ANDROID APPLICATION FOR AUTOMATIC ACCIDENT DETECTION

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Abstract

Vehicle Accidents are fact of life. Driver inattention causes most of the vehicle accidents. And these Accidents produces economic cost and social cost, as well as injuries sometimes death as well. Therefore we proposed a scheme called "Accident Prevention and Detection System". In this project we 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 Wrapping (DTW) to determine how badly the accident is happened. It notifies first responders of the accident location and owner's medical information. Responders are the number that are stored as emergency number in the application. By implementing this application and further adding a notification system, the response time required to notify emergency responders of traffic accidents can reduce the response time and perhaps help in reducing fatalities. Global Positioning System (GPS) is the only available system today able to show one's own position on the earth any time in any weather, anywhere. In this project addresses this satellite based navigation system at length. 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. Shortly after the accident, emergency services therefore know that there has been an accident, and where exactly.

Keywords: *GPS, Accelerometer, Gyroscope, eCall and SMS*

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1. Introduction

The emergency-Call service is a piece of software that can be installed in any kind of box, that is, and aftermarket device connectable or not to the vehicle's network and/or on-board computer; a portable device (PDA, laptop); or a mobile phone In the last few decades, the total number of vehicles around the world has experienced a remarkable growth. The result of this situation is the increase of traffic accidents on the road, representing a serious problem in most countries. Road accidents are one of the most common causes of death among European Union citizens. Intelligent systems are arising to help develop safety and efficiency services for road transportation. A clear example is the European eCall initiative. It provides fast assistance to victims of road accidents is of utmost importance, especially in severe accidents, in which the victims are unable to call for help and also in secondary roads, in which vehicles may not be easily located by rescue personnel. For these reasons, an intelligent emergency call system utilizing sensors to automatically detect a crash and using a wireless network to send critical information to emergency services in a rapid manner would save lives.

2. RELATED WORK

Emergency call systems have been proposed in the literature the authors describe a system that gathers vehicle data and sends it to a centralized database when an accident happens. Upon receiving trigger signal – the accident is detected though one or several sensors located in the vehicle – the system gathers the information provided by video cameras present in the vehicle, This database can be accessed by authorized parties, e.g., such as insurance companies. Similarly, describes a system that notifies the status of a moving object – in terms of photos of the object and its environment, data of collisions and temperature of object, and its positioning – to concerned parties. This status is conveyed or notified to insurance and roadside assistance when a collision happens. 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 parties about historic data of speed, acceleration, location and braking. Various research projects by research institutes and car manufacturers around the globe have been focusing on inter vehicle communication systems. Worldwide systems for emergency reporting regardless of their communication method whether wired or wireless, helps to define the strategies about our systems. Some of the projects related to the proposed system are listed below: Manuel Fogue and his Team mates proposed a prototype architecture called e-NOTIFY, designed to improve the chances of survival for passengers involved in car accidents. The system offers automated detection, reports, and assistance to passengers involved in road accidents by. The goal of this system is to provide an architecture that allows 1) direct vehicle to vehicle (V2V) involved in the accident, 2) automatic sending of a data file containing important information,3) a preliminary and automatic analysis of the damage to the vehicle as well as drivers, based on the information received from the app. A deep survey of Android and iOS application repositories for applications showing road safety shows that only very few applications have high ratings and good user feedback. Examples of such applications are:

- Avertino - It is a safety increase application. It generates permanent, regular or temporary road danger location based warnings. These events are reported by the users who are using this application and are subject to confirmation by rest all other users. When approaching a fixed location, the application warns the user who is using this application through a visual and audible alert. It is available for iOS and android.
- iOnRoad Augmented Driving - It uses augmented reality to analyze in real time, using the camera present on the device, all the objects that are in front of the vehicle while the user drives. It generates alerts and notifies the when the user is not respecting the minimum safety distance between cars or when an exit/entrance happens. It is available for iOS and Android both os.

