

**A STOCHASTIC SOLUTION TO ROAD SAFETY ISSUES  
IN DEVELOPING COUNTRIES LIKE  
BANGLADESH**

**BY**

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This Report Presented in Partial Fulfillment of the Requirements for the  
Degree of Bachelor of Science in Computer Science and Engineering

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## **APPROVAL**

This Project titled “**A STOCHASTIC SOLUTION TO ROAD SAFETY ISSUES IN DEVELOPING COUNTRIES LIKE BANGLADESH**”, submitted by **Kazi Rakib Uddin; ID: 151-15-5175** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering (BSc) and approved as to its style and contents. The presentation has been held on 11-12-2018.

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## DECLARATION

I **kazi rakib Uddin** ID:151-15-5175 hereby declare that, this project has been done by us under the supervision of **Israt Ferdous, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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I would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, I must acknowledge with due respect the constant support and patients of our parents.

## **ABSTRACT**

The project “A stochastic solution to road safety issues in developing countries like Bangladesh” is a model based on Android platform. The main objective of this model is to create a safe and modern road system that can reduce major road hassles like accidents. In this model the accident prone areas such as school, hospital, or any other academic campus sided roads are marked with their geolocations. And those geolocations are centered with a circle. So whenever a vehicle with an integrated android device where the proposed system is installed come across those circles they will identify that particular area. And we can also put limitation to the speed of the vehicle to avoid accident on that particular area. If the vehicle crosses the limit the android device will notify the sergeant who will take the necessary action.

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# CHAPTER-1

## INTRODUCTION

### 1.1 Introduction

Intelligent Transportation System (ITS) is a system that includes intelligence in transportation system. ITS increases awareness about the surroundings of a vehicle to its own system and the driver by enabling communication between vehicles and road side infrastructure. ITS is a revolutionary step to driving assistance systems, aiming at increasing safety, comfort and mobility.

### 1.2 Motivation

As Bangladesh is a developing country there is not much of scope to implement the ITS. The cost will be so high that the people will not be able to take the advantages of ITS. If we consider the road safety issues in Bangladesh that is the current big issue which can be solved with the help of ITS. Thousands of people dies in every single year in Bangladesh. Here is a dead, injured statistic for last eight years.

Year	Number of Accidents	Deaths	Injury
2009	3381	2958	2686
2010	2827	2646	1803
2011	2667	2546	1641
2012	2636	2538	2134
2013	2029	1957	1396
2014	2027	2067	1535
2015	2394	2376	1958
2016( up to July)	1489	1422	1289

Figure 1: injured statistic for last eight years

So here we can see it's a never ending issue that must be solved. Its not possible to stop road accidents entirely but we surely can reduce it. So I decided to do something that will help us to reduce road accidents in Bangladesh.

### **1.3 Overview**

Android systems are now available and also cheap compared to other operating systems. My idea is to use android technology as the main base of my model. And I am going to use the googles Geofencing technology to create fences across the country. There are so many places which are accident prone. So in this model I included those places like school or any other academic building side roads and hospital road sides in fences. And the vehicles will have an android system which will detect such geofences. Whenever a vehicle will come across a geofence then the system will be activated and will monitor the vehicles activity. There must be installed static road side nodes which also run android operating system. The road side node will automatically be notified if the vehicle violates any of the rules that are written in its function. Then the road side node will search for its nearest sergeant and notify the sergeant about the threat he received from the particular vehicle. Then the sergeant can take immediate action.

## **CHAPTER-2**

### **LITERATURE REVIEW**

As ITS is a new concept and its growing fast, there are so many works regarding ITS. Most of them discussed about the infrastructure of ITS and they proposed some models that will help ITS in some manners. None of those models are cost efficient or targeting any ongoing problems in third world countries.

For example in the paper “UAV-Enabled Intelligent Transportation Systems for the Smart City: Applications and Challenges”[1] they proposed a model which includes aerial vehicle or we can say some sort of drones that will assist the ITS. In their model there will be some flying road side units (RSU) which will record the incident scenes. After capturing the scene they will conduct the multihop communicator which will inform the LTE base station and then the base will take necessary initiatives. But this whole process make sense when there will be autonomous transportation system. But developing countries like us doesn't have an autonomous transportation system. We cannot afford such system. We need something more cost efficient.

There is another paper titled as “Integration Challenges of Intelligent Transportation Systems with Connected Vehicle, Cloud Computing, and Internet of Things Technologies”[4]. They made a fantastic point on integrating the emerging technologies such as connected vehicles, cloud computing, and the Internet of Things. They also discussed the challenges for connected vehicles and the integration of cloud computing with its. But as I said earlier these things only make sense when there is an autonomous transportation system.

When everyone is talking about the connected vehicles which is not available in developing countries like us neither we can change it overnight.

So I decided to come up with something more cheaper and more easier to implement. My model only requires the vehicles to have an integrated android system which is connected to the internet. And some road side units which is also an android system.

# CHAPTER-3

## MODEL DESIGN

### 3.1 Model Description

The following figure 3.1 shows the design of the model

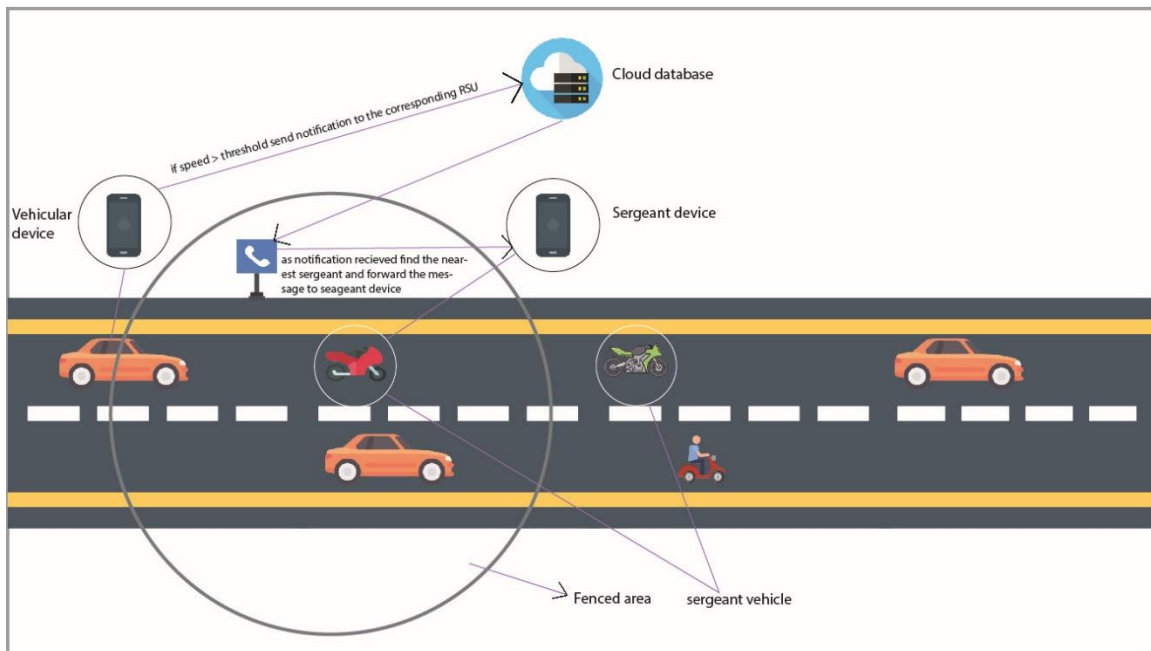


Figure 3.1: Example of the structure of the model

From the above figure we can see that how my model will work. To describe that elaborately I will break it into three major parts.

- Vehicular device
- Sergeant device
- Road side unit (RSU)

**Vehicular device:**

In the device the driver will register with necessary information. For example his NID number, driving license number, vehicles registration number etc.

There will be predefined geofences in that application. Each and every fenced area will have a road side unit. Whenever the device will come across a fenced area it will instantly get its speed. Then it will compare its speed with the predefined threshold value. If the speed is greater than the threshold then it will generate a string message with necessary information. For example the vehicles registration number, the speed of the vehicle etc. and then the message will be sent to the corresponding road side unit of that particular area. The message will first be saved in the cloud database and then will be sent to as a notification to the road side unit. That's the end of vehicular devices function.

**Sergeant device:**

In sergeant device sergeant will go through the same process of registration. He will have to register with his ID, driving license number, vehicles registration number etc.

In sergeant device there is not much of a function. the sergeant device will continuously update its location on the cloud database. And it will receive notifications from the road side node whenever there will be a violation of rule.

**Road Side Unit:**

There will be one road side unit in every fenced area. And the road side unit will act as a bridge to the system. It will receive notifications from the vehicular device whenever a vehicle violates the rule. And then it will search for the nearest seargent. As soon as it will find a sergeant it will notify the sergeant about the incident.

