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A low cost and user friendly vehicle crash alert system using arduino

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Abstract. This paper is aimed at developing a vehicle crash detection system using Arduino, GPS, GSM and accelerometer. Accelerometer detects the sudden change in the axes of vehicle and GSM module sends the alert message on your mobile phone with the location of the accident. Location of accident is sent in the form of Google map link, derived from the latitude and longitude from GPS module. The message also contains the speed of vehicle in kilometers per hour. The proposed model can also be used as a tracking system and much more, by just making few changes in hardware and software. The alert system has been developed in real time and performance is discussed.

Keywords: Arduino, Accelerometer, Crash detection system, Tracking system

1. Introduction

In this automated world life it is impossible without the use of vehicles. The usage of vehicles increasing day by day resulting in the increase of road traffic and also the risk of road accidents. Due to this humans lose their lives and there is no immediate transportation to medical facility. The accidents can't be avoided all the time but they can be reduced by reducing the occurrence of accidents. The system that has been proposed helps to provide medication to the casualties as soon as possible. The drivers working in big concerns tend to make illegal use of vehicles by giving economic loss to the company.

This system can be also used to track stolen vehicles and lost travelling luggage's etc. The system constitute of single-board embedded system that has GPS and GSM modems connected to an Arduino UNO. A vibration system is attached to the vehicle which detects the vibration and condition of the vehicle. The vibration signal is then compared to the normal vibration signal values of the vehicle to confirm that the vehicle has undergone an accidental situation by identifying unnecessary shock or tilt of the vehicle. The information and the exact location of the accident occurred is then informed with the help of GSM module. GSM works with the sim card inserted in it. This paper addresses intelligent security system, safety etc.

This paper is framed as a discussion on recent alert systems, proposed model, real time expansion and working on vehicle crash alert system.



2. A discussion on recent Alert systems

In [1], the author provides a system which makes use of an Android application which can be useful to alert accident through messaging system. For location mapping this application makes use of the GPS technology and also sends a notification of the accident. This generated alert message will be sent to the nearby registered people who are being present within the accident zone to make sure the reputation the message to increase. Based on the reputation of the message it will be sent to emergency services which are being close to the accident zone. Due to privacy problem that people face in the society block-chain methodology is been used in this system to protect the users privacy.

The system in [2], the author provides a system to avoid two-wheeler accident which can be detected and then immediately alert the nearby medical facilities to request help for medical aid. An accelerometer has been attached to the vehicle and a heartbeat sensor is been placed to the human body which has the ability to sense the pulse of the user to understand the seriousness of the accident. Also the android application which is present in the user's smartphone intimates the user's family and friends about the accident for back up. The android application also shares the location of the accident occurred which will come very handy to rescue the patient

In [3] road accidents are primarily detected using the deep learning methodology a neural network is been formed through which the information of a particular accident will be transmitted to the road safety control rooms which helps them to take immediate action. Also this technology also can be very helpful when it's been set up in an accident prone zone which might send adequate data to the desired emergency services. If this system can be perfectly utilized many people lives can be saved.

In [4] the author facilitates a real-time model to reduce automobile accident and seeks to reduce the various possibility for death. This system also ensure that the possibility of the automobile accident can be gradually can be reduced by a solid amount of 9 percent

In [5], this automated alert system is designed to ensure the safety of the casualty by providing a team to rescue and rush for nearby medical facilities. A ZigBee module has been used to transmit the alert message to a team of volunteers for rescuing

In [6], a deep learning-based technique is implemented for the main purpose of detecting the collisions due to an accident and to announce the urgency for medical aid. Deep learning technology is been used to create a web-based platform which consist of sensors which can detect the collision.

In [7], the author provides a system to monitor the velocity of the automobile and detect the accident by using the collected data and send it to Alert Service Center. Microcontroller is been used to monitor the old velocity and new velocity and compare them to detect the accident.

In [8], the author proposes a system to sense the probability occurrences of an accident that might occur by the automobile by using some particular sensors which are fitted to the vehicle. So by the help of this alert can be notified for immediate back up or for personal alerts.

In [9], the author provides a system which can sense the vehicle's velocity and also passengers who are being present in a particular vehicle just before the accident might occur. By using several sensors these data will be collected and then concerned society members can be intimidated by means of messaging system/

In [10], the author provides a system to analyse physical parameters of motion data to identify the motion of the vehicle. By systematically analysing the data's the success rate of the detection can be detected.

In [11], the author provides a system to reduce the false alarm negligible probability by building up an application which can detect an object all physical motions and to intimate accident alert to concerned facilities.

