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Vehicle Alerting and Accident Detection System at Hairpin Bend Curves Using IOT

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Abstract: ***In the developing countries accident is the major cause of death. "Speed Kills", but still people don't care enough to act safe while driving on road. Road traffic accidents and deaths caused by them are most critical issues now days. It is also impacting the country's economy. According to Million Death Study (MDS) about 2.3 million people die in India per year. In that 137 thousand is because of road accidents. That is about 377 people per day. In that 3.7% because of failed to look the road. We can see that many of them are curve roads. In the mountain roads there will be tight curves and the roads will be narrow. In these kinds of situations the driver of a vehicle cannot see vehicles coming from opposite side on the roads. Thousands of people lose their lives each year because of this problem. Since we are talking about mountain roads here other side might lead to a cliff and heavy bends. The solution for this problem is alerting the driver about the vehicles coming from opposite side in Ghats sections. This is done by keeping an ULTRASONIC SENSOR on one side of the road before the curve and keeping a LED light after the curve, so that if a vehicle comes from one end of the curve, sensor senses and LED light glows at the opposite side. By looking at the LED light on/off criteria driver can be alert and can slow down the speed of the vehicle.***
Keywords: MDS, Ultrasonic Sensor, Ghats,

I. INTRODUCTION

In present days the rate of accidents is increasing rapidly. To reduce the accident rate in the country, automatic alert system for vehicle accidents is introduced. Ghats Roads are access routes into the mountainous with number of hairpin bends, which is very risky as compare to normal routes. So chances of accidents in Ghats section is more because of narrow road width, sharp bends, improper camber, valley side etc. While driving on roads at Ghats section many drivers faces accident which results them into serious injuries or even death. When an accident occurs the message is sent to the registered mobile through GSM module in less time. Vibration sensor will be activated when the accident occurs and the information is transferred to the registered number through GSM module. GPS system will help in finding the location of the accident spot. The proposed system will check whether an accident has occurred and notifies to nearest medical centres, police station and registered mobile numbers about the place of accident using GSM and GPS modules. The location can be sent through tracking system to cover the geographical coordinates over the area. The accident can be detected by a vibration sensor which is used as major module in the system. The present technology Internet of things (IOT) has brought fine changes into every portion of our life by making it smart. With the dynamic changes in the models of the vehicles the roads need to have same ability to face them. Evolving towards the future, the road needs to build with advanced sensors and antenna systems to provide a pace with the new era. The design involves the road side units as part of sensor system involving IOT.

A. Problem Statement

While driving on roads at Ghats section many drivers faces accident which results them into serious injuries or even death. The main reason behind this accident is curves and bends of roads while turning in Ghats. It becomes difficult to see vehicles coming from other lane and turning drivers usually have to assume a way for turning at such critical section. This creates a great risk of life, other reason for accident in Ghats section is that only one vehicle can turn at turnings at a time. If two vehicles comes face to face while turning it creates a chance of accidents and it becomes difficult to handle. It becomes more difficult at night to make a turn as vehicle coming from another side of road is not visible due to obstruction and darkness.

B. Objectives

The main goal of our project is to alert the vehicles in Ghats section and automatic detection of accidents. In order to attain the goal, the following objectives have been framed:

1) To provide safe & secure journey while travelling to the Ghats roads, Hill Stations, etc.
2) To take the immediate safety measures in case of accidents at hairpin bend roads.
3) To send the location and alert message in case of accident occurred to the respective registered person number.

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C. Proposed System

In the proposed system, we are using ultrasonic sensor to sense whether the obstacle is present are not. The Arduino will receive the data from ultrasonic sensor. If the obstacle is present on the road, siren and LED will alert the drivers coming on from the other side. Here we are using LED to stop the vehicle. In case of accident, the GPS receives the location of the vehicle that met with an accident and gives the information. This information will be sent to a registered mobile number, nearby hospital and police station for further action.