### 3.2 Model Demonstration

Now as we have a clear idea about how the model works it is time to discuss about the core functionalities of my model. To check the feasibility of my model I have created some Android applications. They will demonstrate some functions of main components of this model. And these main components are

- Creating and monitoring Geofences[6]
- Getting speed of the device
- Sending notification from one device to another through cloud database
- Finding nearby device

#### 3.2.1 Creating and monitoring Geofences

Here I will only discuss about how Geofence work. Geofence is nothing but a geographical fence. It has multiple transitions

Figure 3.2 shows the structure of a geofence

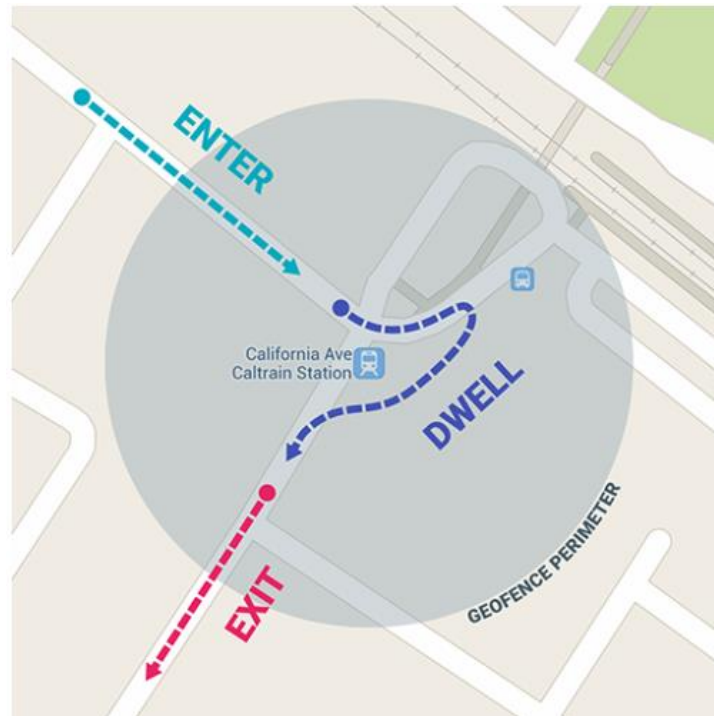


Figure 3.2: Geofence structure

Here we can see the three transitions are Enter, Exit and Dwell. I used two of the transitions.

Here Figure 3.3 shows how geofence works.

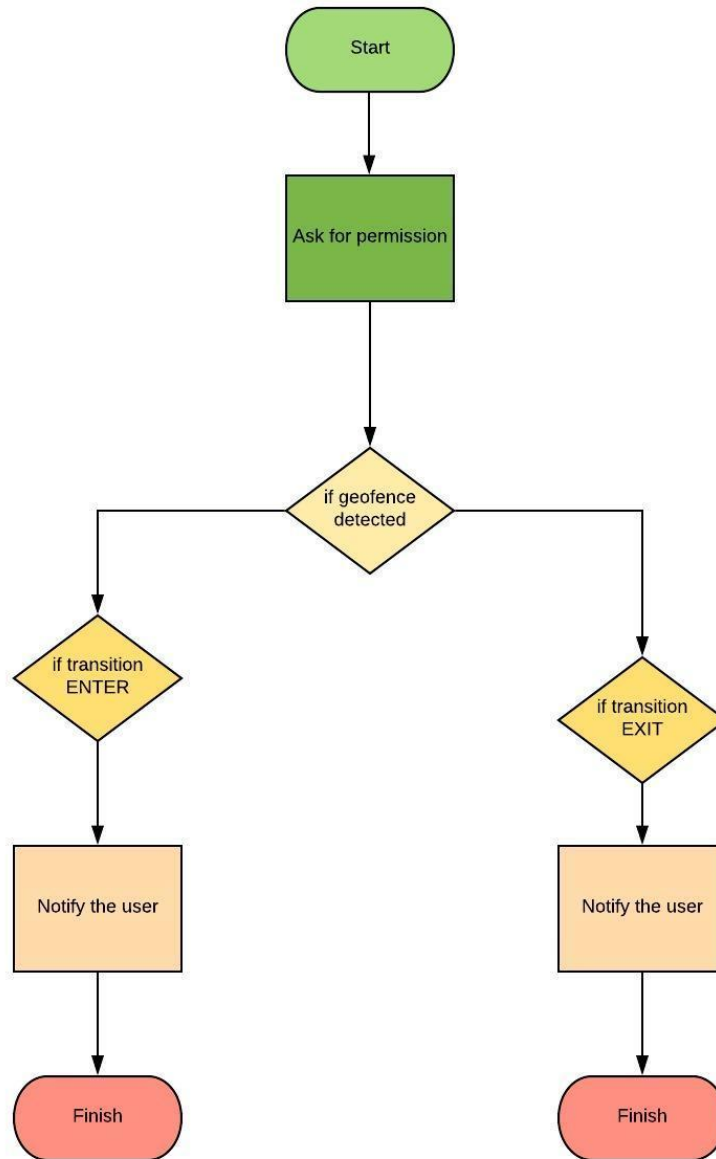


Figure 3.3: Geofence flowchart



### 3.2.2 Getting speed of the device

We can detect the speed of an android device with the help of GPS. The work is pretty simple. At first we have to connect to the GPS if the device is connected to the GPS then we will be able to get the device speed with the help of related functions. The speed will be given as m/s. we can convert it as we want.

Figure 3.4 shows the process of getting the speed of an android device

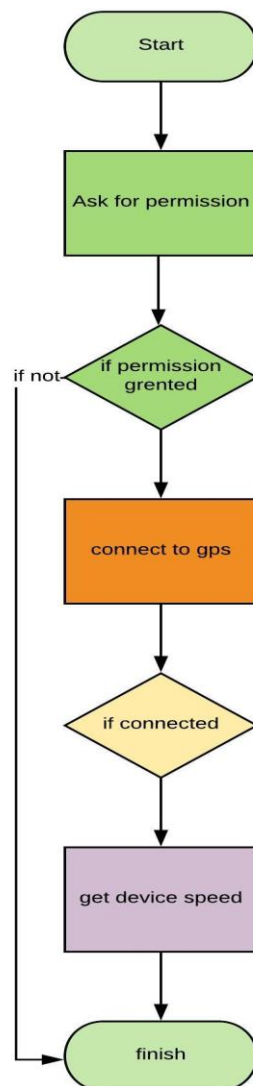


Figure 3.4: speedometer flowchart

### 3.2.3 Sending notification from one device to another through cloud database

Sending message as a notification from one device to another is a complicated task. For the ease of identification I have used an authentication with email and password. In my demo application a user first have to register with his name, email, and password. And each and every time the user will have to authenticate himself by logging in with the email and password he provided at the registration process. After logging in the user will have a list of users who are registered. Then the user will be able to send whatever he wants to send to another user.

Figure 3.5 shows the process of sending message as a notification from one device to another.

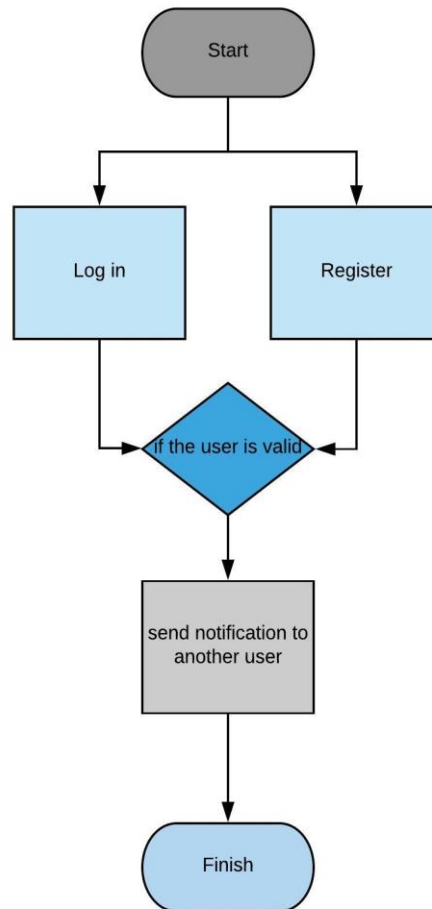


Figure 3.5: push notification flowchart

### 3.2.4 Finding the nearby device

This particular job can be divided into two parts. Device which will be registered into the system and another device to find the nearest among those registered devices.

Here sergeant will be registered to the system as I mentioned earlier. After the registration process when they will be logged in there device will continuously upload their locations latitude and longitude to the cloud database. Here is a flowchart of that process.

Figure 3.6 shows the process of user registration and updating their location to the cloud.

