Road Safety in Himachal using VANET

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

in

Information Technology

By

(Sania Labana (121409))

&

Computer Science and Engineering

By

(Aayush Sharma(121277))

Under the supervision of

(Dr. Shailendra Shukla)

to

Department of Computer Science & Engineering and Information Technology**Jaypee University of Information Technology Waknaghat, Solan-173234, Himachal Pradesh**

CERTIFICATE

Candidate’s Declaration

We hereby declare that the work presented in this report entitled “ Road Safety using VANET” , in partial fulfillment for the award of degree of Bachelor of Technology in Information Technology and Bachelor of Technology in Computer Science and Engineering submitted to 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, 2015 to June,2016 under the supervision of Dr. Shailendra Shukla, Assistant Professor, Department of Computer Science and Engineering. The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Name: Aayush Sharma

Roll No. 121277

Name: Sania Labana

Roll No. 121409

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

Dr. Shailendra Shukla

Assistant Professor

Department of Computer Science & Technology

Dated:

ACKNOWLEDGEMENT

We would like to express our gratitude and appreciation to all those who gave us the perfect environment for completion of this report. A special thanks to our final year project supervisor, Dr. Shailendra Shukla, whose stimulating suggestions and encouragement, helped us to get to the thrust of our topic and understanding the importance of the project. We would also like to acknowledge with much appreciation the crucial role of the staff of Computer Laboratory, who provided us with the lab facilities as and when required.

Additionally, we appreciate the guidance given by the panels especially during the previous project presentation which made us realize the various dimensions. We were probably missing out and hence, they gave away a room for improvement in the project. Again a special thanks to our friends who gave the valuable suggestions regarding the project.

Date: Sania Labana

121409

Aayush Sharma

121277

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LIST OF ABBREVATIONS

VANET- Vehicular Ad hoc Network

GPS- Global Positioning System

PAN- Personal Area Networks

MANET- Mobile Ad hoc Network

ITS – Intelligent Transportation Systems

V2V – Vehicle to Vehicle

V2I – Vehicle to Infrastructure

V2R – Vehicle to Roadside

ADASs- Advanced Driver Assistance Systems

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ABSTRACT

We know that travelling in India by road is dangerous as traffic conditions are chaotic, drivers drive recklessly, and the roads are not maintained properly. Therefore, there is a need to monitor driver behavior and road conditions regularly. In this project we will be using VANET to achieve this purpose.

Many researchers and industries are working on Vehicular ad hoc networks (VANETs) and trying to implement the concepts in real world. VANET are being developed to provide on-demand wireless communication infrastructure among vehicles and authorities. This infrastructure is expected to deliver multiple road safety and driving assistance applications. Vehicles are being equipped with sensors and communication devices that allow them to cooperate with each other. Vehicles can exchange different types of information as per requirements on demand for specified application.

This project aims at using smart phones for the purpose of creating a VANET.
Mobile phones today are equipped with inbuilt sensors that give safety enhancement to the drivers on road. The three axis accelerometer and a GPS tracking system of smart phone can give assistance to the driver while travelling.
The three axis accelerometer of an Android based smart phone is used to record and analyze various and external road conditions that could be hazardous to the health of the driver and the automobile. With real time analysis and alerts of these factors, we can increase a driver's overall awareness to maximize safety. Google Earth is used to create road condition maps using GPS coordinates.

1. INTRODUCTION

1.1 Introduction

In this project, we will build an android application and use the sensors of the mobile to create VANET (Vehicular ad hoc network) which will ensure road safety. Previously a lot of work is done in this field but researchers mainly focused on monitoring either driver behavior or road conditions using specialized hardware deployed inside the car or roadside which is expensive and also requires maintenance. Hence, using mobile sensors is a cheaper way only accuracy has to be provided.

3 axis accelerometer, GPS system, Bluetooth will be the sensors used.

An **accelerometer** is a sensor which measures the tilting motion and orientation of a mobile phone. Thus the data collected from the accelerometer will be stored and checked to find out the state of the vehicle that is if at rest, or moving at a high speed or an accident has occurred.

The **Global Positioning System** is a series of satellites owned by the US government that broadcasts signals that GPS receivers on the surface of the planet can use to determine position through triangulation. This location information will help the central emergency centre to know the location where accident has occurred so that emergency help can be provided and other drivers can be informed so that they can change lanes or drive slow at that location.

Bluetooth is a wireless technology standard for exchanging data over short distances from fixed and mobile devices, and building PANs.

1.2 Problem Statement

The idea is to create a simple VANET, where users can communicate among each other in case an accident has occurred so as to ensure proper safety using their smart phones.

1.3 Objectives:

- Smartphone based approach is considered good as it is inexpensive, relying to the fact that many people already own it.
- It is portable and requires less maintenance.
- Will provide speed or accident location of the vehicle to nearby drivers, hence, easy track of location out of easy human reach.
- Doesn’t rely on any road side infrastructure or car sensors.
- Additional information about the environment can be provided.

1.4 Methodology

- Real time monitoring and surveillance – Accelerometer measures the data in real time and it can be observed that while we are calculating the speed from the collected data there is hardly any observable latency. This critical real-time system, in which timeliness (i.e. the ability of a system to meet time constraints such as deadlines) is significant.

- Sensitivity of the sensor- Since most accelerometers and GPS module are influenced to some degree by temperature, sensitivity is valid over a wide temperature range, typically 25 ± 15°C. Additionally it is valid over some certain acceleration amplitude, usually 5 g or 10 g. Sensitivity is sometimes specified with a tolerance, usually ±5% or ±10%.

- Scalable system – Right now we are having just one module to display STATE of vehicle, its SPEED and its LOCATION but we can expand the system to provide us with other information like the traffic surveillance, Road Hazard Control Notification etc.

- No false alarms – Since the value table used to detect the State of the vehicle has been verified by various organizations for accuracy, we can depend of their research (till we do our own) and say that there will be no false alarms.

- Good response time of the sensor – The response time is the time taken for a sensor, when subjected to a change in input signal, to change its state by a specified fraction of its total response to that change. The sensors’ response time is quite good.

1.5 Organization

Vehicular Ad Hoc Networks (VANETs) are created by applying the principles of mobile ad hoc networks (MANETs) - the spontaneous creation of a wireless network for data exchange - to the domain of vehicles. They are a key component of intelligent transportation systems (ITS).

- <u>To prevent accidents on road:</u>

Year-wise Road Accidents in Himachal Pradesh

Year	Cases Occurred	Persons killed	Persons injured	Vehicles involved
2003-04	2,794	843	4,293	3,195
2004-05	2,758	920	4,674	3,423
2005-06	2,868	861	4,755	2,868
2006-07	2,737	929	4,886	2,917
2007-08	2,953	921	5,272	3,756
2008-09	2,840	898	4,837	3,583
2009-10	3,023	1,173	5,630	3,705
2010-11	3,104	1,105	5,350	3,810

Source: Statistical Outline of Himachal Pradesh 2010-11

-

Table 1: Year Wise Road Accidents in Himachal Pradesh

Road Accidents District wise (2011-11)

District	Cases Occurred	Persons killed	Persons injured
Bilaspur	254	42	331
Chamba	122	126	270
Hamirpur	160	28	265
Kangra	602	106	1,076
Kinnaur	51	65	67
Kullu	189	60	368
Lahaul & Spiti	20	15	30
Mandi	370	153	660
Shimla	430	211	801
Sirmour	227	88	324
Solan	407	134	678
Una	272	77	480

Table 2: District Wise Road Accidents

The statistics show that the number of people killed and total number of accidents occurring in the state are increasing at a very rapid rate. Hence it is high time to employee technology such as Intelligent Transport system (ITS) and using VANETS to ensure safety on roads.

- <u>To prevent intersection crash:</u>

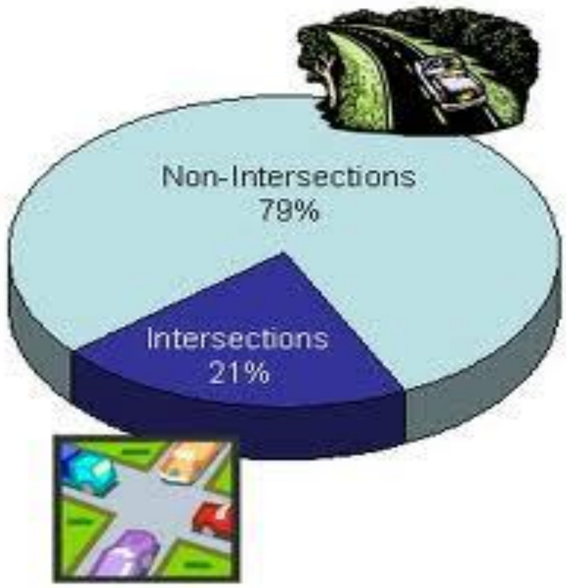


Figure1.5.1

The pie chart shows that 21% of total accidents that occur on road are because of intersection. Thus, if vehicles have information about the vehicles moving around them (in some nearby region), nearby sharp turns or Intersections, the drivers can drive more carefully and hence intersection crashes can to be reduced.

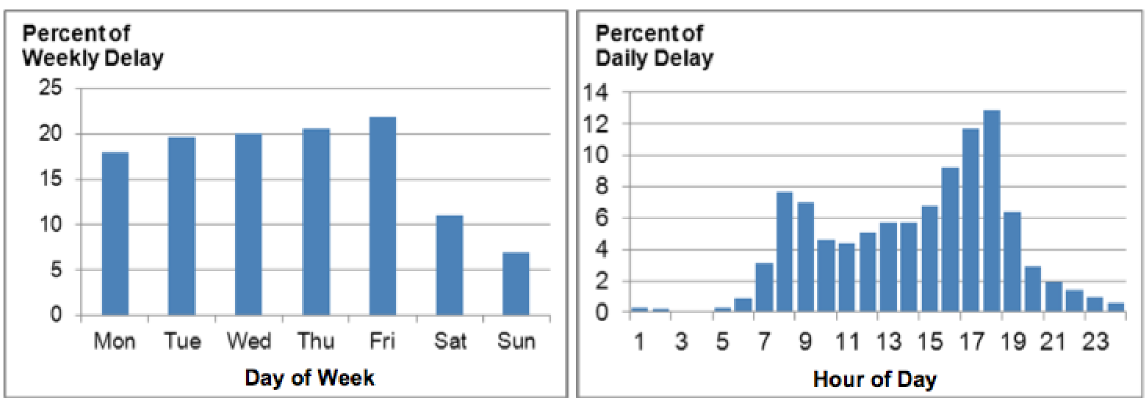
- <u>Cost reduction:</u>

  The tradition approach and architecture for ITS and VANETS involved quite expensive equipments like on-board wireless devices (*e.g.*, UMTS, IEEE 802.11*p*, Bluetooth, etc.) and sensors (*e.g.*, radar, lazar, etc.).

