International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 03 | March - 2023 Impact Factor: 7.185 ISSN: 2582-3930

A Review: Vehicle to Vehicle Communication Using Li-Fi Technology

Mohan Rao[1], Bhoomika M Gowda [2], Deepika P[3], Mallikarjun B G[4], Manya H P[5]

[1]Sr.assistant Professor, ECE, AIET, Mangalore, India

[2345]UG Scholar, Dept of ECE, AIET, Mangalore, India

Abstract - Light Fidelity or Li-Fi, is a form of communication that relies on using light as a medium. This method, known as Visible Light Communication, eliminates the complexity of cable transmission (VLC). Li-Fi has proven to be safe, efficient, and capable of delivering data at extremely high rates as it has evolved over the past few years. The proposed study investigates the viability of integrating Li-Fi into a communication system by describing the architecture, the modulation techniques, and the advantages and disadvantages of Li-Fi. In order to communicate data from a transmitter to a receiver in the communication system utilized in this research to control the speeds of two motors, light is used as the medium.

***Key Words*:** V2V, Li-Fi, VLC, Visible Light Spectrum

1. INTRODUCTION

Li-Fi is an emerging technology and which has vast application in the real time system. Li-Fi is merely a light-based version of Wi- Fi. A technology based on using light as a means for communication is termed Light Fidelity, or Li-Fi. Visible Light Communication (VLC) is the name of the technique that eliminates the complexities of cable communications. Wi-Fi is inherently insecure since it can pass through walls. Li-Fi, on the other hand, demands a Line Of Sight (LOS), doesn't pass through walls, and thus delivers added security. It offers a transmission rate of more than 100Mbps, is the core Li-Fi communication component. With the increase in the number of vehicles on road day by day the risk of accidents also increases. Every time the first automobile slows down, a message is sent through Li-Fi. Correspondingly, the automated braking system is activated to use the received data for braking on highways.

With the help of this technology, a vehicle can detect the movement and the position of the other vehicle at the distance of 10 meters. Li-Fi has 10,000 times more space available than Wi- Fi, which is a significant difference. The vehicle can detect to the drivers changing driving situations and then instantly warns the driver the vehicle to avoid accident. Vehicle-to-vehicle technology will enhance safety, minimize collisions, and assist to safer and more efficient transportation. It is mainly used to ensure the driver a safe and more comfortable drive. This technology enables the vehicles to communicate with the other vehicles and shares the main key information like accidents, traffic etc. Cars with the specified radius can automatically link with other vehicles and transfers the information. It offers a 360-degree information of the location of the opposing vehicle. The information exchanged between the vehicles includes the vehicles position, speed of the other vehicle etc. The vehicleto vehicle communication are mainly of two types, they are:passenger cars and commercial vehicles. The cars which areowned by the companies or businesses such as semi-trucks, taxis,buses etc are called the commercial cars.

2. LITERATURE SURVEY

Shivaji Kulkarni [1] suggest that Vehicle to Vehicle (V2V) communication is a modern tech that improves to the intelligence of our transportation system. Secondly, the technique can prevent traffic jams and accidents. Autopilot system is another domain in which many of are working. In order to make a vehicle autonomous, designers to maintain track of vehicles operating nearby. We must communicate info with our adjacent automobiles in order to accomplish this. Therefore, maintaining a connection between cars is crucial to making them autonomous. In order to connect automotive, V2V (V2p) communication is used. Vehicles connected to each other to exchange information might be thought of as engaging in V2V communication, which also has the potential to reduce traffic and avert crashes. We

utilize Li-Fi (Light Fidelity) technology to achieve connectivity solutions. Utilizing the unused visible light, Li-Fi and comparison of Li-Fi with that of Wi-fi and the criteria of saying the operation speed is fast and accurate and even the data is secured and Li-Fi is a point to point communication system.

According to Noof Al Abdulsalam [2], vehicle-to-vehicle communication has been the most effective approach to reducing automobile accidents. Li-Fi technology, which uses LED bulbs to transmit data over the light spectrum, has been the main focus of discussions on this topic. Various case studies have explored the potential of Li-Fi for vehicle-to-vehicle communication, and both experimental findings and numerical simulations using the Porteous program have shown promising results. Li-Fi has the advantage of providing faster and more secure communication compared to traditional radio-based technologies. The integration of Li-Fi with existing techniques and protocols has also been considered.