II. LITERATURE SURVEY

In the Sensor based accident prevention system and diminishing road accidents on sharp curves using Arduino (Ranga Sreedhar Galla, et.al., November 2017) proposed a system to decrease the number of accidents in curve roads. This was done by alerting the driver by means of LED light which glows when vehicle comes from the other side of the curve. The vehicle is detected by the help of Ultrasonic sensor which was interfaced to the microcontroller Arduino UNO. However sensor based light system is implemented using wire which is difficult to maintain. In this paper they used Arduino and wired technology..

Advance road safety for Ghats's roads at hairpin bend (Harshada Targe et.al. Jan-2018) proposed a technique consisting of two CCTV cameras and two LCD screens which displays the live scene captured from the CCTV. But this system is the initial cost price of camera is high moreover the installations of CCTV camera may also increase the initial expenditure depending upon the complexity of the CCTV camera system. The CCTV camera system can only monitor a limited area and CCTV camera might not catch all activity due its positions. In this paper they used Arduino with CCTV and LCD technology.

In Vehicle Accident Detection and Reporting System Using GPS and GSM (Ravinra wakole et al., 2014) implies system which is a solution to this drawback. Accelerometer sensor can be used in car security system to sense vibrations in vehicle and GPS to give location of vehicle, so dangerous driving can be detected. When accident occurs, Accelerometer will detect signal and will send signal to AVR controller, microcontroller will enable airbag to blow and message with accident location is sent to preprogrammed numbers such as ambulance, police station, etc via GSM.

In Automatic Vehicle Accident Detection and Reporting with Black Box (Mazher Iqbal and S. Heena Kousar, 2015) mentioned an automatic vehicle accident detection and reporting System using black box. The proposed system use ARM controller, black box, LCD, GPS module and GSM modem. This framework is placed in moving vehicle to detect accident and report to In Case of Emergency (ICE). In case of accident ARM controller communicate with GPS module in prefixed terms and sends the vehicle location information such as Latitude and Longitude to first responder over GSM. The proposed systems gather position information to manage focus using GPRS by Google Earth. MEMS sensor detect the surplus vibration in case of accident and activate the above framework send the message to specific server and Black box. The Black box records the voice at that instant. The recorded voice in Black box is exceptionally helpful for identifying the cause of accident.

III. SYSTEM DESIGN

A. System Architecture

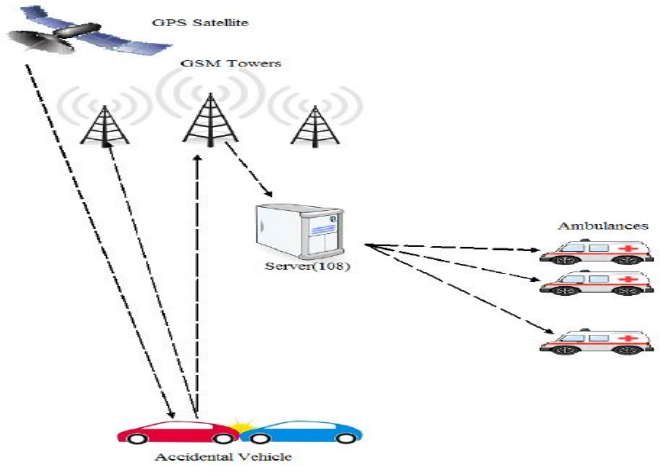


Fig. 1 Architectural diagram for Architecture of proposed Accident detection System

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The figure 1 depicts the architectural diagram of Accident detection system. The Accident detection and Tracking System is the system which track vehicle current location using global positioning system (GPS).This product gives the live updates of accidental vehicle with their location details. It ensures the vehicle which has got accident to send location details to specified mobile numbers and as well as display it on map. As per the system architecture, Accident detection and Tracking System is working same as follows. When the accident will occurred, then the system will direct send the accident detection message along with location details of the accidental vehicle to emergency dispatch sever further it will send that alert message to the specified mobile number. By using system like this we can decrease the mortality rate which is led by accident.