  All this added up to a lot of extra cost on the contrary today everyone has a smart phone, so we can cut out this extra cost and retrieve reliable information and establish communication using sensors of the smart phone itself.

- <u>Other problems</u>

  There is an urgent need to improve traffic management throughout the world.
  The growing congestions are of great concern and results in a lot of time waste.



The above fig. shows percent of weekly hours delayed and what hour of the day has the most delays due to traffic.

2. LITERATURE SURVEY

2.1 History

Recent Works in VANETs

- **Dash Navigation, Inc.** a start-up in Sunny Valley, CA started offering a service in 2009 called The Dash Driver Network that allows drivers to broadcast their location and speed in exchange for receiving updated traffic information compiled from other vehicles in the network.

- This system is centralized and relies on wireless internet connectivity which is not widely available on roads and highways around the globe. Because the collecting entity is a central, trusted location, privacy concerns are mitigated.

- **The CAR 2 CAR communication Consortium**, a non-profit organization initiated by European vehicle manufacturers with the objective of improving road traffic safety and efficiency published in 2007 a manifesto in which it proposes standards for V2V and V2I communications among other things.

- In 2008, **The European Union** deployed systems relying on V2V and V2I communications by reserving a radio frequency across the EU for vehicle applications aiming at enabling co-operative systems between carmakers.

- **The Google Driverless Car** is a project by Google that involves developing technology for driverless cars. The system combines information gathered from Google Street View with artificial intelligence software that combines input from video cameras inside the car, a LIDAR sensor on top of the vehicle, radar sensors on the front of the vehicle and a GPS position sensor attached to one of the rear wheels that helps locate the car's position on the map. Google anticipates that the increased accuracy of its automated driving system could help reduce the number of traffic-related injuries and deaths, while using energy and space on roadways more efficiently.

- Nericell, a system researched and developed by Microsoft that detects traffic honking, bumps, and vehicle braking using external sensors. For detection, it uses sensors such as a microphone, GPS, accelerometer for traffic localization. The system is deployed for testing in cars using a convenient method to identify fatigued surfaces of a road. Traffic monitoring system that uses GPS data to obtain individual vehicle location information, process it, and distribute route information back to a mobile phone.

2.2 Introduction to VANET

Study

Vehicles connected to each other using wireless ad hoc formation form a wireless network called “Vehicle Ad Hoc Network”. A **Vehicular Ad Hoc Network**, or **VANET** is a technology that uses moving vehicles as nodes in a network to create a mobile network.

- VANET is a subgroup of MANET where the nodes refer to vehicles. Since the movement of Vehicles are restricted by roads, traffic regulations we can deploy fixed infrastructure at critical locations.

- The primary goal of VANET is to provide road safety measures where information about vehicle’s current speed, location coordinates are passed with or without the deployment of Infrastructure.

- Apart from safety measures, VANET also provides value added services like email, audio/video sharing etc.

Communication Types

- **Vehicle to Vehicle (V2V)**

  - Vehicle to Vehicle communication approach is most suited for short range vehicular networks.
  - It is fast and reliable and provides real time safety.
  - It does not need any roadside Infrastructure.
  - V2V does not have the problem of Vehicle Shadowing in which a smaller vehicle is shadowed by a larger vehicle preventing it to communicate with the Roadside infrastructure.

- **Vehicle to Infrastructure (V2I)/Roadside**

  - Vehicle to Infrastructure provides solution to longer-range vehicular networks.
  - It makes use of preexisting network infrastructure such as wireless access points (Road-Side Units, RSUs).
  - Communications between vehicles and RSUs are supported by Vehicle-to-Infrastructure (V2I) protocol and Vehicle-to-Roadside (V2R) protocol.
  - The Roadside infrastructure involves additional installation costs.

Hybrid Models

- Vehicle to Vehicle (V2V) & Vehicle to Infrastructure (V2I)

- Vehicle to Vehicle (V2V) & Vehicle to Roadside (V2R)

Results Used:

We decided on using vehicle-to-vehicle communication as it does not require any road side infrastructure and is fast and reliable. Also it avoids the problem of vehicle shadowing i.e. a smaller vehicle is shadowed by a larger vehicle preventing it to communicate with roadside infrastructure.

Source:

From references [1]

2.3 Study of Sensors of the smart phone

Study

An automated approach for detecting potholes or bumps with lesser errors is through the use of embedded sensing devices or smart phones.

Tremendous growth in smart phones embedded with numerous sensors such as accelerometers, Global Positioning Systems (GPSs), magnetometers, multiple microphones, and even cameras. The scope of sensor networks has expanded into many application domains such as intelligent transportation systems that can provide users with new functionalities previously unheard of.

Targeting a GPS system of smart phone is an alternative device for Advanced Driver Assistance Systems (ADASs) that can assist the driver and compliment any existing active safety features. Given its accessibility and portability, the smart phone can bring a driver assist to any vehicle without regard for on vehicle communication system requirements.

A dedicated hardware such as GPS devices and accelerometers in vehicles or cameras on roadside and near traffic signal is required.

The accelerometer sensor distinguishes the bumpy road from a smooth one. It can be used to detect single speed bumps and lengthier patches where the road is consistently bumpy. Once the accelerometer values are recorded there is a need to find the exact location. This can be done with latitude-longitude points of GPS system. The latitude-longitude information can be extracted from the location fixes returned by GPS.A GPS fix is the location identified by the GPS receiver.

In this system different features of road conditions are collected from three axis accelerometer and the exact location of these features of road conditions is located by the latitude-longitude coordinates of GPS system.

The sensors can also be used in an automobile for safety giving quick assistance to the people who got the accident. The fall detection and accident alarm system for the vehicle can gain attention because the system will save the life and give medical treatment on time. A wireless black box using accelerometer and GPS tracking system can be developed for accidental monitoring. In the event of accident, this wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member so that they can provide ambulance and prepare treatment for the patients. The system consists of cooperative components of an accelerometer, microcontroller unit, GPS device and GSM module for sending a short message.

An **accelerometer** is applied for awareness and fall detection indicating an accident. The speed of vehicle and threshold algorithm are used to decide a fall or accident in real-time. Mobile short message containing position from GPS (latitude, longitude) will be sent when vehicle accident is detected. The robust package design is implemented so that it is safe from water's spray and dust in environment. The module is aimed to be installed inside the vehicle.

Results Used:

Reviewing the research paper we decided on using the accelerometer sensor to find out the acceleration and the GPS module to check the current location of the device.

Source:

From references [2]

2.4 Using Crowdsourcing and MapReduce methods

Study

Road congestion has become a major problem in cities in developing countries resulting in massive delays, wastage of fuel and road accidents. For proper handling it is essential to observe the congestion patterns. Methods like on road cameras, etc. require huge investments whereas crowd-sourcing methods generate large amount of redundant data.

- Sensing road congestion and computing analytical data is challenging research area. Current technologies for sensing road traffic include the inductive loop system, using air borne cameras, image processing, RFID's or other active devices.

- Companies like Google, Tomnod and Waze are using crowdsourced location and speed data to estimate the on- road traffic and provide routing and real time updates with high inaccuracies and is not suitable for its real time application.

- Work is based on event sensing to estimate road traffic congestion without using any onboard electronic circuitry, and using MapReduce for analytics, thereby making this process both monetarily and computationally efficient.

- The proposed approach is that the road network can be modeled as a graph of connected lanes where a lane is a stretch of road between any two adjacent speed-breakers. Each lane is represented

Observations used

- A logical assumption is that the user will close the application whenever he is not driving.
- Only one application will be used in a given vehicle.
- Data will be sent after the accident.
- Location data will be collected through the GPRS.

Source:

From references[4]

2.5 Pothole Detection

Source:

From [3]

Study

Crowdsourcing can be utilized for collection of large data sets. Using standalone implicit crowdsourcing for collecting large data as it adds user incentive for providing data. Since most smartphones come with the sensors they become an ideal way for implementing crowdsourcing as they are an integrated part of the crowd.

- Approach to protect potholes is to record the value of acceleration along the z-axis of the device and specify a maximum value that this acceleration cannot cross i.e. the z-threshold value.

- For checking the sudden change of acceleration when a pothole is encountered, calculate the difference in the previous and the current value of acceleration and fix a threshold for this i.e. z-difference threshold value.

- To solve the problem of the dynamically changing axis, the accelerometer event data is used to get the value of gravity.

- If magnitude of acceleration recorded is larger than the threshold it is considered.

- The experimental data was taken from the crowd using smartphone sensing using the application for detection of pot holes in Bihar in India was 96.8% same when tested on the same area twice.

- So, large data set with more than 96% accuracy can be collected by the method of crowdsourcing, thus verifying its reliability.

- The large amount of data collected could be used to model the roadway of an entire city by collecting real time data from the sensors of the smartphones.

Observation used:

In accordance to the research, we will be using the accelerometer to calculate the acceleration due to gravity and the acceleration on the device and measure the threshold

2.6 Connecting accelerometer and checking accuracy of values obtained

In order to improve the traditional model of VANETS we made use of the accelerometer to get the acceleration values that helped us to obtain the:

I. Speed of the car.
II. Judge the State of the Vehicle i.e. at rest, motion, sudden stop, tilt and finally judge if accident has occur.

But checking the accuracy of the data obtained from accelerometer is a main concern.

Source:

From [6]

Study

Through this system they tried to study the road and driving pattern making use of mobile sensors like accelerometer and GPS.
Their system is able to detect real time potholes and also data for offline post-processing. Four algorithms have been proposed for detection of potholes.

The first two algorithms (Z-THRESH and Z-DIFF) are for real time detection and the other two (STDEV (Z) and G-ZERO) are used for off-line post-processing of data

All values of accelerometer sensor i.e. x, y and z are fetched from Smartphone's internal services and displayed to the user. Data was collected at time intervals i.e. 200ms (5 readings per second).

