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Vehicle Monidroid: Smart Vehicle Positioning and Condition Monitoring System for Accident and Tracking with Real-Time Position and Image

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Abstract: ***Security is a major concern in our society today and over time, the security of vehicle has become a priority. Various tracking systems were developed to keep track of shipped goods. Passive systems were deployed for this purpose in olden days. However, for applications requiring Real-time location information, Active systems are required to transmit the location of the vehicle in Real-time. This project is an integrated monitoring system design with GPS and GSM to incorporate location information and surveillance using SMS to determine the exact location of an object, person or another asset to which it is attached. Using GSM modem this information can be transmitted to a remote user. This system contains a single onboard system equipped with GPS and GSM modems along with IP camera connected with microcontroller. A software is developed to read the user's request process and analyze the incoming SMS message to provide complete data exchange i.e. location, condition, and a picture of asset connected to the device and send it to the remote user for emergency references. This system can be a valuable tool for providing real-time control and monitoring.***
Keywords: GPS, GSM, Smart Surveillance, Processing IDE, Real-time image

I. INTRODUCTION

The Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards, vehicle thefts and the road accidents that take place frequently cause huge loss of life and property because of poor immediate emergency facilities.

Security is a major concern in our society today. Every day, purchase vehicles for different purposes, but for whatever the reason, a lot of money is spent in the transaction which demands that adequate provision be provided for its security and safety during transit.

Automobile accident and theft is a serious problem which is getting rampant day after day. It is then necessary for vehicle users and emergency services everywhere to have a way to detect an accident and track down the vehicle in case of accident or theft.

Smart Vehicle Surveillance System is one of the measures of monitoring vehicles. The word Surveillance means to observe or monitor something. Real-time vehicle tracking and monitoring is a method used to track and monitor any remote vehicle equipped with a hardware unit that receives and transfers signals through GPS and GSM technology with capturing of the image at that instant. It makes use of GPS to provide the actual geographic real-time position of each vehicle and GSM to intimate the user about the location. A vehicle tracker is, therefore, a major and essential device that should be in every vehicle because it gives the owner the ability to know the exact location of such cars at any point in time anywhere in the world with geography information systems (GIS). It is very useful for both individuals and companies. It can help a company in the sense that the company workers cannot take the company car(s) to unassigned locations. It can also help an individual who is probably on a business trip to know whether his car is still where he left it or not. Today, the vehicle tracking system is playing a major role in most sectors as vehicles have become a major means of transportation.

Automatic vehicle accident detection, tracking and messaging system is an embedded intelligence implanted into the automobile. The purpose of the project is to find the vehicle where it is and locate the vehicle by means of sending a message using a system which is placed inside of vehicle system. This Project is to provide an optimum solution by providing intimation to the users about the vehicle location in case of accidents and theft supported with image capturing to describe the condition in either case.

The system is designed to automatically detect the vehicle accident and provide the accident location with the facilities of image capturing of vehicle and passengers, track the vehicle’s movement. This project is a step towards improving the Tracking & Monitoring of vehicles during transit.

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II. RELATED WORKS

Over time, the security of vehicles has become a priority. Various inventions and technologies have been brought about to put minds at rest, but to get the complete information during vehicle accident and theft of the vehicle is much of a tedious task.

At present technologies like the car alarm system have been put in place but it is limited to an audible distance and it doesn't give the location of the car if it is successfully stolen and there is no system available to notify the emergency services during an accident.

A solution to knowing the location of vehicles when they are met with an accident and stolen is the Real Time Vehicle Monitoring System that involves the installation of a vehicle tracker in a hidden position in the vehicle so that it is not easily located while providing essential clues as to the location of the vehicle.

In this system, we are using the basic microcontroller ARDUINO for cost-effective and also for easy understanding. Here we used programming for better accuracy and GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to our remote devices (mobile phones) using GSM modem with image capturing. This module has also a feature of the tracking system as an added advantage to the user. This system also allows the user to detect their vehicle in case of vehicle theft and misplacing. It helps in tracking the vehicle by providing the exact longitude and latitude of the vehicle location, which can be easily located by using online map services.

