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Accident Detection and Alert System using Android Application

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Abstract: Large numbers of deaths are caused by Traffic accidents worldwide. The global crisis of road safety can be seen by observing the significant number of deaths and injuries that are caused by road track accidents. In many situations, the family members or emergency services are not informed in time. This results in delayed emergency service response time, which can lead to an individual's death or cause severe injury. The purpose of this work is to reduce the response time of emergency services in situations like traffic accidents or other emergencies such as theft/robberies and medical emergencies. By utilizing onboard sensors of a smartphone to detect vehicular accidents and report it to the nearest emergency responder available and provide real-time location tracking for responders and emergency victims, will drastically increase the chances of survival for emergency victims, and also help save emergency services time and resources.
Keywords: Real time location tracking, Global Positioning System, Accelerometer, On-board Mobile sensors.

I. INTRODUCTION

A large number of deaths are caused by Traffic accidents worldwide. As the usage of vehicles is increasing drastically, the traffic hazards and road accidents also increased which takes the life of the people is under high risk [1]. Nearly 1.3 million people are killed every year and about 50 million injured worldwide due to road accidents, which averages to 3,287 lives, lost every day [3]. Road collisions are the second leading cause of death for people between the ages of 5 and 29 and the third leading cause for people between 30 and 44[3][4]. One of the reasons is the driver's mistake the lack of best emergency facilities available in our country [1][2]. However, most of the time it has been observed that the deaths occurred in the road accident is due to the late arrival of the ambulance to the accident spot. Although in most cases the injury is not severe and we could save the affected lives, however, due to the late arrival of the rescue team, the injuries turn fatal. This paper gives the system to reduce the accident rate in the country by automatically detecting the accident location details by using a smartphone and send the nearest available responders to help. We are using an alarm system which helps in improving the emergency system of the accident system. This system detects the accident occurrence using GPS module and then search for nearest emergency responders from victims location and will send an alert notification to the nearest emergency responder and also send SMS to the emergency contacts containing the location of the victim within 500m to 1km.

II. LITEARTURE SURVEY

A lot of work has been done for automatic accident detection. Different methods used by the researcher to detect an accident automatically such as accident detection using smartphones, GSM and GPS technologies, VANET, and mobile applications.

A. Using GSM and GPS[5][6][7][8][9]

GPS (Global Positioning System)is a satellite navigation system used to identify the exact location of an incident, speed, time and direction. The system determines longitude and latitude of a position where an accident occurs through the GPS module. Then it sends a message which contains the position of the vehicle to the emergency department.

B. Using Vehicular Ad-hoc Network (VANET)[8]

In, VANET is used as an accident detection technique with the help of two sensors, a crash sensor, and an airbag system. When these sensors sense an accident, the information is sent to a microcontroller-based system. The location of the accident is determined using GPS and system sends the location of the accident to a predefined number using GSM. The VANET is used to transmit the message to the rescue team. s

C. Using Smartphones [10]

Car manufacturers like BMW or GM have incorporated a built-in automatic collision notification system. They use sensors like accelerometer and airbag deployment monitors in their vehicles to determine an accident event and send this information using built-in cellular radios to the response center.

Bannaravuri Amrutha Valli et al.[11] used Embedded technology to detect the accident using accelerometer sensor and android technology is used to determine the name of that location instead of latitude and longitude values.

Hamid M. Ali et al.[4] proposed a mechanism that distinguishes between the speed variation of the low-speed vehicle and walking or slowly running person. the proposed system consists of two phases; the detection phase which is used to detect car accident in low and high speeds. The notification phase, and immediately after an accident is indicated, is used to send detailed information such as images, video, accident location, etc. to the emergency responder for fast recovery.

Taewung Kim and Hyun-Yong Jeong et al.[12] proposed an algorithm for detecting an imminent collision in general road scenes. The proposed algorithm consists of crash probability data generated from Monte Carlo simulations that consider driver behavior and vehicle dynamics, a tracking algorithm that uses an interactive multiple-model particle filter, and a threat assessment algorithm that estimates crash probabilities.

III.   PROPOSED SYSTEM

The most likely reason for an individual's death in an accident is lack of the first aid provision that is because of emergency services not receiving information about the accident in time. The proposed system overcomes the drawback of the existing systems by detecting vehicle accidents and report it to the nearest available to help in an emergency. Figure 1 shows the architecture of the proposed system.
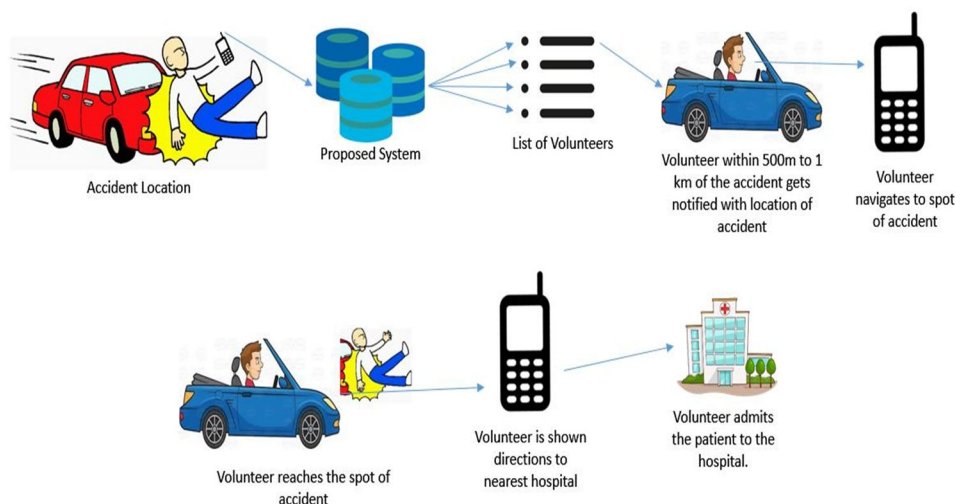

