

ACCIDENT DETECTION AND REPORTING SYSTEM

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Abstract - The usage of vehicles is rapidly increasing and at the same time the occurrence of accident is also increasing day by day. India is the country which has world's 1% of vehicles and holds the no 1 position for road accidents which is 11% of the death by road crash. A report says in every 4 minutes 1 person is getting killed by road crashes. Hence, the value of human life is ignored. Accidents are unexpected events which we cannot prevent completely, but can save their life by expediting the ambulance to the hospital in time. Many life are losing without getting timely treatment or medical facilities. The objective of this scheme is to minimize the delay to reach out the hospital and at the same time provide the information of causality to the emergency vehicles. The paper implies system which is a solution to this drawback. Almost everyone use smartphones nowadays so we aim to take advantage of the different basic and advanced sensors in the smartphones for gathering information's such as speed, pressure, gravitational force, sound and location. When an accident occurs the Accelerometer will detect signal and will send message to server. The message contains information of accident location, images and vehicle details etc. The message will be sent to preprogrammed numbers such as ambulance, friends, relatives etc. via GSM.

Key Words: Android, Accelerometer, GSM(Global Service for Mobile Applications) GPS (Global Positioning System).

1. INTRODUCTION

The high demand of automobiles has increased the road accidents and traffic hazards. people are risking their life or there is a high risk for their life. The main reason for this is just because lack of accident detection and notification to the authorized emergency contacts at the right time. The most common or traditional approach of accident detection was human observation. At this scenario we cannot detect where the accident has occurred and sometimes we cannot identify who is the person met with the accident. And the important part is that, if there isn't any human intervention the individual may die. To address this problem, some researchers have developed accident detection system that uses some hardware modules which is configured with specific sensors for accident detection.

Global positioning system (GPS), is being used in many applications, especially for navigation and positioning. Many vehicles that are shipped today have GPS devices that sense the position of the vehicles and send the information to the cloud servers. Smart cities can provide mobility solution by emerging intelligent transport systems. By reducing the response time to the collisions we can reduce traffic fatalities which is more effective. There are many systems, such as e-notify, that can help in detecting and reporting traffic accidents. Even though this may be an effective solution it is very expensive and not all vehicles are equipped with onboard units. The implementation is also difficult to the existing vehicles because the system is based on hardware modules which is not available in all existing vehicles in the road, even if the vehicles have such sensors also it may get damaged in a minor collision, In such cases accident cannot be detected by the sensors.

Our proposed system will use sensors in the smartphones to automatically detect accident. Some existing systems utilize smartphone sensors to detect accidents but these systems have so many errors like false positive rates. This paper proposes an accident detection and notification system to overcome these issues.

The rest of the section is organised as follows: Section 2 contains literature survey on road safety, vehicular communication, and rescue operation after an accident. Section 3 proposes a model architecture for accident detection and reporting. Section 4 tells about the implementation of the proposed system. Section 5 presents the test cases and results obtained in the experiments. Finally, section 7 presents conclusions and future work.

2. RELATED WORKS

Y. Zhao et al. [1] have proposed a crash notification system that utilizes mobile devices, detecting accidents through accelerometer and GPS data. This system delays in sending the message about an accident. Patel et al. [2] developed an android application that detects accidents using only accelerometer data. The system automatically sends a pre-recorded voice message to 108 ambulance services. Khot et

al. [3] propose a smartphone-based system that detects an accident using an accelerometer and finds the nearest emergency point to send the location of accident. But this system has a problem that, a single point of failure leading to a tendency for false reporting. Zaldivar et al. [4] have developed a smartphone application using an onboard unit. This application has a feature which enables the driver to speak with his/her vehicle. The application detects the accident using airbag triggers and then informs the emergency service provider through email or SMS. One drawback of this application is that, this requires the smartphone application to be running on background. Thompson et al. [5] propose a system that detects accidents using the sensors in a smartphone. The phone uses its GSM connection to send the accident information. This system is partially automated as it sometimes requires some third party to send the emergency information to the responders.

3. PROPOSED SYSTEM

Accident detection system using smartphone (android) would be more convenient because it utilize less resource. The facilities provided in the existing system and proposed system are same, The difference comes when the proposed system provides all functionalities in a single device. The system is developed and implemented to track the vehicle and the accident quickly and hence precede the further rescue action. The Accident detection system using android can provide better service to the user at less cost. This proposed system is robust such that we can overcome the drawback of existing system.

