Arduino Based Car Accident Detection, Prevention and Reporting

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***Abstract*—This paper focuses on solving the important problem of people not getting help when they are in a car accident. The system uses an Arduino microcontroller along with several sensors to prevent, detect, and report accidents. It includes GPS, GSM, accelerometer, eye-blink, piezo-pressure, fire, and alcohol sensors to enhance security. The Arduino analyzes data from all these sensors to spot possible crashes, unsafe driving, signs of driver fatigue, and other dangers like fire or alcohol presence. If a danger is detected, the system sends alerts to the driver and sends details like the location of the incident to emergency services through GSM. This complete and flexible system helps improve road safety by taking a proactive and preventive approach to avoid accidents.**

I. INTRODUCTION

In today's busy world, road safety is big concern. The number of accidents is rising, so we need new solutions to reduce risks and improve how emergencies are handled. This paper talks about an Accident Prevention, Detection, and Reporting System that uses an Arduino board and several advanced sensors. These sensors include GPS, a Neo SIM800L GSM Module, a Fire Sensor, an Accelerometer ADXL335, an Eye Blink Detection system, an Alcohol Sensor, and a Piezopressure Sensor.

The main goal of this system is to spot possible dangers on the road, keep track of the driver's state, and send emergency alerts quickly to the right people.

The GPS helps track the exact location of an incident, making it easier to map where accidents happen. The GSM module sends instant messages to emergency services and important contacts.

The Fire Sensor helps detect fires early in the vehicle.

The Accelerometer gives information about sudden changes in speed, which can help identify crashes or risky driving. The Eye Blink Detection system checks if the driver is tired, and the Alcohol Sensor finds out if someone is driving under the influence.

To make the system more effective, a Piezopressure Sensor is used to detect sudden impacts.

This helps the system tell the difference between normal driving and an accident. Together, these sensors create a smart safety system that helps protect both drivers and passengers.

This paper looks at how the system was designed, built, and tested.

It shows how using these advanced tools can greatly lower the number of accidents and help emergency services respond faster. The research proves that combining these technologies can build a strong and dependable system for both personal and business vehicles.

Road accidents are one of the leading causes of injury and death worldwide. With the increasing number of vehicles on the roads, ensuring driver and passenger safety has become a major concern. Traditional methods of accident detection and emergency response are often slow and inefficient, leading to delayed medical assistance and, in many cases, loss of life. To address this critical issue, modern technology offers the potential to create automated systems that can detect accidents in real time, take preventive actions, and instantly notify emergency services.

This project presents an Arduino-based Car Accident Detection, Prevention, and Reporting System aimed at reducing fatalities and improving road safety. The system integrates various sensors and communication modules to monitor driving conditions, detect potential collisions or accidents, and automatically alert emergency contacts or authorities with the exact GPS location of the incident.

The key components of the system include an Arduino microcontroller, an accelerometer or vibration sensor for collision detection, ultrasonic sensors for distance monitoring to prevent collisions, a GPS module for real- time location tracking, and a GSM module for sending alert messages. Together, these components work seamlessly to detect accidents, minimize the risk of crashes, and ensure a timely emergency response

II. LITERATURE SURVEY

Arduino based accident prevention, detection and reporting system aims to stop accidents caused by drowsiness, alcohol use, vehicle vibrations, and fire. The main reasons for accidents include these issues, and different sensors are used to detect these factors and send data to the Arduino UNO micro-controller. The Arduino sends an alert message using GSM and GPS modules, along with the location of the accident. In previous projects, air bag sensors were not used, but in this project, a piezo pressure sensor is used, acting as an air bag sensor. This system uses various sensors like ADXL335, alcohol sensor, fire sensor, and eye-blink sensor in one setup to detect accidents, whereas earlier projects used only one or two sensors. It uses GPS directly, which has no limitations as it depends on base stations in the area, unlike earlier systems that used Bluetooth, which had limited connectivity. These systems are helpful because they improve functionality and reliability by adding features to existing systems, helping to prevent accidents.

