Automatic Accident Detection and Notification System

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Abstract—**Vehicular Accidents are a major cause of concern in today's world. Safety of the driver and the co passengers can be threatened because of various reasons that lead up to an accident and moreover there is a huge lag between the time of accident and time when emergency services reach ground zero. Many lives can be saved if proper emergency services reach the accident location at the right time. With the help of the proposed system not only accidents are detected but also notifications are sent to the nearest hospital, police station and emergency contacts. Accidents are detected using three sensors i.e, accelerometer, force resistive sensor and gyroscope so as to get accurate results. These sensors form the part of the embedded system which has an arduino and bluetooth module. The arduino constantly receives the sensor data and sends it to smartphone application via the bluetooth module. The smartphone detects whether an accident has occurred or not using the Accident detection algorithm. On detection of an accident, a message along with the gps coordinates (users current location), blood group and vehicle plate number (collected at the time of user registration) is sent to the nearest hospital, police station and emergency contacts. This process can significantly reduce the number of casualties because of delay in receiving proper medical care. Also in order to minimize false positives, an alarm system has been included which goes off as soon as accident has been detected. If the driver is safe, he/she can shut the alarm and cancel the sending of the message. The alarm rings for about 30 seconds after which it automatically forwards the message to emergency services and contacts. This application will help the service providers to reach on time and save valuable human life.**

Keywords—**Accelerometer, gyroscope ,bluetooth, nested if-else, Embedded Processor, gps, gsm ;**

I. INTRODUCTION

In this day and age there is an extreme increment in the utilization of vehicles. Such substantial car use has expanded activity and along these lines bringing about an ascent in street accidents. This incurs significant damage on the property and additionally causes human life misfortune as a result of inaccessibility of quick well being facilities. Complete mishap aversion is unavoidable yet at any rate repercussions can be lessened. Proposed framework tries to give the emergency facilities to the casualties in the briefest time conceivable.

As human lives are in question, the discovery and reaction time are urgent factors for the victim(s) of a vehicle mishap and also the overseeing agencies. Indeed, even a slight decrease in the reaction time can diminish the number of fatalities and monetary loss by a huge factor.

The AADNS system uses the input from sensors and passes it to the smartphone via bluetooth.Using Accident detection algorithm, we can detect the occurrence of an accident with the inputs.

Registration includes user's personal info like blood group, etc. along with his photograph. In case of emergency, notification will be sent to nearest blood banks through mobile Search nearest Hospitals, police stations and blood bank. First user have to do registration to application then if any accident occurred then it is detected by GPS tracker and the personal details of those who have met with an accident that has been already stored in database is sent to nearby blood bank, hospital, friends, family members. Global Positioning System (GPS) is used to identify the location of the vehicle.GSM is used to inform the exact vehicular location to the emergency numbers. Message will give longitude and latitude values. From these values location of accident can be determined. Such a module works the same as a regular phone.

II. LITERATURE SURVEY

- ANDROID APPLICATION FOR AUTOMATED ACCIDENT DETECTION- This paper presents a system that uses smartphones to automatically detect and report vehicle accidents in a timely manner. Data is continuously taken from

smartphone's accelerometer and analyzed using Dynamic Time Warping (DTW) to determine how badly the accident is happened. An e-Call System it automatically calls the nearest emergency Centre. Even if no passenger is able to speak, a Minimum Set of Data is sent, which includes the exact location of the Accident Site.

- CAR ACCIDENT DETECTION SYSTEM USING GPS AND GSM-The proposed system consists of two units namely, Crash Detector Embedded Unit and Android Control Unit. Crash Detector Embedded Unit is responsible for detecting the accident condition using three-axis accelerometer sensor, position encoder, bumper sensor and one false alarm switch. Bluetooth module (HC-05) is used to send the accident notification to the victim's android phone where an android app will get the GPS location of accident spot.

- REAL TIME TRAFFIC ACCIDENT DETECTION SYSTEM USING WIRELESS SENSOR NETWORK- This paper proposed the use of Wireless Sensor Network and Radio Frequency Identification Technologies. Sensors will be installed in a vehicle which will detect accident location and speed of the vehicle. These sensors will then send an alert signal to a monitoring station and monitoring station, in turn, will track the location where the accident has occurred.

- INTELLIGENT SYSTEM FOR VEHICULAR ACCIDENT DETECTION AND NOTIFICATION-Accident can be detected using flex sensor and accelerometer, while location of accident will be informed to desired persons such as nearest hospital, police and owner of vehicle through sms sent using GSM modem containing coordinates obtained from GPS along with time of accident and vehicle number. Camera located inside vehicle will transmit real time video to see current situation of passengers inside vehicle.