Fig. 2 Architecture of Proposed Ghats Alert system

The figure 2 depicts the architectural diagram for Ghats alert system. Ultrasonic sensor, sensing distance with the help of duplex communication. We are alert the driver by blinking LED and BUZZER. The Alerting system in Ghats's section system is able to transmit data which is sensed from other side of the road using ESP32 transceiver as a wireless transmission technology. The system is completely integrated and can give alert to the driver by using buzzer and led. This system helps to detect the vehicles by Using the Ultrasonic Sensor. This system provides the information about the vehicles coming from the opposite side of the vehicles in the Ghats section. This system is useful when the driver can't see the vehicle in the opposite side of the vehicle because of long curve roads in the Ghats section. Thus the system provides the safety and security to the driver.

B. Flowchart

This proposed system is a prototype model of Accident detection and Vehicle Tracking System using GSM and GPS modem and Arduino working will be made in the following steps:

1) An accelerometer sensor will first sense the occurrence of an accident and give its output to the controller.
2) The GPS detects the latitude and longitudinal position of a vehicle.
3) The latitudes and longitude position of the vehicle is sent as message through the GSM. Whenever an accident has occurred the position is detected and a message has been sent to the pre-saved static IP address.

Figure 3 shows the flowchart of proposed accident detection and tracking system. Figure 4 shows the flowchart for ghats alert system.

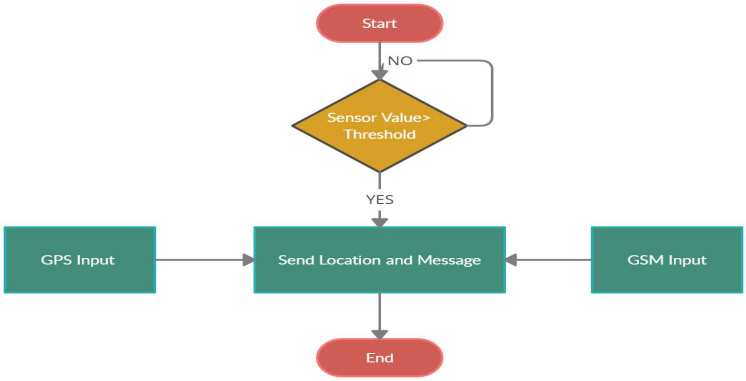


Fig. 3 Flowchart of Accident detection proposed system

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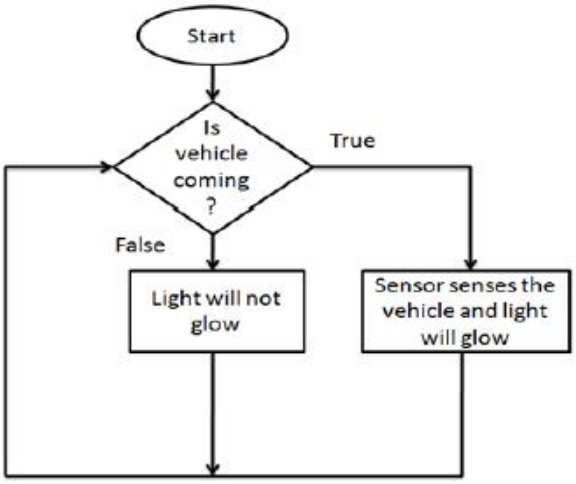


Fig. 4 Flowchart of ghats alert system

IV. IMPLEMENTATION

A. *Methodology Of Accident Detection and tracking System*

Figure 5 shows the circuit diagram of accident detection and tracking system. It is implemented in following two steps:

1) *Step 1:* Detection of Signals from vibration sensors. Whenever the accident (crash) occurs or tilting of car takes place, accelerometer gets activated. The signals from these sensors are sent to the control unit. The sensors are calibrated in such a way that if the i/p signal value (here tilting angle) exceeds certain predefined value, the CU sends the signal to the GSM module.
2) *Step II:* Detection of location and sending those locations via GSM message. The GPS module keeps on continuously recording the location co-ordinates. Whenever the accident occurs the CU detects whether the signals i/p value are within the limited value provided while the CU is being programmed. If the values (tilt angle) are greater than the given value, it indicates that the accident has occurred. The MCU sends the detected co-ordinates through the GSM module in the form of SMS service. CU is also programmed in such a way that mobile numbers of one or two relatives or friends of the driver is added to the list of persons to whom the SMS should be delivered. The message is sent to the registered mobile numbers. Co-ordinates of the place are sent in the form of Latitude and Longitude.

