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Electronic Control Module Subset for a Vehicle

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Abstract: The project proposes a safety and alert system which sets out to address problems faced by the vehicle at the time of pre-accident and post-accident and make the vehicle more sound in safety culture in regards to responding to the accidents. The proposed system consists of 4 features. Firstly, a Collision detection system is a part of a safety feature that warns drivers in the event of an imminent collision. When this system-equipped vehicle comes too close to another vehicle in front of it, a visual, audible, and/or tactile signal occurs to alert the driver to the situation and it also detects if the accident had happened or not. Secondly, the Collision Avoidance System is also a part of the Safety system which helps in avoiding the collision when no response is there from the driver when an alert is given. Thirdly, the Electronic Gyro Engine Kill Switch which is part of post-accident safety which turns off the engine and disconnects the battery so that there is no current flow at the time of the rollover. The collision, roll-over, and pitching of the vehicle are detected by a group of piezoelectric sensors and gyroscope and accelerometer module (M.P.U. 6050). Fourth and the last feature is an accident alert system that is used to trigger the standalone-GPS Module which provides the coordinates to the emergency service operator & the emergency contact mentioned by the owner of the car. The location is sent through a GSM module with the location, Car Number, and impact area in form of a message. The complete system is analyzed & designed using Proteus, Arduino IDE, OpenCV, and Raspberry Pi. The proteus is used to design the circuitry, run the virtual simulation of the circuit, and also used it to obtain data sets so that the errors can be rectified. Arduino IDE is used for the coding part of the microcontroller. OpenCV and Raspberry Pi are used for the Image Processing part.

Keywords: Image Processing, Raspberry Pi, Arduino, Vehicle Safety, Open CV, Canny Edge Detection

I. INTRODUCTION

A road traffic injury is defined as "a fatal or non-fatal injury sustained as a result of a collision or event involving at least one road vehicle in motion on a public or private road to which the public has right of access, resulting in at least one injured or killed person." In society, these accidents are regarded as unavoidable and a natural part of life, occurring at random. But in reality, these are results of a complex set of interactions among the public with their vehicles and the prevalent environmental conditions along with the existing legal provisions. Many times, road traffic accidents are preventable. Road traffic injuries take the lives of nearly 1.3 million people every year and at the same time injure 20-50 million people. According to World Health Organization (WHO), it is the leading cause of death for people aged 15- 29 years. Road traffic injuries are expected to be among the top five major causes of death by 2030. After a vehicle accident, you are likely to experience a wide range of emotions. You might be terrified, perplexed, or even angry. These are quite natural emotions. Accidents involving motor vehicles are unforeseeable. They are something that every driver hopes to never have to deal with. Thousands of accidents occur every day, unfortunately. Underdeveloped and developing countries which constitute 82% of the world population bear a heavy economic toll of about 3% of their GDP due to Road Traffic Accidents (RTA). 90% of road traffic accidents occur in these countries where the level of motorization accounts for 54% of world registered vehicles. India, a rapidly developing country with expanding economy has one of the highest motorization growth rates which is accompanied by rapid expansion in road networks and urbanization. As a result, the country is dealing with a variety of difficulties and consequences related to RTA and road safety. In the year 2015, the total number of RTA was 5,01,423 with an increase of 2.5% in 2014. In the year 2015, these accidents claimed the lives of 1,46,133 people. According to published data, 29.9 percent of people died in accidents in India in 2015. Furthermore, on average, 1374 accidents and 400 deaths occur on Indian roads each day, resulting in 57 accidents and the loss of 17 lives every hour in our country. As of 2015, the total number of registered motor vehicles was 2,10,023,000. During the same year, the road length was 54, 72, 144 kilometers. These road networks consist of national highways, state highways, district roads, rural and village roads. Simultaneously the composition of the vehicular population as registered were two-wheelers (73.5%) followed by cars, jeeps, and taxis (13.6%), goods vehicle (4.4%), buses (1%), and other vehicles (7.5%). This result in 167 vehicles per thousand people with a dramatic increased from 8 per thousand people in 1981. The economic loss to the country due to road traffic accidents is 3.7% of GDP. An important reason for the neglect of road traffic accidents in public health is the concept that accidents and injuries are random events. Such occurrences are seen as unavoidable. They are seen as unplanned, unavoidable, and unpredictable events that cannot be avoided.

The primary cause of road traffic accidents in India is driver's negligence (77.1 percent). Other causes include weather conditions, malfunctioning automobiles, poor road conditions, and so on. As engineers, it is our responsibility to deliver new technology to society for the welfare of all, but it is also our concern to seek the need for reduced human efforts in areas where human health is at risk. The Major objective of this project is to design a safer traveling system & the project proposes a safety and alert system which sets out to address problems faced by vehicle accident victims and make the vehicle more sound in safety culture in regards to responding to the accidents.

Other Major Objectives are as follow:

1) To develop a cost-effective kit to operate in the car without any compromise in the pre-built & to maximize the passenger's safety.
2) To develop a capable industrial level project for major safety improvises in the vehicle & to study its implementation.
3) To utilize the power source present in the car.

The project includes the design & implementation of software for an ECM (Electronic Control Module) Subset of the car which increases safety & alert to the knowns of the victim.

a) Study of the possible categories (Based on Car safety) to lay an outline on the modification of current safety protocols of cars.
b) Creating a stable & cost-effective mechanism for the car.

The Electronic Control Module subset of the vehicle focuses on accident and collision safety. To do so, it consists of 4 modules which are as follows:

- Collision Detection System
- Collision Avoidance System
- Electronic Gyro Engine Kill Switch
- Accident Alert System.

II. LITERATURE REVIEW

Distance measurement of an item is utilized in numerous applications such as automobile control, medical applications, robotic movement control, and so on. This can be accomplished with a variety of sensors, including ultrasonic, infrared, radar, and laser. Ultrasonic sensors are the least expensive and have the highest dependability of any measurement method [1].

The location of strategic piezoelectric sensors on the structure and an electronic-computerized system has allowed us to determine the instant and position at which the impact is produced [2].

The Hough transform method is used to detect lanes on the OpenCV platform, and the canny edges detector is used to detect edges. The results prove that the real time-based lane identification and tracking are done efficiently. For both straight and curved roadways, the lane is correctly detected. The necessary indication is given to the driver in case of the vehicles try to depart the lane. The proposed techniques for the lane departure warning system are also successfully checked with captured videos [3].

Using Geographical Positioning System (GPS) and Global System for Mobile Communication (GSM) technology in the system aids in displaying the object's traveling path on the monitor and communicating the same information to the user's cell phone on demand by demanding the specific information via SMS. This device is extremely valuable in automobile theft situations, as well as for teenaged drivers who are being observed and tracked by their parents. The outcome demonstrates that the object is being tracked with little tracking error [4].

III. TECHNOLOGY USED IN SYSTEM DESIGN

Components and technology used in the system are as follows:

A. *Piezoelectric Sensor*

A Piezoelectric Sensor requires no external voltage or current source, they can generate an output signal from the strain applied. This makes them a popular choice for many applications. The use of them is growing significantly throughout different industries and they are sometimes incorporated into other sensors. “Piezoelectric” is Greek for “press” or “squeeze” so a piezoelectric sensor effectively measures compression using the piezoelectric effect.

