# CHAPTER 1
# INTRODUCTION

## 1.1 PROJECT TITLE:

**NavAR**: Augmented Reality Assisted Navigation Application using Google Maps.

## 1.2 OBJECTIVE:

To use the phone's camera and Augmented Reality along with Google Maps to provide real-time navigation assistance.

## 1.3 OVERVIEW:

Satellite navigation plays a very important role in our daily lives, be it in travel assistance, taxis or finding new information about a place.

Our project aims to enhance the usability of Google Maps by providing an additional virtual assistance using augmented reality. Users can attain a real-time direction assistance through the app, which utilises the phone's camera, digital compass and GPS to project the directions on the phone's screen as an overlay on the camera feedback.

This will help users to better navigate complex roadways and urban environments.

## 1.4 EXISTING SYSTEM

1. **ARCity by blippAR (Available only on iOS)** [3] - The app helps you navigate and explore 300 cities worldwide using augmented reality and computer vision at scale.

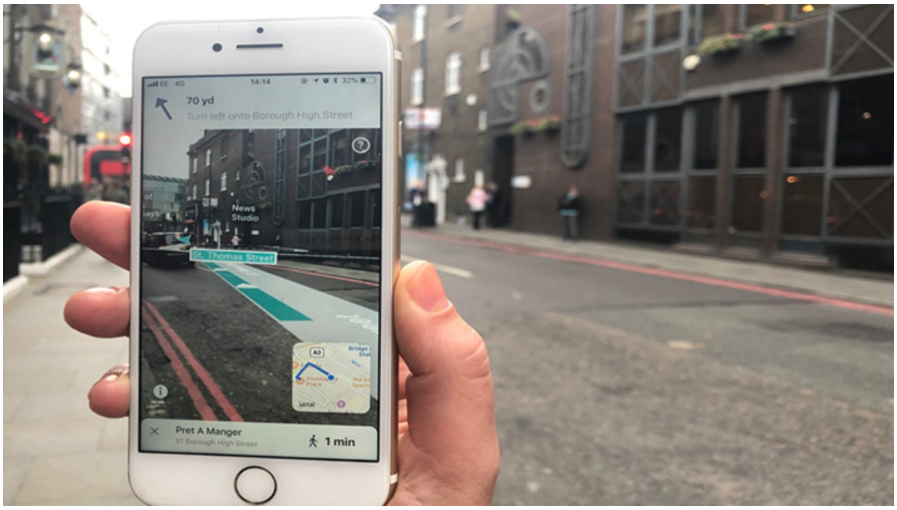


Fig 1.1: ARCity by blippAR[1]

2. **AR Navigation & Nearby GPS, AR Walking Navigation by AR Technology | GP[1]S Navigation | Future Apps (Available only on Google Play Store)** [4] - AR Navigation 2019 – AR GPS Navigation AR Maps, AR Driving Directions is augmented reality navigation app that let you explore the world map see your current location or find any places with Nearby GPS & AR Navigation.


Fig 1.2: AR Navigation & Nearby GPS, AR Walking Navigation[2]

[1] Source: https://www.blippar.com/blog/2017/11/06/welcome-ar-city-future-maps-and-navigation
[2] Source: https://play.google.com/store/apps/details?id=com.augmentednavigation.routefinder.famousplaces.roads&hl=en

## 1.5 PROBLEM DEFINITION

While modern GPS systems have evolved a long way in providing users a detailed navigation system, the readability of maps remains a struggle for many users. This application aims to solve this very problem by adding another layer of readability by utilising the phone's camera and incorporating augmented reality to provide the necessary directions.

## 1.6 PROPOSED PLAN

With the above problem clearly defined, our aim is to create an augmented reality application to work simultaneously with Google Maps to provide camera assisted navigation using the phone's camera.

We aim to complete the above in the following ways:

1. Create a basic AR app with plane recognition with custom markers
2. Create an Android application with Google Maps SDK to extract location information
3. Integrate the modules to obtain AR assisted navigation