Various trends are being employed to enable vehicle-to-vehicle communication in the automotive industry. Wireless communication protocols like Wi-Fi and Bluetooth are commonly used to facilitate data exchange between vehicles. Dedicated short- range communication (DSRC) technology is also being used for vehicle-to-vehicle and vehicle-to-infrastructure communication. In addition, Li-Fi technology, which uses LED bulbs to transmit data over the light spectrum, is being explored as a potential trend. Recent work in this area has focused on improving the state-of- the-art in Li-Fi technology, with a particular focus on serial Li-Fi data transmission from an LED transmitter to a photodiode receiver. These ongoing research efforts are expected to result in further advancements and improvements in the field of vehicle-to- vehicle communication.

R. Anbalagan [3] explains that "Vehicle to Vehicle Data Transmission" refers to the exchange of information between two cars to ensure passenger safety and protection. Li-Fi technology, which uses light fidelity, has evolved over the years and requires careful consideration for its potential use in vehicles. Vehicle-to- vehicle communication is the most effective method for reducing minor accidents. Li-Fi technology utilizes LED bulbs as the main component for transmitting data over the light spectrum. The hardware aspects of a VLC communication system consist of a commercial LED transmitter and a mounted receiver on a vehicle. In order to keep implementation costs low, a small-scale prototype was designed due to the unavailability of all system components. The implementation process involved significant efforts to maintain cost-effectiveness..

Gerardo [4] suggests that social media, video streaming, and gaming services are some of the fun applications that can be efficiently communicated between user devices and vehicles using vehicular networks. Using cellular resources during mobile communication may not be the most effective or cost-efficient option. Therefore, Li- Fi technology is proposed as an alternative for vehicle communications, as it is a low-cost, high-data-rate, and efficient- bandwidth-use solution. The utilization of Li-Fi system is recommended for creating a bandwidth-efficient system by using frequencies other than those used by congested cellular, Wi-Fi.

Prabhu [5] states that the late twentieth century is referred to as the age of technological advancement, which has led to an increasing need for automation to make life more comfortable and convenient. The development of smart cars has gained significant attention due to the advancements in automation and embedded systems. These smart cars are modernizing the traditional automotive industry, and significant investments are being made by companies worldwide to design and create them. However, every technological advancement faces unique challenges. In this study, the author proposes the design of a Li-Fi and ultrasonic sensor-based collision detection system for a networked running vehicle using the Arduino platform. This new and advanced collision detection technology aims to prevent vehicle collisions and reduce the number of deadly traffic accidents. The proposed solution utilizes Li-Fi transmitter and receiver frameworks. This study is expected to inspire others to explore the concept of smart cars and the use of Li-Fi technology to develop more effective strategies to extend the transmitting range of the Li- Fi system and come up with

creative solutions to address the issues associated with line-of-sight (LOS) communication.

Riccardo et al [6] discuss the importance of wireless communications and GNSS-based positioning in ensuring vehicular safety. Vehicles must be able to exchange information about their respective situations in order to react swiftly and reduce the likelihood of accidents. However, current wireless communication and positioning methods are not optimal, particularly on board vehicles. The study explores the potential benefits and drawbacks of integrating Light-Fidelity (Li-Fi) technology to improve wireless communication and positioning. Although Li-Fi technology is becoming more mature, it has not yet been fully tested in the context of vehicular safety. Therefore, its full potential remains to be seen in the coming years. V2V communication is still in its early stages and requires further attention. It is a practical and theoretically sound solution, but thorough investigations are needed to address issues such as communication across multiple nodes and the impact of outdoor settings. The current outstanding concerns in the use of Li-Fi for vehicle-to-vehicle communication are hybrid positioning circumstances and field testing.

According to Shanmugha [7], India is one of the rapidly developing nations, which results in poor traffic management. Bi-directional Visible Light Communication (VLC), also known as Li-Fi, uses light modulation at speeds that are faster than what humans can perceive. Li-Fi has several advantages over other communication protocols, and it can be used to create Vehicle-to-Vehicle (V2V) communication. Li-Fi-based V2V communication system offers connectivity over a wide area and provides increased security and faster data rates. Emergency personnel, such as ambulances, firefighting engines, and police cars, can distribute through congested roadways more quickly using a Li-Fi based V2V communication system. The proposed V2V communication system includes a headlight and taillight of a vehicle made in and out of Li- Fi transmitter and receiver, respectively. When a stoplight receives notification about an approaching vehicle, the proposed system prompts the signal to turn green immediately, reducing the amount of time emergency vehicles must wait in busy lanes.

