

Automatic Accident Detection and Emergency Alert System using IoT

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ABSTRACT

One of the primary causes of a vehicle accident is speed. If emergency personnel had been able to learn about the tragedy and arrive in time, many lives might have been saved. Many unique characteristics can be found in an intelligent vehicle, such as a smart car, that has electronic driver assistance controls installed. In this context, a few clever ideas are included in this project work, such as axis detector, vibration sensor, a close-running car alarm on the front and rear sides, MQ3 Alcohol. The Arduino Uno board serves as the main processing unit, and it is interfaced with the sensors mentioned above. Accelerometer is detect the sudden change of axis of the vehicle, Vibration sensor detect the hitting of vehicle, if such condition detects, Arduino take the location of the vehicle from GPS sensor and send message through GSM (Global System for Mobile communication) along with location to the family member mobile. In addition to being used to detect alcohol level of the driver. If this occurs, an emergency alert will show and an alarm will sound.

KEYWORDS: IOT, GPS, GSM, MQ3, Accelerometer

INTRODUCTION

The invention of a transportation system has given humans the ability to have the highest civilization above all other living things on the planet. Our daily lives are greatly impacted by automobiles. We use it to get to work, communicate with friends and family, and transport our goods. But it can also do us harm and possibly result in our deaths from accidents. One of the most significant and fundamental danger factors when driving is speed. It influences a crash's severity as well as one's likelihood of getting into one [2].

Accidents still happen occasionally despite the numerous efforts made by various governmental and non-governmental groups throughout the world through various programs to raise awareness against irresponsible driving. If the emergency services had been able to get the crash information in time, many

lives might have been saved. According to a study by Virtanen et al., 4.6% of accident fatalities may have been avoided if emergency services had been available at the scene of the accident in a timely manner. As a result, effective automatic accident detection with automatic transmission of the accident location to the emergency services is essential to save priceless human life.

For the calendar year 2022, States and Union Territories (UTs) have recorded a total of 4,61,312 road accidents, resulting in 1,68,491 fatalities and 4,43,366 injuries. Compared to the previous year 2021, there were 11.9 percent more traffic accidents in 2022. Similarly, there was an increase of 9.4% and 15.3%, respectively, in the number of fatalities and injuries caused by traffic accidents [7].

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Table 1: Major Parameters of Road Accidents 2021 & 2022

Parameter	2021	2022	% Change
Number of Accidents	4,12,432	4,61,312	11.9
Number of Persons killed	1,53,972	1,68,491	9.4
Number of Injury	3,84,448	4,43,366	15.3
Accident Severity (Persons killed per 100 accidents)	37.3	36.5	2.14

Road users may suffer serious injuries, mild injuries, loss of life, or no injuries at all as a result of a traffic accident. A fatal accident is one that claimed the lives of one or more people. An accident resulting in severe harm is defined as one in which one or more victims sustain serious injuries (not necessarily in the sense of the IPC definition of grievous damage). A minor injury accident occurs when the victim or victims don't need to be hospitalized.

LITERATURE REVIEW

P. Josephinshermila et.al, used different sensors that are employed in this suggested vehicle safety system to acquire different parameters. The temperature, gas and collision sensors are the ones that are employed here. The crash sensor is used to identify the accident. Within the car, sensors for temperature and gas are installed to look for anomalies. The car also has a GPS installed inside. The microcontroller receives the data whenever there is an anomaly in the sensed data. The microcontroller receives a number of inputs, including anomalies in temperature, volatile gases in the cabin (in the event that the driver is intoxicated or puffing on a cigarette), and the vehicle's current location [2].

Firas Muhammad, et al., presents an accurate, scalable, and real-time vehicle monitoring system. GSM, GPS, and GPRS networks—which are appropriate for a wide range of applications worldwide—are used to do this. Real-time continuous tracking is possible by combining GPS and GPRS, and the position is displayed on a Google map using the Google Map API. The Arduino is the system's brain, and although the GPS provides location-based data, the GSM module is controlled by AT commands that enable data flow to the module [4].

A. Navya et. al proposed the intelligent vehicle monitoring system, along with various sensors. In order to detect natural light, an LDR is employed. When natural light is no longer present, headlights are automatically powered on and turned off. Infrared sensors are utilized automatically activate the alarm by detecting the approaching vehicle at both the front and rear ends. The addition of a smoke sensor allows for the detection of fire traces within the vehicle. If such traces are found, an alarm will activate and information will be presented on an LCD. Accident detection is done using MEMS (Deviation sensor) [6].

