IMMEDIATE RESPONSE SYSTEM IN CASE OF ROAD ACCIDENTS

Project report submitted in fulfillment of the requirement for the degree of Bachelor of Technology

In

Information Technology

By

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Under the supervision of

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To

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CERTIFICATE

Candidate's Declaration

This is to certify that the work which is being presented in the report entitled **"Immediate Response System in case of Road accidents"** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted in the department of Computer Science & Engineering and Information Technology**,** Jaypee University of Information Technology Waknaghat is an authentic record of our own work carried out over a period from August 2016 to May 2017 under the supervision of **Dr. Pradeep Kumar Singh** (Assistant Professor, Computer Science & Engineering Department).

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Vibhu Kapoor, 131405 **Kopal Tripathi, 131409**

This is to certify that the above statement made by the candidates is true to the best of my knowledge.

Dr. Pradeep Kumar Singh

Assistant Professor (Senior Grade)

Computer Science & Engineering Department

Dated:

ACKNOWLEDGEMENT

We owe our profound gratitude to our project supervisor **Dr. Pradeep Kumar Singh**, who took keen interest and guided us all along in my project work titled **—Immediate Response System in case of Road accidents**, till the completion of our project by providing all the necessary information for developing the project. The project development helped us in research and we got to know a lot of new things in our domain. We are really thankful to him.

Table of Contents

List of Figures

List of Tables

Abstract

Every day, a large number of people die from accident injuries. An effective approach to reduce this is to reduce the time between an accident and alert notification to the desired person. Recent approaches use built-in vehicle accident detection and notification system. These approaches work well but they are not easily available in all the cars.

Whereas, to detect traffic accidents using smartphones is possible now because of the advances in connectivity and sensors deployed on the smartphones.

The aim is to reduce the response time using Internet of Things . The proposed system includes two phases the detection phase which detects car accident in all speeds.

The notification phase, immediately after an accident is detected, is used to send detailed information such as accident location to the emergency responder for fast recovery.

This report includes two objectives of using smartphone-based accident detection systems. First, it provides solutions to key issues such as preventing false positives by polling onboard sensors to detect large accelerations. Second, it presents the system design of the prototype smartphone-based accident notification system.

Keywords- Internet of Things, Reponse Time, Sensor

1.INTRODUCTION

In this section Introduction of the topic, Problem statement, Methodology used , objective of the project , organization of the project are discussed.

1.1 Introduction

In India there has been a 2.5 percent increase in the number of accidents on the roads from 2014 to 2015. And the number of causalities increased by 4.6 percent in the same duration of time. India bears a loss of 17 lives every hour in the form of road accidents.

Accidents mainly happen due to driver's fault which include intake of alcohol or drugs, poor condition of roads or rash driving.

Human life is very valuable, timely help is the most important thing a person can ask for. During accidents, people lose their lives due to the late availability of proper medical facilities provided at the right time. The system which is developed detects the accident in the vehicle/car and notifies pre-programmed numbers.

Safety has become a major factor that is to be taken care of as the numbers of accidents have increased rapidly, many lives are lost due to lack of proper post-accident system and mapping the accident location. In case of any accident, the system sends text message to the pre defined number.

We can send messages to any number of mobiles. The relatives of the people who met with accident, the police and the hospital can be informed by this method. The hospital can send an ambulance at the desired location for fast response. This uses a GPS (Global Positioning System) which is inbuilt in the smartphone to know the correct position of the vehicle.

Immediate Response System in case of Road Accident is an Internet of Things based system which will enable reduction in time to provide the medical facility. This project targets the long distance road journey on the national highways, where there is not much provision for medical help immediately after an accident. This problem could be solved using IOT (the worrisome issue of causalities in case of road accidents).

We have explained precisely all the processes involved starting from getting the data, to sending alerts in case of emergencies. Basically the data collected from the sensors is sent to web server where it is send further to the desired people (via web).

Today the role of IOT in everyday life is increasing each day. There have been a tremendous increase in the positive effect IOT has brought into people's life.

The number of causalities in case of road accidents has been increasing and is critical. A major reason for this can be attributed to the late message to the doctors and the people concerned.

Today the role of Internet of Things in everyday life is increasing each day. There have been a tremendous increase in the positive effect IOT has brought into people's life.

The number of causalities in case of road accidents has been increasing and is critical. A major reason for this can be attributed to the late message to the doctors and the people concerned.

The proposed system helps to reduce the response time and in a way reduce the number of causalities.

The system takes the data from the sensor and send the message using bluetooth to the smartphone which further sends the sms (including the accident location) to the recovery number.

Immediate Response System in case of Road Accident is an Internet of Things based system which enables reduction in time to provide the medical facility [1].

This project targets the long distance road journey on the national highways, where there is not much provision for medical help immediately after an accident[2].

This problem is solved using IOT . The details and all the processes involved starting from getting the data, to sending alerts in case of emergencies are explained precisely.

1.2 Problem statement

The percentage of causalities in case of road accidents could be reduced to 40% if medical help was provided on time. Most of the causalities happen because there is no one to inform the medical staff about the causality at a particular place.

Following are the reasons why response time is more:

-The person in the vehicle is not in condition to call the hospital

-The accident has taken place in an isolated location

-The vehicles crossing by are least bothered to call for medical help

-The ambulance arrives late because they have been informed late

-The medical staff has no idea about the severity of the accident

If the latest technology in trend can be used to overcome this problem then it will be of great benefit to the society. Loss of life is a major concern and what is the use of technology if it can't be applied in this aspect of life.

1.3 Objectives

The objective of the project is to minimize the causalities in case of road accidents by reducing the response time of the medical help. The family or the doctor will be informed as soon as the accident is detected.

1.4 Methodology

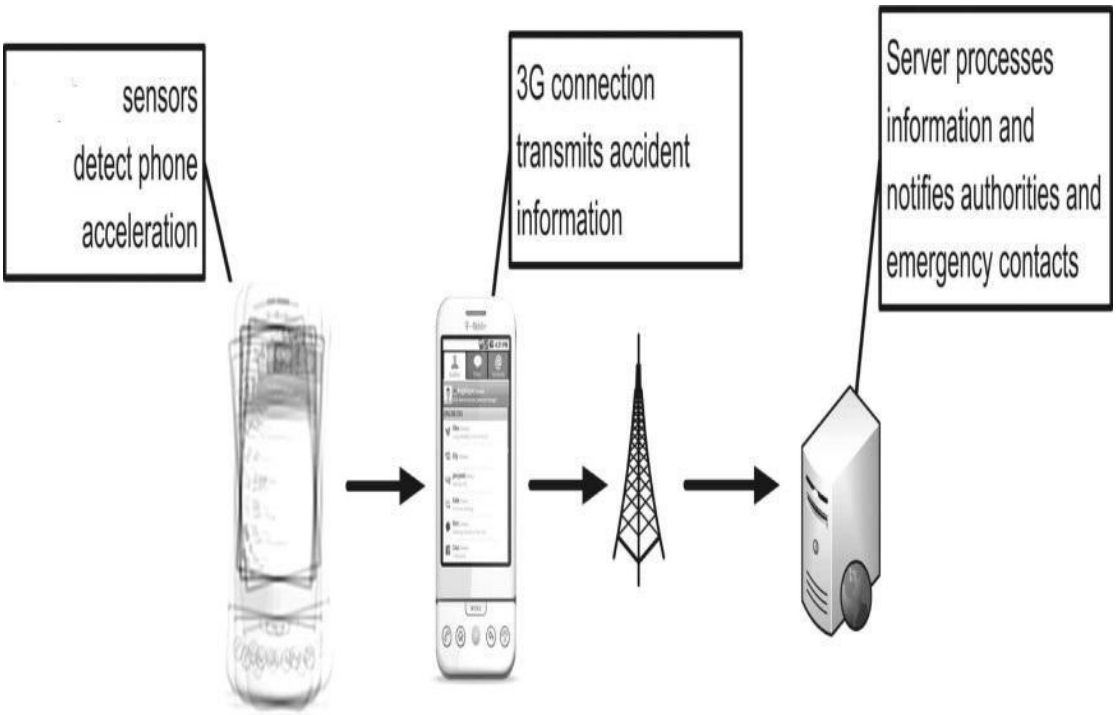


FIG 1. Layout of the System[1]

The sensors deployed on the aurdino board i.e. the accelerometer detects the acceleration and sends the information to the smartphone present in the car/vehicle using the Bluetooth module deployed on the car.

The smartphone gets the location by using Google Maps (location and internet connection must be available at that time) and sends it to the pre defined mobile number as a simple text message.

1.5 Organization

The methodology of the proposed system is divided in the following two phases:

The first phase is the hardware phase in which the circuit designing, and mathematical calculations are done to detect the collision.

The second phase is developing the android application and sending the text message to the desired phone number including the location of the accident.

1.5.1. First Phase

For the circuit part, accelerometer and Bluetooth on the aurdino are used.

The aurdino processes the input from the accelerometer and detects if there is a collision based on the three axis(ax, ay, az)[9].

Accelerometer provides thousands of data at a single moment and not all data is a signal for collision. To check the maximum value the accelerometer hits, three variables in different dimensions are used. Also, to get the time duration in which these parameters hit the maximum value, time variables are needed too[10].

If there is a collision, aurdino sends the data to the mobile phone through the Bluetooth.

Audino has two methods setup method which is the initialization method and the second is the loop method which includes the part which needs to be done again and again[11].

The Setup method does the following:

- The speed at which the code is supposed to run
- accelerometer is initialized
- start the wire port (connected to accelerometer)

- starts the serial port(connected to bluetooth)

The Loop method does the following:

- reads the values of accelerometer
- finds the maximum value

1.5.2. Second Phase

The second phase involves the development of the android application, which acts as a user interface to feed the following data

- Phone number of the receiver
- Alert text message
- Name of the sender(The person who meets with accident/the smartphone of the person using the application)

The android application also acts as an interface to allow Bluetooth pairing. When the data is received using Bluetooth and collision is detected the android application uses Google maps to get the location of the accident and append it to the text message and send it to the desired number.

The main logic behind detecting collision is that whenever the acceleration of the moving vehicles becomes negative i.e. it changes its direction in a very small amount of time(2 seconds), then there is said to be a collision.

This is based on the laws of Physics, which says that according to Newton's Third Law of Motion, for every action there is a equal and opposite reaction.

And hence, when the moving vehicle hits any other object it is will definitely receive a reaction in opposite direction in a very small amount of time.

2. LITERATURE SURVEY

2.1. Introduction

In this section 5 different research papers which are similar to the proposed project are discussed.

2.2. Related Work

In [10], M. Grimm et *al.* have discussed that according to the estimation of WHO, The World Health Organization, annually road accidents cause more than 1.2 million deaths and more than 25 million serious injuries all across the world. In 2020, in the ranking of the global burden of disease, road accident tragedies are expected to become third in rank. Most of these cases occur in low and middle income nations, putting road traffic fatalities at par with as severe as malaria deaths. Having a control/reduction in the number of road injuries and causalities could provide large gains to middle class households.India is important as it holds the tag of being one of the highest per person traffic fatality in the world. In 2010, more than 133,000 people lost their lives on the Indian roads. According to the records, about 85% of all casualties are of men, aged between 30 to 59 and 15% women. Unlike China, causalities are ever increasing. The social costs is calculated to be at 3.2% of GDP, a loss that includes both the economic and the social development.Increase in motorization levels along with expansion are the major reasons of road accident causalities across the states of India. This is also attributed to the increased number of vulnerable people on the roads, i.e. pedestrians and two-wheelers. A few of the states can expect that they will be reaching the target point soon after which rate of causalities will decline. To speed up this process, our analysis suggests the following areas where policy intervention can be extremely effective. First, the study suggests that more emphasis on enforcement of traffic rules can reduce road accident causalities' rates. In our example, if mean expenditure of every policeman is increased by 10%, the fatality rate is going to be reduced by 2%. Second, urbanization will strongly increases the pedestrian fatalities by 15 percent. These can be best prevented by making a distinction between pedestrians and vehicle users, for instance by constructing sidewalks, traffic lights, well indicated road signs and bus stops. Third, a gender discrimination towards females in the mortality among the most vulnerable

road users is found to be. Hence, awareness campaigns must be launched and they must specially be focusing on women, for example to promote the use of helmets on bikes and seat belts in the cars. Fourth, accidents tend to have a strange connection with the religion of the person. Although this cannot be controlled as it is the intensity of road use, this suggests that road user's behavior might also differ according to the religious groups and that awareness and behavioral change campaigns should be focusing more on those groups which are more involved in the accidents. These findings may also apply to some of the other countries, especially those that are also still in the situation where causalities per population are increasing, and not decreasing.

In [11] S. Pooja discusses that currently, as the economy is growing, the crime rate is increasing as well. Car theft, which is one of those big crimes which is difficult to remove. The recent types of car theft involved the car being towed away. There are many ways and solutions to avoid the car theft, common car alarm system which almost all cars have installed, and also by using the recent trend in technology which is the Global Positioning System (GPS) where the parts of the car can be located. The project and research is conducted for enhancing the features of car alarm system. And the best thin is that it can be added to the current car alarm system without any major changes in it. SMS/GPRS which is a vehicle security system is an advanced feature of the existing car security system. The model describes a unique approach for routing and tracking with mobile vehicles in an outdoor and large place based on the Global Positioning system (GPS), A device deployed on the vehicle is connected to the engine. When the car is lost, the data is being used by the car/vehicle owner for more future analysis. Sitting at any distant place, a particular phone number, which is there in the vehicle, is automatically dialed by owner to the hardware. By seeing the signals received by the cellphone, anyone can control the movement of the engine; for example to lock or stop the engine when needed. This can be modified so that the person also can lock the vehicle from his own mobile phone only.