According to Manar [8], self-driving cars and the Internet-of- Vehicles technology are gaining popularity, and many companies are investing in this field to promote the most advanced and secure autonomous vehicles. However, this rapid growth in the Internet of Vehicles poses several security concerns that threaten both the industry and consumers. Therefore, there is an urgent need to conduct research on security-related risks and recommend solutions that can ensure the safety of drivers and the security of the industry. This study aims to conduct a comprehensive literature review on the Internet of Vehicles and security to achieve this objective. The research work aims to conduct a thorough literature review on the Internet of Vehicles and security, with a focus on identifying security-related dangers and proposing solutions to guarantee the security of industry and the safety of drivers.

Abhinav [9] explains that the Parking Cloud Service and indeed the Vehicle Mining Service are Two Innovative And Groundbreaking Vehicle Cloud Services. One solution to the increasing traffic and safety issues on highways is to leverage cloud-based computing and the Internet of Things (IoT). To achieve this, advocates suggest implementing an Intelligent Transportation System (ITS), which is a contemporary vehicular communication system that operates on the cloud. Meanwhile, different groups are working on their own solutions, such as developing an urban traffic management system or utilizing a cloud-based approach .We'll concentrate onautos equipped with sensors and actuators that can acquire environmental parameters and use it to boost traffic management and pollute The Vanes, which transmit safety messages between vehicles, are becoming commonly used in the traffic system to ensure the safety of passengers and provide comfort to travelers. Through The Transportation Of These Security Messages In An Open-Access Environment ion control.

According to Rahul [10], Li-Fi is a communication technique that uses light as a medium, also known as Visible

Light Transmission (VLC), to eliminate the need for cable communication. Over time, Li-Fi has developed into a secure and effective method for transmitting data at very high speeds. The proposed paper aims to explore the feasibility of integrating Li-Fi into a communication system by outlining its architecture, modulation methods, and advantages and disadvantages. The paper also includes an example of a communication system that uses Li-Fi to control the speed of two motors. The benefits and drawbacks of Li-Fi are discussed, with its high-speed data transmission being one of its main advantages. Furthermore, the paper introduces Li-Fi as a V2V communication application used in a project where two motors' speed was controlled through data transmission between their control systems.

Vishal [11] explains that between vehicles (V2V) Our transportation system is becoming more intelligent. The use of Light Fidelity (Li-Fi) technology in outdoor vehicular networks is a promising solution that can help reduce traffic congestion and accidents. Li-Fi is a type of Visible Light Communication (VLC) that uses visible light for data transmission. This paper presents the initial designs and results of a small-scale prototype that uses Li-Fi technology for sub data transmission, which is still a relatively new breakthrough and requires further investigation for its viability in outdoor vehicular networks. The paper will also discuss Li-Fi in comparison to currently employed methods and traditional trends for vehicle to vehicle communications, with the aim of proposing an affordable method for reducing accidents. The hardware required for creating a VLC communication system includes a car mount receiver and a commercial LED-based traffic light

Kaarthick [12] states that the project aims to mitigate the impact of accidents on daily life and prevent motor accidents caused by factors such as a driver losing control, failing to brake, or losing focus. To achieve this, the project utilizes a cutting-edge technology called Li- Fi for vehicle-to-vehicle communication. The system involves an LCD display, a vibration sensor, a Li-Fi transmitter, and a receiver. If the front vehicle experiences an unusual event, the second vehicle will slow down, and both drivers will be alerted. Many vehicle manufacturers are currently focusing on incorporating IoT features like healthcare and accident prevention into their vehicles. The proposed system simplifies the process of vehicle-to-vehicle communication, enabling drivers to receive warning signals quickly and respond appropriately to prevent accidents and traffic congestion. The project also has potential for expansion to connect vehicles with smart city infrastructure. Visible light communication is a wireless communication solution that is continually evolving.

Mugunthan [13] emphasizes the importance of effective communication in collaborative work. Communication can take various forms between humans and machines, and switches have traditionally been the primary means of machine communication.

