ABSTRACT

In automobiles, many advancements in technology could take place. Either interior or exterior, but cases of accident depend on the driver and the other automobiles surrounding the driver. So, it takes a keen importance in emergency service providence in automobiles in case of any accidents. In this project emergency service is activated as soon as there is any sight of accident. Accident stimulus is taken from the sensors like vibration, tilt and flame sensors. This sensor module is connected to the microcontroller which operates to perform the activity to send alert message in the system and also outside the system. If in case there is no accident witnessed but still the sensor module has detected the emergency, driver can always switch the alert of from the switch provided which is again connected to the microcontroller. Microcontroller sends signals to the Bluetooth module connected to it in case of accident. Bluetooth module which is to be connected to the phone of the user or the driver will get access to the android application. In this android application the driver has to login and feed his personal details so that it helps in case of accident. He will also be asked to feed his close contact to whom he wishes to send alert message in case of accident. This application send message to the close contacts and also send message for the nearby hospital ambulance driver with location of accident. Since the ambulance driver may or may not be near the accident area, application also get access to the ola or uber application to find the nearby driver to pick up to the nearby hospital for emergency. From this application time for surveillance to be provided is reduced so as to get immediate response to the emergency victims.

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Chapter-1

INTRODUCTION

1.1 Background

The high demand of automobiles has also increased the traffic hazards and the road accidents. In present days the rate of accidents can be increased rapidly. Due to employment the usage of vehicles like cars, bikes can be increased, because of this reason the accidents occurs. People are going under risk because of their over speed, due to unavailability of advanced techniques, the rate of accidents can't be decreased. To reduce the accident rate in the country this paper introduces an optimum solution. Automatic alert system for vehicle accidents is introduced; the main objective is to control the accidents by sending a message to the registered mobile and nearby hospital, using wireless communications techniques. When an accident occurs at a city, the message is sent to the registered mobile and nearby hospital through GSM module in less time. When individual met with an accident which might be a very critical situation as their lives are on stake where no one can rely on passerby or the strangers for the needful help and cooperation. So it is very important to get to the optimal solution that might be a life line for the individual. This is because of the lack of best emergency facilities available in our country. An automatic alarm device for vehicle accidents is introduced in this paper. This design is a system which can detect accidents in significantly less time and sends the basic information to first aid center within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred. This alert message is sent to the rescue team in a short time, which will help in saving the valuable lives. Thousands of people are dying because ambulances takes too long to answer emergency calls. Human life is too precious to be lost in road accidents which are one of the major cause for fatalities in India. A switch is also provided in order to terminate the sending of a message in rare case where there is no casualty, this can save the precious time of the medical rescue team. There is delay involved in each and every stage of the process right from detecting accident, dispatching an ambulance till the patient is safely handed over to the casualty. We wanted to automate the whole process to reduce the delays in each stage. This system is used to integrate the user and ambulance services with the use of internet to save time and life. System constitutes of client and server application when the

accident detection module reports an accident by using three axis accelerometer to the cloud sever that would automatically dispatches the nearest ambulance by processing the GPS coordinates and providing specific route to the certain accident spot. The android application used by the ambulance driver assists the driver to reach the location quickly and safely. We also wanted to help two-wheeler driver to use phone in very secure way so that he/she can primarily concentrate on road without any hassle.

1.2 Motivation

When Paris was attacked, Facebook immediately launched Safety Check tool that promoted users in affected area to confirm their safety. Users could share their safety status with their Facebook friend using the tool. After this incident, the demand and development of savior mobile apps that serve as a life saver went high.

Here we have put together a list of outstanding mobile apps that alert safety system and help you in unfavorable situations.

1.2.1. Medical ID (iPhone/Android)

Fig1.1. Medical ID App icon

With smartphones allowing you to create a Medical ID, you can get immediate help in an emergency situation. With this Medical ID that you can access from your phone's Emergency Call screen, people can identify you as known and refer you medical record. a pre-installed health app lets you create the ID.

You can view a person's Medical ID by tapping on Emergency Call on the lock screen. The ID will pop up with their details such as Full name, blood type, emergency contact, etc.

1.2.2. Guardly (iOS)

Fig1.2.Guardly App icon

This app can be a great life-saving tool that helps organization employees or business individuals to connect with their organization's security operations from literally anywhere. Security operators, admins and dispatchers can avail Guardly to send reliable emergency alerts and helpful messages to staff members in critical situations.

If there is a threat (fire, shooter, and thief) in the building, the security man can notify all the employees to be cautious. Guardly detects and transmits real-time GPS location within the premise and forms two-way communication with security, community, or 911.

1.2.3. Disaster Alert (iOS/Android)

Fig1.3.Disaster Alert App icon

This app is brought in by Pacific Disaster Center's World Disaster Alerts and provides users a useful real-time access to data about upcoming or active hazards around the globe and relevant disaster warnings. Disaster Alert shows events that are highly dangerous and potentially hazardous to people and assets.

Detailed information and hazard reports can be accessed and shared by users. Nearly 1.5 million users globally rely on this app.