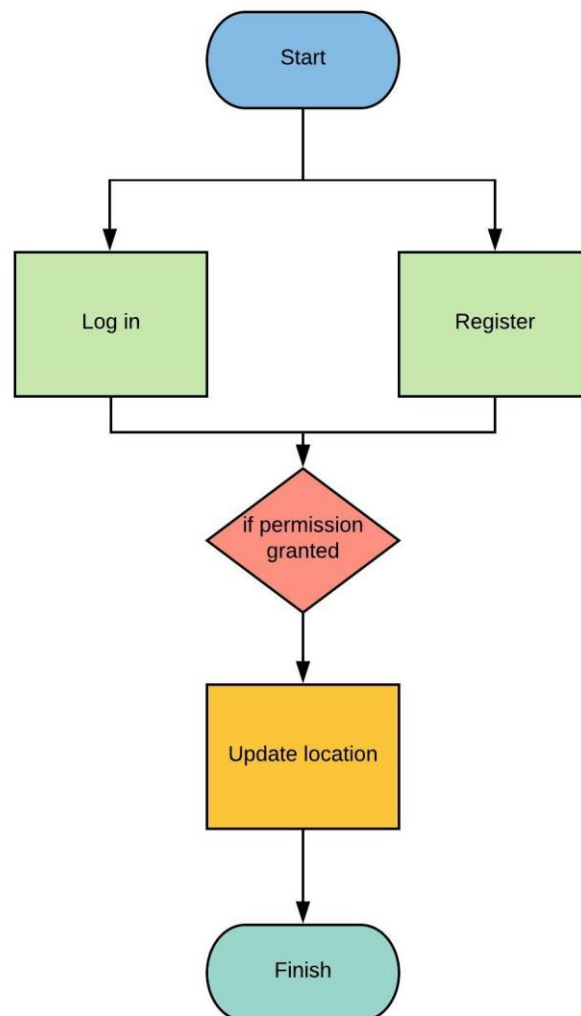


Figure 3.6: sergeant registration application flowchart

The other device which will search for the nearest device it will get the data from the database and get its own location. Then it will run the **Haversine algorithm** to calculate which device is nearest.

Figure 3.7 shows the process of finding the nearby device which have already been registered.

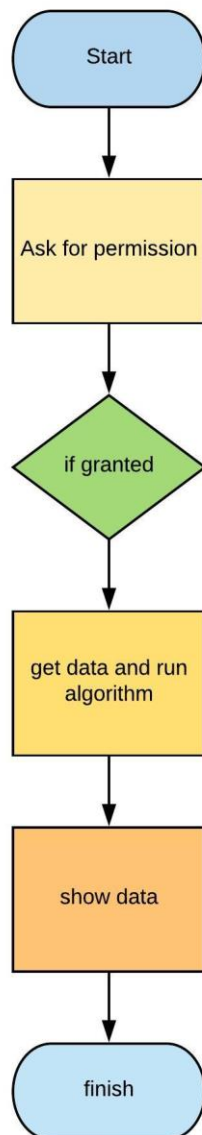


Figure 3.7: nearby finder application flowchart

## CHAPTER-4

### FEASIBILITY STUDY AND SIMULATION

#### 4.1 Introduction

In this part I will discuss about the tools and techniques that I have used to create the demo applications to check the feasibility of my model. As I have worked on android platform and also used firebase I will discuss about the android platform and firebase.

#### 4.2 Android platform

Android [5] is a mobile operating system developed by Google, based on a modified version of the Linux kernel and other open source software and designed primarily for touchscreen mobile devices such as smartphones and tablets. As android is open source anyone can develop android applications. To develop android applications there is an IDE provided by Google named as Android studio. I have developed my applications using Android studio.

#### 4.3 Firebase

Firebase [7] is a cloud database which is now a Google property. It is both free and paid. You can take the free services provided by firebase. But if you need more then you have to pay. Firebase offers so many things like a real time database, firebase cloud messaging, firebase authentication etc.

In real time database one can store their data in a structured way. That can be linked with android or web applications.

Firebase cloud messaging is a cross-platform solution which can be used to send notification from one device to another.

Firebase authentication is a service that can be used to authenticate users only using client-side code. It supports social log in providers like facebook, google, github etc.

## **4.4 Simulation**

Now I will discuss about the functionalities of my applications. There are a total of five applications. We will discuss one by one

### **4.4.1 Geofencing**

As I already have discussed how geofence works now I am going to discuss about how I have created geofences and how my application works. As my model is to provide road safety at first I will have to find where to provide that safety. As I mentioned earlier that there are so many places that are prone to accident. And from some recent incidents i have been inspired to include school side roads too. the aim is to find the latitude and longitude of those places and declare them as a geofence.

To demonstrate that I have crated two geofences. One is my home and another one is my university. what I had to do is get the latitude and longitude of those two places and give a radius that how big the fence should be. I gave it 200 meters. So if I am within 200 meters of my home or my university my phone will notify me that.

Figure 4.1.1 shows the opening page of Geofencing application

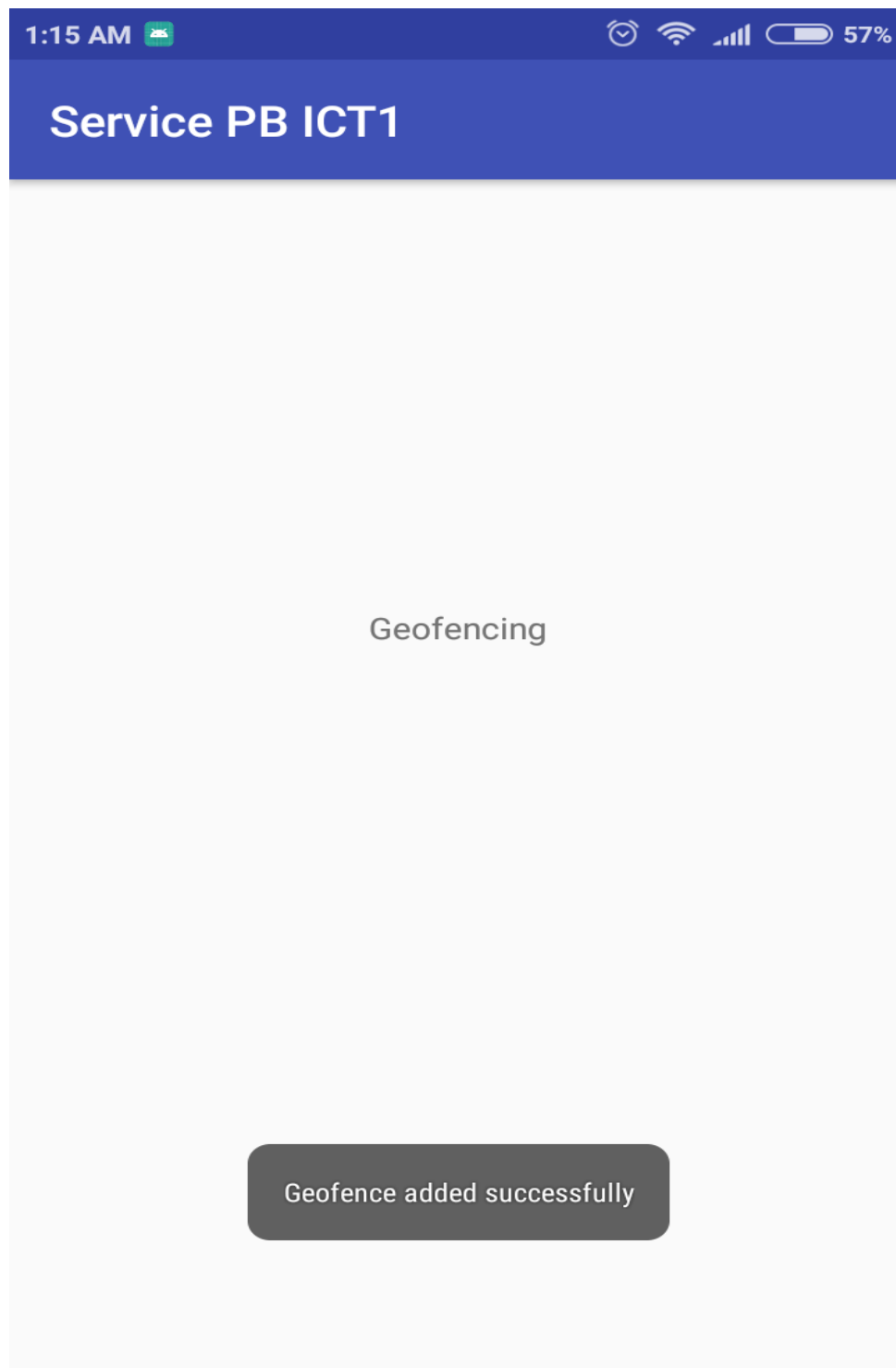


Figure 4.1.1: opening page of geofencing application

Figure 4.1.2 shows that at 9:43 AM as I entered within the 200 meter of my university it notifies me that I am at my university.