In [12] Hamid M. Ali *et al* discusses that vehicle tracking ensures safety for all the vehicle and the alert system ensures rescuing the people so that causalities are reduced . This system helps to achieve the target of safety in roads. Recent technologies like the Global Positioning System, helps to track the movement f the vehicle and hence enhances the scope of the

project. Many good works have been created by the new Vehicle Tracking System. The hardware is secretly fitted and thus is not visible to the person outside or even inside the vehicle. It can continuously or not be used as a covert unit to the system, sends the location data to the monitoring unit. If the vehicle is lost, we can get the location from te tracking system and then inform the desired authorities about the same that the accident or any such case has happened. This for instance definitely gives the system a very strong edge over other pieces of technology for the same situation. The proposed alert system detects the collision and then the accident and then it finally sends the location of the accident in the form of a link which includes the Global Positioning System coordinates to the pre defined/ pre assigned mobile phone number or an email to the pre defined/ pre assigned email id. Fire can also be detected in the system as we have used a fire detector system model which works on the fact that if the temperature of inside the vehicle reaches beyond a threshold value then an alert message is launched and sent to the desired receiver. The sensor which is used here is an infrared sensor which specializes in detecting collisions and obstacles on the way which result in accidents. In case there is any detection of the same the desired person/committee will be notified. The system automatically sends a return reply to that particular mobile. A code is also made to detect the precise location of the accident location using the Global Positioning System. The following framework brings benefit as it is required to have a wide request and is versatile in nature. Better booking or course arranging can empower you handle bigger occupations stacks inside a specific time. Vehicle following both if there should arise an occurrence of individual and also business reason enhances wellbeing and security, correspondence medium, execution observing and expands efficiency. So in the coming year, it will assume a noteworthy part in our everyday living. Primary adage of the venture is to fuse distinctive sorts of sensors with the goal that they help in decline the odds of losing life in such mishap which we can't prevent from happening. At whatever point mischance is cautioned the paramedics are come to the specific area to build the odds of life. This gadget development is a great deal more valuable for the mishaps happened in forsook spots and midnights. This vehicle following and mishap ready element assumes significantly more critical part in everyday life in future.

In [13] M Rajeswari *et al* discuss that nowadays there has been an increase in the vehicle accident rate when we compare the date to previous decades and this has put to risk hundreds

of lives every year. Our valuable life is lost when we commit small mistakes while driving and approximately 65 out of 100 such collisions can be avoided if the vehicle operator was informed at least one half second prior to the collision which, in turn, can dramatically reduce the total number of road-way accidents. In order to alert the vehicle drivers and to control the vehicle's speed, we are proposing a system which employs "ZigBee" sensor that provides warnings and automatic braking when any collision occurs. If information pertaining to accidents could have been sent to the emergency services, they would be able to reach in time and hence, many lives would have been saved. Therefore, it is evident that collision detection is one of the important criterion in today's situation. When accelerometers sense vibrations above a specified threshold value, system will assume that collision has occurred and would make use of GSM, GPS, and GPRS to send information which would include photo, and location to predefined telephone numbers. Studies on collision avoidance and detection system have been carried out by many researchers. Different approaches has been proposed and after putting great effort, accurate and reliable algorithms have surfaced. Systems that are previously existing mainly reduce the vehicle speed using an electric power source, photoelectric sensor and microcontroller. Owing to this, even when the operator wants to drive the vehicle at high speeds, it will move with low speeds only. Here, the brake acts as a switch and only when the brake is applied several times, the system starts working and other than that there is no alterative push to the system. Such a system will be more complicated and if we consider the case of C.I. engines, it will be difficult to manufacture as well and also there is a chance of a disconnected battery from the system. Main objective of collision avoidance system is avoiding the early accidents due to the adverse weather conditions and hence, such systems provide greater security to users in bad weather conditions. IR sensors and ultrasonic sensors are used to measure the relative speed and distance of all the vehicles surrounding a particular vehicle. Adding to this, it also provides collision detection system using GPS, and GSM which again is a very useful information to save the person. It is to be noted that such a kind of collision avoidance system is useful only in bad weather conditions.

Detection of traffic incident studies are also concerned about the change of traffic conditions after an accident occurs. Traffic conditions changes before an accident is focused by traffic accident predictions that are real-time in nature. But it is greatly restricted by number of

monitoring sensor, and algorithms used to confirm the accident. Main drawback of this system is that someone has to witness the accident.

Drivers initiated incident system, that is, a collision detection system using a GPS receiver to sense the speed of vehicle, detecting the collision based on that speed, and sending the location and time of that collision from the GPS data processed by micro controller using GSM network is comparatively better than traffic incident system. But the algorithm employed by this system is quite complicated. “T = V - U / A where V = initial time, U = final time, and A = acceleration or deceleration” this equation is used to calculate the final speed after one second of applying brake and then it is compared with the table that contains maximum speed starting from the initial speed of, say, 160 kph. If the speed is less than the maximum possible speed then it is assumed that collision has occurred. A wireless interface is then used to notify the nearby emergency hospitals. More lightening has been observed in areas near RF cellular towers compared to other areas and some of the fruits grown near the RF tower area are also affected. Radio Frequency waves can be easily intruded by the hackers which will result into important data being leaked. The main objective of the collision avoidance system is to avoid collision in areas such as school zones, blind spots, and hilly stations by providing pertinent warnings and applying automatic brakes. During night times when the beam is not switched to low manually, the system can be employed in automatic beam switching. In the system proposed by us, we make use of “ZigBee” transceiver in the already mentioned areas. When the vehicle enters the zone, say a school zone, the “ZigBee” transmitter which is placed in the school zone will be transmitting signals continuously and those signals will be received by the “ZigBee” receiver which is aptly placed in the vehicle, and it is processed by the micro controller “SS7V51RD2” and via “L293 driver circuit” motors of the vehicle is controlled and hence, the speed is reduced.

As soon as the said vehicle leaves the school zone, it will regain its normal speed. In the areas where hilly stations mainly extends up to 5000 km, it is highly impossible for a person to remember all the routes and directions, and in such cases this type of systems are of greater use. “ZigBee” transmitters placed in hilly regions provide warnings and braking of the vehicle when it enters such a zone. Block diagrams of collision avoidance and detection system can be visualized. During the night times, as we initially mentioned, most of the

collision occurs because of the high intensity beam of the vehicle. Drivers passing by should insist on lowering the high intensity beams in order to make path visible otherwise it may lead to collision. In such cases if high intensity beam is not lowered manually, with the help of our system, it will be switched to low automatically. This system works on the theory that when the intensity of beam is greater than a specified value, it is to be switched to low.

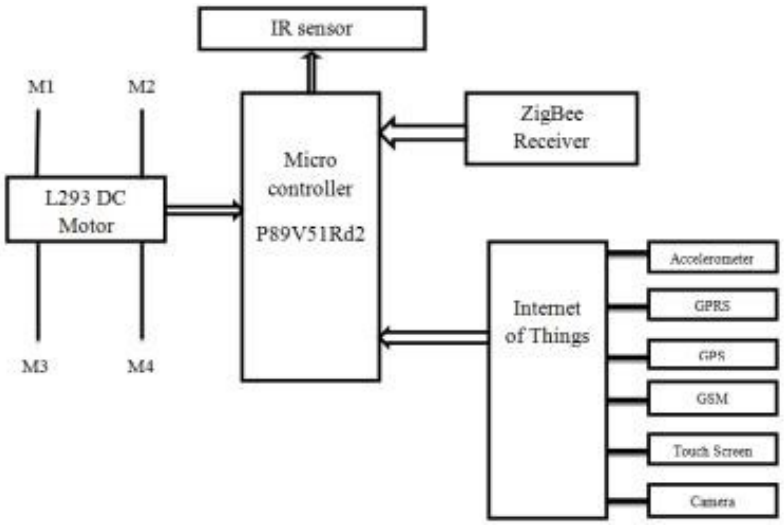


FIG 2. Systematic diagram of using IR sensor with IOT[2]

In [14] Md. M. Islam *et al* discusses that there is an advance system which can avoid accident by detecting the distance between humans and the vehicle. We can incorporate an automatic force known as the braking force that can be executed in this system. The system can also handle the steering by automatically location the other vehicle.An automatic horn can also be developed in case the driver of the vehicle forgets to press the horn.Most accident detection models use complex 3 axis accelerometer, gravity sensor, or costly android mobile phones with a very complex circuit. The developed system is not only cheap that is it is cost effective but it is also very simple to both, use and understand.This is owing to the fact that a tilt sensor is used to detect accidents whenever any major accident happens be it flipping over or jumping of the car. We are detecting the angle by which the vehicle gets rotated from ground. Tilt sensor is used to measure a rotation of minimum +15 degrees or -15 degrees.The very first step is to detect human. There are only three possibilities that can arise: Human is at left, middle, right of the car.According to PIR a notification will be sent to move the

steering to avoid contact with the human. If avoidance with the obstacle is impossible, then the tilt sensor will be reduced. When the aurdino board gets this signal, it initiates an alarm and then sends a tweet to the internet through wireless module. GPS module for location tracking was not included by us as there are already several Wi-Fi modules available in market to know the pin point location of a car. Relay disconnects the battery of the vehicle while accident occurs. Many a time, spark from batteries ignite fire and that causes severe damage. To avoid spark from the battery, relay is used which disconnects it from the positive terminal of the battery. Continuous buzzing indicates that accident has occurred and that an immediate help is needed. Tilt sensors measure any angle rotation around +15 degrees or -15 degrees which confirms the indication of the accident. Tweet is then sent to the owner.

Owner's tweet account is earlier saved in the Arduino and is also connecting to the IP of Wi-Fi module. There are also other alert systems which can be implemented such as mailing to GMAIL, or posting on Facebook.

3. SYSTEM DEVELOPMENT

The parts discussed in this project are the hardware requirements, software requirements , various components.

3.1 Hardware requirements

-Aurdino (Microcontroller)

The microcontroller is required so as to process the input and output from the sensors and give it to the Bluetooth module.

-Breadboard

The circuit of the collision detection and to send location using GPS are to be implemented on the breadboard (initially).

-Male to male wires (initially)

-Female to female wires (initially)

-Male to female wires (initially)

-Accelerometer sensor

-Bluetooth module

-Aurdino Case holder

The board is sensitive to water and many other materials. Hence there is a need to keep it in a case holder so as to avoid it from any damage.

-Car object

To demo the project a toy car object will be required, onto which sensors will be deployed.

-Mobile phone

To demo the project mobile phone is needed to show that messages are sent to the desired number

3.2 Software requirements

-Android Studio

-Libraries

-Fire base as a Cloud

3.3 Components

3.3.1 Accelerometer Sensor

Accelerometer sensor is used in measuring the acceleration, but here acceleration is not the one as the acceleration which is defined as the rate of change of velocity. Accelerometer measures the acceleration due to the forces of the earth(gravity), even when it is kept at rest(9.81 m/s^2).

Whereas the acceleration under a freely falling object measures acceleration as 0.

Accelerometer has a lot of uses in all aspects of life. There are some types of accelerometers which are highly sensitive types of accelerometers and are parts of inertial navigation systems for various types of aircraft and missiles.

Accelerometers are also used to measure the movement in the machines which is rotating. They are used in digital devices like tablets, computers and digital cameras to ensure tha screen images are properly fitted and are straight.

Drones also use accelerometers for stabilizing the flights. Differences in proper acceleration, mainly gravity, over their separation in space can also be measured by coordinated accelerometers.

There are both single- and multi-axis models of accelerometer which are present to measure the acceleration as a vector quantity, i.e both the magnitude and the direction of the proper acceleration.

It can also be used to sense the orientation. More handy electronic devices and video controllers are using micro machined accelerometers to measure the location of the device or provide inputs for the game.

FIG 3. Accelerometer Sensor [5]

3.3.1.1.Principle of accelerometer

Accelerometer is used when we need to calculate the acceleration when it is under a freely falling object or people. There is for sure a local inertial frame in space and the accelerometer is used to calculate the acceleration relative to that frame.

This acceleration is known as g or the acceleration due to gravity.

Accelerometer is also helpful in this project as it the sensor which is very helpful in the case when there is a collision but then it is a very light collision and cannot be treated as an accident.

In such case if any other sensor like HC SR04 collision sensor are used, then there will be a fake alert message to the desired people.

Using accelerometer, it is possible to detect if the car starts to move even after the collision. If the car does not move after collision then it is an accident but if it starts to move then it cannot be treated as an accident.

An accelerometer which is at rest relative to the surface of the Earth will indicate almost 1 g upwards, because at any position on the surface of the Earth there is an acceleration upwards.

The local inertial frame is relative to the freely falling object.

The offset of gravity must be subtracted and proper corrections must be made to obtain the acceleration due to motion with respect to the Earth.

3.3.2 Bluetooth Module

HC-05 sensor is a Serial Port Protocol module and is used to transmit data from aurdino board to the mobile phone using the pairing of Bluetooth device. It helps to transmit data using wireless connection.

It is uses Bluetooth V2.0+EDR (Enhanced Data Rate). It also has 3 Mbps Modulation and the whole 2.4GHz baseband and radio transceiver.