Image capturing helps in getting the idea about the vehicle and the passenger condition during accident and image of the driver in the case of theft or loss. Image is stored in a system which can be used for further analysis. It is also helpful in asset tracking, fleet management, transit tracking.

III. SYSTEM DESIGN

Prototype system consists of seven components that interact with each other in real-time to achieve an automated response system to provide the location with a real-time picture of asset and users. It consists of the following components.

A. Controller unit
B. GPS unit
C. GSM unit
D. Camera unit
E. Vibration sensorS
F. Power supply
G. Display unit

Microcontroller (Arduino) is interfaced with a vibration sensor, GSM module, GPS module. The camera is interfaced directly with the software part through the programming part. GSM module and Microcontroller are provided with individual power supply, while GPS and Vibration sensor is fed from the microcontroller. GPS once connected to the system keeps taking the data in the form of latitude and longitude from the satellite. Microcontroller interfaced with the vibration sensor that continuously monitors the condition detects the accident. In the same time microcontroller also keeps the track for the data for tracking through GSM from the users. In both the cases once the signal is received to the microcontroller, immediately captures the image using a camera and stores it with intimating the specified users with the location of the place using GSM module.

IV. CIRCUIT DIAGRAM

Fig. 1 shows the circuit diagram for the connection of different modules to the microcontroller (Arduino). VCC and GND of GSM, GPS and Vibration sensor and LCD Module are connected to 5V and GND pin of Arduino. Vibration module is connected to the pin 12, Tx and Rx pins of GSM is connected to the pin 7 (Rx) and pin 8 (Tx) respectively of Arduino. Tx pin of GPS is connected to the pin 0 (Rx) of Arduino. LCD module data pin D7(14), D6(13), D5(12), D4(11) is connected to pins 2,3,4,5 with E (Enable) and R/W (Read/Write) is connected to pin 6 and 12 respectively of Arduino.

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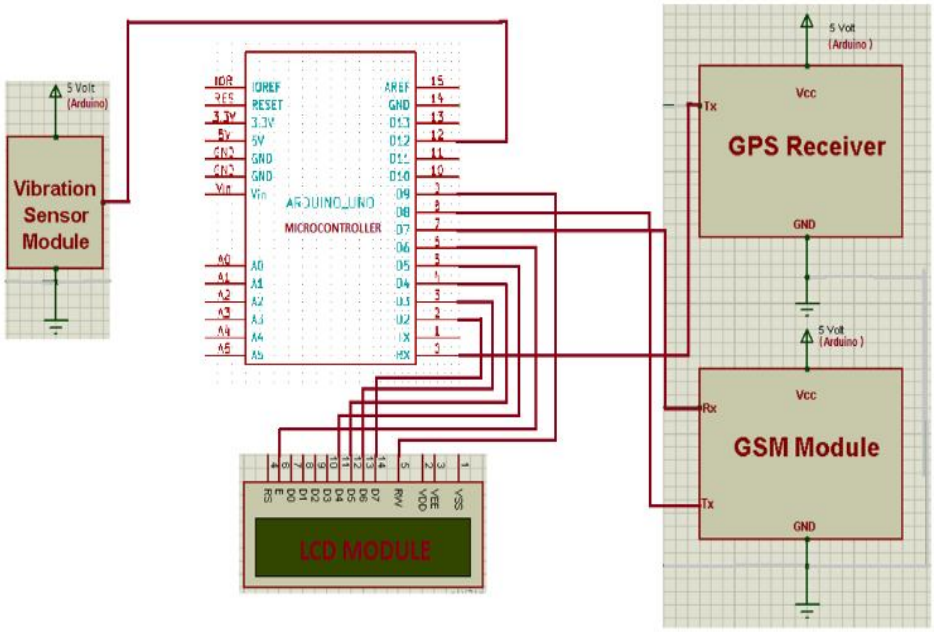


Fig. 1.Circuit diagram

V. BLOCK DIAGRAM

It shows the system is initialized on power ON. GPS is continuously taking the data from the satellite about the longitude and latitude of the place. GSM takes the network signal for the dual communication from the user and vehicle.

