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ADVANCED AUTOMATIC VEHICLE DETECTION AND RESCUE SYSTEM

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ABSTRACT

Road accidents rates are very high nowadays, especially two wheelers. Timely medical aid can help in saving lives. This system aims to alert the nearby medical center about the accident to provide immediate medical aid. The attached accelerometer in the vehicle senses the tilt of the vehicle and the a heartbeat sensor on the user's body senses the abnormality of the heartbeat to understand the seriousness of the accident. Thus the systems will make the decision and sends the information to the smartphone, connected to the accelerometerthrough gsm and gpsmodules. The Android application in the mobile phone will send text messages to the nearest medical center and friends. Application also shares the exact location of the accident and it can save time.

Keywords-Accident detection, alertsystem, GPS, GSM, Accelerometer, Android application.

I. INTRODUCTION

Nowadays, the rate of accidents has increased rapidly. Due to employment, the usage of vehicles like cars, bikes have increased, because of this reason the accidents can happen due to over speed. People are going under risk because of their over speed, due to unavailabilityof advanced techniques, the rate of accidents can't be decreased. To reduce the accident rate in the country this paper introduces a solution. Automatic accident detection and alertsystems are introduced. The main objective is to control the accidents by sending a message to the registered mobile, hospital and police station using wireless communications techniques. When an accident occurs in a city or any place, the message is sent to the registered mobilethroughGSMmoduleinlesstime.Arduinois theheart ofthesystem which helps in transferring the message to different devices in the system. Vibration sensor will be activatedwhentheaccidentoccursand theinformationistransferred totheregisterednumber through the GSM module. The GPS system will help in finding the location of the accident spot. The proposed system will check whether an accident has occurred and notify nearest medical centers and registered mobile numbers about the place of accident using GSM and GPS modules. The location can be sent through a tracking system to cover the geographical coordinatesoverthearea. Theaccident can bedetectedbyavibration sensorwhich is used as a major module in the system.

II. METHODOLOGY

The automatic vehicle accident detection and rescuesystem proposed in this work is shown in Fig. 1. It is a compact IoT-based system, and operates at a low-cost inThe automatic vehicle accident detection is an IoT-based project divided into 4 main subsystems namely accident detector subsystem, Emergenc Medical Service (EMS)subsystem.

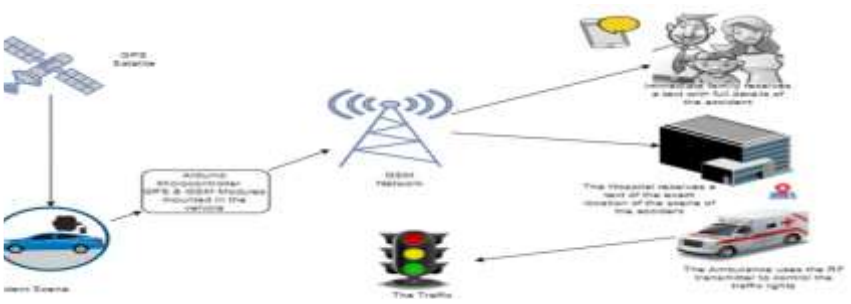

Figure 1: Overview of the automatic vehicle accident detection and rescue system

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III. OBJECTIVESANDSCOPE

The main objective of this project is to prevent casualties which happen due to lack of medical assistance in time. Certainly, if the accident happens due to other cases, the used electronic devices will be able to provide the spontaneous message and exact location to police and ambulance in order to recover victims. Avoiding casualties caused by road accidents is the main goal of this paper, with the help of Accelerometer and GPS present in the mobile phones. Based on the data collected from these sensors, which are present in most mobile phones, the location of the accident is sent at the same time of the accident to the friendsand relativeswhichtheuserallowedand stored,and alsotothe rescueand emergency services.

3.1 EXISTINGSYSTEM

This idea proposal has been introduced at the start of the modern age of mobile phones. With the introduction of GPS sensors in the mobile, security applications based on GPS were proposed. Then they proposed special hardware devices which can be linked with mobile phones. Though, it had the disadvantage of actuallybuying extrahardware with more money. With the massive development of mobile phones in the last decade and new sensors added with the development, the extra hardware can be avoided. The present application of this paper is present in a very few countries and providing the information with the relatives and friends with the emergency services the efficiency of the application can be increased massively.