It works on a CSR Bluecore CMOS technology on External single chip which uses AFH(Adaptive Frequency Hopping Feature). It has 12.7mmx27mm dimensions.

FIG 4. Bluetooth module HC05 [6]

Hardware Features

- It has up to +4dBm RF transmit power
- It's sensitivity is -80dBm
- It operates in low Power 1.8V
- It operates in 1.8 to 3.6V
- It's I/O is with edge connector
- It has programmed Input and Output control
- UART interface baud rate which is programmable
- It is present with an integrated antenna

Software Features

- It has a default Baud rate of 38400
- It does not have any parity
- 1 is its stop bit size
- If there is a rising pulse in PIO 0 the device will be disconnected.

- It has 8 data bits
- Its data control has these baud rates supported- 460800, 9600, 115200, 19200, 38400, 57600, 230400
- PIO 10 and PIO 11 must be connected to the red and the blue led. When master and slave are paired, red and blue led blinks 1time per 2 seconds in interval and when it is disconnected only blue led blinks 2times per second.
- The automatic pairing PINCODE is ”0000” by default
- It can automatically connect to the last connected device on power by default.
- It can automatically reconnect in 30 minutes when disconnected
- Permit pairing device to connect as default

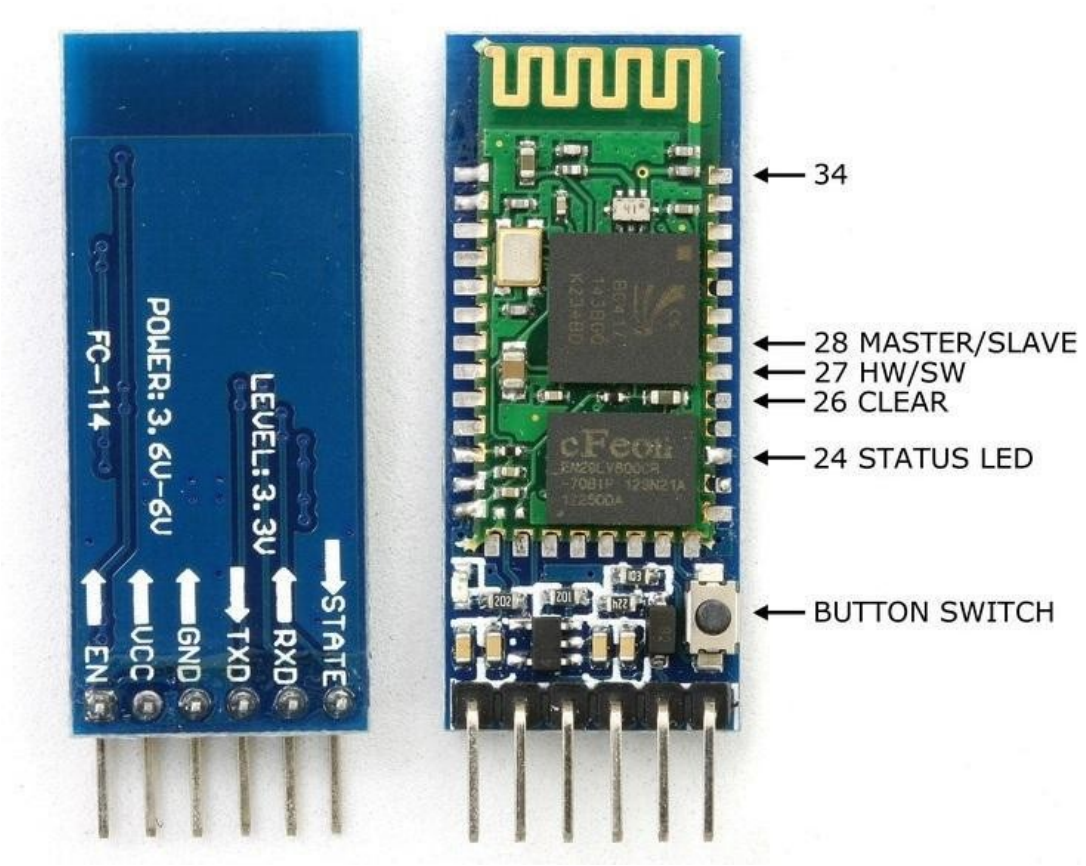


FIG 5. Parts of HC 05 [7]

More Features of Bluetooth module

- HC-05 is a module than can be set as either Master or Slave
- It is just a small 3cm long module which runs on 3.3V power with 3.3V signal levels
- Ithas no pinsandaregenerallysolderedtoalargerboard
- It has two modes of operation, one is the Command Mode in which we can send AT commands to it and the Second one is the Data Mode where it shares data with another bluetooth module.

The HC-05 Bluetooth Module has 6pins

These are the 6 pins:

1. ENABLE

When the enable point is at LOW, the module is in the disable phase which means that the module will not turn on and hence will not communicate. When enable is open or is given a 3.3V power supply, the module is enabled i.e the module is in the on state and the communication can also takes place.

2. VCC

Power supply Voltage can range from 3.3V to 5V

3. GND

Used to Ground the circuit i.e. 0V supply of power

4. TXD & RXD

These two pins are used to act as an universal asynchronous receiver/transmitter interface for communication with the board.

5. STATE

It is used to indicate the status of the Bluetooth device. When the module is not connected to any other device its signal becomes low. When this happens the LED light flashes constantly which is an indication of the fact that it is not paired with any other device.

On being paired with any device the signal goes high and at this state the LED light blinks with constant delay indicating that the module is connected.

6. BUTTON SWITCH

This is used to turn the module into AT mode. To enable AT command mode, we have to press the button switch for about a second.

Bluetooth Slave

By default every Bluetooth module acts as a slave and hence t is not mandatory to configure it as slave. But in case of master, we have to change it to slave.

Following commands are used:

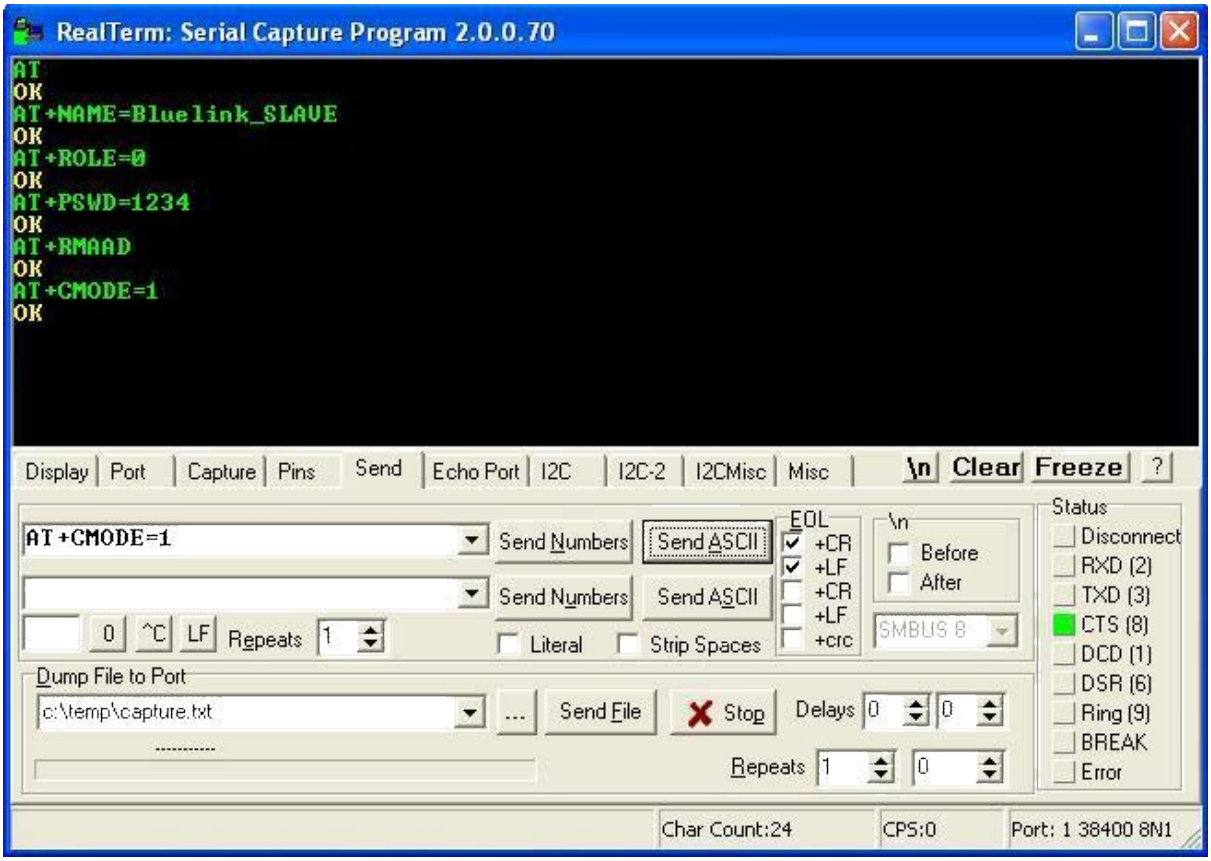


FIG 6. Bluetooth as Slave[8]

Bluetooth Master

Following commands are used

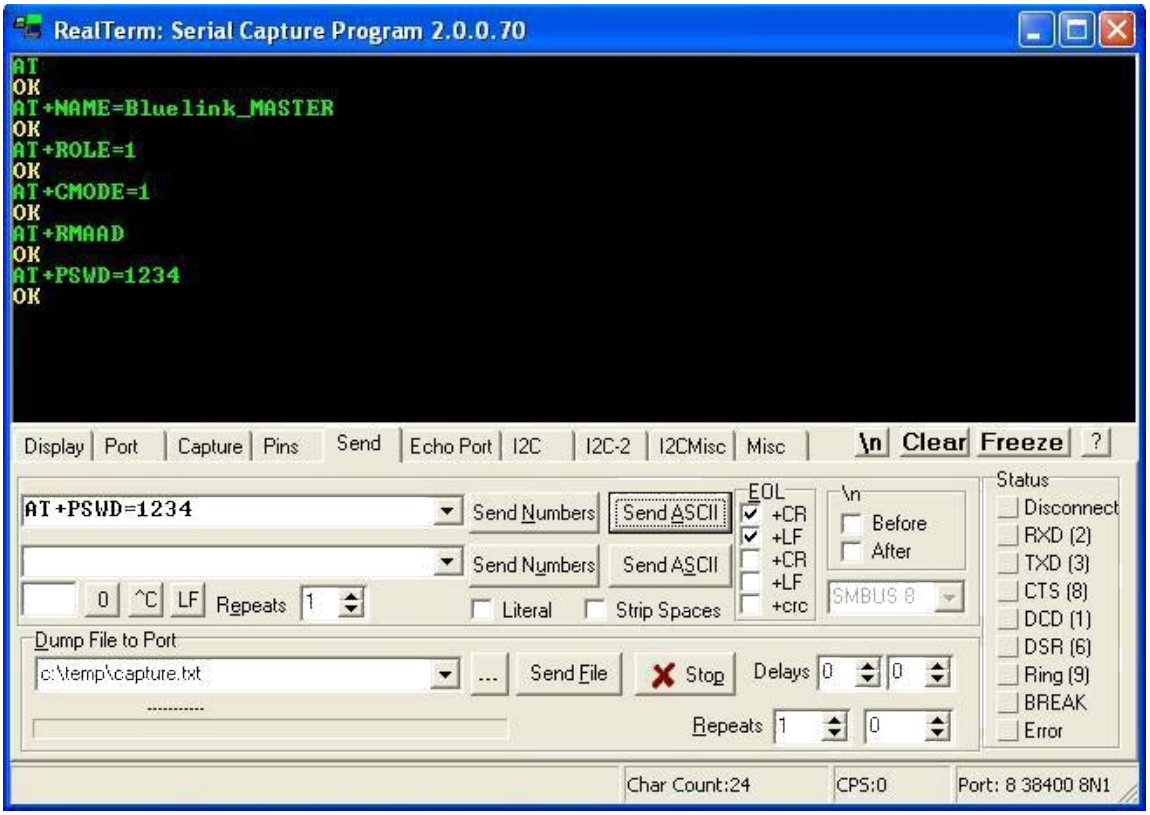


FIG 7. Bluetooth as Master[8]

Pairing master and slave

Inquiry is the first phase which helps to build a connection. In this phase the master sends a request in the form of an inquiry to all the devices found within the access point range. Relevant devices reply with their address.