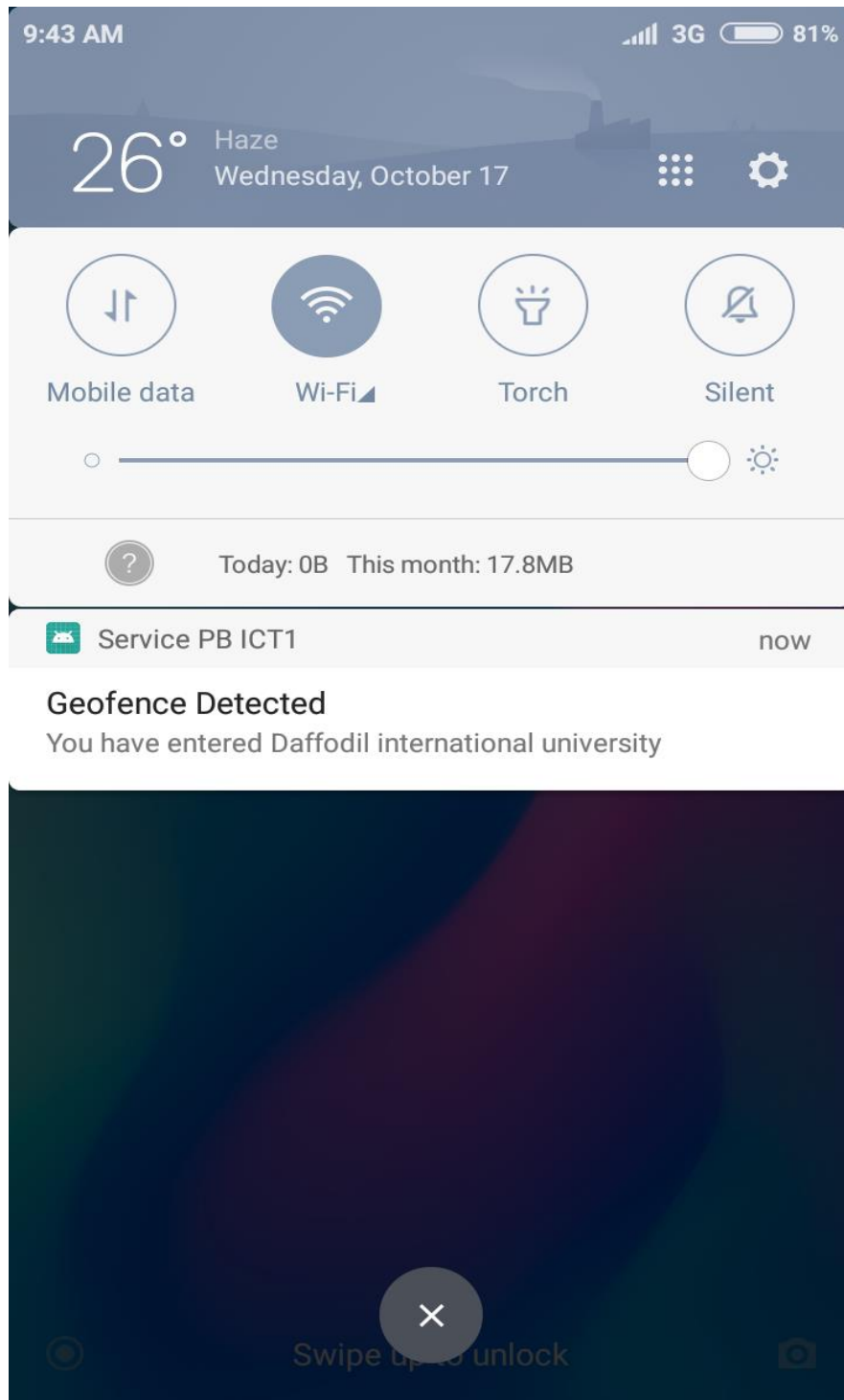


Figure 4.1.2: Transition ENTER notification



Figure 4.1.3 shows that as I have exited from that radius of my university at 10:31 AM it notifies me again that I have exited my university

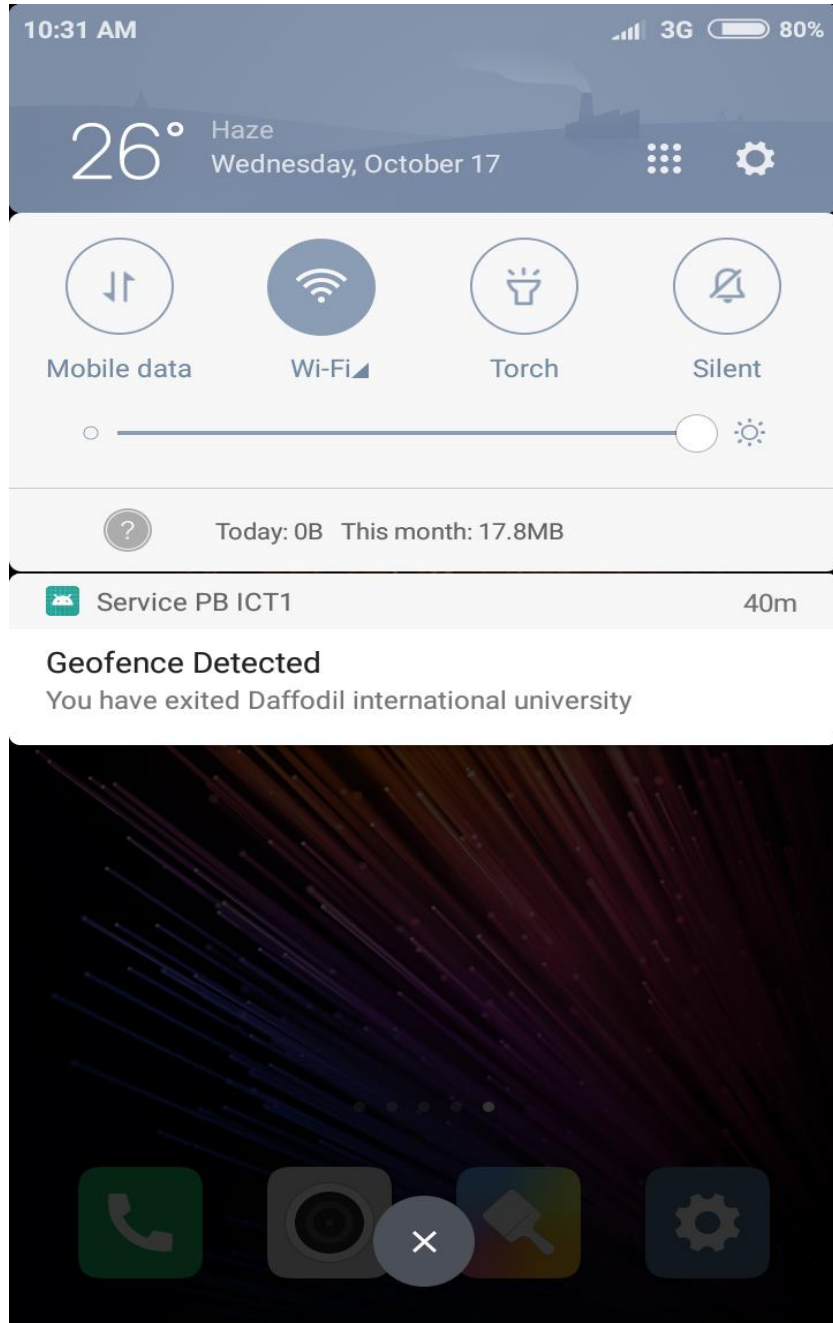


Figure 4.1.3: Transition EXIT notification

#### 4.4.2 Speed checking

As I have said earlier that we are getting the speed of a device with the help of GPS at first the GPS should be enabled in the device. And I also implemented a class called LocationListener. As I implemented the class now I have to override its methods. The overridden method that we need is onLocationChanged which this method takes location as an argument. From this argument we can get the device speed by simply writing location.getspeed().

Figure 4.2.1 shows the first page of speedometer application.

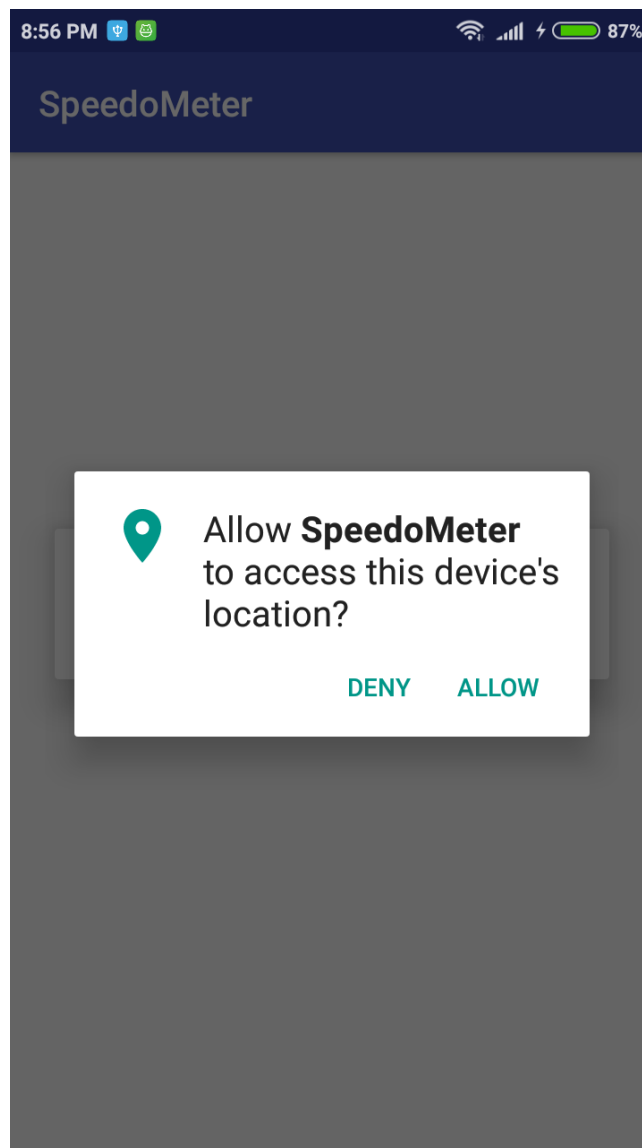


Figure 4.2.1: opening page of speedometer

Figure 4.2.2 shows that once the permission is granted the app then searches for GPS.