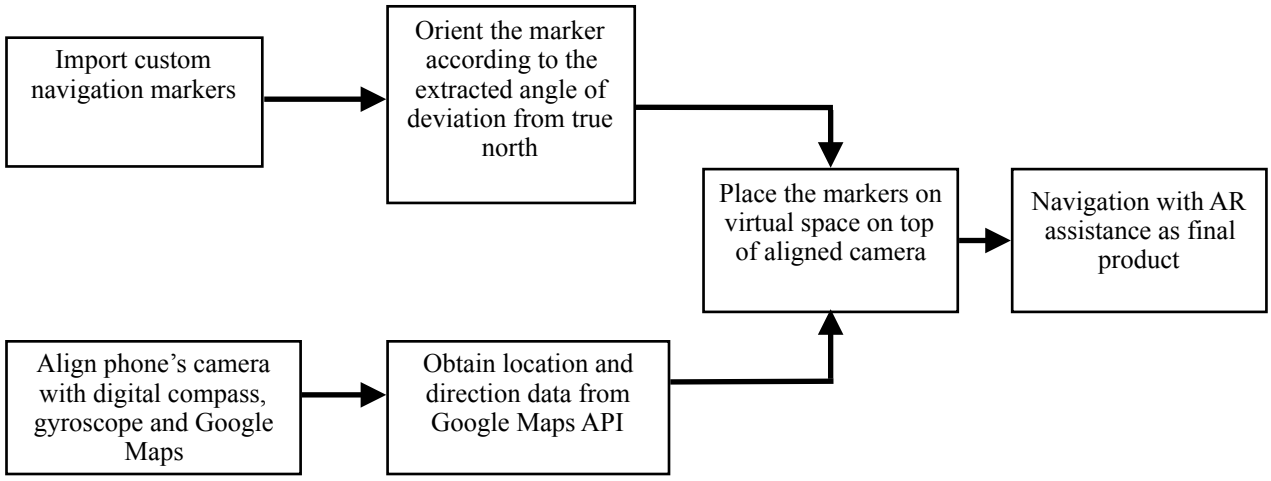


Fig 1.3: Proposed Workflow

# CHAPTER 2
# REQUIREMENT ANALYSIS

## 2.1 SYSTEM REQUIREMENTS

### 2.1.1 HARDWARE REQUIREMENTS

Processor: Intel Pentium 4 (With SSE2 instruction set support) or later [1]

RAM: 3 GB or more [1]

GPU: DirectX 10 (shader model 4.0) support [1]

Disk Space: 3 GB or more [1]

Screen Resolution: 1280X800 or more [1]

Android Phone with Android 7 and above [5]

### 2.1.2 SOFTWARE REQUIREMENTS

OS: Windows 7 SP1 or later, MacOS 10.11 or later [1]

Android Studio 3.3

JDK 8

ARCore 1.7

Programming Languages: Java [1]

## 2.2 FEASIBILITY STUDY

### 2.2.1 ECONOMIC FEASIBILITY

#### 2.2.1.1 COCOMO MODEL

The basic Constructive Cost Model (COCOMO) [3] equation will take the following form:

Effort Applied (E)= $a_b(KLoC)^{b_b}$ [person-months]

Development Time (D)= $c_b$(Effort Applied)$^{d_b}$ [months]

People Required (P)=Effort Applied/Development time [count]

Where KLoC is the estimated number of delivered lines (expressed in thousands) of code

The coefficients $a_b$ $b_b$ $c_b$ $d_b$ are given by:

Table 2.1: COCOMO model coefficient values

| Software Project | $a_b$ | $b_b$ | $c_b$ | $d_b$ |
|---|---|---|---|---|
| Organic | 2.4 | 1.05 | 2.5 | 0.38 |
| Semi-detached | 3.0 | 1.12 | 2.5 | 0.35 |
| Embedded | 3.6 | 1.20 | 2.5 | 0.32 |

Taking the project type to be semi-detached, we get the following calculations:

Effort Applied, E= $a_b$(KLoC)$^{b_b}$ [person-months]

E=3.0*(4K)$^{1.12}$ PM

E=14.17 PM

Development Time, D= $c_b$(Effort Applied)$^{d_b}$ [months]

D=2.5*(14.17)$^{0.35}$ months

D=6.32 months

People Required, P=Effort Applied/Development time [count]

P=14.17/6.32 count

P=2.24 count

P≈3 count

### 2.2.2 TECHNICAL FEASIBILITY

The requirements for making this application are as follows:

- Android Studio
- ARCore
- Google Maps SDK for Android (free for one year)
- Google Places API (free for one year)
- Google Directions API (free for one year)

The above mentioned utilities are open source. Hence the project is technically feasible.

### 2.2.3 OPERATIONAL FEASIBILITY

The finished product will have an easy-to-use, simple and intuitive interface. The end user does not require any special training to use this application. Therefore, the application is operationally feasible.