The introduction of switches for machine operation has been a result of technological advancements, with ongoing development of models such as voice recognition, hand gesture movement, and mind reading. Machine-to-machine (M2M) communication has also been established, allowing machines or systems to inform each other of their state and conduct intelligent work independently. The article focuses on smart communication between vehicles and traffic signals as well as between vehicles using Li-Fi (Light Fidelity) technology to share important information. An Arduino simulator tool is used to simulate the proposed Li-Fi technology-based smart communication for vehicle-to-vehicle and vehicle-to-traffic signal communication. However, sunlight and street lighting can affect the transmission of signals, requiring high-frequency LED lighting to mitigate these issues.

According to Jay[14] people often experience frustration with slow wireless internet connections, whether it's their own or borrowed from others, due to the large number of devices connected to a single router. This is because the radio spectrum is congested due to the increasing number of internet users, and the demand for wireless data is doubling every year. To address this issue, Dr. Harald Haas has developed a solution called "Data through illumination," which uses a solid-state high-intensity light source called LI-FI. LI-FI enables data transfer through fluctuating currents in white LED light bulbs, which can be used for both general and specialized illumination. By using LI-FI technology,

each light bulb that transmits data can contribute to a cleaner, greener, safer, and brighter future. LI-FI technology has the potential to solve problems such as a lack of radio-frequency bandwidth by establishing new communication channels using existing hardware.

Abdul Aleem's article highlights that car collisions are a major cause of traffic accidents globally, leading to a significant number of fatalities. The World Health Organization (WHO) reports that in 2018 alone, over 1.2 million people lost their lives due to traffic accidents. The aim of the project is to minimize the occurrence of vehicle collisions and reduce the impact they have on people and society..of accidents in daily life. There are many causes of this unfavorable condition that leaves people dead or disabled. And suggests that several factors can lead to risky situations while driving, such as a sudden loss of focus, brake failure, or instability. These situations could be avoided by implementing a communication system among vehicles, which would allow drivers to control their cars based on their position relative to other vehicles. There are various prototypes of vehicular communication systems available, including the 5.9 GHz Dedicated Short Range, but there are some limitations to their implementation. However, the use of visible light could be a potential solution to these restrictions.

Prakash Tripathi [16] explains that Vehicle-to-Vehicle (V2V) communication is a developing technology that enables the distribution of traffic updates and warnings to moving vehicles. The successful deployment of Vehicular Ad-hoc Networks (VANETs) is dependent on ensuring the security and privacy of the communication system. In recent years, there have been significant advancements in hardware and software technologies that have the potential to improve highway safety, traffic efficiency, and passenger and driver comfort. VANET is one of the most important types of Mobile Ad-hoc Networks, and its study remains a popular research topic. Li-Fi, a new field of study, is a promising technology that can be applied to various networking-based applications, such as Cloud Computing, Cluster Computing, MANET, and VANET. Li-Fi has the potential to revolutionize wireless data transport.

Lucas[17] vehicle networking is becoming more prevalent. Current cars utilize cellular networks and TCP/IP to connect with centralized servers. However, certain automotive applications, such as real-time safety and traffic control information exchange, require direct V2V communication, which is difficult to achieve using existing technologies. To address this challenge, the study explores the named-data strategy as a potential solution. The article proposes a strawman proposal and presents case studies to analyze the advantages and disadvantages of the data name design.

To the best of our knowledge, the study discussed in the article is the first to explore the use of the named data technique for communication between V2V and V2R. Our approach enables traffic collection and distribution by vehicles, unlike IP addresses. The exchange of information between parties occurs through the use of data names that have been agreed upon and are transparent to all engines during the application development process.

3.CONCLUSIONS

Improving the driving efficiency in an foggy and misty places especially in the ghats and traffic management is still an active and challenging task. As per the research vehicle to vehicle communication technique has made the driver easier to drive without any interventions and it also controls the traffic. The data is communicated in the form of visible light and here Li-fi technology is been used which transmits the data from one vehicle to other and the data is maintained and monitored throughout.