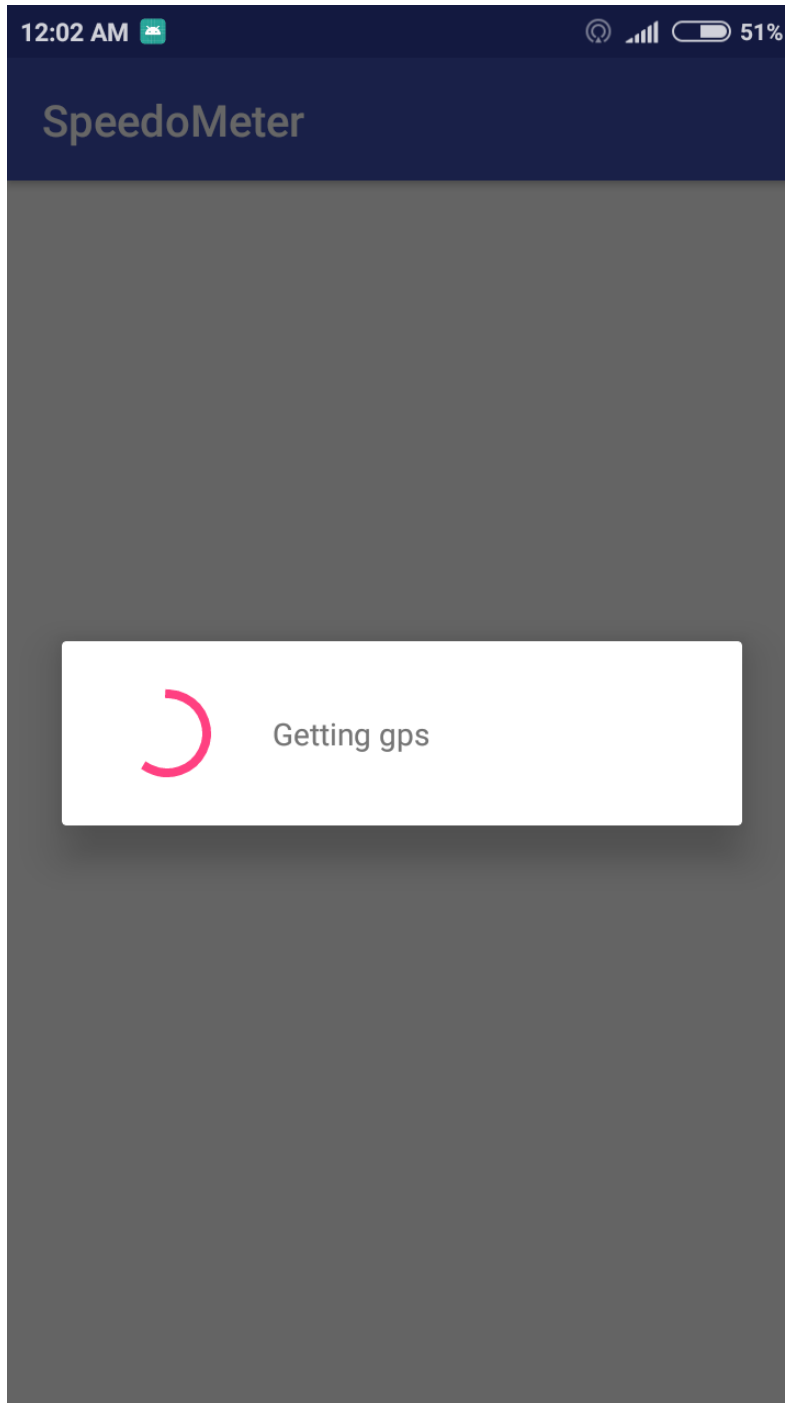


Figure 4.2.2: searching for GPS

Figure 4.2.3 shows that once it connects to GPS then the location of the device is set by the GPS.

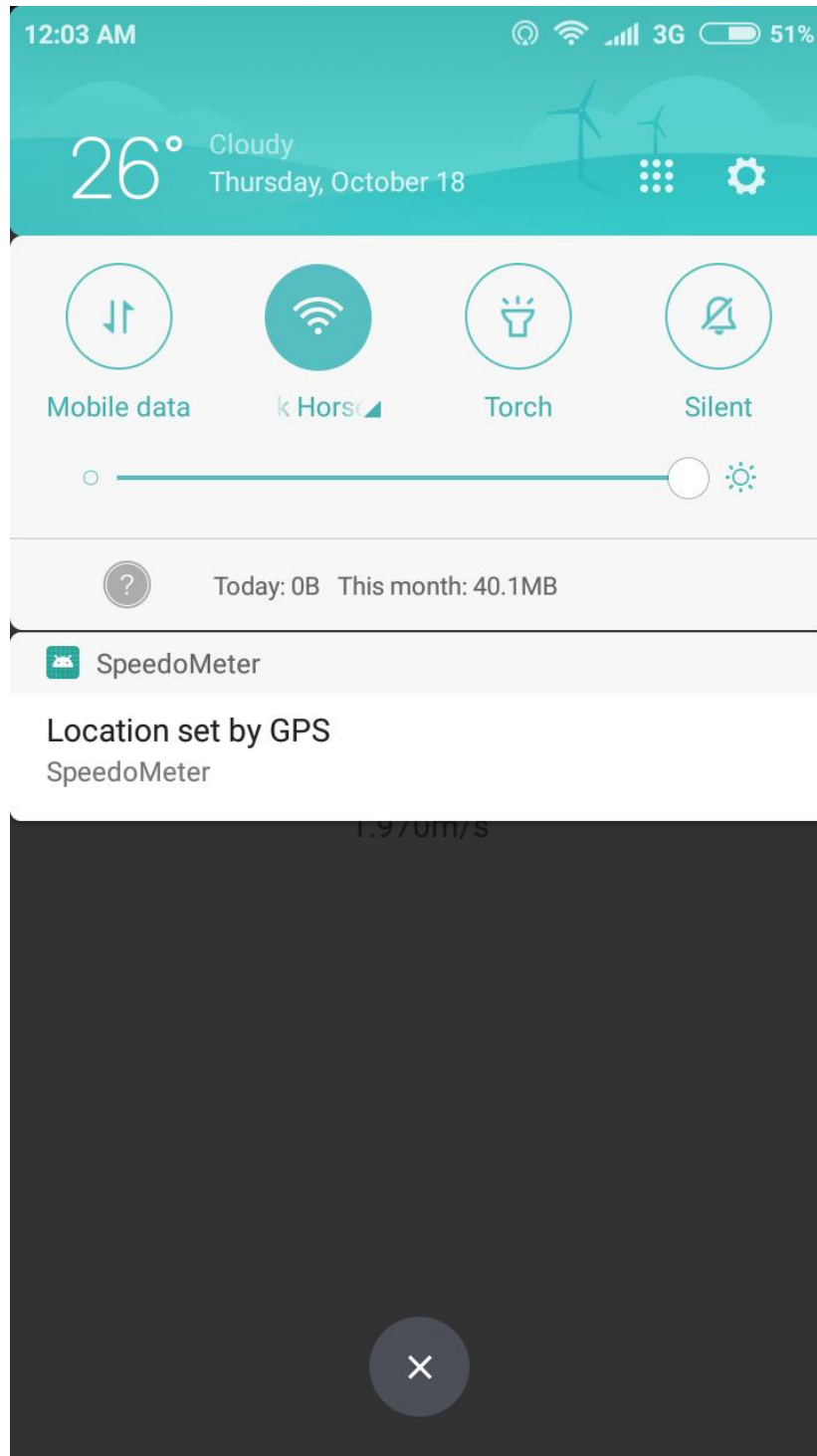


Figure 4.2.3: connected to GPS

Figure 4.2.4 shows the current speed of the device.

