Crowd Sourced IntelligentRoute Planner

By

Capt Sarmad Idrees

Maj AtifRafique

CaptMunibUllah

Submitted to the Faculty of Computing Software Engineering

Military College of Signals, National University of Sciences and Technology, Islamabad

in partial fulfillment for the requirements of a B.E Degree in

Software Engineering

May 2016

ABSTRACT

CROWD SOURCED INTELLIGENT ROUTE PLANNER

The project is a Mobile (Android) application which will integrate with the Google Maps and will give the best route with minimum ETA (Estimated Time of Arrival) to a particular destination (selected by a user). It will use the Users Mobile GPS to track him/her on the route and calculate the time (wherever he is going) and will save/Upload that time taken on that specific time of day to the Application server which will later be provided to the other users.

It is totally crowd sourced application but initially the school/office timings of the city will be added to the application server which will have a certain amount of uncertainity in the ETA provided. As the users will grow in number and start to travel using the application, the timings will get better.

The application is tested on the functionality of providing the ETA from the App server, the connectivity to the server, the time recording mechanism and interfacing with the google Maps. The time provided by the app will depend on the number of users actively participating in provding route data.

CERTIFICATE FOR CORRECTNESS AND APPROVAL

Certified that work contained in the thesis – Route Planner carried out by Capt Sarmad Idrees, Maj Muhammad AtifRafique and Capt Muhammad MunibUllah under supervision of Dr. Hammad Afzal for partial fulfilment of Degree of Bachelor of Software Engineering is correct and approved.

Approved by

Dr. Hammad Afzal

CSE DEPARTMENT

MCS

Dated: _____May, 2016

DECLARATION

No portion of the work presented in this dissertation has been submitted in support of another award or qualification either at this institution or elsewhere.

DEDICATION

In the name of Allah, the Most Merciful, the Beneficent

To our parents, without whose unflinching support and unstinting cooperation,

a work of this magnitude would not have been possible.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisor **Dr. Hammad Afzal** for the continuous support of my project, for his patience, motivation, and immense knowledge. His guidance helped us in all the time of development of the project, writing of this thesis and for enlightening us the first glance of the project. I could not have imagined having a better advisor and mentor for this project.

Besides my advisor, we would like to thank **Dr. Seemab Latif, Dr. Naima Altaf and Asst Prof Bilal Rauf**for their insightful comments and encouragement, but also for the hard question which incented us to widen ourscope of the project from various perspectives.

We thank our fellow labmates in for the stimulating discussions, for the sleepless nights we were working together before deadlines, and for all the fun we had in the last four years.

TABLE OF CONTENTS

Table of Contents

LIST OF TABLE

LIST OF FIGURES

Key to Symbols or Abbreviations

SRS	–	SoftwareRequirementsSpecification
A-GPS	-	Assisted Global Positioning Service
TTT	-	Time to Travel
API	-	ApplicationProgrammingInterface
3G	-	3rd Generation (loosely defined, but generally includes high speed internet, always-on data access)
ADT	–	AndroidDevelopmentToolkit
IDE	–	IntegratedDevelopmentEnvironment
RUP	–	RationalUnifiedProcessSystem
SAD	–	SoftwareArchitectureDocument
SDK	–	SoftwareDevelopmentKit
UI	–	UserInterface
UML	–	Unifiedmodelinglanguage

Chapter 1: Introduction

1.1 Overview

Travelling has become a major requirement of people today. Roads have become one of the prime modes of transportation. For an ordinary traveler, finding his/her Route in the minimum time to the destination is a difficult task specially in big cities of Pakistan. If the passenger has less experience in travelling by Route to a particular place it is difficult to correctly identify the Route which has the lowest cost in both time and distance.

This project addresses the above problem via an android application which ensures a reliable service to its users to find the desired Route, given the source and the destination.

1.2 Problem Statement

To identify and select a best route to Travel within the city by personnel transport to the destination with the minimum traffic and delays.

1.3 Approach

Thisprojectaddressestheaboveproblemviaanandroidapplicationwhichensuresareliableser vicetoits userstofindthedesiredRoute, giventhe sourceandthedestination with a working Android phone having firmware greater than Android version 3.0 and AGPS with internet connectivity.

1.4 Objectives

The objective of this project is to build a system to aid the travelers in the process of selecting a route to their destination with the minimum time to travel.

