

# Intelligent Accident Detection With Mobile Phone Using Internet of Things

**G Gouthami<sup>1\*</sup>, Kavya B V<sup>2</sup>, Kavya B R<sup>3</sup>, Kavita<sup>4</sup>, Sagar B<sup>5</sup>**

<sup>1,2,3,4,5</sup>Dept. of Computer Science ,East West Institute of technology, Vishveswaraya Technological University, Bangalore, India

DOI: <https://doi.org/10.26438/ijcse/v7si15.1620> | Available online at: [www.ijcseonline.org](http://www.ijcseonline.org)

**Abstract**—The Internet of Things (IoT) has been growing rapidly in recent years and widely used in variety of applications such as military, marine, smart home, intelligent transportation, smart health, smart grid and smart city domains. Due to the advancement in technology and increasing traffic, road accidents and traffic hazards have increased, causing more chances of loss of life due to lack of timely help facilities. This project is an attempt towards finding solutions for timely accident notification. The proposed project records the parameters of vehicle at regular intervals of time, through a smart device installed in the vehicle and sends these values onto the Android App, vehicle owner or a third party. The system will facilitate the users in a number of ways such as notification for immediate aid in case of accident, tracking the vehicle conditions in cases of accident and disabling the vehicle remotely. The hardware components include the smart device installed in the vehicle and a mobile phone for user interaction. The smart device installed in the vehicle does not interfere with the normal functioning of the vehicle or cause overheads.

**Keywords**—Internet of Things (IoT), Renesas Microcontroller, Global Positioning System (GPS), Accelerometer, Analog to Digital Converter (ADC), Android application, Global System for Mobile (GSM), Liquid Crystal Display (LCD).

## I. INTRODUCTION

In the modern world, long distance travel is made easier and more reliable. You can reach to any part of the world any time you wish with wide variety of the modern means of transportation. But the advancement in the technology has very less effect on making your commute a safer one. Emergencies are not predictable and avoiding them is quite a challenge too, but with proper aid and quick reach for help can avoid catastrophe. According to WHO(World Health Organization) the number road traffic injuries is caused an estimated 1.25 million deaths worldwide. That is ,one person killed every 25 seconds and there is one death every 4 minutes in India. One of the ways to reduce this number is by management of accident victims. One of the most common causes of road deaths is due to loss of oxygen supply. This is mostly caused by a blocked airway, which leads to death in less than 4 min. The first hour after the trauma is called the “golden hour”. If proper first aid is given within the golden hour the road accidents victims have the greater chances of survival.

The incomplete combustion in the engine of a vehicle leads to emission of different gases contributing to increase in the pollution and adversely affecting the environment [7]. Detection and control of these gases is an important area of work. This emission from vehicles cannot be completely avoided but, it definitely can be controlled. Now a day’s accidents are a common reason for deaths. These are critical

things to control so here we come up with a concept to reduce pollution and detect the location of accident and making sure necessary action is to be taken [3]. The challenges imposed to local PSOs in saving human lives resulting from vehicles accidents have become a crucial concern due to the huge aforementioned number of departed people. As far as many injured could lose their lives, and since no on-site medical assistance has been provided promptly as a result of late accident reporting, inaccurate geographic location, and lack of injured medical information, the need for automated and intelligent mobile solution tackling this burden becomes a must.

## II. RELATED WORK

Road accident is a major problem our nation is facing today. Study shows that if our eyes are exposed to bright light source more than 1000 lumens even from 20 feet, we experience a glare, due to over exposure of rods and cones inside our eye. Even after source of glare is removed, after imaging remains in our eye that creates a blind spot. Also many accidents occurs on roads having steep turns and curved roads in hilly areas, due to presence of blind spots [1][3]. These areas cannot be seen directly by looking forward or by looking through either of side mirrors. Many reasons causes these blind spots like steep curves in roads, weather conditions, poor infrastructure, improper street lights etc. which creates problems for driver. A vehicle with normal headlights sends the light rays tangential to curves; this

reduces the ability of driver to see the blind spots. These blind spots can be eliminated for safe driving using adaptive headlight system. Many people lost their lives every year in vehicle collision majorly due to driver's inability to observe keenly in vehicle's vicinity while driving and in traffic condition, while overtaking, sudden braking on turns, loss of control etc. There are certain research works carried out on anti-collision devices using ad hoc wireless network, V2V communication, V2P communication[2], GPS and radar implementation but all focuses on communicating the driver and later he will take action manually which includes chances of collisions[4][5][6]. But we have developed a system which will not only provide driver a safe warning but also automatically apply braking system after specific time if any sudden action not taken by driver. This section provides a brief summary of works related to using mobile phones for detecting accidents[8][9]. In 2010, a group of researchers from Vanderbilt University proposed the mobile phone application. This application keeps track of accident/event data by recording the path, speed, forces of acceleration on a vehicle leading up to the accident[3]. A research was conducted with the assumption that the phone is inside the user's pocket at all times, and therefore any forces applied to the phone would have been applied to the user. This system is an Android application on the client and Java and uses the Spring Framework on the server[10][11], its provides an in-depth analysis regarding their client server architecture and the use of what they refer to as 'on board' sensors; accelerometer and GPS sensors were used to detect collisions. False positives were prevented by using contextual information, speed and acceleration filters. Other challenges addressed in this research include excessive power consumption possible destruction of the phone and determining whether or not the user is inside the vehicle.