1.2.4. First Aid by American Red Cross (Android/iOS)

Fig 1.4.First aid by American Red Cross App icon

It is always advisable to keep the first-aid kit with you and First Aid by the American Red Cross is a great ad-free resort for those looking to learn about emergency aid and disaster preparation. It introduces users to the basic first aid lessons on many topics through supporting videos, FAQs and illustrations along with condensed instructions and a handy red button to contact 911.

Users can also find check-list on disaster preparedness and links to other useful resources from American Red Cross.

1.2.5. ICE (iOS/Android)

Fig1.5.ICE App icon

The ICE (In case of an emergency) app takes and stores crucial information that can be used in time of emergency by active responders or hospital staff to address the situation. It includes emergency contacts, personal information, medical condition and any other important details.

The app allows you to use it even when you can’t unlock the phone while being stuck in an accident. Upon losing your phone, the ICE lock screen helps you with ‘if found’ message. App is available in 13 languages so that you can change the language while travelling to foreign locations.

1.2.6. FEMA (Android/iOS)

Fig1.6.FEMA App icon

FEMA is from the Federal Emergency Management Agency that is responsible for handling the U.S. government's response to disasters of big scale. The app prepares people for possible hazards and emergency situations with a set of important preparation tips.

This includes the suggestions and guides to creating your emergency kit for serious disasters like flood or hurricanes, and also basic instructions on ensuring safety before and after disaster strikes. FEMA is also a great resource for finding Disaster Recovery Centers and Shelters and informative FEMA blog.

1.3. Literature Survey

In this framework, we work on accident detection technics by referring following papers, in [1] author proposed solution to detect accident sound sensor, flame sensor using raspiberry pi. Which is also used to keep track of the accelerometer readings. In [2] GPS and GSM framework used for accident detection with help of vibration sensor and send quick message to the relatives. Another work of dispatching emergency services to appropriate location is done by using Analytic Hierarchy Process (AHP) in [3]. In paper [4] the author proposed all this system fully automated using different sensor on every stage to send message for relative and hospital.

In [5] author designed a system which used alcohol sensor, vibration sensor. And GPS and GSM module were used forming an IoT network and cloud server to store all information. In [6] framework includes a microcontroller-based low-cost Accident Detection Unit (ADU) that contains GPS and GSM modem used for sending SMS and Alarm. In paper [7] author has talked about how to control traffic which help in accident reduction using intelligent traffic lights ITL. In paper [8], author proposed a project by how network problem can be overcome with the help of smart cities. In paper [9] VANETs is used to connect between different automobiles while travelling and make all the vehicle connected. In paper [10] mobile is used which access the help of wretch server to send emergency alert without any external aid. In this paper we study all above paper and basic idea to detect accident by system which available to every twowheeler easily and reduce delay in providing emergency services to victim. So here we came up with new idea which implement fully automated system for all process.

1.4. Objectives

To accomplish goals below are the following objectives:

- Ensure coordination between emergency management program and other programs including: safety, security, integrity, damage prevention, public awareness and environmental protection.
- Complete hazards identification and consequence analysis to develop operational specific emergency procedures.
- Consult and inform the public and other external agencies, as appropriate, of the procedures, plans, and training materials to educate and prepare those who may be involved in or affected by an emergency.
- Develop, implement, establish and report on controls to prevent, manage and mitigate conditions during an emergency, under a coordinated and systematic response management structure (the Incident Command System).
- Notify and activate early all necessary company and response organization resources to respond in a timely manner to emergency incidents.
- Regularly evaluate and continually improve incident management, regulatory interface, customer communication, and community relations plans and protocols.

Chapter-2

WORKING OF THE SYSTEM

2.1. Problem definition

In case of automobile accident, there must be immediate access to the emergency services. The taken by the emergency responders will play a major rule in this kind of situation. So as to reduce this problem this project help in immediate service avail lance. The accident alert system and android app is interconnected with IOT. At first user have to install the app and have to register his details and have to enter his emergency contacts. If there is any occurrence of accident then the sensors in this device will detect the accident and then forward this information to the smart phone which is connected to it via Bluetooth. Now the remaining mechanism is done by app where app will automatically triggers an alarm upon receiving this information from the IOT. If the Driver fails to turn off this alarm within a specified time limit, the app sends a message to the contacts loaded by him which also contains the location of the accident to his emergency contacts and to the nearby hospital.

The android app developed will be having link to other application like Ola and Uber, since ambulance pick up time might be late to the location. This android app will send notification to the nearby Ola or Uber driver of emergency. It’s up to the driver intention to help the accident prone victims to help, company should give rewards for his act of humanity and gain respect and increase his commodity of service. Though ambulance driver intend to come as soon as possible to the accident area, driver from Ola/Uber whose work is to transport passenger can also help the emergency victims. To implement this service from the official app, if automobiles manufacturer look forward to this surveillance which is a lifesaving project can change the death rates of accidents.