Rajvardhan Rish, Sofiya Yede, Keshav Kunal, Nutan V Bansode [1] proposed a system that says the leading cause of deaths in road accidents is due to delayed medical help. This can be prevented by sending messages to authorities and emergency contacts promptly. The system includes GPS, GSM, accelerometer, and Arduino. It alerts the nearest hospital, police headquarters, family, and friends during an accident, mainly by detecting changes in the accelerometer. The system sends a Google map link using the GPS module and Arduino. The vehicle sets a flag bit on the Arduino UNO when an accident is identified, until it detects sudden deviation from the threshold values with the help of a measuring system detector. During the accident, the device sets the effective sensitive value for measuring instrument detectors unless a crash is observed. Once the accident or set bit is detected by the measuring instrument detector, the Arduino activates the GSM module, which has a manually saved signal of the accident victim's emergency contact, and sends a prestored SMS to that contact. Though this system works well, it does not detect rare minor accidents without casualties. This can lead to a waste of resources and time in the case of minor accidents. Moreover, it uses the Arduino UNO, which is less powerful than the latest micro-controllers available. Therefore, we decided to only take the system architecture components that would be beneficial to our project in terms of accuracy, which are the following: GSM, GPS module, and accelerometer.

Aarya D.S, Athulya C.K, Anas.
P, Basil Kuriakose, Jerin Susan Joy, Leena Thomas [2] proposed a system that states vehicle accidents are one of the most leading causes of death. The time between the accident and the arrival of emergency medical services at the accident site is a critical factor in survival rates.

Prashant Kapri, Shubham Patane, Arul Shalom [3] proposed a system that says accidents might happen in isolated areas where no one is present to report the mishap. Inbuilt hardware modules in luxury vehicles have been developed to detect and report accidents. Unfortunately, such devices are expensive and not mobile.

There are several efforts, applications, and approaches aimed at providing security and safety in case of an accident. A completely unique approach to extend the protection of road
travel victims involves the ideas of wireless detector networks and the Bluetooth protocol. It is mentioned that vehicles can form a mobile ad-hoc network and exchange information perceived by onboard sensors [3]. The platform of the robot in the operating system and software system development environment provides a well-tried optimum solution for public safety in case of accidents. A thorough survey of victimization, portable devices, microcontroller, Bluetooth, and JAVA technology has been well tried.

Mr. S. Kailasam, Mr. Karthiga, Dr. Kartheeban, R.M. Priyadarshani, K Anithadevi [4] states that lack of

attention, drowsiness, and drunk driving are the main causes of road accidents.

This paper proposes a system to prevent these situations. The system monitors the driver's face when the car starts, which helps in continuous observation. It uses two functions: one to detect eye blinking and the other to read the blinking. Automatic driving and braking systems are also combined with a controlling system using Python programming.

III. PROPOSE STSTEM

To overcome the shortcomings of current systems, this project is designed to use different sensors to detect accidents.

The system uses GSM and GPS modules to locate the accident and send automatic messages to the ambulance. It also uses a piezo pressure sensor to sense pressure when an accident happens and triggers the car's airbag. By using various sensors, the system becomes more efficient and dependable. This system is especially helpful in detecting accidents and can save lives.

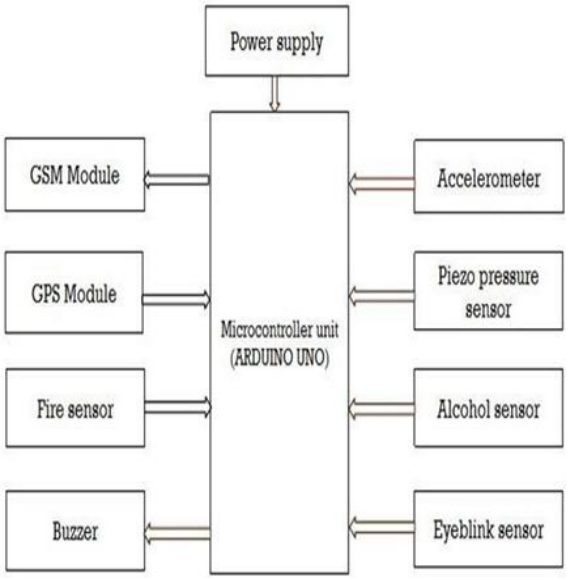

Figure 1: Bock Diagram

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The circuit connections are made as follows: the X, Y, and Z pins of the accelerometer are connected to A0, A1, and A2 pins of the Arduino, respectively.

The piezo-pressure sensor is connected to A4, the alcohol sensor to A3, the eye-blink sensor to pin 4, the fire sensor to pin 10, the buzzer to pin 9, the GSM receiver to pin 1, and the GPS transmitter to pin 2 of the Arduino.

