A Novel Approach Using Sensor Technologies For Enhancing Accident Safety Assistance System In Different Environments

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Abstract: The accidents are becoming a common occurrence on the roads due to negligence. According to recent survey 70% of the accidents occur due to driver’s carelessness. This proposed method “smart assist system” ensures the human safety. The main reasons for accidents are fire accidents in the vehicle, sudden lane changing, and fall asleep while driving, drunk and drive. The proposed system mainly focuses on the areas of blind spot, drowsiness, and flame and alcohol detection. These problems can be rectified using various sensors with the help of a controller. The indicators are used to alert and ensure the safety of the driver and also the passengers. The signal received from the sensors are fed to the controller and the actions are taken by the controller accordingly. These safety features are added to the vehicles which helps to avoid accidents by alerting the driver, implementing safeguards and take over the control.

Index Terms: Accident, Alcohol, Blind spot, Drowsiness, Drunk & Drive, Flame, Safety, Sensors

1. INTRODUCTION

Vehicle accidents are considered as one of the major issues. According to recent survey for every minute a major accident occurs in India and around 17 people die every hour 1214 road crashes occur every day in India. Road accidents are happening more frequently and causes many damage to the government and the people. 70% of the road accidents occur due to drivers careless mistake. Most of the road users are quite aware of the all general rules and safety measures while driving in roads but it is only their negligence, which causes the road accidents and crashes. Every year, millions of people die because of road accidents, many of them suffer from non-fatal injuries and become physically disabled. Road accidents costs nearly 51800 crore across the board costing. The challenge is to reduce the number of accidents occurs due to driver's carelessness. For which, it’s better to take action before an error occurs.

But sometimes it's not in our hands for example vehicle malfunction, components failure and many injured lose their lives for not getting informed beforehand. An automated smart system would be the best solution considering the circumstances. The main causes of accidents include drunken driving, use of mobile phones, fatigue, collision of vehicle with obstacles, over speeding etc... This proposed system is add safety features to the vehicle that will tend to avoid accidents by alerting the driver, implementing safeguards and taking over control of the vehicle. We had find a solution for this problem statements which will minimize happenings of the error.

2 OBJECTIVE

The objective of this proposed system is to ensure safe transport for all by detecting human errors. The human errors include drunken and drive, fall asleep while driving, sudden lane changes and sudden fire in the engine bonnet. The proposed system mainly focuses on the areas of blind spot, drowsiness, flame and alcohol detection. These problems can be rectified using various sensors with the help of a controller. The indicators are used to alert the driver to ensure the safety of the driver and also the passengers. The signal received from the sensors are fed to the controller and the actions are taken by the controller accordingly.

3 METHODOLOGY

The proposed methodology is to develop a smart system that can alert a driver to avoid the road accidents and ensure the safety of driver and passengers. This smart system includes the features of blind spot identification, alcohol detection, fire detection and drowsiness detection. This can be achieved by integrating the sensor with controller and the indicators. The sensors used are eye blink sensor, alcohol sensor, ultrasonic sensors and the fire sensor. The controller controls the indicators. Indicators used here are two LED, buzzer alarm and LCD display. Firstly, the blind spot identification is done by placing the ultrasonic sensors at left and right back end of the vehicle. Ultrasonic sensor detects the object and the obstacles in the blind spot area and indicates the driver by two LED’s that are placed in left and right side of the driver dash board. The blind spot identification is used to avoid accidents due to lane changing and careless driving of adjacent vehicle driver.
Secondly, the drowsiness of the driver is detected by the eye blink sensor and for this purpose the driver has to wear an eye blink sensor attached with glass frame which gives high output to the controller when the driver close the eye for more than two seconds and gives an alert to the driver and passengers through buzzer and also displayed in back side of vehicles that driver is drowsy. Thirdly, we have to monitor the alcohol level of the driver for safe and focused driving. The alcohol level is measured by placing the alcohol sensor. The alcohol sensor is placed near the steering wheel which detects driver alcohol level not the passengers. When the levels go beyond it stops the vehicle by locking the motor drive and displays that the driver is drunken in LCD display. When the alcohol levels become normal then it allows the driver to start the vehicle. Finally, we have to monitor any fire or flame in the vehicle engine bonnet and in the back side of the vehicle for those using gas fuels. The small flames lead to huge fire accident so it should be identified immediately and the vehicle has to be stopped. For this purpose a flame sensor is used for identifying the flame. When it detects any flame the buzzer will on and the motor drive stops the vehicle and ensures the safety of the passengers. By using these sensors and safety indicators we can avoid most of the accident and ensure the safety of drivers. The main advantages of our proposed method are low cost and can be interfaced with all kind of vehicles.

4 BLIND SPOT DETECTION
For the purpose of blind spot identification two ultrasonic sensors which are placed in left, and right side of the vehicle. The figure 2 shows the collision report of the accidents happened in Tamil Nadu in the year of 2018-2019. The majority of the accidents are happened due to frontal collision nowadays many automobile industries working on that to reduce the problem. Here we have to find the solution for the side collision of vehicles by detecting the objects in the blind spot and avoid the collision by prior intimation. That is done by placing the ultrasonic sensors in the vehicle. Table 1 shows the range of the two ultrasonic sensors fixed in the back end of the car. The range for the blind spot is fixed as 20 when any objects present in the region of blind spot it detected by the ultrasonic sensor and indicated to the driver.

