

Vehicle Accident Alert System

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Abstract

Over the past few years, the usage of vehicles has drastically increased. The transportation system has undergone a lot of development and the latest technology is being used in vehicles. With the increase in the number of vehicles on the road, the number of accidents has also proportionally increased. The most important factor in reducing the number of casualties in an accident is the response of emergency services. To reduce the time of response, a Vehicle Accident Alert System is proposed that automatically detects an accident and alerts a predefined phone number by sending an SMS (short message service). The system comprises of an accelerometer, vibration sensor, GPS, and GSM module. The heart of the system is the Arduino Uno. A threshold algorithm is used to detect an accident.

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1. Introduction

Accident is referred to an unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury. The primary concern of every human being is health. In emergency situations, a quick response is required to avoid loss of human life. In developing countries like India, a large number of people die due to accidents. In 2015, there were about five lakh road accidents in India, which killed about 1.5 lakh people and injured about five lakh people [21]. In many situations, rescue operations cannot be executed because the accident location cannot be detected. An accident alert system is proposed to detect the location of an accident and quickly inform the whereabouts of the accident and the speed (knots) of the vehicle to emergency services or a predefined mobile number through Short Message Service (SMS). This provides a way for accident victims to get immediate help. The proposed system consists of an Arduino board, accelerometer, vibration sensor, GSM, and GPS module.

2. Literature Survey

Kalyaniet al. [1] proposed a system consisting of an Arduino microcontroller, vibration sensor, GPS and GSM module. In this system, an accident is detected with the help of the vibration sensor which detects the accident vibrations and activates the GPS. The GPS is used to receive the coordinates of the accident whereas the GSM

module is used to send the received coordinates through SMS via the Arduino Uno chipset [5]. This accident system can be fitted anywhere in the vehicle [2]. This system is also proposed in [5],[6]. The major drawback of this system is the inefficiency in detection of accidents. A small vibration which need not necessarily be any major accident would also activate the system.

A better system model proposed by Shaileshet al. [7] replaces the vibration sensor with another component known as the accelerometer. Here, whenever an accident occurs the Micro electromechanical system (MEMS) will detect a signal and send it to the ARM controller which further sends it to the GPS module to collect the coordinates. These coordinates are then sent Through GSM modem which contains GPS parameter values. If the accident is minor a button can be pressed signifying, it's a minor accident else it is a major accident.

Aliet al. [3] presented a hybrid solution by including both an accelerometer and vibration sensor. In this system the hardware is paired to the smart phone via a Bluetooth and is operated with an android application. Once paired the configuration page of the mobile app would appear which asks for the driver name and emergency contact. This page also displays the position of the vehicle. As soon as an accident occurs, a message is sent to the mobile app through the paired Bluetooth which in turn sends an emergency request containing the accident location to the emergency contact previously inputted.

3. Working Components

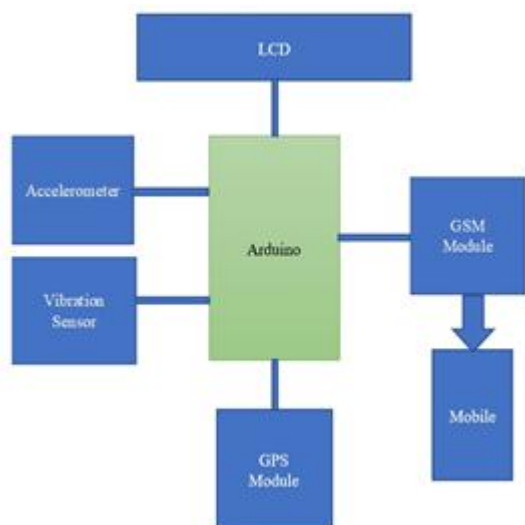


Figure 1: Block diagram of Vehicle Accident Alert System

1: ARDUINO

Arduino Uno is a microcontroller board based on the ATmega328P microcontroller. It is the heart or control unit of the system. It collects data from the accelerometer, vibration sensor, GPS, and GSM modules and displays the required output on an LCD screen. Arduino gathers all the information and sends the message of an accident to the receiver through the GSM module.