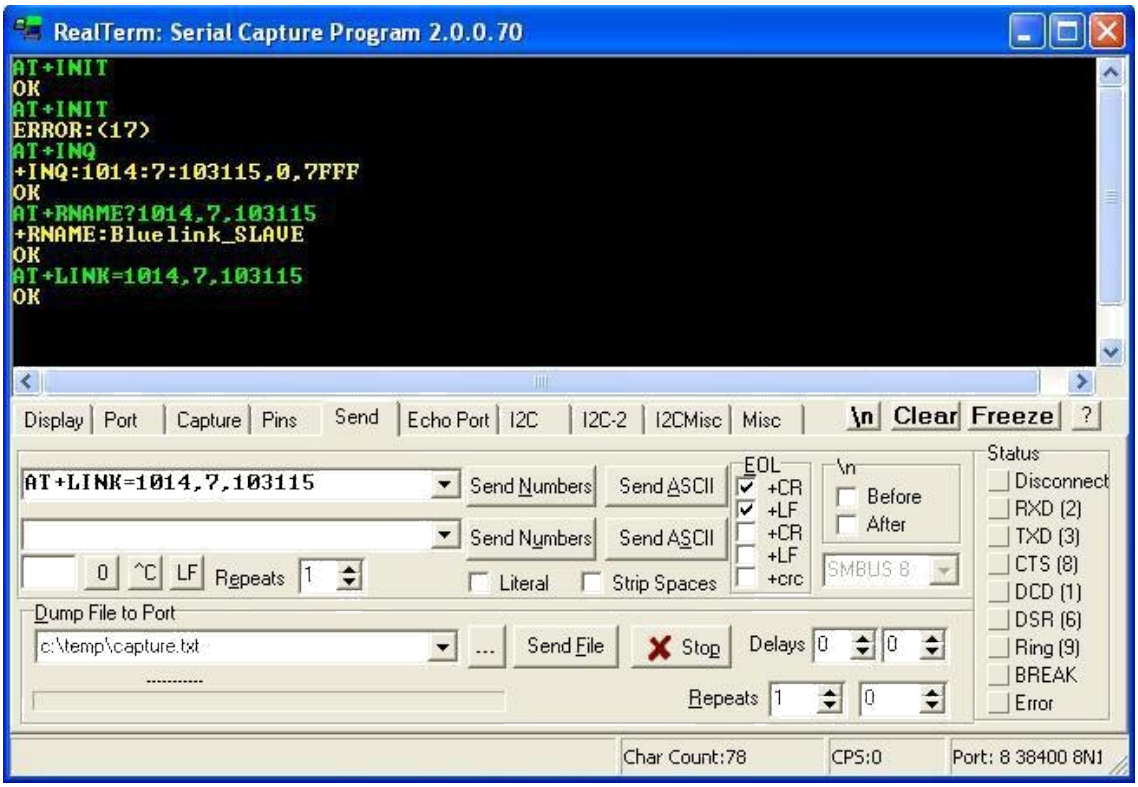


FIG 8. Pairing of Bluetooth as Master and Slave[8]

3.3.3 Aurdino

The microcontroller, Arduino Uno board is based on the ATmega328. It has 14 digital input/output pins

- 6 for PWM outputs
- 6 for analog inputs
- 1 16 MHz crystal oscillator
- 1 for USB connection
- 1 for a power jack
- 1 for ICSP header
- 1 for a reset button.

The Uno contrasts from the previous microcontrollers in the way that it doesn't utilize the FTDI USB-to-serial driver chip. Rather, it utilizes the Atmega8U2 customized by methods for a USB-to-serial converter.

It utilizes a USB link or power it by utilizing an AC-to-DC connector to bolster the microcontroller.

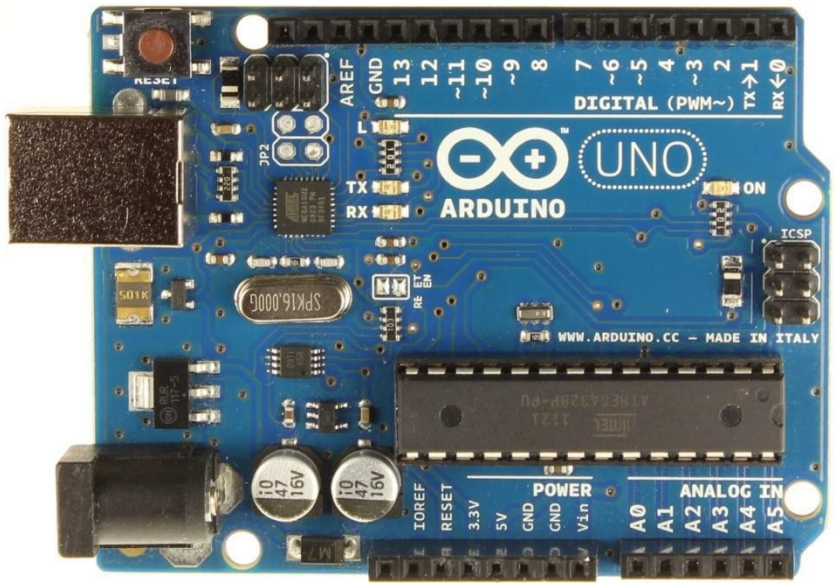


FIG 9. Aurdino Board

The following figure is the pin out diagram of the Aurdino UNO R3

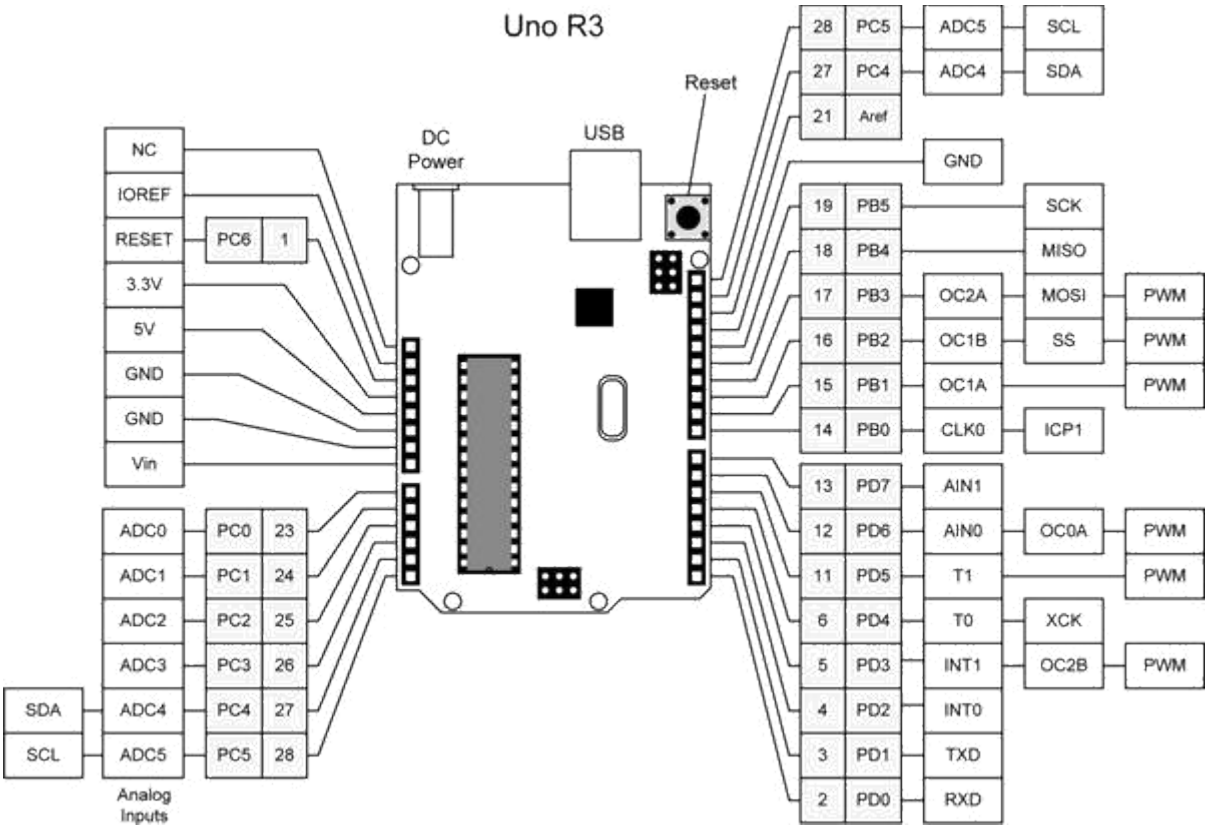


FIG 10. Pin out Diagram of Aurdino[9]

3.3.4 Connecting Aurdino with HC05 Bluetooth module

Despite the fact that Bluetooth Low Energy Modules are accessible at a sensible cost, the vast majority of these modules are not perfect with existing gadgets that bolster the exemplary Bluetooth.

The HC-05 is a costly module that is good with extensive variety of gadgets including cell phone, portable PCs and tablets.

Adding a Bluetooth to Arduino can take your venture to the following level. It opens up bunches of potential outcomes for (UI) and correspondence.

The telephone/tablet and so forth can go about as a UI component or information lumberjack and mediator for your next venture.

So how about we begin , in the initial segment we will basically take a gander at how simple it utilize the module with Arduino and exchange information to a Smart Phone.

Later we will take a gander at different setups the HC-05 module like the gadget name, pass-code, methods of operations and the majority of that with the assistance of AT summons.

Later we will likewise take a gander at matching to Bluetooth modules, designing one as Master and different as Slave.

You require not design the module, in the event that you straightforward need to utilize it.

Transferring simple data

We will begin with an extremely straightforward case of building up a serial association between the HC-05 and the Smart Phone and send and get message.

We can take the case forward to control gadgets or log any information that we wish.

Hookup

We will utilize pin number 10 and 11 of the Arduino to associate the HC-05 and utilize the Software Serial library to link with the module.

The Hardware serial port on arduino is utilized to send/get messages from the PC to the Arduino.

The voltage divider on the Rx line of the module is prescribed to guarantee that module does not get motions over 3.3v.

In a genuine application you might need to utilize the HW serial port itself to associate the Bluetooth module, in the event that you require equipment interferes.

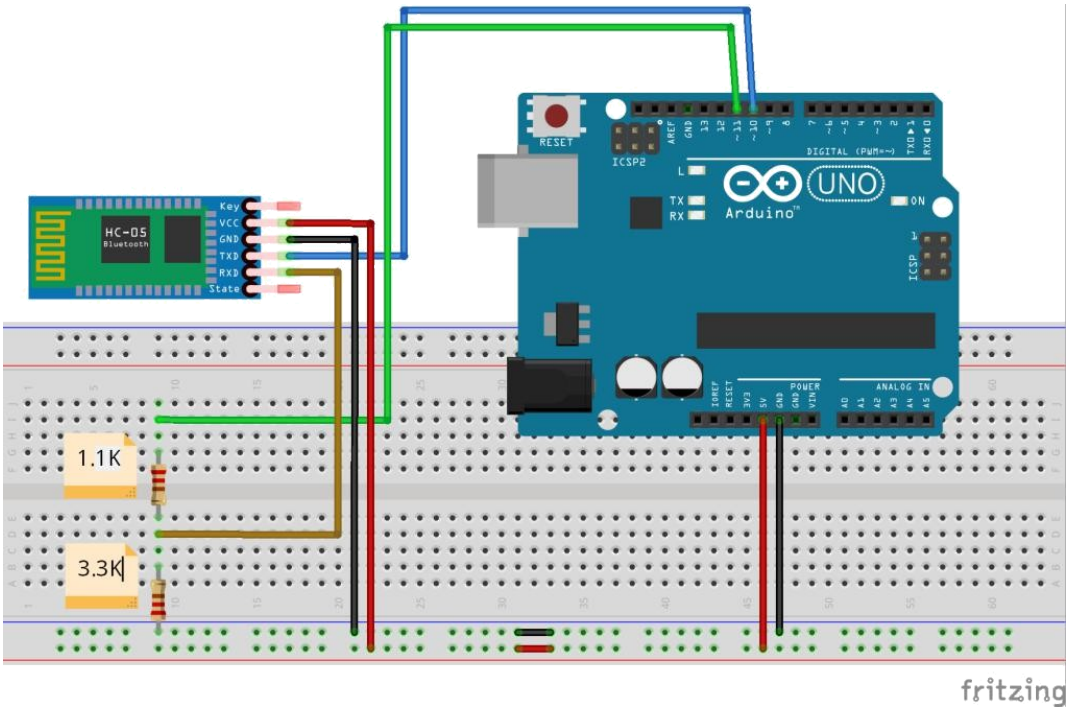


FIG 11. Aurdino with HC 05 [4]

3.3.4 Connecting Aurdino with accelerometer

The accelerometer utilizes next to no present, so it can be connected to your board and run straightforwardly off of the yield from the advanced yield pins. To do this, you'll utilize three of the simple information sticks as computerized I/O pins, for power and ground to the accelerometer, and for the individual test stick. You'll utilize the other three simple contributions to peruse the accelerometer's simple yields.

