ACCIDENT DETECTION USING ANDROID SENSOR AND SMARTPHONE

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ABSTRACT

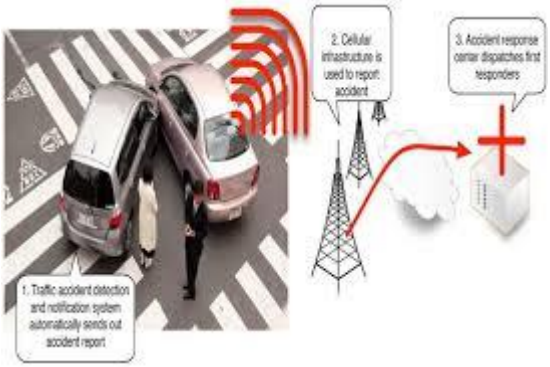
Android is a Linux-based operating system designed primarily for touchscreen mobile devices such as smartphones and tablet computers. There are more than 2.6 million apps available for android/ The android smartphones also has a number of other features to make user experience, more comfortable and in the system developed those features are used .The Android System has a GPS locating feature which helps the user to identify their current location. The Android System also has an Accelerometer sensor which is generally used for orientation changes of the mobile screen. But, these features can be used for various other purposes and in the system developed these features are used to detect the accidents. The GPS system can be used to identify the user's location while travelling. This is made possible by the use of Google's location service in the developed system .The Accelerometer sensor in the android smartphones can be used to detect abnormal vibrations during travel .Mostly the vibrations are caused by Accidents. In the system developed vibration is detected, the location is identified as address and sent to an emergency number. This system can be implemented for accident Detection and providing assistance to accident victims on time.

KEYWORDS: Android, Accelerometer , Global positioning system.

INTRODUCTION

Traffic accidents are one of the leading causes of fatalities in the US. An important indicator of survival rates after an accident is the time between the accident and when emergency medical personnel are dispatched to the scene. Eliminating the time between when an accident occurs and when first responders are dispatched to the scene decreases mortality rates by 6%. One approach to eliminating the delay between accident occurrence and first responder dispatch is to use in-vehicle automatic accident detection and notification systems, which sense when traffic accidents occur and immediately notify emergency personnel. These in-vehicle systems, however, are not available in all cars and are expensive to retrofit for older vehicles.

Since android is an open source operating system it is easy to develop applications using java and as well as the native language and then converting it into the Android Classes. The idea what is been proposed is to have a basic 1 GHz computer system running in the car with Android operating system being the sole controller. The system is eing interfaced with the vehicle ECU and the sensors and it helps the user to have a better control over the vehicle. The reason why we chose Android over other operating systems is that it enables android powered devices to act as USB hosts. That means we can use them with a whole host of peripheral devices and development boards that have USB connectivity. And Android comes with another feature that allows the android OS to run on devices other than a mobile phone or a tablet. So it can be run on devices like laptops and PCs. And programming and main OS features will be exactly same as that of the previous android versions.



Vehicle-based Accident Detection and Notification System

Automatic collision notification systems use sensors embedded in a car to determine when an accident has occurred . These systems immediately dispatch emergency medical personnel to serious accidents Conventional vehicular sensor systems for accident detection, such as BMW's Automatic Crash Notification System or GM's OnStar, notify emergency responders immediately by utilizing built-in cellular radios and detect car accidents with in-vehicle sensors, such as accelerometers and airbag deployment monitors.

Solution approach ⇒ Traffic accident detection and notification with smartphones. To address the lack of accident detection and notification systems in many vehicles, smartphones can be used to detect and report traffic accidents when accident detection and notification systems are unavailable. Smartphones, such as the iPhone and Google Android, have become common and their usage is rapidly increasing. In the 2nd quarter of 2010 alone, 325.6 million smartphones were sold . This large and growing base of smartphone users presents a significant opportunity to extend the reach of automatic accident reporting systems.The advantage of using Android is that every vehicle irrespective of the manufacturer will have a common software interface (Android). And android is open source and free and already available, so there is no need to put in a lot of money on development of a new Car OS system. And also that Android has moved more from an OS to being a trend today.