3. PROPOSED SYSTEM

In order to provide an accident detection mechanism and eCall implementation, Android application was developed and connected to USB port. The highlighted features of the platform beneficial for project are the availability of a Global Positioning System receiver, two Radio Frequency modules, a Field Programmable Gate Array for lower MAC, baseband PHY layer usage and Universal Serial Bus connections. A. Smartphone A smartphone was chosen as a Application Unit (AU) due to its hardware resources and software capabilities, also because it has a 3 axis linear accelerometer. The GSM/GPRS capabilities are very beneficial for the eCall execution. The Android application developed was sub-divided into two modules:

- Design: Related to the Graphical User Interface (GUI) elements,like icons, colors, layouts, photos and visual effects that were added.
- Core: Mainly related to the application's functionality. It allows the GUI elements to do required tasks when demanded as well as Autonomous Accident Detection (aAD) and eCall processing.

3.1 GUI:

It is made by a large square that can take the colors green, yellow and red, by a grey circle that contains textual information and a settings button. A Notification Activity was developed to warn the driver of dangerous road occurred ahead on his route, so that they can go to the location with alertness. The layout was designed to be simple and to enable the retrieval of information in short time .The event is broadcasted by the IT2S platform to other ITS-G5 platforms in the locality. Vehicles equipped with HDy Copilot will show the event on its Notification Activity panel, while others, equipped with ITSG5 compatible equipment, will also notify the driver.The OBD-II reader is connected to the IT2S Single Board Computer (SBC). Application also has configuration screen, where user can verify national emergency number as well as other contacts to be contacted in case of an emergency. When the Android application detects an accident a countdown event is started and displayed to the user, who can cancel it before the countdown sequence terminates. After the countdown an eCall is implemented and a broadcast event is sent from IT2S platform.

3.2 Accident Detection Algorithm

Accident Detection Algorithm is at the core of the eCall system and focus to provide the application to automatically detect vehicle accidents. To identify most car accidents, both collisions and rollovers should be detected separately. Car collisions produce certain acceleration values that can be used to calculate the severity of injuries. On the other hand the sensor fusion algorithm fetches data from the gyroscope. This data is then multiplied by the sampling interval to get a rotation increment. Device implementation is the sum of the rotations. To omit the resulting drift, a high-pass filter is applied. The resulting orientation is the aggregation of the low frequency components from Accelerometer/Magnetometer usage and the high frequency component of gyroscope orientation. A rollover event is declared whenever smartphone rotates at least 45 degrees over the device's Z axis, from its starting position. Run ADA Activity diagram, depicted, uses the linear accelerometer, the magnetometer and gyroscope sensors provided on the Android smartphone. In addition to these sensors the algorithm also uses the vehicular sensor data, like the airbag activation signal. The Acceleration Severity Index is used in Europe to calculate the potential for occupant risk in full-scale crash tests involving roadside safety hardware. The acceleration produced during an accident was studied by several and it was found out that the threshold above accident takes place is 4g(g = 9.8m s2).

In our ADA the 4g threshold is used along with the ASI metric, i.e., the 4g threshold assesses if a car accident takes place and the ASI metric provides an idea of its severity. The 4g threshold was proving that it is possible to detect such accelerations using a smartphone. The exact details about collision, vehicle and the smartphone must have inelastic bound, so that the forces applied to the smartphone are the same of the vehicle. For such reasons, the smartphone must be attached to the vehicle with a holder. Different method used for detecting accident is the airbag deployment. This information we will get through the OBD-II signals received by the IT2S ITS-G5 station. To detect rollovers, algorithm constantly monitors smartphone orientation and movement using a sensor fusion technique. Using Android SensorManager API, its possible to get the device orientation though the SensorManager.getOrientation() method, using accelerometer and magnetometer data. The output of this method provides data with high frequency noise, because of the magnetometer. To get rid of the noise a low-pass filter is applied.

