

IOT Based Accident Prevention and Reporting System using GSM and GPS

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Abstract: *In recent years, road accidents have become a major cause of death and injury worldwide, necessitating the development of intelligent systems to enhance road safety. This project presents an IoT-based accident prevention and reporting system that utilizes GSM and GPS technologies to detect potential accidents, alert drivers, and ensure immediate emergency response.*

The system integrates various sensors such as ultrasonic sensors for obstacle detection, accelerometers for crash detection, and alcohol sensors for monitoring driver sobriety. Upon detecting abnormal driving behavior or a collision, the system automatically captures the vehicle's GPS coordinates and sends a real-time alert via GSM to predefined emergency contacts and nearby authorities. This enables quick assistance and can potentially save lives by reducing response times.

Moreover, the system acts as a preventive mechanism by issuing alerts to the driver when risky driving patterns or hazardous conditions are detected. By combining real-time monitoring, location tracking, and automated communication, this project aims to create a smart, responsive vehicle environment that improves road safety and reduces accident-related fatalities.

Keywords: *road accidents*

I. INTRODUCTION

There are various existing accident detection systems available in the market today, ranging from in-vehicle cameras to smartphone apps. In-vehicle cameras can detect when a car is drifting out of its lane or getting too close to another vehicle and alert the driver with audible and visual warnings to help prevent an accident. Automatic emergency braking systems use sensors to detect when the car is in danger of colliding with another vehicle or object, and will automatically apply the brakes to avoid the collision. GPS tracking systems can be used to track the location of a car and can notify emergency services in case of an accident. Smartphone apps can detect sudden changes in acceleration or orientation, and then notify emergency services or a designated contact of the driver. Lastly, aftermarket accident detection systems can be installed in older cars to add accident detection features using sensors or cameras to detect when the car is in danger of colliding with an object or another vehicle, and then alert the driver or emergency services as needed. While these systems can be helpful in preventing accidents, drivers should always remain alert and attentive while driving as no system is fool proof.

The growth of technology and infrastructure has made the life of people easier. The revolution in technology has also increased the traffic hazards and the road accidents. Many of the loss of life causes due to the late response by emergency services. Our project will provide an optimum solution to this drawback. An MPU 6050 can detect the tilting of the vehicle. If the tilting exceeds a specific threshold, then a signal through Arduino Nano is sent to GSM module. The GSM module will send message indicating that an accident has occurred to the pre-registered numbers. The GPS Module will send the location of the vehicle. The ultrasonic sensors can measure the distance between vehicles. If the distance is too close, then driver will be alerted. A car accident detection system using MPU6050, GPS, and GSM can be designed to detect and report car accidents. Here is a brief overview of how the system can work.

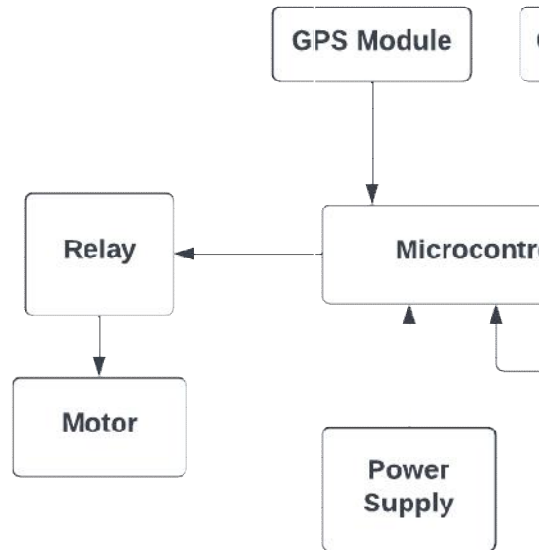


II. LITERATURE SURVEY

Sr. No.	Author's Name	Title of the Project	Description	Publish Year
1.	S. Kim et al. Edwin R. Arboleda, Airah Cahigan	Real-Time Vehicle Accident Detection Using Sensor Fusion and Deep Learning	The system uses sensor data from accelerometers and gyroscopes to detect accidents, and then applies deep learning algorithms to analyze the data and classify the accident type.	2024
2.	Mohamed R. Abdelkader, N. P. Singh et al	Intelligent Road Traffic Accident Detection System Using Machine Learning and Image Processing	This paper proposes a voice-controlled wheelchair based on a star- algorithm to overcome limitations in physical disabilities caused by ageing, accidents & diseases.	2023
3.	Tan kianhou, Yagasena and Chelladurai	Smartphone-based Accident Detection and Notification System	This paper proposed a smartphone-based accident detection and notification system that uses the smartphone's sensors to detect accidents and notify emergency services	2022
4.	M. R. Islam et al Kanyaa Anandraj, Manobala Duraisamy	Smartphone-based Accident Detection and Notification System	The system uses the accelerometer, gyroscope, and GPS sensors to detect sudden movements and changes in speed, and then sends an alert to emergency services with the location of the accident.	2021
5.	Ahmed I. Iskanderani, J. Wu et al Wasif	A review of Intelligent Transportation Systems (ITS) for accident detection and notification	Intelligent accident detection and management system for smart cities that uses various technologies, such as IoT, machine learning, and big data analytics, to detect accidents and manage emergency responses.	2022



