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A PROJECT SYNOPSIS ON

Smart Vehicle and Vehicle Accident Management System

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY , PUNE IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE

BACHELOR OF ENGINEERING (Computer Engineering)
SUBMITTED BY

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Abstract

Internet of Things (IoT) and 5G are enabling intelligent transportation systems (ITSs). ITSs promise to improve road safety in smart cities. Therefore, ITSs are gaining earnest devotion in the industry as well as in academics. Due to the rapid increase in population, vehicle numbers are increasing, resulting in a large number of road accidents. The majority of the time, casualties are not appropriately discovered and reported to hospitals and relatives. This lack of rapid care and first aid might result in life loss in a matter of minutes. To address all of these challenges, an intelligent system is necessary. Although several information communication technologies (ICT)-based solutions for accident detection and rescue operations have been proposed, these solutions are not compatible with all vehicles and are also costly. Therefore we propose a smart vehicle and vehicle and accident management system for a smart city.

The aim of the solution is to cater the need of the car driver, be economical and compatible to all vehicles.The combination of passive and active vehicle safety technologies can effectively improve vehicle safety. Most of them predict vehicle crashes using radar or video, but they can't be applied extensively currently due to the high cost. Our strategy aims to improve the transportation system at a low cost. In this context we develop a solution that is based on collecting vehicle data from On Board Diagnostics Tool. Prepare a communication gateway via Android Device to our cloud and process this vehicle data for accident management and paperless hospitalization and claim process. For accident detection we make use of a specially designed hardware. It comprises of telematics unit working on CAN bus protocols, accelerometers and gyroscope.The collected information is further processed for accident identification. Additionally, a navigation system is designed to inform the relatives, police station, and the nearest hospital.

Contents

1.0 Project Title

Smart Vehicle and Vehicle Acciden tManagement System

2.0 Introduction

Road traffic accidents (RTAs) are becoming more common nowadays, as evidenced by the fact that the number of accidents is increasing on a daily basis. Increasing populations increase the number of vehicles on the road, increasing the likelihood of accidents occurring on the road. Every year, according to the World Health Organization (WHO), traffic accidents result in 50 million injuries and 1.35 million fatalities [1]. Accidents involving automobiles are now the eighth most common cause of death, up from ninth in 2015. If safety measures are not undertaken, this rating could jump from eighth to fifth in the near future, according to the Association for Safe International Road Travel (ASIRT). In recent years, even in developed countries with flawless road safety regulations, mortality in traffic accidents have been on the rise [3]. The lack of immediate help to save a life is one of the most prominent causes of death in a road traffic accident. Some various
methods and techniques can assist in minimizing the frequency of traffic road accidents and saving lives. Using new technologies with diverse strategies in our daily lives may be solved in this modern world evolving with new technologies day by day. The vision of 5G and the Internet of Things (IoT) can enable unforeseen applications, such as smart healthcare, smart cities, intelligent transportation, and many others in today's world [4]. Various technologies support these applications and meet needs like high data rate and low latency, among others [5]. These applications use a variety of sensors to collect data from the environment every minute and exchange it with one another. Based on this information, further action is taken. In today's environment, the need for accident detection and reporting to relevant authorities and family is vital. Accident detection and tracking, as well as timely notification of an accident to the emergency department. This will result in lives being saved and injured persons being rescued. As a result, this study presents a low-cost 5G and IoT-based reporting and accident detection system. The proposed method is categorized into two phases: identification of accidents and reporting of those accidents Multiple smartphone sensors are employed to identify an accident, including GPS, accelerometer, and pressure sensors. Threshold analysis is used to determine the cause of an accident. When an accident is detected, the nearest hospital, police station, and family are notified.

3.0 Technical Keywords (As per ACM Keywords)

Technical Key Words:

- Smart Vehicles
- Telematics
- Internet of Things
- Weka Algorithm
- Voronoir Diagram
- Edge Computing

4.0 Domain of Project

Internet of Things, Web development, Android Development, Data Processing

5.0 Problem Statement

It is an internal project.
India needs more control and support from IT services to manage automobile accidents and automate services and infrastructure related to accidents. More than 4 lakh accidents are recorded. India lags an infrastructure to deal with the losses caused due to accidents. No family is ready to deal with the trauma or emotional breakdown of accident. Hence, an automated system is very necessary to make accident response, hospitalization and insurance claims easy.

