Intelligent Vehicle Accident Detection and Reporting System Utilizing GPS and GSM Technologies

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Abstract*— This project introduces a novel approach to address the pressing requirement for swift emergency and communication technologies in this system highlights its ability to completely transform response to car accidents, with a primary focus on ensuring safety. The system we propose combines various sensors and communication technologies to establish an advanced accident detection and reporting system. An accelerometer sensor is utilized to detect vibrations within the car, while a direct current motor replicates the movement of the vehicle's wheels, and a toggle switch regulates the ignition of the vehicle. GPS technology is utilized to get real-time location data for the purpose of detecting dangerous driving behaviors. When an accident occurs, the vibrator sensor activates the microcontroller, which then initiates a sequence of automated reactions. The reactions encompass actions such as stopping the car and sending an alarm message to preselected emergency contacts, such as surrounding individuals, ambulance services, hospitals, and police stations, with the precise location of the accident. Effective communication is enabled through the use of GSM technology, guaranteeing the prompt delivery of vital information. This system signifies a notable progress in road safety technology, with the ability to significantly decrease the time it takes to respond to accidents and potentially prevent loss of life. The incorporation of state-of-the-art hardware components emergency response systems in the automotive sector.

Index Terms- Accident Detection, Emergency Communication Road Safety Technology. Real-time Location Data

I. INTRODUCTION

Road traffic accidents are an enduring and catastrophic worldwide problem, resulting in significant human anguish, financial detriment, and societal upheaval. Although there have been significant advancements in car safety technologies and traffic management measures, the impact of accidents on individuals and communities continues to be overwhelming. Annually, a substantial number of individuals suffer injuries or lose their lives in traffic collisions, highlighting the pressing want for inventive strategies to reduce their consequences and enhance emergency intervention.

Timely and efficient emergency response is crucial following a vehicle collision. The capacity to swiftly contact and aid individuals affected can have a significant impact on whether they survive or perish, as well as affect the extent of the damage incurred. Furthermore, effective collaboration with emergency services and pertinent authorities is crucial for handling the consequences of an accident, easing rescue efforts, and resuming the flow of traffic.

In light of these difficulties, this study introduces an Intelligent Vehicle Accident Detection and Reporting System (VADRS) as a proactive measure to improve road safety and emergency response capabilities. The VADRS utilizes cutting-edge technology, namely GPS (Global Positioning System) and GSM (Global System for Mobile Communications), to identify accidents, precisely determine their position, and promptly establish connection with emergency responders and relevant individuals.

In light of the increasing number of road traffic accidents, the planned VADRS has multiple aims. Firstly, the goal is to accelerate the identification of accidents by deploying advanced sensors that can identify abnormal vehicle behavior that suggests a collision or impact. Furthermore, with the utilization

of GPS technology, the system aims to accurately ascertain the precise location of accidents, facilitating prompt deployment of emergency personnel to the site. Furthermore, the VADRS enables immediate and uninterrupted transmission of distress signals and crucial information to emergency responders, surrounding individuals, hospitals, and law enforcement agencies by utilizing seamless connectivity through GSM networks.

II. PROBLEM STATEMENT & OBJECTIVES

Road traffic accidents persistently present a substantial peril to global public health and safety, resulting in the loss of millions of lives and the occurrence of injuries every year. Although there have been improvements in car safety technologies and traffic management systems, effectively identifying accidents and quickly starting emergency response activities are still significant obstacles. Accident victims often experience unfavorable outcomes, such as higher chances of death and long-term disability, due to delays in notifying authorities, incorrect location information, and ineffective coordination among emergency services.

Moreover, the absence of efficient communication routes between individuals involved in accidents and emergency services can worsen the seriousness of injuries and impede the prompt implementation of life-saving operations. Often, valuable minutes elapse before emergency responders are notified of the collision, resulting in avoidable deaths and worsening the socio-economic consequences of road traffic accidents.

To tackle these issues, it is necessary to create inventive solutions that utilize cutting-edge technologies to enhance accident detection, track locations accurately, and establish effective communication with emergency services. An all-encompassing strategy is required to develop an Intelligent Vehicle Accident Detection and Reporting System (VADRS) that can swiftly identify accidents, precisely determine their location, and enable instant communication with necessary parties

The current issue is the absence of a strong and effective system for promptly identifying and reporting road traffic incidents. This hinders emergency response efforts and jeopardizes road safety outcomes. It is crucial to create and implement a sophisticated system that can effectively combine sensor data, GPS technology, and wireless communication capabilities. This system will improve emergency response operations and reduce the negative impact of road traffic accidents.

III. EXISTING SYSTEM

Existing systems like the e Call system in the European Union and services such as OnStar by General Motors, Ford SYNC Emergency Assistance, Automatic's Smart Driving Assistant, and various mobile apps and wearable devices have made strides in improving emergency response for road traffic accidents. The e Call system automatically contacts emergency services and sends critical information, but its deployment is limited to newer vehicle models and relies on cellular network availability. OnStar offers comprehensive safety services, including automatic crash response, but is proprietary to GM vehicles and involves subscription fees.