- Detect accidents in real-time using sensor data (vibration, acceleration).
- Prevent accidents by monitoring driver condition (drowsiness, alcohol), and issuing alerts for safe driving.
- Report accidents automatically with exact GPS location and time to emergency contacts or services via GSM/SMS.
- Low-cost, real-time, standalone system that can be retrofitted into vehicles.

IV. WORKING

The core controller used is Arduino, to which various sensors are connected to detect accidents. The sensors detect changes in the vehicle such as fire, alcohol presence, vibrations, pressure, drowsiness, and activated sensors send information to Arduino. Since GPS is connected to Arduino, it tracks the location of the accident. The location is sent via Google Maps to emergency services or any other number through GSM module. The location of accident can be known and we can save the victim. The alert message is sent through GPS and GSM to emergency services, and the buzzer will sound.

Figure 2: Working

From the accident location, GPS tracks the spot through satellite, and an alert message is sent to a specified mobile number via GSM module, which helps to rescue the victim in the accident. Accelerometer ADXL335: In accident prevention systems, accelerometers play a crucial role by detecting sudden changes in acceleration. These

devices measure acceleration forces and can trigger alarms or reporting mechanisms when abrupt deceleration indicative of a collision is detected. Integrating accelerometers into vehicles or wearable devices allows for real-time monitoring and reporting of potential accidents, enhancing safety measures

Figure 3: Accelerometer ADXL335 courtesy

The alcohol sensor MQ3 is a type of gas sensor made to find alcohol vapors in the air. It uses a material called tin dioxide (SnO2) that helps it sense alcohol. This sensor works well with different kinds of alcohol, like ethanol, methanol, and isobutane. The MQ3 is part of a group of gas sensors called MQ sensors. It is used to detect and check the amount of alcohol gas in the air. It can find alcohol levels between 25 to 500 parts per million.

Figure 4: Alcohol sensor courtesy

Eye Blink Sensor: This Eye Blink sensor detects eye blinks using infrared technology. When the eye blinks, the pattern of reflected infrared waves changes, allowing the sensor to identify the blink. If the eye is closed, the sensor outputs a high signal, while if the eye is open, it outputs a low signal. The key component of the Eye Blink Sensor is the infrared sensor, which consists of two parts: an IR transmitter and an IR receiver. The IR transmitter sends out infrared waves toward the eye, while the IR receiver monitors the reflected waves. When the eye blinks or closes, the reflected waves change, and the receiver detects this change, resulting in a high output. If the eye is open, all the infrared waves are absorbed, and the output is low.

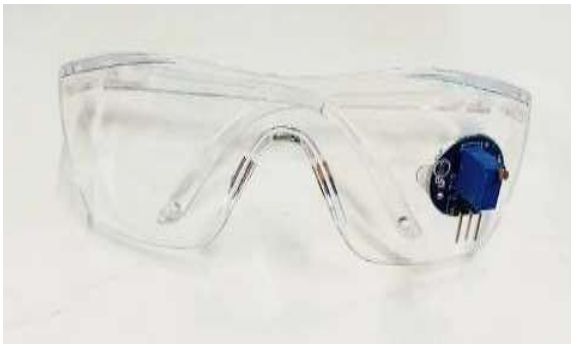

Figure 5: Eye-blink sensor courtesy

The NEO-6MV2 is a GPS (Global Positioning System) module used for navigation. It determines the location on Earth and provides output data including longitude and latitude, helping to identify the position. It belongs to a family of standalone GPS receivers that feature the highperformance u-blox 6 positioning engine. These receivers are flexible and cost-effective, offering various connectivity options in a small (16 x 12.2 x 2.4 mm) package. The compact design, along with power and memory options, makes the NEO-6 modules ideal for battery-powered mobile devices that have strict constraints in terms of cost and space. Its innovative design ensures excellent navigation performance even in challenging environments. It tracks the location of an accident and sends the information to emergency services