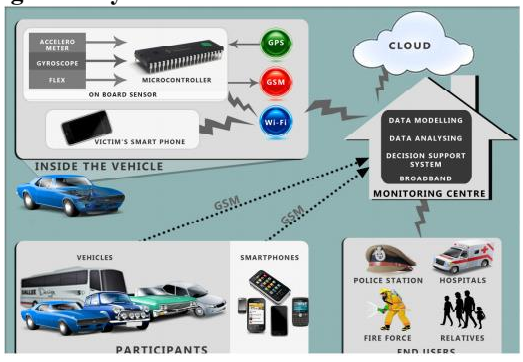
PROPOSED SYSTEM

- **An android App to detect accident using the Android Sensors is proposed**
- **The emergency number or any number to contact is selected**

- **The current latitude and longitude position is tracked using GPS service**
- **The latitude and longitude values are calculated as the vehicle moves**
- **The accident is detected using the sensor in android smartphone called accelerometer**
- **When the Gforce is greater than certain threshold value then the latitude and longitude values are converted to address**
- **The address which is retrieved is sent as a message to the number which is set**
- **If it is a remote area then the address along with the distance is sent as a message**
- **The message reaches the emergency service within 3-5 seconds**

CHALLENGES TO BE FACED

This section explores the challenges associated with detecting car accidents using a smartphone's sensor data. A task of critical importance in accident detection is ensuring that false positives are not reported to emergency services, such as 911. According to the US Department of Justice, 25 to 70 percent of calls to 911 in some areas were "phantom calls" where the caller immediately hangs up . California receives approximately 6 million 911 calls from cell phones and between 1.6 and 3.6 million of these calls are phantoms. Clearly, smartphone traffic accident algorithms must be careful not to increase the volume of phantom emergencies. It is hard to strike a balance between no accident false positives and fully reporting all traffic accidents that occur. Vehicular accident detection systems, such as OnStar, have a significant advantage since they are integrated with the vehicle and its on board air bag deployment and crash sensors. Sensor data received by these systems directly correlates to the forces experienced by the vehicle. In contrast, smartphone accident detection systems must indirectly predict when an accident has occurred based on sensor inputs to the phone. Since phones are mobile objects, they may experience forces and sounds (indicative of a traffic accident) that originate from other sources, such as a user dropping the handset. Accident detection algorithms for smartphones must use sensor data filtering schemes that are resistant to noise, yet provide high enough fidelity to not filter out valid accidents.



Challenge 1:

Detecting Accident Forces Without Electronic Control Unit Interaction

Conventionalin-vehicle accident detection systems rely on sensor networks throughout the car and direct interactionwith the vehicle's electronic control units (ECUs). These sensors detect acceleration/deceleration, airbag deployment, and vehicular rollover . Metrics from these sensors aid in generating a detailed accident profile, such as locating where the vehicle was struck, number of times it was hit, severity of the collision, and airbag deployment.

Smartphone-based accident detection applications must provide similar information. Without direct access to ECUs, however, it is harder to collect information about the vehicle. Although many cars have accident/event data recorders (ADRs/EDRs), it is unrealistic and undesirable to expect drivers to connect their smartphones to these ADRs/EDRs every time they get into the car. Not only would connecting to ADRs/-EDRs require require a standardized interface (physical and software) to ensure compatibility, but it would require exposing a safety-critical system to a variety of smartphone types and middleware platforms. These conditions make it infeasible to verify and validate that each rapidly developed smartphone version integrate properly with every ADR/-EDR. Moreover, while many new cars have some form of ADR/EDR, any smartphone application that required interaction with an on board computer would be useless in cars that lacked one. What is needed, therefore, is to collect the same or similar information utilizing only the sensors present on the smartphone alone. Section ?? explains how we address this challenge by using the sensors in the Android platform to detect accelerations/decelerations experienced by car occupants and Section 4 analyzes device sensor data captured by smartphones and shows that low false positive accident detection is possible.

Challenge 2:

Providing Situational Awareness and Communication with Victims to First Responders

Situational awareness involves being informed of the environment of a specific area at an instant in time, comprehending the state of that environment, and being able to predict future outcomes in that space . There are three levels of situational awareness:

(1) perceiving emergency indicators in the environment, such as a driver seeing the collision of two vehicles in front of them.

(2) comprehending the implications of those indicators, such as the driver realizing that they need to slow down.

(3) possessing an ability to predict what will transpire in the future, such as the driver determining that one of the cars involved in the accident will end up in the left lane.

After an accident, accident detection systems can provide critical situational awareness to first

responders regarding the condition of the vehicle and occupants. This data can then be used by first responders to comprehend the physical state of the passengers and possibly predict how long they can survive without medical attention. For example, OnStar automatically places a voice call from the vehicle to an emergency dispatch service so that first responders can inquire about the condition of the vehicle's occupants, provide guidance, and predict whether or not an ambulance should be dispatched. These accident detection systems can also determine and report back to first responders information on air bag deployment, which indicates a serious accident. Moreover, accident detection systems, such as OnStar, can pinpoint the GPS coordinates of an accident and relay this information to first responders. Effective smartphone accident detection systems must be able to replicate the complex situational awareness capabilities that are used by first responders. They must also provide indicators of the environment in a form that can be consumed by first responders. For example, the raw acceleration values of the phone are unlikely to help first responders understand what happened in an accident. Moreover, the Smartphone Traffic Accident Detection 7 system must provide sufficiently rich information to first responders to predict the future state of the driver and passengers, which is hard when the phone cannot directly measure their health or the car's condition. Section 3.5 describes how we use a combination of VOIP telephony, text messaging, mapping, and bystander reporting to provide situational awareness to first responders.