Chapter 2: Literature Review

2.1 Introduction

People travelling to different locations daily or randomly don't ever know that how much time they will take for their route. They often get to know after reaching to their destination that if they would have adopted some other route then they could have saved their valuable time. Travelling has become a major requirement of people today. Roads have become one of the prime modes of transportation. For an ordinary traveler, finding his/her Route in the minimum time to the destination is a difficult task specially in big cities of Pakistan. If the passenger has less experience in travelling by Route to a particular place it is difficult to correctly identify the Route which has the lowest cost in both time and distance.

2.2 Background

People travel daily to their offices or drop their children to schools and colleges first and then travel to their workspace. They themselves don't know that why on some day they reach early to their office or why on some other day they get late from work in spite following the same route they used to travel daily. This is because of the uncertainty in the traffic on the roads on different timings. People cannot remember that on what day the road will be congested or on what time there will be no traffic at all. This problem needs to be addressed in this modern age of technology, but the solutions are very costly and unworkable.

2.3 Related Work

Some links that show the work done in the field of traffic management are as follows

www.trafficsa.com.au/

www.trafficcontrolsystems.co.nz/

2.4 Recent Work

Presently, work is being done on the same issue by a team of software engineers who will install cameras on major places of the city and monitor the traffic by image processing techniques. The data will be live for the users and they can get the traffic updates.

Apparently the solution is good for traffic monitoring but is practically not possible as there would be a requirement to install the cameras at major places of the city and to provide internet connectivity. It will increase the cost more than the solution it provides.

2.5 Proposed Project

The project is a Mobile (Android) application which will integrate with the Google Maps and will give the best route with minimum ETA (Estimated Time of Arrival) to a particular destination (selected by a user). It will use the Users Mobile GPS to track him/her on the route and calculate the time (wherever he is going) and will save/Upload that time taken on that specific time of day to the Application server which will later be provided to the other users.

It is totally crowd sourced application but initially the school/office timings of the city will be added to the application server which will have a certain amount of uncertainity in the ETA provided. As the users will grow in number and start to travel using the application, the timings will get better.

2.6 Shortcomings and Issues

1. The application is using Google Maps through its provided API which is limited in achieving the desired functionality. The Geo Fence points provided by the API are only provided if the user asks for a route. The solution to this problem demanded a new software for the administrators of the server where they can get the geo fence points and add them to the server.

2. The ETA and its validity totally depends upon the number of the users who travel using the route planner application with their AGPS turned on.

3. Bad weather conditions can cause problem in connectivity of the AGPS.

4. Internet connectivity is not always available in Pakistan and data cannot be sent in real time. A solution to this problem was created in the application by letting the data being recorded in offline mode and send the data to the server whenever there is internet connection available.

Chapter 3: Software Requirement Specification

3.1.Introduction

To get to know that how can we use the crowd travelling on the roads to provide us with the route details of how they travelled and how long it took them to travel. We need to get this information from the crowd and give it to the crowd.

3.1.1Purpose

Purposeofthischapteristodescribethedetailedrequirementspecificationforthe‘ Route Planner’Route ManagementApplicationforAndroidPlatform.Itwillexplainthepurposeand featuresofthesystem,the interfacesofthesystem,whatthesystemwilldo,theconstraintsunderwhichitmust operateandhowthe systemwillreacttoexternalstimuli.

Theintendedaudienceofthisdocumentincludestechnicalassessmentpersonnela ndotherprospective developerswhowouldliketo developthissystemwithfurther modifications.

3.1.2 Scope

Travellinghasbecomeamajorrequirementofpeopletoday.Roadshavebecomeone oftheprimemodesof transportation.Foranordinarytraveler,findinghis/herRoute in the minimum time tothedestinationisadifficulttask speciallyin big cities of Pakistan.If thepassengerhaslessexperienceintravellingbyRoutetoa particularplaceitis

difficulttocorrectlyidentifytheRoutewhichhasthelowestcostinbothtimeanddistance.

Thisprojectaddressestheaboveproblemviaanandroidapplicationwhichensuresareliableservicetoits userstofindthedesiredRoute, giventhe sourceandthedestination.