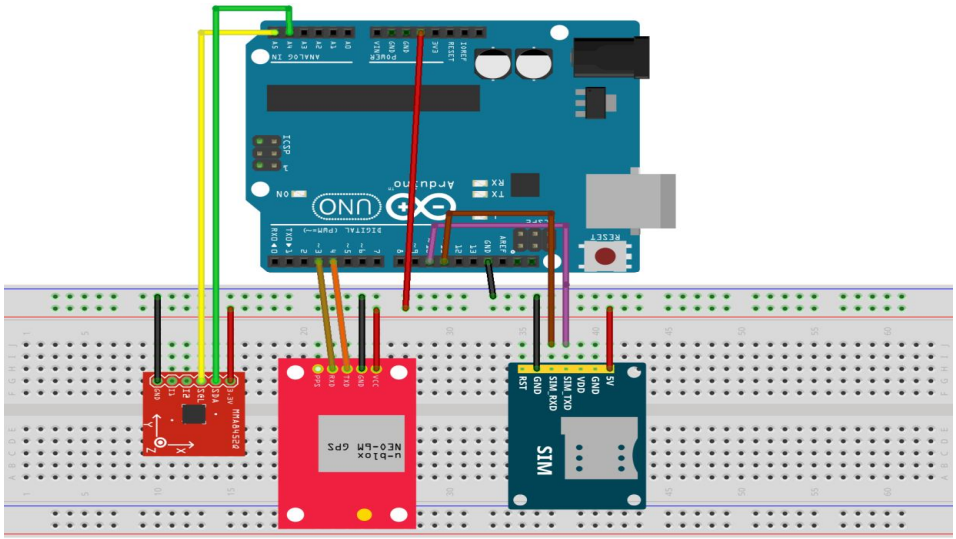


Fig 5 Circuit diagram of proposed accident detection system

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B. Methodology Of Proposed Ghats Alert System

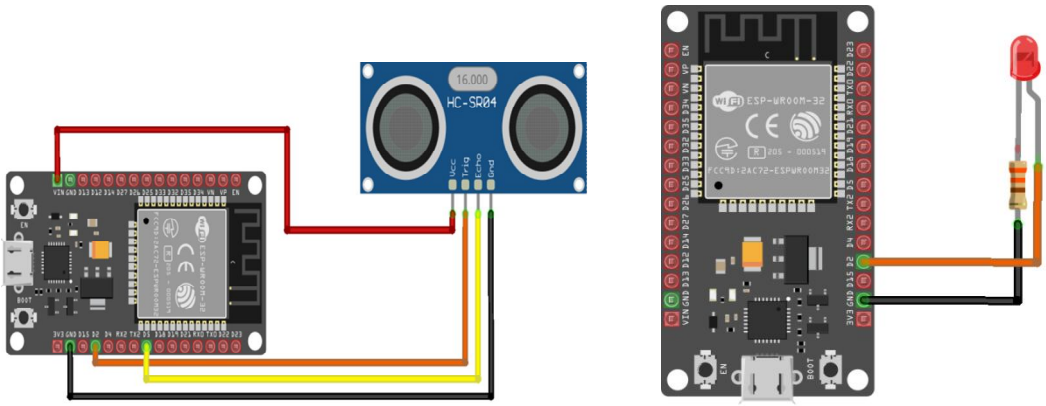


Fig 6 Circuit diagram of proposed ghats alert system

Figure 6 shows the circuit diagram of ghats alert system. Ultrasonic sensor has 4 pins. They are +5V VCC, GND, Trig pin and Echo pin. Here Trigger pin is output pin and Echo pin is input pin. Ultrasonic sensor sends the signal in the form of pulses from trigger pin. When this signal hit the object it will get reflected back and is received by the echo pin. From echo the signal is sent to ESP32 control unit.

