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Visible Light Communication for Vehicle Monitoring

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Abstract: ***High number of accidents had been placed all over the world due to the collision between automobile vehicles. According to the report of the world health organization (WHO), road traffic crashes results in the death of approximately 1.3 million people around the world each year with non-fatal injuries. Therefore, vehicle and people safety are very important. The idea is to propose of reducing the accidents in our daily lives and to avoid accident between vehicles. This involves arresting the human errors and technical failures of vehicles in prior. The hazardous situation can be overcome if there is a proper communication protocol used in all vehicles and depending upon the driver's position controls. There are various vehicular methods and protocols are available. These radio frequency (RF) based communication ideas have some limitations i.e. data interference, spectrum break and security issues. These drawbacks can be overcome by using Visible Light Communication. This produces high frequency bandwidth, standard security, interference reduction and high speed data rate. Visible Light Communication is a data communication system which uses visible light for high rate data transmission and receiving operation. This method of technology is called as Light Fidelity (Li-Fi). Through this proposed system, it will slow down the vehicle and gives an alert to the driver also it gives an emergency stop. Even though an accident occurs, SMS will be sending along with location to Public service provider. This presents the highly accurate method to avoid accidents between two vehicles.***
Keywords: Li-Fi safety, Accident detecting and alert system, Automatic flagging system, Emergency stop system.

I. INTRODUCTION

In today's world, people are dependent more on usage of vehicles due to busy work life style. Also, in need of transporting goods from one place to another. Either it can be two wheeler or four wheeler the number of vehicles on the road is increasing day by day. This shows a good scale of improvement but on other side chances of road accidents also increasing. Driver's negligence or carelessness to road and traffic conditions is one of the major causes for road accidents. It can be fatal and ruins human life upside down and henceforth we must do our best to avoid them. Road incidents are caused by large number of human factors such as failing to act according to weather conditions, road design, signage, speed limits, lighting conditions, pavement markings, and roadway obstacles. Drivers distracted by mobile devices or get tired and sleeping due to long time driving which leads to a disaster. Transportation systems of today are closer than ever bound to experience a major technological transformation. Vehicles on roads have come a long way from the bare metal-on-wheels they used to be, to the sensing and computation capable machines they are today. High-end models of last generation vehicles nowadays are equipped with hundreds of embedded computers and sensors which allow them to perceive their surroundings and interact with it in semi-autonomous, and eventually, fully-autonomous fashion. Although at a slower pace, the road infrastructure has evolved as well as adaptive traffic lights and communication capable pay tolls are being deployed on roads. An anticipated next step in the evolution course of transportation systems is to adopt the concept of communication and enable information exchange between vehicles and with infrastructure. This will unleash the full potential of next generation transportation systems while shifting the paradigm from autonomous driving to cooperative driving. To achieve complete automation vehicle in India it is challenging due to different condition road in different places. Also, it was more expensive to achieve full automation. High number of population which result in high number of vehicle for transport purpose and goods shipping. High number of vehicle usage, which leads to high number of road accident cases due to human error. This factor makes us important to think to ensure vehicle and its road safety. In this project, we create a system for increasing road safety and to avoid collision between vehicles whereas the vehicle will communicate with each other while receiving signal from vehicle, it starts to slow down automatically and distance will be calculated. Also, when it reach to the safety distance there will be an alert sound to the driver to stay focus on road and there will be a emergency stop when the vehicle goes very close than safety distance. This system also has a SOS (Save Our Souls) message alert technique, when accident occurs it gives accident spot location of user to public-safety access point.

