driver assistance systems are discussed. We move away from systems based on electronic devices such as ABS and ESC and examine the progress made in the use of electronic devices such as radar, video and lidar.

Driver Vision Using Smartphones as Sensor Platform Augmentation In order to increase driver's safety awareness and improve driver's safety, we introduce a new system that uses Dynamic Time Rule (DTW) and Smartphone-based sensor fusion. Detect, analyze and record this data. The behavior does not have to be external [13]. Distinguishing itself from prior driving model investigations, our system consolidates data from various sensors pertaining to axes-related information into a unified classification framework. Design management using light communication: A feasibility study. The study delves into the viability of visual light communication (VLC) as a means of information exchange within group settings. A comprehensive VLC model was constructed to assess the bit error rate (BER), influenced by factors such as vehicle proximity, ambient noise, angle of incidence, and receiver bandwidth. Our analytical framework establishes the relevant metrics for evaluation [14,15].

4.EXISTING SYSTEM:

The existing setup necessitates both a transmitter and receiver installed at the front and rear of each vehicle, enabling its versatility across various scenarios. This article focuses on analyzing two scenarios simultaneously. A message originating from the transmitter positioned in the taillight will be directed towards vehicle number 2. Utilizing the RF antenna receiver located at the front of vehicle 2, the message will be received. Subsequently, the LCD screen will be employed to relay a warning regarding vehicle 2's deceleration. This warning, received by the RF antenna receiver on vehicle 2, will be cross-referenced with its current speed. Should vehicle 2 be approaching an intersection while vehicle 1 is traveling at a high velocity, the driver will be alerted to remain vigilant and check for other nearby vehicles.

5.PROPOSED WORK:

The primary aim of the aforementioned project is to seamlessly integrate Li-Fi technology into existing systems. Li-Fi technology is being advocated due to its superior safety compared to Wi-Fi, as it has the ability to penetrate walls [18,19]. With Li-Fi being a burgeoning technology, its adoption is increasingly widespread. The envisaged device could potentially utilize any light source to transmit wireless data akin to a Wi-Fi hotspot. This approach offers a solution to issues such as limited radio frequency bandwidth. Consequently, this innovation boasts numerous advantages. Embracing this technology can propel us towards a future that is greener, safer, and more pristine [20].

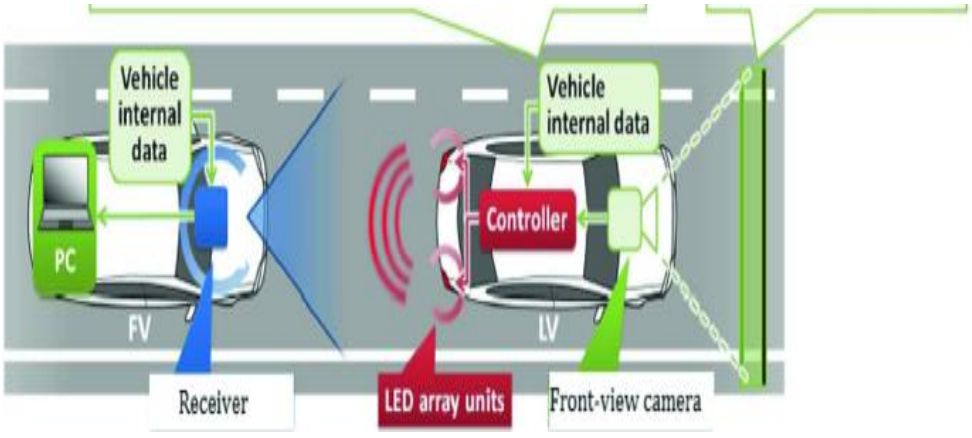
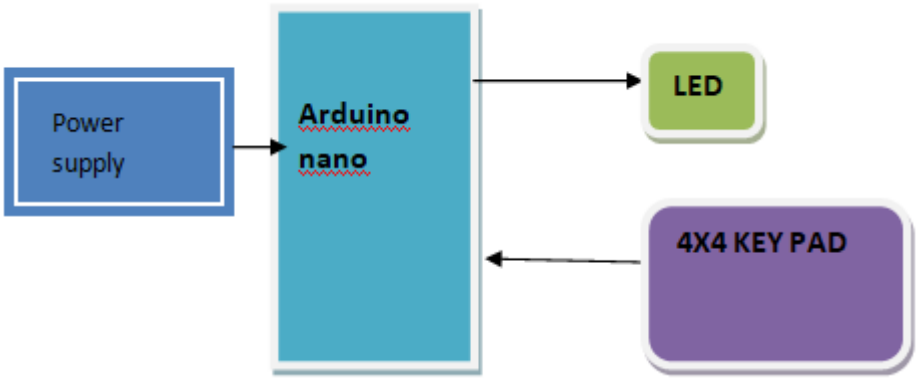