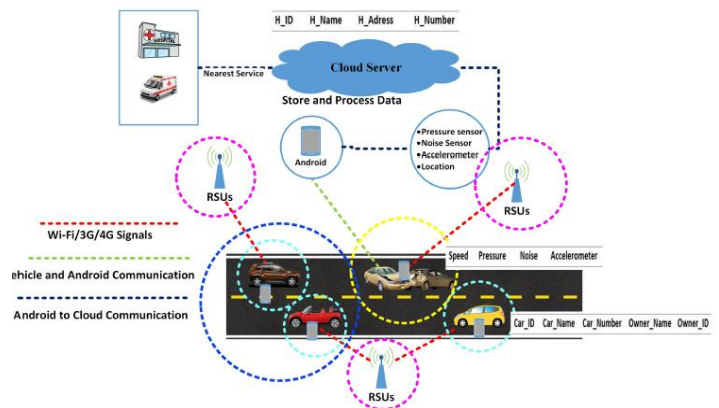
The android phones provide different sensors which monitors the motion of the phone/device. The main two sensors are accelerometer and gyroscope which helps to detect movement of device by measuring linear acceleration and rotation vector. Some devices have software based sensors derive their data from the magnetometer and accelerometer, but some other devices also use gyroscope to derive their data. Most of the android devices have an accelerometer and gyroscope. GPS is also available in every android phones which is now available in the market. The software-based sensors availability is more variable because they rely often on one or more hardware sensors to derive their data.

There are some drawbacks in the existing system so that we designed an optimal solution for accident detection using single hardware and software configured device. This will help the emergency services for identification and tracking of an accident in effective manner which is also less

time consuming. Inorder to achive this we have come up with an idea to make an alert system using android,which reduces human interventions in a good number.this is more efficient and ensures the utilization of the system in maximum for detection and tracking of the vehicle.

The user has to login and get authenticated from the centralized server. The device which uses the application must be ensure that GPRS(General Packet Radio Service) is being enabled. By the successful login it will try to access the user's current location and checks GPS is working fine or not.Authenticated devices will be transmitting GPS details, such as longitude and latitude information for monitoring.other other sensor datas will be collected and analysed regularly.

WORKING OF PROPOSED SYSTEM:-



4. IMPLEMENTATION

Our proposed system has of two phases which are Accident detection phase and notification phase. The detection phase we implemented an android application has been developed which is basically using java programming language. The application is developed for Android OS with minimum API level 17 and target API level 26. A user who installed this application will be registered first fro system use. Once user registration is completed successfully, to use the system the user has to enter their ID and Password to login to the system. The system will start recording and transmitting the data when the user click on start tracking. The application will continuously read datas from the device sensors and sends the data to the cloud. If an accident is identified, the application will start a timer alarm for 30 sec which lets the

user to turn off the alarm if it was a false accident so that further procedures can be stopped immediately.

Once an accident is identified, The device will send request to the nearest emergency services through SMS and they can inform the nearest hospital too. The application is linked to a website where the database of all users, emergency services and hospitals are stored. When the emergency service accepts the requests the other services will get informed so that possibility for multiple contact can be reduced. The website is developed using html, css, javascript etc and the application is connected with firebase. The emergency services which are getting the request will get the location of the device/person using the GPS data, which will result in easy navigation.

4.1 Pseudo Code

4.1.1 Algorithm for Detection:-

Data used: values from smartphone sensors

Result: accident detection Status

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if (G - Force/4 + Sound/140 + Pressure/350) >= (1) AND
(Speed) >= (24) then I ← 1 ;
else if (G - Force/4 + sound/140 + Pressure/350 +
SVP/2.06) >= (3) then I ← 1 ;
else if (G - Force/4 + Sound/140 + Pressure/350) >= (1)
AND (ElapsedTime) < (MP) then I ← 1 ;
else I ← 0 ; end if I = 1 then START alarm_timer;
alarm_timer= 10 seconds;
if (alarm_timer) <= (10seconds) then
status= accident_occur:

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else
status = no_accident;
end Get location From GPS;
SET location(lat, lang) = current location(lat, lang); GET
car_info from database;
GET emergency_number from database;
MESSAGE = (location, speed, G-force, Owner_Info,
emergency_number); CONNECT available WiFi/3G/4 G;
Send MESSAGE to server; else
status = no_accident;
end

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4.1.2 Algorithms for notifications

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Data: MESSAGE = (location,Owner_Info, Vehicle_Info)
Result: Ambulance Dispatched;
Server decode the message;
lat1 = start.lat; lon1 = start.lng; lat2 = end.lat; on2 =
end.lng; dLat = lat2 - lat1;
dLon = lon2 - lon1;