A Direct-Recording Electronic (DRE) voting machine records votes by means of a ballot display provided with mechanical orelectro-optical components that can be activated by the voter (typically buttons or a touchscreen); that processes data with computer software; and that records voting data and ballot images in memory components. After the election it produces atabulation of the voting data stored in a removable memory component and as a printed copy. They typically tabulateballots as they are cast and print the results after the close of polling. The main limitation is that the system overcomes the problem of queues however its main weakness is that it can be hacked and the results manipulated.

Ford SYNC uses a paired mobile phone to call emergency services, depending on the phone’s functionality and network availability. Automatic's Smart Driving Assistant connects to a vehicle’s OBD-II port and uses a smartphone app for crash detection and emergency alerts, relying on the connected smartphone's operational status. Mobile apps and wearable devices use sensors to detect crashes and notify emergency contacts, but their effectiveness is

limited by sensor accuracy and the dependency on the user carrying the device. These existing systems, while beneficial, face significant challenges in providing universal, reliable, and prompt emergency response, underscoring the need for a more advanced solution like the proposed Intelligent Vehicle Accident Detection and Reporting System (VADRS).

IV. PROPOSED SYSTEM

The proposed technology offers a highly effective, economical, and instantaneous solution designed to prevent car accidents. The system functions by constantly monitoring sensor data, and when these data surpass predetermined threshold values, it automatically generates an alert to indicate potential hazards. If the driver does not answer within a set period of time, the system will take proactive measures by sending notifications to preprogrammed contacts using GPS and GSM technologies, giving them the vehicle's current location. The system's fundamental elements consist of a microcontroller called PIC, which coordinates the operation of different sensors, including the vital vibration sensor used to identify abnormalities that may indicate potential accidents.

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No possibility to add, alter or delete votes once entered, which makes Blockchain a truly safe technology to use. Votes entered by the voters can be verified by them proving transparency. Once updated at any single system or node, the data is instantly reflected all the authorised nodes preventing corruption. Manual or human intervention is almost negligible as smart contracts are used at all election processes, saving human resources, and preventing error. Coercion of votes is technically impossible as voters can cast their votes from any preferred location at any time during the election process.

V. SYSTEM DESIGN ARCHITECTURE & FLOW

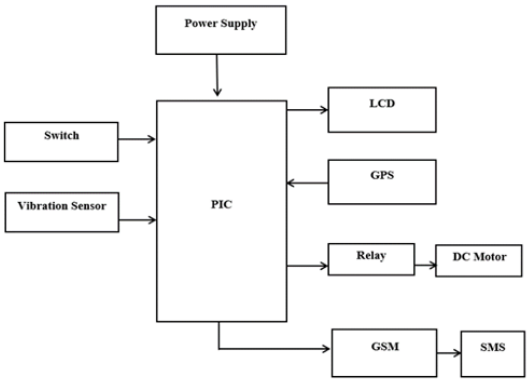


Figure 1. Product Architecture

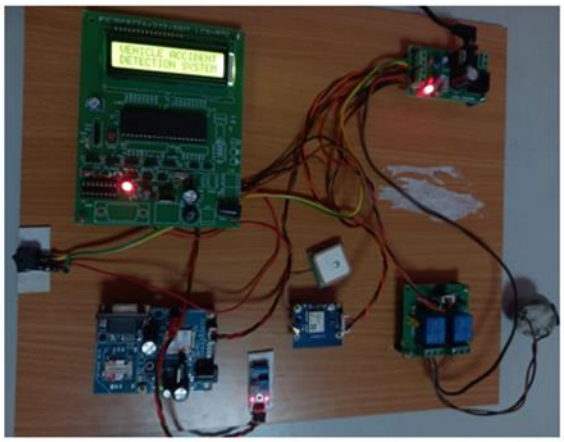


Figure 2. Overall system view

VI. SYSTEM IMPLEMENTATION

Connect the power supply to the PIC microcontroller and ensure it powers all the necessary components, including the LCD, GPS module, vibration sensor, GSM module, and relay

Figure 1. Initializing Of System

Program the PIC microcontroller to continuously monitor inputs from the switch and vibration sensor. Include logic to process signals from the GPS module and format the data for display and SMS alerts.

Figure 2.GSM initialization

Connect the switch to an input pin on the PIC microcontroller to act as an ignition signal.

Connect the vibration sensor to another input pin on the PIC microcontroller to detect vibrations or shocks

Figure 4. Detection of Accident Occurred

Connect the GPS module to the microcontroller, ensuring it can send location data to the PIC.

Program the microcontroller to read and process the GPS data.

Figure 5. Sending message to receiver

Connect the relay to an output pin on the microcontroller and the DC motor to the relay. Program the microcontroller to activate the relay (and thus the DC motor) based on certain conditions, such as simulating vehicle movement or other mechanical actions

Figure 6. Sending Co-ordinates to receiver

Connect the GSM module to the microcontroller for sending SMS alerts. Program the microcontroller to send an SMS containing the accident alert and GPS coordinates when an accident is detected.