A piezoelectric sensor converts physical parameters - for example, acceleration, strain, or pressure into an electrical charge which can then be measured. They are highly sensitive and very small in size making them well suited to everyday objects.

B. Ultrasonic

An ultrasonic sensor is an electronic device that detects the distance between two objects by producing ultrasonic sound waves and converting the reflected sound into an electrical signal. Ultrasonic waves travel at a quicker rate than audible sound (i.e. the sound that humans can hear). The transmitter (which generates sound using piezoelectric crystals) and the receiver are the two primary components of ultrasonic sensors (which encounter the sound after it has traveled to and from the target). The transmitter (which generates the sound using piezoelectric crystals) and the receiver are the two basic components of ultrasonic sensors (which encounter the sound after it has traveled to and from the target). To compute the distance between the sensor and the item, the sensor measures the time it takes from the transmitter emitting sound to making contact with the receiver. D = 1/2 T x C (where D is the distance, T is the time, and C is the sound speed of 343 meters/second) is the formula for this computation. For example, if a scientist aimed an ultrasonic sensor towards a box and the sound bounced back in 0.025 seconds, the distance here between the ultrasonic sensor and the box might be 4.2 m. Ultrasonic sensors are mostly utilized as proximity sensors. They can be seen in self-parking technology and anti-collision safety systems in automobiles. In addition to robotic obstacle detection systems, ultrasonic sensors are used in manufacturing technology. Ultrasonic sensors are less susceptible to interference from smoke, gas, and other airborne particles than infrared (IR) sensors in proximity detection applications (though the physical components are still affected by variables such as heat).

C. Raspberry Pi

The primary processing of our system is Raspberry Pi. Image frames captured by Pi cam go through different algorithms which help us to find out the lane markers. The python OpenCV library is used to implement the image processing algorithms. The prototype's present position is then calculated, and the steering direction is plotted. The PID algorithm regulates motor speed and, as a result, motion direction. Various components of our system are described in detail in the following sections. The Raspberry Pi single-board computer serves as the central module of the entire embedded image collecting and processing system. The main signal processing chip unit used in Raspberry Pi is Broadcom 2836 900MHz Chip in which CPU is a 32-bit ARM Cortex A7 processor. The webcam utilized in the project is an Intex IT-305WC. The Raspbian-wheezy operating system image is installed on the Raspberry Pi, which is a Linux version. The operating system is a collection of fundamental utilities and programs that enable Raspberry Pi to function as a standalone computer. The operating system on the Raspberry Pi board is installed with the help of a Micro SD Adapter and a class 4 8GB Samsung Micro SD Card. Then, using a Micro SD card, OpenCV is installed on Raspbian-wheezy.

D. Pi Camera Module

The Pi camera module is a small, lightweight camera that works with the Raspberry Pi. It communicates with the Raspberry Pi through the MIPI camera serial interface protocol. It is most commonly utilized in image processing, machine learning, and surveillance projects. Because the payload of the camera is so small, it is widely employed in surveillance drones. Apart from these modules, Pi may also use standard USB webcams that are connected to a PCl.

E. Arduino Mega 2560 Board

The Arduino board is an open-source microcontroller board based on the Atmega 2560 microcontroller. This board's growing environment runs the processing or wiring language. These boards have revitalized the automation sector with their simple-to-use platform, where anyone with little or no technical background may begin by learning the basic required skills to program and run the Arduino board. These boards are used to extend distinct interactive items, but we can also link to software on your PC such as Max MSP, Processing, and Flash.

The ATmega2560 microcontroller is used in microcontroller boards such as the "Arduino Mega." It has 54 digital input/output pins, 16 of which are analog inputs and 14 of which are utilized as PWM outputs, 4 hardware serial ports (UARTs), a crystal oscillator-16 MHz, an ICSP header, a power jack, a USB connection, and an RST button. This board primarily covers everything required to support the microcontroller. As a result, this board's power supply can be accomplished by connecting it to a PC via a USB cable, a battery, or an AC-DC adapter.

A base plate can be used to shield this board from an unexpected electrical discharge. The Mega 2560 R3 board's SCL and SDA pins are connected to the AREF pin. In addition, there are two most recent pins near the RST pin. The IOREF is a single pin that allows shields to modify the voltage supplied by the Arduino board.

Another pin is not related and is saved for future use. These boards operate with any old shield but can be adjusted to function with newer shields that use these extra pins. The Arduino board is a free and open-source microcontroller board based on the Atmega 2560 microcontroller. This board's growing environment performs the processing or wiring language.

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F. MPU 6050

IMU sensors such as the MPU 6050 are utilized in self-balancing robots, UAVs, cell phones, and other applications. IMU sensors assist us in determining the three-dimensional position of an object attached to the sensor. These values are usually in angles to help us to determine its position. They are used to detect the orientation of cell phones or in wearable devices such as the Fitbit, which uses IMU sensors to track movement.

IMU sensors have a wide variety of uses and are even thought to be an essential component in quadcopters.

1) ADXL 345 accelerometer
2) ITG 3200 gyroscope
3) Spark fun 6 DOF IMU sensor board
4) MPU 6050

They are, however, not as accurate on their own as they are when paired. Among the lot, the Intenseness MPU 6050 to be the most reliable and accurate IMU sensor. The MPU 6050 not only costs less than the other sensors, but it also performs better.

G. Kalman Filter

The filter is an algorithm used to reduce the error which is induced in the system due to the forces that are present such as inertial forces. This minor force disrupts the measurement, and because these forces are on the accelerometer, a low pass filter is needed for the corrected result.

There are 2 types of filters commonly used along with the complementary filter and Kalman filter. A complementary filter is used when a long-time integral is needed has a total gain of one and is made up of a high pass filter and a low pass filter. This is useful in high-frequency noise and can give good results in that situation. Whereas Kalman filter works on the prediction of value based on the past value as it compares the current value with the previous value and based on its error it guesses the upcoming value and this is a very good model for the object continuously changing its values.

H. GPS (Global Positioning System) Module

The United States Department of Defense created the Global Positioning System. It employs 24 to 32 Medium Earth Orbit satellites to send precise microwave signals. GPS receivers can use this information to establish their current location, time, and velocity. The United States Air Force maintains GPS satellites. Civilians commonly use GPS as a navigation system. Any GPS receiver on the ground contains a computer that "triangulates" its position by taking bearings. Civilians frequently utilize GPS as a navigation method. Any GPS receiver on the ground contains a computer that "triangulates" its position by taking bearings. from at least three satellites. The answer is delivered in the form of a geographic position - longitude and latitude - to within 10 to 100 meters of precision for most receivers. These coordinates can then be used by software applications to provide driving or walking instructions. Getting a hold of GPS receivers on the ground normally takes some time, especially if the receiver is in a moving vehicle or crowded urban areas. The initial time required for a GPS lock is usually determined by how the GPS receiver boots up.

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I. GSM (Global System for Mobile Communications) Module

The European Telecommunications Standards Institute (ETSI) developed GSM (Global System for Mobile Communications) to establish protocols for second-generation (2G) digital cellular networks used by mobile phones. General packet radio service (GPRS) is a packet-oriented mobile data service available on the 2G and 3G cellular communication systems' worldwide system for mobile communications (GSM), where protocols refer to a set of invisible computer rules that regulate how an internet document is transferred to your screen and 2G is short for second-generation wireless telephone technology, this provides advantages such as the ability to send text messages, image messages, and MMS (multimedia messages).

