Smart Accident Prevention and Identification System

[1]Mrs. K. Bhagya Rekha, [2]Mrs.K. Hari Priya, [3]N.Lakshmi Kalyani, [4]G.Lakshmi Deepthi, [5]N Sai Srithaja, [1,2,3,4,5]CSE department, Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology, Hyderabad, India. [1]konrekha@gmail.com, [2]kodali.haripriya@gmail.com, [3]neerukondait@gmail.com, [4]gopisettideepthi@gmail.com, [5]srithaja.nibhanupudi@gmail.com.

Abstract. Accidents involving four-wheel vehicles are the second leading cause of death on the world's roadways, accounting for around 11% of all road fatalities in India. Human mistake, road hazards, and malfunctioning vehicles are just a few of the causes of traffic collisions. Accidents caused by humans may be reduced with the help of a system that sends out warnings to drivers in dangerous situations. The goal of this initiative is to reduce traffic accidents caused by both natural phenomena and driver mistake by providing early warnings and prompting drivers to take preventative action. The system employs sensors to keep tabs on the car in relation to the road, and then issues warnings to the driver so that he or she may avoid causing any harm to the vehicle or to any obstacles in the driver's path.

Keywords: Road accidents, Alcohol detection, Proximitywarnings, Accident detection.

I. INTRODUCTION

At least one person is injured or killed in a traffic accident if at least one vehicle collides with an obstacle in the road. To help drivers avoid potential collisions, certain vehicles are equipped with accident warning systems that sound alarms and display warnings when certain circumstances, both inside and outside the car, are met.An Arduino Uno microcontroller kit is used to put the plan into action.To better sense the nozzle and deter-mine whether the driver is impaired, the alcohol sensor is mounted on the top surface of the steering wheel.The purpose of the ultrasonic sensor is to warn the driver of any potential dangers, such as other cars or objects in the road.The driver of the vehicle is warned so that he or she may take preventative measures.If the driver does not reduce speed in response to an onboard diagnostics (OBD) sensor's analysis of variables including speed and coolant temperature, a warning is sounded.In addition to tracking the condition of your car, the technology may help you safely switch lanes.By notifying the driver before the vehicle reach-es a point of no return that might result in an accident, the warning system is able to prevent the vehicle from entering a potentially dangerous position.This project assists the driver in maintaining focus despite the many potential distractions that may arise while on the road. .

II. RELATED WORKS

Many studies and attempts were made to build a warning or alerting system that could identi-fy the conditions of accidents beforehand and prevent them [1]. These systems focus on detecting the accident and relaying the accident condition and details of the people involved to authorities like police, ambulance, and acquaintances using GPS and GSM modules.

Aswin M, Sujitha E, Archunan P, and Sandhya Devi R S (2021) used an approach where an Android smartphone is used to identify incidents and notify the closest available emergen-cy personnel of them, along with the precise location of any victims. On the side of emergen-cy responders, the technology would alert them to nearby situations and give them access to real-time Google map monitoring of emergency victims. This will make it easier for rescuers to locate the victim and bring them to safety quickly. Uses an accelerometer sensor, microcon-troller, drowsiness detector, tilt sensor, GPS, and GSM [3].

Arsalan Khan, Farzana Bibi, Muhammad Dilshad, Salman Ahmed, and Zia Ullah (2018) have developed a system that uses an onboard accelerometer sensor to detect accidents, generate emergency alerts, and send them to the closest emergency responders. It also sends an SMS to emergency contacts with the accident's location coordinates. The system's real-time location tracking capabilities for both victims and responders will significantly improve an accident victim's chance of survival by delivering emergency care on time. The system will also assist in other catastrophes, like fires, burglaries and thefts, and other medical crises. On a real-time Google map, emergency responders will be able to pinpoint the victim's location [2].

In their 2018 solution, Frahim Wadud Taj, Abdul Kadar Muhammad Mausam, S. M. Taslim Reza, Md. K. Kalim Amzad Chy, and Iftekhar Mahbub suggested using an Arduino to control the entire process along with a GPS receiver and GSM module[14][15]. The vehicle's coordi-nates are found using a GPS receiver, and an SMS alert with the coordinates and a link to Google Maps is sent using a GSM module. Accidents or rapid changes in any axis are detected using an accelerometer, namely the ADXL335 model. Additionally, status messages or coordinates are shown on an

 DOI : 10.35291/2454-9150.2022.0497

optional 16x2 LCD. Both the SIM28ML GPS module and the SIM900A GSM module were used[17].