2.2. System Architecture

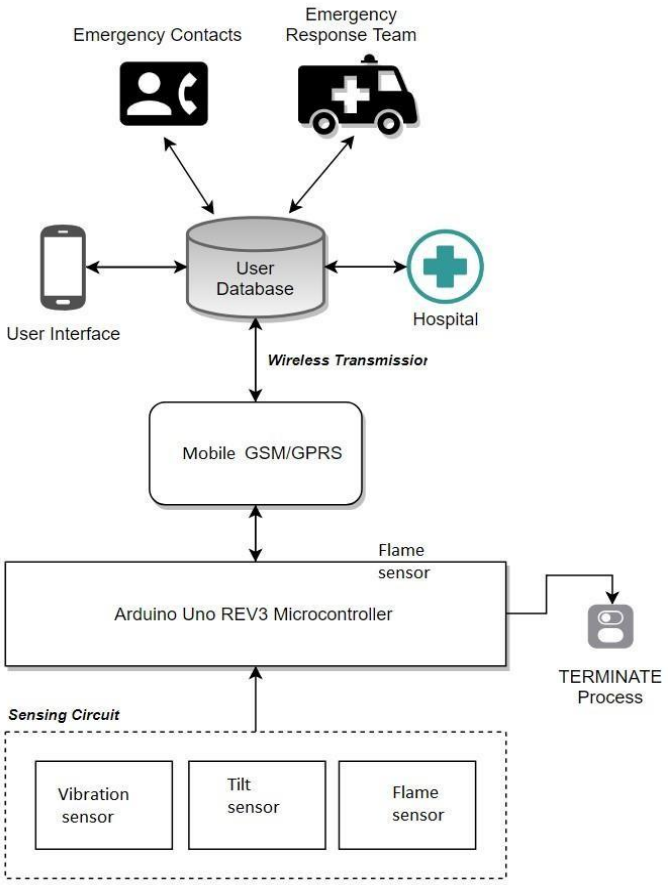

Fig2.1. System Architecture diagram

2.2.1. Sensing Circuit

This is the component of the system that detects the occurrence of an accident and retrieves the GPS location.

a) Vibration sensor to protect door or window is used it generates a loud beep when somebody tries to break the door or window. The alarm stops automatically after three minutes. The circuit uses a piezoelectric element as the vibration sensor. It exploits the piezoelectric property of the piezo electric crystals.

b) Tilt sensor: A tilt sensor is an instrument that is used for measuring the tilt in multiple axes of a reference plane. Tilt sensors measure the tilting position with reference to gravity and are used in numerous applications. They enable the easy detection of orientation or inclination. Similar to mercury switches, they may also be known as tilt switches or rolling ball sensors.

c) *Flame Sensors:* Flame Detection Sensor Module is sensitive to the flame, but also can detect ordinary light. Usually used as a flame alarm. Detects a flame or a light source of a wavelength in the range of 760nm-1100 nm.

2.2.2. Arduino UNO R3 Microcontroller: Arduino UNO R3

It is based on the ATmega328 AVR microcontroller board. It has 20 digital input/output pins, a 16MHz resonator, USB connection, power jack, in-circuit system programming and a reset button. Apart from connecting the various sensors to the microcontroller, the TX and RX pins of the R3 are connected to the SIM900A module, ensuring serial transmission of data.

2.2.3. Mobile GSM/GPRS

- GPS device (mobile phone) can tell our precise location (position) in a process called trilateration. In geometry, trilateration is defined as the process of determining absolute or relative locations of points by measurement of distances, using the geometry of circles, spheres or triangles.
- It needs to get a message from at least three, preferably four satellites
- GPS receiver measures the distance between itself and each satellite.(distance = time of arrival * speed of light)
- GPS needs very accurate timing which it achieves with atomic clocks on board each satellite.
- Along with distance, the device needs to know exactly where the satellites are in space at any given time. This information is held inside the GPS receiver itself.
- Finally, by using mathematics, it can work out where it is on the ground and shows location.

2.2.4. Database

The database stores the information that the user provides during account registration, collects the real-time accident data and retrieves accordingly. For example, an emergency contact would be notified of the accident location and which EMT has been dispatched, whereas the hospital would be able to access the vital health information of the victim, such as his blood group and medical background.

Chapter-3

Components and Implementation

3.1. Components

3.1.1. Vibration Sensor

At present in the industry like research and development, the ability of monitoring, measuring as well as analyzing the vibration is very important. Unfortunately, the suitable techniques for making a measurement system for vibration with precise & repeatable are not always clear to researchers with the shades of test tools & analysis of vibration. There are some challenges related while measuring the vibration which includes a selection of suitable component, the configuration of the system, signal conditioning, analysis of waveform and setup.

The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality. The working principle of vibration sensor is a sensor which operates based on different optical otherwise mechanical principles for detecting observed system vibrations.

Fig 3.1. vibration-sensor-module

The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities are also accessible. The sensitivity of the sensor can be selected based

on the application. So it is essential to know the levels of vibration amplitude range to which the sensor will be exposed throughout measurements.