X-axis points toward right along the smaller side, Y-axis points up along longer edge and Z-axis points towards the sky perpendicular to the plane of the front face of the screen.

This system gives 10% false negative rate for bump detection and 21.6% false negative rate and 2.7% false positive rate for braking detection.Through their experiment they found out the following table:

Event	Axis Used for Detection	Threshold
Normal Braking	y-axis(in negative direction)	-1 to -3
Sudden Braking	y-axis(in negative direction)	<-3
Sudden Forward Acceleration	y-axis(in positive direction)	>3
Left Turn	x-axis(in negative direction)	<-1
Right Turn	x-axis(in positive direction)	>1
Pothole	z-axis (change in value from positive to negative)	±1.5
Bump	z-axis (change in value from negative to positive)	±1.5
Rough Road	z-axis (continuous occurrence of potholes)	±1.5

Table 3: Experimental Data

Observation

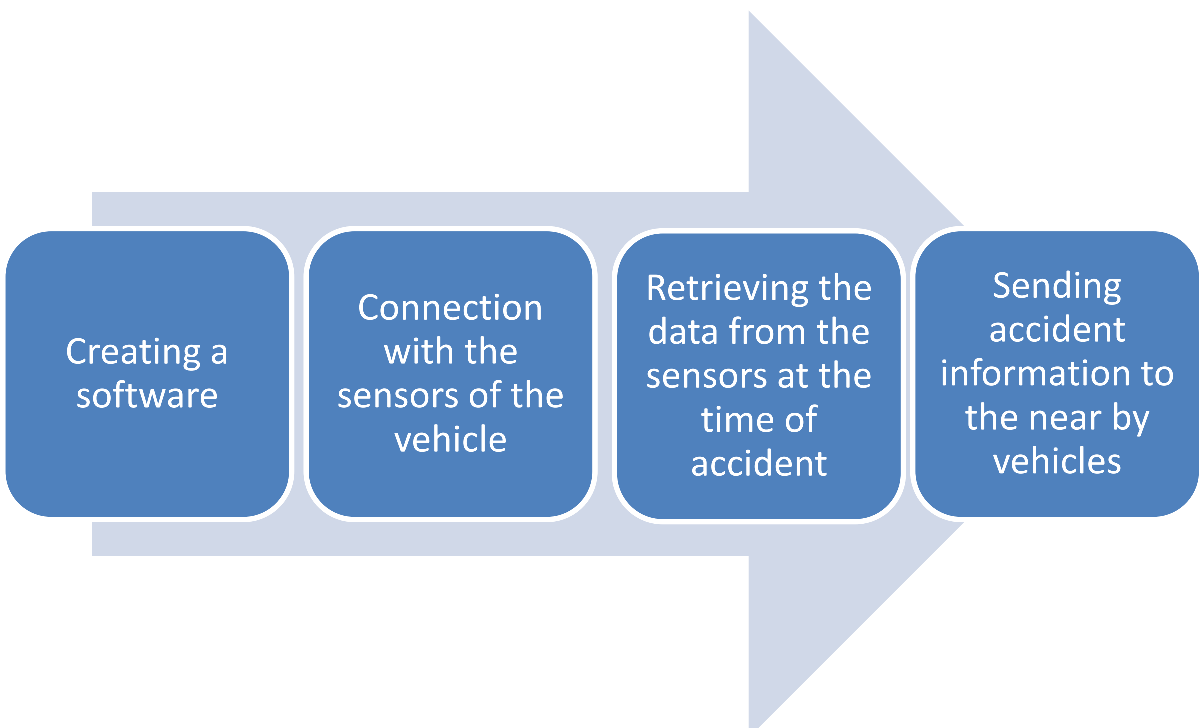
This experiment and research paper helped us to get a table classifying various driving events and road anomalies.

3. SYSTEM DEVELOPMENT

The project design required various components for designing the system and the mobile app. Various use case, activity flow, class diagrams were drawn to:

- Analyze the procedure how the app will be built
- The interdependence of various components on each other
- Overall flow of information among various components

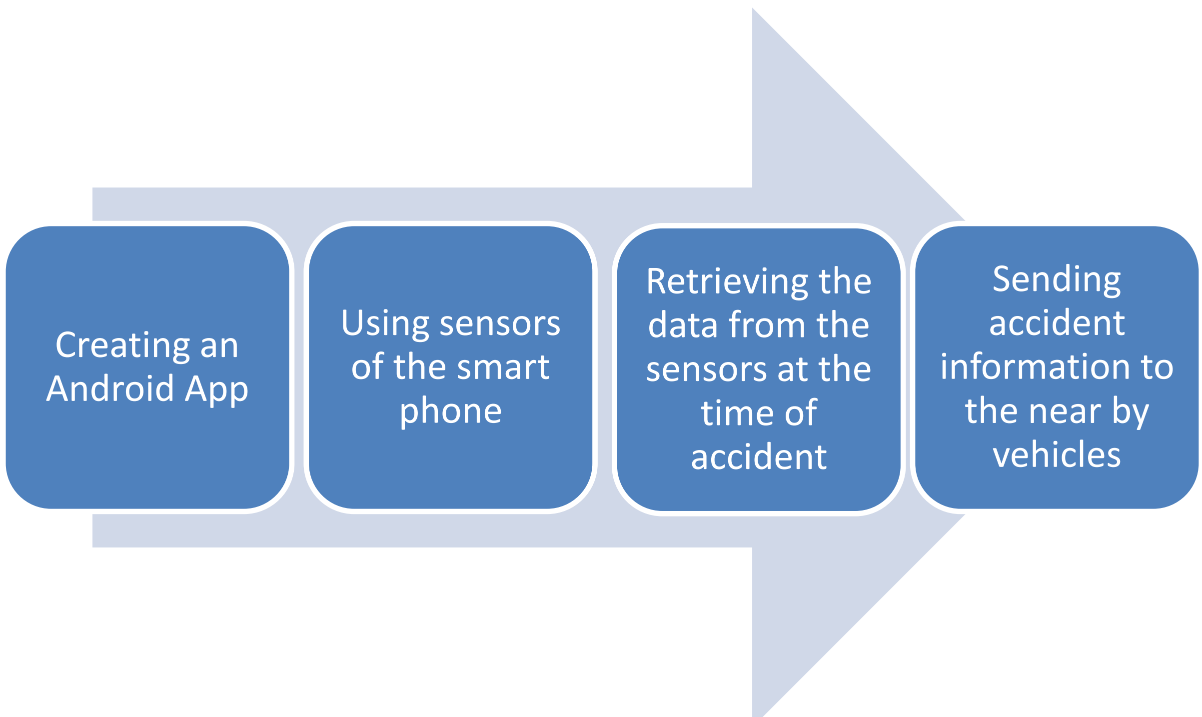
3.1 Traditional VANET structure



Sensors of vehicles included:

On-board wireless devices (*e.g.*, UMTS, IEEE 802.11*p*, Bluetooth, etc.) and sensors (*e.g.*, radar, lazar, etc.). But this added to **additional cost** to VANET system and required maintenance.

3.2 Project design



Sensors of smart phone include:

- Accelerometer /Digital gyro.
- GPS

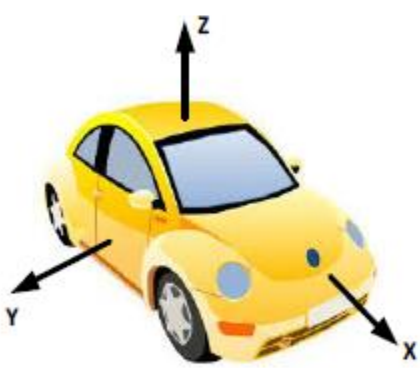
3.3 Assumptions:

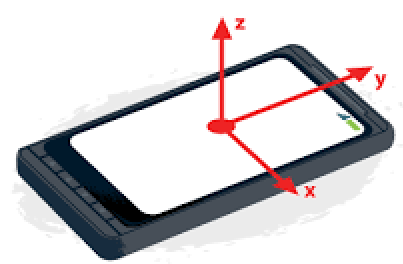
- Only one application is used in a given vehicle.
- User will close the application whenever he/ she is not driving.
- Data will be broadcasted after the accident has occurred.
- While detecting the tilt angle and concluding the danger degree of tilt is totally depend on the ground clearance of the vehicle because this is the major point of consideration for vehicle over turning.

3.4 Components:

a) **Accelerometer**:

- An **accelerometer** is a device that measures proper acceleration ("g-force").
- New smart phones are embedded with 3- axis accelerometer.
- Thus accelerometer will give us the acceleration phone is experiencing in all the 3 axis.
- In our project, we will use accelerometer to find the velocity of the vehicle and the angle car is making with the road i.e. the Tilt Angle.
- By measuring the amount of static acceleration due to gravity, you can find out the angle the device is **tilted** at with respect to the earth.





(b) **The Global Positioning System (GPS)**

The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

- In our app. it will provide the location of accident to the other users and central emergency centre.
- Most Android smart phones have *AGPS (***Assisted GPS)** chips installed**.**
- Android smart phones with AGPS chips can also have a lock with GPS satellites without the need of data plan or network but require time to have a lock with GPS satellites.