III. METHODOLOGY

A. Input Module

The Input Module peruses sensor information on increasing speed, turn and power and passes the gathered information to the Implanted Processor. The accelerometer is additionally utilized to compute the speed of the vehicle that is utilized as a part of the accident detection logic. The Gyroscope detects the rotation/tilt of the car and peruses the information in the wake of preparing in degrees every second. The four power sensors situated at each side of the car identify the effect power of the mishap.

B. Embedded Processor

The Embedded Processor assumes the part of an interpreter. It incorporates a flag handling module that specimens the adjusted information consistently, and a Bluetooth module that sends the adjusted information to the cell phone. What's more, utilizing the readings of the accelerometer, the speed of the vehicle is computed and utilized by the choice help segment in the cell phone.

C. Bluetooth Module

We have used two bluetooth modules i.e, one that is included in the embedded unit and the other is included in our smartphone. The one used in the embedded unit is HC-05 Bluetooth module. This module keeps receiving processed data from the arduino. On Accident detection the data is sent to the bluetooth module of our phone. As soon as we open the application in our smartphone, the bluetooth module is automatically switched on.The application runs in the background continuously.

D. Smartphone

The mobile phone application acts as the accident detection module as well as the way to send notification to emergency services. It had the accident detection algorithm, nested if else logic and the reaction module that enables sharing of accident data with user's emergency contacts and nearest hospital and police station. The Bluetooth module of the cell phone collects data from the embedded system.

E. Nested If-else

A nested function (or nested procedure or subroutine) is a function which is defined within another function, the enclosing function. Due to simple recursive scope rules, a nested function is itself invisible outside of its immediately enclosing function, but can see (access) all local objects (data, functions, types, etc.) of its immediately enclosing function as well as of any function(s) which, in turn, encloses that function. Suppose if an acceleration value is greater than or equal to the threshold value automatically a message is sent to the emergency contacts as "Accident Detected". If the acceleration value is less than threshold value then it means "No accident".

F. GPS Module

A GPS is a worldwide route satellite framework that gives geolocation and time data to a GPS recipient anyplace on or close to the Earth where there is an unhindered viewable pathway to at least four GPS satellites. The GPS framework does not require the client to transmit any information, and it works freely of any telephonic or web gathering, however these advances can upgrade the value of the GPS situating data. The GPS framework gives basic situating abilities to military, common, and business clients around the globe.

IV. ALGORITHM AND FLOWCHART

Accident Detection Algorithm:

Step 1) Setting up Threshold values for the different sensor values.

Step 2) Creating Rule base that should be satisfied for accident to be detected using Nested if-else.

Step 3) User phone number verification during first login using OTP.

Step 4) Once verified,user needs to fill registration form.

Step 5) Then the application simply runs in the background in correspondence with smartphone bluetooth.

Step 6) Collection of sensor data from embedded module

Step 7) Feeding the data to smartphone application AADNS.

Step 8) Comparing the received values with the set threshold values.

Step 9) If the received values are equal to or greater than threshold values , then accident will be detected.

Step 10 On accident detection, alarm goes off to alert the driver that if he/she is safe they can shut the alarm.

Step 11) On completion of 30 seconds the application automatically send a message to emergency contacts and emergency services.

Step 12) The message includes the current location acquired through gps system, the vehicle plate number and the blood group of user(collected during registration).
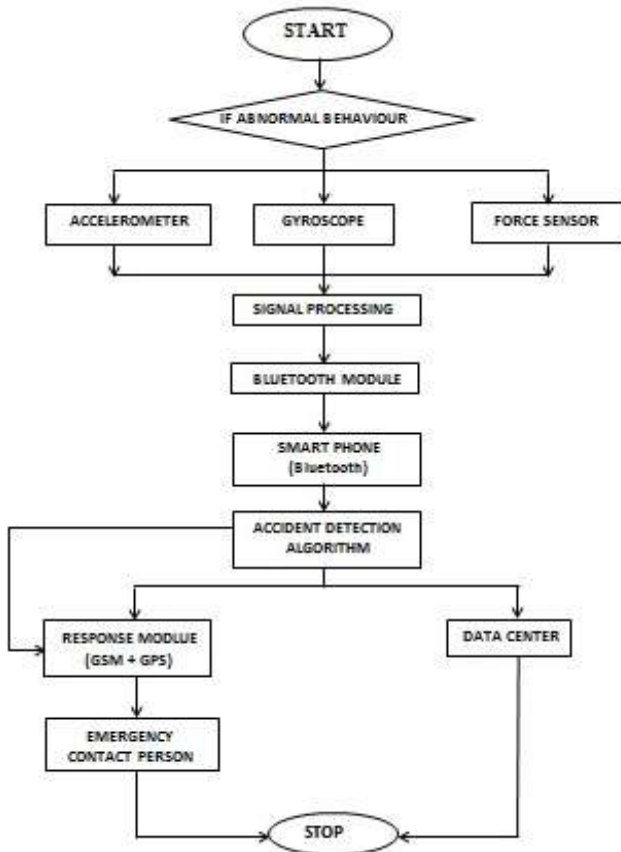
V. IMPLEMENTATION