The goal of the project is to build a working prototype of the ideated accident identification and prevention system using IoT technologies. The warnings or alerts issued by the system can be categorized as precautionary and needed. The precautionary warnings include: the alcohol sensor is used to detect if the driver is in a drunken state. If the driver is drunk, an audio warning is issued by the system, and the engine stops. The ultrasonic sensor analyzes the boundaries of the vehicle for any obstacles or other vehicles near and issues a warning when objects are detected too near the vehicle. The block diagram of the system can be seen in figure 1 as shown below. The OBD sensor is used to monitor the speed of the vehicle primarily and also check the health of the vehicle. An audio warning is used when the vehicle does not deaccelerate even when nearing an impediment on road.

III. METHODOLOGY

The proposed system controlled by an Arduino UNO, and all sensors like MQ3 sensor, HC-SR4 sensor, ELM327 sensor, SD card module, HC-06 sensor, SD card, speaker connected to it[16]. The architecture of Proposed system is shown in fig.1

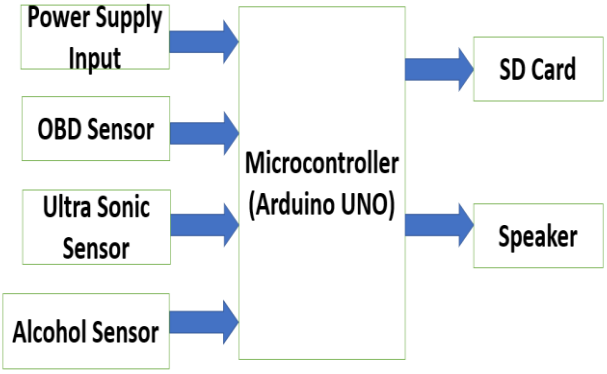

Fig. 1. Block diagram of the system

When the module is powered on, all components in this system are automatically calbraed. The alcohol sensor sends a reading of the alcohol sensor to Arduino as soon as setup is finished. It is MQ03 sensor detects alcohol gases in the air at concentrations of 0.05 mg/L to 10 mg/L while functioning at temperatures between -10 and 50°C and consumes less than 150 mA at 5 V. The sensitive substance in this sensor, SnO2, has a reduced conductivity in clean air. As a result and The data perceived by it is logged and compared with the preestablished limitations, and if the alcohol concentration ex-ceeds the limit, the controller sends a signal to the driver informing them that they are intoxicated.

Additionally, the system uses a sensor to track temperature and speed, which are then examined against a set of predetermined restrictions. The Arduino will send the driver a warning message if the engine temperature is greater than usual. The driver is advised to reduce speed while taking into account the posted speed limit and the distance between the car and the obstruction. An ultrasonic sensor is used to measure the distance, which is then sent to the Arduino for recording and comparison with predetermined limitations. If the car is too close to slow down or is almost there, a warning is delivered [18].

The module first measures the driver's alcohol consumption. The Alcohol MQ03 module provides the sensor readings. The driver can tell if someone has been drinking by the smell of their breath[6]. The sensor has analogue and digital measuring capabilities. For this module, we are alerting the driver and using analogue readings. The MQ-3 sensor reading can be obtained by the Arduino code, which can then compare it with a threshold level and notify the driver of the results. Specific ranges are taken into consideration while determining the alcohol concentration. A driver is considered sober if their blood alcohol level is under.08%. If the number is larger than 120 but lower than 400, then the amount of alcohol consumed is within legal bounds. However, if the alcohol content is over 400, the system will alert the driver that they are driving while intoxicated.