When the system is detected to be abnormal, it is confirmed that the accident has occurred. The vibration/acceleration of the vehicle is detected to confirm the cause of the accident. At the same time, it also monitors for serial data from the user through the GSM module.

As soon as the accident is detected or the tracking signal is received, microcontroller gets the signal to be activated.

At that time it takes data from the GPS about the location, displays on the LCD screen captures the location from the camera and then sends the location data using GSM. And the cycle repeats for the next case either data case.

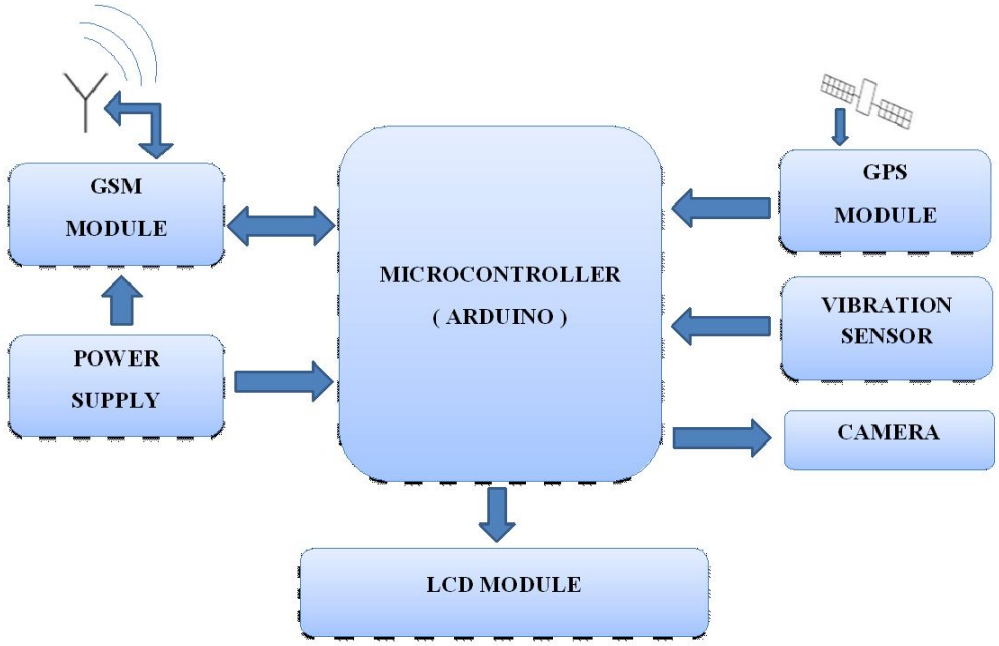


Fig. 2.Block diagram

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VI. SOFTWARE USED

A. Arduino IDE Software

The Arduino IDE is a cross-platform Java application that serves as a code editor and compiler and is also capable of transferring firmware serially to the board.

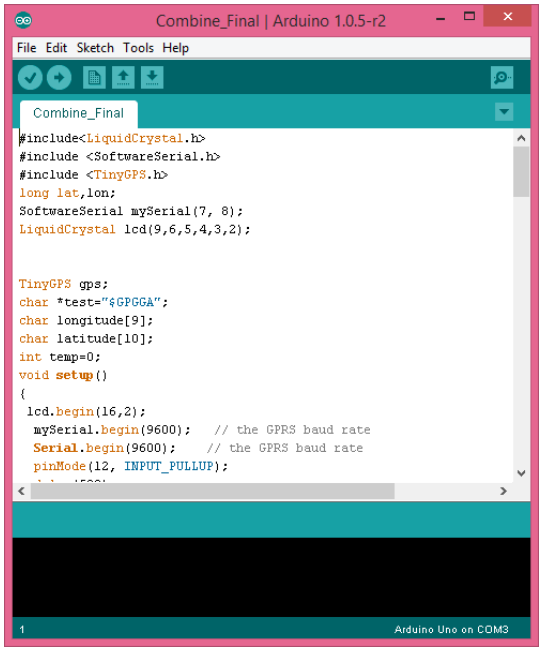


Fig. 3. Arduino IDE window

B. Processing 3 Software

Processing is an open source programming language and integrated development environment (IDE) built for the electronic arts, new media art, and visual design communities with the purpose of teaching the fundamentals of computer programming in a visual context, and to serve as the foundation for electronic sketchbooks.

