



DYNAMIC ACCIDENT DETECTION AND ALERT SYSTEM USING ARDUINO

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Abstract

This research aims to address the critical issue of individuals being left without assistance in the event of an accident while riding their vehicle. With the implementation of an accident detection and alert system, this project seeks to provide a solution to this problem. The system utilizes an Arduino, GPS Receiver, and GSM module to control the entire process. The GPS Receiver identifies the vehicle's direction, while the GSM module sends an SMS containing the directions and a link to Google Maps to the assigned contact. The system can detect severe accidents using a Vibration sensor and can also identify rollovers. The microcontroller sends this information to the GSM module, which transmits the data, including the victim's precise location, to the assigned contact. The contact can then use the GPS MODEM to locate the victim and provide immediate assistance. This project offers a professional and innovative solution to a significant problem, ensuring the safety of individuals riding their vehicles. The implementation of the Accident Detection and Alert System using Arduino is a highly effective solution, particularly in developing nations such as Nepal, India, and Bangladesh where the number of vehicles on the road is rapidly increasing. With the rise in vehicular accidents, fatalities have also been on the rise. However, the Accident Detection and Alert System using Arduino can prevent uncertain deaths by sending a message alert to a registered mobile number, providing the precise location of the accident through a Google map link. This system is a valuable investment in ensuring the safety of drivers and passengers alike.

Keywords – GSM Module, GPS Modem, Arduinio Uno, Google Map Link.

I. Introduction

In the twentieth century, the automobile industry experienced exponential growth, leading to a significant increase in the number of vehicles on the road. Unfortunately, this also resulted in a rise in the number of accidents, primarily caused by heterogeneous traffic and a lack of traffic separation. Shockingly, India has the highest number of road accident deaths globally, with 13 million fatalities reported in 2014-15 alone. These statistics only account for recorded accidents, and the actual number is likely much higher. Fortunately, modern navigation technology, such as GPS, has become an integral part of vehicle systems. By utilizing various sensors, GPS can accurately locate a vehicle's position on the road network. Map Matching algorithms integrate GPS data with spatial road network data to identify the correct link on which a vehicle is traveling and determine its physical location. This technology can be utilized to detect accidents and alert Rescue Service Centers, providing immediate assistance to accident victims [12].

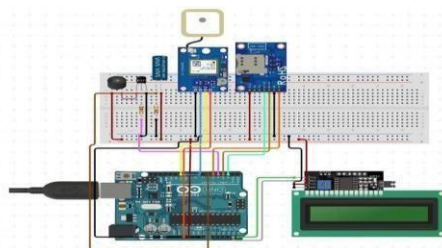


Figure 1: Basic Circuit Diagram

While existing accident detection and prediction systems have limitations, our system aims to automatically detect accidents and alert the nearest hospital or medical services of the exact location. Our device can detect accidents and send alert messages to rescue teams in significantly less time, potentially saving lives. The alert message includes geographical coordinates, time, and angle of the accident. The device is activated by a sensor, which sends its output to the microcontroller, triggering the alert. Our project utilizes a GPS and GSM module for optimal performance. As road safety continues to be a major social concern globally, our system offers a professional and effective solution for detecting and responding to accidents promptly [17].

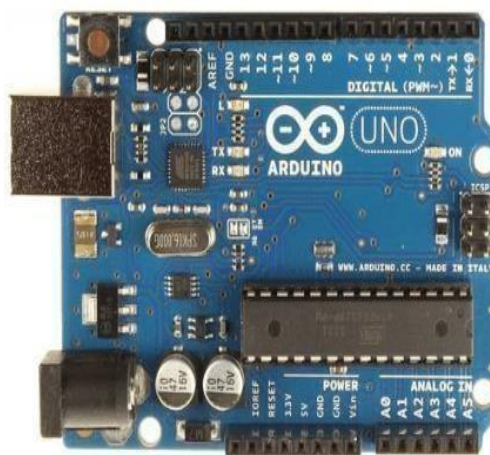
II. Basic Theory

a. Arduino Uno

The Arduino UNO is a standard board developed by Arduino.cc, based on an ATmega328P microcontroller. Its name, UNO, meaning 'one' in Italian, was chosen to mark the first release of Arduino Software and also because it was the first USB board released by the company. With its digital and analog Input/Output pins, shields, and other circuits, the Arduino UNO is a powerful board that is widely used in various projects.

Compared to other boards such as the Arduino Mega, the UNO is easy to use and includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP header. It is programmed through IDE, which stands for Integrated Development Environment, and can run on both online and offline platforms. The IDE is common to all available boards of Arduino, making it a versatile and reliable tool for developers and hobbyists alike.

