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Crash Notification System for Portable Devices

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Abstract

Crash Notification for portable device presents an early crash notification system that can be implemented in handheld and aftermarket devices. This system features a crash detector, which can be connected over a wired or wireless link. Systems and services are at an increasingly developed to improve quality of service, safety and the environmental impact of the road traffic system. In wireless technologies, intelligent systems are arising to help develop safety and efficiency services for road transportation. The box hosts the notification (message) service, which sends Minimum Set of Data to the Server Center. In this approach, real-time location data are collected by Global Positioning System (GPS) mobile phones to track vehicles traveling on roads. So, that they can save the injured peoples as soon as possible. Smartphones and their onboard sensors (such as GPS receivers and accelerometers) are promising platforms for constructing such systems.

1.Introduction

Road accidents are one of the most common causes of death among citizens. Real-time traffic information is essential for supporting the development of many Early Crash Notification Service for Portable Device applications: accident detection, vehicle navigation etc. It is widely accepted that providing rapid assistance to victims of road accidents is of utmost importance, especially in severe accidents, in which the victims are not able to call for help [2]. Thanks to advances in wireless technologies, intelligent systems are arising to help develop safety and efficiency services for road transportation. For these reasons, an intelligent emergency call system or data message (eg: sms) system utilizing sensors to automatically detect a crash, and uses a wireless network to send critical information (e.g., location of the accident, vehicle identification and number of passengers) to emergency services in a rapid manner would save lives [3].

We target a mobile smartphone as an alternative device for Driving Assistance System (DAS) that can assist the driver and compliment any existing active safety features. Given its accessibility and portability, the phone can bring a driver assist to any vehicle without regard for on-vehicle communication system requirements.

This provides two contributions to the study of using smartphone-based accident detection systems. First, we describe solutions to key issues associated with detecting traffic accidents, such as polling onboard sensors to detect large accelerations. Second, we discuss how smartphone-based accident detection can reduce overall traffic congestion and increase the preparedness of emergency responders. Smartphone-based accident detection applications provide several advantages relative to conventional in-vehicle accident detection systems [7], *e.g.*, they are vehicle-independent, increasingly pervasive, and provide rich data for accident analysis.

2. Literature review & Related work:

More complex emergency call systems have been proposed in the literature, e.g., [2]-[5]. In [2], the authors describe a system that gathers vehicle data and sends it to a centralized database in case of an accident. Upon a trigger signal – the accident is detected though one or several sensors located in the vehicle. Similarly, [3] describes a system that notifies the status of a moving object – in terms of images of the object and its surroundings, data of collisions and temperature of the object, and its positioning – to third parties over a radio link. This status is notified to insurance and roadside assistance companies whenever a collision is detected. In [4], the authors present an automatic emergency alert system for two-wheeled vehicles that includes an accident detector – inclination sensor and decision unit – and a system to inform third parties about historic data of speed, acceleration and braking. However, these solutions are not available in all vehicles, and are proprietary of the car makers and/or service providers. The European e-Call initiative will solve this problem by embedding an in-vehicle e-Call platform that will launch an automatic voice and data call to the pan-European emergency service in case of an accident. This service, which is expected to be offered in all new four-wheeled vehicles by 2010, will provide E112 with information about the vehicle and its location. The e-Safety Forum's e-Call Driving Group is responsible for e-Call's implementation recommendations [6].

Analysis of external sensors data for vehicle performance is a large area of study. Some work has been done in the form of theoretical research and development in a practical design. It uses multiple external sensors such as a

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microphone, GPS, accelerometer, and Global System for Mobile communications radio for traffic localization. Pothole Patrol [14] is another system that monitors road conditions using GPS and an external accelerometer for detection.

Hernandez et al. [12] developed a prototype of an on-board unit that allows the driver to communicate with his vehicle, as well as with other available devices (PDAs, cellular, sensor networks, and so on) and with the road infrastructure in order to consume intelligent transport services.

3. Analysis of Problem

Accidents are quite common on Indian Roads. Currently motor vehicle accidents rank ninth in order of disease burden and are projected to be ranked third in few years. Worldwide, the number of people killed in road traffic crashes each year is estimated at almost 1.2 million, while the number injured could be as high as 50 million. In India, over 80,000 persons die in the traffic crashes annually, over 1.2 million are injured seriously.

Vehicle manufacturers continue to increase their emphasis on safety. Analysis of external sensors data for vehicle performance is a large area of study. It uses multiple external sensors such as a microphone, GPS, accelerometer, and Global System for Mobile communications radio for traffic localization. Pothole Patrol [14] is another system that monitors road conditions using GPS and an external accelerometer for detection.

Providing constructive feedback to the driver is crucial in correcting bad driving behaviors. Recently, Ford and BMW have proposed ideas on this type of driver assist, where it can be integrated into their telematics system, along with hundreds of other vehicles sensors [14]. Building a smartphone-based wireless mobile sensor network for accident detection system is hard, however, because phones can be dropped (and generate false positives) and the phone is not directly connected to the vehicle.