3.1.2. Flame sensor

A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can be easily damaged to high temperature. So this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 600. The output of this sensor is an analog signal or digital signal. These sensors are used in firefighting robots like as a flame alarm. A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame. This sensor/detector can be built with an electronic circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice. The pin configuration of this sensor is shown below. It includes four pins which include the following. When this module works with a microcontroller unit then the pins are

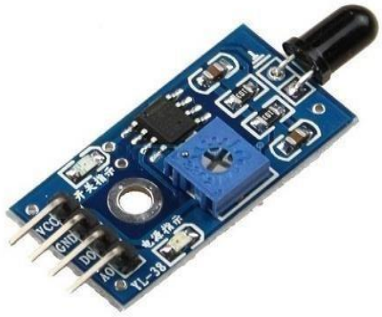

Fig 3.2. Flame-sensor

- Pin1 (VCC pin): Voltage supply rages from 3.3V to 5.3V

- Pin2 (GND): This is a ground pin
- Pin3 (AOUT): This is an analog output pin (MCU.IO)
- Pin4 (DOUT): This is a digital output pin (MCU.IO)

Flame-sensors are classified into four types

- IR single frequency
- IR multi-spectrum
- UV flame detectors
- UV/ IR flame detectors

3.1.3. Arduino

The Arduino Uno is one kind of microcontroller board based on ATmega328, and Uno is an Italian term which means one. Arduino Uno is named for marking the upcoming release of microcontroller board namely Arduino Uno Board 1.0. This board includes digital I/O pins-14, a power jack, analog i/ps-6, ceramic resonator-A16 MHz, a USB connection, an RST button, and an ICSP header. All these can support the microcontroller for further operation by connecting this board to the computer. The power supply of this board can be done with the help of an AC to DC adapter, a USB cable, otherwise a battery. The ATmega328 is one kind of single-chip microcontroller formed with Atmel within the megaAVR family. The architecture of this Arduino Uno is a customized Harvard architecture with 8 bit RISC processor core. Other boards of Arduino Uno include Arduino Pro Mini, Arduino Nano, Arduino Due, Arduino Mega, and Arduino Leonardo.

The features of Arduino Uno ATmega328 includes the following.

- The operating voltage is 5V
- The recommended input voltage will range from 7v to 12V
- The input voltage ranges from 6v to 20V
- Digital input/output pins are 14
- Analog i/p pins are 6
- DC Current for each input/output pin is 40 mA
- DC Current for 3.3V Pin is 50 mA
- Flash Memory is 32 KB
- SRAM is 2 KB

- EEPROM is 1 KB
- CLK Speed is 16 MHz

The Arduino Uno board can be built with power pins, analog pins, ATmegs328, ICSP header, Reset button, power LED, digital pins, test led 13, TX/RX pins, USB interface, an external power supply. The Arduino UNO board description is discussed below.

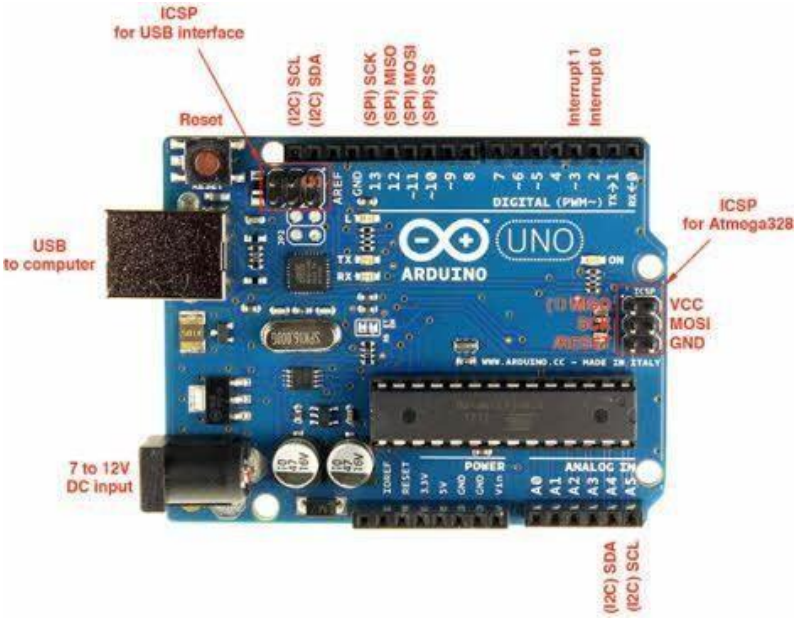

Fig 3.3. Arduino Uno Board Pin Configuration

The Arduino Uno power supply can be done with the help of a USB cable or an external power supply. The external power supplies mainly include AC to DC adapter otherwise a battery. The adapter can be connected to the Arduino Uno by plugging into the power jack of the Arduino board. Similarly, the battery leads can be connected to the Vin pin and the GND pin of the POWER connector. The suggested voltage range will be 7 volts to 12 volts.

The 14 digital pins on the Arduino Uno can be used as input & output with the help of the functions like pinMode(), digitalWrite(), & digitalRead().

Pin1 (TX) & Pin0 (RX) (Serial): This pin is used to transmit & receive TTL serial data, and these are connected to the ATmega8U2 USB to TTL Serial chip equivalent pins.

Pin 2 & Pin 3 (External Interrupts): External pins can be connected to activate an interrupt over a low value, change in value.

Pins 3, 5, 6, 9, 10, & 11 (PWM): This pin gives 8-bit PWM o/p by the function of analogWrite().

SPI Pins (Pin-10 (SS), Pin-11 (MOSI), Pin-12 (MISO), Pin-13 (SCK): These pins maintain SPI-communication, even though offered by the fundamental hardware, is not presently included within the Arduino language.