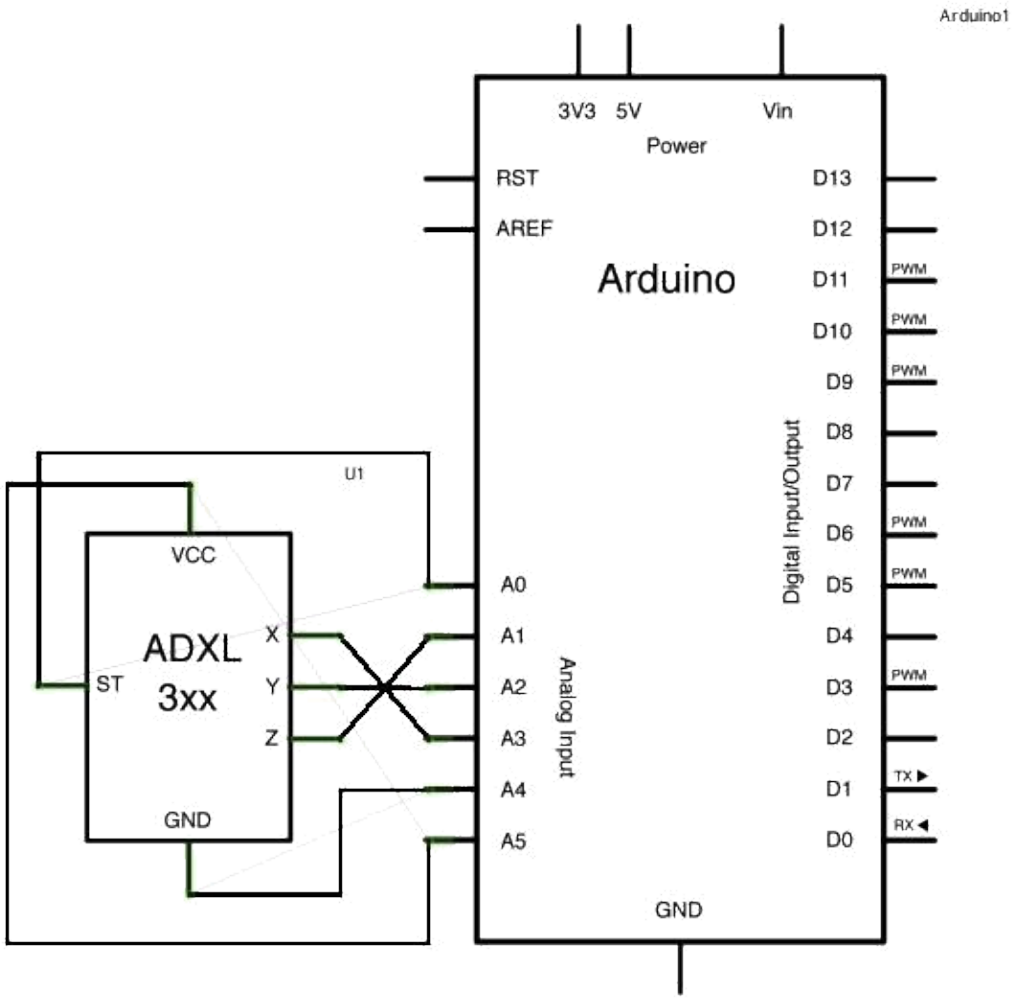
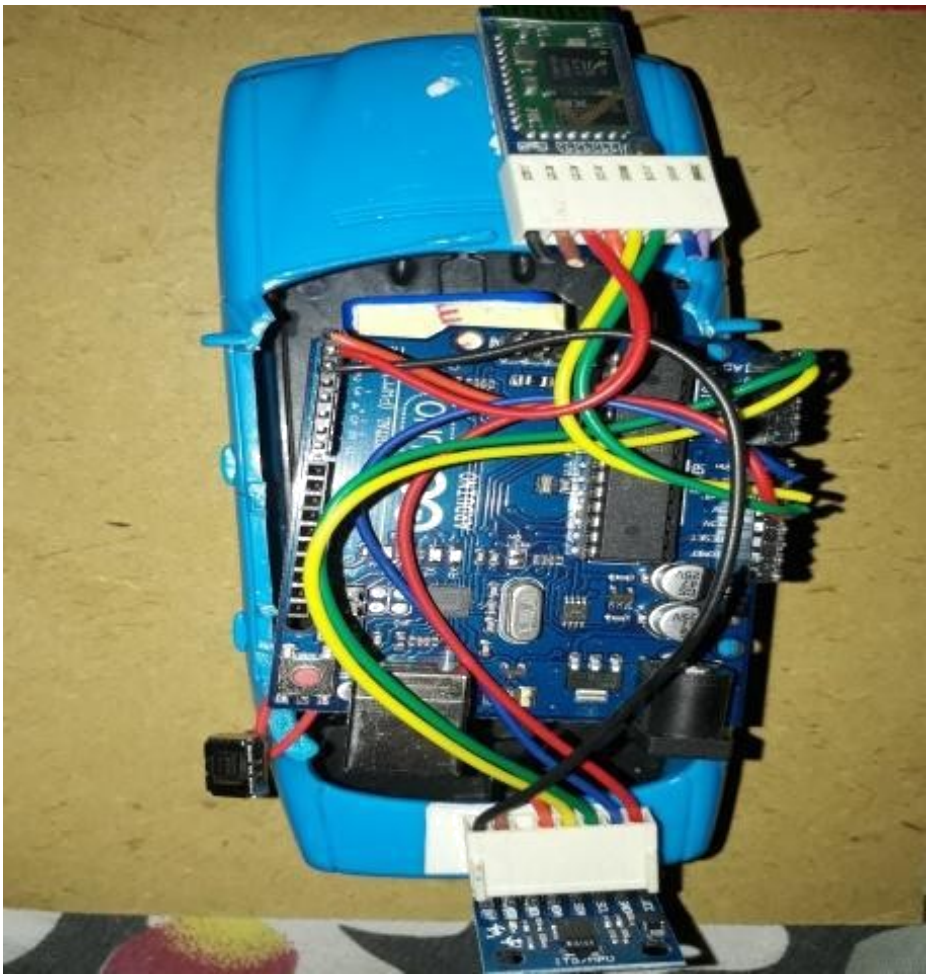


FIG 12. Aurdino with accelerometer[3]

3.3.5 Circuit

The circuit given below consists of t parts:

- Accelerometer
- Aurdino board
- Bluetooth Module
- Power battery
- On/ Off Switch



. **FIG 13. Dummy Model**

3.3.6 Android Studio

Android Studio is the specialist IDE for android application development.It works in perspective of IntelliJ IDEA. On top of IntelliJ's powerful code chief and fashioner instruments, Android Studio offers a great deal more components that enhance your productivity when building Android applications, for instance

• An versatile Gradle-based shape structure

• A speedy and highlight rich emulator

• A bound together condition where you can create for all Android contraptions

• Instant Run to push changes to your running application without building another APK

• Code organizations and GitHub compromise to help you manufacture essential application components and import test code

• Extensive testing mechanical assemblies and structures

• Lint mechanical assemblies to catch execution, convenience, variation similitude, and distinctive issues

• C++ and NDK support

• Built-in support for Google Cloud Platform, making it easy to arrange Google Cloud Messaging and App Engine

For developing the Android Application, we have used the Android Studio Software. In the proposed system an android application is needed so as to act as an interface to get paired to the Bluetooth module which will send data from the aurdino to the application.

The android application also allows us to set 3 parameters:

- Phone number to which text message is to be send
- Alert message text
- Name of the sender

The following picture shows the home screen page of the application.

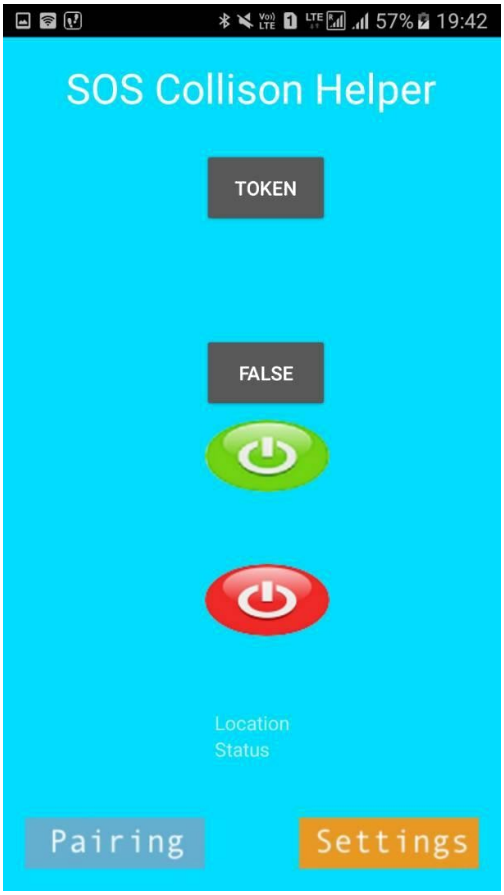


FIG 14. Home screen Android Application

This is the screenshot of the screen which pre determines the phone number, help message and the name of the user

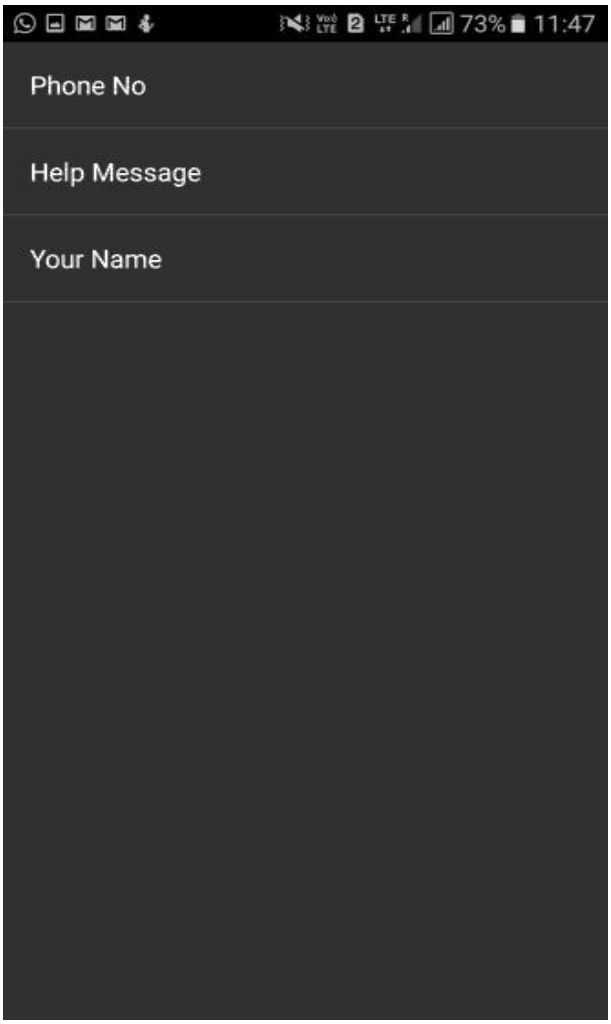


FIG 15. Setting page of Android Application

This is the screenshot of the screen which gives a list of pre paired devices to choose from

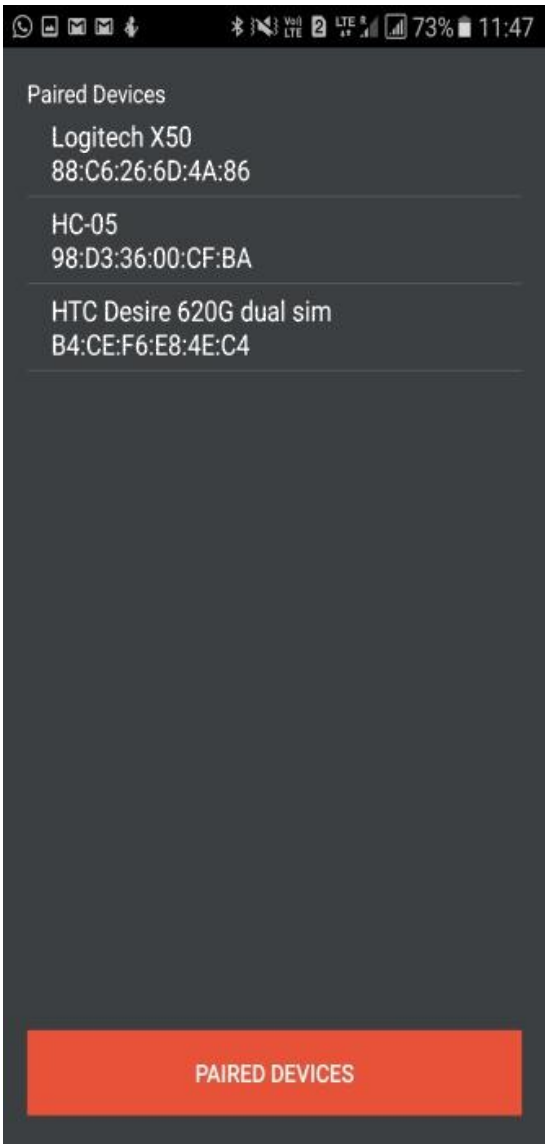


FIG 16. Pairing page of Android Application

4.PERFORMANCE ANALYSIS

In this section analysis of the project is discussed. After that the mathematical development in the project is brought about.And in the end the output is displayed and discussed.

4.1 Analysis

The developed system ensures decent performance in terms of detecting the accident and then sending the alert.The system is also rapid in action and it takes not more than 1 minute for it to send the alert.

The features of the system are :

-Fast in sending alert

-Probability of collision detection is high (because of the accelerometer sensor)

This could be further improved if infra red sensors are used which have even better range.

-It is necessary that no false alerts are sent

This might happen when for example there is some non accident object in the range of the distance sensor

-The sensors used so far are able to detect collision in only one direction

This could be improved by either using better but costlier sensors or by using more number of sensors in different directions.

The result obtained is the text message on the desired smartphone which has 3 components

1. Alert Message text
2. Name of the sender
3. Accident Location link of google maps

The following table shows the time duration in which message is received

TABLE 1. Distance gaps

The following table shows the distance between the actual accident and the location shown on the link.

Trial Number	Distance gap (in km)
1.	2.3
2.	1.2
3.	2.0
4.	0.6
5.	2.1
6.	0.7
7.	0.9
8.	1.3
9.	1.9
10.	0.4

TABLE 2. Time Gap

The following table shows the time between the actual accident and the message received on the phone.

Trial Number	Time of accident	Time when message is received	Time duration in which message is received (in minutes)
1.	10:04	10:05	1
2.	11:23	11:24	1
3.	12:09	12:11	2
4.	13:46	13:48	2
5.	14:12	14:13	1
6.	15:33	15:34	1
7.	16:55	16:56	1
8.	17:27	17:31	1
9.	18:38	18:39	1
10.	19:31	19:33	2

The results obtained in the above two tables are justified.