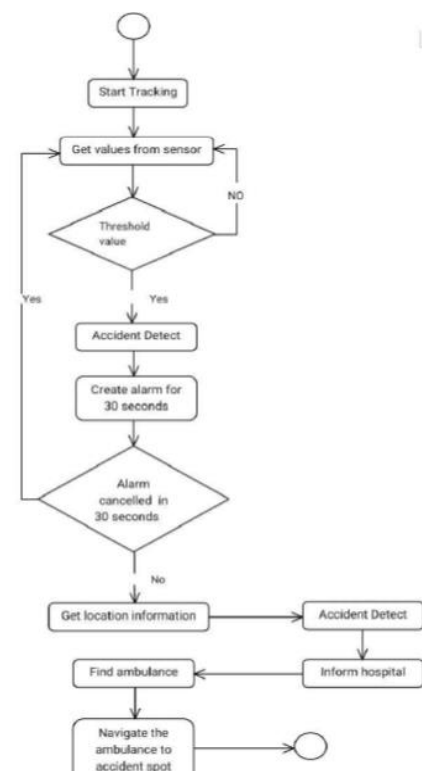
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a= Math.sin(dLat / 2) * Math.sin(dLat / 2) ;
b= Math.cos(this.toRad(lat1)) * Math.cos(this.toRad(lat2))
; c= Math.sin(dLon / 2) * Math.sin(dLon / 2) ;
d= a+b*c ; e= 2 * Math.atan2(Math.sqrt(d), Math.sqrt(1 -
d)) ;
Dist= R * c ;
Cloud finds the nearest hospital using the HAVERSINE;
Hospital= nearest_hospital;
Update the data base;
Server sends notification to Hospital Web Interface; Hospital
dispatch the ambulance.

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4.1.3 Flow chart



4.2. SYSTEM ARCHITECTURE

The architectural design process is concerned with establishing a basic structural framework for a system. The Large systems are always decomposed into sub-systems that provide some related set of services. The initial design process of identifying these sub-systems and establishing a framework for sub-system control and communication is called Architecture design and the output of this design process is a description of the software architecture.

Modern mobile phones come with a variety of sensors that automate or ease many of our daily tasks. This field takes into account the presence of an accelerometer, a gyroscope, compass and a barometer.

Accelerometers in mobile phones are used to detect the orientation of the phone. The gyroscope or gyro for short, adds an additional dimension to the information supplied by the accelerometer by tracking rotation or twist. An accelerometer measures linear acceleration of movement, while a gyro on the other hand measures the angular rotational velocity. Both sensors measure rate of change. In practice it means that an accelerometer will measure the directional movement of a device but will not be able to resolve its lateral orientation or tilt during that movement accurately unless a gyro is there to fill in that info. With an accelerometer you can either get a really "noisy" info output that is responsive or you can get a "clean" output that's sluggish. But after combining the 3-axis accelerometer with a 3-axis gyro we get an output that is both clean and responsive in the same time.

5. EXPERIMENTAL RESULTS

The accident-detection cannot be tested in a real world or live environment due to safety concerns and even if we are testing in controlled environment it is also challenging and costly. The application records acceleration on 3axis-speed value, pressure value and noise value at a high rates which are possible. This data is sent to the cloud and processes this data to detect accident.

Experiment No.	Speed Value	Noise Value	Accident Detection
1	20	130	✓
2	20	135.5	✓
3	30	170	✓
4	40	184.5	✓
5	50	200	✓

The above table shows the Base value of accident detection.

Let us consider the performance of accident detection systems with different variety of sensors. These are the three cases which we are considering:

Case1: Here in this case ,we compared the extrscted real speed value with the system that has one sensor only.This system will not detect the accidents which occurs at speed less than 24 kmph.

Case2: In this case, we compare the situation where we have to check values from 2 sensors. We cosider noise sensor and speed. This system does not identify an accident at lower speeds. Only when the speed is greater than 24 kmph, it may identify an accident ,which could be false one. If the vehicle is at a low speed and still the noise exceeds the threshold, the system may not consider it as an accident, which could be false again where accident might have occurred.

Case3: In this case, we use multiple sensors like accelerometer, pressure sensors and noise sensors to identify

accidents. Here by using multiple sensors we can increase accuracy of accident, the chances of false negative and false positive report s reduced. It is also possible to detect the accidents at low speed.

Experiment No.	Speed	Actual Detection	Case 1	Case 2	Case 3
1	20	✓	×	×	✓
2	20	✓	×	✓	✓
3	30	✓	✓	✓	✓
4	40	✓	✓	✓	✓
5	50	✓	✓	✓	✓

The table shows the comparision of systems using different numbers of sensors for detecting accidents.

6. CONCLUSION

The use of science and technology in every walk of life. The importance of road safety has increased a lot and the main priority is being given to reduce the alarming time when an accident has occured, so that the lives who are wonded can be attended in a short time by the rescue team. This system provides an optimised solution which has the advantages such as low cost, easy extendable, small size and portability. This can overcome the problems of lack of automated system for the detection of accident location/spots. At the same time we can see that the time for searching the location is reduced and the person can be treated as soon as possible which will save many lives. The accident will be detected by both Accelerometer sensor and location can be detected using GPS which will give the accurate information about the location or the spot. The system will process the data, as soon as data is received from the sensor the alarm is notified and alert/request message is sent through the GSM module. The automatic detection accident location will help in providing security to the vehicles and to the lives of the people. Hence, this project provides a feasible solution to traffic hazards and it gives security to vehicle and reduces loss of valuable lives and property.

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