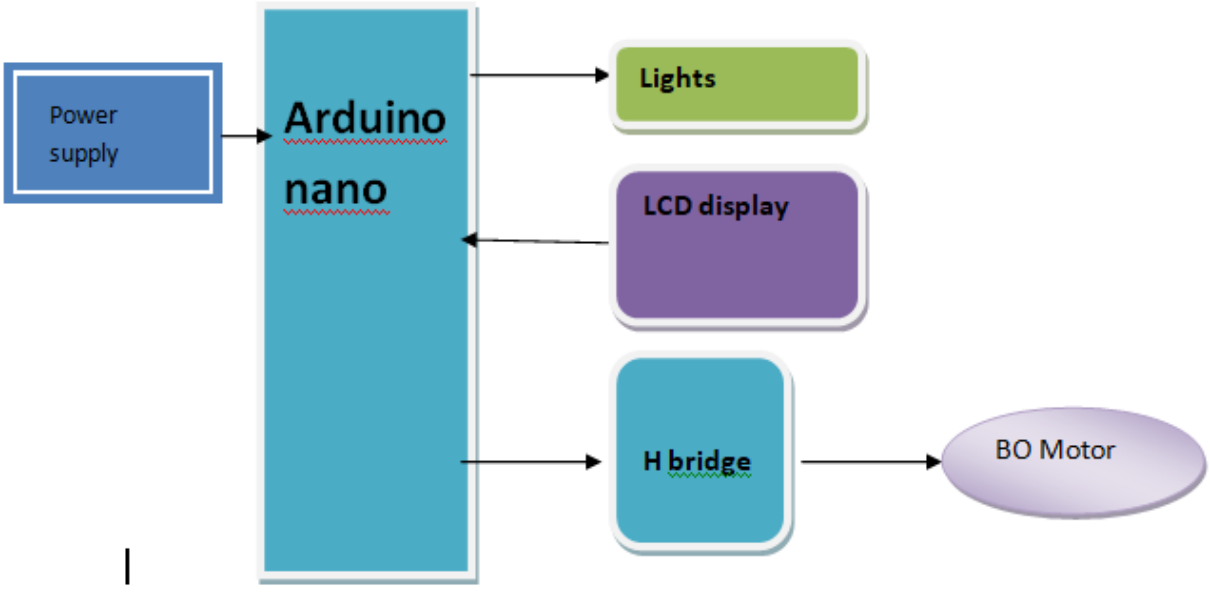
Fig. 1. Vehicle to Vehicle communication using LiFi

6.Block diagram:

Fig.2. Transmitter unit:



Receiver Unit:



7.WORKING OF LI-FI:

Li-Fi utilizes the light emitted by the light source for transmission, requiring the utilization of the Visual Light Communication (VLC) framework for message transmission [21]. Li-Fi communication comprises two main components.

A. Li-Fi Transmitter:

Initially, the Arduino board will be linked to the first transmitter. Subsequently, the Arduino board transmits the data to the transmitter, where it is converted into binary format and prepared for transmission. The data is then transmitted through the LED. When the binary digit is 0 [22,23], the LED remains steady; Conversely, if the binary digit is 1, the LED flashes. The rapid switching of the LEDs renders them imperceptible to the human eye. This method constitutes a means of data transfer utilizing Li-Fi.

B. Li-Fi Receiver:

The LED emits light, which is captured by the photovoltaic cell and subsequently transmitted to the photovoltaic cell receiver. This receiver then translates the binary data into tangible information before relaying it to the Arduino board.

C. Speed and Efficiency:

Li-Fi can provide higher bandwidth compared to radio frequency because it uses the visible wavelength spectrum and does not require a license. With reduced interference, 10 Gbps should be achieved, which is higher than any current RF technology.