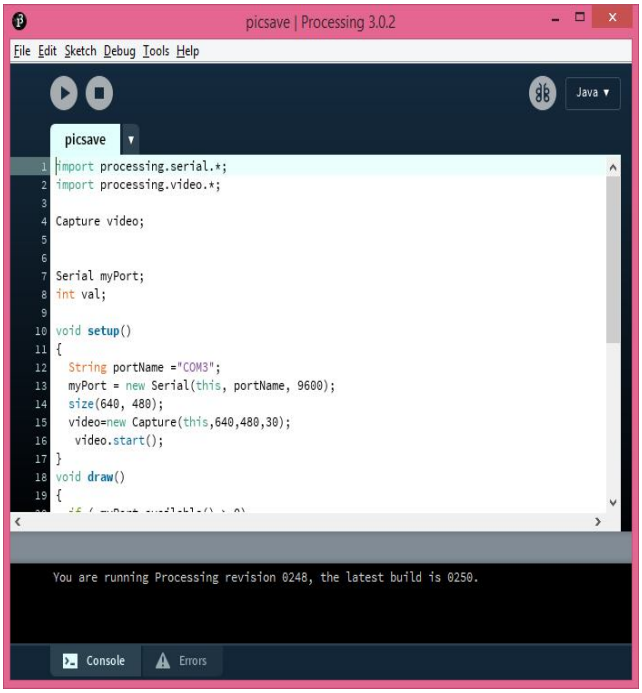


Fig. 4. Processing IDE window

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VII. FLOW CHART AND WORKING

Vehicle Monidroid is a smart vehicle monitoring and tracking system together with the vehicle and modern electronics provides the smart surveillance of vehicle during transit.

This device installed in a vehicle to enable the owner or a third party to track the vehicle's location. Most modern vehicle tracking systems use Global Positioning System (GPS) modules for accurate location of the vehicle. Many systems also combine a communications component such as cellular or satellite transmitters to communicate the vehicle's location to a remote user.