The input module of the proposed system that comprises accelerometer (MPU-6050), gyroscope and force sensors (4-6) collect information from the vehicle. These input systems send information to microcontroller processor (Arduino uno). It transfers the information to the bluetooth module which then sends data to the android application. This application is run on a smartphone and it takes the location details from Network provider and sends message to concerned authority.
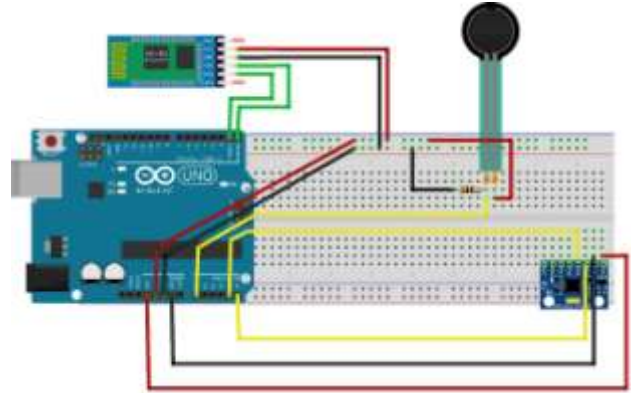
Accelerometer: This 3-axial component acquires the data about the current acceleration of the car along three orthogonal axes. The accelerometer is also used to calculate the speed of the vehicle that is used in the Accident Detection module.

Gyroscope: The Gyroscope senses the rotation/tilt of the car and reads the data after processing in degrees per second. This rate of rotation is used for evaluating if the car has rotated to its side or flipped completely.

Force Sensor: The force sensor located at front side of the car detects the impact force of the accident.

VI. TEST CASES AND RESULTS

CASE 1: When the car collides with any object with great impact - In this case the car is travelling with an average speed and then collides with another object with great impact, the resultant output would be that an accident has been detected and the alarm begins to ring for 30 seconds. If the alarm is turned off before the timer goes off i-e the traveller is safe and does not need emergency services. Hence the SMS won't be sent to the emergency services. Otherwise the SMS will be sent to the Emergency services for help.

CASE 2: When the car experiences collision from the sides or back - In this case the car is travelling or is at halt and experiences a collision from the sides or back of the car. If the collision is with great impact i-e higher than the threshold value ,the alarm begins to ring. If the alarm is not turned off, emergency services are contacted through SMS.

CASE 3: When the car collides with any object but with less force - In this case the Car is travelling with an average speed and then collides with another object with less force/impact. The impact experienced by the car is very less i-e less than the threshold value for an accident to be detected. Hence no accident is detected.

CASE 4: When the car rolls over in an accident - In this case the car while travelling meets with an accident in such a way that it experiences a roll over. The orientation of the car changes along with an impact experienced on it.Hence an accident is detected. This is assumed to be a critical situation, therefore no alarm will ring and the message to the emergency contacts and services will be sent for immediate help without wasting a second.

CASE 5: When the car experiences sudden deceleration - In this case, when driver of the car suddenly applies brakes,the car experiences a drop in acceleration. Since no impact or roll over is detected, we can conclude that no accident has occurred.

CASE 6: When the car is travelling at an elevated path - In this case, the car is travelling on an elevated platform. Example - Hilly areas, where the roads are steep and the car makes certain angle with the ground. This changes the orientation of the car but accident is not detected.

VII. CONCLUSION

Accident information would reach the emergency services within seconds. Significantly improves the time gap for rescue operation and save the life of huge number of victims. Victims personal details would be easily obtained through his registration with this application. Alert messages are send through GPS. Accelerometer and gyroscope is used here in order to detect the plausibility of an accidents.

VIII. FUTURE SCOPE

This report presents the techniques and algorithm that will be used to develop AADNS system. The comparative study of various other accident detection approaches being used elsewhere in the world is presented in this report. And also how our system is preferable to those mentioned. The use of GPS/GSM module in the embedded system will help locate the victim in case the mobile phone gets damaged. Use of commercial sensors will help bring more accuracy.

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