For implementation of the connectionless communication between two ESP32 we use ESP-NOW protocol. ESP-NOW is a connectionless communication protocol developed by Espressif that features short packet transmission. This protocol enables multiple devices to talk to each other without using Wi-Fi. This is a fast communication protocol that can be used to exchange small messages (up to 250 bytes) between ESP32 boards.

ESP-NOW is very versatile and you can have one-way or two-way communication in different arrangements. The pairing between devices is needed prior to their communication. After the pairing is done, the connection is safe and peer-to-peer, with no handshake being required. This means that after pairing a device with each other, the connection is persistent. In other words, if suddenly one of your boards loses power or resets, when it restarts, it will automatically connect to its peer to continue the communication.

V.RESULTS AND SCREENSHOTS

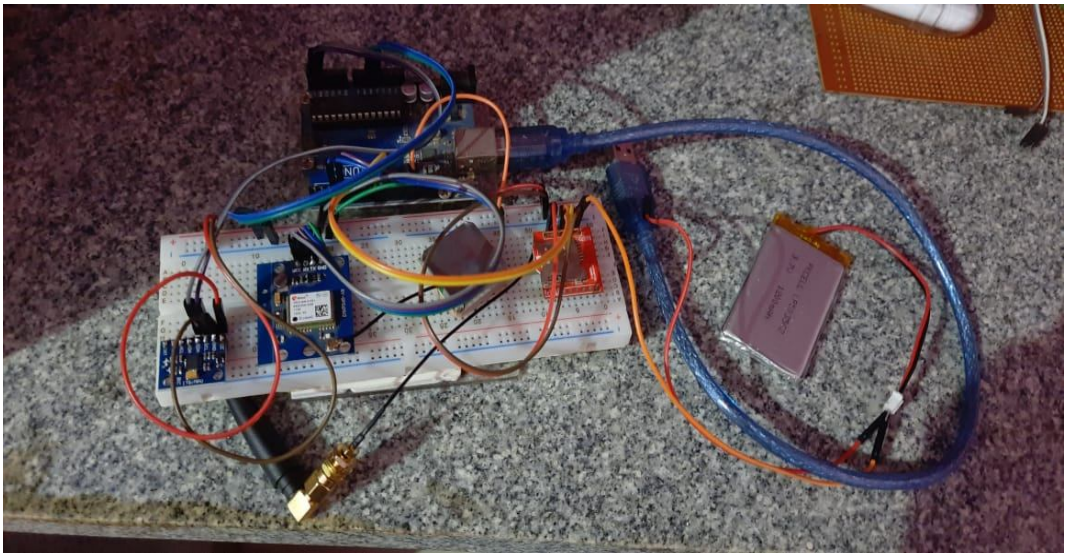


Fig 7 Module of proposed Accident Detection System

The figure 7 shows the accident detection system module in which Arduino acts as control unit. Accelerometer, GPS and GSM are interfaced with the Arduino. For testing purpose we just tilt the module and values of accelerometer is accessed by the Arduino when the values cross the threshold value, Control unit will alert GSM to send the message.