3.1.3References

- AndroidDeveloperesweb http://developer.android.com/index.html

3.1.4Overview

TherestofthedocumentcontainsanoveralldescriptionoftheRouteManagementApplication(section2)andthe specificrequirementsofthesystem(section3)

3.2. OverallDescription

3.2.1 ProductPerspective

ThisapplicationTakes the usersstartingplaceusing the AGPS andprompts to enter the destination intheuserinterfacesimplyby searching for the place or by selecting a random point on the map,asone wouldddoinGooglemaps.Theoutputwillconsistofavailable options/routeswith the estimated TTT from the server whereusercanselectfrom.Interfacewillbe madeto havea similarlookand feelthatis consistentwithandroidapplications.Thesystemisexpectedtoevolveseveraliterationsoverseveral releases.

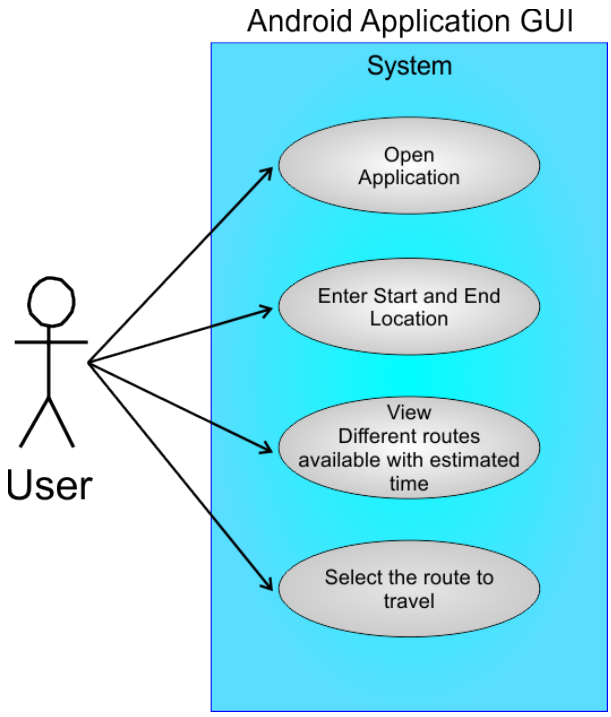

Figure 1 Use Case Diagram (Users perspective)