6.0 Internal Guide

Prof. Neha Patil

7.0 Type of Project

Non-sponsored project

8.0 Sponsorship Details and External Guide Details

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9.0 System Architecture

As shown in the diagram the OBD-2 will collect accident sensitive data and the accelerometer and gyroscope will reflect the changes in the car during accidents. This data will be then relayed to our Telematics hardware via bluetooth protocol. The other bluetooth configuration will relay the data to android smartphone where the data will be then sent to cloud via 5G/4G cellular network to our server/cloud. In the advent of accident this will trigger a response system to nearby hospital and your insurance provider for accident service. The data registered by the user related to vehicle and medical health will also be forwarded in order to eliminate the preliminary time lost in initial phases of treatment.
The RAD architecture is composed of five distinct layers: apps, database, cloud, network, and perception. The perception layer in the described RAD architecture is responsible for communicating with the smartphone's sensors. The perception layer's principal function is to gather data from the sensors. The collected information is based on sound, speed, pressure, gravity, and vehicle location.After data collection, it is passed to the network layer for processing. The network layer's function is to connect the edge to the perception layer. The network layer is based on 4G, 5G, or Wi-Fi to transfer the perception layer to the cloud layer. The presented algorithm is embedded in the edge layer, detecting the accident and performing the analysis based on a defined threshold. If any accident is detected, the nearest hospital and ambulance are informed, and data are forwarded to the database layer. Finally, the database layer saves the data in the database (i.e., accident information, driver information, vehicle information, and hospital information). Collected data are then forwarded to the application layer for further process with the help of smartphones and web-based systems for the driver and hospital.