3.5 System Requirements:

- **Hardware requirements**:

  Android phone with:

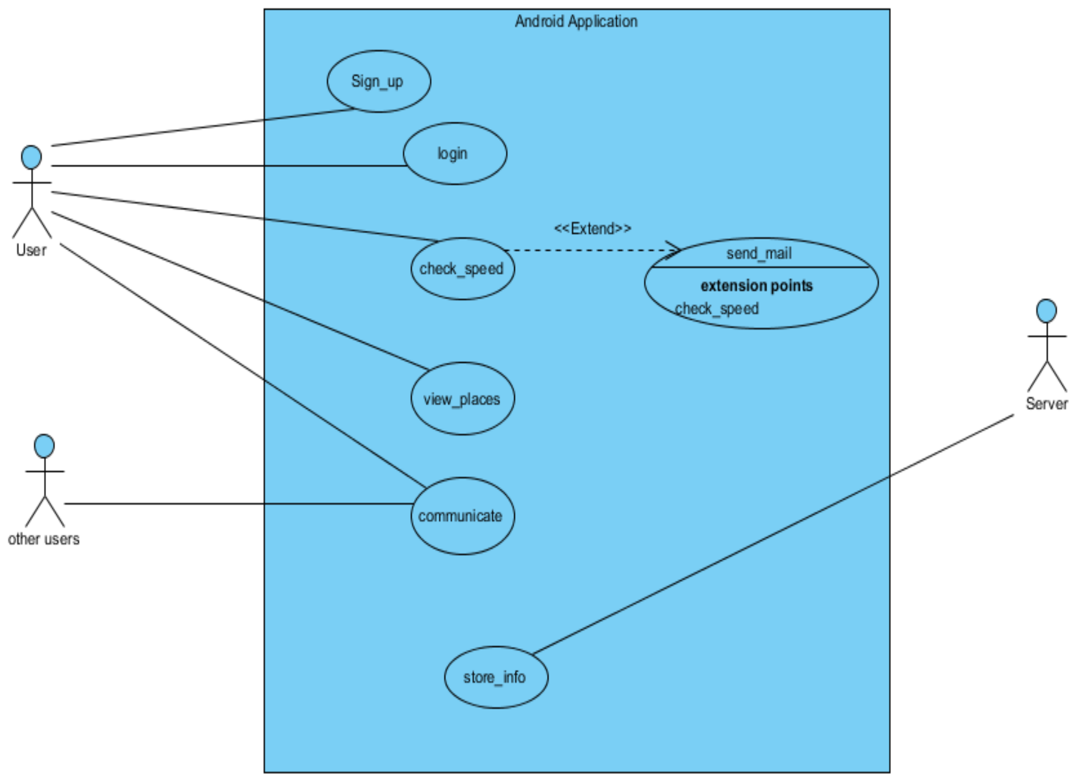
  a) CPU: 1.0 GHz and above
  b) OS: Android OS, version v4.4.4
  c) RAM: 512 MB and above
  d) Memory : 8 GB
  e) Accelerometer sensor
  f) GPS

- **Software requirements:**

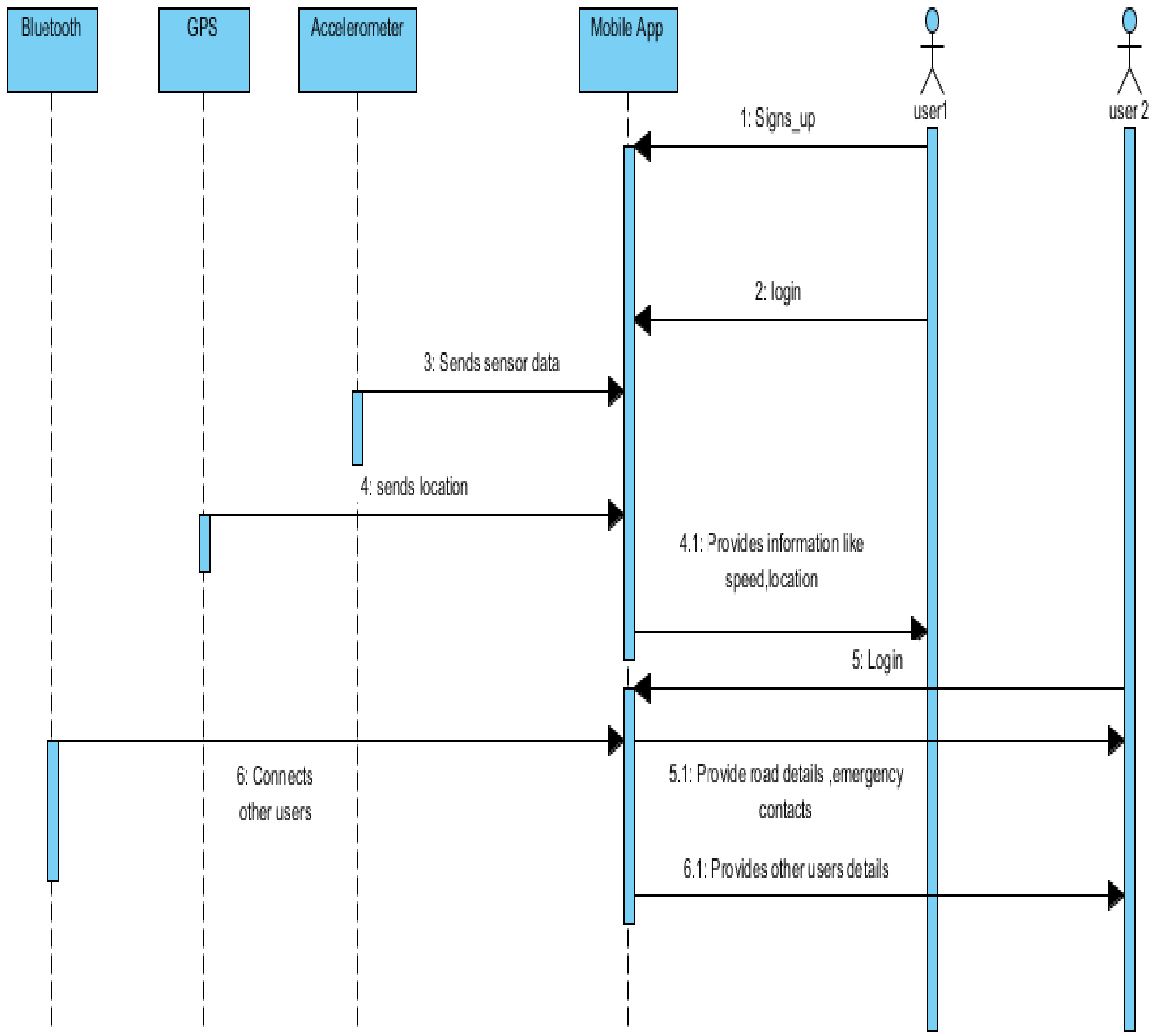
  a) OS: windows
  b) Software: Android studio

3.6 Diagrams

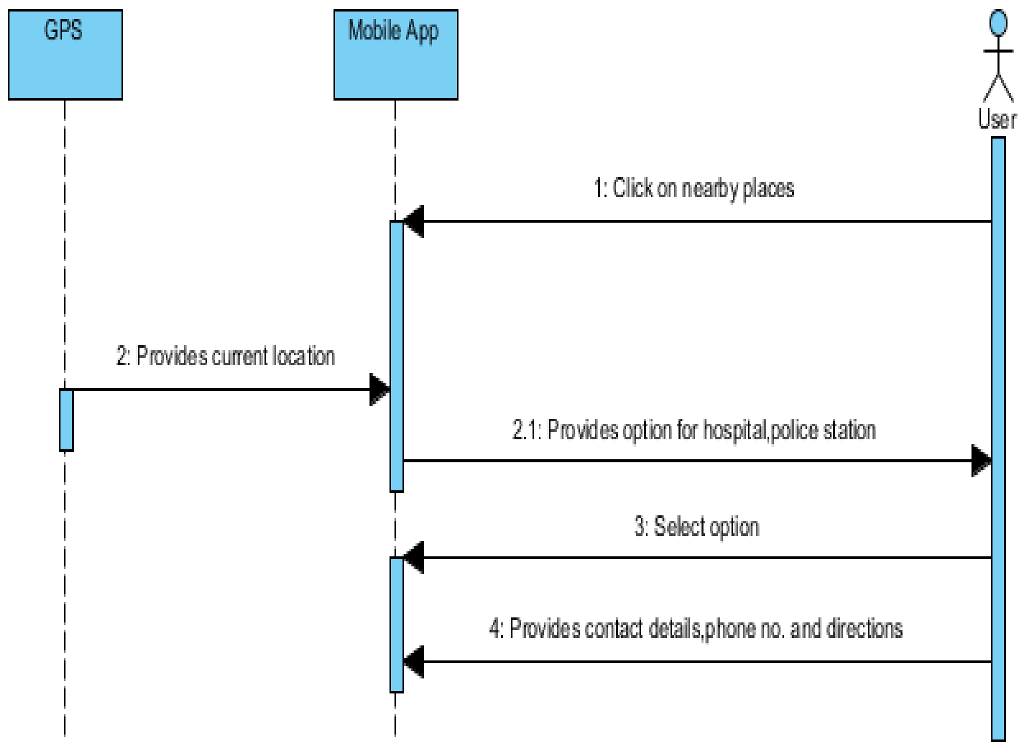
3.6.1 Use Case Diagram



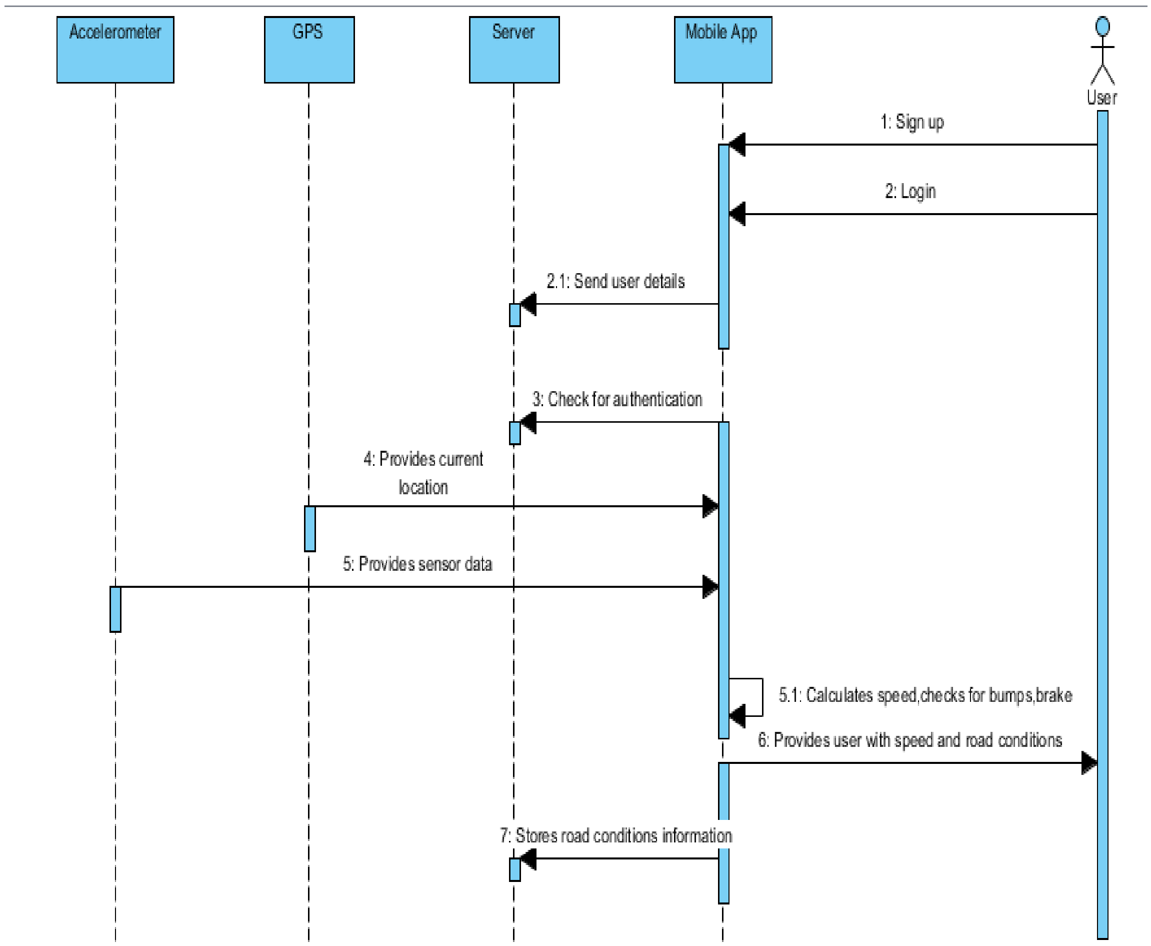
3.6.2.1 Sequence Diagram (Before Accident)