A. Flow chart

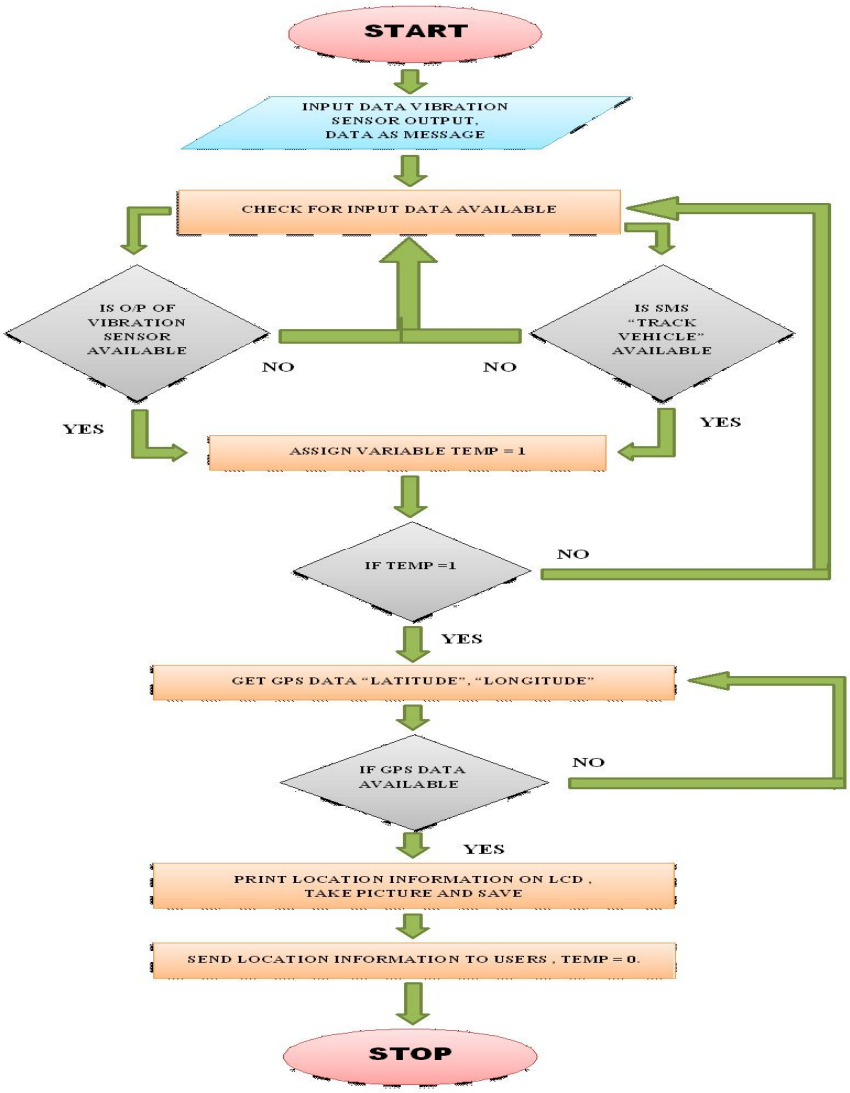


Fig. 5.Flow chart of device working

B. In case of accidents

Whenever an accident occurs vibration sensor automatically detects the accident as its piezoelectric material vibrates to generate the signal and sends it to the microcontroller.

The signal received is in the form of the digital signal (LOW). Once the data is received microcontroller gets is activated and starts communicating between the modules.

GPS module which keeps on taking the position of location provides the microcontroller with particular locations where an accident has occurred.

It then directs the internal software (processing) to capture the image of the vehicle and concerned passengers.

At the same time, GSM sends message to authorized members about the position of the vehicle.

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C. In case of tracking

Whenever there is the case of vehicle misplace or loss/ theft, and the user wants to track its vehicle regarding its position. In that case, the user has to send the message of "TRACK SIGNAL" to the SIM used in the GSM module.

Once the message is received to the GSM, it automatically detects and sends the received data to the microcontroller.

The received signal is compared with the serial data defined in the program to track the vehicle. Once the data get matched microcontroller gets is activated and starts communicating between the modules.

GPS module which keeps on taking the position of location provides the microcontroller with particular locations where an accident has occurred.

It then directs the camera using software (processing 3) to capture the image of the vehicle and concerned passengers.

At the same time, GSM sends message to authorized members about the position of the vehicle.