The trials resulted in an immediate response which will further contribute in reducing the response time of the system.

The average time gap based on these 10 trials comes out to be 1.3 minutes, which can further be reduced if the connectivity is increased.

The average distance gap based on these 10 trials comes out to be 1.34 kms.

The following 2 pictures depict the database on the cloud which stores the message when the accident is detected, or any other weather forecast is predicted.

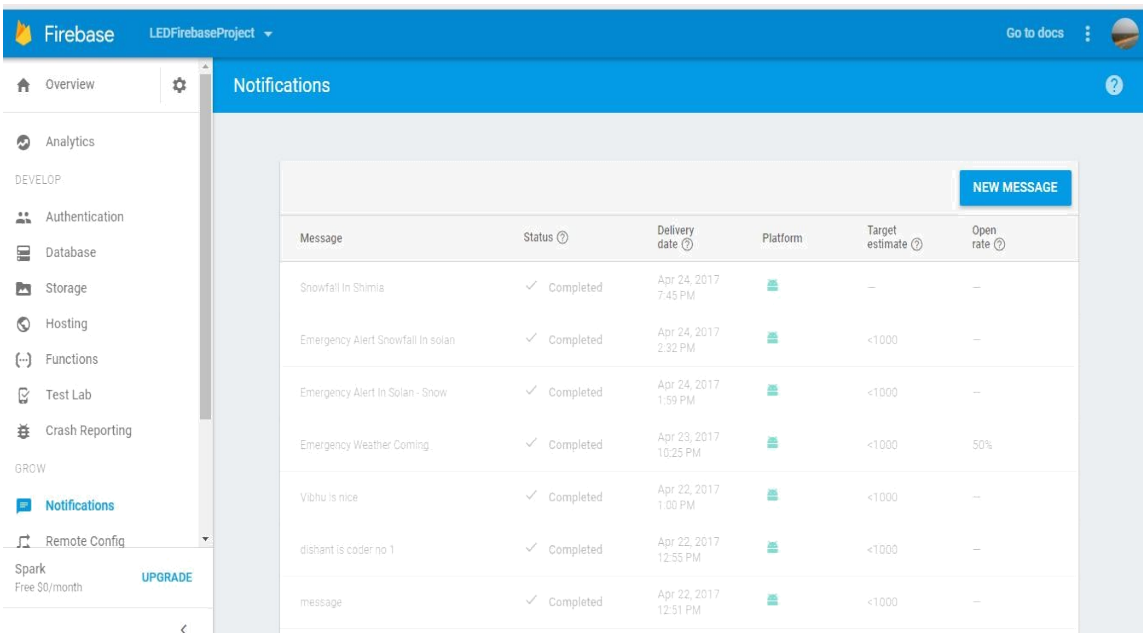


FIG 17. Messages on Cloud

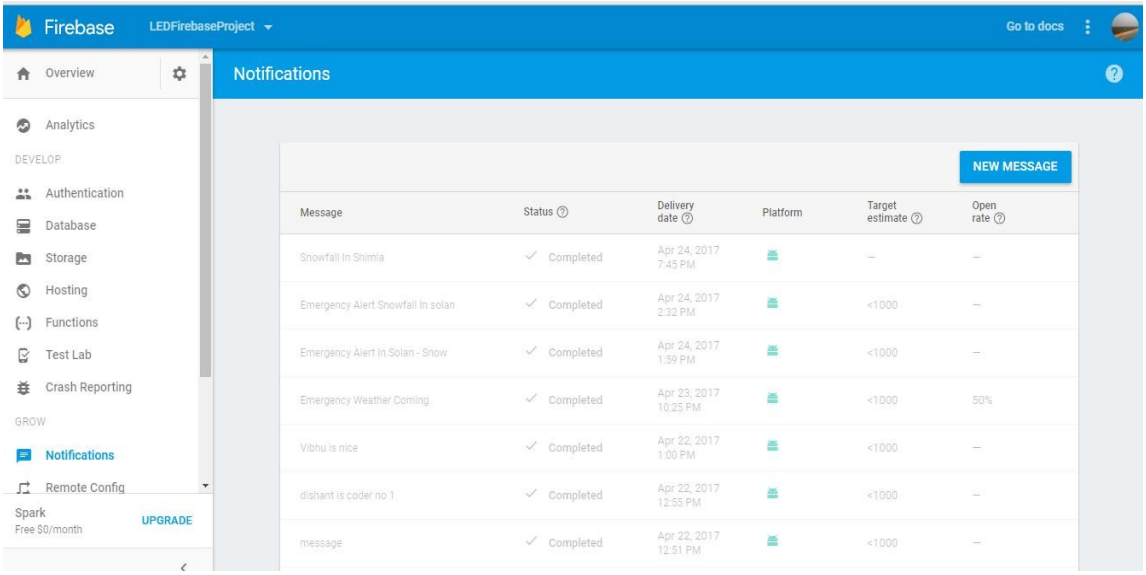


FIG 18. Cloud Database

4.2 Mathematical development

Given below is the logic to detect the collision, i.e. if any of the acceleration axis shos a value greater than 3200, then there has to be a collision.

```
if(ax > axm)
  then axm = ax;
if(ay > aym)
  then aym = ay;
if(az > azm)
  then azm = az;
if(gx > gxm)
  then gxm = gx;
if(gy > gym)
  then gym = gy;
if(gz > gzm)
  then gzm = gz;
  if(aym > 30000 && azm > 30000 )
  then print "Collision"
```

The following is the logic which determines that when there is a hit, the car stops immediately or starts to move after a while.

Collision must be detected when the car immediately comes to stop and also receives a slight reaction the the opposite direction.

if (avg - gz > 8000)

then print "Collision”

Set avg = 0

Set delay of

2seconds otherwise

Set avg = (avg + gz) / 2;

4.3 Results

Whenever a collision is detected the alert message including the location is sent to the desired people.

The following picture shows the text message received on the desired mobile phone

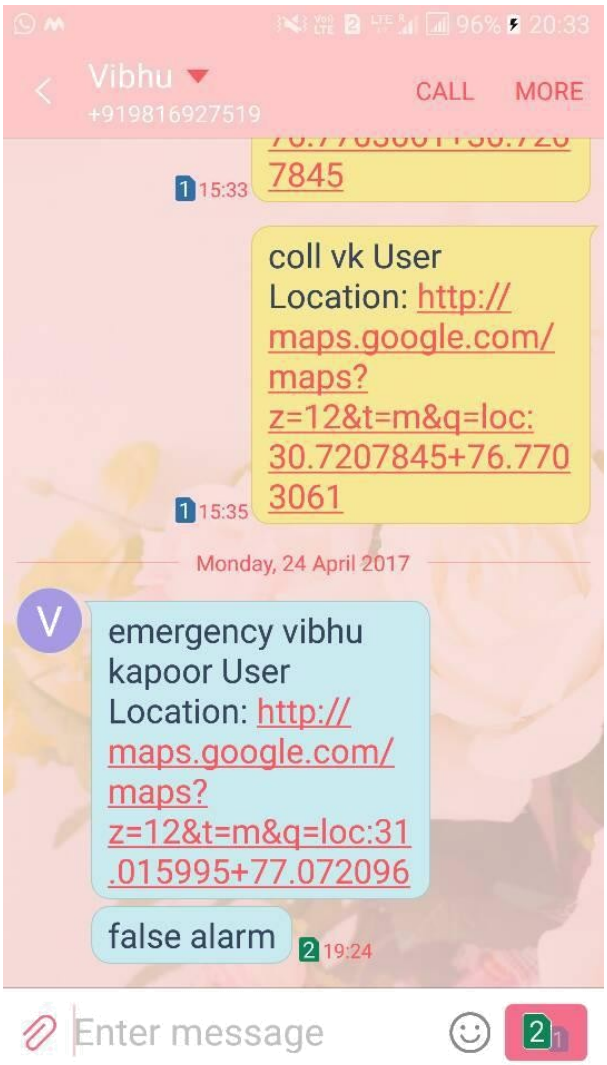


FIG 19. Message received on smartphone

Here the alert text message is “emergency”, the user who met with accident is “vibhu kapoor” and the accident link is attached too.

On opening the link the following location is opened on the Google Maps

FIG 20. Link of accident location on Google Maps

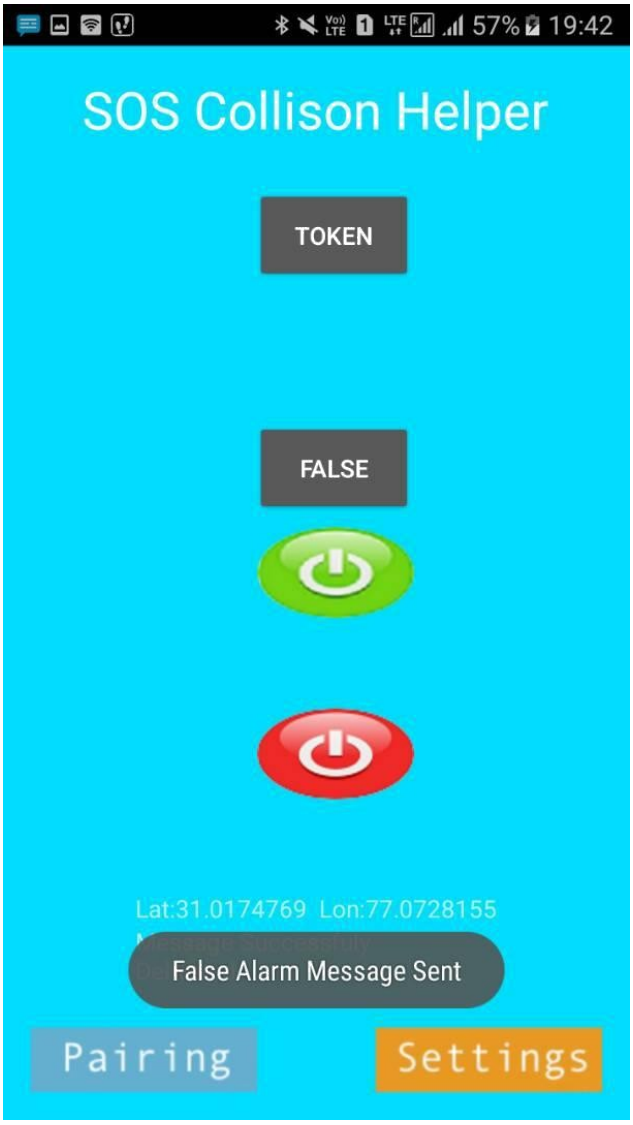


FIG 21. Notification that false message was sent

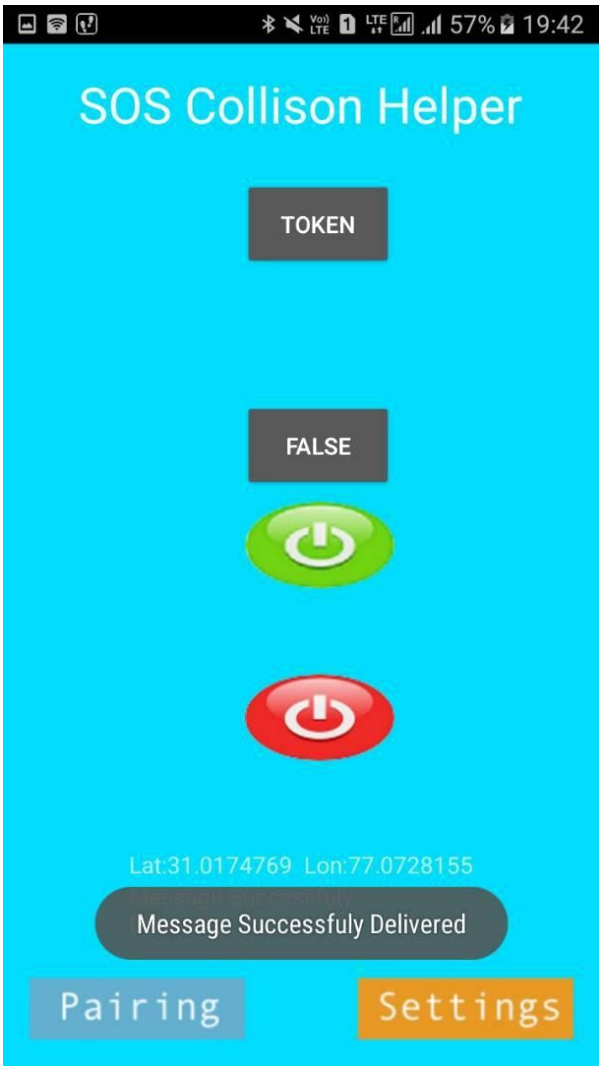


FIG 22. Notification of message delivery

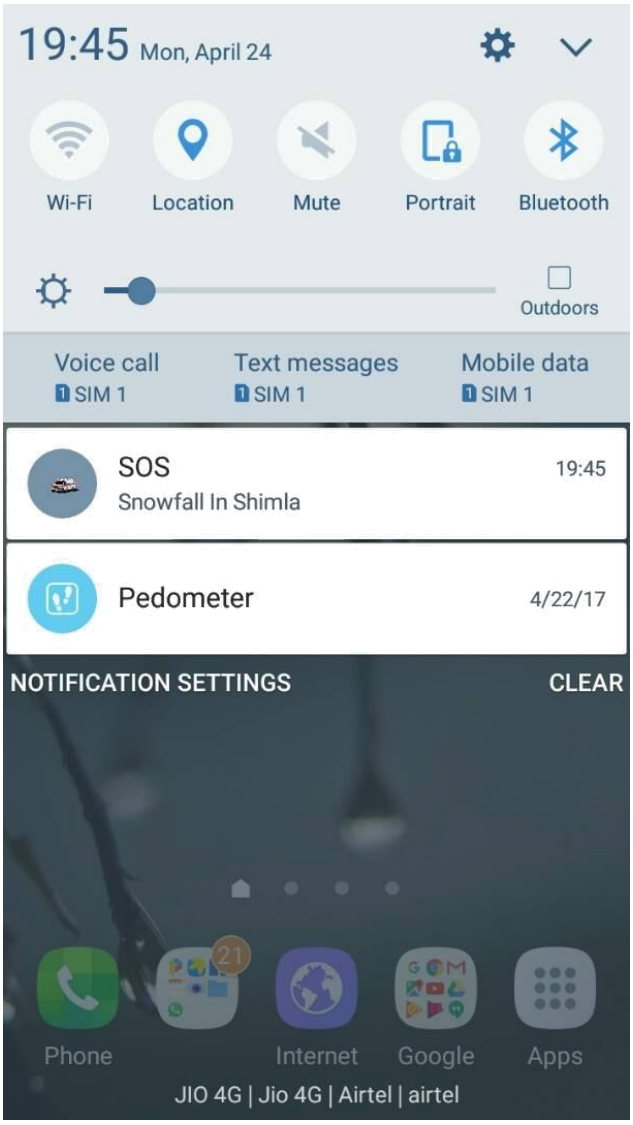


FIG 23. Message received from the Cloud

In this picture when the object is moved away from the collision sensor the distance changes which can be seen in the next image

5. Conclusions

In this section conclusions, future scope and applications are discussed.