The notable limitations of recent alert systems are:

1. They are expensive
2. If phone is damaged, location cannot be accessed.
3. The victim is required to confirm the assistance needed which is not practical in case he is seriously injured

3. Proposed alert model

Figure 1 shows the block diagram of the proposed system, which deals with the vehicle crash alert system. Arduino UNO is the brain here, it helps other components to communicate with each other. Whenever accident occurs, the system wakes up. Initially accelerometer detects the sudden change in the motion and it communicates with Arduino UNO, further vibration sensor also involves in the detection of the accident.

Once the Arduino UNO has confirmed the collision, it communicates with GPS (NEO-6M) and receives the coordinates of the location. The received location contains latitude and longitude, this information plays the vital role here in this project.

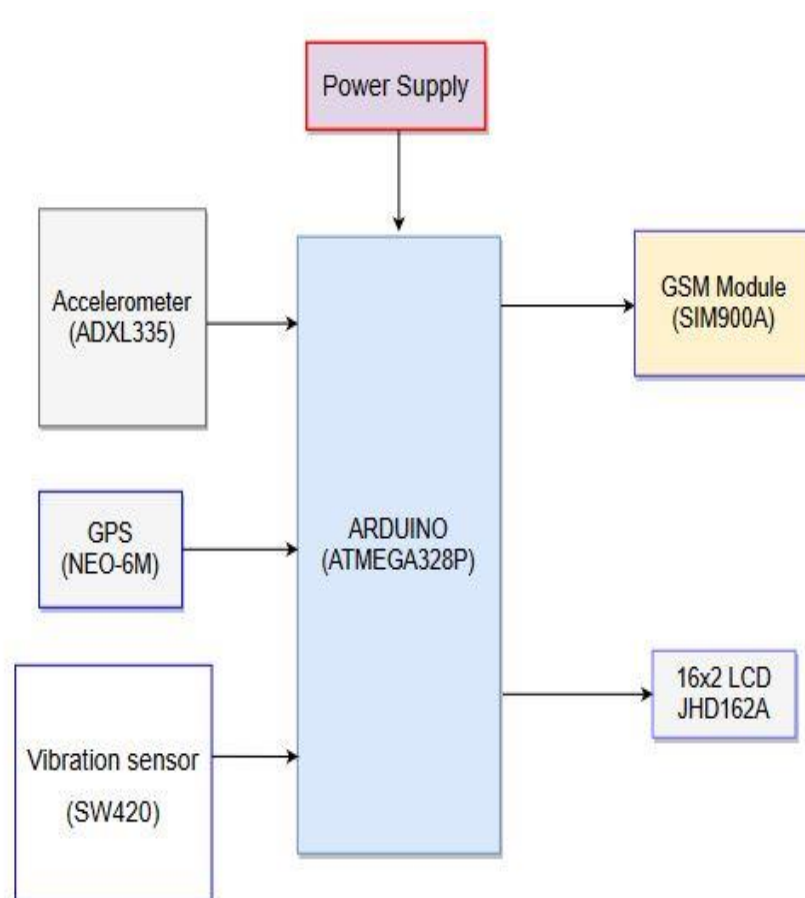


Figure 1. Schematic of Proposed alert model

The received data from the GPS is this sent to GSM for further communicating purpose. After installing this system in the vehicle, the user is asked to register the phone number of the beloved ones, so that in case of emergency the GSM module sends SMS to number given by the user. Now the GSM module sends the location of the accident occurred to the nearby hospital or beloved one. The information sent contains the location of the accident occurred in the form of Google maps link along with the emergency message.

The number of accidents has been increasing day by day, the main purpose of the system is to provide the location of the vehicle where the accident has occurred and also sends the information to

the authorities wirelessly with the help of GSM and GPS systems. Vehicle crash alert system detects the location of the crashed vehicle and sends the information such that medical help can be given in shorter time. When the car undergoes an accident the sensors which are attached gets triggered immediately. Thus there will be lesser time for the ambulance to reach the accidental spot. The vibration sensor which fitted in the vehicle plays a major role by detecting the crash of the vehicle and the GPS system helps to find the coordinates of the crash site and GSM module sends the information to the authorities for faster medical help. By this way the system becomes intelligent in communication and protecting human life from accidents.

3.1. Design of VCAS

The below figure 2 depicts the circuit diagram of the proposed VCAS.