3.2 DrawbacksoftheExistingSystem

Thelivesystemcan't workifanyof thefollowingoccur atthetimeof the crash:

- Automaticorphoneisdisconnectedordamaged.
- NoGPSsignalatthetimeofthecrash.
- Insufficientcellularsignaltouploadcrashdetails.

IV. PROBLEMSTATEMENT

The use of vehicles increases in the proportion of the population. Due to the traffic congestion, the accidents are also increasing day by day. This causes the loss of life duetothe delay in the arrival of ambulances to the accident spot or from the accident spot to the hospital. So, it is necessary to take the accident victim to the hospital as soon as possible. Whenever an accident occurs, it has to be informed to the investigation unit. So, it is also beneficial if the intimation is reached to the enquiry section so that the time for the investigation can be minimized.

V. PROPOSEDMETHOD

The main idea of this paper is to build an application that makes use of the sensors present in mobile phones like GPS and Accelerometer and detect any collision if there is a sudden external disturbance in the speed with the help of the Sensor Fusion Based Algorithm. With the help of the data obtained from the Accelerometer sensor, when there is a sudden disturbance to the mobile phone, the user is notified with an alert message before sending the request help signal. If no emergency is required, they can cancel it within 10 seconds. But, if they press the "Call Help" button or if the alert message is unattended for more than 10 seconds, the "request for help" message will be sent to the emergency services as well as the family members, the users provid

VI. SYSTEMARCHITECTURE

In this system, the external disturbance is detected by the accident detection module andwhen it is detected,afunction is called to findthecurrent location oftheuserwith thehelp of GPS in the Location Detection Module. The location data obtained from the GPS is sent tothe emergency services to request help.

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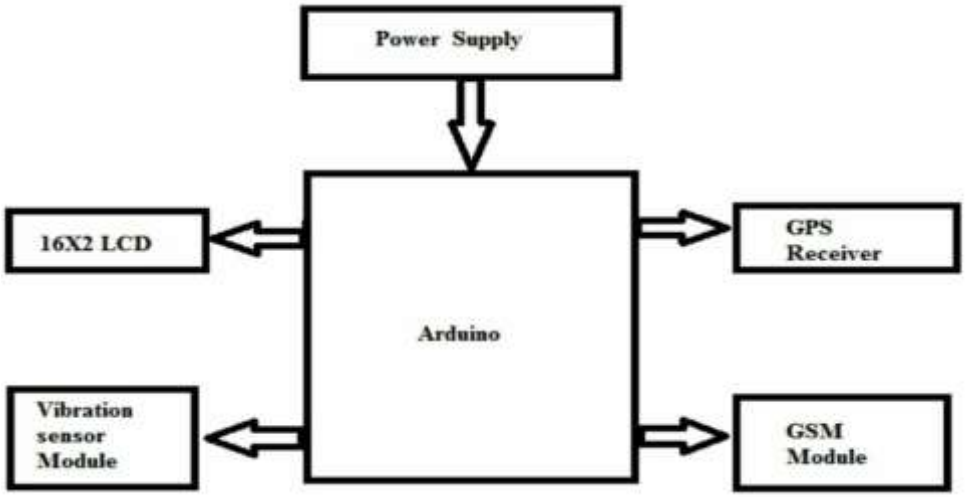

Fig1: Ardunio System

Vehicle unit consists of an accelerometer which keeps on informing the coordinate of vehicle position to the microcontroller. If it is found at random, the GPS location tracker tracks and informs the emergency number with values of latitude, longitude and google map position using the GSM SIM module.