Mobile phones today are equipped with numerous sensors that can help to aid in safety enhancements for drivers on the road. Implementing the portable crash detection service will alert the user from road crash by giving an alert notification on the portable device. Given the sensing capability of smartphones, we use the internal accelerometer and GPS of the phone in place of the expensive hardware installed in vehicles to assist active features provided in newer Driving Assistance System (DAS).

Our device, which is a mobile phone [7]-[9], contains GPS, microphones, and an accelerometer offering flexibility in methodology and user implementation. We propose a device that is not only already in abundance but portable enough as well to be one of the most effective multipurpose devices that are able to analyze and advise on safety conditions. In this, we use the accelerometer of an Android-based smartphone, with real-time analysis and auditory alerts of these factors; we can increase a driver's overall awareness to maximize safety [10].

4. Proposed Work and Objectives:

4.1 Architecture:

We explore the possibility of implementing an automatic crash detection and notification service for portable devices, which shall render for two-wheeled and second-hand vehicles. This uses the GSM cellular network to communicate between the portable device and the Server Center.

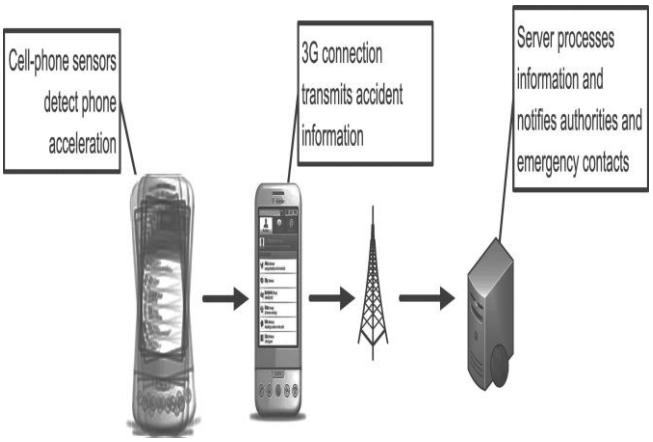

Fig 4.1 : Architecture of e-call system.

The standardization activities related to the technical solution for the implementation of the architecture of e-call service covers main issues: A solution is to send e-Call data over an SMS, which is a reliable, widely-supported, low-cost messaging, system that could support the transmission of MSD's (Minimum Set of Data). This message contains the information about the accident that is sent to the emergency Server Center. The geographic location is pro-

vided either by the Global Positioning System (GPS) coordinates or cellular-network triangulation.

A. *E-call box:*

This focuses on an e-Call-compliant, portable implementation of an automatic emergency service. The e-Call box (aftermarket, portable or mobile device) is a communications-enabled Device, where the communications technologies shall encompass at least GSM. This service is a piece of software that can be installed in any kind of box, that is, an aftermarket device connectable or not to the vehicle's network (CAN) and/or on-board computer; a portable device (PDA, laptop); or a mobile phone[1]. This scheme is especially useful for two-wheeled vehicles and second-hand cars, which have no in-built emergency system. Our emergency call service consists of three processes:

i) The detection of the accident

ii) The composition of the MSD and

iii) The transmission of the MSD over a cellular (GSM) link.

B. *Crash sensor*

The phone contains three-axis accelerometer that is capable of detecting multiple motions triggered by a vehicle. An accelerometer was chosen as the crash sensor because it is a low-cost solution capable of detecting frontal, lateral and roll-over crashes. The *automatic detection of an accident* is achieved by permanent listening to the crash sensor. Whenever the sensor is in motion, it sends data to the e-Call box, which keeps the most recent t_s msec of velocity and acceleration data in its memory. The emergency service constantly scans this data. If a peak above a certain threshold is found, it is analyzed and compared to the typical acceleration profiles of various types of crashes..

The proposed system offers two fundamental advantages:

1) It can be implemented on any device, making it suitable for second-hand cars and two-wheeled vehicles, which are out of the scope of the e-Call standard.

2) It may provide optional data to emergency services obtained from the passenger's handheld devices.

However, our solution also presents potential drawbacks. Analyses the main performance Bottle-neck the e-Call box implementation in a handheld device, i.e., quality and reliability of the wireless link and the effectiveness of accelerometers as the only crash sensor.

One of the solutions being considered by the industry to increase traffic safety is the development of driving assistance systems. The objective of these technologies is to assist the driver in his task, by diffusing information and/or alert messages. The Driving Assistance System is application for mobile system which uses real time data in stream format. So we decided to choose Android 2.1 and above Platform for DAS. Now DAS is divided into two main components.