Using the ultrasonic sensor HC-SR04, the module can detect the barrier and calculate the distance between the vehicle and the obstacle [4]. The sensor sends out an ultrasonic wave that travels through the air and reflects off of the barrier before returning to the module when it encounters it. Both the travel time and the speed of sound are used to get an accurate distance estimate. Depending on the driver's proximity to the identified impediment, the system will sound an appropriate alert. There are three distinct regions established by the system: safe, warning, and dangerous. Distances of less than 30 centimetres are regarded as being in the danger zone. When the sensor detects a distance inside the "red zone," the driver receives a warning. Distance values between 30 and 70 centimetres fall inside the caution zone. The sensor will advise the vehicle to reduce speed whenever it detects distances within the danger zone. We consider the motorist to be in a safe zone when the value is more than 70 centimetres.

Multiple indicators may be used for accident detection [5]. This component monitors the vehicle's speed and coolant temperature to foresee potential collisions. Using an OBD (ELM327) sensor, we are able to capture the data values and then check them against the parameters set in Arduino. The ELM327 bridges the gap between your computer and the car's on-board diagnostics system (OBD-II) by transmitting data wirelessly through USB, Wi-Fi, or Bluetooth. Using a Bluetooth HC-06 module, this component transmits the information. Here, the ELM327 interfaces with the car's on-board diagnostics (OBD-II) system and sends information to Arduino through a Bluetooth HC-06 module [7][12][13].

The temperature of the vehicle's engine coolant is a proxy for the temperature of the internal combustion engine. Overheating may cause fractures in the engine, which can cause oil leaks and poor performance. The vehicle should not be driven at this time. The coolant temperature is measured by the on-board diagnostic (OBD) sensor and sent to the Arduino through the Bluetooth module for comparison with a predetermined threshold. When the coolant temperature reaches or surpasses 220 degrees, the driver is warned about the potential for overheating and the appro-

 DOI : 10.35291/2454-9150.2022.0497

priate safety measures are followed. The speed of the car is another variable that may be gleaned from the data collected by the OBD sensor[8]. The speedometer reads in kilometres per hour. The speedometer reading is taken from the on-board diagnostics system and sent to the Arduino [9][10][11]. A warning to the driver would include both the vehicle's speed and the distance between it and the barrier. In this section, predetermined boundaries are taken into account; for example, if the vehicle is travelling faster than 10 kilometres per hour while in the danger zone or 20 kilometres per hour while in the warning zone, the driver will get a warning to slow down. If the car is travelling at more than 70 kilometres per hour and is in a designated safe zone, there is no danger of it being involved in an accident.

IV. RESULTS

By placing the prototype in the vehicle, we show how the suggested system may be put into practice. The prototype works as expected, providing alerts whenever a potentially hazardous situation is identified. Multiple observations are used to fine-tune the sensing values' precision and accuracy. The alcohol sensor in an automobile needs around 15–20 seconds to warm up when the engine is started. The time that elapses between turning on the ignition and when the car really begins to move counts as part of this phase. Below is a visual representation of the three states the alcohol detector keeps tabs on.

In the absence of alcohol use on the part of the vehicle's operator, the alcohol sensor will provide results shown in Fig 3 and Fig 4:

Fig. 2. Alcohol Sensor attached to steering

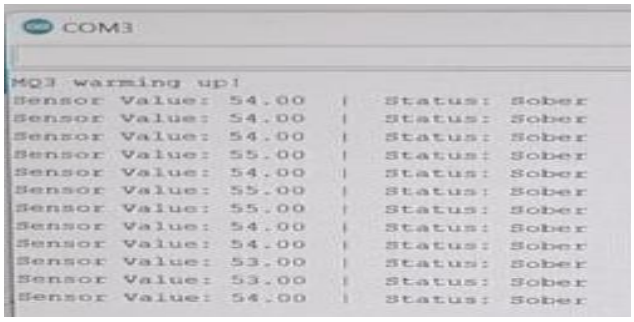

Fig. 3. Readings for reference

The following measurements are recorded by the alcohol sensor when the driver's blood alcohol content is under the legal limit as in Fig 5 and Fig 6.