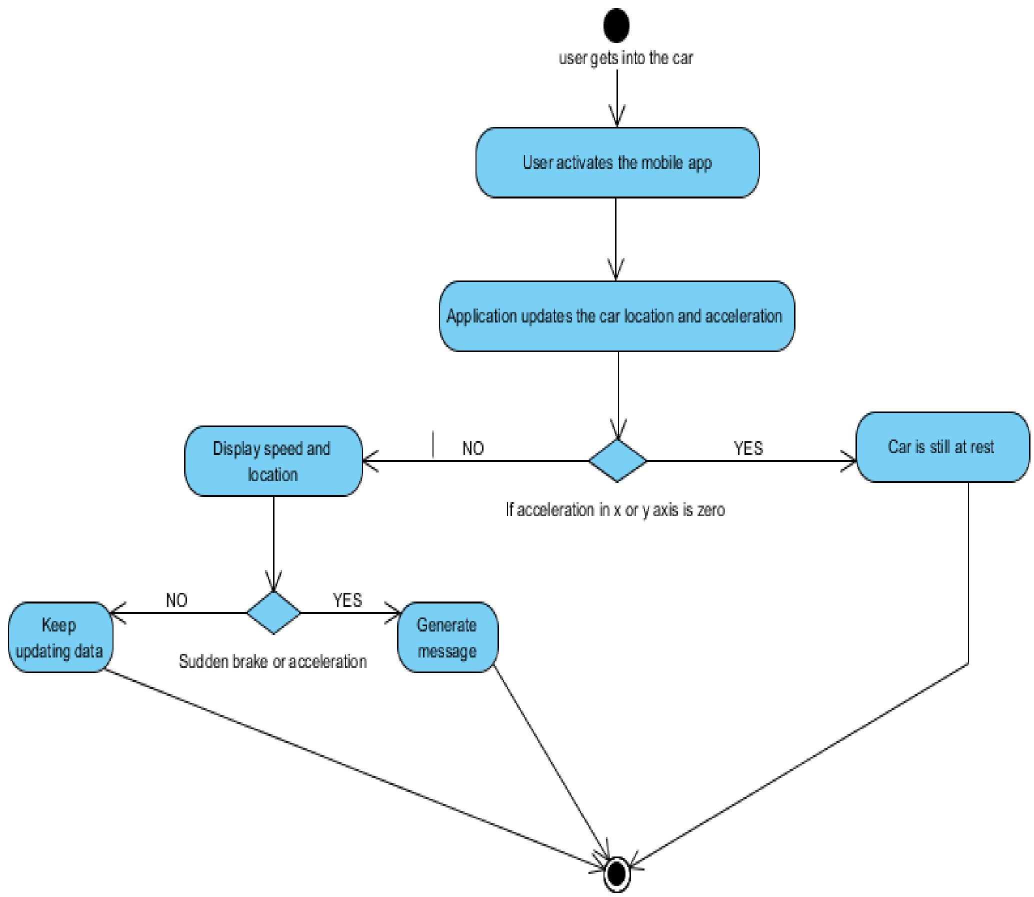
3.6.2.2 Sequence Diagram (After Accident)



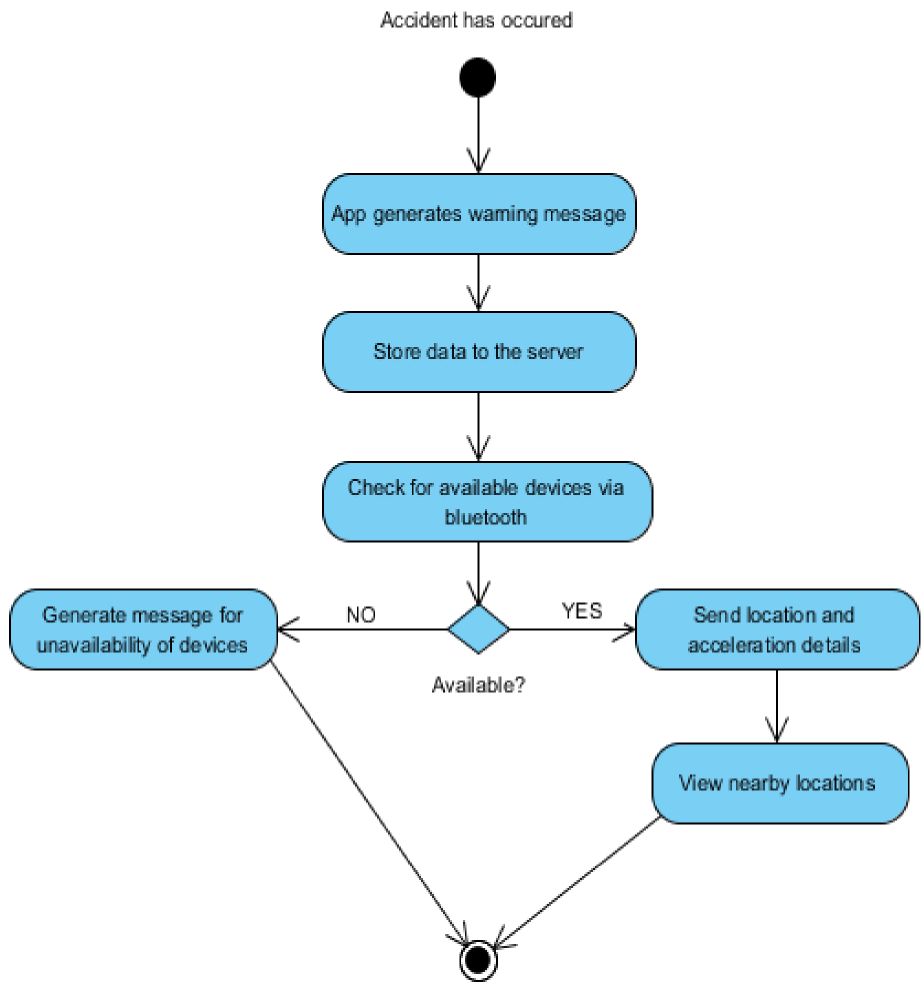
3.6.2.3 Database Connection



3.6.3.1 Activity Flow (Before the Accident)



3.6.3.2 Activity Flow (After the accident)



4. PERFORMANCE ANALYSIS

As we are using the accelerometer sensor of the smart phone, a few basics of the accelerometer are as follows:

The accelerometer is a hardware sensor used to detect a shake motion.

Hardware, software, and the user are melding in ways previously thought to be the stuff of science fiction. Hardware like touch screens, gyroscopes, and accelerometers is enabling software to detect physical user nuances. No longer is a keypad the only choice for interacting with your phone. At times simple gestures and motions can and do provide a more natural and immersive user experience.

An accelerometer is defined as an instrument for measuring the time rate of change of velocity with respect to magnitude or direction.

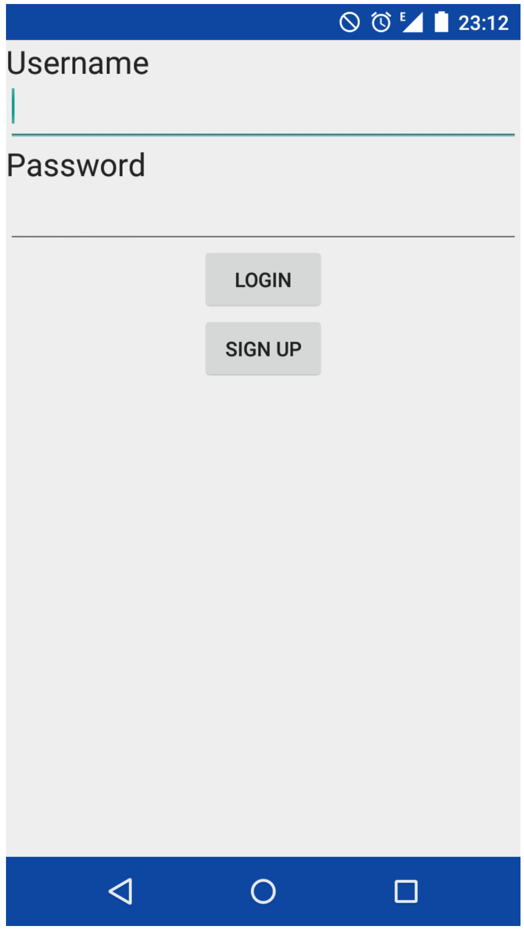
4.1 Features

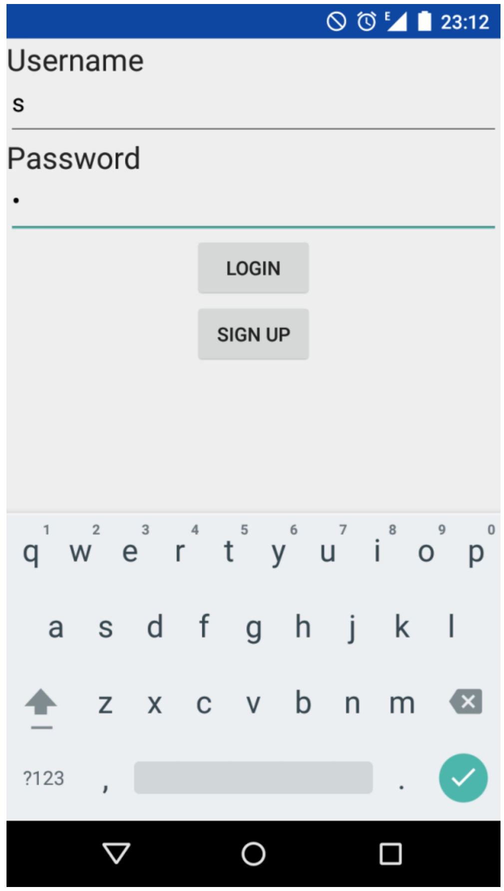
a) Security

In order to make sure that only authentic users can operate the app a sign up and login feature has been provided.