In simple terms, GSM is primarily used to transmit one's voice over cell phone networks that use that technology. GSM also introduced several new features, including SMS, international roaming, fax, and data messaging services. Another prominent option was the ability to download ringtones, logos, and photographs, allowing users to customize their phones.

J. Servo Motor

Servo motors are fantastic gadgets that may be directed to a specific position. They often have a servo arm that can turn 180 degrees. Using the Arduino, we can direct a servo to a specific location, and it will do so. Servo motors were first utilized in the field of Remote Control (RC), typically to control the steering of RC automobiles or the flaps of an RC plane. They eventually found applications in robotics, automation, and, of course, the Arduino world. Seven years ago, the first motor I ever connected to an Arduino was a Servo motor. A closed-loop control system is referred to as a servo. To accomplish the desired result, a closed-loop system uses the feedback signal to alter the speed and direction of the motor.

The same principle applies to RC servo motors. It has a tiny DC motor connected to the output shaft via gearing. The output shaft is attached to a potentiometer and drives a servo arm (pot).

The potentiometer gives position feedback to the servo control unit by comparing the motor's present position to the goal position. The control unit corrects the actual position of the motor to match the intended position based on the error.

IV. CONSTRUCTION AND WORKING

“Collision Detection system” is an active safety feature that warns drivers in the event of an imminent collision. When this system-equipped vehicle comes too close to another vehicle in front of it, a visual, audible, and/or tactile signal occurs to alert the driver to the situation. Vehicle collision warning system is developed to detect oncoming collisions between vehicles and to provide dangerous information to alert the driver. A collision indicates a conflict or an intersection between two vehicles’ trajectories in both time and space domains. The system uses Ultrasonic sensors and piezo electric sensors to detect possibility of collision about to happen or collision happed to start the procedure to alert to emergency operators.

To detect the possibility of collision from the vehicle ahead or any object, ultrasonic sensors are used so that they can detect the obstacle distance and alert the driver that the object is ahead or in back from that particular distance and have possibility of collision.

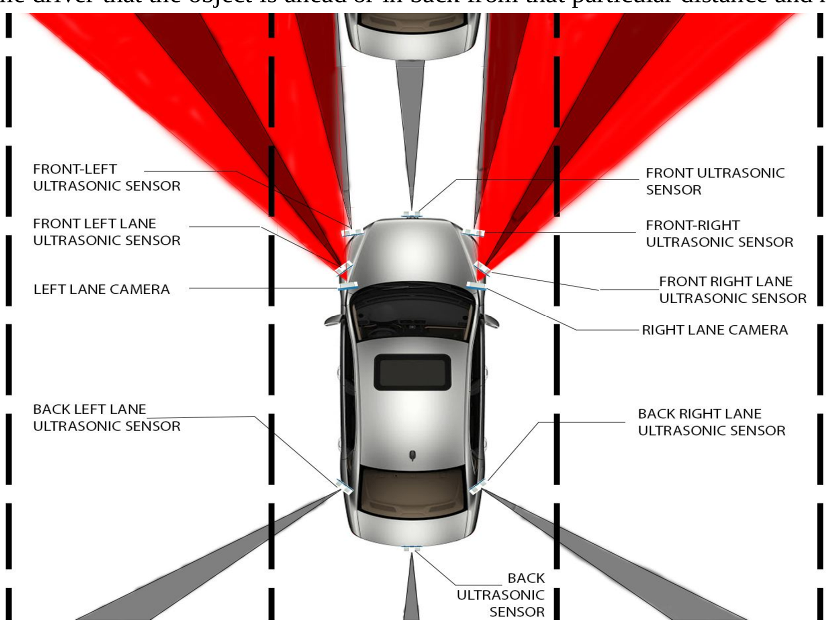

Fig. 1 Placement of Sensors

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When the system alerts the driver about the upcoming obstacle but no action is taken by the driver to avoid it the "Collision Avoidance System" comes into action which helps in changing the lane or apply brakes according to the situation to avoid accident or collision to happen. To do so the system uses ultrasonic sensors and Image Processing to avoid a collision. Image Processing is done to detect and switch lanes easily.

When the distance between the vehicle and object is between 3 to 2 m the collision avoidance system will be activated. The system will check the left lane first because more priority is given to the left lane. After all, slow-moving lanes are left by using ultrasonic sensors, the left lane is checked whether there is an object or not. If there is no object on the left lane the system will turn the car to the left lane. If there is an object or vehicle in the left lane then the system will check the right lane. If there is no object or vehicle on the right then the system will turn the vehicle to the right. If there are objects both in the left and right lane then the vehicle's brake will be applied.

When the distance between the object and vehicle is between 3 to 2 meters. Ultrasonic sensors 4 and 6 will check whether there is an object or vehicle on left. If there is no vehicle in 4m front and 4m back then Arduino sends the command to raspberry pi to start the left camera.

Now Image Processing will start. First, it will convert all pixels to Grayscale then it will 'Smoothen the Images" and use the "Canny Edge Detection" method to bring out the borders between the objects, and ultimately Hough Line Transformation method will be used identifies shapes and lines. After drawing the lines, it will map out the distance as vectors and measure their angles from horizontal. It's a very interesting technique. It adds all the measured angles and predicts the path of the lane.

The angle measured is in Radians not in degrees. The declared threshold value, in this case, is 6.