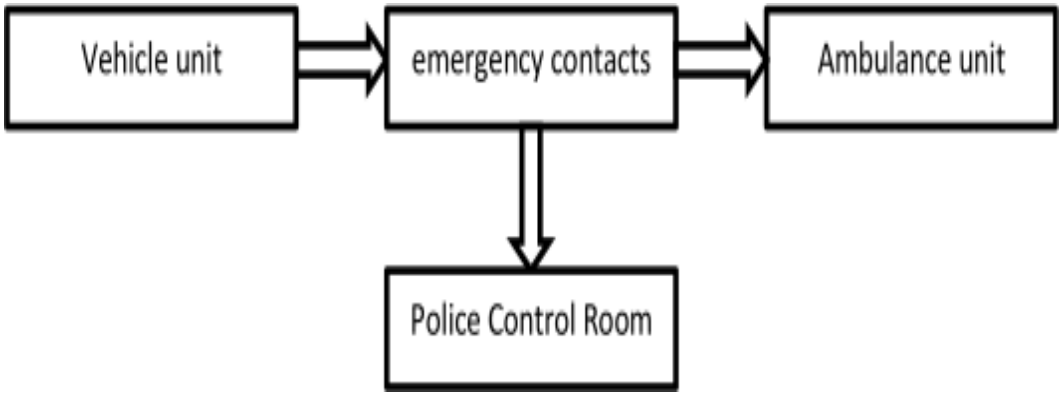

Fig2: VehicleUnitServiceSystem

Vehicleunitsendstheinformationtotheemergencycontactslikepolicecontrolroom and an ambulance unit.

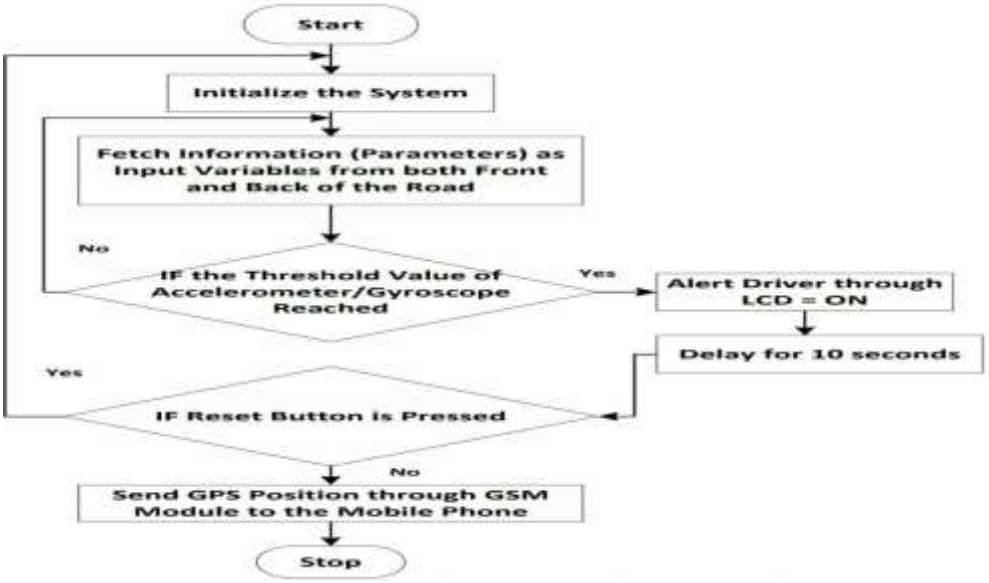

Fig3: Advanced Automatic Vehicle Detection And Rescue System

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Inthissystematfirst,weworkedonthepreventionofvehicleaccidentandevenafterllthepreventivemeasuresappliedif theaccidentoccursthesystemdetectsit.Afterthedetectionofvehicleaccident,thesystemautomaticallyreportstothea mbulance serviceandpolicestationwithoutanytimelosssothatthecasualtymightnotloss his/her life due to lack of medical assistance in time. The system is installed in the vehicle.. For the detection of vehicle accidents accelerometers are installed and for reporting ,GPS module and GSM module are used. Motor (control switch) is used for engine control and buzzer,ledlights etc. are used for warningduring prevention. All thesedevices areinterfaced withthecentralmicrocontroller ArduinoUno)unit. Accelerometer detects the occurrence of accident and sends signal to the microcontroller for further functioning. The GPS module provides the location, speed, time and date of thecertain place where the vehicle is in the real time. If an accident occurs, the accelerometer detects it and location of accident is obtained using GPS, and finallysends the information to the ambulance service and police by the help of a GSM module. The message obtained in mobile phone consists of the location of the accidental place in the form of google map link which will help the emergency units like ambulance service and police station to reach the casualty in time and rescue the lives.

1. The Arduinosetupisinstalledina vehicle'scrashguard or inbumpersof the vehicle on each side.
2. When collision occurs it triggers the push button and it sends a notification to the Arduino Board.
3. ArduinowilltakethisinputandwillconverttotheSIM808.
4. ThecoordinatesaresharedthroughGSM.
5. ThroughGSMthenotificationispassedtothesavedmobile number.
6. ItcontainstheexactGPSlocation.
7. Theapplicationisusedtoknowtherouteandlocation.
8. Iftheaccidentisnotseverethepersoncanturnoffthebuzzerandthedevicewillcome back to normal.