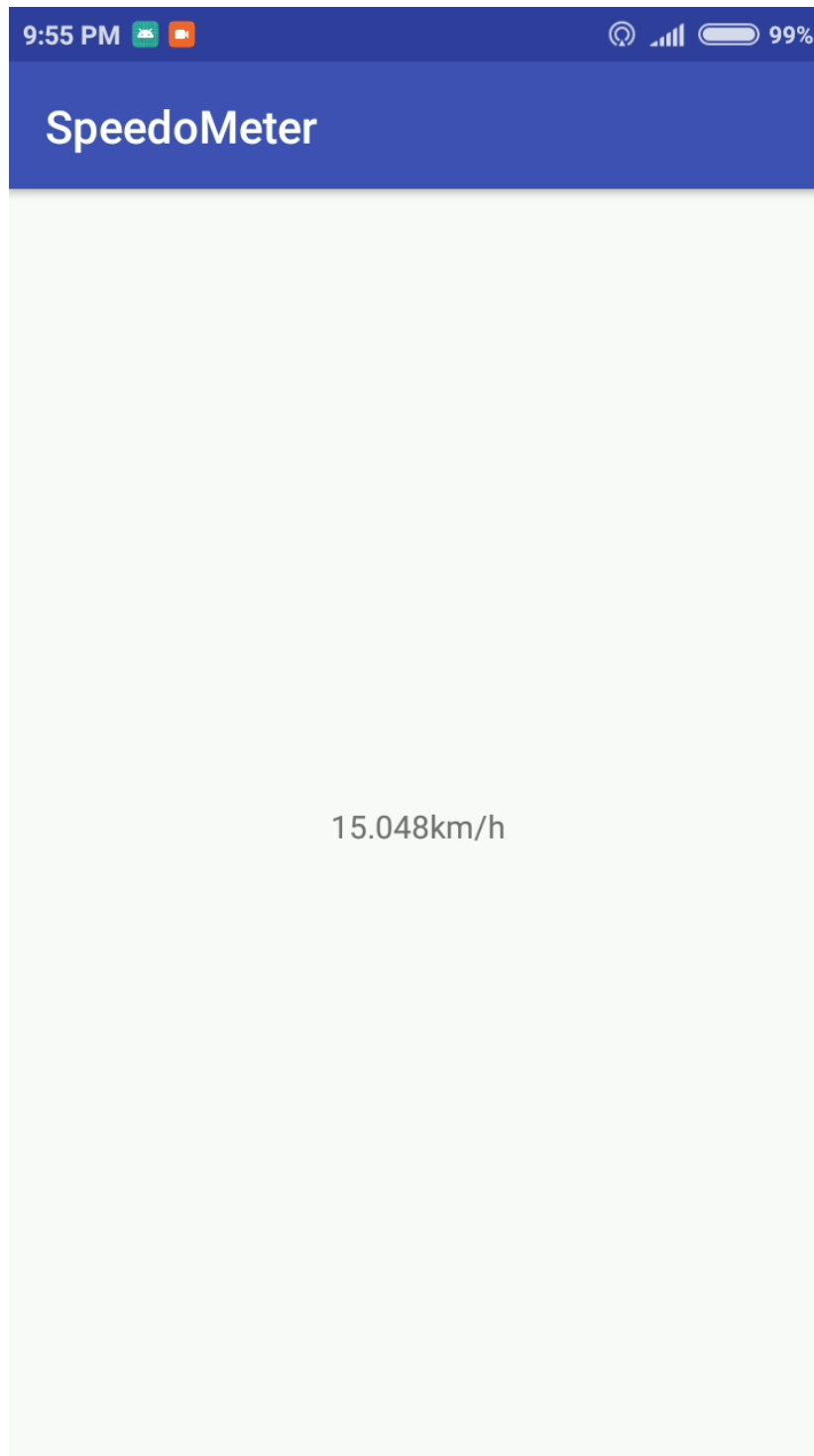


Figure 4.2.4: showing the speed of the device

### 4.4.3 Sending notification

As I mentioned earlier I am using firebase to send notification between devices. I have added my application in the firebase and also added the necessary dependencies in my application. And I had to write some functions using node.js for firebase. At first I have created a firebase authentication system to authenticate the user using his email and password. When he will click register or log in the app will automatically get the token-id of the device. The token-id is necessary to identify a particular device. After this I am showing the user a list of user who are registered using Recycler view.

Figure 4.3.1 shows the log-in and registration page of push notification application

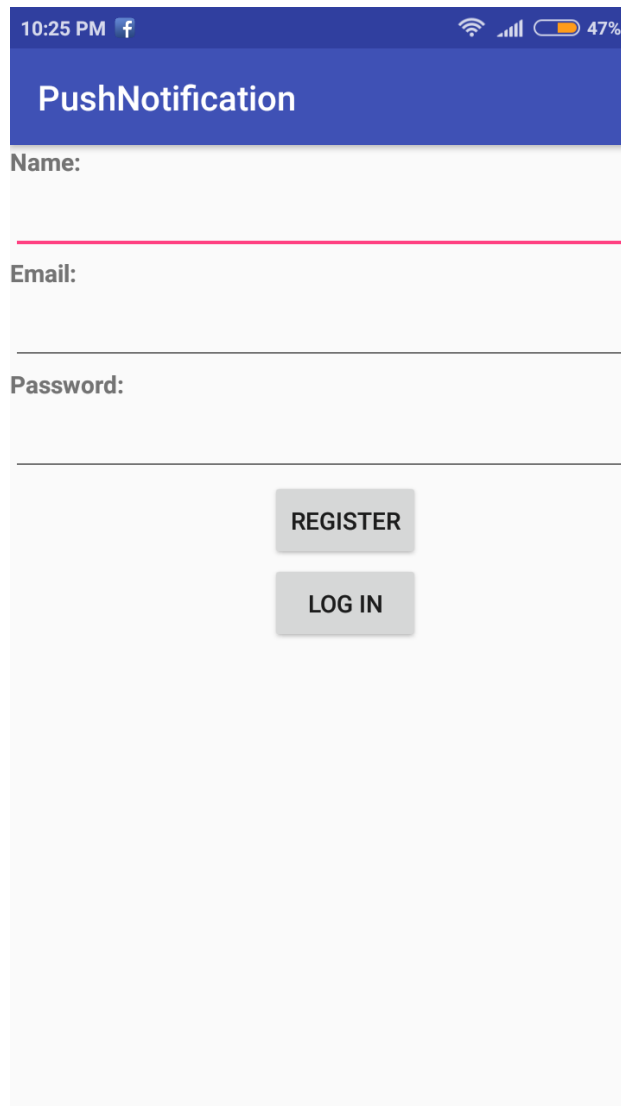


Figure 4.3.1: opening page of push notification application

Figure 4.3.2 shows a list of users who are registered including the use who is logged in right now. Now the user can send to any of these user including himself.

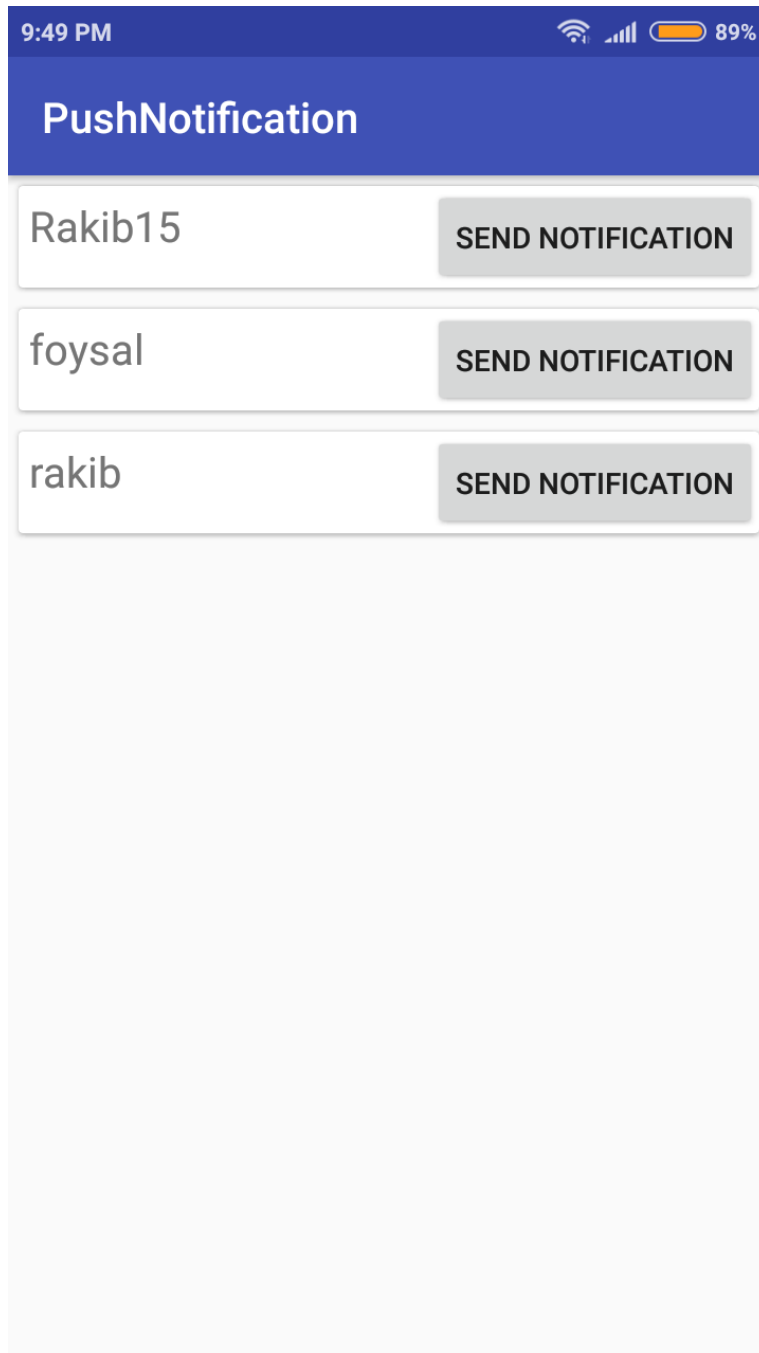


Figure 4.3.2: users list

Figure 4.3.3 shows the process of sending notification. Here I am sending notification to myself.