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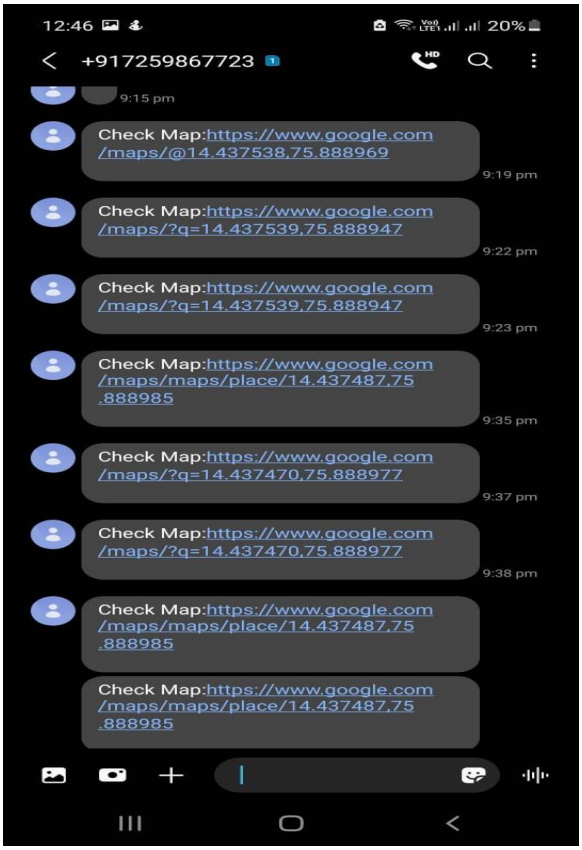


Fig 8 Messages received in the specified mobile through GSM

Figure 8 shows the text messages received when the accident occurred. Clearly it is seen that the text message consists of the coordinates in the form of Latitude and Longitude.

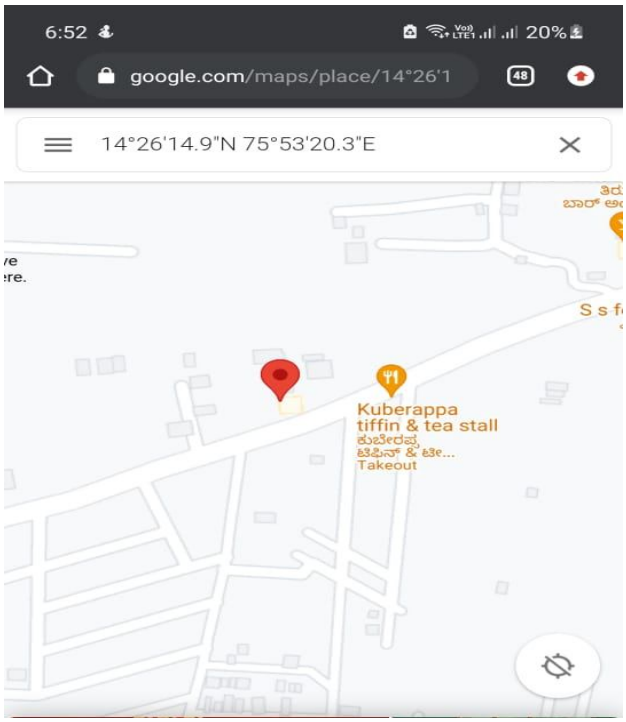


Fig 9 Location of accident identified in google map through GPS

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Fig 10 Ghats alert system proposed model

The above figure 10 shows our ghats alert system model. When the vehicles comes infront of ultrasonic sensor, the ESP32 send the message to the another ESP32 which is located on the other side of curved road to on the light. In the above figure blue light is on to show that vehicle is coming on the other side of curve.