2: GSM MODULE

GSM stands for Global System of Mobile communication and is used for the purpose of cellular data communication. The SIM900A module is used for the communication between the GPS, GSM and the allocated mobile number. It is an ultra-compact and reliable wireless module. It delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.

3: GPS MODULE

The Global Positioning System (GPS) is a satellite navigation system, that is based in space which provides location and time information no matter what the weather condition, anywhere near or on the Earth where there is a unhampered line of sight to either four or more GPS Satellites. SIM28ML is the GPS module used. Using this GPS module, the location of the accident can be detected through the coordinates. This location information is first sent to the Arduino and is then sent to the predefined number through the GSM module.

4: VIBRATION SENSOR

A Vibration sensor is a sensor that is used to measure, display and analyze linear velocity, displacement and

proximity, or acceleration. Vibration sensor module SW-420, uses a comparator to detect a vibration over the threshold point and provide digital data, either logic high or low (0 or 1). During normal operation it is in logical low but when a vibration is detected, the signal is set to logic high. The sensitivity of the sensor can be customized accordingly and is non directional. SW-420 is used to detect a minor accident when interfaced with the Arduino Uno chipset

5: ACCELEROMETER

The accelerometer measures dynamic acceleration resulting from motion, shock, or vibration as well as the static acceleration of gravity in tilt-sensing applications. The accelerometer used here is ADXL335 which is a low powered, triple axis, MEMS accelerometer. ADXL335 is configured with Arduino Uno chipset to detect any change in acceleration in any of the three axes i.e. X, Y, Z axis.

4. Working

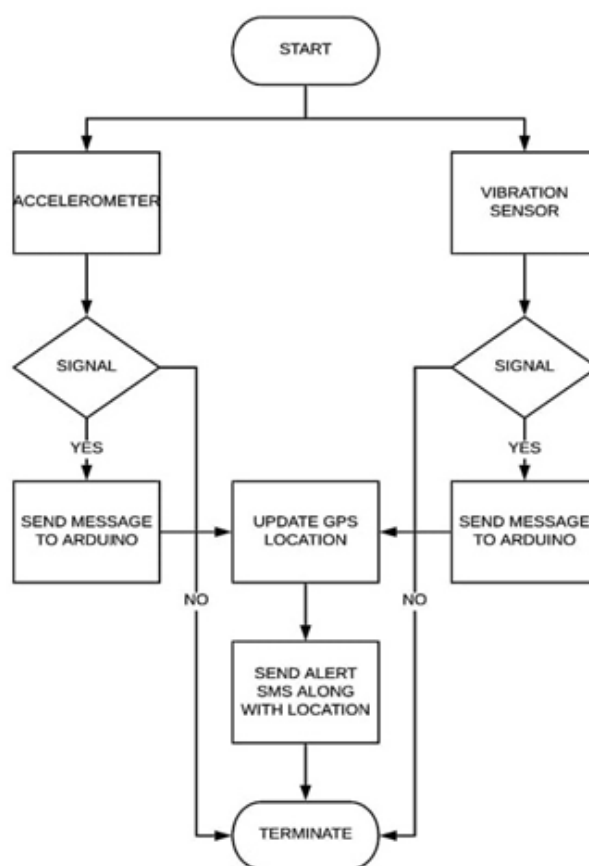


Figure 2: Flowchart of accident notification message

Here, Arduino is used to control all the working modules. When a person meets with an accident, it is detected by either the accelerometer or the vibration sensor. The accelerometer detects the sudden change in either the x, y or z axis. This information is sent to the

Arduino microcontroller and the location of the vehicle is received through the GPS module. The location of the accident and the speed of the vehicle in knots is sent to a predefined mobile number as an SMS using the GSM module. The message that is sent contains a Google Map link so that the location of the accident can be easily tracked in a user-friendly graphical map display. In order to display status messages or coordinates, an optional 16x2 LCD can also be also used.

5. Conclusion

This Vehicle Accident Alert System is proposed to reduce the number of casualties in an accident. The system is comprised of sensors that the Arduino board, which is fitted in the vehicle controls. A threshold algorithm is used to determine whether an accident has occurred or not. Therefore, whenever an accident occurs, the precise location of the accident and the speed of the vehicle (knots) is sent to the predefined time in a very short amount of time.

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