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Research paper

Developing A Framework for Accident Detecting and Sending Alert Message Using Android Application

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Abstract

Accident detection systems help reduce fatalities stemming from car accidents by decreasing the response time of emergency responders. This paper focuses on development a framework for detecting accident and sending alert message using android application. The proposed framework developed in order to produce the android application or system with three main functional components which are detecting the occurrence of the crash, detecting the location of the crash and sending the alert message. These three components are interdependent on each other by the flow of the system.

Keywords: *Crash Notification Framework, Automated Accident Notification, Accident Detection*

1. Introduction

In the recent five years, the number of road accident has evidently increased. Not only that, the number of fatality involving road accident has also increased. Statistics released by the Malaysian Institute of Road Safety Research (MIROS) in 2016 shows that the number of road accident cases in Malaysia from 2010 to 2014 also increased as reported.

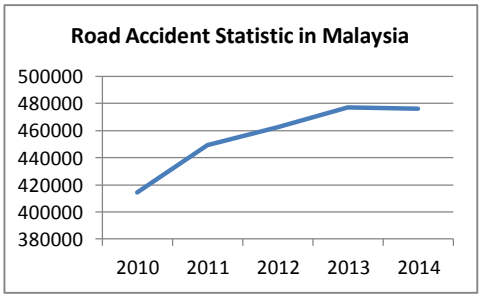


Fig. 1: Number of Road Accident in Malaysia (MIROS, 2016)

The number of cases recorded in 2010 is 414,421cases, in 2011 is 449,040 cases, in 2012 is 462,423 cases, and in 2013 is 477,204 cases. However in 2014, number of road accident cases decreased to 476,196 as shown in Figure 1. The major aim and objective of this research is to develop a framework for detecting accident and sending alert message using android application. Developing a frameworks is very important things because the frameworks plays an important role as a guideline in guiding the entire process of the research study.

2. Related works: Published Framework for Vehicle's Crash Notification

Based on Mahmoud Abuelela et al (2011), an automated crash detection and notification framework should consist of pre-accident and post-accident component which is accident detection and notification dissemination as shown in Figure 2. For this research, the proposed framework consists mainly of three components, which are system architecture, road accident detection component, and emergency deployment as shown in Figure 3 in section 4.

Mahmoud Abuelela et al (2011), propose a novel framework for incident detection and notification dissemination in Vehicular Ad-hoc Networks (VANETs). This framework consists mainly of three components: a system architecture, a traffic incident detection engine and a notification dissemination mechanism. The basic idea of this framework is to collect data from passing cars about their experience on the road, then use this data to detect traffic anomalies and finally notify drivers about traffic delays and incidents, if any. Figure 2 shows the main three components of the proposed framework and how
they interact with each other.

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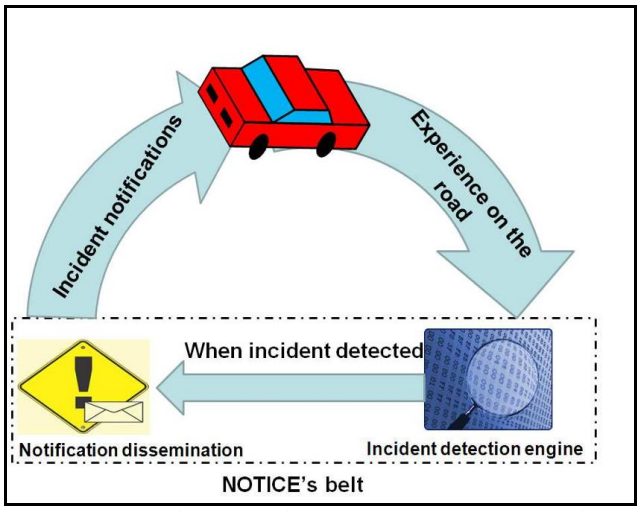


Fig 2: Published framework for accident detection and notification (Mahmoud Abuelela et al 2011)

3. Method Road Accident Detection Component

Automated Vehicle's Crash Notification System is developed with three main functional components which are detecting the occurrence of the crash, detecting the location of the crash and sending the alert message. These three components are interdependent on each other by the flow of the system.

3.1 Detecting the Occurrence of the Crash

The Android Phone platform provides several sensors that let the phone monitors the motion of a device and one of these sensors is accelerometer which is always hardware-based. The accelerometer is an instrument or sensor to measure the acceleration applied to the device, including the force of gravity. Besides that, the measurement of g-force is typically achieved using an accelerometer.
G-force as a directionless measurement calculation formula:

double g = Math.sqrt(x * x + y * y + z * z);

Equation 1. G-force Calculation Formula. Jeremi Banks, (2011)

(where x, y and z represent the accelerometer value in three axes which are in gravity g range).

The occurrence of the crash will be detected using accelerometer which is built-in in smart phone. The accelerometer will detect the sudden deceleration produced in crash and measure the g-force. By setting the minimum g-force value (for example 5.5G), that' 5.5G force value will be the triggering point for the system to assume that the accident occurred when the accelerometer measured g-force value more than 5.5G. Consequently, the system will detect the occurrence of the crash by measuring the g-force value and will assume that the accident occurred when the value of g-force exceeds the minimum value assigned.