Pin-13(LED): The inbuilt LED can be connected to pin-13 (digital pin). As the HIGH-value pin, the light emitting diode is activated, whenever the pin is LOW.

Pin-4 (SDA) & Pin-5 (SCL) (I2C): It supports TWI-communication with the help of the Wire library.

AREF (Reference Voltage): The reference voltage is for the analog i/ps with analogReference().

Reset Pin: This pin is used for reset (RST) the microcontroller.

Memory

The memory of this Atmega328 Arduino microcontroller includes flash memory-32 KB for storing code, SRAM-2 KB EEPROM-1 KB.

The Arduino Uno ATmega328 offers UART TTL-serial communication, and it is accessible on digital pins like TX (1) and RX (0). The software of an Arduino has a serial monitor that permits easy data. There are two LEDs on the board like RX & TX which will blink whenever data is being broadcasted through the USB.

A SoftwareSerial library permits for serial communication on Arduino Uno digital pins and the ATmega328P supports TWI (I2C) as well as SPI-communication. The Arduino software contains a wired library for simplifying the utilization of the I2C bus.

Arduino Uno can detect the surroundings from the input. Here the input is a variety of sensors and these can affect its surroundings through controlling motors, lights, other actuators, etc. The ATmega328 microcontroller on the Arduino board can be programmed with the help of an Arduino programming language and the IDE (Integrated Development Environment). Arduino projects_can communicate by software while running on a PC. Once the Arduino IDE tool is installed in the PC, attach the Arduino board to the computer with the help of USB cable. Open the Arduino IDE & select the right board by choosing Tools–>Board..>Arduino Uno, and select the right Port by choosing Tools–>Port. This board can be programmed with the help of an Arduino programming language depends on Wiring.

3.1.4. Bluetooth module

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART). HC-05 is a Bluetooth module which is designed for wireless comunication. This module can be used in a master or slave configuration.

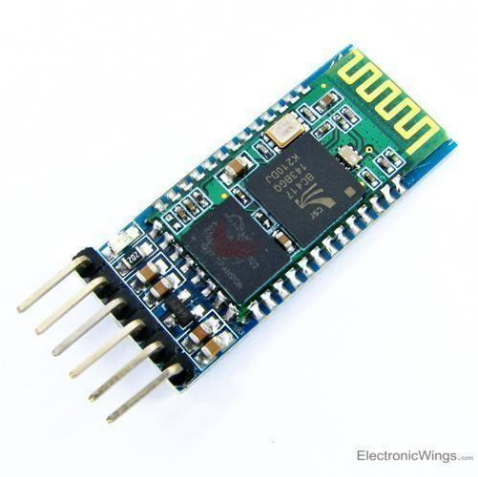

Fig 3.4. HC-05 Bluetooth Module

Fig 3.5. Pin Description

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

It has 6 pins,

1. **Key/EN:** It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode.

The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

1. **Data mode:** Exchange of data between devices.
2. **Command mode:** It uses AT commands which are used to change setting of HC-05.

To send these commands to module serial (USART) port is used.

2. **VCC:** Connect 5 V or 3.3 V to this Pin.
3. **GND:** Ground Pin of module.
4. **TXD:** Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)
5. **RXD:** Receive data serially (received data will be transmitted wirelessly by Bluetooth module).
6. **State:** It tells whether module is connected or not.

HC-05 module Information

- HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.
- This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator.

- As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

3.1.5. Android application

An Android app is a software application running on the Android platform. Because the Android platform is built for mobile devices, a typical Android app is designed for a smartphone or a tablet PC running on the Android OS. Although an Android app can be made available by developers through their websites, most Android apps are uploaded and published on the Android Market, an online store dedicated to these applications. The Android Market features both free and priced apps.

Android apps are written in the Java programming language and use Java core libraries. They are first compiled to Dalvik executables to run on the Dalvik virtual machine, which is a virtual machine specially designed for mobile devices.

Developers may download the Android software development kit (SDK) from the Android website. The SDK includes tools, sample code and relevant documents for creating Android apps.

Novice developers who simply want to play around with Android programming can make use of the App Inventor. Using this online application, a user can construct an Android app as if putting together pieces of a puzzle. The Andriod application made here in this project is used to get information of the person driving the automobile. His basic information such as his name, address, contact number, family members contact information, his blood group are fed during the login of the application.

In case of accident the application in the phone gets initiated with data acquired from the Bluetooth via accident detection module. Accident detection module involve sensors and microcontroller, which is connected to Bluetooth module to send data to phone.

Application in the phone detects the location of the phone and search for the nearest hospital and send the location of the accident area to the hospitals ambulance driver, since the driver and the hospital might be far away from the location of accident the application also sends

notification of emergency to the nearest Ola/Uber driver. This way immediate surveillance to the emergency situation in case of an accident is achieved.

3.2. Working of the System

The microcontroller, along with the entire system, is powered from an external supply. When the system is in its initial state, all the values are below the threshold and no corresponding action is taken. The system continuously monitors the values recorded by the tilt, vibration and the flame sensor.