5.1 Conclusions

In this project we propose an Internet of Things-based monitoring system for people travelling long distances by road. This system monitors the real time aspects like vehicle breakdown using sensors and sound of collision.

The most popular scenario is to ensure that there do not send any false alerts. The intervention of Internet of Things in everyday life is fast increasing and this is a serious issue which needs to be looked upon as there are various cases in which causalities in case of road accidents arise due to longer response time.

It has been seen that the smartphone based road accident detection system is not easy to handle. It has many obstacles that prevent it from achieving 100% accurate detection. One of the obstacles; is avoiding false alerts.

A future work can be tried to improve the accuracy of detection and to reduce the probability of false positive signs that are generated from the user when the vehicle is travelling at a low speed. The scope of the system can be improved by sending pictures of the accident along with the text message.

The immediate response system in case of road accidents is ideal for smart cities where the connectivity even on the distant areas like highways is not an issue.

The message can also be shared on the cloud so that it can directly be shared with olice/hospitals/relatives of the person who met with the accident.

With the use of crash sensors and a GPS tracker ,the proposed system promises to improve the flexibility and scalability of road accidents.

5.2 Future Scope

The project can be implemented in a real time environment if more number of sensors are used for every possible bit of collision.Also more advanced sensors like the infra red sensors (as they have better distance) can be used for better detection of accident.

A sensor called acceleration sensor can be deployed on the device so that there are not any false calls.It could be coded as if after the collision sensor detects the collision(supppose a fake one) then it can check that if within 5 minutes of that fake detection the car sarts moving again and maintains a speed of 30kmph or more then the alert was a false one.

GPS is planned to be integrated with the current system so that the location of the accident could also be sent.

Another use of GPS can be to find out the nearest hospital and police and send an alert to them as well (because they will be the ones reaching much earlier) using Google Maps.

5.3 Application

The project is applicable for long road journeys in the isolated regions where there is no immediate medical help in case of road accidents.

The applications of the project can be extended to other areas also like for shorter/intercity accidents.

It can further be integrated with Smart cars system in future which include traffic control, accident detection, weather updates based on the location the car vehicle/car is heading towards

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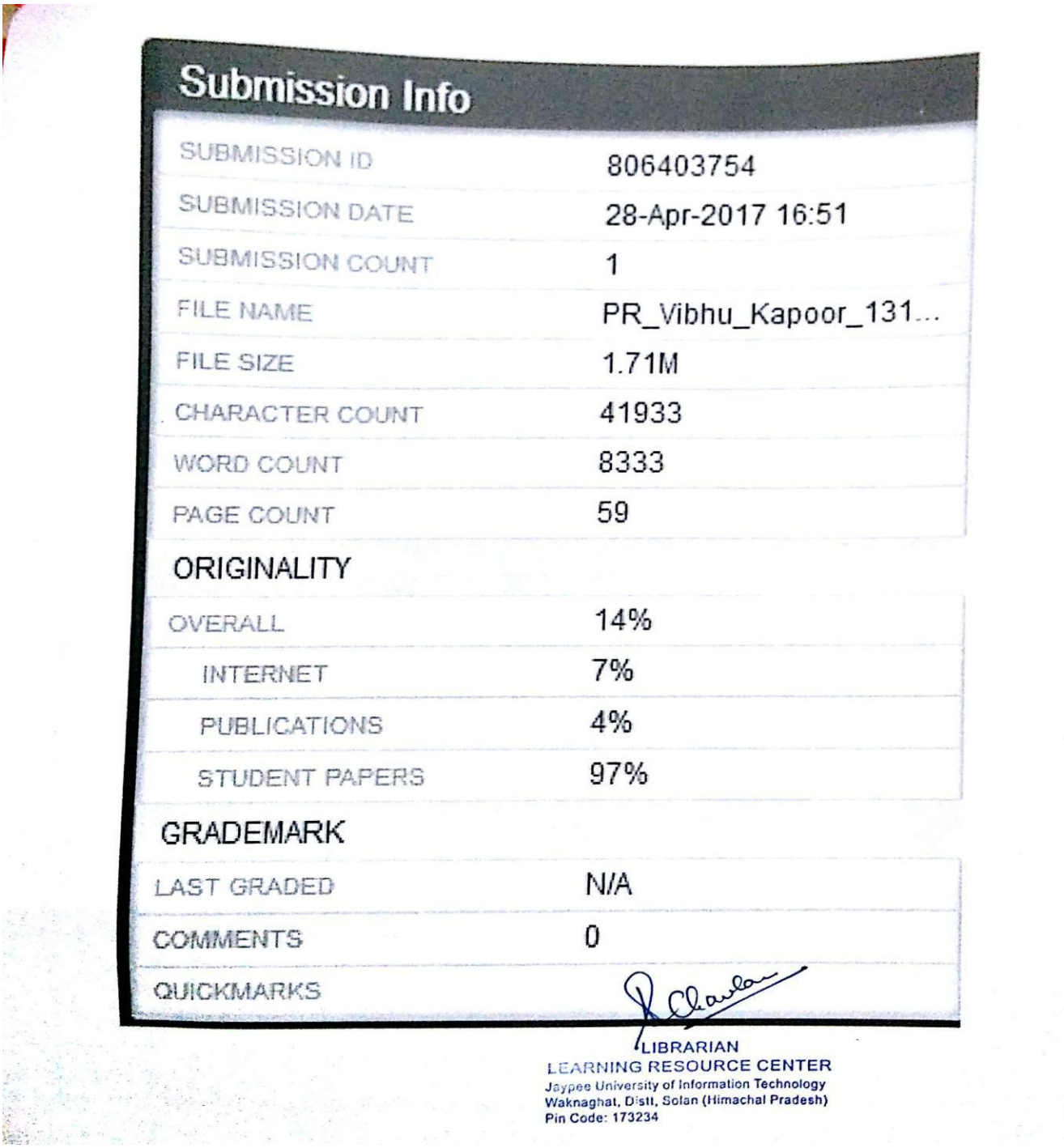

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Communicated Paper

IOT Enabled Immediate Response System for People in case of Road Accidents

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Abstract

Every day, a large number of people die from accident injuries all over the globe. An effective approach to control the post accidents impact which may help in saving the life of the people by sending alert notifications to hospitals, police station and their relatives. Alert notification will help in getting the quick response in case of accident occurnce. Few systems are already in place as built in vehicle accident detection systems. However, these systems are very costly and lack in terms of availability. Whereas, to detect traffic accidents using smartphones is easily possible now because of the advances in connectivity and sensors deployed on the smartphones.

The aim of this paper is to reduce the response time using Internet of Things(IOT) . The proposed system includes two phases; the detection phase and the notification phase. The detection phase detects car accident in all speeds. The notification phase is used to send detailed information such as the accident location to the hospital, police station and relatives of the person who met with an accident immediately after an accident is detected, for fast recovery.

This paper includes two contributions; of using smartphone-based accident detection systems. First, it provides solutions to critical issues such as fake/false alerts by deploying onboard sensors to detect large accelerations. Second, it presents the system architecture of the prototype smartphone-based accident detection system.

Keywords-Internet of Things, Reponse Time, Sensors

1. Introduction

Today the role of IOT in everyday life is increasing day by day. There have been a tremendous increase in the positive effect IOT has brought into people's life. The number of causalities in case of road accidents has been

increasing and is found to be critical in a number of cases. A major reason for these causalities can be due to the late message/information to the doctors and the people concerned.The proposed system helps to reduce the response time of the ambulance reaching the accident location and hence reduce the number of causalities. The proposed system takes the data from the sensor and send the message using bluetooth to the smartphone which further sends the sms (including the accident location) to the recovery number whenever the accident is detected.Immediate response system in case of road accident is an IOT based system which enables reduction in time to provide the medical facility. This proposed scheme targets the long distance road journey on the national highways, where there is not much provision for medical help immediately after an accident. After implementation of the proposed system results can be analyzed in order to get the causalities reduced.

This paper is divided in 6 parts; Introduction is followed by Motivation behind the proposed system in section 2. In section 3 works on the related system is discussed. This is followed by the methodology used for developing the proposed system in section 4. The results obtained from various trials on implanting the model are listed in section 5. In section 6 the discussion of the results obtained is done.

2. Motivation

In this section the motivation behind the proposed system and the need/ importance are discussed.

There has been a tremendous increase in case of road accidents in the past few years. Many of the causalities happen because the medical help did not reach on time. In India there has been a 2.5 percent increase in the number of accidents on the roads from 2014 to 2015. And the number of causalities increased by 4.6 percent in the same duration of time. India bears a loss of 17 lives every hour in the form of road accidents [1].
Accidents mainly happen due to driver's fault which include intake of alcohol or drugs, poor condition of roads or rash driving. In any of the case if the medical help reaches on time the statistics can be turned positive. One of the reason for the late response by the medical staff could be that they are informed late about the accident and when they reach it is already too late for any recovery. Automating this scenario so that alert is directly sent to the medical staff and family will be a great accomplishment. The main scope of the project is for long road journeys, because usually in the accidents inside the city there has not been much delay in the response time. It is mainly the long journeys where there is no immediate help or even other people to inform about the accident to the hospitals. There have been cases where the vehicle had to wait for as long as 10-12 hours for any help. And the victims are generally not in a state to even make calls to inform their family.

The proposed system is important for the society as it will help in saving the lives of people who die in road accidents just because of the medical help reaching late. The proposed scheme will reduce the number of causalities by providing a system immediate alerts on the smartphone as well as on the cloud when accident happens.

3. RELATED WORK

In this section, in order to understand the current studies of work done in their area, total four papers are considered and are discussed as follows.

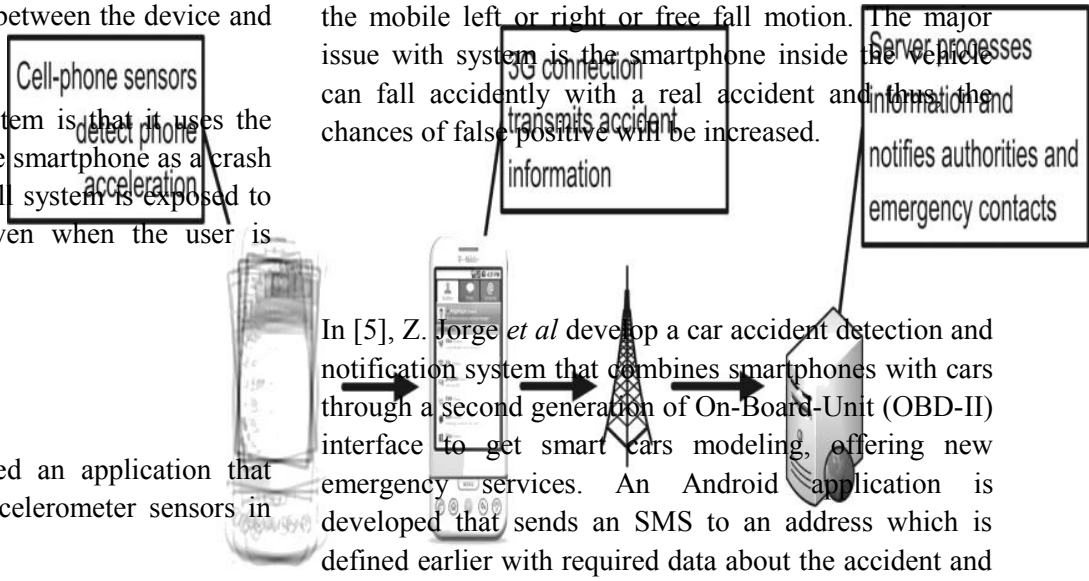
In [2] C. Thompson *et al* have built an accident detection and notification system based on smartphone. In this system, a prototype smartphone based application called Wreck Watch was developed which implements a methodology to detect and notify accidents by using sensors which are inbuilt in the vehicle and interfaces. The major problem with WreckWatch is that the system gets deactivated when the speed is below the threshold level as its detection process begins to record the data from the accelerometer and looks for accidents only if the vehicle and smartphone speed is greater than the threshold level and thus, this filtering will shut off the detection process in low speed condition and will not be able to detect the accident at that speed.