1. Crash Prediction System

2. Road Assistance System

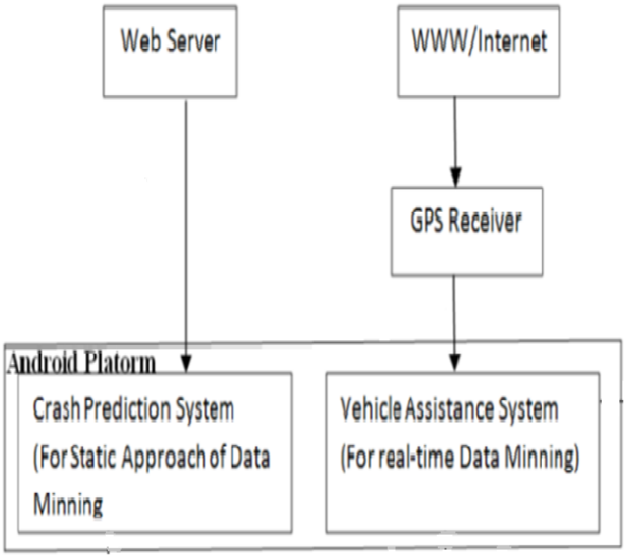

Fig 4.2 : Block Diagram of DAS System

Web Server:-

It is a generic web server which support server-side scripting of PHP, The behavior of this web server can be scripted in separate files. Web servers are not always used for serving the World Wide Web. They can also be found embedded in devices such as printers, routers, webcams and serving only a local network.. So because of this dynamic feature we use it to provide data to our Crash prediction System of DAS. Web Services allow the communication between mobile devices and servers more compatible.

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WWW/Internet:-

Everyone knows about Internet and World Wide Web, we need Internet connection so that we can enable GPS receiver in our mobile for the data demands in real time in the form of stream.

GPS Receiver:-

It is a Global Positioning System uses satellite navigation. The GPS system is operated by the government of the United States of America, which also has sole responsibility for the accuracy and maintenance of the system. In mobile system which is having Android platform support GPS tracking. In that case it communicates with GPRS, and then to a database which will store the location of the device has found itself to be at, so that multiple devices path or our designated path would be tracked. That would require internet connection. Maps are either stored on the device or received over a connection. Navigation is computed based on those maps' databases. These likely are a licensed item with a cost associated, though if you use a service like Google Maps they have the license with NAVTEQ and others.

Using GPS location positioning to support monitoring can reduce the risk of losing track of targets. Therefore, it can be embedded in devices as a locator to track the missing target based on the precise longitude and latitude of the location. The data received from GPS including self-positioning longitude, latitude, time and speed generally will be combined with GPRS or wireless technology. The receiver could be any device including mobile phone, PDA, notebook, etc. This research will adopt GPS self-positioning to track and return location data to the server for further computation.

Augmented Factor:-

Augmented Reality (AR) is a variation of Virtual Environments (VE), or Virtual Reality as it is more commonly called. VE technologies completely immerse a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world.

Therefore, we are going to add this factor in our visual of map for better convenient of driver. It also gives one major augment variable that is text to speech conversion. For Vehicle Assistance System we use data of real time in stream format. The data come from GPS Receiver which is embedded on mobile of Android platform.

Crash Prediction system:-

This component of the system is user interface from where user can interact. Principal Component Analysis (PCA) will use to emphasize the relationships between characteristics such as age, gender and vehicle type, to the crash variables. For Crash Prediction System we use data of type Contextual information, It is a kind of static data which use in traditional data mining Approach. Here it provides data for safely behavior of driver.

Vehicle Assistance System :

This component of system is the user interaction between client and wed services. In this, portable device will act as clients. Vehicle Assistance System will access the maps as per the requirement of the user or as per the request of the user. This map will help the user to travel the path easily from source to destination by following the instructions given in the direction of map.

Objectives:

The main objective is to design a system which assists driver and direct safe path for driving with prediction of the behavior of driver and vehicle. It is going to assist generic road safety problems. They improve driving performance by analyzing the current situation and assessing the probability of crashes. It also assist driver with map with Augmented Reality. This system give the full assistance to driver in-term of human and environment behavior, which are the two major factors for safe driving.

5. APPLICATION

The major application areas of crash detection system includes, Location based real time accident monitoring and also in Road and location assistance to driver. Car accident detection and highway congestion control is an emerging application for wireless mobile sensor networks. Recent advances in phone technologies are making it possible to detect car accidents in a more portable and cost effective manner than conventional in-vehicle solutions.

Smartphone-based accident detection applications also provide several advantages relative to conventional in-vehicle accident detection systems, *e.g.*, they are vehicle-

independent, increasingly pervasive, and provide rich data for accident analysis. **S**martphones in a wireless mobile sensor network can capture the streams of data provided by their accelerometers, compasses, and GPS sensors to provide a portable "black box" that detects traffic accidents.

CONCLUSION

Using a mobile phone, we can demonstrate some innovative applications that are integrated inside an automobile to evaluate a vehicle's condition. By using a device as an android based phone, it relatively make easy to acquire data to be thoroughly analyzed. Its accessibility and portability, the phone can bring a driver assist to any vehicle without regard for on-vehicle communication system requirements. With real-time analysis and auditory alerts of these factors, we can increase a driver's overall awareness to maximize safety. Its mobility and rise in popularity, a smartphone-based measuring device makes these findings unique and applicable for future implementations.

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