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II. RELATED WORKS

AgonMemedi and Falko Dressler proposed a Visible Light Communications (VLC) is becoming a mature communication technology, particularly for indoor usage. The application in outdoor environments is especially interesting in the scope of Vehicular VLC (V-VLC), however, there are some critical challenges remaining. In general, VLC is a good complement to Radio Frequency (RF)-based communication. For automotive use cases, V-VLC can benefit from the huge available spectrum and the readily available Light Emitting Diode (LED)- based lighting systems of modern cars. Its Line Of Sight (LOS) characteristics, the directionality of the light, and the smaller collision domain substantially reduces interference. In this survey article, we study the state of the art of V-VLC and identify open issues and challenges. We study the V-VLC communication system as a whole and also dig into the characteristics of the VLC channel. For the beginner in the field, this review acts as a guide to the most relevant literature to quickly catch up with current trends and achievements. For the expert, we identify open research questions and also introduce the V-VLC research community as a whole.

Harald Haas, Liang Yin, Cheng Chen, Stefan Videv, Damian Parol, Enrique Poves, Hamada Alshaer, and Mohamed SufyanIslim proposed a LiFi is networked, bidirectional wireless communication with light. It is used to connect fixed and mobile devices at very high data rates by harnessing the visible light and infrared spectrum. Combined, these spectral resources are 2600 times larger than the entire radio frequency (RF) spectrum. This paper provides the motivation behind why LiFi is a very timely technology, especially for 6th generation (6G) cellular communications. It discusses and reviews essential networking technologies, such as interference mitigation and hybrid LiFi/Wi-Fi networking topologies. We also consider the seamless integration of LiFi into existing wireless networks to form heterogeneous networks across the optical and RF domains and discuss implications and solutions in terms of load balancing. Finally, we provide the results of a real-world hybrid LiFi/Wi-Fi network deployment in a software defined networking testbed. In addition, results from a LiFi deployment in a school classroom are provided, which show that Wi-Fi network performance can be improved significantly by offloading traffic to the LiFi.

Parth H. Pathak, XiaotaoFeng, Pengfei Hu, PrasantMohapatra proposed a solid-state lighting is revolutionizing the indoor illumination. Current incandescent and fluorescent lamps are being replaced by the LEDs at a rapid pace. Apart from extremely high energy efficiency, the LEDs have other advantages such as longer lifespan, lower heat generation and improved colour rendering without using harmful chemicals. One additional benefit of LEDs is that they are capable of switching to different light intensity at a very fast rate. This functionality has given rise to a novel communication technology (known as Visible Light Communication - VLC) where LED luminaires can be used for high speed data transfer. This survey provides a technology overview and review of existing literature of visible light communication and sensing. This paper provides a detailed survey of visible light communication system and characteristics of its various components such as transmitter and receiver, physical layer properties of visible light communication channel, modulation methods and MIMO techniques, medium access techniques, system design and programmable platforms and visible light sensing and application such as indoor localization, gesture recognition, screen-camera communication and vehicular networking. We also outline important challenges that need to be addressed in order to design high-speed mobile networks using visible light communication.

Stefano Pergoloni, ZeinabMohamadi, Anna Maria Vegni, ZabihGhassemlooy, Mauro Biagi proposed an indoor environments, visible light communications paradigm is emerging as a viable promising solution complementary to well-known radio frequency technology. At the same time, the information about user's location is useful for accessing the medium via space division multiplexing, handling over or providing access to location-based contents. In this paper, we present two localization mechanisms based on the wavelength domain by assuming that each anchor point uses a spectrally dedicated signature for the user to readily identify it. The first approach i.e., wavelength-based localization, assumes a simultaneous transmission of three different pulse streams emitted by the red-green-blue (RGB) light emitting diodes (LEDs). The second method i.e., colour-based localization, considers the subsequent transmission of RGB pulses. Localization is then computed through traditional received signal strength and time difference of arrival approaches. Moreover, we resort to the properties of metamerism so that the red, green and blue components used by LEDs provide the white light sensation to the human eye. The performances of the two proposed schemes are close to theoretical bounds. Even in the worst cases, the estimation error varianceis in the order of 10^4 m^2. Finally, the signaling request forestimating user position is less than others in the Literature and is independent from the number of anchor points.