### 2.2.4 SCHEDULE FEASIBILITY

#### 2.2.4.1 WORK BREAKDOWN STRUCTURE

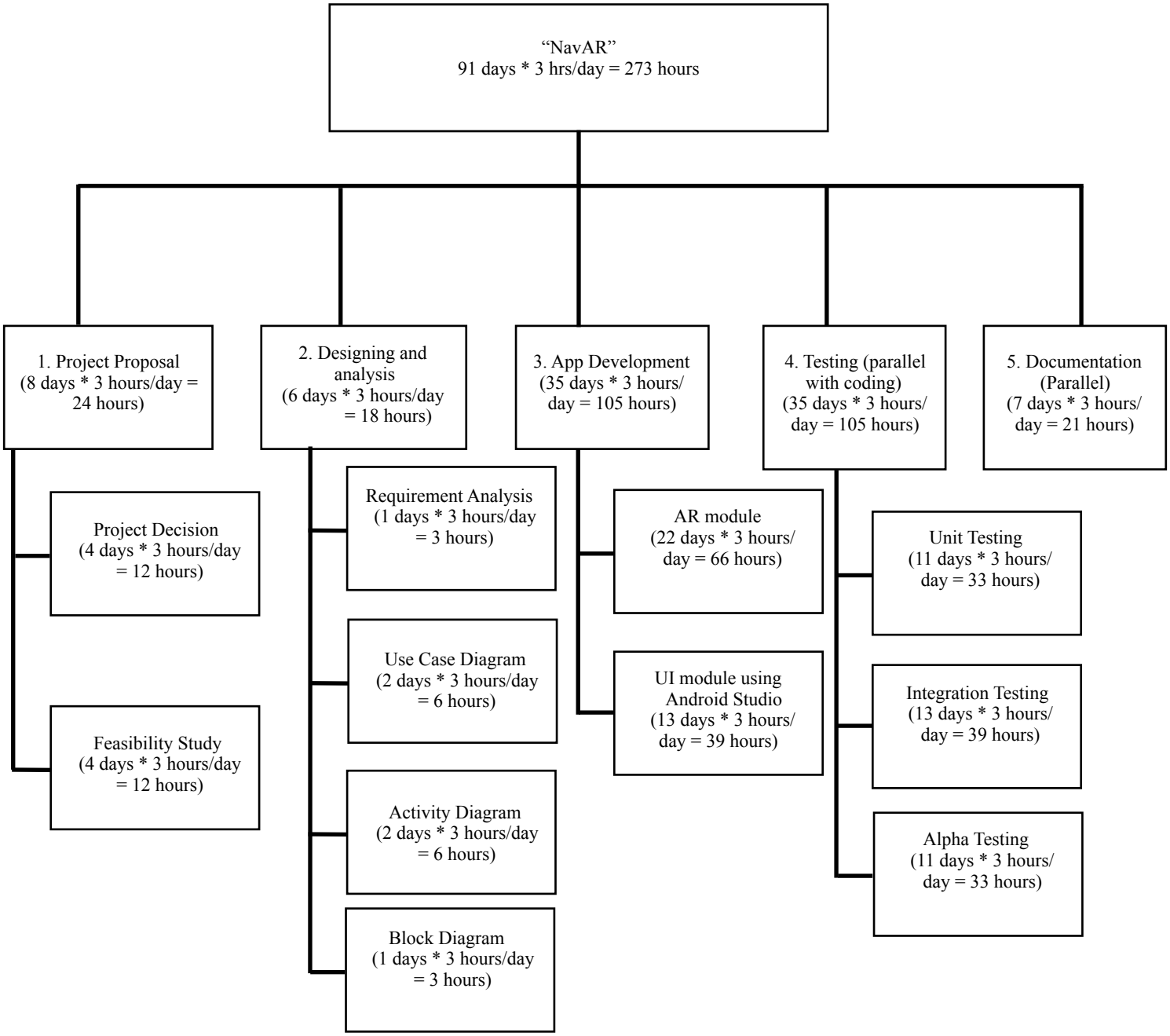


Fig 2.2: Work Breakdown Structure

## 2.2.4.2 GANTT CHART

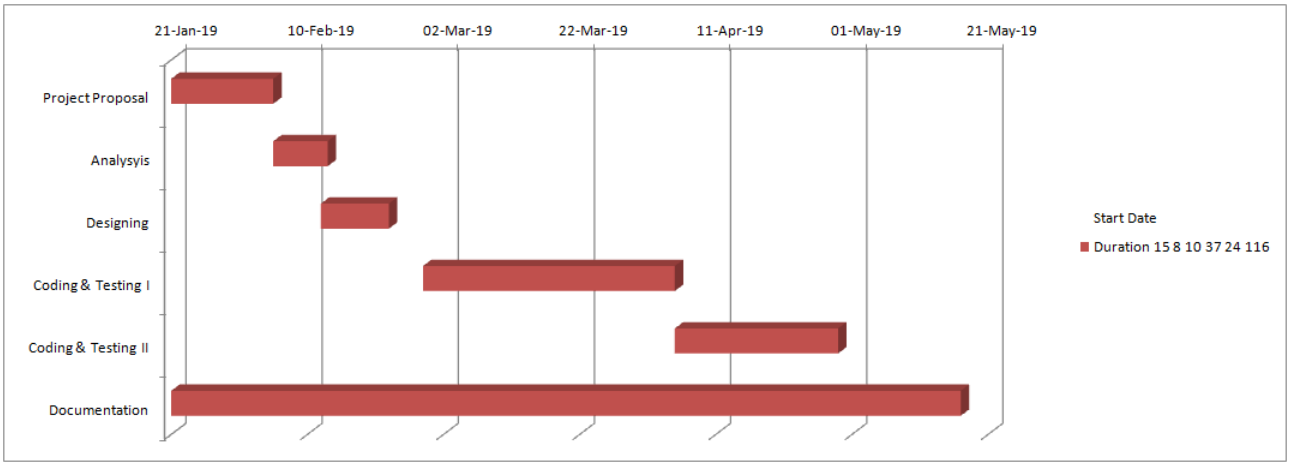


Fig 2.3: Gantt Chart

# CHAPTER 3
# DESIGN DIAGRAMS

## 3.1 USE-CASE DIAGRAM

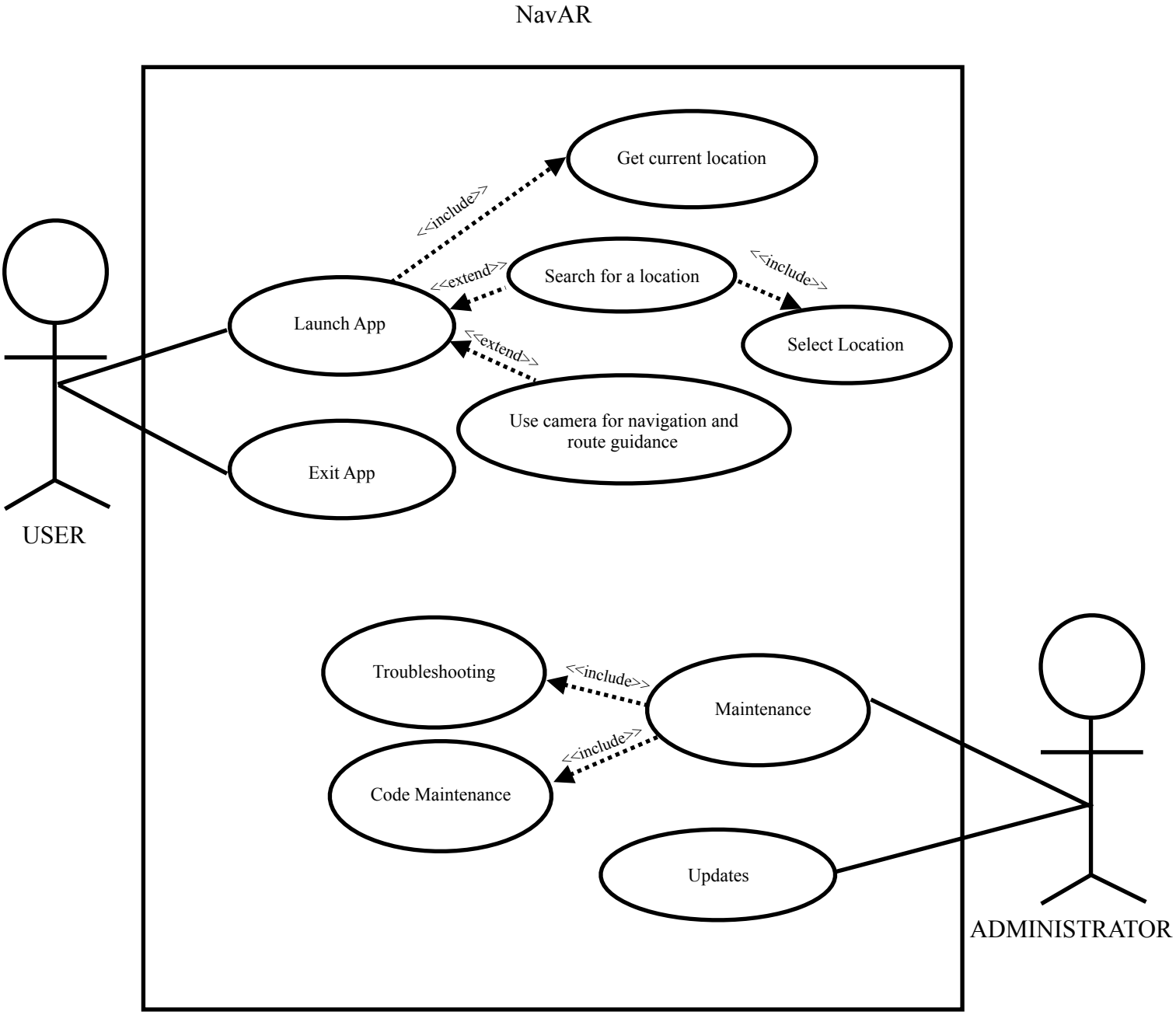