D. Availability and Security:

Unlike radio frequency technology, where security concerns are prevalent, Li-Fi technology presents no health hazards as it relies on light for communication. For instance, the American Hospital Association highlights restrictions on Wi-Fi usage in certain hospital zones, such as operating rooms, due to its potential interference with other devices and obstruction of signals from diagnostic equipment.

8. HARDWARE DESCRIPTION:

8.1. Arduino Nano:

Arduino Nano is the classic breadboard-friendly design board for Arduino in its smallest form. Arduino Nano comes with pin headers and Mini-B USB connector for easy connection to the breadboard. Based on the Atmega328, The NANO Version 3 represents an open-source, minimal embedded board featuring an SMD package microcontroller. Designed to be surface-mount and breadboard-friendly, this board conveniently interfaces with a miniUSB port. Since this motherboard does not have a DC power supply, it can be powered via a Mini USB cable [21,22]. He decided and switched to a higher capacity, eliminating the need for the power selector jumper.

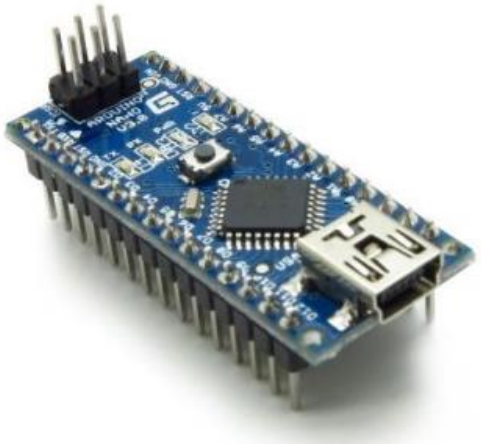


Fig.3. Arduino nano

8.2.LDR Sensor Photoresistor

The LDR Sensor Photoresistor Photocell 50-100K, developed by Senba Sensing Technology, is a passive component known as a photoconductive cell. It functions by diminishing the intensity of light received within the sensitive region of the resistor component. Photoresistors or photoresistors or photocells are made of semiconductor materials and have a difference (uniformity) that varies depending on the intensity of light falling on them [23,24]. Based on these features, LDR sensors with different shapes and illumination areas can be designed. LDR sensors are used in toys, lights, cameras, etc.

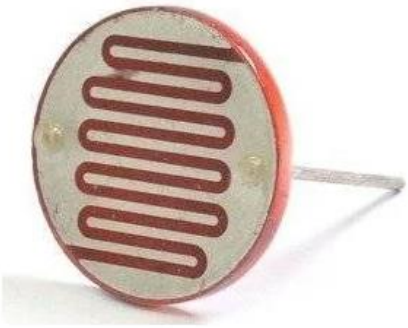


Fig.4. LDR Photoresistor

8.3.4x4 Matrix 16 Keys Keypad:

The Matrix Keyboard Membrane Switch is a durable and eco-friendly soft touch keyboard that has been used 100 million times and is of excellent quality. This DC 12V 4x4 Switch Matrix Membrane Switch Keyboard is a great product with very low price to meet your application needs [25]. This 16-key keyboard provides a convenient human interface for microcontroller functions. A simple adhesive back provides an easy way to attach the keyboard to a variety of applications. Keypad 4x4 has a total of 16 keys in matrix format. This is a non-moving membrane keyboard. An 8-pin female connector must be connected to the microcontroller circuit.

Fig.5. 4x4 Matrix Membrane Keypad

8.4.L293D Dual H-Bridge Motor Driver IC DIP-16:

The L293D stands as an integrated circuit (IC) featuring dual H-bridge drivers. These motor drivers function akin to current generators, employing a current control signal while delivering a heightened current signal to propel the motor. With two built-in H-bridge driver circuits, the L293D enables simultaneous operation of both DC motors in either forward or reverse directions. Pin inputs 2, 7, 10, and 15 govern motor operation, affording control over the two motors. Moreover, in modes of operation where the input impedance registers low, the drivers are deactivated, resulting in their outputs being turned off and entering a state of high impedance [26]. Engineered to handle inductive loads such as relays, solenoids, DC and bipolar stepper motors, as well as high current/high voltage loads commonly found in well-powered equipment.