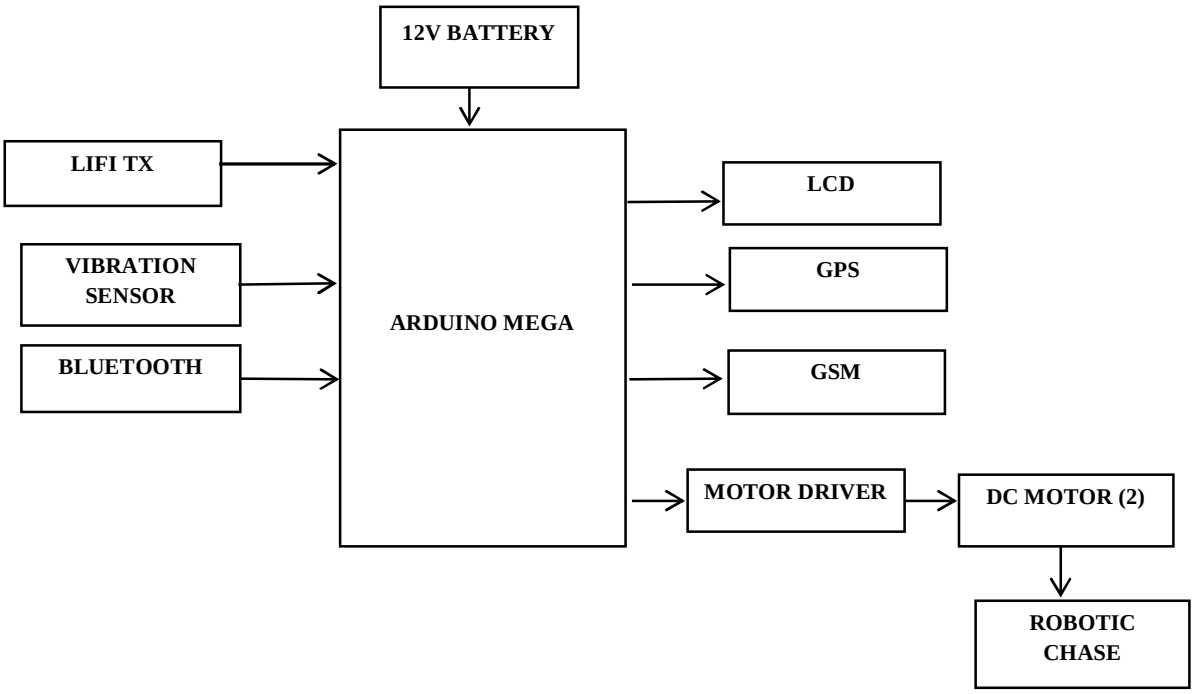
Yanbing Liu, Xiaowei Qin, Tianyi Zhang, Ting Zhu, Xiaohui Chen, and Guo Wei proposed an in recent years, visible light communication (VLC), considered as a compelling technology to solve the spectrum problem of traditional radio frequency (RF)

communication, has attracted attention in scientific and industrial communities. However, for a variety of reasons, the design of the VLC uplink scheme has become a significantly challenging problem. In this paper, in order to address the preceding problem, we propose a novel decoupled TCP extension protocol for a VLC hybrid network. Different from regular TCP protocol, decoupling operation to TCP transmission in our new protocol can break through TCP's limitation to a unidirectional link and allow users to fully utilize network resources in a VLC hybrid network consisting of a VLC downlink and a complementary uplink. Furthermore, today most hosts are equipped with several interfaces, so we combine decoupled TCP (DETCP) with multipath TCP (MPTCP) and extend DETCP to a multipath communication situation. Using several links simultaneously ensures more efficient and reliable data transmission in a VLC network. Based on our implementation of the Linux kernel, our experimental results show that our protocol can effectively accomplish the decouple work and achieve high throughput. In addition, several factors that influence the performance are analyzed based on our measurement results.