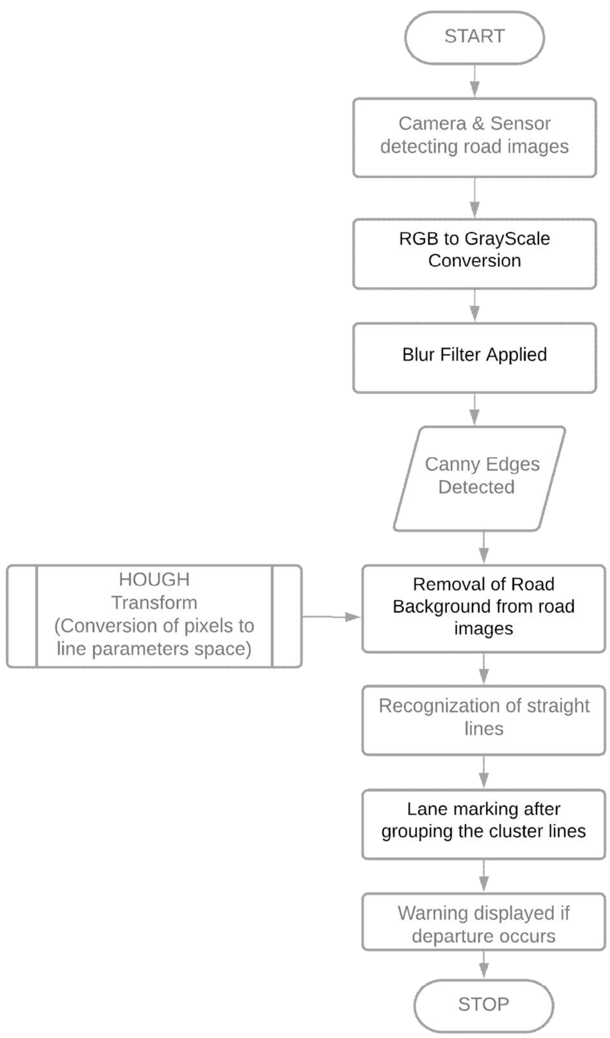

Fig. 2 Flowchart of Image Processing

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As the left camera is seeing all drawn line having less than a 90-degree angle so it will have less threshold. If the threshold is lesser than the declared threshold then using raspberry pi GPIO pins, the signal will be sent to Arduino to take left. When Arduino gets the left signal, it will turn the servo motor to -45 degrees. The servo is connected to the front wheels, it is assumed that if the servo motor turns -45 the front wheel of the vehicle will also move -45 degrees. The vehicle will keep taking a left turn till the left signal is given. When the threshold value is equal to declare threshold the Left and Right GPIO output pins will be set to low, in this condition Arduino will treat it as straight command and will turn the servo to 0 degree which means the front wheel will move to 0 degrees and car will move forward straight in the lane and the collision will be avoided.

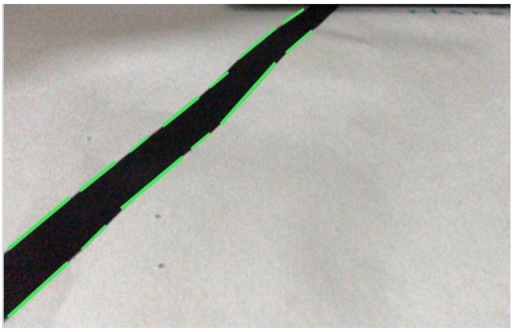

Fig. 3 Left Lane Detection

Fig. 4 Right Lane Detection

If there is an object or vehicle in the left lane then it will check the right lane for the object or vehicle which will be detected by the ultrasonic sensors 5 and 7. If no object or vehicle is detected the same process will be followed but, in this condition, the right camera will be used and the drawn line will be having an angle of more than 90 degrees and will have more threshold than a then declared threshold. If the threshold is more than the declared threshold then using raspberry pi GPIO pins, the signal will be sent to Arduino to take right. When Arduino gets the right signal, it will turn the servo motor to 45 degrees. The servo is connected to the front wheels, it is assumed that if the servo motor turns 45 the front wheel of the vehicle will also move 45 degrees. The vehicle will keep taking the right turn till the right signal is given. When the threshold value is equal to declare threshold the Left and Right GPIO output pins will be set to low, in this condition Arduino will treat it as straight command and will turn the servo to 0 degree which means the front wheel will move to 0 degrees and car will move forward straight in the lane and the collision will be avoided.

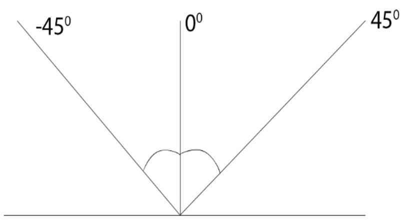

Fig. 5 Servo Movement

If the object or vehicle is there both on left and right lane the brakes will be applied by setting the brakes to pin to HIGH.

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Collision Detection systems and Collision Avoidance systems also offer varying degrees of a brake support. If the system senses that the driver has not responded to the collision warning or the collision avoidance system does not respond due to any case like the object came closer very quickly or the vehicle was moving very fast, the safety system will apply brake force to slow the vehicle. Brake application may not completely stop the vehicle, but it can reduce the speed of the vehicle substantially, thereby preventing a more forceful crash.

Despite this accident happens, which will be detected by the piezoelectric sensor as there will be an impact on the vehicle then the post-accident safety features will come into action. This comprises of two parts firstly, "Electronic Gyro Engine Kill Switch" and Secondly, "Accident alert system". When an accident happens there can be a rollover which can damage the engine and can also generate sparks and cause fire, to prevent it Electronic Gyro Engine Kill Switch is used.

The system works by comparing the current angle with the reference angle and detecting the difference between them usually vehicle topples near 46 degrees or more and at -46 degrees or less. However, it can be used to warn drivers at different angle degrees and notify them. This solely depends on the design of the vehicle as when the C.O.G. of a vehicle comes out of the chassis and contributes its mass to make rollover possible.

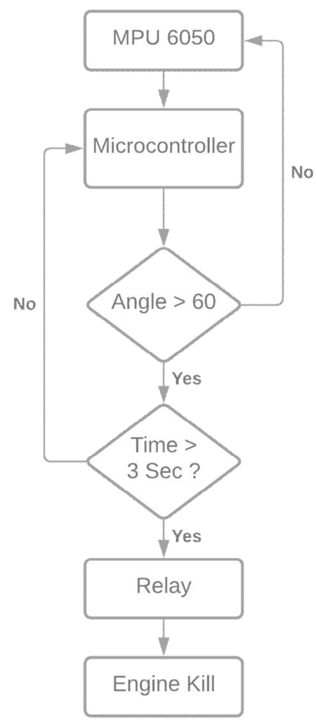

Fig.6 Gyro Kill Switch Flow Chart

Therefore, if roll or pitch angle exceeds 46 degrees or is less than -46, then a rollover should be detected and if the difference between the current angle and the calibrated angle is greater than 46 degrees or the defined angle then the system will check those for 3 sec or given equivalent time that will be used to check whether the situation is under drivers control or not and if not, it will pass a signal to relay that will turn N.O. (normally open) of the relay to close. This will connect the kill wire to the chassis and the engine will get killed.

Initially, the maximum angle of elevation of the vehicle concerning its wheel track and wheelbase is calculated considering the center of gravity (CG) of the vehicle. Then using simulation software, the maximum degree of CG shift in a banked road and the vehicle rolling angle at which the vehicle will roll over leaving the track is plotted in a graph subjecting to different velocities. Hence concerning the graph manually in static the vehicle's balancing point and the maximum angle at which the vehicle will topple is found out using the device (Gyro Scope Embedded) fitted in the vehicle.

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After finding out manually the maximum elevation limit of the vehicle and threshold value is set to alert the driver for safety & caution. A time delay is set for the activation of the kill switch concerning the angle measured when the vehicle is tipped over. Considering the following values, the below-given steps are followed for calibration and installation of the device.

1) The initial step fixes the device in-vehicle mount; the gyro sensor activates once the vehicle battery turns ON.
2) Once the vehicle runs over the track, the gyro sensor continuously generates the angle of degree the vehicle is proceeding.
3) Arduino programming is done according to the specification of vehicle needs concerning the center of gravity of the vehicle, the tilt angle is set for warning indication.
4) Gyro sensor calibrates the angle at which the vehicle is proceeding where when the angle is greater than 46^o and less than 320^o, a warning light is lightened up on the driver dashboard.
5) If the calibrated if roll or pitch angle exceeds 46 degrees or is less than -46 degrees for more than 3 seconds, the relay switch is turned ON which functions to kill the engine.