Figure 2: Overview of Arduino Uno board.



b. GSM SIM900 A

The use of GSM technology in monitoring and controlling transformer load is a highly efficient and cost-effective means of communication. With its deterministic character, GSM enables the remote control of DC motors, stepper motors, temperature sensors, and solid-state relays through a simple message sent via a GSM modem. This eliminates the need for manual operation and transportation, making it an ideal solution for industrial controls, automobiles, and appliances. The SIM900A modem, equipped with a SIM900A GSM chip and RS232 interface, allows for easy connection to a computer or microcontroller using USB to Serial or RS232 to TTL converters. By opening a serial connection and sending AT commands, the modem can be easily configured to perform various functions. With its reliability and ease of use, GSM technology is the preferred choice for remote control and monitoring application.



Figure 3: Overview of GSM module

c. LCD (Liquid Crystal Display)

A liquid crystal display, commonly known as LCD, derives its definition from the unique combination of two states of matter - solid and liquid. By utilizing liquid crystal technology, LCD screens produce a visually stunning image that is widely used in laptops, televisions, cell phones, and portable video games. Unlike the bulky cathode ray tube (CRT) technology, LCD's ultra-thin composition is made possible by its multiple layers, including polarized panel filters and electrodes. LCD technology is a popular choice for displaying images in electronic devices like mini computers and notebooks. As light passes through a lens, it interacts with the liquid crystal layer, creating a grayscale image that is then combined with colored light to produce a vivid, high-quality image on the screen. In summary, LCD technology offers a sleek and efficient alternative to traditional display screens.

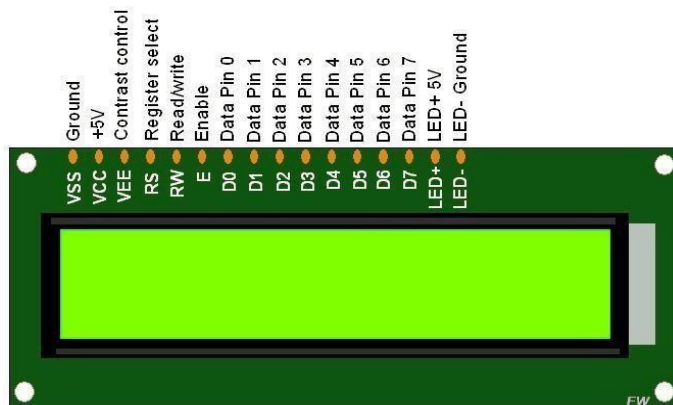


Figure 4: External View of LCD.

d. GPS NEO 6M

GPS technology has revolutionized the way we navigate and track vehicles. With tracking systems, a base station can monitor vehicle movement without driver intervention, while navigation systems assist drivers in reaching their destination. Although the two systems differ in function, their architecture remains similar. In the event of an accident, the GPS system can pinpoint the vehicle's location and relay the information via GSM, alerting the relevant party through SMS or call. Our NEO 6M GPS module utilizes cutting-edge technology to provide accurate positioning information, complete with a battery for faster GPS lock. It's also compatible with ardupilot mega v2, offering optimized performance for your multi rotor control platform. Trust us to provide the best GPS solution for your needs.

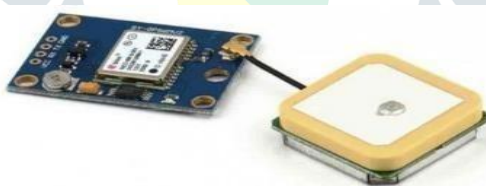


Figure 5: GPS NEO 6M

e. Vibration Sensor

The Normally Open Vibration Sensor Module is a versatile device designed to activate a variety of functions, including theft alarms, smart cars, and electronic building blocks. It is important to note that this module is designed to detect small vibrations and has a short trigger time, which may not be sufficient to drive a relay. However, it can be directly connected to some information displays or relay modules, although its effectiveness may vary [14].

When the product is not vibrating, the vibration switch remains in the off state, and the output is high, causing the green light to remain off. When the product is vibrating, the vibration switch enters momentary conduction mode, causing the output end to go low and the green indicator light to turn on. The output can be easily connected to a microcontroller to detect high and low levels and determine if there is any vibration in the environment, thereby playing an essential role in alerting users of potential danger.

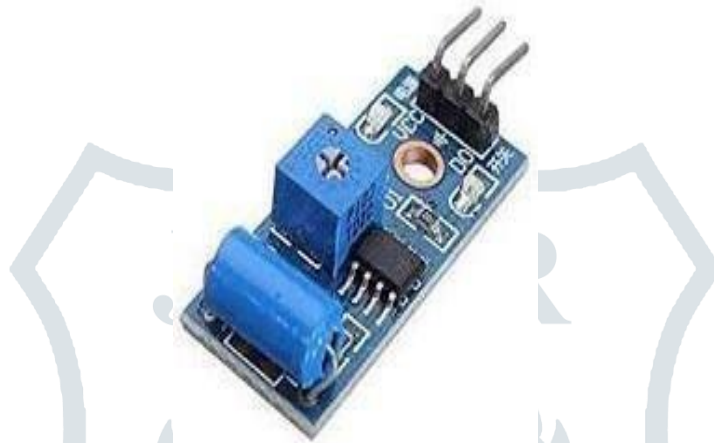


Figure 6: Vibration Sensor Module.