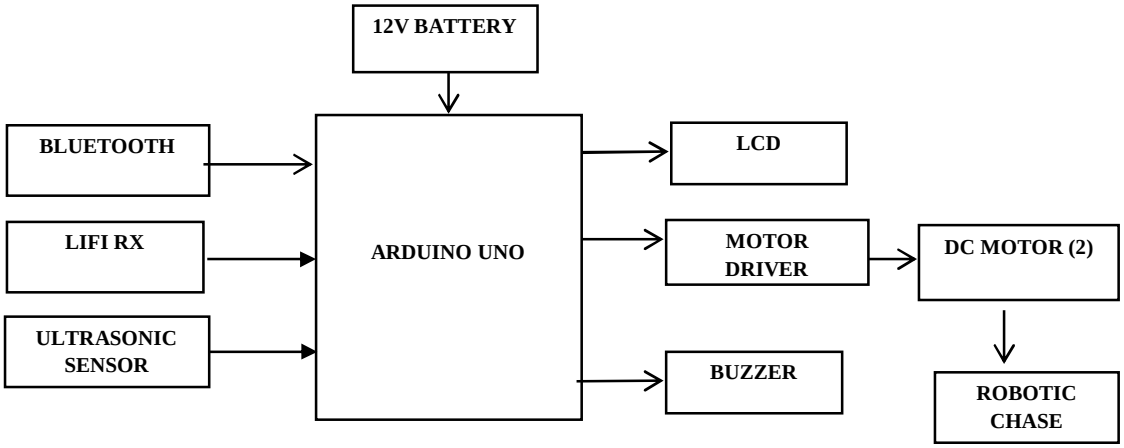
III. PROPOSED SYSTEM

In our proposed system, vehicles are communicating each other, so that the possibility of accident happens less. Here, we have Visual light based communication between vehicles so that, the vehicle informs to other which make the driver to be stay focus even when they slightly loss focus. These drawbacks of RF can be overcome by using Visible Light Communication. This produces high frequency bandwidth, standard security, interference reduction, and high speed data rate. The proposed system has a system to alert the driver. If the driver was careless, this system has automatically slow down and emergency stop to avoid the accident. Even when accident occurs, this system has accident detection and alert system which help to avoid loss of lives or wounds and injuries.

A. Block Diagram Of Transmitter Unit



B. Block Diagram Of Receiver Unit



IV. RESULTS AND DISCUSSION

The output of the proposed system is shown in fig 1 and 2.

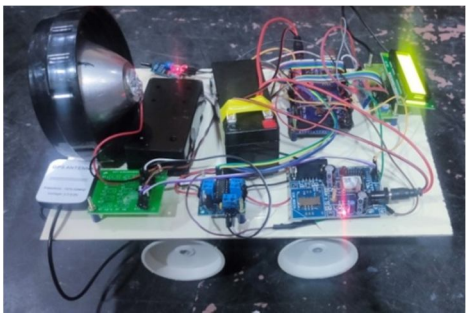


Fig 1 Transmitter Unit

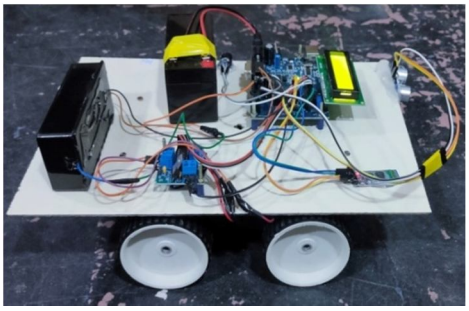


Fig 2 Receiver Unit

When accident is detected, an alert SMS is sent to public service provider or user regarding about the accident of the user. The message consists of a link which is clicked to connect to Google map to show the accident location. As shown in fig 3 and 4.

As shown in fig 5 and 6. Arduino Bluetooth controller app is used to give command to prototype model. This android application established a connection between mobile and prototype model. . The application has modes like controller, switch, dimmer, terminal to control prototype model using mobile phone.

As shown in fig 7 and 8. Both units have LCD display which shows the action of the proposed system. It shows the information like right indicator, left indicator, direction, stop, etc. The robotic chase is controlled automatically when the distance between the

vehicles is reduced through LIFI and a buzzer alert is given to the driver. When the receiver unit get too close to the transmitter unit, the robotic chase of receiver unit gets an emergency stop. All the information is displayed in LCD.