M Pavan Manikanta, et. al proposed a comprehensive system that aids in the detection of mishaps like accidents and fire outbreaks and also aids in the development of a rescue system. The system senses data with the use of intelligent sensors, and IoT is used to send messages. A designated medical facility and fire station receive the alarm message to help rescue the victim. The vehicle can be located using the GSM and GPS modules. The ARDUINO board, which is based on the ATmega328 microcontroller, is used in the proposed system. A piezoelectric sensor is a machine that uses the piezoelectric effect to transform pressure, acceleration, temperature, strain, or force into an electric charge. The main function of a flame sensor is to recognize and react to the presence of a fire or flame. DHT11, a low-cost digital temperature and humidity sensor used to measures temperature. The alert was displayed using a liquid crystal display (LCD) [9].

Nandish B M et al. notifies responsible parties when an accident occurs. The most recent execution techniques concentrate on providing aid to the driver even while he is restricted in a remote location and unable to respond. It keeps an eye on the car to gather data on the separation between two cars. Ultrasonic sensors have the ability to measure distance. Every second, this measurement is updated. The several components of the system that need to be correctly placed in an automobile. In order to determine where the accident occurred, the GPS module collects the latitude and longitude coordinates of the car from a satellite. The data is transmitted to the GSM modem after encoding is finished. Node MCU transmits the signal to the GSM modem for the purpose of sending an accident message to pre-programmed phone numbers. It collects location information from the GPS receiver module and then sends the information to the cell phone in SMS text format while also uploading longitude and latitude data and other information to the cloud [11].

Yade Abhishek Kailas and et al used the designated location and notify the family and any nearby emergency services, including police stations, hospitals, and ambulances. System also informed via the Android mobile application that all of the device's components are already available for Android smartphones. In the event of an accident, the program

will identify it and notify your preferred contact number along with its live location. It deals with incident detection, alerting paramedics to the precise location, transporting them to the closest hospital, and attending to the incident victim's medical needs [12].

Pankaj Chourasia et al., proposed system that used GSM and GPS. When an accident happens, registered mobile numbers receive a GSM network message with the GPS coordinates of the incident site. It is discovered that the suggested method is quite helpful in pinpointing the scene of the accident so that the injured party can receive emergency medical attention. Installing this technology in the car will make it cost more, but doing it as a precaution would end up being highly beneficial. [18].

PROPOSED METHODOLOGY

Our goal is to create an integrated system that will aid in the detection of mishaps such as accidents, Alcohol detection of vehicle driver, axis change of vehicle, as well as the development of a rescue system. The IoT is used by the system to send messages and perceive data with the aid of smart sensors. There is GPS to detect locations as well. To save the person, the alert message is forwarded to family member. The vehicle may be located using the GPS and GSM modules.

Proposed Working Model

- Arduino UNO, which reads data from MPU6050 Gyroscope/Accelerometer Sensor, serves as the control unit. If there is a fall in the axis, the accelerometer will detect it. If Arduino notices a significant change in the vehicle's axis.
- If vibration sensor SW-420 and Comparator LM393, module determines whether there is any vibration that exceeds the threshold.
- It retrieves the current location from the GPS module and uses the GSM module to send it through SMS to the mobile phone.
- The buzzer is turned on by Arduino before the SMS is sent, and after 30 seconds of beeping, the SMS is sent.
- The saved personal members of a family are informed regarding the accident through the GSM module.
- IR sensor will detect nearby vehicles on both ends (Front or Back) also turn on the buzzer that alerts the driver.
- Alcohol/ gas sensor to sense the alcohol content in the breath of the driver and alerts the driver and the surroundings

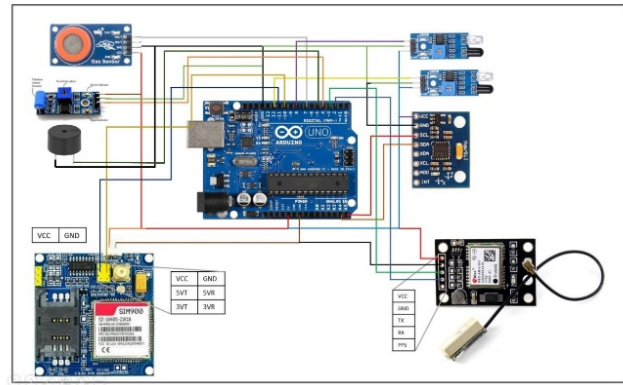


Figure 1: Circuit diagram of proposed methodology.

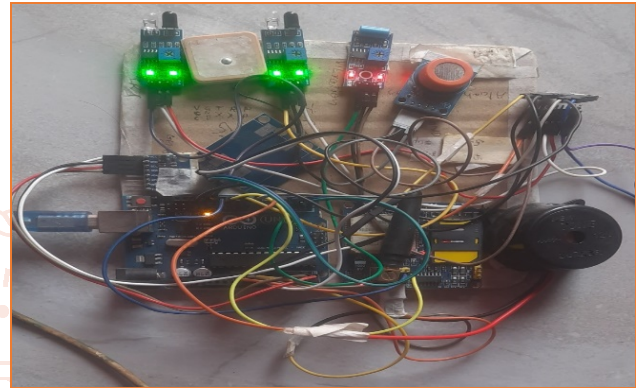


Figure 2: Proposed working model

Devices Used

Arduino: Arduino is a company, user community, and open-source hardware and software project that specifies in single-board microcontrollers and microcontroller kits for building digital devices.