After the engine is killed the Emergency Distress Message is sent once the Alert system is activated, a distress message pre-defined by the user is sent both to the emergency services as well as the emergency contacts that have been selected by the user. For the exact collection of the accident, the longitude and latitude coordinates of the vehicle are collected using the GPS module and convert these longitude and latitude coordinates in Google Maps. The distress message contains the exact location of the vehicle, Car number, and the impact area. These messages are sent using the GSM module present in the system.

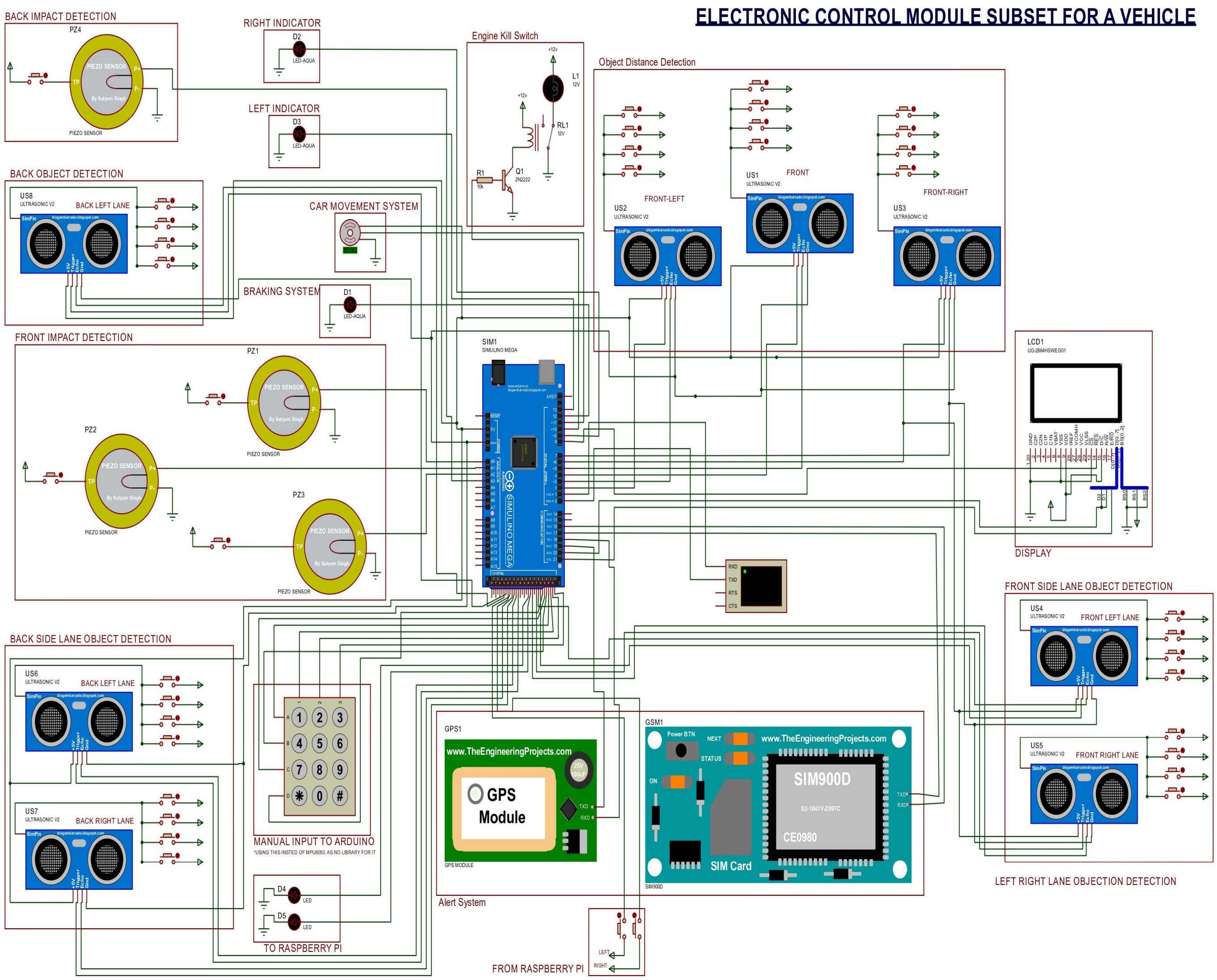

Fig.7 Proteus Simulated Circuit

V. TEST AND RESULTS

D, To obtain the result few tests, were conducted to demonstrate the programming analogy & to derive the output in case of implementation on hardware. Certain Conditions were assumed and standardized & the system was tested for the same. The results are as follows with the tests condition along it: -

While testing the system the following results were obtained. When the system start is continuously monitoring the data from the ultrasonic sensor as mentioned in figure 8.

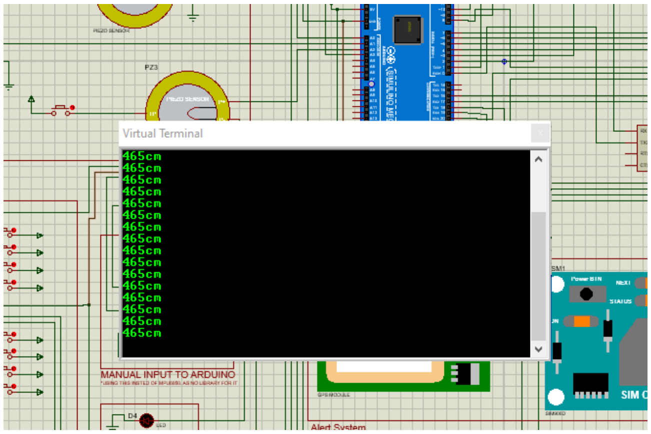

Fig. 8 Distance Measurement by Ultrasonic Sensor

When Ultrasonic detects an object in the range of 4 to 3m (as shown in figure 9) it displays an alert message on the Display embedded in the car (as shown in figure 10).

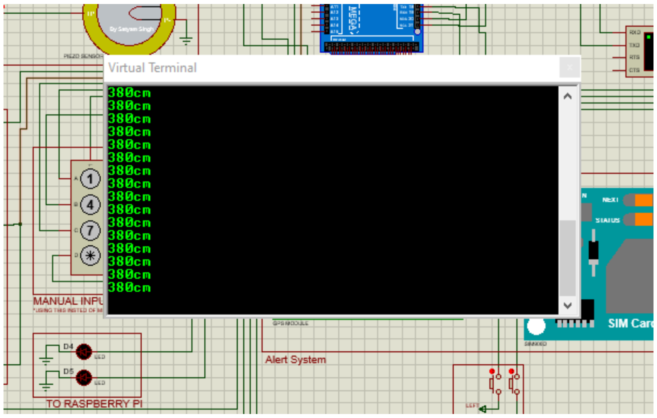

Fig. 9 Distance of car in the range of 4m to 3m

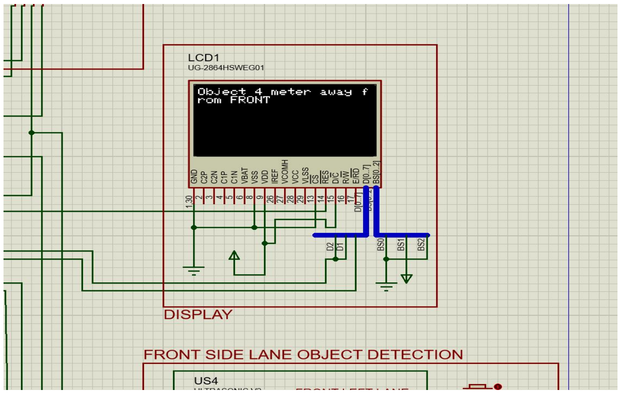

Fig. 10 Action in case of 3m to 4m

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Still, no action is taken by the driver and the range comes in between 3 to 4m then Collision Avoidance System is activated (as shown in figure 11).