Fig.6. L293D Dual H-Bridge Motor Driver IC

8.5.BO Motor 300 RPM:

The 300 RPM Double Shaft BO Motor - Straight Type Motor offers commendable power and speed with reliable performance, making it an optimal choice. Its smaller axles, coupled with compatible wheels, contribute to a more efficient design suitable for various applications or robotic systems. Featuring mounting holes on its body and being lightweight, it facilitates easy integration into circuits [27]. This motor is compatible with 69mm diameter plastic gear motor wheels, serving as a replacement for our metal gear DC motors. With an operating voltage range of 3-12V, it is well-suited for constructing small to medium-sized robots, catering to the needs of DIY enthusiasts. This motor kit is not only cost-effective but also compact and simple to install, making it highly suitable for mobile robot cars. Primarily utilized on our 2WD platform, it proves to be a reliable choice for various robotic projects.

Fig.7. BO motor

8.6.LED:

A 3mm white transparent LED is a type of semiconductor bulb with two prongs, designed to emit light when activated. When the LED terminals receive the correct voltage, it triggers a process known as electroluminescence, where electrical energy is converted into photons. This enables the recycling of electrical sockets and components within devices, releasing energy in the form of light. The specific color emitted by the LED is dictated by the variance in energy levels within the semiconductor material.

Fig.8. LED

9. Future Application of LI-FI:

- Education
- Medical Applications
- Cheaper Internet Access in Airports
- Groundwater Use
- Applications in sensitive areas
- Traffic management
- Mobile connection

10.Advantages:

Fiber can be used in some places affected by electromagnetic fields. such as airplanes or hospitals and will not cause interference [28].

• Speed and bandwidth. Li-Fi offers various Gbps speeds on mobile devices.

• Military level security. Light can be packaged and fixed in physical space.

• There is no disease.

• Reliability.

• Low latency.

• No interference.

11.RESULT:

Each vehicle is connected to a sensor through a microcontroller. MEMS sensors, which stands for microelectromechanical systems, are utilized to detect the vehicle's axle. The process functions as follows: When a pulse is transmitted using light fidelity technology, light is directed towards the receiver, where photons are captured by the photovoltaic cell.

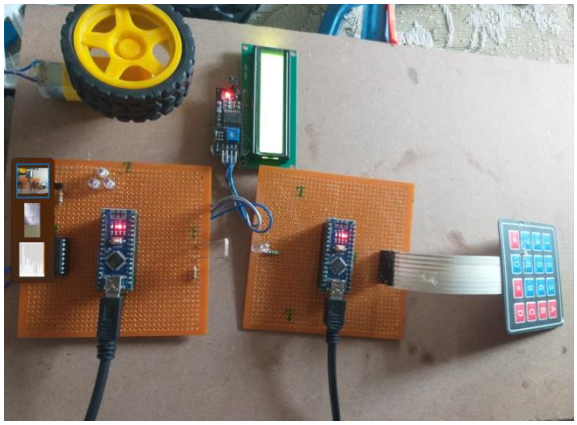


Fig.9. LIFI data transmission for Vehicle to ehicle communication

12.CONCLUSION:

The Li-Fi concept was introduced with the technology combined with current and legacy standards for vehicle-to-vehicle communication. The planning process has good solutions that can alleviate the situation. This article describes the design of the system in detail. This article presents proof of concept by transferring data from a Li-Fi prototype. As the population increases, incidents also increase. These machines reduce this greatly. Li-Fi helps transfer data in the car faster. The technology can also be used in street lighting to convey traffic information. Since it uses light to communicate, it is not limited anywhere. There is no interference in the signal. Therefore, this tool

is the best alternative for sending information. It will allow mutual access in places where internet access is not normally allowed, such as offices and airplanes. If this technology is used well, we will soon have WI-FI hotspots with good lighting everywhere. It will be cleaner, greener, and the future of humanity will be safer. Since this machine has great potential, a lot of research is being done in this field. As the population increases in the world, the number of events is changing very rapidly. These machines reduce this greatly. Li-Fi helps transfer data in the car faster. The technology can also be used in street lighting to convey traffic information. Since it uses light to communicate, it is not limited anywhere. There is no interference in the signal. Therefore, this technology is superior to other data transfer methods. It will allow mutual access in places where internet access is not normally allowed, such as offices and airplanes. The system offers a solution that will reduce the number of accidents on the roads, and it is believed that the safety of drivers and passengers can be ensured in the future through the integration of all areas.