### III. METHODOLOGY

The proposed system uses the following components and methods namely:

#### A. Renesas Microcontroller

Renesas microcontroller is a 16-bit CPU core for embedded microcontrollers of Renesas Electronics introduced in 2010. It has 64 pins and its model name is R5F100LE. Out of 64 pins, 58 pins are used as General Purpose Input Output (GPIO) and 6 pins are reserved pins (name of the reserved pins are  $V_{SS}$ ,  $V_{AD}$ ,  $V_0$ , RS (Reset), RW (Read-Write), E (Enable) . The Renesas microcontroller also consists of 10-bit ADC (Analog to Digital Converter), 8 channels, 8 timers and 12 interrupts. The RAM size is 4kB and ROM size is 64kB. The speed of Renesas microcontroller is 32 MHz. The input voltage is 12V and operating voltage is 5V. It has 11 ports, each contains some pins. The UART (Universal Asynchronous Receiver and Transmitter) protocol is used for serial communication. It has 3 UARTs of which 2 are

reserved for GPS and GSM. It consists of 3 sections namely power section, control section and communication section. Power section is used to convert the input voltage into operating voltage. Control section is used to control the operations. Communication section is used to dump the code.

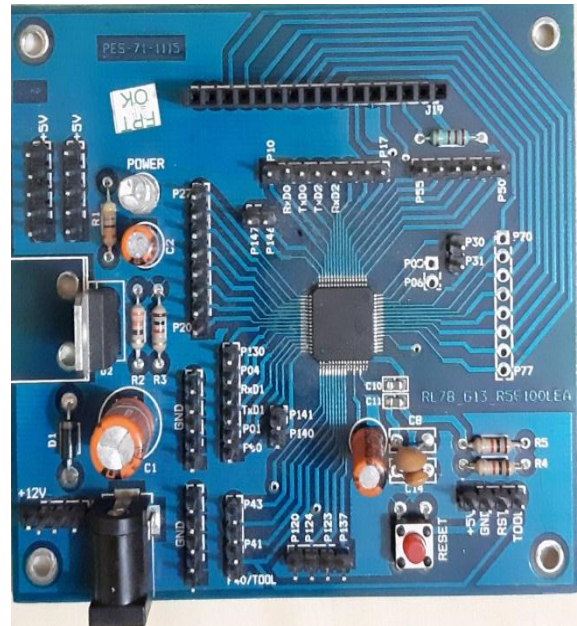


Fig 1: Renesas microcontroller

#### B. Global Positioning System

A Global Positioning System, also known as GPS, is a system of thirty-one satellites designed to help navigate on the Earth, in air, and on water. A GPS unit takes radio signals from satellites in space in orbit around the Earth.

When the accident has occurred, alert message will be sent to the android application installed in the smartphone of the caretaker along with three-dimensional position (includes latitude, longitude and altitude) and time.



Fig 2: Tracking location using GPS

#### C. Global System for Mobile

Global System for Mobile communications (GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for

second-generation digital cellular networks used by mobile devices such as mobile phones and tablets.

GSM module is used to send alert messages to android application when accident has occurred.



Fig 3: Sends alert message to android application using GSM

#### D. Liquid Crystal Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi-segment. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, they are namely Command and Data respectively.



Fig 4: LCD to display the internal operations

#### E. Accelerometer

The accelerometer is used to detect the accident. Whenever the accelerometer reading crosses the threshold, then the alert will be sent to android application, meanwhile if you have not pressed then it is the confirmation for the accident, then the alert message will be sent to respective person through the GSM.

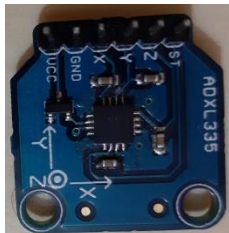


Fig 5: Accelerometer for measuring vibrations in vehicle

#### F. Switch and Buzzer

Switch is used to turn on/off the further process and buzzer is used to send make a noise to alert the nearby people. For example, if there is an minor accident the passenger will be pressed the switch that time there is no information send to the Android App suppose if there is an major accident all the information will send to the Android App that message is sent to the nearest hospitals. The related database will be stored in the android application, along with that you will get buzzer beep.