III. Working Principle

The entire setup will be meticulously mapped out in the form of a comprehensive block diagram. An accident sensor will be the first to detect any untoward incident and relay the information to the microcontroller. The GPS system will then pinpoint the exact latitude and longitude of the vehicle, which will be transmitted via GSM to a pre-saved phone number stored in the EEPROM. A button sensor will be utilized for accident detection, and a buzzer will activate to signal system activation. Locating the exact position of the accident is crucial for timely medical assistance. The phone numbers can be easily modified by the user as needed. The microcontroller will send an alert message to the pre-saved numbers via the GSM module, and the user can pre-enter any message into the system. A clear status display will be provided on an LCD screen. In the event of no casualties, the message transmission can be terminated with a switch, which will restart the microcontroller and initiate the process anew.

IV. Simulation Results

When an accident occurs the vibration sensor detects collisions and passes that signal to the microcontroller by using GSM and GPS a SMS is sent to the registered mobile number mentioned in the code and the latitude and longitude is also sent in the form of Google maps. The message is received by the registered mobile number along with the specific location.

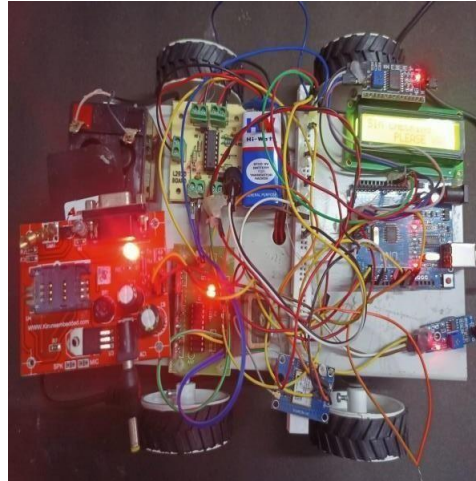


Figure 7: Hardware Module.

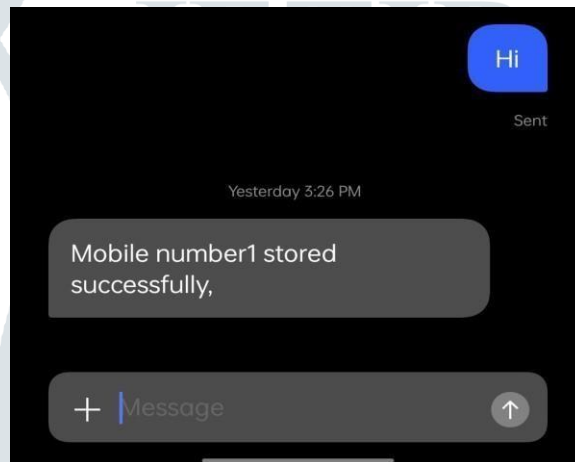


Figure 8: When mobile number is stored successful



Figure 9: Latitude and longitude values where the accident was detected.

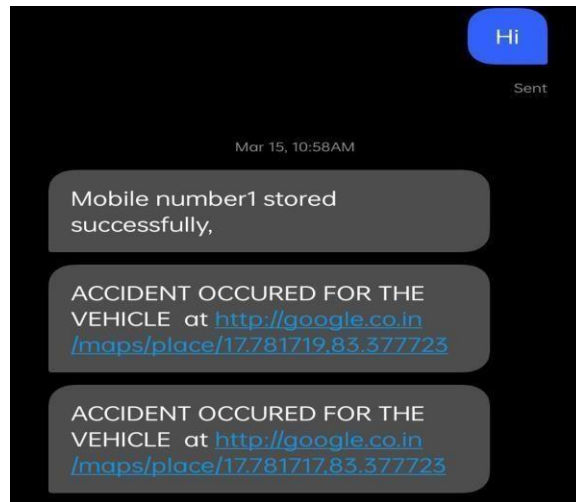


Figure 10: Message received by the specified phone number.



Figure 11: Location of the accident sent via Google Map.

V. Conclusion

This innovative system offers an optimal solution to the inadequate emergency facilities provided to victims of road accidents. By utilizing advanced technology, immediate action can be taken to alert the relevant parties through messaging. It is important to note that this system is network-dependent and may not function in areas with poor network coverage. The proposed method is highly advantageous to the automotive industry, enabling medical teams to respond promptly and save precious human lives.

Vehicle tracking systems are also essential for efficient fleet management, leading to increased profits through better scheduling and route planning. Both for personal and business use, vehicle tracking enhances safety and security, communication, performance monitoring, and productivity. It is evident that this technology will play a significant role in our daily lives in the years to come..

The primary objective of the accident alert and detection project is to reduce fatalities resulting from unavoidable accidents. By alerting paramedics promptly, the chances of saving lives are significantly increased. This vehicle tracking and accident alert feature is expected to become even more critical in our day-to-day lives in the future. However, communication may be challenging in areas with no GSM network provision.

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