Fig 3.1: Use Case Diagram

## 3.2 ACTIVITY DIAGRAM

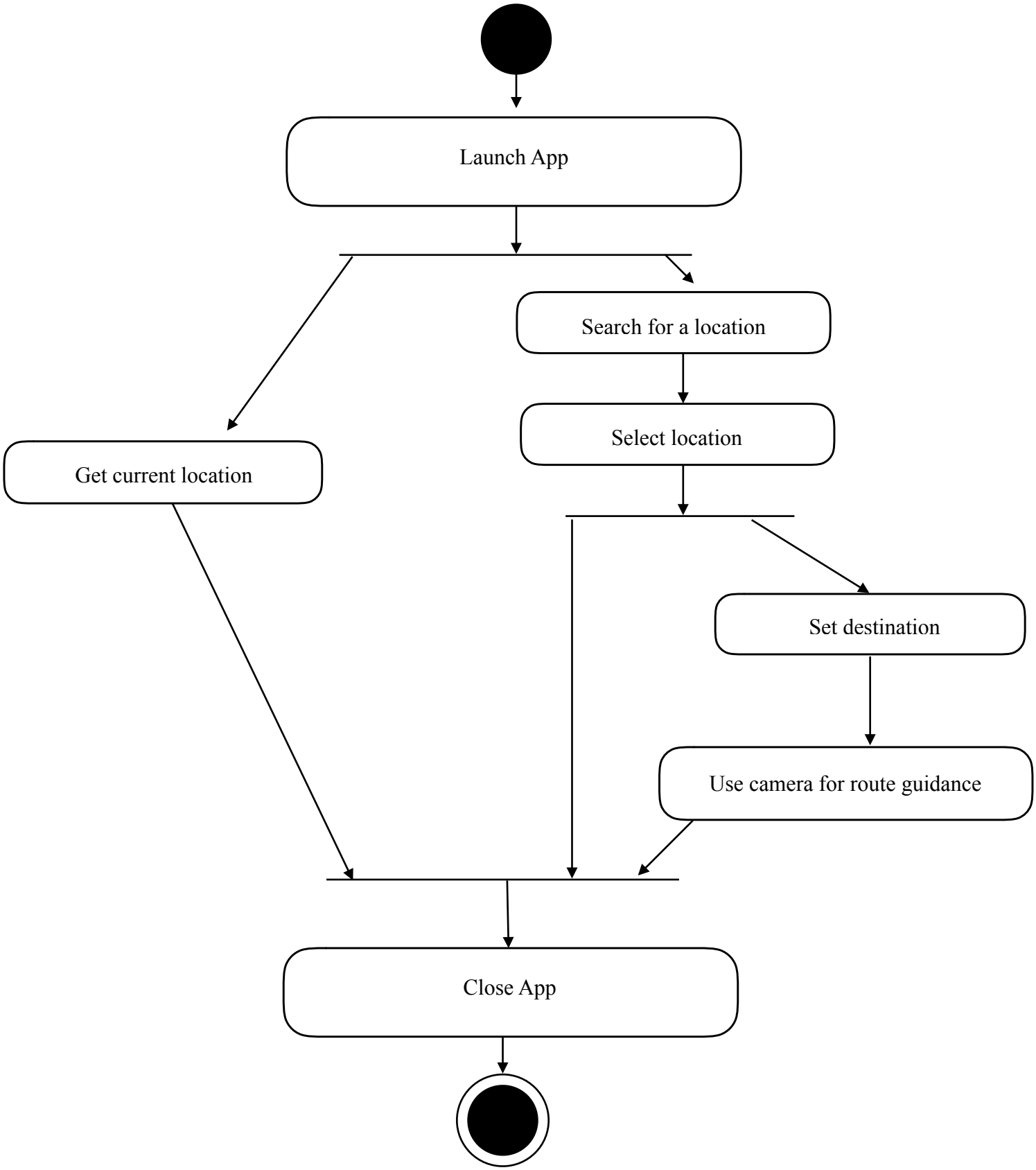


Fig 3.2: Activity Diagram

# CHAPTER 4

# IMPLEMENTATION AND TESTING

## 4.1 TESTING

### 4.1.1 MAP

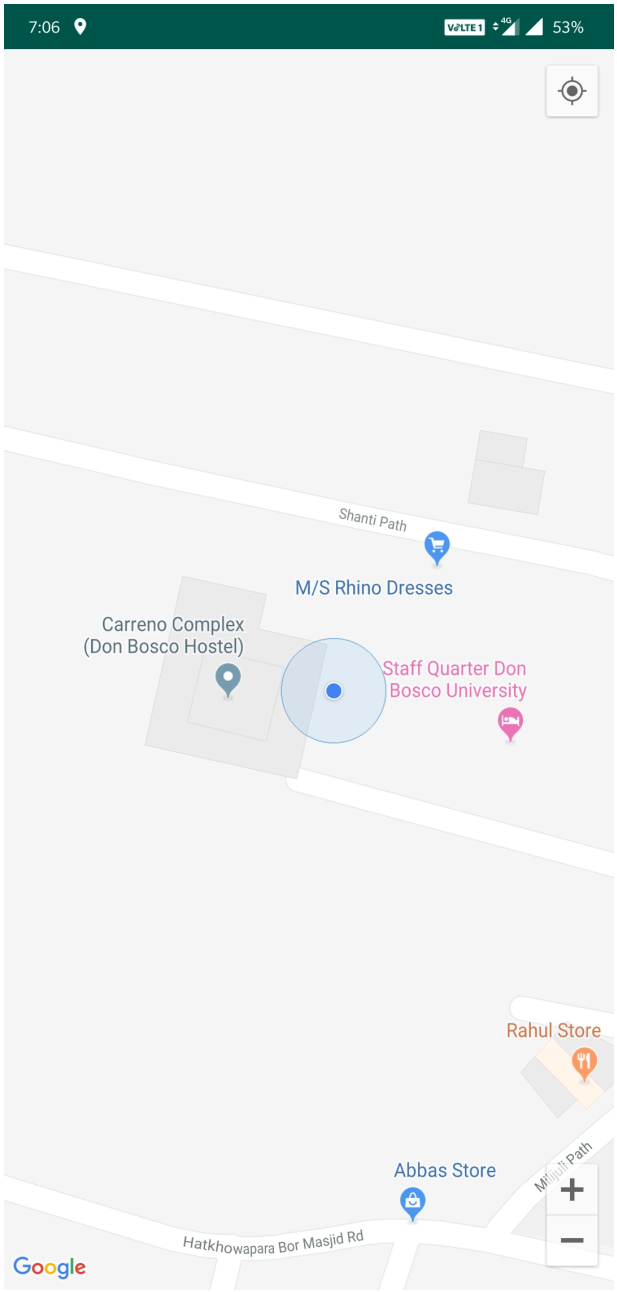


Fig 4.1: Maps interface

The map section gives the primary interface for the application and houses all the functionalities prior to navigation, that is, getting the current location, searching for a destination and reviewing the route.

### 4.1.2 AUGMENTED REALITY

The Augmented Reality section will provide the route guidance using the camera input and location markers as shown below.