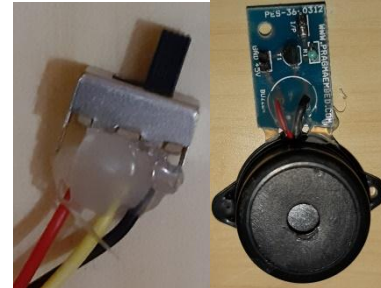


Fig 6: Switch and Buzzer

## IV. RESULTS AND DISCUSSION

#### A. Analog-to-Digital Conversion

The Renesas microcontroller has a 10-bit Analog-to-Digital converter which converts the analog voltage value into digital voltage. The analog value will be in the binary form which is machine-readable form and not understood by humans. The proposed system detects the accident when the accelerometer is tilted either left or right. When the accelerometer is tilted, the voltage value is converted from analog to digital by Analog-to Digital Converter. Some threshold value is set to the accelerometer which is less than 145 and greater than 175. When the accelerometer crosses the threshold then, the accident is detected and accelerometer value is converted from analog to digital and displayed on the LCD. Analog-to-Digital Converter converts the voltage value from analog to digital using the formula:

$$ADC = (V_{ref} - 5/2^n - 1) * 100$$

where  $V_{ref}$  is the reference voltage, 5V is the operating voltage and  $n=10$  as renesas microcontroller contains 10-bit ADC.

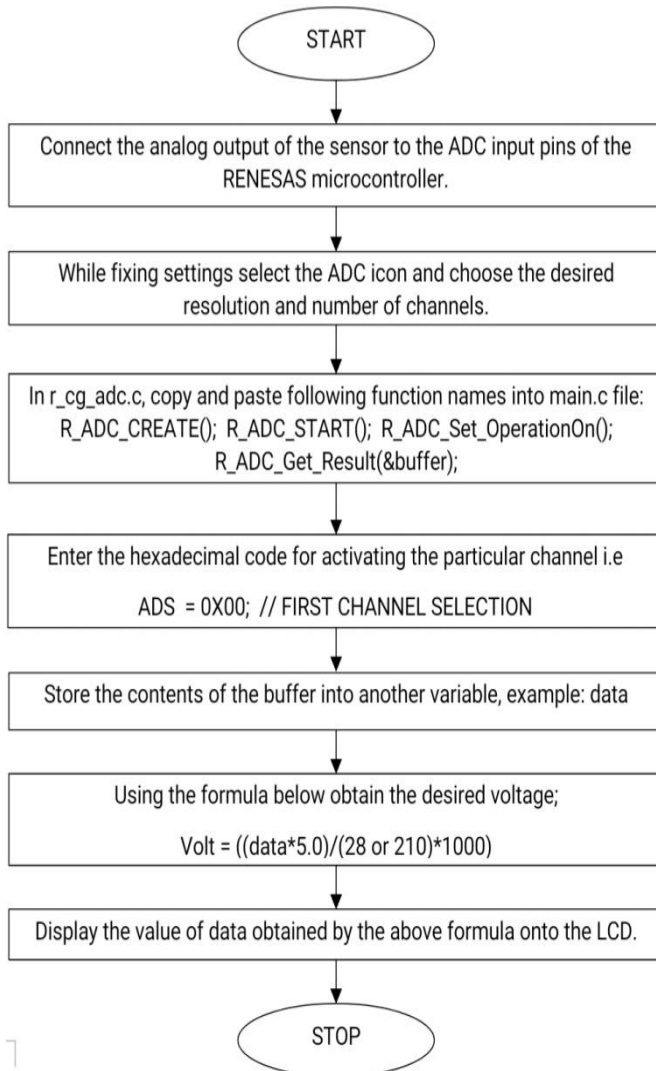


Fig 7: Flowchart of Analog-to-Digital Conversion

**B. Android application**

An android application called “Location Track” is installed in the smartphone of the caretaker. When the accident has occurred then alert message will be sent to the android application of the caretaker through GSM installed in the vehicle. The android application consists of login page where the user must his/her username and password for authentication purpose. After the successful login, the page will be directed to main screen.

The exact location where the accident has taken place is tracked using the GPS and alert message will be sent to the android application along with latitude and longitude value. When the user clicks on Show Map button then the page will be directed to Google Maps. In the proposed system, the location will be shown at the distance of 100m.