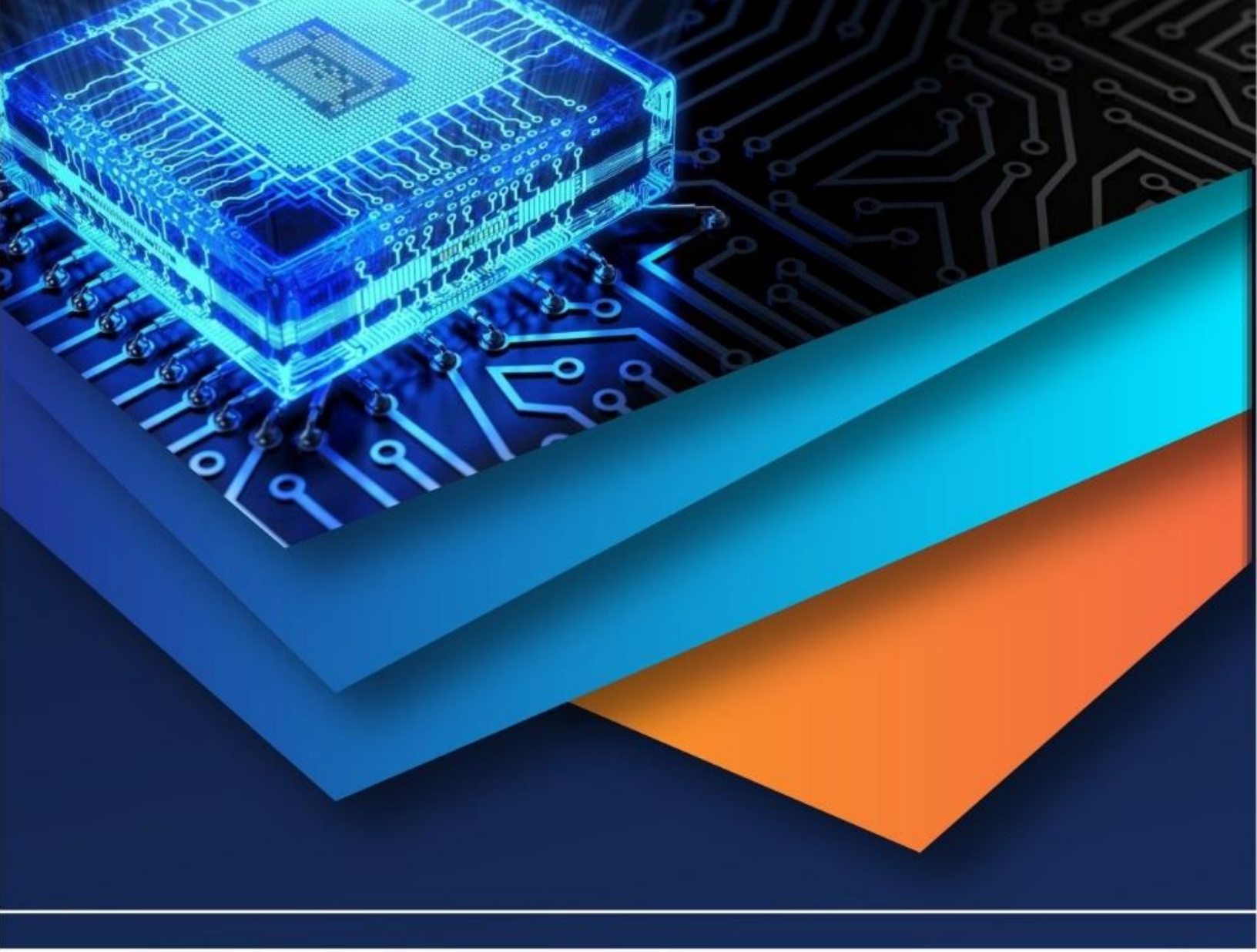
VI. CONCLUSION

This section summarizes and concludes the contributions made by our project. The aim of our project is to decrease the number of accidents in curve roads and also to detect the accident location. This is done by alerting the driver by means of LED light which glows when vehicle comes from the other side of the curve. The vehicle is detected by the help of Ultrasonic sensor which is interfaced to the control unit. Also the detection of accident location is done by interfacing GSM, GPS and accelerometer to control unit. The cost of developing proposed system is low as different modules like GPS Module are already available in the vehicle so it can be said that as far as the power consumption and money saving aspects are considered it is in turn a low power consuming and a much cost effective device which in turn has no negative effect on the vehicle's performance and is easily deployable in it. Our developed system possesses high reliability and in most of the cases the results obtained were quite accurate. Hence this device can become a boon in Transportation systems as this can bring down the mortality rate in turn effectively.

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