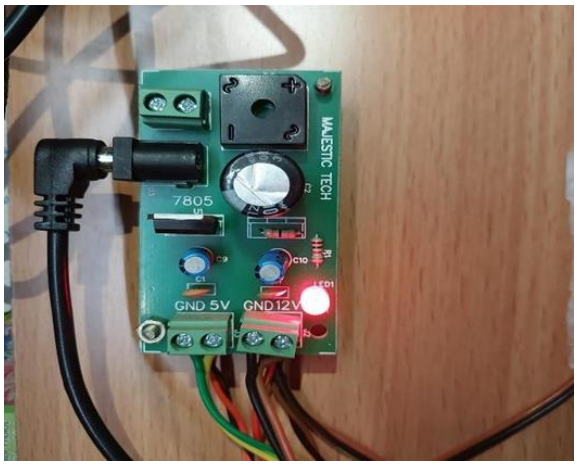


Figure 7. Power supply to convert 230v to 12v and 5v

Power on the system and verify that each component is functioning correctly.

Simulate various scenarios, such as activating the switch, generating vibrations, and checking GPS data accuracy. Ensure the LCD displays the correct information and that the GSM module sends the appropriate SMS alerts.

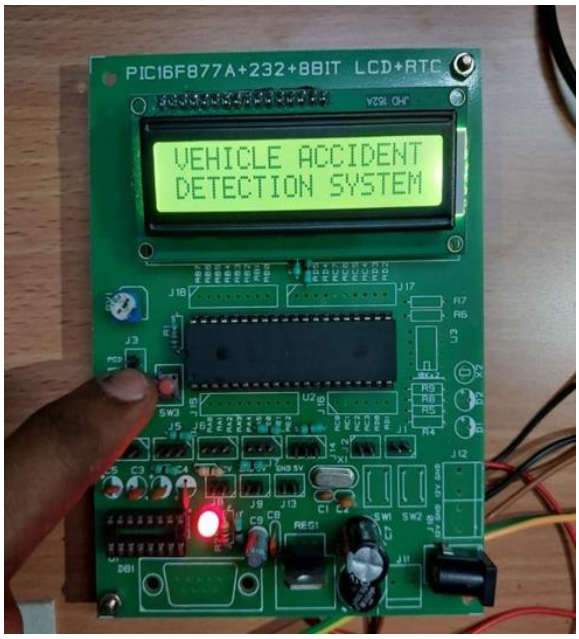


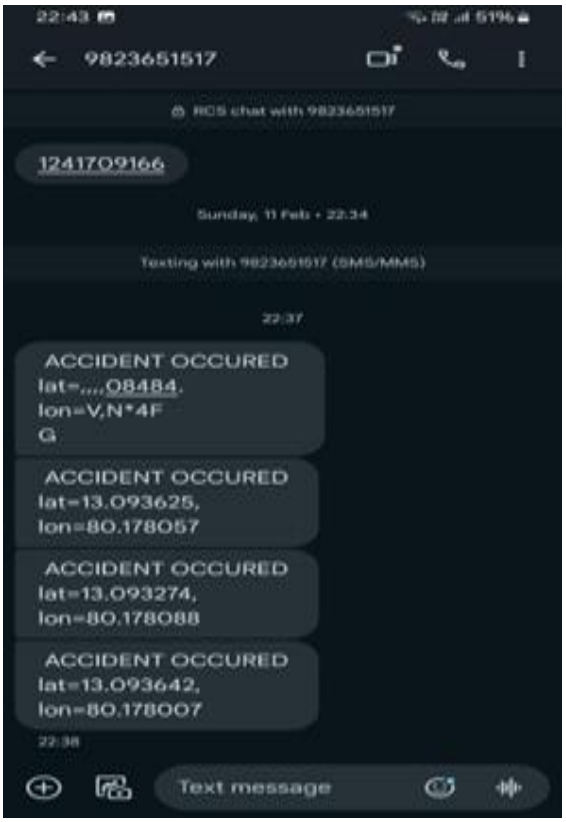
Figure 8. Reset button

Securely mount all components on a board or within a housing, ensuring stable connections and proper insulation to prevent short circuits or interference.

Double-check all connections and perform a final system test to confirm overall functionality

VII. RESULTS

We now present the snapshots of the system, which send alert Message with latitude and longitude coordinates to linked mobile number of user family



CONCLUSION

The Intelligent Vehicle Accident Detection and Reporting System (VADRS) is an innovative road safety system that provides a proactive approach to preventing accidents and responding to emergencies. This system effectively combines sensor data, GPS tracking, and GSM communication for prompt detection of potential accidents, generate immediate alerts, and accurately share position information with emergency contacts.

This proactive strategy not only improvesthe safety of those inside the car but also enables emergency responders to intervene promptly, potentially saving

lives and decreasing the severity of injuries. Moreover, the system's automated nature enhances the efficiency of emergency response operations by reducing delays and maximizing effectiveness.

The proposed VADRS has the potential to decrease accident rates and enhance road safety results, making it likely to be widely adopted and integrated into current transportation infrastructure. The proposed system exemplifies the profound influence of technology in protecting lives and reducing the consequences of road traffic accidents, as we persist in our efforts to create safer roads and improve emergency response capabilities.

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