When the microcontroller detects a change in the measured values, it detects the occurrence of an accident. Typically in this scenario, the vehicle either experiences a collision or gets tilted. This produces a response from the tilt and vibration sensor, and the latter sends an electric charge to the microcontroller, thereby alerting it.

The system does have a physical TERMINATE button, which can be pressed by the driver in case of a false positive. In this case, the entire alert process is terminated at once. That is, if the driver is physically unharmed, then he may choose to simply press the TERMINATE button and no alerts will be sent.

In the case that the process isn't terminated, the microcontroller retrieves the accurate latitude and longitude data from the mobile GPS through Bluetooth module after it is parsed. The microcontroller activates the Bluetooth module. Using GPRS, it establishes connection with the database and retrieves the emergency contact information which it sends a text message to. Simultaneously, the GPRS also transmits the location data to the database. The database reflects this information in the Application UI.

Information regarding both the accident location as well as the victim gets sent to the hospitalside interface. This can be used to dispatch an ambulance to the site as soon as possible, and keep a track of the victim's medical record.

If the victim has previous history of visiting a particular hospital, then that hospital is given priority for treating the patient. In the meantime, the emergency contacts are constantly updated about the status of treatment for the patient, such as which EMT has been dispatched and which hospital he is being taken to.

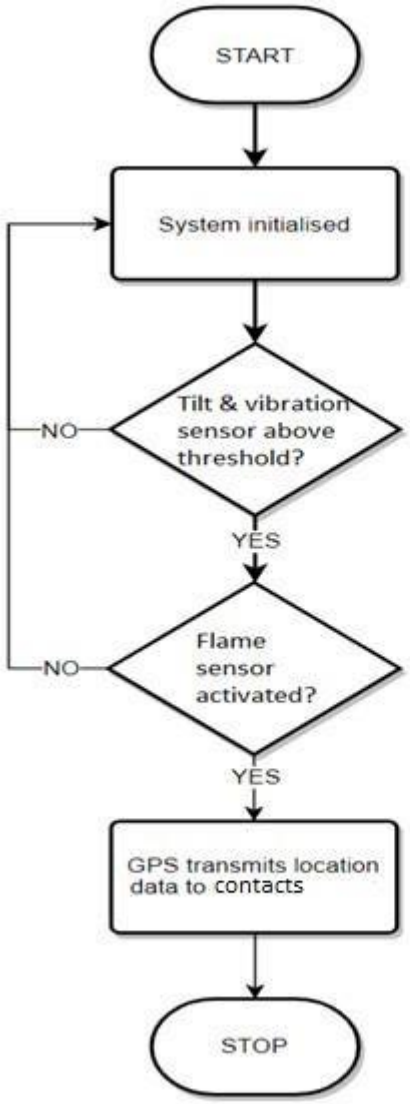

Fig 3.6.Process flow diagram for detecting accident

3.3. Detection Phase Specification

The most important factor that is used, by car accident detection systems, to detect car accident is the G-Force value, of above 4G, experienced by smartphone accelerometer sensor. The data used in these studies mean a unique opportunity to analyze how acceleration influences the risk of injury. The results are shown that most occupants suffer from neurological signs, had a mean acceleration above 4G. Actually G-Force value is not enough evidence, to detect car accident, which would lead to false positive sign. The proposed detection phase, running inside the

smartphone, continuously sampling and reading the accelerometer sensor to detect the collision. In the case of an accident, the smartphone experiences the same acceleration force experienced by the occupants of the vehicle, because smartphones are frequently carried in a pocket attached to the occupants. In fact, there are several issues that have to be considered during the accident detection phase. These issues are listed and analyzed as follows:

- To filter out acceleration values caused sudden stop, whose acceleration values could be interpreted as car accident, the empirical results mentioned is showed, it experiences approximately 2G's on the y-axis and z-axis with nearly 3G's on the x-axis before it is reset. Also in case of sudden stop (emergency braking) that does not result in a crash, the acceleration experienced is less than that experienced during the fall, it experiences approximately less than 1G's in each direction. Therefore, 4G is chosen as acceleration threshold value to suppress any false positives occurs inside the vehicle.
- The most important system done in this field is activated when the vehicle is at high speed of above 24 km/h and the acceleration experiences greater than 4G. This system didn't take into account accident detection when the vehicle is travelling at a low speed, below 24 km/h, which is also subject to an accident. Thus, one of the main contributions of this project is the detection of car accident at a low speed, below 24 km/h, and the acceleration experiences greater than 4G.
- Also it is worthwhile to take into account some cases that cause false positives while the user is outside the car and other false positives whose acceleration values are unknown. So to address these issues and to minimize the false positives presented from these cases, other parameters are investigated and adopted to determine the accident emergency.

Chapter -4

Merits and Demerits

4.1. Merits

1. Save time and increase notification efficiency

Having a system that can send notifications automatically to large lists of contacts can help reduce time spent collecting contact information and manually sending alert notifications to each person that needs to be notified. Automating alert sending can save emergency operations staff valuable time that they can spend performing other important tasks.

2. Prepare notification templates in advance

During emergencies, preparation is key. The more you are able to prepare in advance, the smoother the emergency resolution process will go. A web-based emergency notification system allows for the creation of generic emergency notification templates in advance and stores them in the system to be used and updated whenever they are needed.