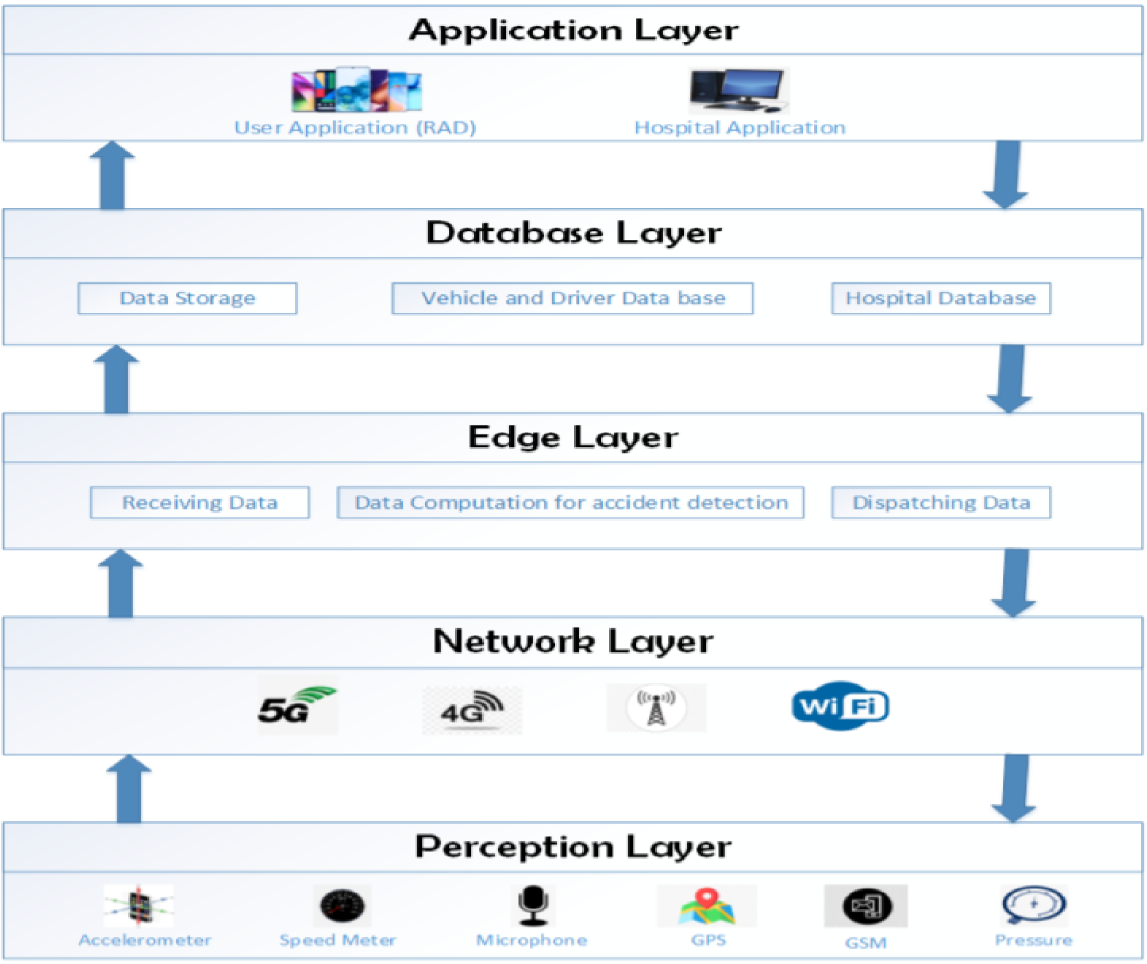

Figure 1: System architecture

10.0 List of Modules and Functionality

1. Data Extraction:
   In this stage, the crucial data like speed, rpm, throttle, ABS, Brake pressure, fuel pressure, Temperature are extracted from different sensors using the On Board Diagnostic Tool. This data along with the accelerometer and gyroscope i.e. MPU 6050 is passed on to ATMEGA microcontroller using the HC-05 bluetooth protocol.

2. Data Collection and Proppgation:
   The data thus collected is channeled through the Micro Controller to the Smartphone Application, The Smartphone application also holds

the data of vehicle as well as driver medical history. This data can be seen in real time and in the advent of accident a trigger is generated that carries all the data to our dedicated server/cloud. Thus, the smartphone acts as communication gateway for the car to communicate with the cloud via 5G/4G cellular network.

3. Processing:
   In this step the data once collected in the advent of an accident is stored in database. The current location of accident is retrieved and based on weka algorithm the map of nearby location is divided into Voronoir diagram, Using Euclidean distance the nearest hospital is pinged and the whole dataset for the victim is raised to nearby hospital. The first hospital to respond is allocated as end location for the ambulance and shortest path of google MAP API is activated to evacuate the victim. On the other front the accident data is analysed against our designed algorithm to identify the type of accident. Based on the data set trained comparisons are made to validate the accident. This prepares an First Information Report for the Insurance Provider and trigger the API to raise a claim process by automatically entering all required official data for claim process. Later the officer may inspect but the families need not pay attention or go through such procedures.

4. Post processing:
   Based on the further human actions of hospitalisation and claim inspection a case file is prepared, The accident repairs and vehicle performance is registered. The whole case is then closed and after the vehicle and driver receive the fitness certificate from the hospital and service center the account is unlocked for further driving purpose. This data will be stored for analysis and preparation for the autonomous vehicle model. Discussed in the future scope. Thus with the help of this data accident prediction and elimination algorithms can be developed and model can be trained against this data.

11.0 Goals and Objectives

- Goal :
  The goal is to develop a Internet of Things hardware on the lines of telematics to capture the data. This data shall be utilised for user end application such as driver smartphone app and hospital and insurance web portal.

- Objectives :
  The objective of this accident management system is to eliminate the wastage of time during accident and automate the paper work procedure that is required during hospital treatment and chargesheet filing for insurance.

12.0 Methodology

In this section, we describe the proposed system model. The proposed system is based on two key mechanisms. An Android application for smartphone and web-based systems. The android application helps us collect data, such as pressure and noise with the help of the accelerometer and smartphone microphone. Based on these values accident is identified.

- Establish Collection:
  The Android application is installed by the user and activated with internet access (i.e., Wi-Fi/4G/5G). With the help of the Android application, the smartphone collects the data of pressure sensor, accelerometer and microphone, and GPS data.In this stage, the crucial data like speed, rpm, throttle, ABS, Brake pressure, fuel pressure, Temperature are extracted from different sensors using the On Board Diagnostic Tool. This data along with the accelerometer and gyroscope i.e. MPU 6050 is passed on to ATMEGA microcontroller using the HC-05 bluetooth protocol.