Presently SQLite is being used to store the information about the users and verify the username and password combination at the time of login. The main package is android.database.sqlite that contains the classes to manage the SIGN-UP database.

Once the app is used on large scale all the user data will be stored on server in encrypted form. This is important so that the location and travelling details of users are kept confidential and privacy of user is not compromised.


23:12
Username
Password
LOGIN
SIGN UP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Username
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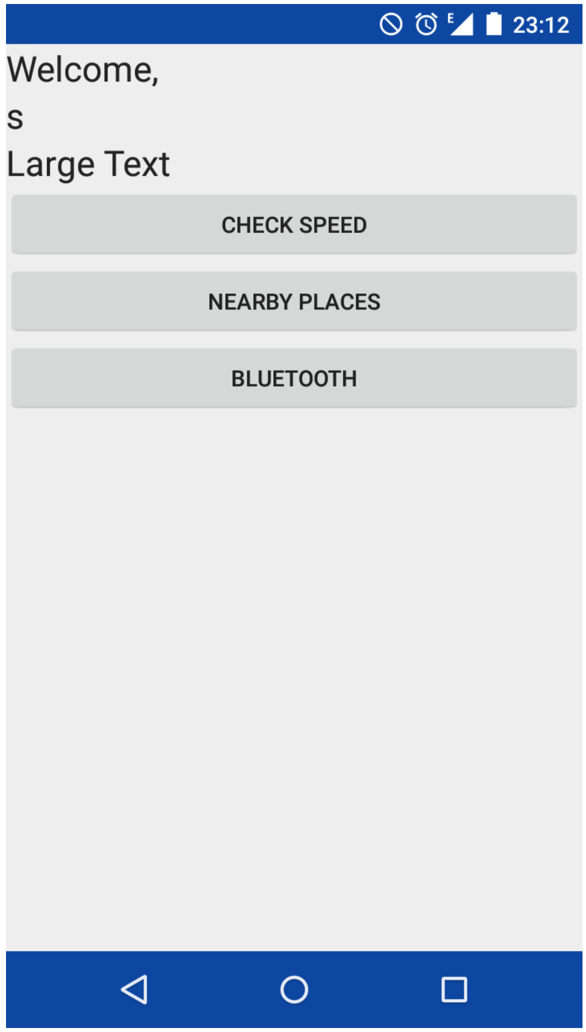
Password
LOGIN
SIGN UP
?123



Welcome page of the Application wherein users can access various features, namely, Check speed, Nearby Places and Bluetooth connectivity.

b) Speed and road conditions

Mobile sensor i.e. accelerometer is being used by the app to provide user speed. Accelerometer is a device that measures proper acceleration which can be easily used to calculate speed by:

First calculating net acceleration.

Then using the first law of motion v= u+ at.

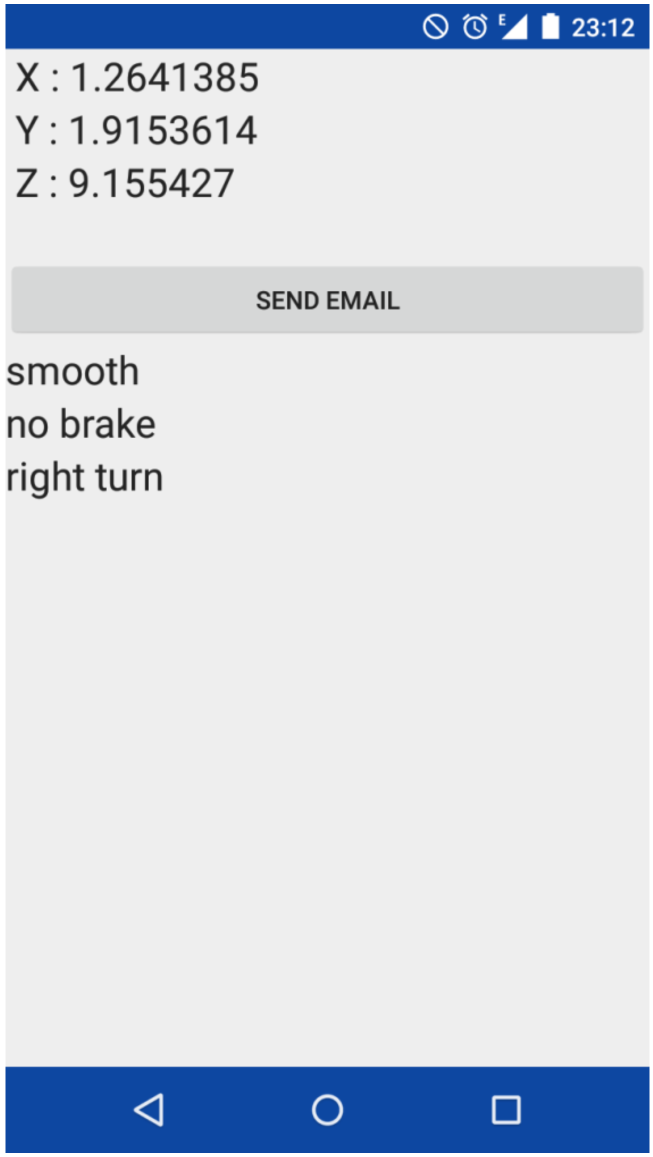
Further using following data we can actually examine the conditions of road and record the places where there are

1) Sharp turns

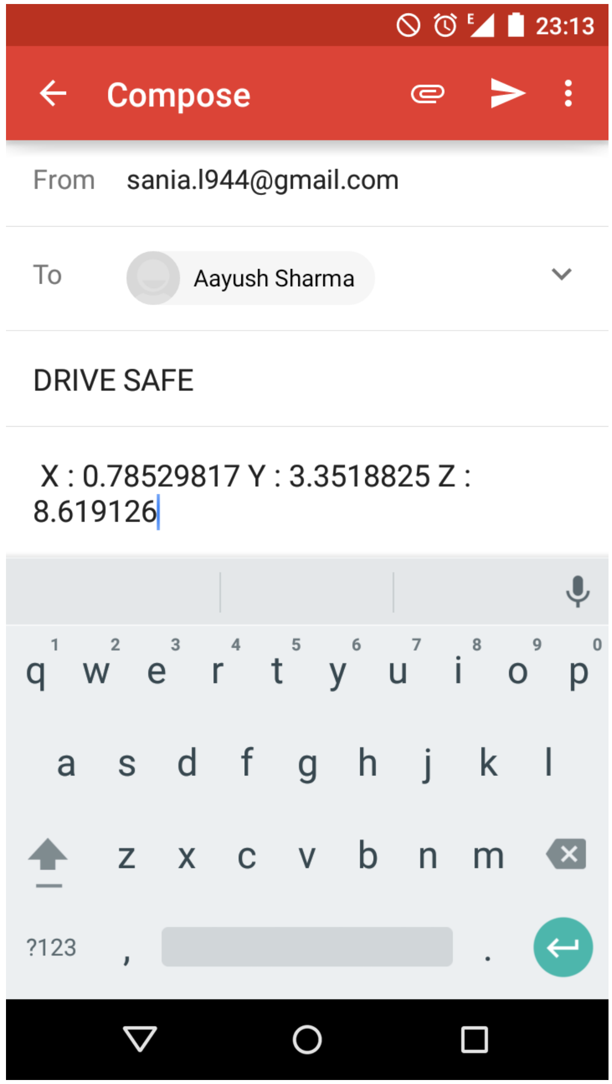
2) Potholes

3) Areas which require sudden brakes (accident prone areas)

Once recorded on the server the data can be shared with all the users of the app and hence help to provide safety for the drivers.

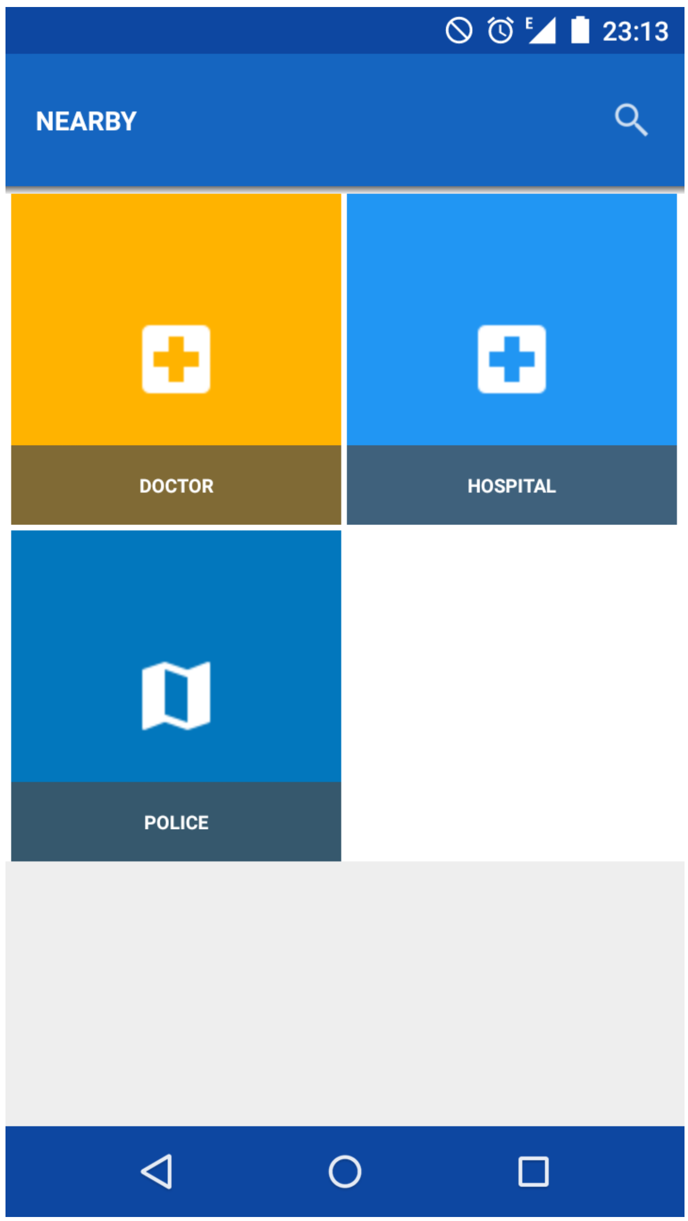

23:12
X : 1.2641385
Y : 1.9153614
Z : 9.155427
SEND EMAIL
smooth
no brake
right turn