3. Multi-channel communication increases timeliness of notification receipt

Imagine sending an emergency notification via email to a recipient who rarely checks their email and therefore remains oblivious to a threat. A potentially dangerous situation, right? A system that is able to take advantage of all the popular communication methods (such as email, SMS, voice, fax, and social media) and send an emergency notification to all these methods with a single blast to ensure all contacts are made aware of the situation as soon as possible.

4. Send to contacts' preferred method of communication

The other side of the coin is that some contacts don't wish to receive a notification blast to all their various communication channels at once. An emergency notification platform can allow users to send only to contacts' preferred communication methods, meaning that they are not inundated with messages, especially if they regularly check at least one channel. If no preferred method has been indicated by a contact, mass notification systems provide a fallback through

each available channel until it finds a method through which to send the emergency notification.

5. Target specific contacts in geographic regions

There is an accident and Ola/Uber driver, ambulance driver and the hospital needs to know the accident area. Through the application we can retrieve the coordinates of the accident area and can save life by accessing treatment as soon as possible.

6. Have contacts confirm receipt of the notification

The emergency notification has been sent, but how can you know that every contact has received the message? By enabling a confirm receipt function, recipients of the notification will be required to indicate that they have opened and read the alert. With this feature, you are able to tell which contacts may need to be sent the message again or that another contact method may be necessary to reach them.

7. Share results with other organizations

Another benefit of an emergency notification system is the ability to share receipt confirmations and other results from the blast with other stakeholders by sharing them to a common operating picture. Since the system is web-based, it's easier to provide access to other users in other locations who may benefit from the information. Ensure only those with proper clearance can view the information by instituting proper permission controls.

8. View detailed reports after the emergency

Once the emergency has been dealt with and everyone is safe and sound, the results of the emergency notifications that were sent are automatically gathered into online reports that can be viewed and archived. These reports can contain as little or as much information as desired, from the names of all contacts that were sent the alert to which communication method they used to confirm the notification.

9. Optimize notifications for future emergencies

With all the data collected from past incidents, notifications can continue to be optimized to be even more efficient for the next emergency that comes along. Perhaps it was noted that SMS was the communication method used the most often by contacts to confirm they received of the

notification. This may cause officials to change their fallback order so that the system looks for an SMS number before searching for an email address. By having this data on hand from previous emergencies, the process can more easily be updated and refined than if there were no such data collected or if the notification process was completed manually.

10. Day-to-day use increases familiarity with the process

Practice makes perfect. The more a process is utilized, the smoother things will go when it is needed next. One of the largest benefits of using an emergency notification system is that it doesn't only have to be used during emergencies. There are multiple ways a notification system can be used for everyday situations and tasks, such as notifying the public of road closures and detours. Through daily use of the system, officials will become more comfortable with it and will therefore become more confident in its usage during an actual urgent scenario, thus increasing efficiency and reducing uncertainty.

The primary goal during an emergency is to ensure the safety and security of all citizens and with an emergency notification system this goal is more achievable than ever. A proper system allows for fast and comprehensive alerting as soon as an emergency scenario has been identified and will include detailed reporting capabilities for officials to keep track of which citizens have and have not received the notification. A fully robust system contains multi-channel alerting, with the ability for contacts to confirm they have received the message, as well as multiple contact selection methods to be sure that only those who need to be contacted will be.

4.2. Demerits

- Three of the main concerns that accompany the Internet of Things are the breach of privacy, over-reliance on technology, and the loss of jobs. When anything is put on the internet it will always be there. Of course there are security measures that are taken to protect information, but there is always the possibility of hackers breaking into the system and stealing the data. For example, Anonymous is a group of individuals that hacked into federal sites and released confidential information to the public. Meanwhile the government is supposed to have the highest level of security, yet their system was

easily breached. Therefore, if all of our information is stored on the internet, people could hack into it, finding out everything about individuals lives. Also, companies could misuse the information that they are given access to. This is a common mishap that occurs within companies all the time.

- Another argument against IoT is the over-reliance on technology. As time has progressed, our current generation has grown up with the readily availability of the internet and technology in general. However, relying on technology on a day to day basis, making decisions by the information that it gives up could lead to devastation. No system is robust and fault-free. We see glitches that occur constantly in technology, specifically involving the internet. Depending on the amount that an individual relies on the information supplied could be detrimental if the system collapses. The more we entrust and the more dependent we are on the Internet could lead to a potentially catastrophic event if it crashes.
- Finally the connecting of more and more devices to the Internet will result in the loss of jobs. The automation of IoT "will have a devastating impact on the employment prospects of less-educated workers" (Schumpeter, 2010). For example, people who evaluate inventory will lose their jobs because devices can not only communicate between each other, but transmit that information to the owner. We already are witnessing jobs being lost to automated machines, such as the checkout line in supermarkets and even ATM's. These disadvantages can be largely devastating to society as a whole, as well as individuals and consumers.
- The main disadvantage of emergency surveillance is lack of network. Off course network cannot be widespread to all the region. If there is an accident in no network region it is difficult to send data to the surveillance for emergency operation. Though this problem can be solved by vehicular add hoc network, implementation is a major drawback. VANETs has been created to facilitate communication between vehicles themselves and between vehicles and infrastructure. VANETs may soon allow vehicles to easily communicate among themselves and also with fixed infrastructure. This will not only improve road safety, but also raise new commercial opportunities such as infotainment for passengers. Car accident prevention, safer roads, pollution and congestion reduction are some of the goals of VANETs.