- Detection of accident:
  The equation for detection of an accident in the [40] is used. Where DA is flag pointer of accident occurrence. In the equation: AC is a value of acceleration that is noticed with the help of a smartphone; Noise is a value noise noticed with the help of a smartphone by using a microphone; SVP is a variation of speed after a specific period, which is helpful to identify the accidents at low speed; Threshold of Accident (TA) is the value defined (i.e., 1.5) that accident detected; Speed (S) is a value of speed, calculated by G-Force; Threshold for low speed (TLS) is the value defined (i.e., 3) that accident detected at low speed; MPT is a maximum period time to consider an accident at low speed. The cloud identifies the accident with the help of Equation (1) by processing the collected data. The alarm is activated when the accident is identified. There are 10 s with the user to deactivate the alarm to avoid false accident reports. If the alarm is not deactivated within 10 s, the nearest hospital is informed with an emergency message for further action. Algorithm 1 describe detection of accident.Notification when an accident is confirmed, the location of an accident is found out with the help of GPS. In the proposed scheme, Google Map is used to find out the locationof an accident. The system forwarded the information of vehicle, location and passengers by utilizing 4G/5G/Wi-Fi to the nearest hospital for immediate action.

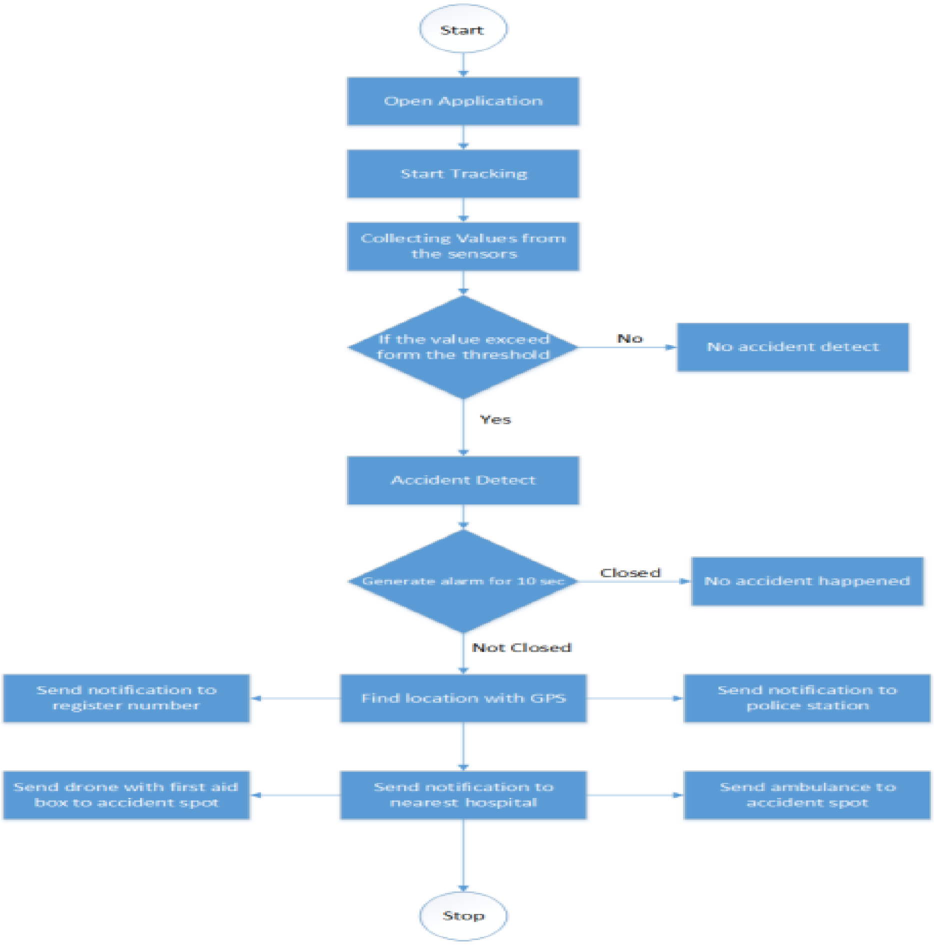

Figure 2: Flow Chart

- Implementation of System:
As mentioned earlier, the proposed system has two phases: the android application is a smartphone used to detect an accident, while the web-based system is used for hospital notification. Implementation of the accident detection phase Java language is used for programming, and the android studio is used for android application development. After installation of an application on a smartphone, the user needs to register with different information. Once the registration process is completed, the applicant can log in to the system with their user name and password. After logging into the system, the user clickson the start tracking button to transmit and record data. The application continuously collected the data from the sensors of the smartphone and forwarded it to the edge. If the value exceeds the defined threshold,