C) Sending data via email

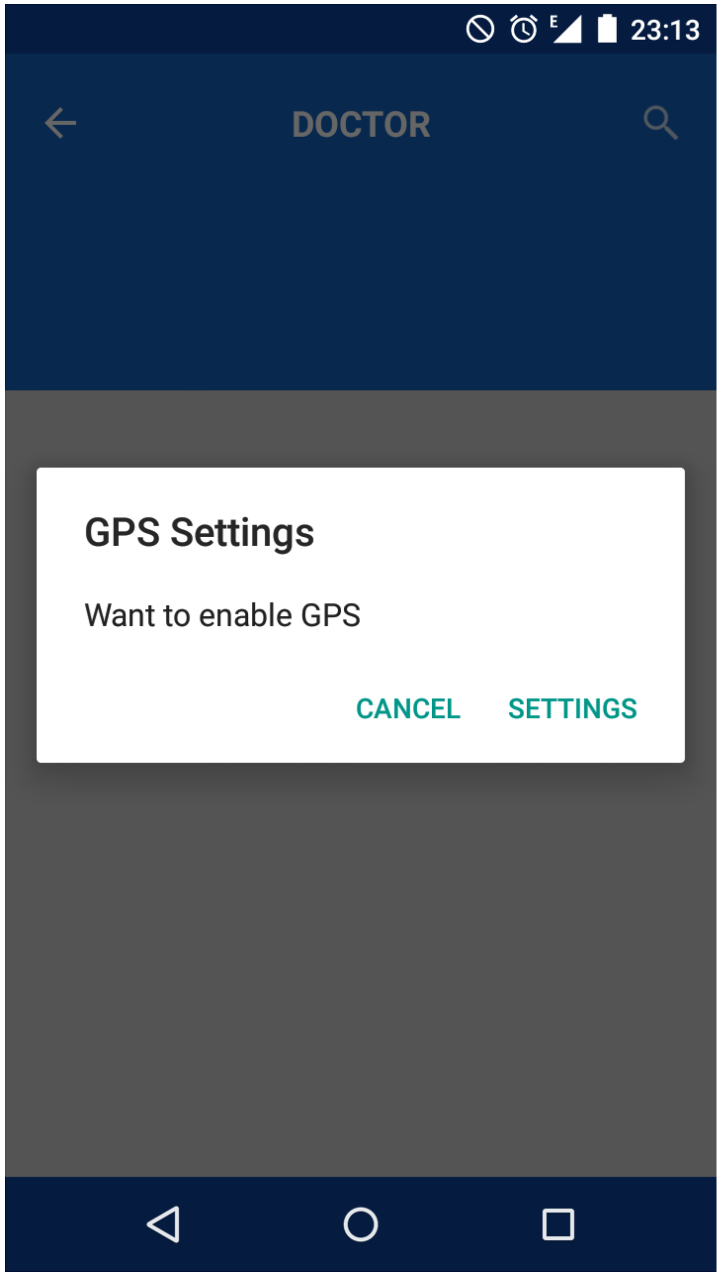


c) Emergency contacts

In case of any emergency (accidents, medical emergency, theft etc.) the user can easily get the location, the contact numbers as well as directions to the nearby places.



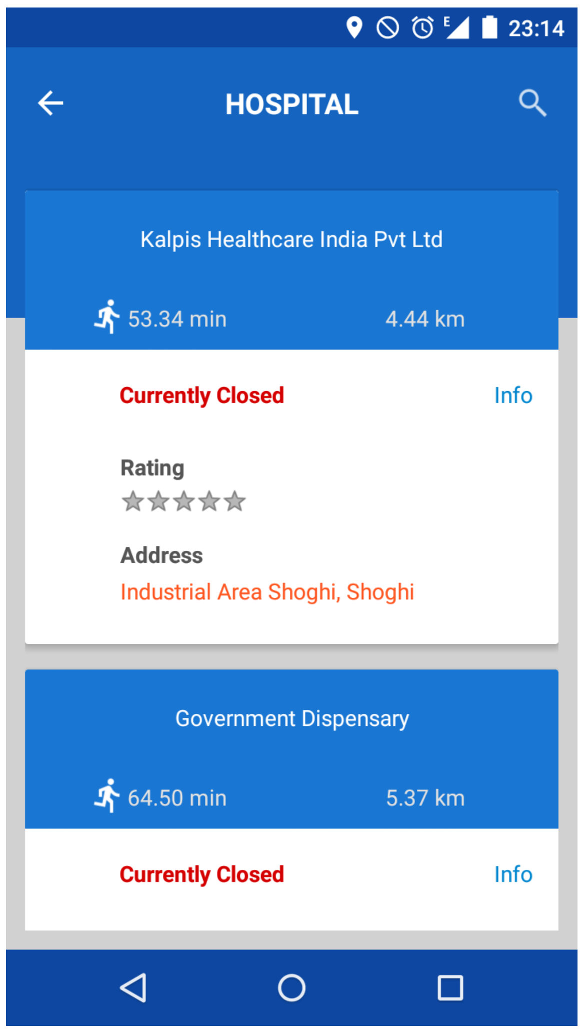
Firstly, enabling the GPS for location on map.



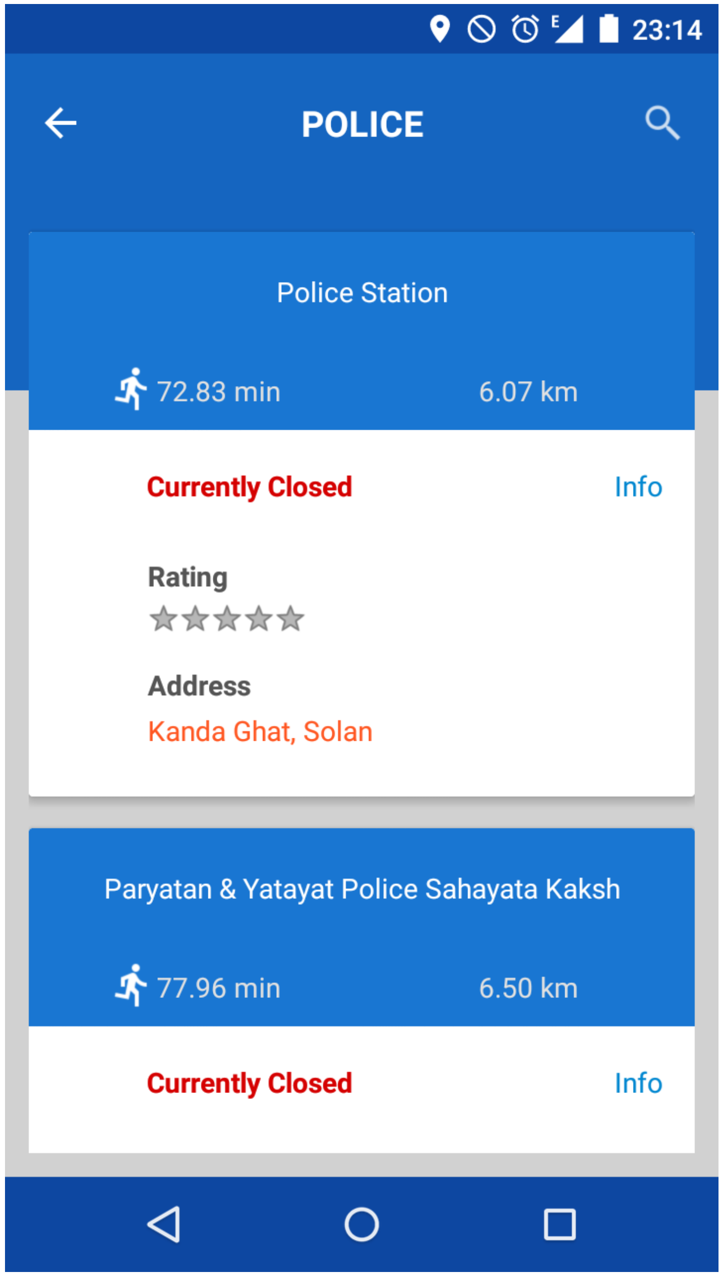
To provide this feature the app makes use of GPS. The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

Thus this will ensure that all the users are safe and can locate and reach the nearby hospitals and police station as soon as possible to avoid any sort of mishaps.