III. BLOCK DIAGRAM



Working Principle:

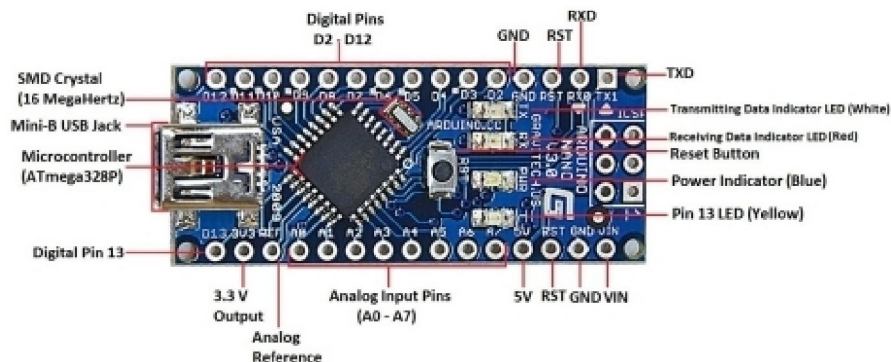
The vehicle may move normally on the road in a fixed speed. When the speed exceeds and tilting of vehicle happens, the tilting is sensed by the MPU 6050, which is a combination of accelerometer and gyroscope. MPU 6050 senses the tilting of vehicle continuously and sends the signal to Arduino Uno. A threshold value of tilting will be already fixed. When Arduino Detects that the tilting is more than the fixed value then it can be assumed that an accident has occurred. All of a sudden, Arduino makes the GSM Module to send an alert message to the registered emergency numbers. Along with that, the longitude and latitude of the vehicle will be send to the registered number through GPS module. The purpose of ultrasonic sensors is much more highlighting. The ultrasonic sensors detect the distance between two vehicles. When the distance is sensed as too close then the driver can be alerted to slow down or to apply the break. In addition, when the vehicles are close to each other the speed of vehicles are automatically set to low.

IV. HARDWARE REQUIREMENTS

- Arduino Nano
- LCD 16x2
- Mpu6050
- GPS neo 6m
- GSM Sim800L
- Module Relay single channel 5v
- Adaptor 5v 1amp
- Dc motor
- 9V Battery



Arduino Nano:



Arduino Nano:

Arduino Nano is a small and compact board based on the ATmega328 microcontroller, which is the same microcontroller that powers the Arduino Uno board. It is designed for embedded projects and is suitable for use in a wide range of applications. It also has a variety of input and output pins, including digital and analog pins, PWM pins, and more, which can be used to connect to a wide range of sensors, actuators, and other electronic components.

Some of the key features of Arduino Nano include:

Small size: The Arduino Nano is very small, measuring just 45mm x 18mm, which makes it ideal for use in compact projects where space is at a premium.

Voltage regulator: The Nano includes a built-in voltage regulator, which allows it to be powered from a wide range of sources, including USB, batteries, and external power supplies.

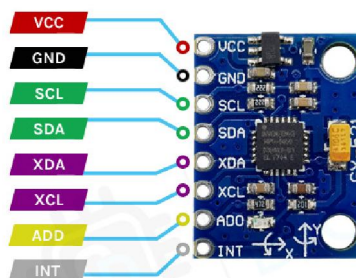
Low power consumption: The Nano has a low power consumption, making it ideal for use in battery-powered projects or other low-power applications.

Compatibility: The Nano is compatible with the Arduino IDE and libraries, which makes it easy to get started with and to build projects quickly and efficiently.

MPU6050:

The MPU6050 is a Micro-Electro-Mechanical Systems (MEMS) that consists of a 3-axis Accelerometer and 3-axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motion-related parameters of a system or object. This module also has a (DMP) Digital Motion Processor inside it which is powerful enough to perform complex calculations and thus free up the work for Microcontroller.

The module also has two auxiliary pins, which can be used to interface external IIC modules like a magnetometer, however, it is optional. Since the IIC address of the module is configurable, more than one MPU6050 sensor can be interfaced to a Microcontroller using the AD0 pin. This module also has well documented and revised libraries available hence, it is very easy to use with famous platforms like Arduino. So, if you are looking for a sensor to control motion for your RC Car, Drone, Self-balancing Robot, and Humanoid, Biped or something like that, then this sensor might be the right choice for you.