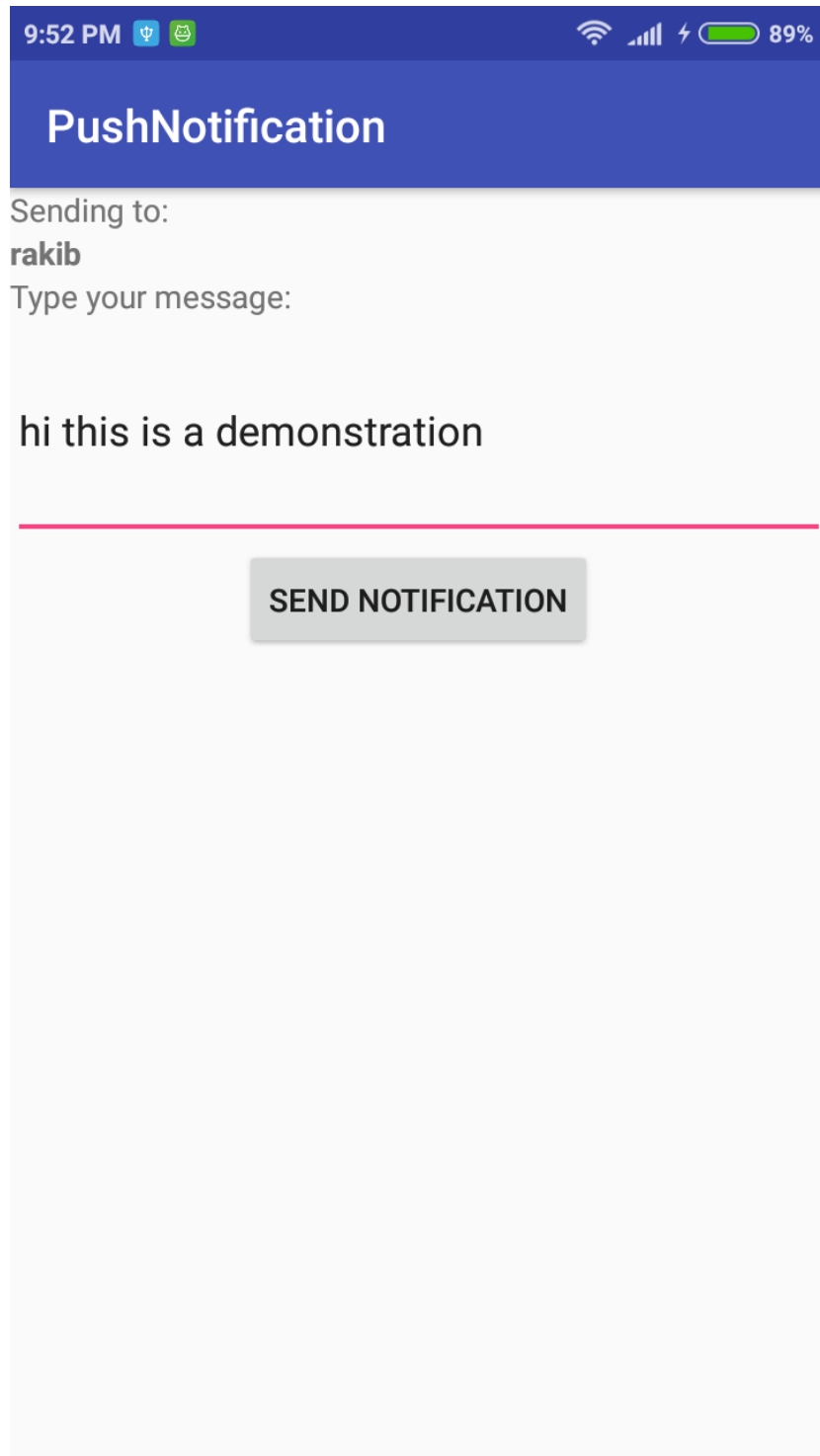


Figure 4.3.3: sending process



Figure 4.3.4 shows that the notification has been received.

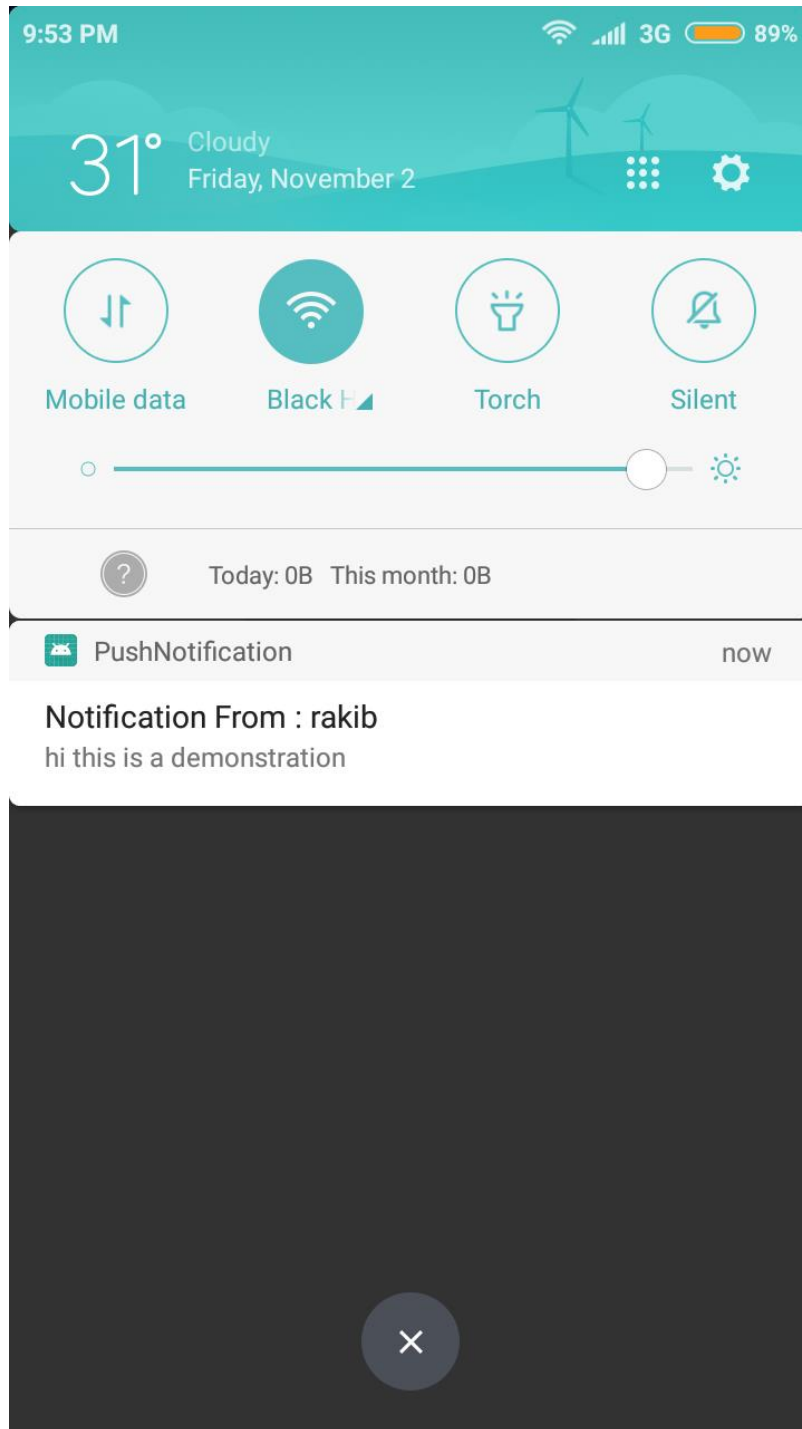


Figure 4.3.4: notification received

#### 4.4.4 Nearby device

To demonstrate this I had to develop two different applications. One application is developed for sergeants. In that application there is a firebase authentication process with email and password. When the app will start there is service which will update the devices location in every 10 seconds to the database.

Figure 4.4.1 shows the first page of the application which is asking for permission.

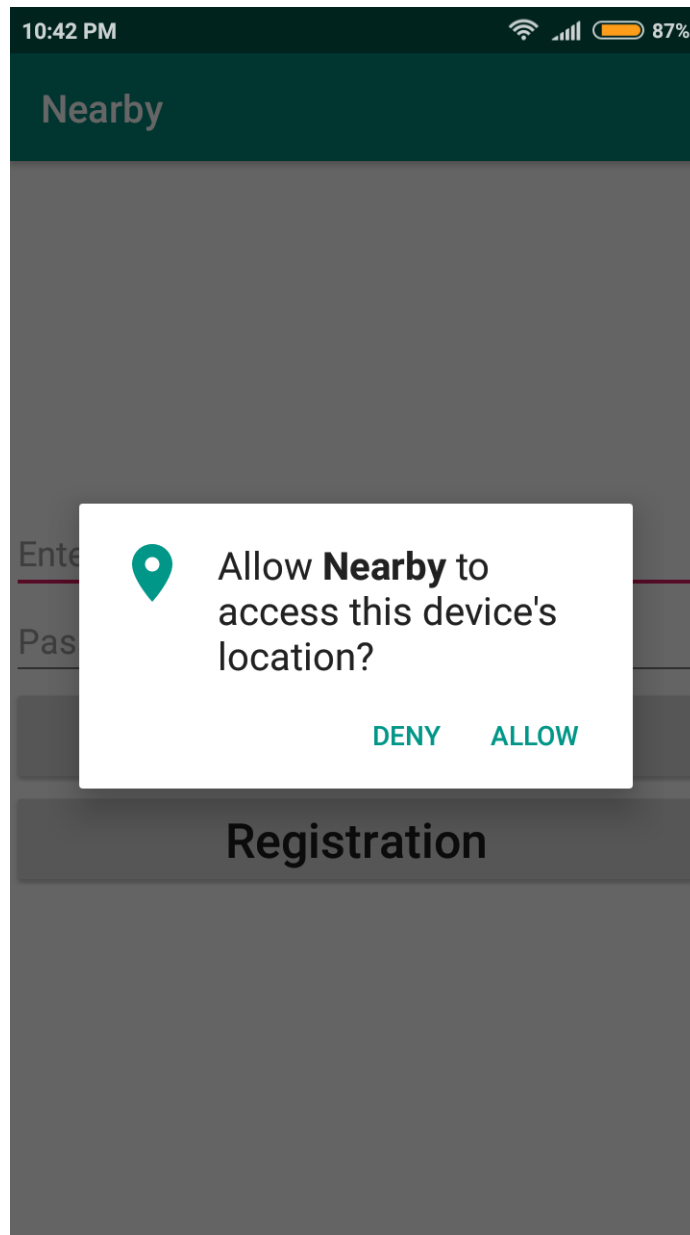


Figure 4.4.1: first page of nearby application

Figure 4.4.2 shows the log-in and registration page.