Fig. 4. Sanitizer used to test the sensor for alcohol detection

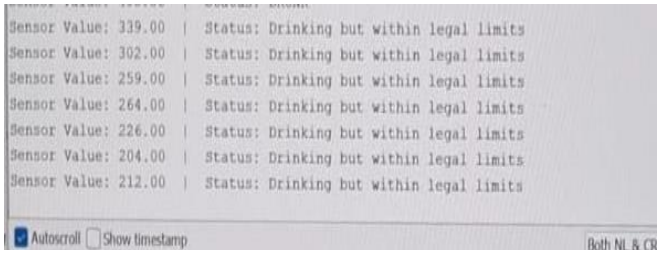

Fig. 5. Readings for reference

Similar findings are observed when the vehicle operator has drank alcohol beyond the permissible limits (to permit driving on road) show in Fig 7 and Fig 8.

Fig. 6. Sensor showing green color indicating that alcohol consumption in more

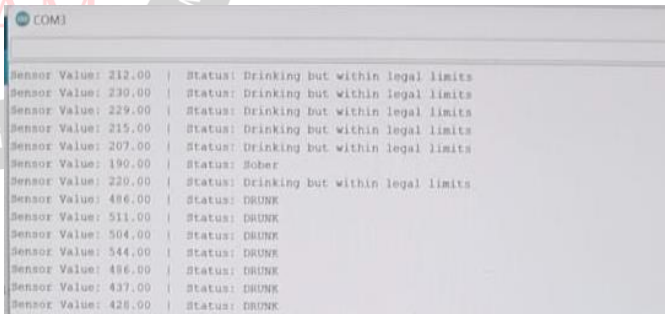

Fig. 7. Readings for reference

The ultrasonic sensor measures how far away an object is in the vehicle's path. with it securely fastened to the front bumper, the sensor can take reliable readings. in each of the three cases below, the acquired readings Fig 8 may be placed.

- When the barrier is less than 30 centimetres away, the vehicle must brake and come to a complete stop before reaching the danger zone designated by the distance. Because of this, a warning is sent reading "Obstacle ahead" if the vehicle does not stop before the designated area.
- The distance between the vehicle and the obstruction, measured in centimetres, is defined as a warning zone when the gap is more than 30 cm but less than 70 cm. Upo ap-

 DOI : 10.35291/2454-9150.2022.0497

proachng this limit, the vehicle should begin to slow down; otherwise, a "nearing obstruction" notice will be given.

- No warning is given when the obstacle is more than 70 c entime-

tres away since this gives the driver adequate time to avoid crashing into it.

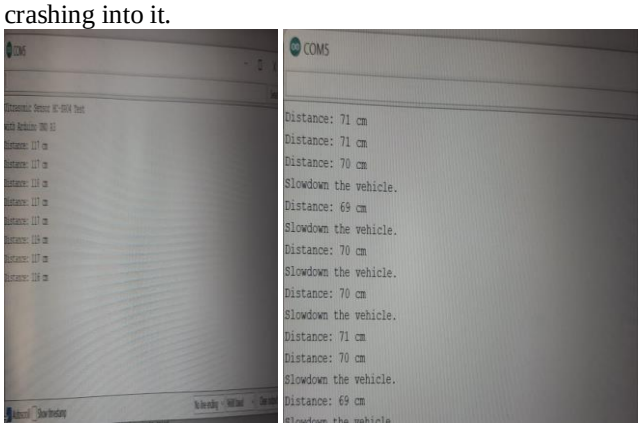

Fig. 8. Readings from ultrasonic sensor

V. CONCLUSION

By forewarning the driver of potentially dangerous situation s, the smart accident prevention and detection system hope t o reduce the likelihood of accidents occurring in real life by implementing a system with minimal number of sensors for detection of obstacles, alcohol consumption by drivers and notifying the same to users such that they can take any pre-cautionary measures according-ly. Installing the system in a four-wheeled vehi-cle served as a test bed for the prototype, which was built a nd tested according to the intended design. The system's abi lity to provide situation specif-ic audible warnings for the vehicle operator is shown to be f unctional and effective for the drivers during the jour-ney, preventing accidents from occurring.

REFERENCES

[1] Saravanan Alagarsamy, S.Ramkumar, G.Vishnu Varthanan Govindaraj , TheepiKashree , Mounika Balasubramanian, Soundarya Kannan , Kavi Saila Sree, “Identification of Accident and Alerts Using IoT based System”, August 2020.