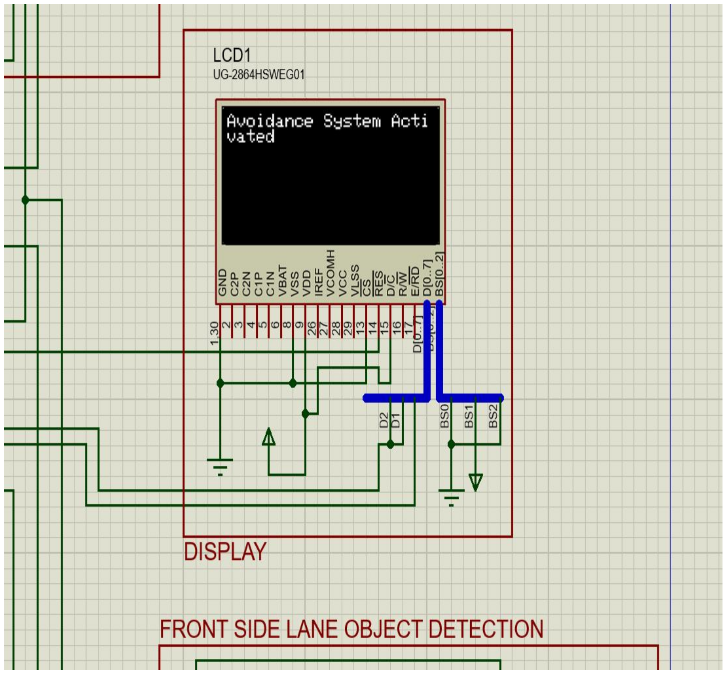

Fig. 11 Avoidance system Activated after the crucial distance

When Collision Avoidance System is activated, it will check the left lane for any obstacle if an obstacle is there then it will check right (as shown in figure 12).

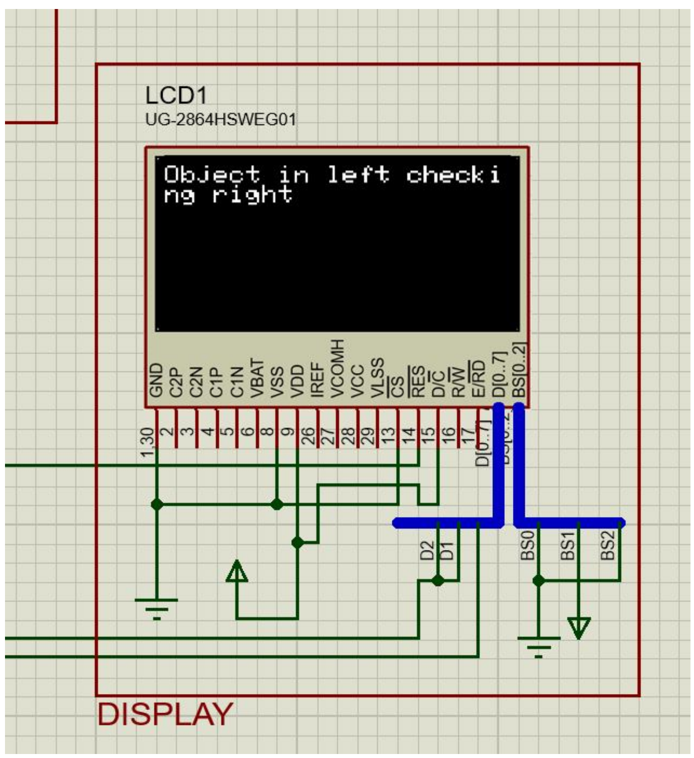

Fig. 12 After Checking Left Lane Checking of Right Lane

If there is no obstacle in the right lane then the system will turn the vehicle in the right lane and the image processing will take place which will detect the lane and it will give the right signal to Arduino till the vehicle full changed the lane and then it will give straight signal so that vehicle moves straight in that lane (Fig. 13 shows the turning right alert in a display of the vehicle).

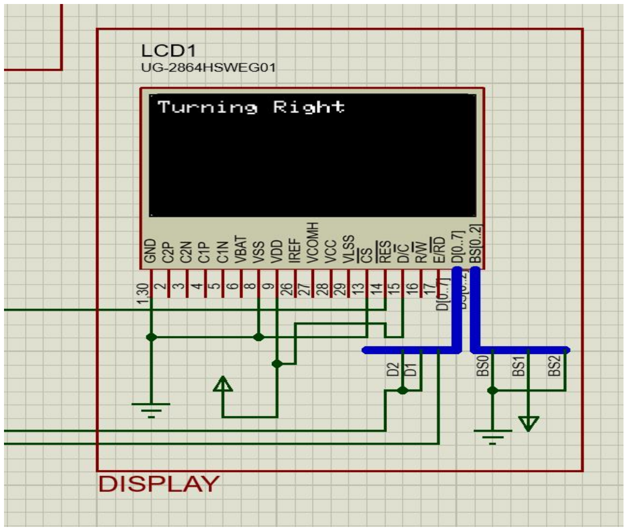

Fig. 13 In Case Right Lane is empty, Turing Right

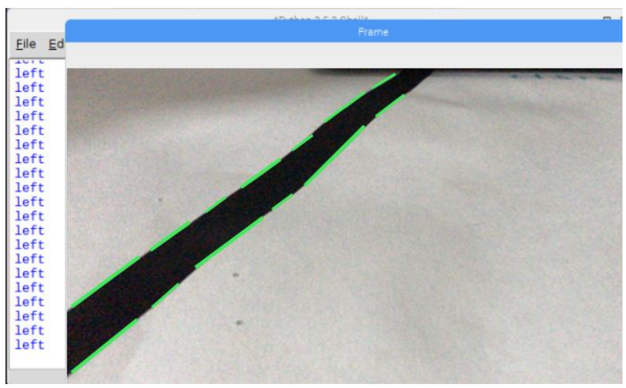

Fig. 14 Raspberry Pie Detecting Lanes for left

If the condition of the left turn is there when no object is there in the left lane the following result will be there from the image processing as shown in fig 14. And if there is object in left lane then right lane will be checked, if it is empty then the following result will be displayed (as shown in fig. 15) and according to the condition the servo motor will turn. And Car will keep taking turn untill the straight condition is received.