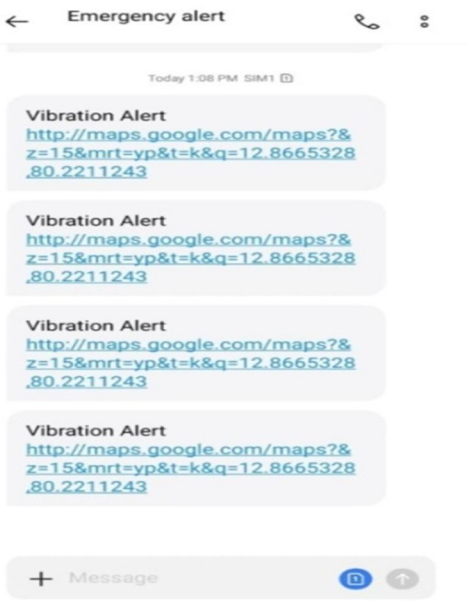


Fig 3 Alert SMS

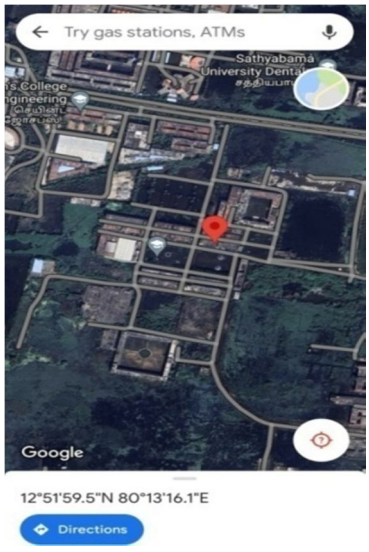


Fig 4 Accident Location

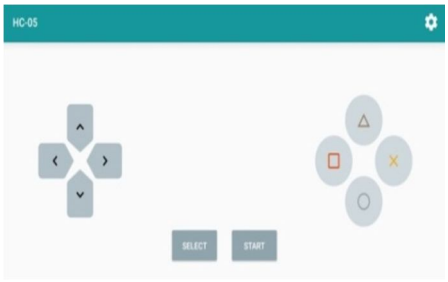


Fig 5 Controller Mode

Fig 6 Terminal Mode

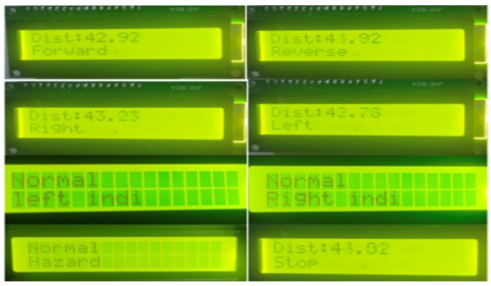


Fig 7 LCD Information Display

Fig 8 Interfacing Information Display

V. CONCLUSION

Growing population and technology creates high demand on transport facility for moving from one place to another and shipping goods to different location. Large number of vehicle leads to traffic collision which causes dangers to lives. To avoid traffic collision between vehicles, we use LiFi to avoid accident between vehicles. The vehicle itself sends operational information to the vehicle near by it. In this project, a system is created for increasing road safety and to avoid collision between vehicles whereas the vehicle will send operational information to near vehicle using Li-Fi Tx while near vehicle receiving signal using Li-Fi Rx, it starts to slow down automatically and distance will be calculated by ultrasonic sensor and emergency stop to avoid accident between vehicle. When accident occurs the system will alert the user and will send emergency alert message to public service provider. The V-VLC research domain is catching more and more momentum, both in the academic research community as well as in the automotive industry. Building upon concept, methods, and technologies known from indoor VLC as well as from IEEE 802.11 WLAN, substantial progress had been made recently. This ranges from early conceptual studies to simulation experiments and now to first prototypes. Nevertheless, there are still many open questions that need to be investigated in order to mature the technology. In this survey, the state of the art in V-VLC communication systems and highlighted open challenges to be studied by our research community. This survey as a reference as well as a guide for both experts and beginners in the field.