3.2 Detecting the Location

Detecting the location is important to determine the place or location of the crash. There are several equipment's used to track down the required location, such as maps, compasses, satellites, Global Positioning System (GPS), etc. This requirement is essential in tactical operations like search and rescue to track down the victim. All Android phones were equipped with maps and GPS.

Assisted GPS (AGPS) chips had been installed in most Android smartphones. AGPS takes the help of network towers and WI-FI hot spots to immediately determine the location nearby and also help the Android GPS enabled smartphone to get a lock with GPS satellites. The AGPS chips build in Android smartphone can also have a lock with GPS satellites without connecting to any data plan or network but require clear sky view (Rathod, 2013).

The system needs to enable the GPS connection in smartphone setting in order to get connected to GPS. When system triggered or detected the occurrence of the crash, it will locate the current location via GPS and it will track the current longitude and latitude.

3.3 Sending Emergency Alert Message

When using this system, the user needs to assign their next of kin's phone number for whom they want to send the alert message. The system detects the occurrence of the crash when the value of g-force exceeds the minimum value assigned, an alarm will scream for 30 seconds and a countdown timer will appear on the screen simultaneously. It is to alert the user if there is any false alarm detected to prevent the system from sending the false information. When countdown timer ends and user did not stop the alarm, the system will automatically send an alert message to assigned phone number using Short Messages Service (SMS) system.

4. Proposed Framework - Road Accident Detection and Emergency Deployment

When all the detection and sending the emergency alert notification process has been done, the third parties will received an information about the crash. As mentioned in section 3(c), the third parties which is family members or emergency response unit will received an emergency alert information message (contained about crash data which is location of the crash, time and date of the crash occurred). From the data received, the emergency response unit will deploy their rescue team to the crash location based on GPS location triggered.

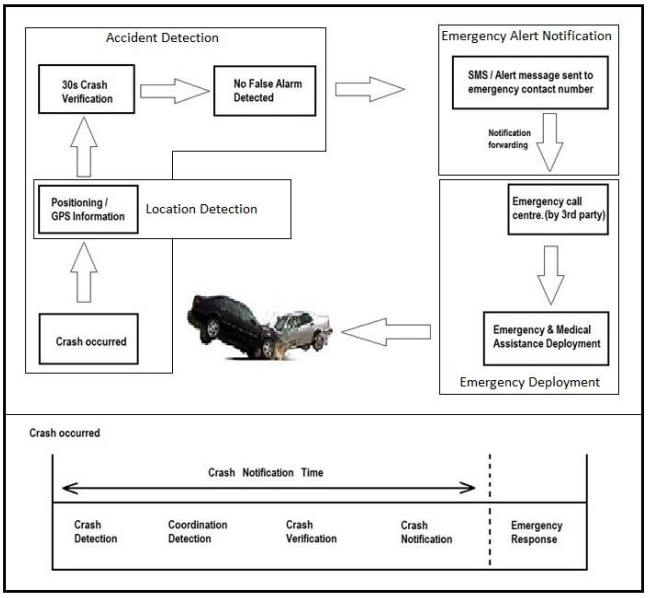


Fig 3: The Proposed Framework Interacting Component

5. Conclusions and Future Work

Although conventional in-vehicle accident detection systems provide emergency responders with crucial information at the earliest possible time, adoption of these systems is limited by their non-

portability and cost. Smartphones present a promising platform on which to construct an accident detection system. This paper described how the Android smartphone application working process in order to become automatic road accidents notification system by combining three major component in the framework for accident detection and notification dissemination which are (a) Detecting the Occurrence of the Crash , (b) Detecting the Location , and (c) Sending Emergency Alert Message.

For detecting the occurrence of the crash, it will be detected using accelerometer which is built-in in smart phone. The accelerometer will detect the sudden deceleration produced in crash and measure the g-force. Consequently, the system will detect the occurrence of the crash by measuring the g-force value and will assume that the accident occurred when the value of g-force exceeds the minimum value assigned.

For detecting the location, the system will use GPS technology to track the exact location. The system needs to enable the GPS connection in smartphone setting in order to get connected to GPS. When system triggered or detected the occurrence of the crash, it will locate the current location via GPS and it will track the current longitude and latitude.

For sending emergency alert message, user needs to assign their next of kin's phone number for whom they want to send the alert message. The system detects the occurrence of the crash when the value of g-force exceeds the minimum value assigned, an alarm will scream for 30 seconds and a countdown timer will appear on the screen simultaneously. It is to alert the user if there is any false alarm detected to prevent the system from sending the false information. When countdown timer ends and user did not stop the alarm, the system will automatically send an alert message to assigned phone number using Short Messages Service (SMS) system.

Future improvements needed to extend the framework with more functionalities. For better implementation, the system need to integrate with the current built-in device in the car. With this integration, user do not need some extra devices to work as an accident detector. Other than that, the assignment of next of kin's phone number aspect which can be upgraded to the nearest authorities emergency centre contact number which means when the system detected the occurrence of an accident, the system will detect the nearest authorities emergency centre such as hospital or police station and alert them with the accident alert message.

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