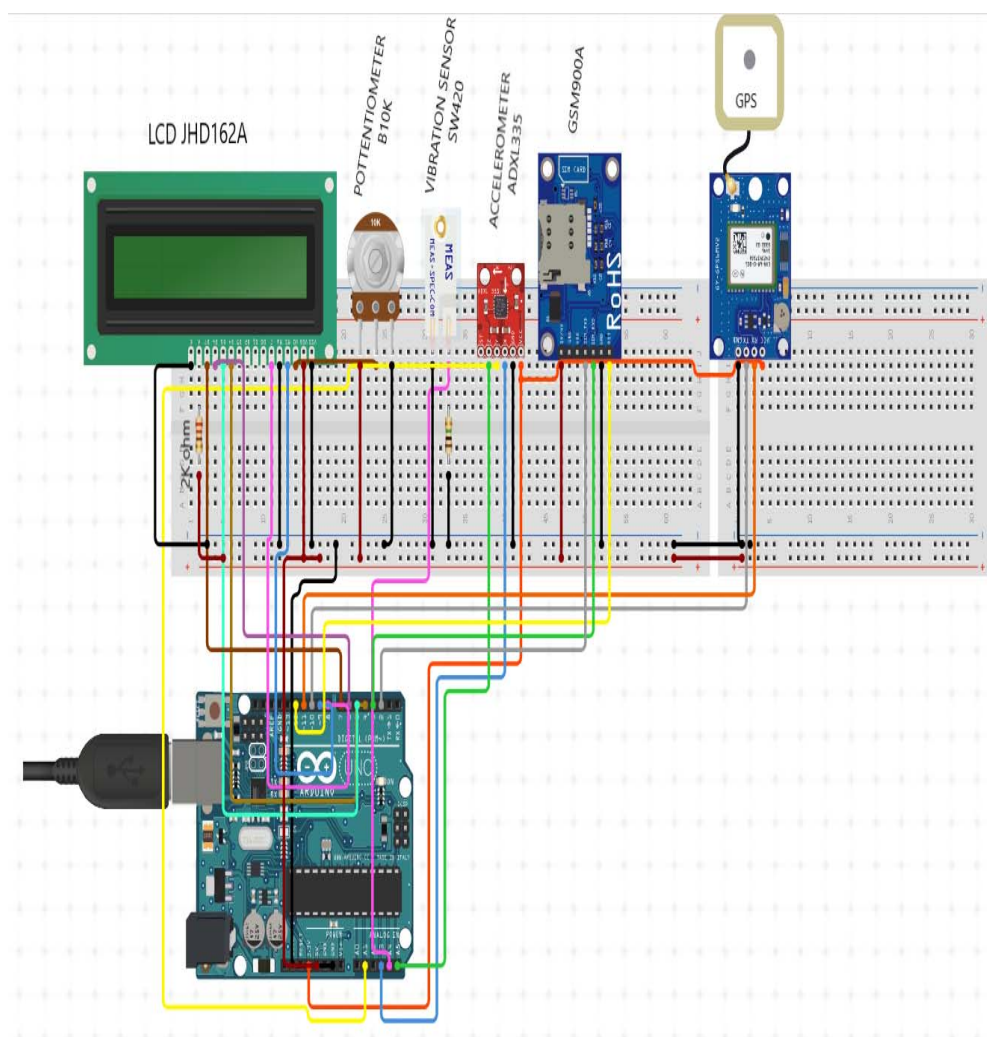


Figure 2. Schematic diagram of Vehicle crash alert system

From the above given circuit diagram of the vehicle crash alert system, the connections of the components to the Arduino UNO board is as follows. The GPS's TX pin is connected to the pin 10 of the Arduino UNO. RX of the GPS is left as it is. The GSM module has RX and TX pins, which are connected to the pin D2 and D3 respectively to the Arduino board. GSM is given a power supply of 12

volts separately and it is grounded. The interface of the LCD to the Arduino UNO is also done similarly, D4, D5, D6, D7 pins of the LCD is connected to the pins 6,7,8,9 of the Arduino UNO and EN of LCD are connected with pin number 4 and 5 of Arduino and RW pin is connected along with ground. For controlling the brightness of the LCD screen, a potentiometer is connected along with the LCD.

The accelerometer contains X, Y, Z pins, which are connected to the A1, A2, A3 pins of the Arduino Uno board. The accelerometer is also grounded along with other components. The vibration sensors V_{out} pin is connected to the A4 pin of the Arduino Uno board and it is grounded. This is how the all the components are interfaced with the Arduino UNO board.