REFERENCES

[1] Proposed Framework for V2V Communication using Li-Fi Technology Shivaji Kulkarni Dept. of Electronics and Communication B. V. B. College of Engineering and Technology Hubli, IndiaAmogh Darekar Dept. of Electronics and Communication B. V. B. College of Engineering and Technology Hubli, India

[2] Design and Implementation of a Vehicle to Vehicle Communication System Using Li-Fi Technology Noof Al Abdulsalam, Raya Al Hajri, Zahra Al Abri, Zainab Al Lawati, and Mohammed M. Bait-Suwailam Department of Electrical and Computer Engineering, Sultan Qaboos University, Muscat, Sultanate of Oman

[3] Vehicle to vehicle data transfer and communication using LI-FI Technology R. Anbalagan a , M. Zahir Hussain a , D. Jaya balakrishnan b, D.B. Naga Muruga , M. Prabhakar c, Department of Automobile Engineering, Rajalakshmi Engineering College, Chennai 602105, India Department of Mechanical Engineering, Sriram Engineering College, Tiruvallur 602024,

India Department of Mechanical Engineering, AVIT, Chennai 000000, India

[4] Performance Analysis of V2V and V2I Li-Fi Communication Systems in Traffic Lights Gerardo Hernandez-Oregon, Mario E. Rivero-Angeles , Juan C. Chimal-Eguıa´ ,Arturo Campos-Fentanes, Jorge G. Jimenez-Gallardo, Ulises O. Estevez-Alva, Omar Juarez-Gonzalez,Pedro O. Rosas-Calderon,Sergio Sandoval-Reyes and Rolando Menchaca-Mendez

[5] Design of Collision Detection System for Smart Car Using Li-Fi and Ultrasonic Sensor Prabu Krishnan is with the Department of Electronics and Communication Engineering, National Institute of Technology Karnataka, Surathkal, Mangalore 575025,India

[6] The Potential Benefits of On-Board Li-Fi for the Cooperation among Vehicles Riccardo Scopigno , Senior Member IEEE, Alessia Autolitano , Tankut Acarman , Çağdaş Yaman and Suat Tops

[7] Li-Fi Based Automatic Traffic Signal Control for Emergency Vehicles Shanmugha sundaram R, Prasanna Vadanan S, Vivek Dharmarajan Department of Electrical and Electronics Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, India

[8] Systematic literature review on Internet-of-Vehicles communication security Manar Abu TalibSohail Abbas, Qassim Nasir and Mohamad Fouzi Mowakeh

[9] VEHICLE TO VEHICLE COMMUNICATION USING CLOUD DATA SYSTEM -Abhinav Vanama, Dr. Jitendra Sheetlani

[10] INTERNATIONAL CONFERENCE ON RECENT TRENDS IN ADVANCED COMPUTING2019, ICRTAC 2019 Li-Fi for Vehicle to Vehicle Communication – A Review Rahul George, Sri kumar Vaidyanathan, Amandeep Singh Rajput, K Deepa, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Bengaluru, India.

[11] Vehicle To Vehicle Communication Using Li-Fi Technology Vishal Mishra , Anand Yadav, Prabhat Singh Rawat1, Md.Uzair1, Ravi Shankar2 UG student of Department of Electronics & Communication, Babu Banarasi Das Institute of Technology and Management Lucknow, Uttar Pradesh, India

[12] Vehicle To Vehicle Communication Using Li-Fi Technology Kaarthick Saran. S1, Keerthivasan. V2, Parthiban. D3, Pradeep. P4, Dr. C. Amali5

[13] Concept of Li-Fi on Smart Communication between Vehicles and Traffic Signals Dr. S. R. Mugunthan,Associate Professor,Department of Computer Science and Engineering, Sriindu college of Engineering and Technology,Sheriguda, Hyderabad, India.

[14] LI-FI Technology – A Visible Light Communication Jay H. Bhut, 2Dharmrajsinh N. Parmar,Khushbu V. Mehta,Electronics & Communication Engineering, Marwadi Education Foundation, Rajkot, India.Communication System Engineering, Charusat University, Changa,India

[15] Collision Avoidance between Vehicles through Li-Fi based Communication System Abdul Aleem Jamali†, Mahesh Kumar Rathi††, Abdul Hakeem Memon††,Bhagwan Das†, Ghanshamdas† and Shabeena††Department of Electronic Engineering, Quaid-e-Awam University of Engineering, Science and Technology, Nawabshah,Pakistan. ††Department of Electrical Engineering, Mehran University of Engineering and Technology, Jamshoro, Pakistan.

[16] Security in Vehicular Ad-hoc Network using Li-Fi Prakash Tripathi Department of RDBM & Mahatma Gandhi Chitrakoot Gramodaya University, India

[17] Data Naming in Vehicle-to-Vehicle Communications Lucas Wang1, Ryuji Wakikawa, Romain Kuntz, Rama Vuyyuru, and Lixia Zhang Computer Science Department, University of California, Los Angeles Toyota Info Technology Center, USA Mountain View, CA