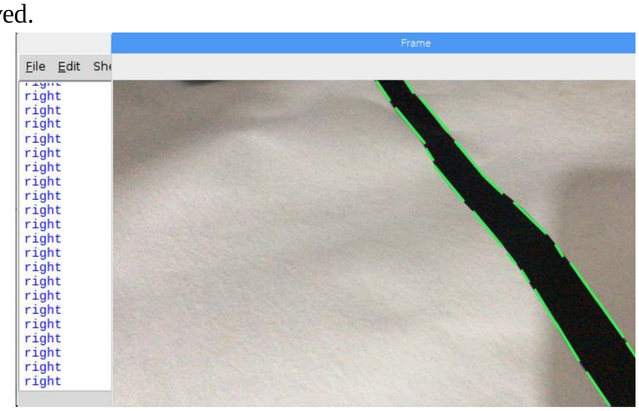

Fig. 15 Raspberry Pie Detecting Lanes for Right

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Fig. 16 shows the turns car taking a left turn, fig. 17 shows the vehicle taking a right turn, and fig. 18 shows the vehicle steering into straight movement.

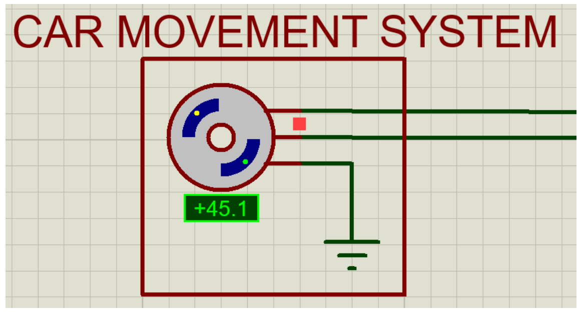

Fig. 16 Turning Left

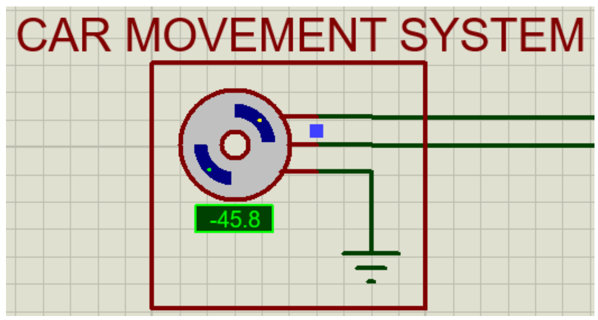

Fig. 17 Turning Right

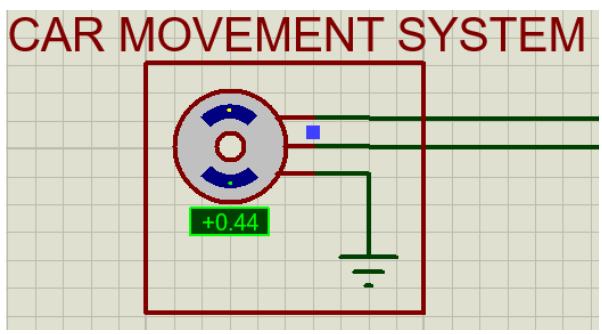

Fig. 18 Servo motor in straight condition

Also, when the vehicle turns left or right the indicators glow as shown in fig 19 & 20-

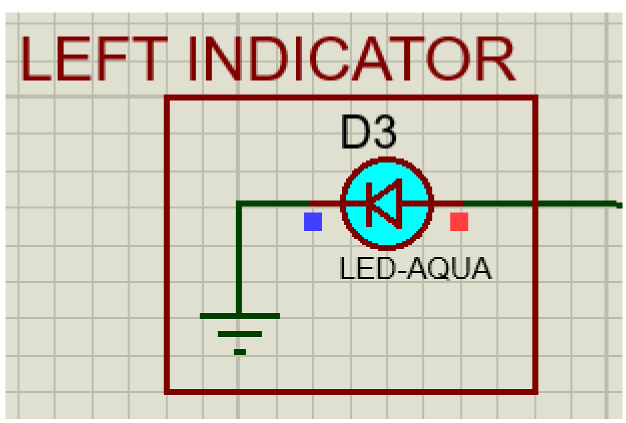

Fig. 19 Output shown by the use of LED Blink for left

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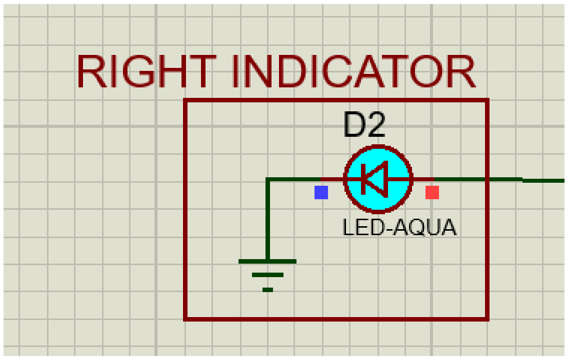

Fig. 20 Output shown by the use of LED Blink for Right

If the system senses that the driver has not responded to the collision warning or the collision avoidance system does not respond due to any case like the object came closer very quickly or the vehicle was moving very fast, the safety system will apply brake force to slow the vehicle as to show in fig. 21.

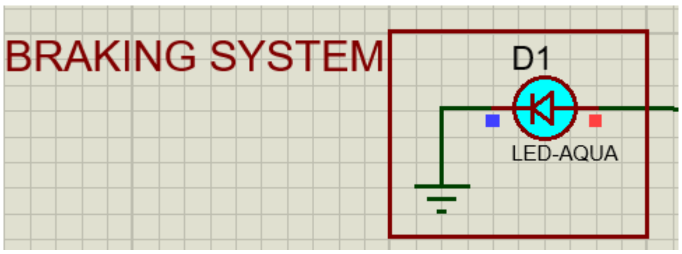

Fig. 21 In case both Lanes are occupied Braking is initiated in the same lane

Still, after all the accidents happen the Electronic Gyro Engine Kill Switch will be activated and will check whether the vehicle has a rollover. If the vehicle has a rollover then the kill switch will be activated the engine will be turned off. Fig. 22 shows the Engine in on state and Fig. 23 shows the engine turned off.

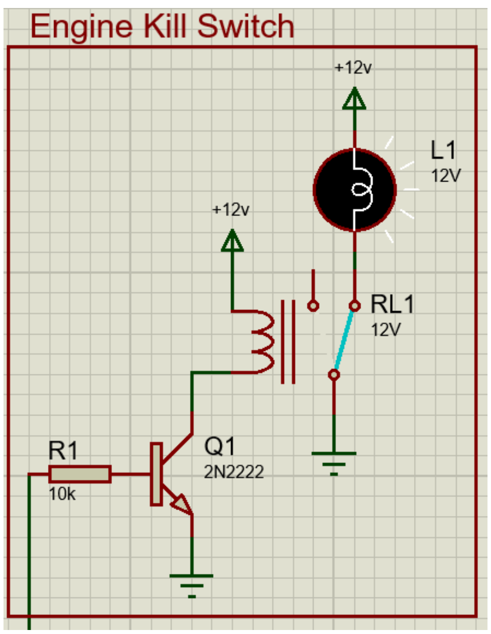

Fig. 22 Engine in ON state

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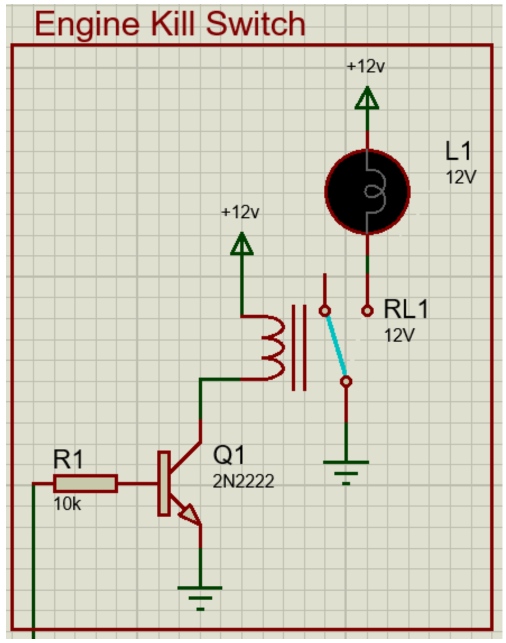

Fig. 23 Engine in OFF state

When an accident has happened an Emergency Distress Message is sent both to the emergency services operator as well as the emergency contacts that have been selected by the user. Message sent to the emergency services operator is shown in fig. 24 and message sent to the emergency contacts that have been selected by the user is shown in fig. 25.