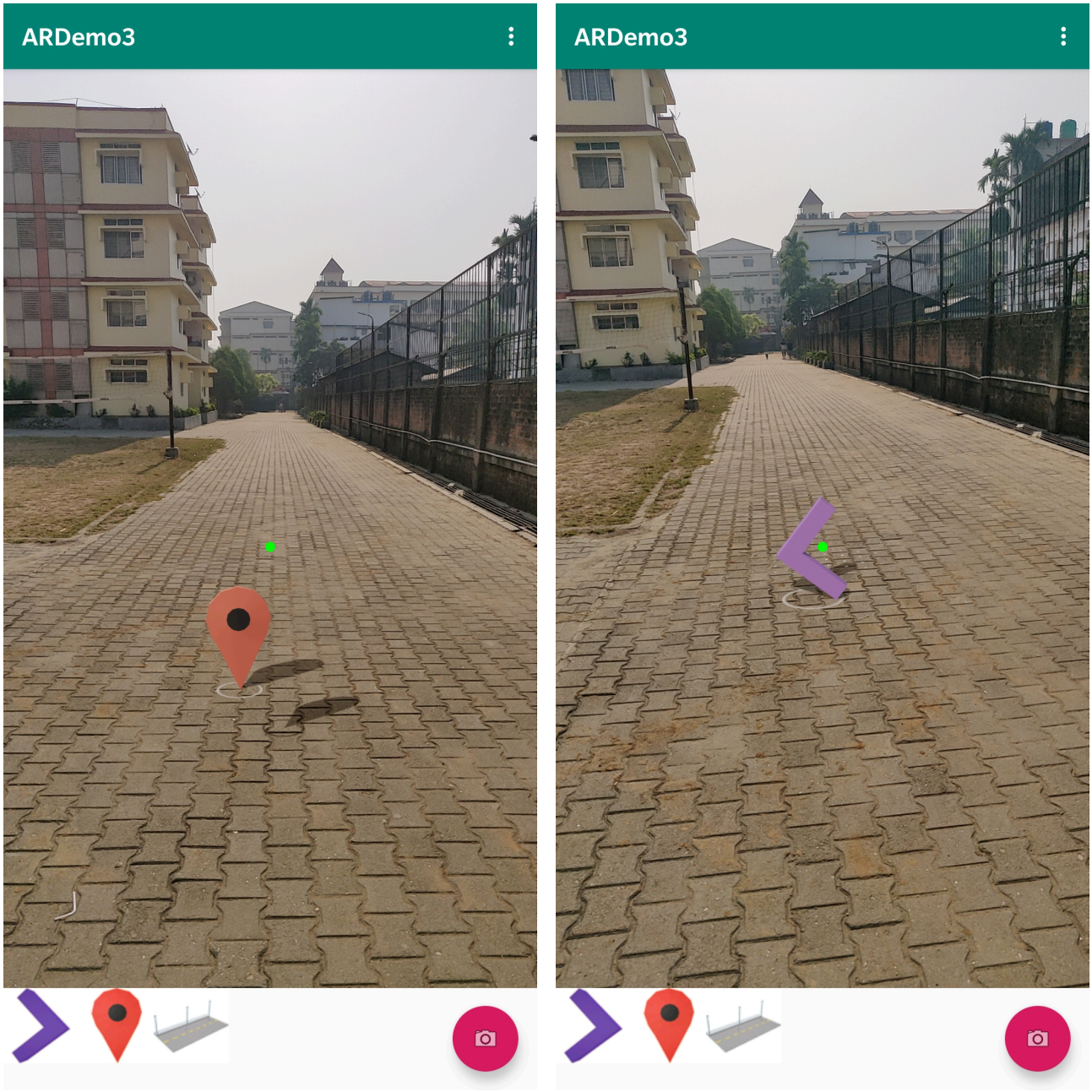


Fig 4.2: Augmented Reality interface

## 4.2 IMPLEMENTATION

### 4.2.1 CODE SAMPLES

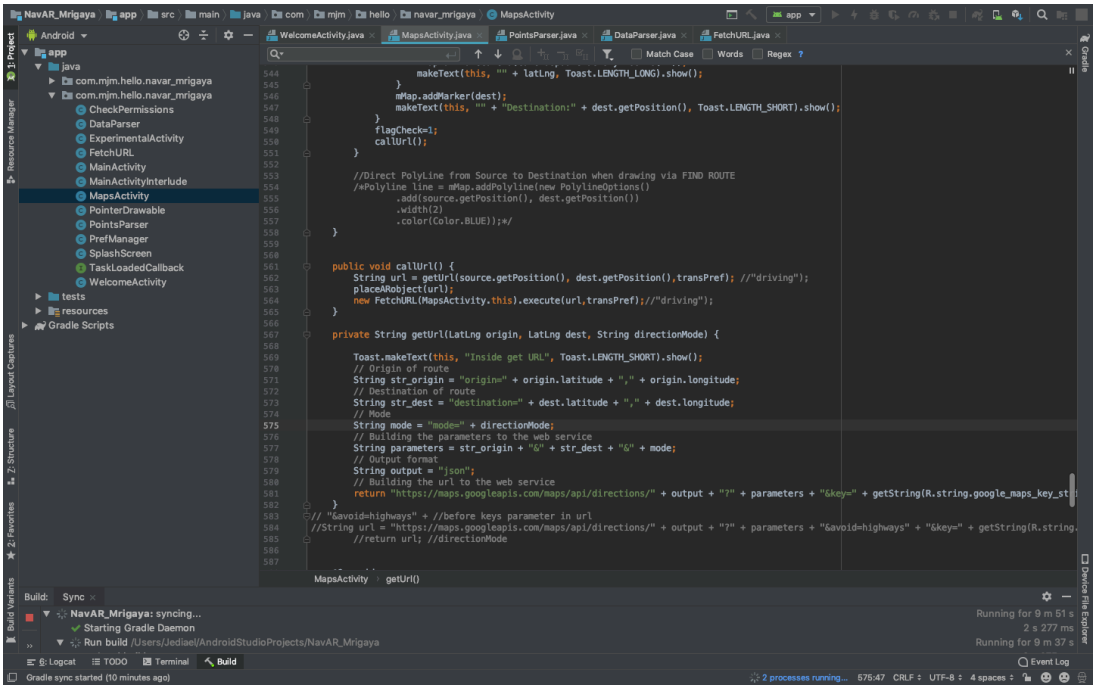

Fig 4.3: Getting directions from Directions API

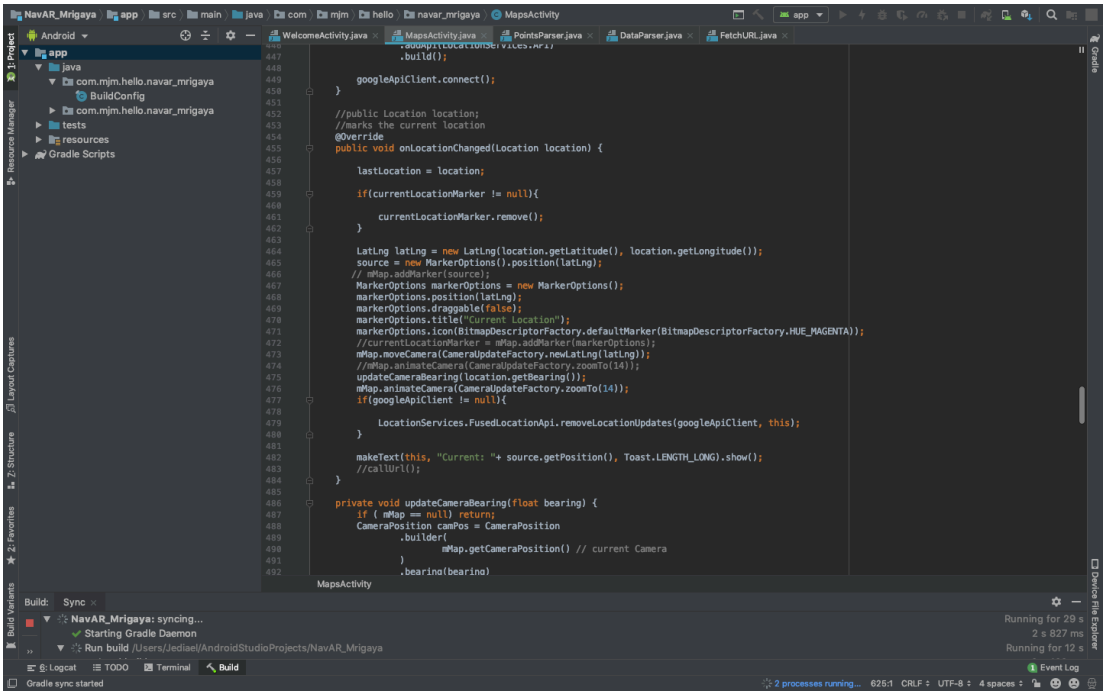

Fig 4.4: Getting current location

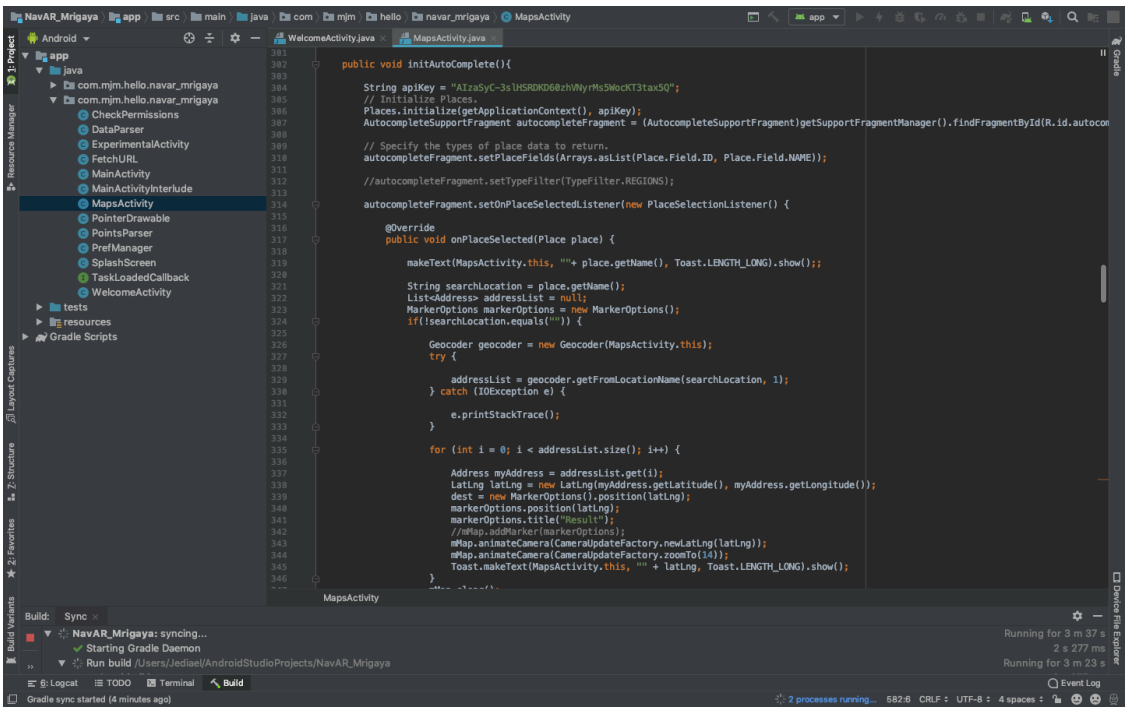


Fig 4.5: Getting autocomplete suggestions from Places API

## 4.2.2 APP INTERFACE

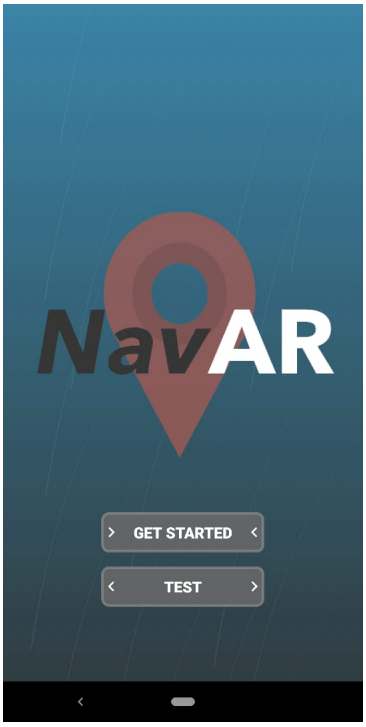


Fig 4.6: Start Screen

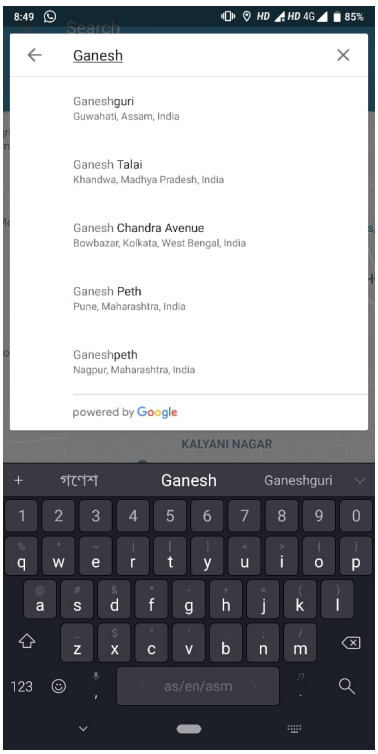


Fig 4.7: Autocomplete in Search