GPS Module:

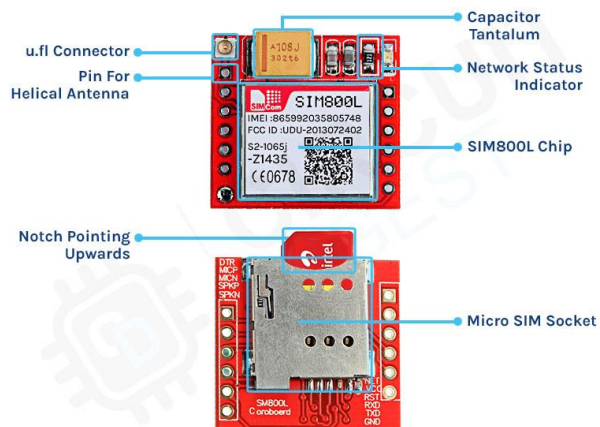
The NEO-6M module is a ready-to-use GSM module that can be used in many different applications. The parts on the NEO-6M GPS module are shown below:



The NEO-6M GPS module has five major parts on the board, the first major part is the NEO-6M GPS chip in the heart of the PCB. Next, we have a rechargeable battery and a serial EEPROM module. An EEPROM together with a battery helps retain the clock data, latest position data (GNSS orbit data), and module configuration but it's not meant for permanent data storage. Without the battery, the GPS always cold-starts so the initial GPS lock takes more time. The battery is automatically charged when power is applied and maintains data for up to two weeks without power. Next, we have our LDO, because of the onboard LDO, the module can be powered from a 5V supply. Finally, we have our UFL connector where we need to connect an external antenna for the GPS to properly work.

SIM800L:

The SIM800L module is a compact, versatile, and easy-to-use module for GSM and GPRS. The parts marking of the module is shown below.



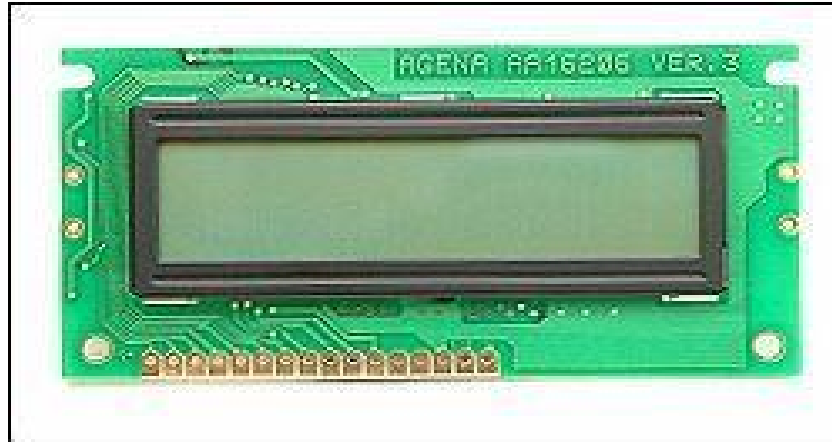
At the heart of the breakout board, there is the SIM800L GSM/GPRS Module made by SimCom. As mentioned in the above pinout section, the operating voltage of this device is 3.4V to 4.4V which means you can power this module directly from a lithium polymer battery. Other than that all the usable pins are broken out to a 0.1" pin pitch that makes this module very breadboard friendly. It also has auto baud rate detection for ease of use. The module needs an external antenna to connect to the network, which is why there are two antenna options available for this board. In the package, you will get a helical antenna that you can directly solder to the NET pin of the module. But if you want to keep the antenna far away from the module board there is an option for connecting the external antenna with the on board UFL connector. Any sim card with 2G connectivity will work with this module.



LIQUID CRYSTAL DISPLAY (LCD):

Most common LCDs connected to the microcontrollers are 16x2 and 20x2 displays.

It is commonly used in various systems to show different status and parameters. LCD16x2 has 2 lines with 16 characters in each line. Each character is made up of a 5x8 (column x row) pixel matrix.



V. SOFTWARE REQUIREMENTS:

1. Eagle
2. Arduino programming language.

VI. ADVANTAGES

- Early detection of accidents
- Accurate location tracking
- Real-time alerts and notifications
- Improved safety features
- Cost-effective

VII. APPLICATION

- Personal vehicles
- Commercial vehicles
- Emergency response vehicles
- Rental vehicles
- Public transportation

VIII. CONCLUSION

The car accident detection system using MPU6050, SIM800L, and GPS is a highly effective and efficient solution for improving road safety and reducing the severity of accidents. The system comprises several key hardware components, including an MPU6050 sensor, GPS module, GSM module, microcontroller, and power supply, all of which work together to provide accurate and reliable data to enable fast and effective accident detection and response. The system offers several advantages, including early detection of accidents, accurate location tracking, real time alerts and notifications, improved safety features, and cost-effectiveness. With a wide range of applications in the field of transportation and road safety, the car accident detection system using MPU6050, SIM800L, and GPS has the potential to save lives, reduce response times, and improve overall safety on the roads. As technology continues to evolve, we can expect to see further advancements in car accident detection systems, further enhancing safety and security for drivers and passengers alike.



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