Figure 1: System Architecture

1) *User Registration:* The user firstly needs to register himself to the system with valid credentials. After login, He/she can view/update his profile at any time after authenticated.
2) *Generating An alert if an Accident is Detected:* The user can turn on Automatic Monitoring which will register an accelerometer service running in the background, it can now detect all kinds of jerks produced by the user on his/her smartphone and correctly differentiate between accidents and normal routine jerks. Upon detecting the right accidents, the system will generate an alert containing an alarm sound on the emergency victim's phone. Users will be able to cancel sending alert to emergency responders in case of a false alert (accident didn't occur) under 15 seconds.
3) *Location Tracking:* Victims location tracking is carried out using Google Location API and save it to rebase real-time database, then search for from victims location and will send an alert notification to the nearest emergency responder and send SMS to the emergency contacts.
4) *Directions to the Nearest Hospital:* When emergency responder accepts the request sent by the victim, it will show real-time location tracking of the responder to the emergency victim on a Google map. It will also provide details about responders (name, vehicle, number, phone, etc.). In case of other emergencies, users can select the type of emergency he/she is in (Fire, Ambulance and Police), then by pressing the panic button the system will search and notify nearest responders.

A. System Flow

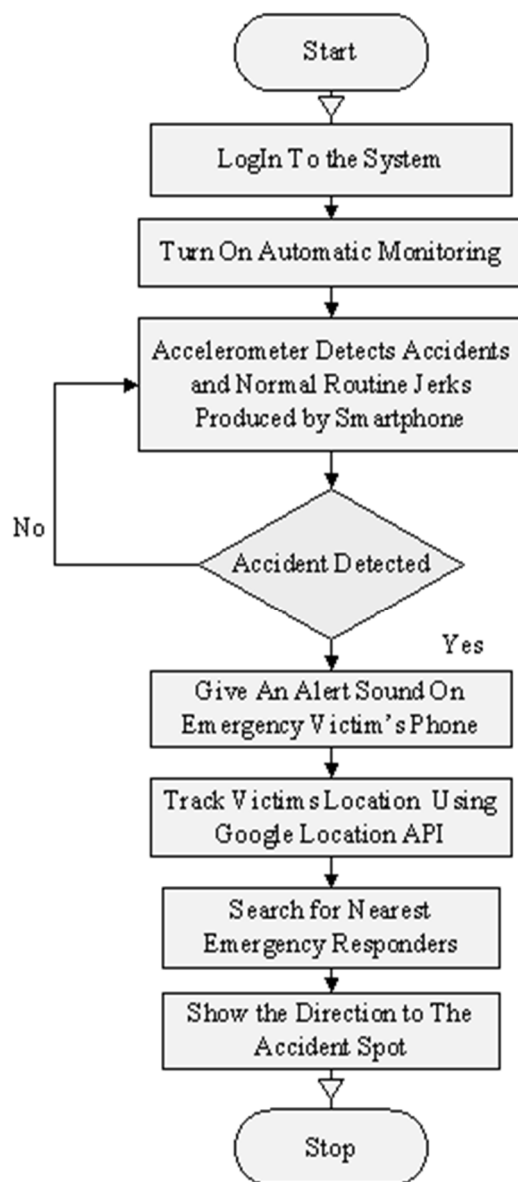Figure 2 gives the detail flow of proposed system.

Figure 2: System Flow

IV. ALGORITHM USED

A. GPS Based Distance Calculation

GPS Based distance formula is used to get distance between to latitudes and longitudes. It is also called **Haversine** Formula.

$$a = \sin^2 (\Delta\varphi/2) + \cos \varphi_1 \cdot \cos \varphi_2 \cdot \sin^2 (\Delta\lambda/2)$$

$$c = 2 \cdot \text{atan2} (\sqrt{a}, (\sqrt{1-a}))$$

$$d = R \cdot c$$

Where,

φ is latitude

λ is longitude R is earth's radius (mean radius = 6,371km);

Note that angles need to be in radians to pass to trig functions!

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B. Fall Detection Algorithm

a) GPS receiver provides speed information in every second

b) The latest two speeds information will stored in memory.

c) After that compare the latest speed with the

Previous speed by utilizing the equations.

$$a = (v2-v1)/(t2-t1)$$

Where v1=previous speed, v2=latest speed,t2=previous time, t1=latest time, a=acceleration

$$t = (v-u)/a$$

Where t= time, v= velocity (speed of vehicle), a=acceleration

d) Central server will raise a flag to indicate that an accident took place.

V. CONCLUSION

This system provides the most favorable way out to poor emergency facilities provided to victims in road accidents in the most feasible way. With the help of proposed system we can detect the position of the vehicle where the accident has occurred so that we can provide the first aid as early as possible. The system uses on board accelerometer sensor to detect accident and generate emergency alert and send it to the nearest emergency responder and will also send an SMS to emergency contact containing location coordinates of the accident. With real time location tracking for both victim and responder the system will drastically increase the survival rate of an accident victim by providing emergency aid in time.Such system helps to reach the accident spot in time and save the valuable human lives.

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