Figure 3: Arduino Uno [6].

MPU6050 Gyroscope/Accelerometer Sensor: An accelerometer determines the drill bit's velocity and direction as well as the tilt angle relative to the earth by detecting the acceleration caused by gravity [16].

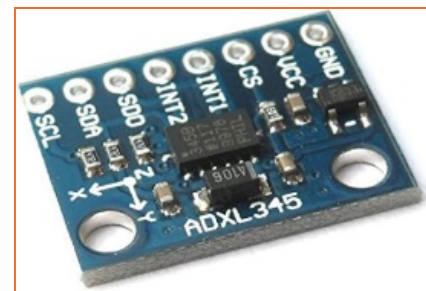


Figure 4: Accelerometer [18].

Vibration Sensor Module SW-420: An apparatus that gauges the quantity and frequency of vibration in a certain machine, system

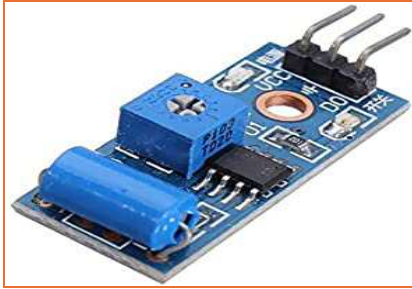


Figure 5: Vibration Sensor [16].

IR Sensor: An electrical gadget that emits in order to sense certain features of its environment

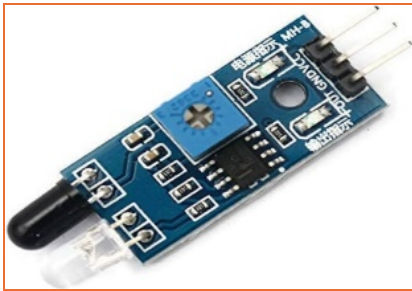


Figure 6: IR Sensor [6].

MQ3 Gas Sensor: The MQ3 gas sensor is an alcohol sensor that measures the amount of alcohol in breath.



Figure 7: GAS Sensor [18].

GPS Module: GPS used to get the latitude and longitude (location) of the vehicle, to identify the accident spot.



Figure 8: GPS Module [18].

GSM Module: To fully utilize the GPRS/GSM capability of the module, a SIM card needs to be inserted.



Figure 9: GSM module [12].

Buzzer: An audio signaling device, often known as a buzzer or beeper, can be piezoelectric, electromechanical, or mechanical (piezo for short).



Figure 10: Buzzer [6].

RESULT ANALYSIS

We have successfully got the SMS of location of the vehicle to family member mobile phone about the mishaps. Also alert the vehicle driver about the nearby vehicle in both side (front and back side) with buzzer sound.

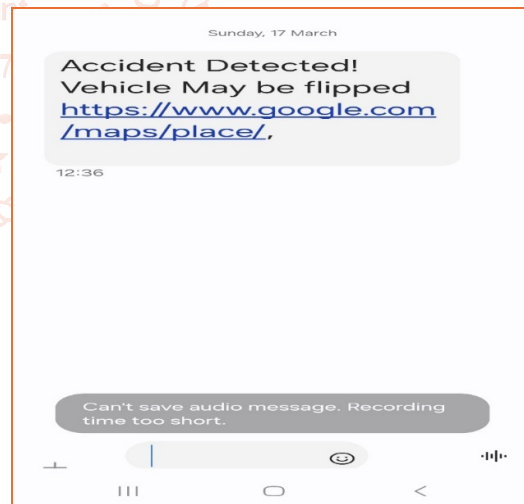


Figure 11: Message received by family member (Goggle Map)

CONCLUSION

The proposed solution considers informing the family member in the event of an accident in addition to locating the car. There isn't currently a suitable solution that combines an accident detection system with a location detection system. This mechanism guarantees not only the safety of the vehicle but also the safety of any passengers or goods within. The user may locate the precise location of the car with ease

because to this system's provision of the location's precise latitude and longitude. Since there is no human involvement in the piloting of the car, this system makes sure to maintain track of its location.

FURUTE SCOPE

This device can be integrated with the car's airbag system, which keeps passengers from hitting interior fixtures like the window or steering wheel. Another way to improve this is to link a camera to the Controller Module so that it can take a picture of the accident scene and facilitate simpler tracking. We can also use Wi-Fi enabled microcontroller and we can provide GPS location of our mobile phones.

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