In [3], the Electronic call system is used to develop an automatic crash detection and notification service for handy devices like smartphones. This system uses the mobile network to communicate between the device and the Server.

The major concern with this system is that it uses the accelerometer sensor inbuilt in the smartphone as a crash sensor, and thus the electronic call system is exposed to high rates of false positives even when the user is outside the vehicle.

In [4], K.H. Patel has developed an application that senses the accident using the accelerometer sensors in the Smartphone.

Once the accident is sensed, the application automatically generates the geographical information by GPS and sends location information using a voice message which was recorded earlier to 108 ambulance emergency response service which runs in India. The most important requirement of this application is that the smartphone should not be kept near the person who is driving the vehicle; it must be kept inside the vehicle and the testing of the accelerometer is performed by moving the mobile left or right or free fall motion. The major issue with system is the smartphone inside the vehicle can fall accidently with a real accident and thus the chances of false positive will be increased.



In [5], Z. Jorge *et al* develop a car accident detection and notification system that combines smartphones with cars through a second generation of On-Board-Unit (OBD-II) interface to get smart cars modeling, offering new emergency services. An Android application is developed that sends an SMS to an address which is defined earlier with required data about the accident and also an alert call is automatically made to the emergency services. The only requirement is that the car must support the OBD-II standard. The OBD-II standard is mandatory since 2001 in U.S and there is a similar standard in Europe, thus this solution is valid for all vehicles in U.S and European countries.

4. Methodology

In this section the methodology used to develop the proposed system is discussed in detail.

The methodology used in thefirst and the second phase is separately discussed in this section.

FIG 1. System Model

The first phase is the hardware phase in which the circuit designing, and mathematical calculations are done to detect the collision.The second phase is developing the android application and sending the text message to the desired phone number including the location of the accident.

4.1. First Phase

For the circuit part, accelerometer and Bluetooth on the aurdino are used.The aurdino processes the input from the accelerometer and detects if there is a collision based on the three axis(ax, ay, az) .Accelerometer provides thousands of data at a single moment and not all data is a signal for collision. To check the maximum value the accelerometer hits, three variables in different dimensions are used. Also, to get the time duration in which these parameters hit the maximum value, time variables are needed too. If there is a collision, aurdino sends the data to the mobile phone through the Bluetooth. Audino has two methods setup method which is the initialization method and the second is the loop method which includes the part which needs to be done again and again.

The Setup method does the following:

- Determines the speed at which the code is supposed to run
- Initializes the accelerometer
- starts the wire port (connected to accelerometer)
- starts the serial port(connected to bluetooth)

The Loop method does the following:

- reads the values of accelerometer
- finds the maximum value

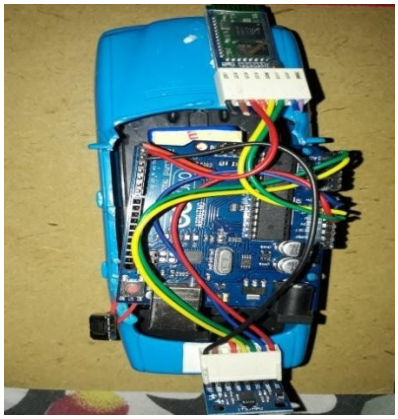


FIG 2. Prototype of the system

The above figure shows the dummy model of the proposed system. A similar system can be deployed on the real car and collision can be detected and notification be sent using the same circuitry.

4.2. Second Phase

The second phase involves the development of the android application, which acts as a user interface to feed the following data

- Phone number of the receiver
- Alert text message
- Name of the sender(The person who meets with accident/the smartphone of the person using the application)

The android application also acts as an interface to allow Bluetooth pairing. When the data is received using Bluetooth and collision is detected the android application uses Google maps to get the location of the

accident and append it to the text message and send it to the desired number. The main logic behind detecting collision is that whenever the acceleration of the moving vehicles becomes negative i.e. it changes its direction in a very small amount of time(2 seconds), then there is said to be a collision. This is based on the laws of Physics, which says that according to Newton's Third Law of Motion, for every action there is a equal and opposite reaction. And hence, when the moving vehicle hits any other object it is will definitely receive a reaction in opposite direction in a very small amount of time

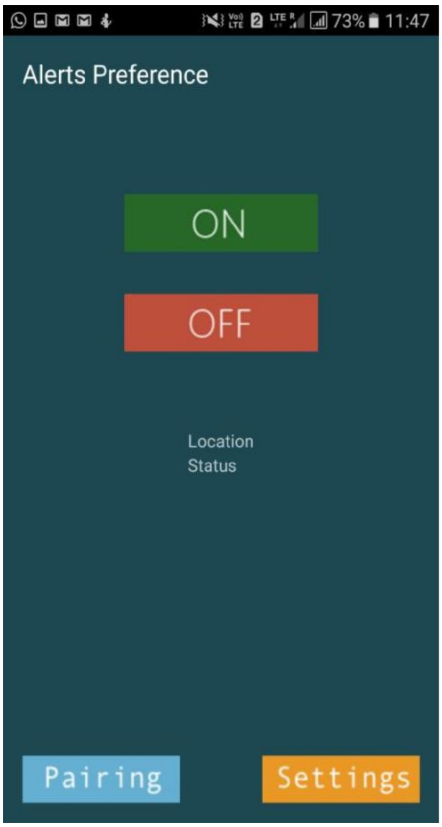


FIG 3. Home Screen

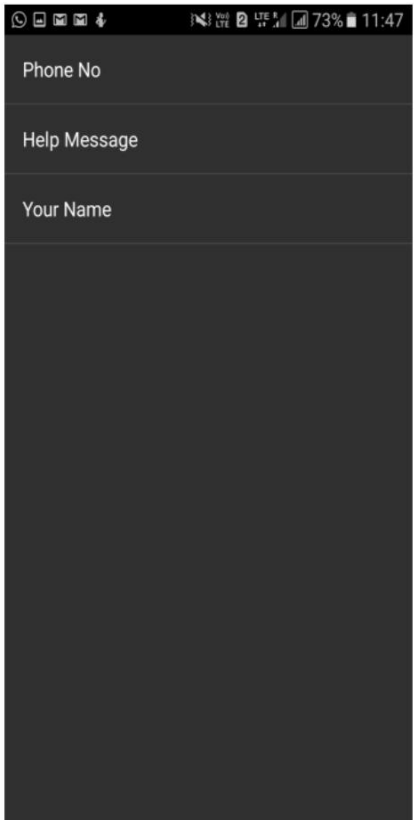


FIG 4. Settings

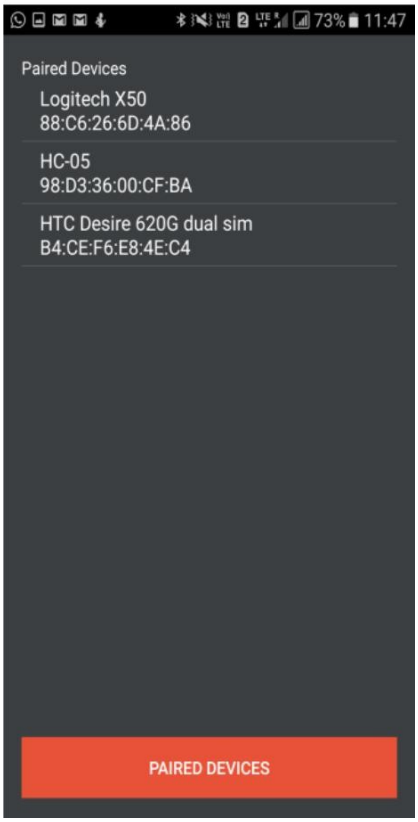


FIG 5. Paired Devices

The above figures represent 3 different snippets of the android application

5. Results

In this section the results of the implemented system have been analyzed.

The result obtained based on the trials performed is the text message on the desired smartphone which has 3 components

- Alert Message text
- Name of the sender
- Accident Location link of google maps

The following two table shows the time duration in which message is received and the distance between the actual accident and the location shown on the link

Table 1. Distance Gap

Trial Number	Distance gap (in km)
1.	0.3
2.	1.2
3.	0.3
4.	0.6
5.	1.1
6.	0.7
7.	0.9
8.	1.3
9.	1.2
10.	0.4

The above table displays the distance in kilometers between the actual accident location and the location detected by the GPS on smart phone. This helps in understanding the accuracy in terms of the precise location provided in the alert message to hospitals/police station/relatives.

Table 2. Time Gap

Trial Number	Time of accident(24 hrs)	Time when message is received(24 hrs)	Time duration in which message is received (in minutes)
1.	10:04	10:05	1
2.	11:23	11:24	1
3.	12:09	12:11	2
4.	13:46	13:48	2
5.	14:12	14:13	1
6.	15:33	15:34	1
7.	16:55	16:56	1
8.	17:27	17:31	1

9.	18:38	18:39	1
10.	19:31	19:33	2

The above table displays the time of accident, the time when alert message is received and calculates the time gap (in minutes) between them. This helps to analyze the performance of the system by understanding how immediately the message is received so as to reduce the response time of the ambulance reaching the accident spot.

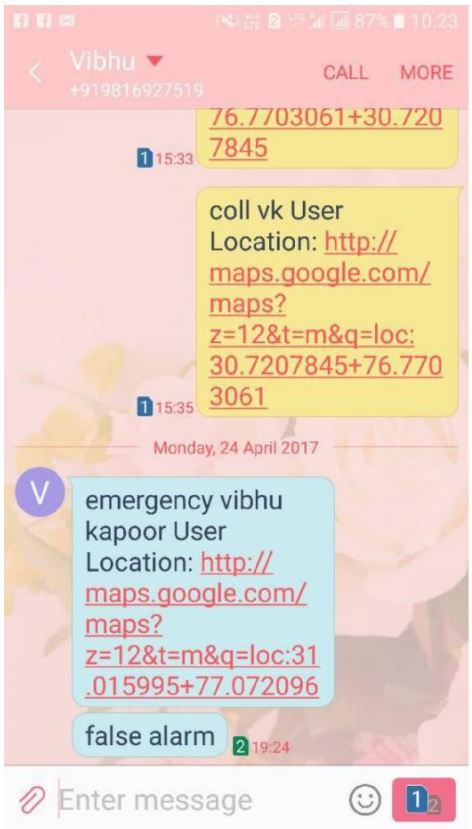


FIG 6. Text message received on smartphone

The above picture shows the text message received on the desired mobile phone

Here the alert text message is “emergency”, the user who met with accident is “Vibhu Kapoor” and the accident link is attached too. The second message which is “false alarm” is received when there was a false alert sent earlier.

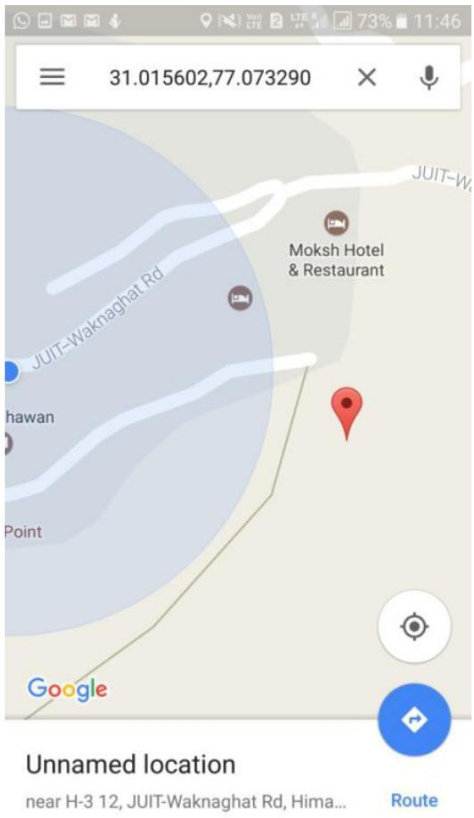


FIG 7. Accident location detected by GPS

The above image shows the link when opened, the accident took place in the JUIT Campus and the map clearly predicts the correct location.

6. Discussion of result

The results obtained in the above two tables are justified. The trials resulted in an immediate response which will further contribute in reducing the response time of the system. The average time gap based on these 10 trials comes out to be 1.3 minutes, which can further be reduced if the connectivity is increased. The

average distance gap based on these 10 trials comes out to be 0.8 kms.

7. Future scope

It has been seen that the road accident detection system based on smartphone is not easy to handle. It has some challenges that prevent it from achieving 100% accurate detection. One of the few obstacles is avoiding false alerts. A future work can be tried to improve the accuracy of detection and to reduce the probability of false positive signs that are generated from the user when the vehicle is travelling at a low speed. Another challenge is that the system requires good connectivity to the internet as it needs the location coordinates. The scope of the system can be improved by sending pictures of the accident along with the text message. The immediate response system in case of road accidents is ideal for smart cities where the connectivity even on the distant areas like highways is not an issue.

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