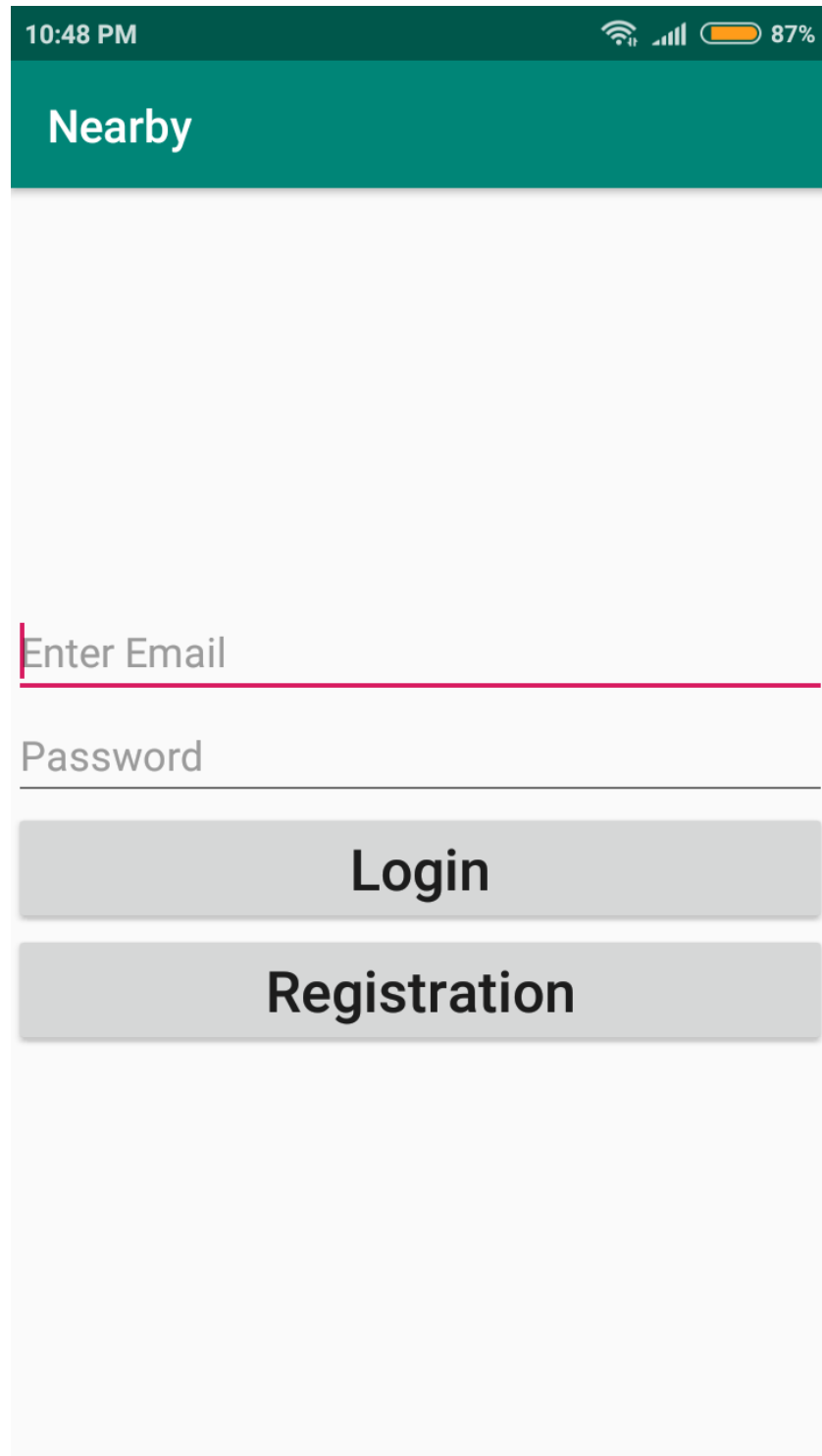


Figure 4.4.2: log-in and registration page

In the other application the data that has been uploaded by the previous application is retrieved from the firebase. Once it gets the data successfully then it runs the **Haversine formula** on the data which returns a linear distance. Then the data is shown in a list in ascending order.

Figure 4.4.3 shows a list of distance. The list is in ascending order which means the first data of the list is the nearest device.

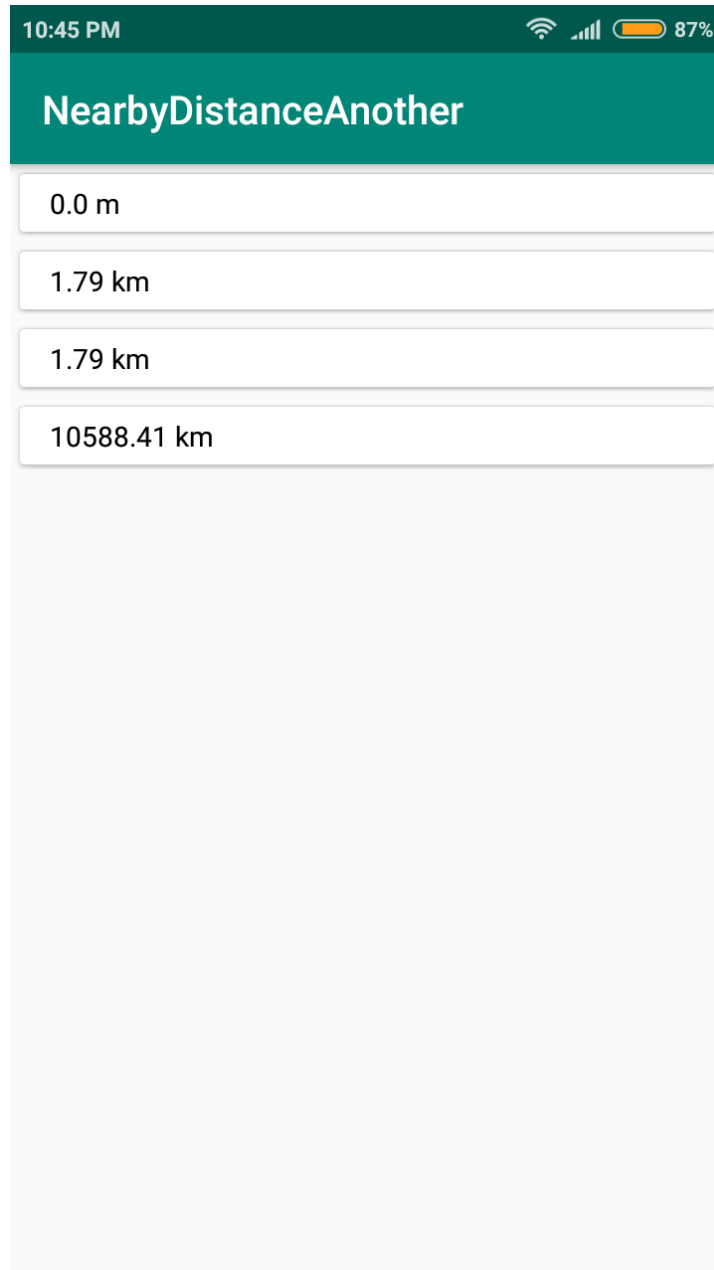


Figure 4.4.3: nearby devices list

## **CHAPTER-5**

### **CONCLUSION AND FUTURE SCOPE**

#### **5.1 Discussion and Conclusion**

The number of dead from road accident never decreasing. And I was always eager to do something to improve the traffic management system in our country. And then the incident happened which shook the students of the whole nation. I decided to do something about it. Then this idea came across my mind and I think it will help us to improve our traffic management system.

I know that this will not completely reduce the road accident but I sure believe that it will increase an awareness among the drivers and compel them to drive safely.

#### **5.2 Limitation**

The only limitation that my model has that it requires the devices to have a bufferless internet connection and to have GPS enabled which can be expensive and battery consuming but comparing to its benefit this can be ignored.

#### **5.3 Future scope**

In the future I will develop my model. There are still some areas that I can work on for example I want make the traffic case filing system online.

The main thing I want to do in the future is to aggregate the whole model and implement it in real life.

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