The Figure 3 shows the direction of detection of vehicle in the blind spot. The direction of detection and the direction of motorcycle is perpendicular to each other. The Figure 4 shows the sensor is mounted at 0.71m above the ground level at the back side of the car, that’s where the sensor is more accurate than other places. The sensor converts the reflected wave to a digital data. With the help of this data, distance of a vehicle/object can be calculated using the formula Distance = (duration/2) / 29.1
The figure 4 shows the ultrasonic sensor time reaction for the different distance during running condition. The ultrasound reflection time increase as the distance increases.

5 EXPERIMENTAL RESULT
This experiment is conducted by placing the sensors in the car. The experiment is performed under the following conditions.

5.1. Static Test. The first test is conducted to test the ability of the model to distinguish between static objects and vehicle. The model gives only a warning signal while encountering a static vehicle and does not provide any signal for Beauregard present on the road.

5.2 Vehicle speed at 60 km/h and 100 km/h. The second test is conducted at 60 km/h and 100 km/h. The model was successfully able to detect the vehicles in the blind spot detection.

5.3. Overtake Test. The third test is conducted while overtaking a vehicle. It is used to whether the car will collide with the other vehicle. The experiment is conducted during both day and night. This model shows very promising result. The table 2 shows the results of the sensor in different conditions below in the following table. When it fails in any one of the condition the sensor position is adjusted to correct position and the test was conducted and finally the perfect position for the sensor is finalized based on the experimental results

<table>
<thead>
<tr>
<th>Test</th>
<th>Daytime</th>
<th>Night</th>
<th>Raining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statics</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>60 km/h</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>100 km/h</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>Overtake</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
</tr>
</tbody>
</table>

5.4. Drowsiness detection
Eye blink sensor monitors the drowsiness of the driver half sleepy while driving causes more accidents
The figure 5 shows the recent survey on road accidents due to distractions the surveys proves that the accident due to the over speeding is reduced now a days by incorporating new technologies and advanced braking system, but the crashes due to the distractions and fatigue are increasing and higher than the accidents due to the over speeding.

From this we can infer that we should reduce the road accidents caused by the drowsiness for the eye blink sensor is used to detect the drowsiness of the driver so we can avoid the accidents by giving an alert to the driver ‘eye blink sensor illuminates the eye around area and detects the drowsiness from the reflected rays.

5.5. Alcohol Detection
The alcohol sensor MQ 3 used to detect the driver’s alcohol level. Alcohol measured as parts per million (ppm) in the surrounding air. The figure 6 shows the number of people die due to drink and drive in different states in the year 2018. this survey shows that many accidents are occurs because of drunk and drive and it also affects the people who are not drunken .four states accidents statistics are shown

The figure 7 shows the response of alcohol sensor output with different amount of alcohol concentration surrounding the sensor. It is that the alcohol sensor value greatly depends on the alcohol concentration.

Deaths due to Drunk and Drive(2018)

Fig. 5. Survey on Road Accidents

Fig. 6. Death Ratio

Fig. 7. Response of ppm via alcohol sensor output voltage
### Actions taken for the three different conditions

5. 5. 1 Intoxicated: First the experiment was conducted with persons who didn’t consume alcohol. The LCD displayed “Intoxicated”. The driver have control over the vehicle.

5. 5. 2 Slightly drunk: The experiment was repeated with persons who consumed alcohol moderately (30–40%). The LCD displayed “Slightly Drunk”. The engine will remains on and driver can control the vehicle.

5. 5. 3 Drunkenness: The experiment was repeated with person who consumed alcohol 40 to 50%.The LCD displayed “Drunkenness” and engine system will lock.

### 5.6. Alcohol Sensor Accuracy

Accuracy is the measurement of an instrument to give equivalent value to the true value or the quantity being measured. The accuracy can be calculated from the percentage error.

\[
\text{Sensor Error} = \frac{\text{Theoretical value} - \text{Actual value}}{\text{Actual value}} \times 100\%
\]

Percentage error = 4.4%

The average accuracy of the alcohol sensor used is obtained as Ave % accuracy = 100 – 4.4% = 95.6%. Thus, our calculation above shows that the alcohol sensor is 95.6% accurate.
6 CONCLUSION

The proposed smart assist system is helpful to avoid vehicle accidents because of driver's careless mistake and negligence. The developed prototype using Arduino has been analyzed in various conditions like obstacles, flame, alcohol and drowsiness. This model can be minimize the accidents occurred during drivers negligence. In future, this smart assist system can be implemented and developed as an Autonomous Vehicle System (AVS). A self-driving car, known as an autonomous vehicle. Autonomous vehicle is capable of sensing its environment and moving safely with little or without human inputs. Human mistakes can be eradicated by incorporating a computational intelligence like Artificial Intelligence, Machine Learning, RADAR and LIDAR in the autonomous vehicles.

REFERENCES