[2] Arsalan Khan, Farzana Bibi, Muhammad Dilshad, Salman Ahmed, Zia Ullah, “Accident Detection and Smart Rescue System using Android Smartphone with Real-Time Location Tracking”, International Journal of Advanced Computer Science and Applications (IJACSA), Vol. 9, Issue 6, June 2018.

[3] Aswin M, Sujitha E, Archunan P, Sandhya Devi R S, “Accident Prevention and Alert System using Arduino”, International Research Journal of Engineering and Technology (IRJET), Vol.8, Issue 3, March 2021.

[4] Isha Khot, Madhura Jadhav, Abhijeet Desai, Vaibhav Bangar, “Go Safe: Android application for accident detection and notification”, International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 5, May 2018.

[5] Afrin, Mahmud, Razzaque, “ Speed Breaker Detection and Warning System on Road”, IEEE International WIE Conference on Electrical and Computer Engineering, December 2015.

[6] Baby D Dayana, Shipra Sinha, Apurv Jha, Padmini Yadav, “Automatic Alcohol Detector Car Control Panel”, International Journal of Engineering and Advanced Technology (IJEAT), Vol.9, Issue 1, October 2019.

[7] Dr. Haider Kadhim Hoomod, Sadeem Marouf M. Al-Chalabi, “Objects Detection and Angles Effectiveness by Ultrasonic Sensors HC-SR04”, International Journal of Science and Research (IJSR), Vol.6, Issue 6, June 2017.

[8] S. A. Nugroho, E. Ariyanto and A. Rakhmatsyah, "Utilization of Onboard Diagnostic II (OBD-II) on Four Wheel Vehicles for Car Data Recorder Prototype," 2018 6th International Conference on Information and Communication Technology (ICoICT), 2018, pp. 7-11, DOI: 10.1109/ICoICT.2018.8528741.

[9] Agus Wibowo, “Communication Concept Between Bluetooth As a Master and Slave To Exchange Digital Information”, International Journal of Engineering and Advanced Technology (IJEAT), Vol.9, Issue 2, December 2019.

[10] Louis Leo, “Working Principle of Arduino and Using it as a Tool for Study and Research”, International Journal of Control, Automation, Communication and Systems, DOI: 10.5121/ijcaccs.2016.1203, July 2018.

[11] Reshma Radhakrishnan, Livin Anto Nellisserry, O. Mularikrishnana, Rojan Thambi, M. Parvathy, “Automatic Vehicle Accident Detection and Rescue System”, Materials Today: Proceedings, 2021.

[12] Mohammed Abdul Kader, Engr. Md Eftekhar Alam, “IoT based Vehicle Monitoring With Accident & Rescue System”, International Conference on Computer and Information Technology (ICCIT), December 2019.

[13] D. Rimpas, A. Papadakis, M. Samarakou, “OBD-II sensor diagnostics for monitoring vehicle operation and consumption”, Energy Reports, 6 (2020).

[14] Shrestha Rajesh, “Study and Control of Bluetooth Module HC-05 Using Arduino Uno”, January 2016, DOI:10.5281/zenodo.155270

[15] Prof. Pankaj A Bhoite, Koli Gopal, Wadile Sagar, Tejaswini Sisodiya, Patil Satish, “Accident Detection System using Arduino”, International Science and Technology Journal, Vol.7, Issue 4, 2018

[16] L. Vijayaraja, R. Dhanasekar, R. Magesh Krishna, M. Mahidhar, “A low cost and user friendly vehicle crash alert system using Arduino”, IOP Conference Series Materials Science and Engineering, February 2021

[17] Frahim Wadud Taj, Abdul Kadar Muhammad Mausam, S M Taslim Reza, Md. K Kalim Amzad Chy, Iftekhar Mahbub, “Automatic Accident Detection and Human Rescue System: Assistance Through Communication Technologies”, International Conference on Innovations in Science, Engineering and Technology (ICISET), Oct.2018

[18] Vipolve Rohilla, Monica Bazzad, “Arduino Based Vehicle Accident Detection System”, International Journal For Technological Research in Engineering, Vol.6, Issue 8, April, 2019.

 DOI : 10.35291/2454-9150.2022.0497