VII. MODULES AND PROJECT DESCRIPTION

ARDUINO: The Arduino UNO is a widelyused open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. The arduino is the major control unit to detect or alert when an accident occurs. It collects the data from vibration sensors, GPRS and GSM modules and reflects the output either in display system or throughamessage. Herethevibration sensorplays amajorrole. This vibration sensorwill receivethe vibrations of the vehicle which in turn acts as an accident detection module. Arduino gathers the information from all other modules and sends the message to the receiver through the GSM module.

GSM MODULE: For providing communication between the GPS, GSM and the allocated mobile number GSM SIM900 module is preferred. The name SIM900 says that, it is a tri band work rangingafrequencyof900MHz to 1900 MHz such as EGSM900MHz,PCS 1900 MHz and DSC 100 MHz Receiving pin of GSM module and transmitting pin of GPS module are used for communication between the modules and the mobile phone.

GPS MODULE: Tofind thelocation on theearth thewholeis divided into somecoordinates where the location can be easily captured by a module called GPS module. Here the GPSused is SIM28ML. This GPS module will find the location of the vehicle and the information fetched by the GPS receiver is received through the coordinates and the received data is first send to arduino and the information is transmittedto thesaved contact through GSM module. The frequency is operated in the range of 1575.42 MHz and the output of the GPS module is in NMEA format which includes data like location in real time.

LCD MODULE: To display the numbers, alphabets and special characters an LCD module with16x2alphanumerictypesisused.Usingthehigherbitdatalinesof LCDpinssuchaspin 11,12,13 and 14 are interfaced to digital pins of Arduino such as pin 8,9,10 in 4 bit mode as showninthebelow figure.RSandEpinsof LCDareconnectedtopin12 and13.Toperform the write operation on LCD the read/write pin is connected to ground.

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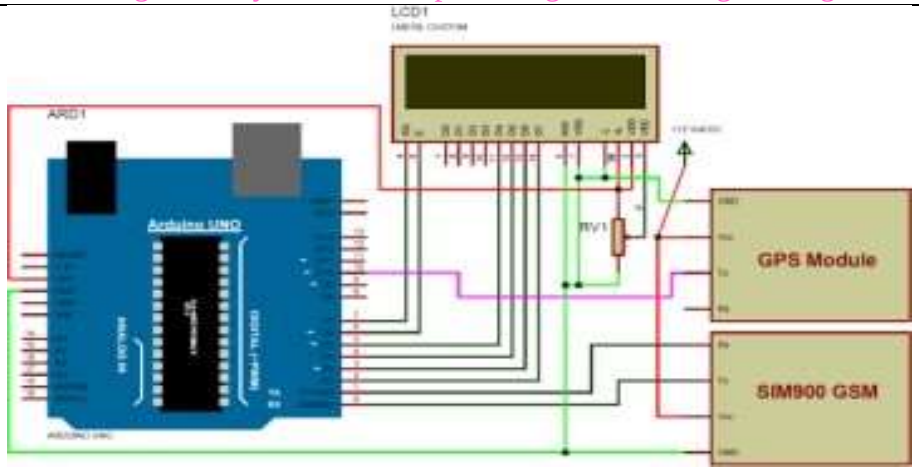

Fig4: WorkingmoduleofAdvanced Automatic Vehicle Detection And Rescue System

The controller used in this project is Arduino which is used for controlling all the modules in the circuit. The two The major parts other than the controller is the GPS module which isused as a receiver and other module is GSM. To receive the coordinates of the vehicle GPS module is used and GSM will send the received coordinates to the user through SMS. Thereis an additional LCD which is used for displaying status message or coordinates. When a person is driving the vehicle met with an accident then the vibrations of the vehicle is received by the vibration sensor and the sensor acts as a accident detection module which further send the information to the micro controller and the location of the vehicle is received through GPS module and the coordinates The vehicle is sent to the GSM module. The received information is sent to arduino uno. The received coordinate information is collected and is send to the respected person,hospitals and police station through SMS.

VIII. IMPLEMENTATION

Our system comprises two phases: accident detection and notification phase. For the accident detection phase, a smartphone application has been fully implemented. For the notification phase, a web-based system has been implemented for use by hospitals.