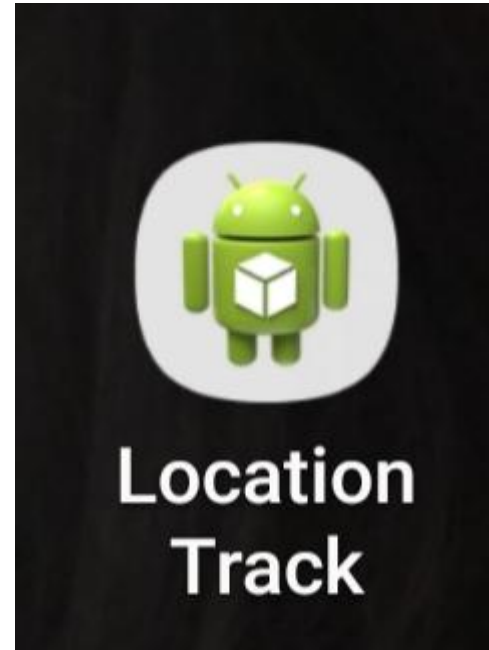


Fig 8: Android application named Location Track

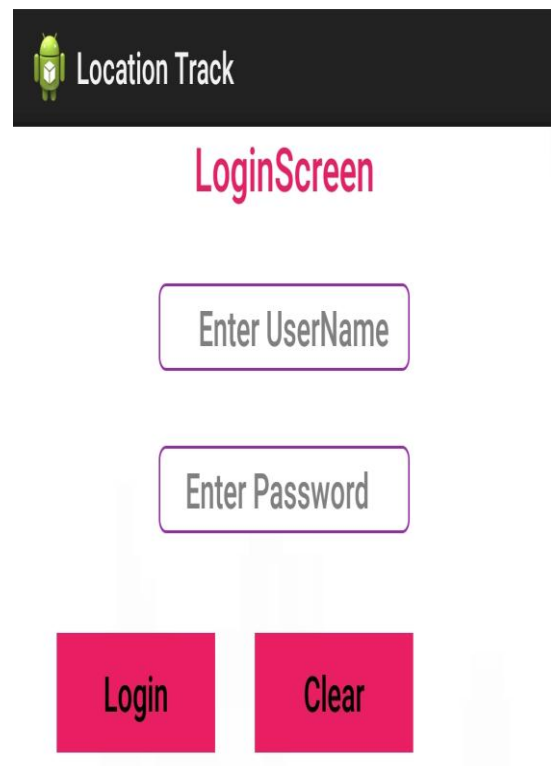


Fig 9: Login page of the caretaker

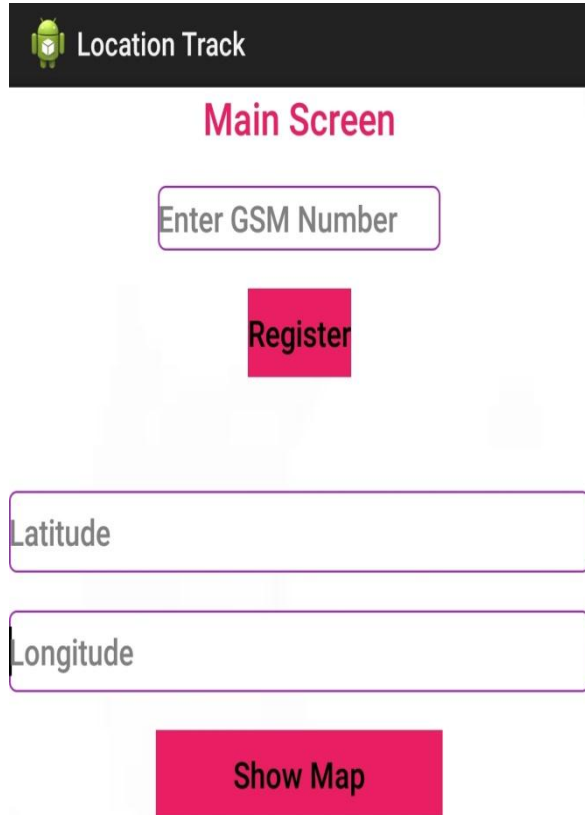


Fig 10: Main screen of the android application which directs to Google maps when clicked on the Show Map button

## V. CONCLUSION AND FUTURE SCOPE

The project is designed using structured modelling and is able to provide the desired results. It can be successfully implemented as a Real Time system with certain modifications. The intelligent accident detection and rescue system is successfully implemented using database Android App and also fulfils all the requirements to be an Android App based framework. This device is capable of reading and collecting the required data and sends them securely to the database so as to maximize the effectiveness of the shared resources. The proposed system is an Android application that detects a road accident using the GPS module the GPS to locate the accident place and GSM to send the accident location. Nowadays, GPS receiver has become an integral part of a vehicle. Besides using in other purposes, the GPS can also monitor the speed and detect an accident. It can use a very cheap and popular GSM modem to send the accident location to the concerned headquarters. Science is discovering or creating major breakthrough in various fields, and hence technology keeps changing from time to time. To make the system applicable for real time purposes components with greater range needs to be implemented.

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