1) Nearby Hospitals



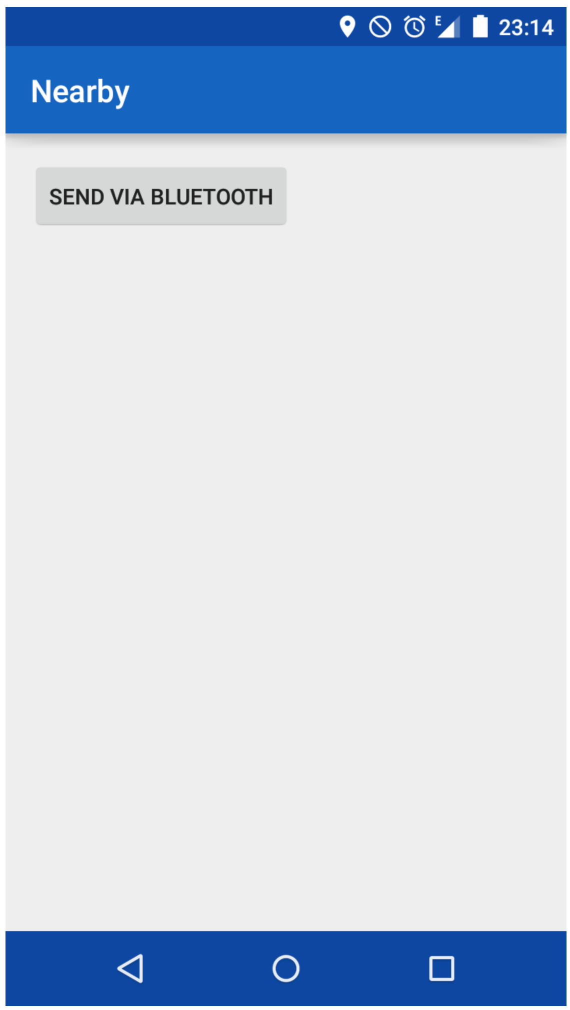
2) Police station

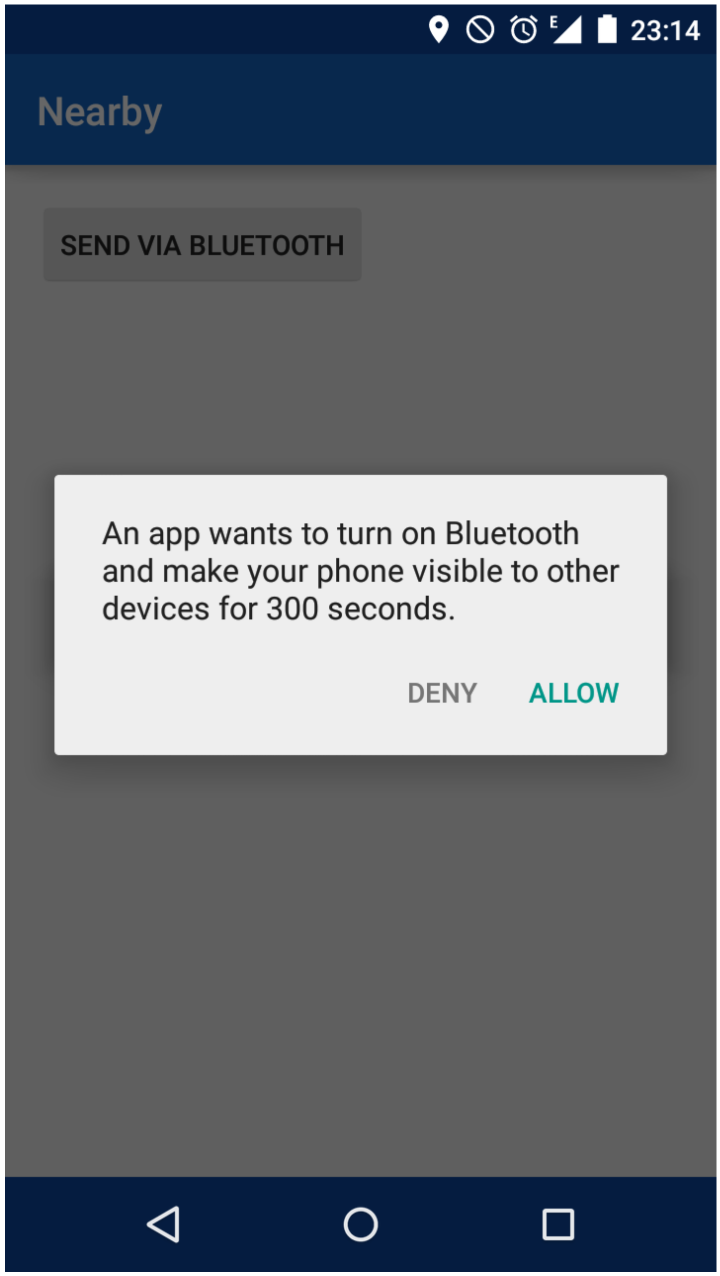


d) Communication

This app will also make sure that all the users on road will stay connected and share all their information like speed, road conditions that they have examined with other drivers (app users) on road itself.

For this the app will use Bluetooth to send the information between different mobiles and to different users.

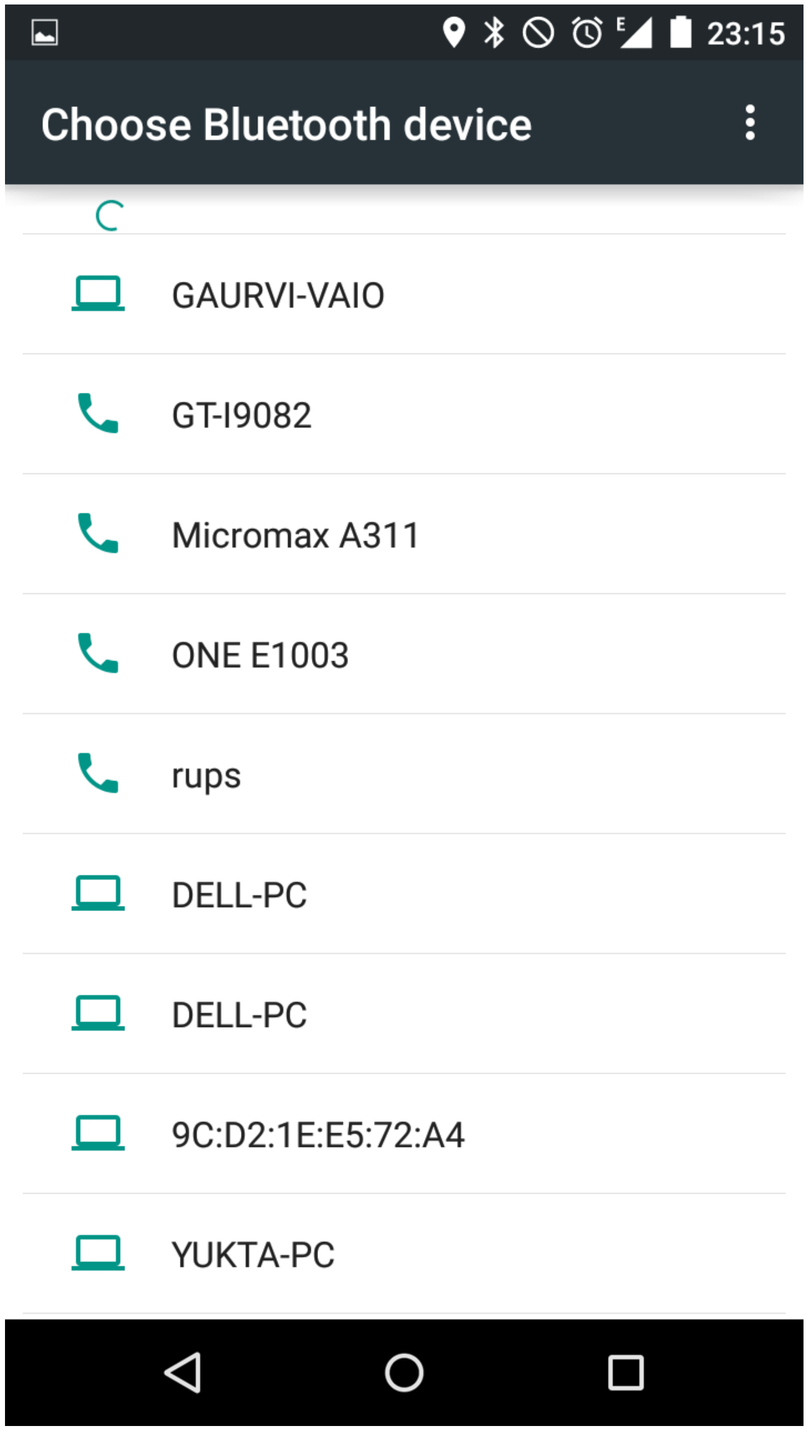



23:14
Nearby
SEND VIA BLUETOOTH
An app wants to turn on Bluetooth and make your phone visible to other devices for 300 seconds.
DENY
ALLOW

The range of Bluetooth used in mobile these days are as follows:

Device Class	Transmit Power	Intended Range
Class 3	1 mW	less than 10 meters
Class 2	2.5 mW	10 meters, 33 feet
Class 1	100 mW	100 meters, 328 feet

Hence Bluetooth will make sure on road connectivity and info sharing between users.


23:15
Choose Bluetooth device
GAURVI-VAIO
GT-I9082
Micromax A311
ONE E1003
rups
DELL-PC
DELL-PC
9C:D2:1E:E5:72:A4
YUKTA-PC

5. CONCLUSIONS

5.1 Conclusion

Smartphone has a very significant impact in terms of performance, thus designing and developing an integrated software/hardware framework, especially for Vehicle. We are designing a smart phone-based platform that exploits low-cost dedicated hardware to interact with sensors on board and in the vehicle surroundings. The achieved system records driving behavior of vehicles and uploads to the cloud server for further solicitations. For an example, if the system detects the vehicle unsafe driving behavior, the vehicle location will be updated in clouds and an alert message will be issued to precise user. They are able to track the movement of this vehicle. In addition, in a traffic accident, the system is helpful to elucidate the accountability timely. The future work will be hardware design of the proposed architecture.

From the project done till now, we can conclude that this system can prove to be a promising system. If implemented on a large scale, streaming data can provide us interesting statistics. Additionally, this system can detect false alarms and alert messages, which is very crucial part. Furthermore, the data from this sensor can improvise the prior results from other systems.

5.2 Future Works

1) First step would be to store all the data i.e. user information and road condition data (bumps and sharp turns with their exact location) on a server which is fully encrypted.

Encryption will ensure that privacy of the user is unharmed and this ways road conditions can be well monitored and users can be provided with full details of the road while he is driving on it i.e. if any sharp turn or bump is arriving. This would make driving more safe and secure.

2) In case the user is driving in an area where there is no net connectivity, then the app should retain all the data in the phone's internal memory itself and as soon as the internet connection is again established the entire data is sent to the server.

That is we will try to make our network delay tolerant.

3) To make the app respond to emergency automatically.

If a sudden brake is applied after which the car stops moving, the server will send a message to the app to know if user is fine.

The acknowledgment of this message will be time sensitive. If the user responds back to the server's message on time then user will be recorded safe and if no response is obtained in a particular duration of time then the server will automatically send emergency to car's current location.

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