8.1 DetectionPhaseImplementation:

An Android application has been developed in the Java programming language.The application is developed for an Android operating system with minimum API level 17 and target API level 26. A user first registers for system use. Once registered, to use the system, the user enters their ID and password to log in to the system. Recording and transmission of data starts when the user clicks to start tracking. The application continually reads the data from thesmartphone'ssensorsand sends the data to thecloud. If an accident is identified, the application generates an alarm for 10 s. Figure below shows the interfaces of smartphone android applications. The smartphone application consists of the following activities:

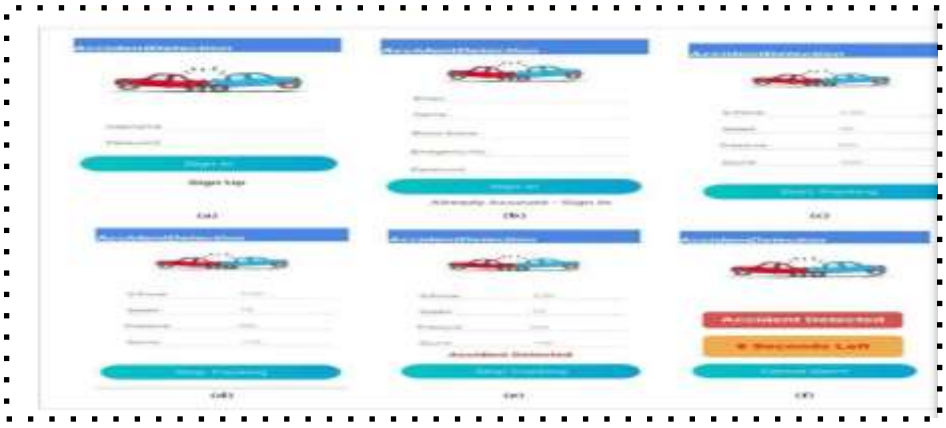

Fig5: AndroidApplication.(a)Sign InScreen;(b)SignUpScreen;(c)StartTracking;(d) No Accident; (e) Accident Detected; (f) Alarm.

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1. StartandStopAccidentDetectionActivity.
2. Trackingof Accidents.
3. Cancellationof Alarm.
4. ManagementofAccount.

8.2 NotificationPhaseImplementation:

After an accident is identified, the cloud determines the nearest hospital and informs the hospital about the accident. This is performed usinga web-based application. The application has been developed using ASP .NET MVC 4. This interface is used by the hospital to establish whether there is an emergency or not. Whenever an accident occurs, the website receives the information regarding the accident. Thewebsite shows thedetails ofthe accident such as the location of the accident and driver and vehicle information. A Microsoft SQL database is used to store all the information regarding an accident. The website uses HTML, CSS and bootstrap for the development of the interfaces. The Google Maps API is used to show the position of the accident on a map. Figure below shows the working of web basedapplication.