Figure 6: GPS Neo-6 courtesy

V. RESULT

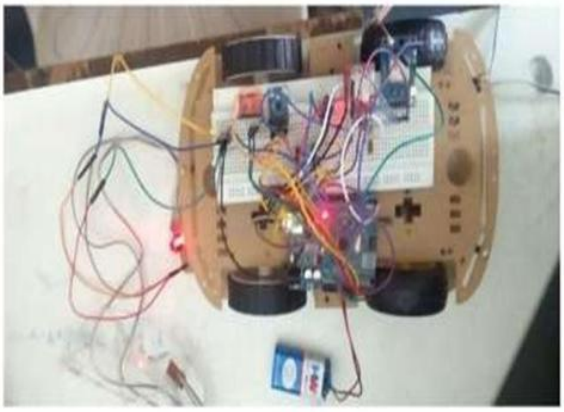

Figure 7: Hardware module

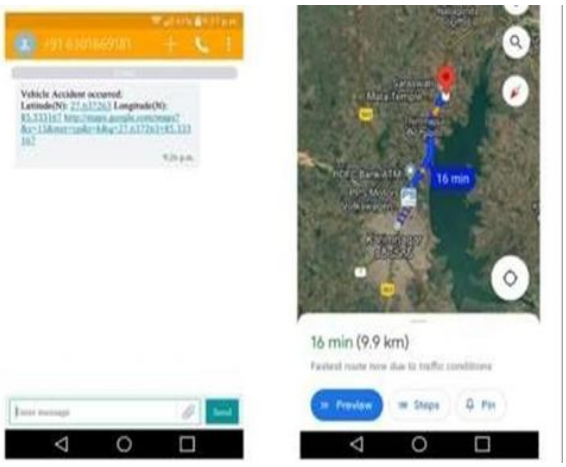

Figure 8: Message received with location of the accident to specified number via Google Map

VI. CONCLUSION

The Arduino-based system helps prevent, detect, and report accidents to improve road safety. It uses sensors like accelerometers, fire detectors, and GPS to quickly spot possible dangers. The system can monitor in real time and send alerts through a reporting system, allowing fast action to be taken. This makes it a useful and effective tool for reducing road accidents and improving traffic safety. With GPS, the system can send location details through a tracking system to show exact geographical coordinates. This helps lower the number of deaths by giving early warnings about accidents.

REFRENCE

[1]Rajvardhan Rish, Sofiya Yede, Keshav Kunal, and Nutan V Bansode proposed a system that says the main reason people die in road accidents is because they don't get medical help quickly.

[2] Aarya D.S, Athulya C.K, Anas.P, Basil Kuriakose, Jerin Susan Joy, and Leena Thomas proposed a system that says vehicle accidents are one of the biggest causes of deaths.

[3] Prashant Kapri, Shubham Patane, and Arul Shalom proposed a system that says accidents can happen in places where no one is around to report the incident.

[4] Mr. S. Kailasam, Mr. Karthiga, Dr. Kartheeban, R.M. Priyadarshani, and K Anithadevi said that lack of attention, drowsiness, and drunk driving are the main causes of road accidents. This paper suggests making a system to prevent these problems.

[5] Syedul Amin, Jalil, and Reaz (2012) proposed an accident detection and reporting system using GPS, GPRS, and GSM technology.

[6] Vikram Singh Kushwaha, Deepa Yadav, Abuyeed Topinkatti, and Amrita Kumari wrote about a car accident detection system using GPS and GSM. It was published in Volume 2, Issue 1 (Jan-Feb 2015), pages 12-17.

[7] Nimisha Chaturvedi and Pallika Srivastava wrote about an automatic vehicle accident detection and messaging system using GSM and GPS modem. It was published in Volume 05, Issue 03 (Mar-2018).

[8] C.Prabha, R.Sunitha, and R.Anitha wrote about an automatic vehicle accident detection and messaging system using GSM and GPS modem. It was published in Volume 3, Issue 7 (July 2014).

[9] Hoang Dat Pham, Micheal Drieberg, and Chi Cuong Nguyen wrote about a vehicle tracking system using GPS and GSM modem. It was presented at the 2013 IEEE Conference on Open Systems (ICOS).

[10] Lih-Jen Kau and Chih-Sheng Chen wrote about a smartphone-based pocket fall accident detection, positioning, and rescue system. It was published in December 2013.

[11] Wadhahi, Hussain, Yosof, Hussain, and Singh

(2018) wrote about an accidents detection and prevention system to reduce traffic hazards using IR sensors. It was presented at the 2018 7th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions).

[12] Pura Javale and others proposed an accident detection and surveillance system using computer technologies, explaining how accidents are detected through computer- based methods.

[13] 13.S.K.C. Varma and others proposed an automatic vehicle accident detection and messaging system using GPS and GSM module.

[14] 14.Nithin thakre and others proposed an automatic vehicle accident detection and localization system using Bluetooth technology.