VIII.RESULT

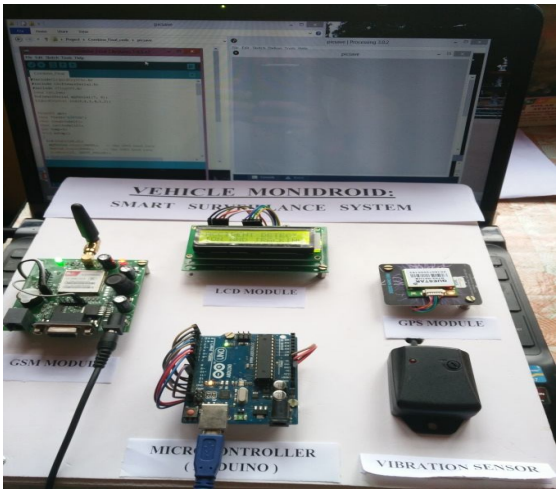


Fig. 6.Working pictures of module

A. In Case of an Accident

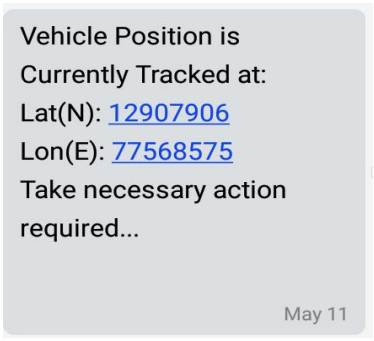


Fig. 7.Message during accident

B. In case of Tracking

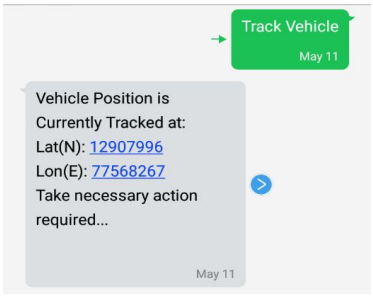


Fig. 8.Messages during tracking

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C. Image Captured By The Camera

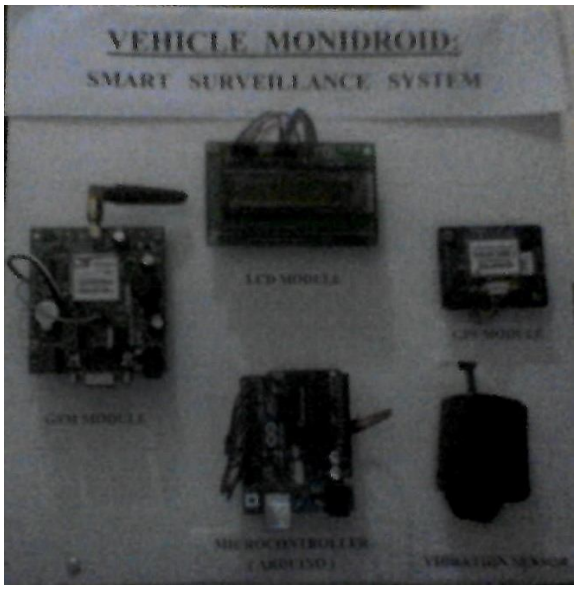


Fig. 9.Camera image during accident and tracking

IX. APPLICATIONS OF THE PROJECT

In our project, there are various applications which we have implemented. Basically, in this project, we have implemented the concept of Tracking.

A. The first application accident management in which we can identify the location of the vehicle in case of accident, capture, and stores the image of the vehicle, passengers and intimate the accident location in the terms of latitude and longitude to the concerned peoples and authorities like police, hospital so, that immediate medical attention can be reached. This help to minimize loss of life and property.

B. In the second application, if the vehicle is stolen and misplaced then it provides the tracking feature to get the location of the vehicle on user mobile. It sends the location information in the message form to the user and captures the image of the driver which can be sent to the police station.

C. In third application is fleet management in which knowing the location of the vehicle at priority, helps to manage the number of vehicles even in a huge rush of traffic.

D. In fourth application asset tracking in which the valuable goods carried on the vehicle can be tracked.

X. ADVANTAGES

A. Helps in providing immediate medication in an accident.

B. Real-time Image helps in condition monitoring.

C. Sophisticated security and Tracking.

D. Simple and reliable operation.

E. Isolated operation of GPS and GSM

XI. CONCLUSION AND FUTURE SCOPE

This project deals with the design & development of a VEHICLE MONIDROID for an automobile, which is being used to identify and manage the accident and also to track the location to prevent or control the theft of a vehicle.

This system is designed to improve vehicle monitoring and accessibility. With the use of wireless technology, vehicle owners are able to protect their automobiles with more passive involvement.

Ideally, this project could be made more convenient and secure with the use of satellite modems instead of cell phones as tracking device as the system may fail when there is no network coverage. This design can be made more enhanced in the future to support the camera, handset phone/hands-free, mobile data LCD display, web-based tracking software, and also PC based standalone software. The GSM modem provides information to the user on his request. The owner can access the position of the vehicle at any instant. He sends a message in order to track the vehicle. The GPS receiver on the kit will locate the latitude and longitude of the vehicle using

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the satellite service. This is a reliable and efficient system for providing monitoring of vehicles through GSM, GPS, and serial communication. In future advancement of this project, a lot of features can be added for making it a more sophisticated device. A micro camera would be attached to the module to capture image and video. Captured Image and Recorded video can be sent to the nearest Police Station or hospital or it can be directly uploaded to the internet. Further, a Relay could be used to turn off the vehicle using a spark plug. An alarm system is attached to intimate the condition of the vehicle and its passengers.