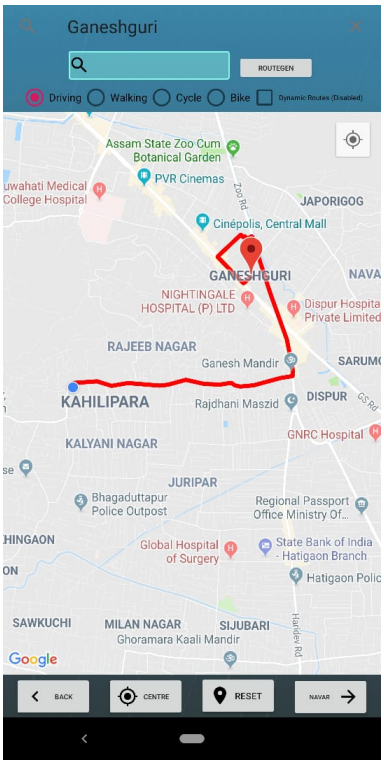


Fig 4.8: Driving Directions


Fig 4.9: Augmented Reality Navigation

| Sl. No. | Input | Screenshot No. | Expected Output | Actual Output |
|---|---|---|---|---|
| 1 | Ganesh | Fig 4.7 | Ganeshguri | Ganeshguri |
| 2 | Ganeshguri | Fig 4.8 | Marker at Ganeshguri | Marker at Ganeshguri |
| 3 | Destination: Dharapur | Fig 4.9 | AR navigation to Dharapur | AR navigation to Dharapur |

Table 4.1: Test Table

## CONCLUSION

With this application, we hope to incorporate Augmented Reality in making our everyday lives easier and more convenient. Our aim for this application is to service navigation in complex roadways, and therefore, help the users to make correct decisions while driving or navigating.

# REFERENCES


[1] **Android Studio System Requirements:**

https://developer.android.com/studio (02/02/2019)

[2] **COCOMO Model:**

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[3] **ARCity by blippAR:**

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[5] **ARCore:**

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