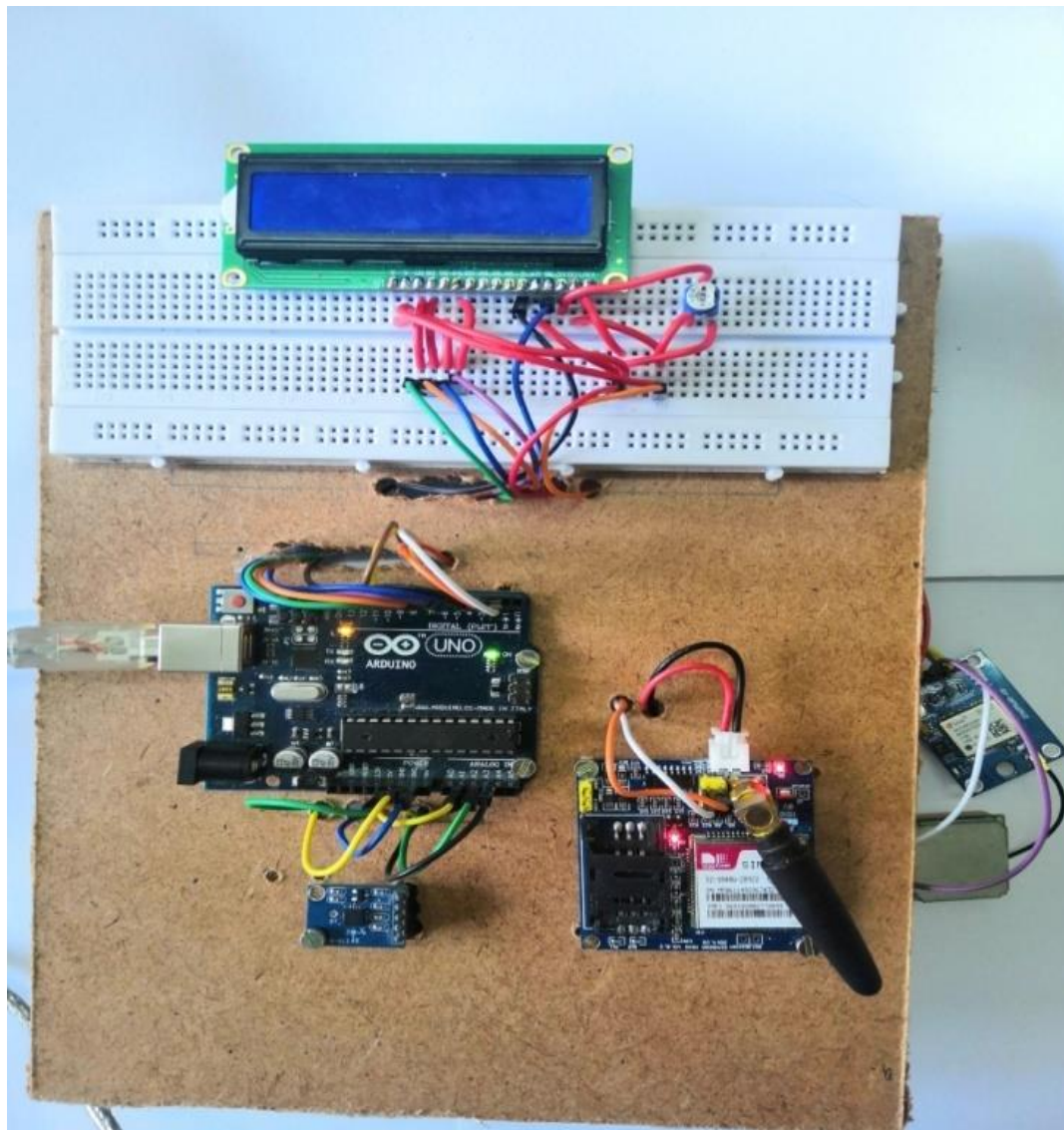


Figure 3. The prototype of VCAS

The proposed method is tested in a motorbike. This system is an immediate aid system and found following merits,

1. Monitors all hazards and threats.
2. Alert messages are sent to the nearby hospitals and police stations.
3. It is an affordable system.

4. Can be used in any kind of vehicle.
5. The alert message regarding the accident is automatically sent,
6. This system can be used for a social cause.
7. It does not need any operation manually

The prototype in figure 3 ensures compactness and an easy installable system in a vehicle and can be further reduced. The importance of saving life depends on time and now this can make in advance.

4. Conclusion

The proposed system helps to detect the accident by collecting all necessary data through the sensors and then process them with the help of Arduino microcontroller and also a GPS module is used for identifying the exact location the accident took place. Arduino acts as transmitter which transmits the message to different type of devices which are being present in the system. At the moment when the accident had been occurred the accelerometer and vibration sensor will be activated, with the help of GSM module we can transfer this data to a particular mobile number. Through GPS the geographical coordinates of the area where the accident took place will be located. By using this model accidents can be avoided and deaths can be prevented. Thus, a low cost and user-friendly vehicle crash alert system based on Arduino is developed and testing was done in order to verify the performance of the system.

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