$$DA = \begin{cases} 1, & if\left(\frac{Noise}{140} + \frac{AC}{4G} + \frac{Pressure}{350}\right) \geq (TA)\Lambda(speed) \geq 24\,\mathrm{km/h}, \\ 1, & if\left(\frac{Noise}{140} + \frac{AC}{4G} + \frac{Pressure}{350}\right) \geq (TLS), \\ 1, & if\left(\frac{Noise}{140} + \frac{AC}{4G} + \frac{Pressure}{350}\right) \geq (TA)\Lambda(ElapsedTime < MPT), \\ 0, & otherwise. \end{cases}$$

Figure 3: Equation

the edge identifies the accident and generates an alarm for 10 s.

- Implementation of Notification Phase:
  After identifying an accident, the nearest hospital is notified about an accident with the help of edge based on a web application. ASP.NET is used to develop a web application. The hospitals use this application to identify emergency conditions. In the event of an accident, the website is notified and receives information regarding the accident. The website shows information about an accident, such as drivers information, vehicle information, and accident location. HTML, CSS, and bootstrap are used to develop a website and Microsoft SQL to store accident data in the database. For location tracking, Google Maps is used to identify the accident location on a map.

13.0 Scope of the Project

The solution consists of hardware as well as software. The hardware will be distributed to user end through insurance provider channel. The user end driver will be active via smartphone application and accident service provider via web app.

14.0 Software and Hardware Requirements

- Hardware requirements:
  - ELM 327 OBD
  - ATMEGA Microcontroller (Arduino Mega)
  - HC-05
  - LCD screen
  - Intel Processor i5 8Gen onwards
  - RAM: 8GB
- Software requirements:
  - Coding Language:Python.Dart,
  - Operating System: Windows 10
  - Arduino IDE
- Web application Development:
  - React.js
  - HTML
  - CSS
  - Node.js
  - DynamoDB
  - Express.js

15.0 Input to the Project

- Input for summarization:
  The whole data will be collected from the OBD and the accident benchmarks have been compared with telematics provider such as Onstar

16.0 Algorithms

Data: Collect the values from the smartphone sensors.
Result: Accident detection with the help of collected data.

initialization;
if $\left(\frac{Noise}{140} + \frac{G-Force}{4} + \frac{Pressure}{350}\right) \geq (1)(speed) \geq 24$ **then**
  Z ← 1 ;
else if $\left(\frac{Noise}{140} + \frac{G-Force}{4} + \frac{SVP}{2.06} + \frac{Pressure}{350}\right) \geq (1)(speed) \geq 3$ **then**
  Z ← 1 ;
else if $\left(\frac{Noise}{140} + \frac{G-Force}{4} + \frac{Pressure}{350}\right) \geq (1) \wedge (ElapsedTime) < (MPT)$ **then**
  Z ← 1 ;
else
  Z ←0 ;
end
if *Z=1* **then**
  Alarm Generate ;
  Timer = 10 sec ;
  if *(Timer)* $\leq$ *10 sec* **then**
    Condition = Accident Detect ;
  else
    Condition = No Accident Detect ;
  end
  Take location information of an accident from the GPS ;
  Take out information of the car from database ;
  Take out the emergency number(i.e., registered of concern person) from database ;
  Notification= Owner information, Location, Emergency number ;
  Connect available 5G/4G/Wi-Fi ;
  Send message to server ;
  Find out the nearest hospital ;
  Send notification to the nearest hospital and police station along with accident location ;
  Hospital Dispatched Drone and ambulance with first aid box ;
else
  Condition = No Accident happen ;
end

Figure 4: Algorithm Accident Detection

17.0 Expected Outcomes

As soon as accident is reported a trigger of 30 seconds should be initiated. After 30 sec the data should hit databases for comparison and nearby hospital should recieve a name card with all driver name, car name, blood group, medical history, location and severity of accident, The insurance provider portal initiate claim process.

18.0 Plan of Project Execution

Sr.No	Month	Tasks
1	August	Topic Finalization and Topic Presentation
2	September	Initiation and Requirement Gathering
3	October	Analysis
4	November	UML Designing
5	December	Task Distribution
6	January	Coding and Implementation
7	February	Coding and Implementation
8	March	Testing and Report Writing
9	April	Final Submission

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