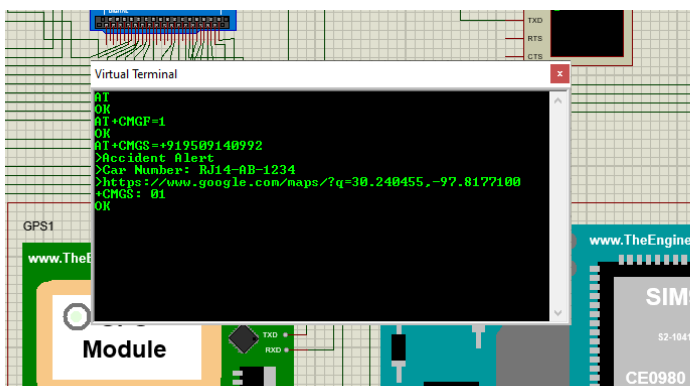

Fig. 24 Post Accident GSM Module is Activated

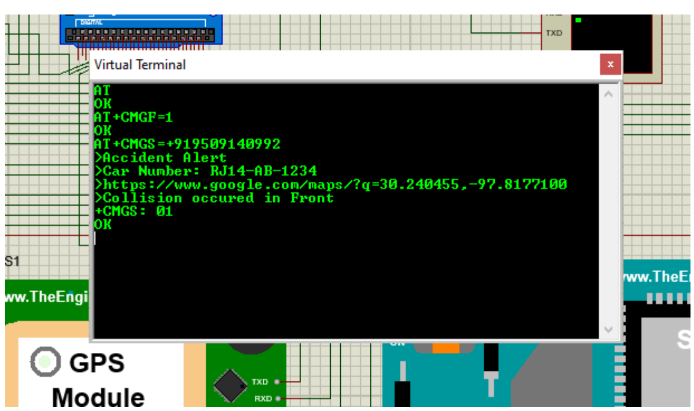

Fig. 25 Location is sent to the prebreaded contact for emergency

VI. CONCLUSIONS

In this paper, the conclusion was made that the proposed system will help in detecting a collision, avoid collision and in any case, an accident happens it will alert the emergency service operator and emergency contact given by the owner of the car with the location of the vehicle, Car number, and impact area. And also, in case of a rollover of the vehicle engine kill switch will be activated so that the engine doesn't get harm and any other casualty like explosion doesn't take place. The Hardware, software, and algorithm have been designed to implement the intended functionality of the proposed system. The test result presents promising results when the whole system is tested.

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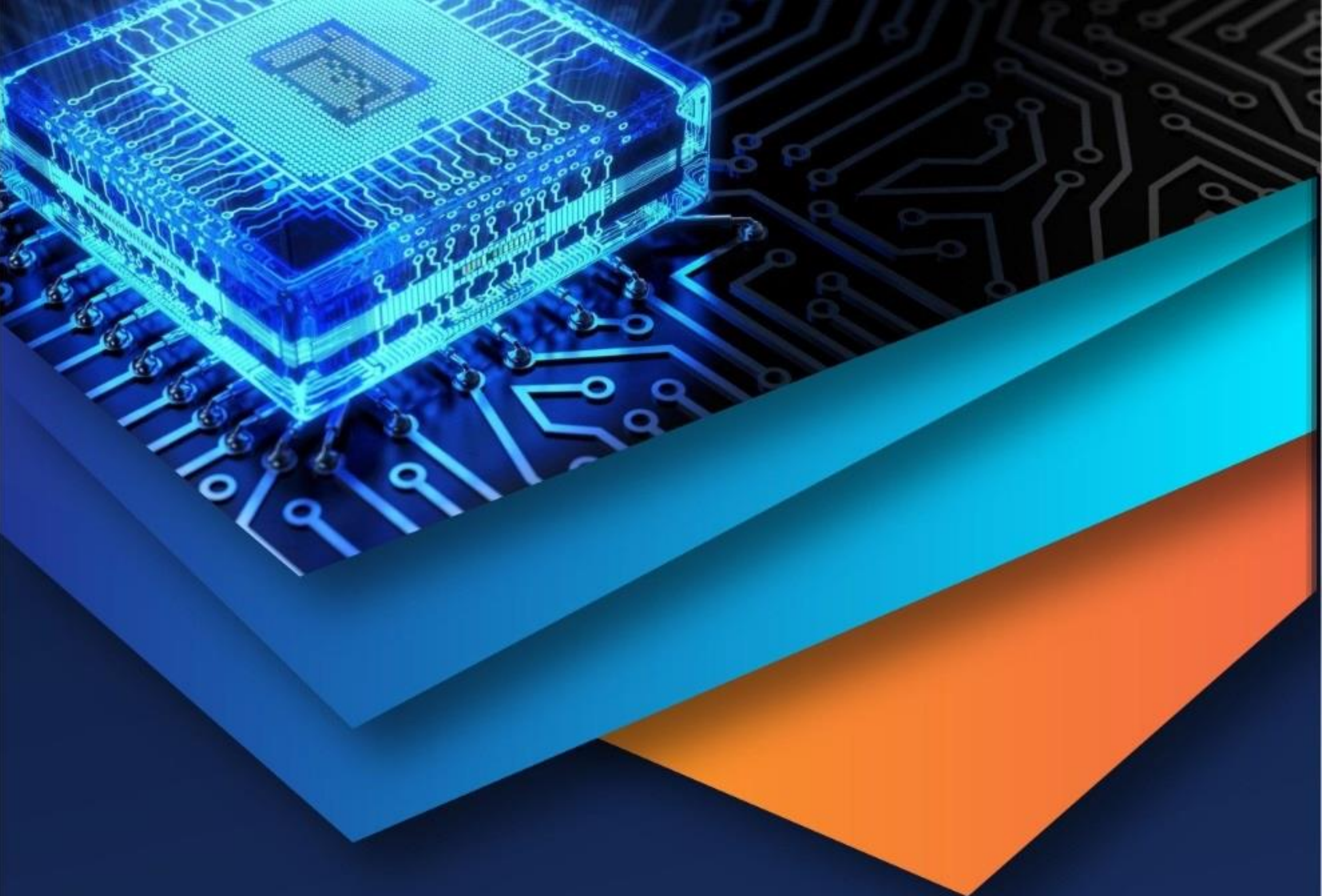

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