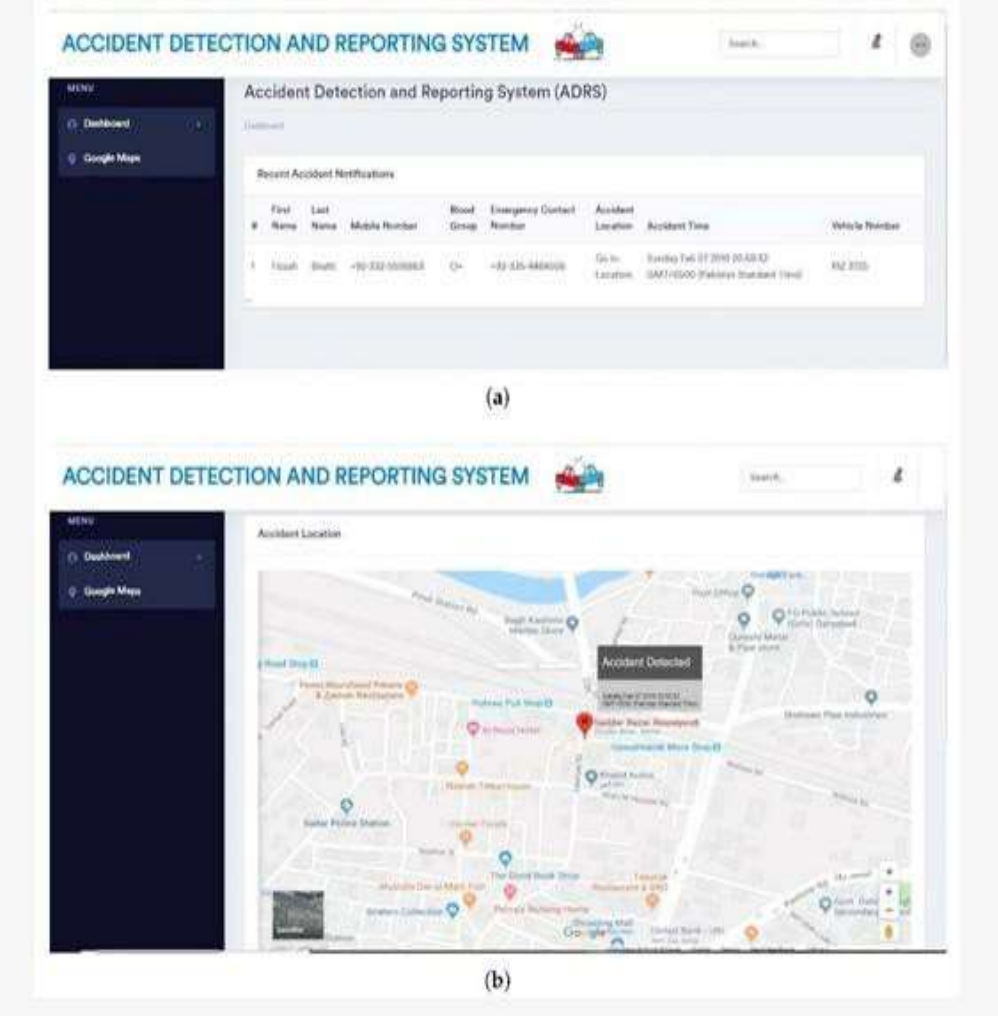

Fig6:(a) accidentdetails;(b)locationoftheaccident.

IX. RESULTS

The overall result of this project is an application that provides help to people who require help but can't ask for it. With the help of the application, their request for help is sent at the time of the accident with their location which helps emergency services provide support as early and effective as possible. All this is done with only the sensors available at low cost.

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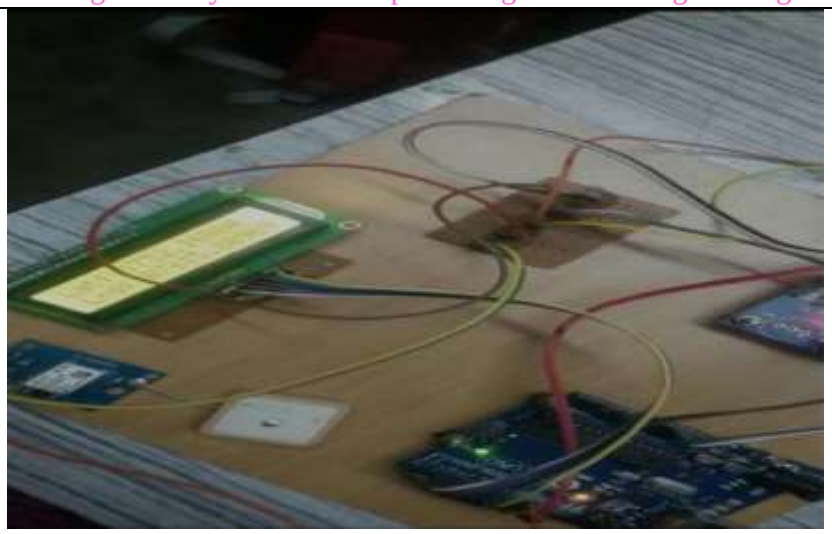

Fig7. InterfacingcontrollerwithLcd.

Fig8. Notificationmessage.