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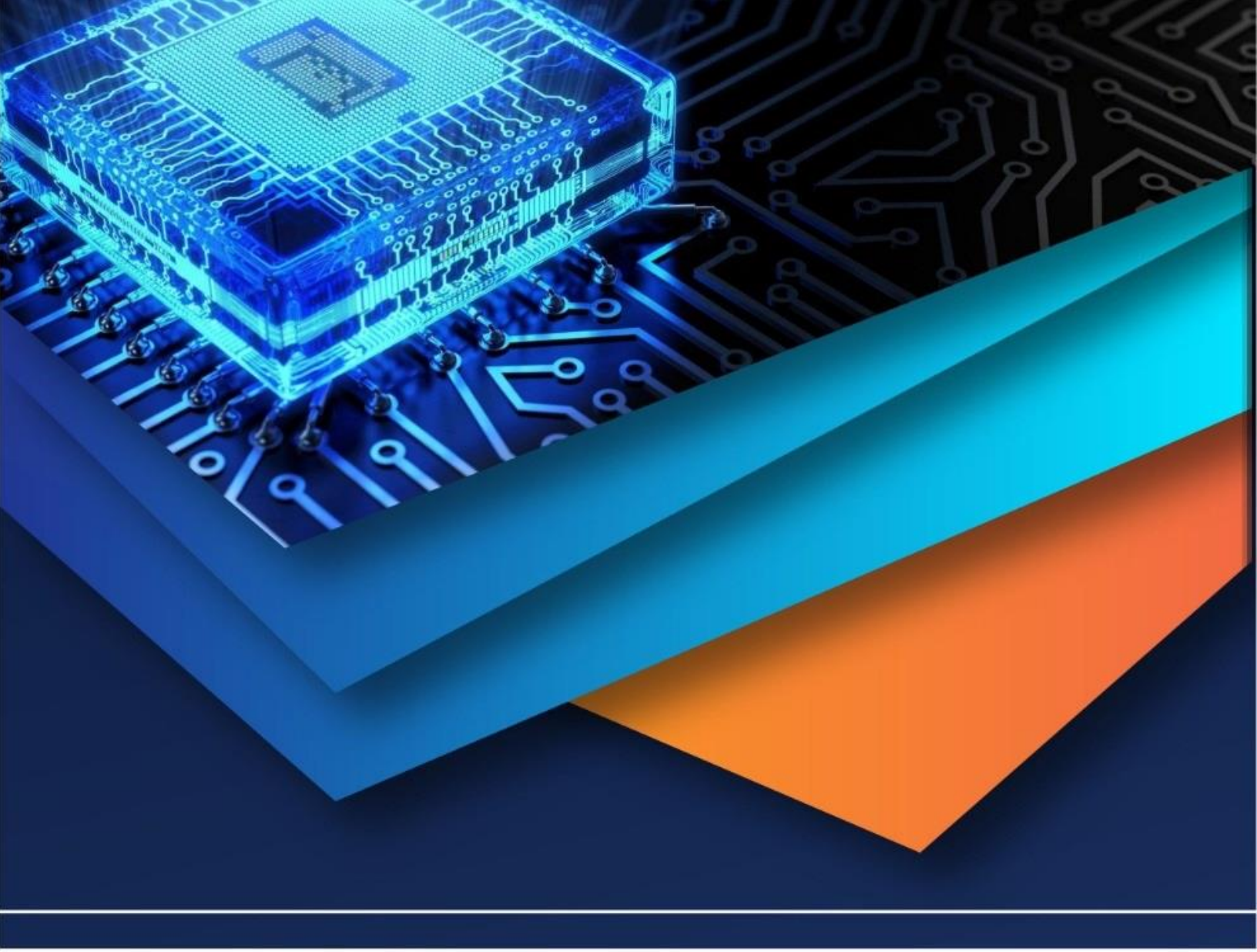
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