Challenge 3:

Preventing False Positives

Vehicle-based accident detection systems monitor a network of sensors attached to the car to determine if an accident has occurred. One key indicator of a collision is an instance of high acceleration/deceleration due to a large change in velocity of the vehicle over a short period of time. These acceleration events are hard to attain if a vehicle is not actively being driven since it is unlikely that an unattended car will simply roll away from a parked location. Since smartphones are portable, however, it is possible that the phone may experience acceleration events that were not also experienced by the user. For instance, a phone may accidently drop from 6 feet in the air. Since a smartphone-based accident detection application contacts emergency responders and may dispatch police/rescue teams.it is essential to identify and suppress false positives. Due to smartphone mobility it is hard to differentiate programmatically between an actual car accident versus a dropped purse or a fall on a hard surface. The inability to identify and ignore false positives accurately, however, can render smartphone-based accident detection applications useless by wasting emergency responder resources on incident reports that were not real accidents. Section ?? explains how we address this challenge by using device usage context (such as speed) to filter out potential false positives and Section provides empirical results evaluating our ability to suppress false positives.

INSTANT MESSAGING APPLICATIONS

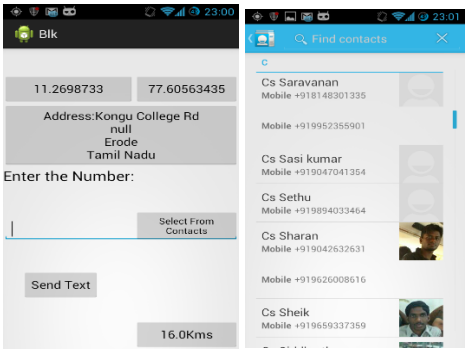
The instant message application allows a user to register to the system in order to use the application. After a user has logged into the system, he/she can add another registered user to be his/her friend. The user can then send or receive a text message while the friend is on-line. A MySQL database is used as a backbone to store the user information.

Architecture

The proposed Instant Message Application uses a Client/Server architecture. The database and web server are on the same machine in this project, but it can also be hosted on different machines. The client can run the application in any other computer, communicate with the server via the network.

Avatar Display

During the registration, the user can choose a picture from the Android gallery to be his/her avatar. The user can also chop or resize the picture. likewise contact number is choosen to send emergency message.



SENDING MESSAGE

- **The retrieved GPS location will be in the form of a Text Message**
- **Before Starting the car , the user either enters the Number or selects it from his phone using the Contact Picker**
- **If an Accident occurs , it is detected using the android sensors and the smartphone sends the message**
- **The Number to which the message needs to be sent is predefined by the Passenger**

LOCATING GPS POSITION

- **The Current GPS location is retrieved using the phones GPS receiver as Latitude and Longitude**
- **These co-ordinates are then converted into Address format using the Google's Geo Coder function**
- **As the car starts to move , the location is constantly updated**

PROCESS

- **Accelerometer is android motion sensor which is used to detect the vibration**
- **When the accident occurs the vibration is detected using this sensor**
- **If the vibration is greater than certain GForce then the message will be sent to the emergency number**

ADVANTAGE

- **The Main advantage of the proposed System is that it can provide automatic emergency help to the accident victim**
- **The App also can send the message within 3-5 seconds of the accident so that help arrives on time to help the victim**

CONCLUSION

To further increase the usage of automatic accident detection and notification systems, smartphones can be used to indirectly detection accidents through their onboard sensors, such as accelerometers. Many challenges must be overcome, however, particularly the potential for false positives from accidentally dropped phones. Due to the large volume of "phantom" (accidental) calls to emergency services, reducing the false positive rate of smartphone accident detection is important.

- **The efficient way to detect the accident in vehicle and to call emergency service is developedy**
- **The system detects the vibration within 3-5 seconds**
- **The emergency service can arrive to the correct location through the message sent**

FUTURE WORK

- **On Board Diagnostic (OBD) device can be used to detect the accidents**
- **It is a Bluetooth device present in all vehicle to monitor the function of the vehicle**

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