- Due to safety matter and the significant damage concerned, crash testing of the car accident detection and notification system (CADANS**)** in real environments (real car accident) is not realistic and practical.

4.3. Applications

We are living in the world where perilous situations can happen to anybody, requiring emergency rescue assistance and relief operations. It might be on our way home from work and suddenly confront an unpredictable disaster or accident that you never imagined before. In a time like this, communication technologies and social media tools emerge as a viable solution to respond to emergencies, connect with rescue specialists and maintain personal safety.

Wireless communication technology has become an integral part of several types of communication devices as it allows users to communicate even from unreachable remote areas. Wireless communication involves the transmission of information over a distance without help of physical conductors. The transmitted distance can be anywhere around the world. It may be between a few meter and thousands of kilo meters. With the help of physical connection or wires, it is impossible for long-range communications. Long-range communications is possible with wireless communication. Telecommunication systems uses some form of energy to transfer information without the use of wires. Information can be transferred in this manner over both short and long distances.

Internet of Things is reshaping almost all industry sectors. Applications like Smart Home, Smart Manufacturing, Smart Healthcare, Smart City, Smart Farming, Connected Cars and Wearable's amongst many others are transforming the Businesses and enhancing the Customer experience. This paper identifies the innovative applications of IoT in Automotive industry in the areas of Connected Car services/applications, Vehicle Communications, IoT in Intelligent

Transportation; IoT based Supply Chain Management in Automotive Industry and New Generation Cars.

Chapter -5

Result and Discussion

5.1. Result

Due to safety matter and the significant damage concerned, crash testing of the car accident detection and notification system (CADANS**)** in real environments (real car accident) is not realistic and practical. Also the lack of the availability of laboratories that can be used to simulate the crash environment is making the crash testing difficult to achieve. However, constructing some cases that simulate the scenarios of the proposed detection phase mechanism and testing the CADANS against these cases would yield a high confidence that supports the reliability and certainty of CADANS. These tests are performed on the CADANS in real environment; by having the driver drives the vehicle in different speeds, so the speed of the vehicle is not steady all the time. Also the other factors, like G-Force and sound decibel are imitated inside the car while the car is moving at different speeds. The idea is to create an environment that mimics the real environment as these mimic environments are required to test the CADANS under different speed conditions (low speed and high speed). Before going to demonstrate the tests on CADANS, the following important issues that must be taken into account are listed below:

- As mentioned and analyzed in detection phase specification, to be interpreted as indication of an accident. So to achieve this issue, during these tests, accident vehicle to obtain acceleration event greater than 4G. Actually this case has repeated many times but the acceleration value experienced by the smartphone is approximately reached to 3.5G. Since it is difficult to obtain forcible acceleration value greater than 4G from the simulated test, a threshold value of 3G is used to test the CADANS for the value of the G-force experiences by the accelerometer sensor to indicate a sign of an accident.
- Since it is difficult to test the CADANS in real accident to achieve a high decibel level of sound event (greater than 140db) without existence of airbag deployment, the radio inside the vehicle is played with high volume and all windows of the vehicle are closed. Due to the vibration of the sound system sensing circuit detects vibration and false detection of accident is observed.

5.2. Conclusion and Future Work

- It has been realized that the smartphone based car accident detection system is not an easy task to handle. It is really surrounded with many obstacles that prevent the researchers from achieving 100% accurate detection system. The proposed system minimizes the impact of this obstacle which is proved in the practical results conducted in this work.
- Every smartphone based accident detection and notification system is exposed to false positives. In the proposed system, helpful supporting features were added to the system to increase the accuracy of detection process and reduce the probability of false positives, which are briefly listed below:

  a. CADANS presents a confirmation screen which gives the user the opportunity to confirm the accident, thus in case of false positive occurs the user can cancel the alarm and notification is aborted.

  b. CADANS allows for uninjured peoples or bystanders to take images/videos and send them to emergency responders, for reporting the accident.

  c. CADANS utilizes smartphone camera to record a video, showing what is happening at the instance of an accident immediately after the detection process indicates that there is an accident. This video is sent to the emergency responders for further inspection and analysis.
- To notify the family or friends quickly about the accident, the proposed system sends SMS message which contains accident location coordinates to predefined emergency contacts.

As a future work, a further analysis can be tried to improve the accuracy of detection phase and reduces the probability of false positive signs that are generated from being the user is inside or outside the car when the vehicle is travelling at a low speed. Therefore, it is suggested that the researchers investigate in the field of “Activity Recognition” based on smartphone sensors, which is used to detect the current activity of the user whether he is driving, walking, running. Also, a voice recognition module can be constructed and added to the proposed system to differentiate between airbag deployment and benign noise.

Achieving this enhancement would increase the proposed system reliability and decrease false positive signs.

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