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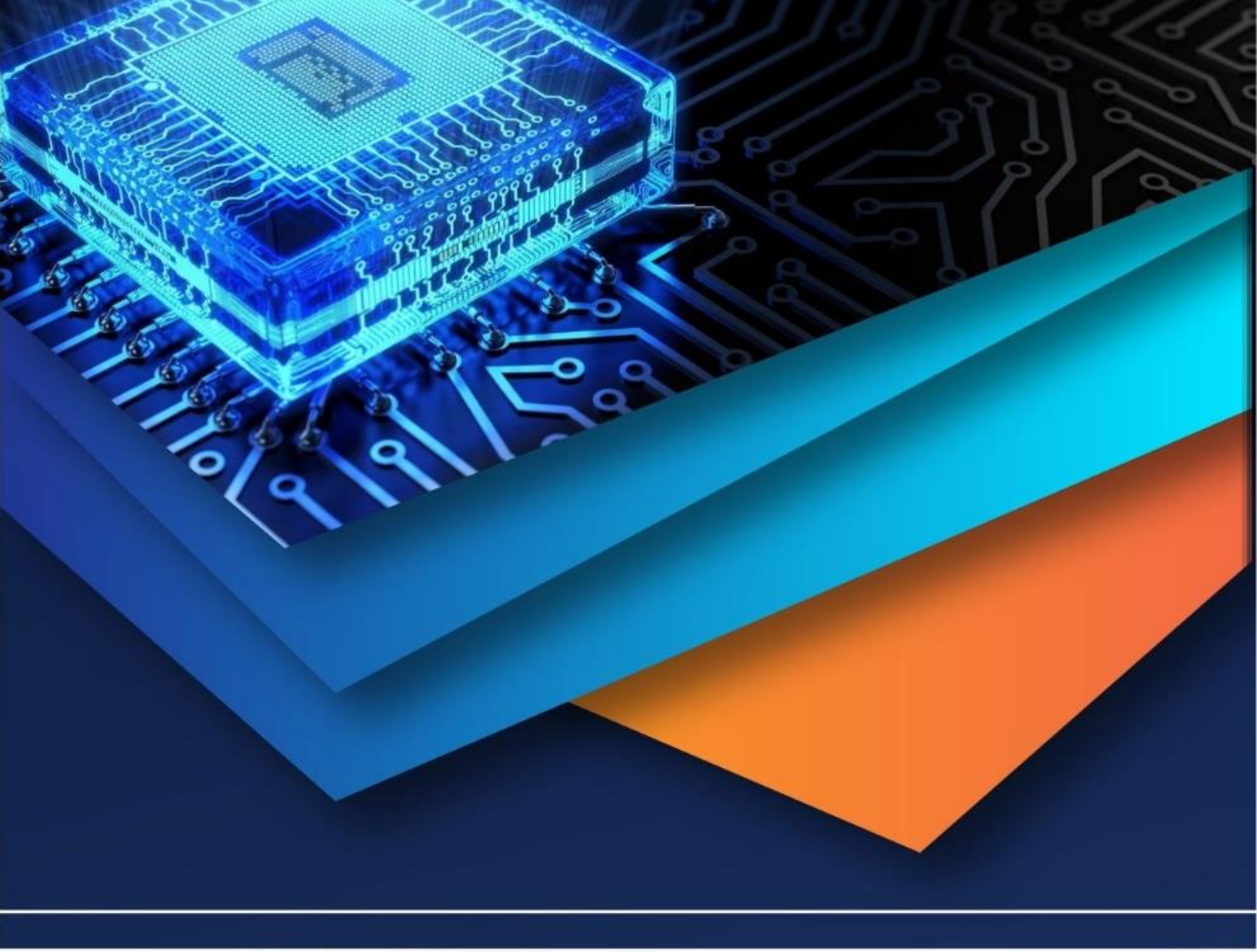

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