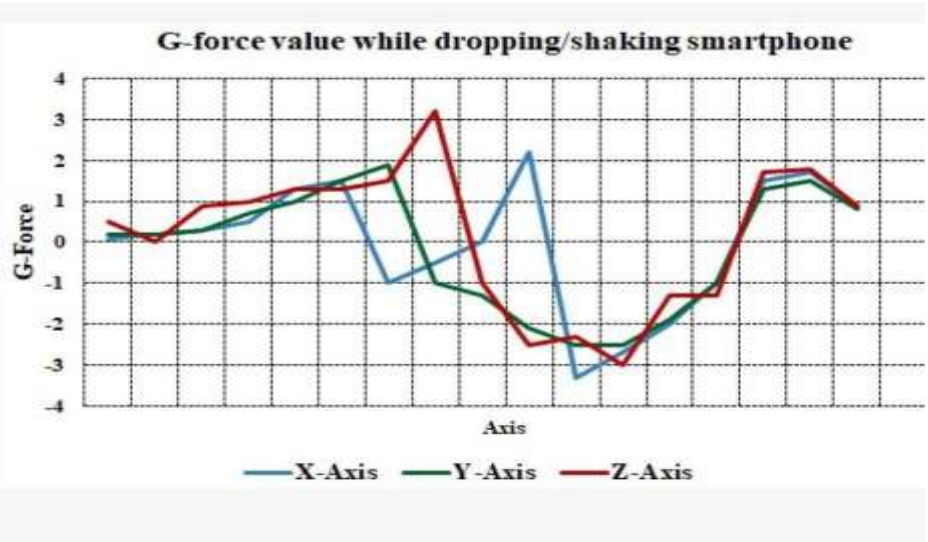

Fig9: ExperimentalGraph

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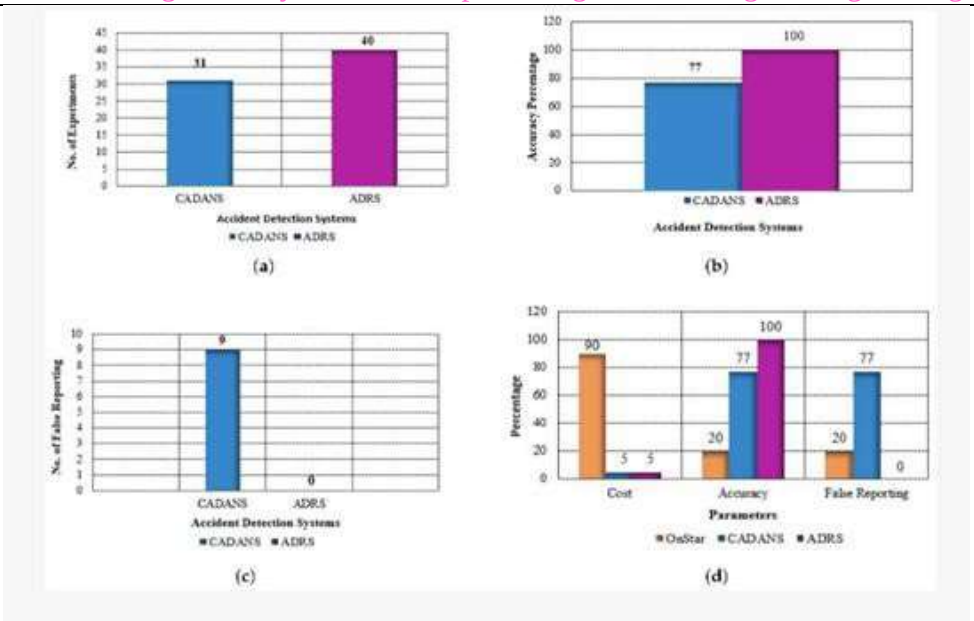

Fig10: Experiment results. (a) comparison of accident detected; (b) accuracypercentage of experiments; (c) false reporting of experiments; (d) parameter based comparison.

X. FUTUREENHANCEMENT

The proposed system deals with the detection of the accidents. But this can be extended by providingmedication to the victims at the accident spot. Byincreasingthe technology,we can also avoid accidents by providing alerts systems that can stop the vehicle to overcome the accidents.

XI. CONCLUSION

The proposed programmed accident detection system can be a rescuer of life for the people who met with accidents. The proposed system is exceptionallyeasyto understand and even a non-specializedPersoncanuseitwithoutanyproblem.Thesystemconsistsofequipmentand programming segments. The equipment unit includes accident detection sensors that are constrainedbyanArduinoboardandisfittedinthevehicle.Thenagain,theprogramming part is an Android application introduced in drivers Smartphones which is used to get the point by point map. In general, the benefits of this system are low cost, secure and simple to use. The system introduced in this work reduces the casualties due to accidents.

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