On the other hand the sensor fusion algorithm gathers data from the gyroscope. This data is multiplied by sampling interval to determine a rotation increment. The device orientation is the aggregations of rotations. To eliminate resulting drift, a high-pass filter is applied. The resulting orientation is the sum of low frequency component from the Accelerometer/Magnetometer orientation and high frequency component of the gyroscope orientation. A rollover happens whenever smartphone rotates at least 45 degrees over the device's Z axis, from its starting position. Linear Accelerometer, Magnetometer and Gyroscope sensors from Android smartphone. In addition these sensors, algorithm uses vehicle sensor data, particularly airbag activation signal. Once algorithm is started, simultaneously keeps three data sources: Incoming USB data frames, required device sensors and device GPS location updates, represented by Analyse Incoming USB Data, Read Device Sensors and Request Location Updates actions respectively. Sensor fusion technique is applied at each new sensor sample. Algorithm detects accidents when one of three situations occur, namely, airbag deployment, rollovers or collisions. Algorithm is constantly analyzing incoming USB data, particularly, OBD-II data frames. After frames are received, its data is extracted, if it carries airbag deployed signal, accident occurrence is validated and an accident detected broadcast is emitted. Device's sensors are constantly being analyzed all at same sampling frequency and are calibrated at startup time. At each new sample, sensors are read and fusion sensor technique is applied (except for linear accelerometer). Whenever acceleration is below 4g threshold, process is repeated for next sample. If 4g threshold is surpassed, collision occurrence is validated and algorithm proceeds to calculation of ASI and transmission of the accident alert. If position varies more than 45 degrees from initial position, device mean speed is checked. This mean speed is calculated using GPS API,is constantly being updated. If mean speed is greater than 20 km/h, process continues, otherwise it ignores change in position and calculates it again. Speed verification was implemented to avoid false positives. Threshold is calculated based on last ten seconds prior to device position change. This threshold assures that vehicle was moving before rollover occurred. After device position change, algorithm checks instantaneous speed for ten seconds. After rollover, vehicle is usually immobilized. Threshold used is 5 km/h due to verified GPS speed calculation inconsistencies at low speeds. If instantaneous speed is lower than 5 km/h, algorithm validates the rollover occurrence and broadcasts an alert message, else it repeats process from beginning. Both waiting time and mean speed threshold are configurable values used for demonstration purposes only and should be changed, prove to be ineffective during real case tests. After one of three accident detectors validate an accident occurrence, algorithm proceeds to retrieval of database stored information and launches Countdown Activity. Countdown time is configured by user in User Settings activity. Accident alert is broadcast by three sources. First is vehicular network, by transmitting Decentralized Environmental Notification Message message containing Road Hazard Warning via IT2S platform. Second is Emergency Medical System, by performing an eCall. During development it was verified that it was difficult to perform an eCall with provided APIs. Solution found to surpass this problem was to send an SMS, containing eCall minimum set of data, followed by a voice call to EMS. In SMS content only Vehicle Identification Number is excluded. This is due to fact that it is still under assessment if in fact it should be used. The SMS sent to EMS is also sent to stored friends/family contacts. To provide required functionality, some software services were implemented on the SBC:

- **Android Manager:** Service that handles communication and events between Smartphone and other peripherals.
- **OBD-II Manager:** Responsible to read and send OBD-II Data.
- **IT2S Manager:** manages broadcast messages and sends them to the IT2S platform.

4. CONCLUSIONS AND FUTURE WORK

The paper presents an accident detection mechanism based on an Android smartphone, ODB-II data and vehicular communications, loaded with the eCall platform: the HDy Copilot. When an accident happens message is broadcast to all with SMS and voice call to emergency numbers. To add further control false positives, the warning notifications are only transmitted if the driver or riders fails to stop a countdown sequence, which is automatically initiated by the accident detection algorithm. The HDy Copilot was developed for Android OS. One of the drawbacks found was the lack of an API that would use the GSM radios as an in-band modem to perform a true eCall. HDy Copilot was implemented successfully and overall functionality worked successfully. Future work consists an analysis of the various activities of different smartphones, which are using sensors. Additional future work includes use of the front camera of the smartphone device to calculate the number of passengers.

5. REFERENCES

[1]. Tunakala Lakshmi narasimharao[1], G.Venkatrao[2] **"ECall-Newly emerging e-call safety Equipment standard and algorithms"**

[2]. Lih-Jen Kau[1], Chih-Sheng Chen[2] **"A Smart Phone-Based Pocket Fall Accident Detection, Positioning, and Rescue System"**

[3]. Minal Shahakar[1], Rupesh Mahajan[2] **"Redistribution of Task Using Load Balancing Heuristics in Heterogeneous Environment"**

[4]. Purva Javale[1], Shalmali Gadgil[2], Chinmay Bhargave[3], Yogesh Kharwandikar[4] **"Accident Detection and Surveillance System using Wireless Technologies"**

[5]. Bruno Fernandes[1], Vitor Gomes[2], Joaquim Ferreira[3], Arnaldo Oliveira[4] **"Mobile Application for Automatic Accident Detection and Multimodal Alert"**