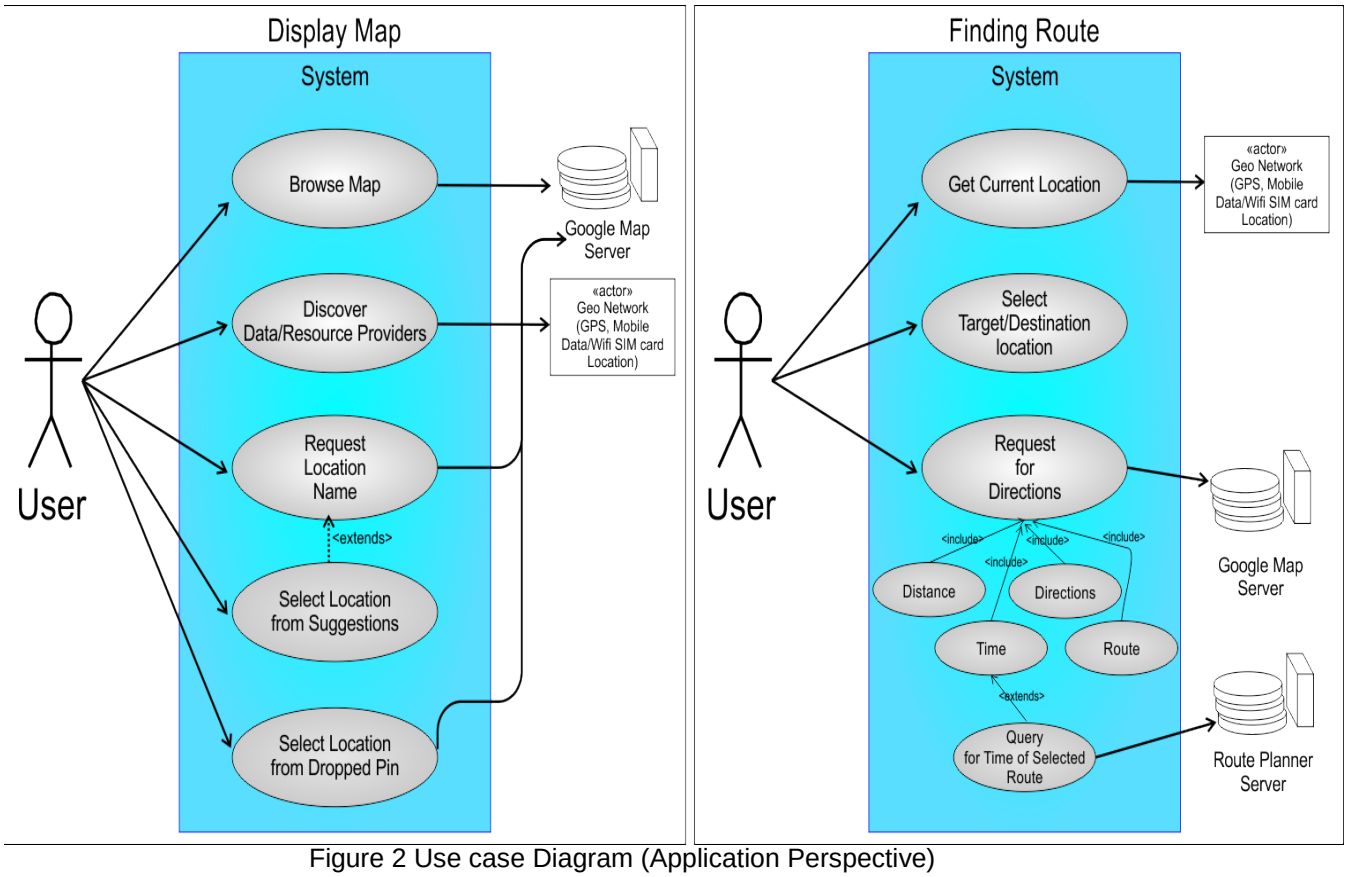

Figure 2 Use case Diagram (Application Perspective)

3.2.2 Productfunctions

- Outputa refinedlistofroutes,accordingtothe beginningandthedestinationswhichtheusers canviewthebestpossibleTTT.
- Routeisgeneratedaccordingtoanoptimizedpathfindingalgorithmwhicha voidsmismatchesandconflictsinroutessuch as traffic or any other delays as muchaspossible.
- Oncetheuserselectsa particularroute, userisprovidedwithaviewof hisrouteandcurrent positionviaGooglemaps.

3.2.3 Usercharacteristics

The user is able to use anandroidphone and it is assumed that he/she is familiar with the Existing Google Maps for Android phones.

3.2.4 Constraints

Sincetheamountof memoryandspaceislimitedinanandroidphone,thedatabasewillnotgetinstal led locally;insteaditwillconnecttoa remoteserver viainternetandfetchrequireddata.Theapplicationmay requirea bitofprocessingpower anddatabase mayneedtobe updatedandexpandedfurther.Sothere shouldbea good always upinternetconnection (3G)whichwillalsobe used whenconnectingtoGoogle maps.

Furthermore, the application requires a constant GPS connection which would get the users location for getting the start point and subsequently throughout the route.

Oneoftheotherconstraintsisthattheapplicationwill notworkonotherplatformsandwillonlyworkon android3.0andlateroperatingsystems since.

3.2.5 Assumptionsanddependencies

Androidhasseveralfeaturesthatareincludedintheapplication.Foranexample, GoogleMaps externallibrary,javasupport,touchscreensupportis used.Theapplicationshouldworkonany handsetaslongasitisrunningAndroid3.0orlater.

SincethemaindependencyisAndroidSDK,theenvironmentthattheyhavesetu pistouseEclipseas theIDE,witha plug-inforSDK.Anyissueswiththeemulatordifferingfromthewayanactualphone willruntheapplicationwillhavetobeconsidered.

Itisalsoassumedthat userinputwillonlycomeinthreeforms,thetouchscreen,keyboard(ifonly phonehasone)andotherbuttonsonthe handset.Sinceeachandroidphonehasits uniquebuttons,they willbeonlyusedto navigatebackand forthandtoterminatetheapplication.Applicationwillmostly relyontouchscreen(andkeyboard)toperformtherestoftheapplicationsnaviga tion.

Theapplicationwill useanexistingdefault Routedatabaseand only travel timings without the traffic delays asatpresent because till the time any user has not travelled from the specific location at a specific time, the server cannot know the time delays.Alsoitwill dependontheGooglemapsexternallibrarytogivethepositionofthe userwhiletravellingina Route.

Listoffeatureswillundoubtedlybemodified throughoutthedevelopmentprocess,butanynew featuresshouldnot haveamassiveeffectondocumentationortheoverallgoal.
Inusingtheonscreenkeyboard,itisassumedthattheuserisliterateandcantypeEnglishinselecting locations.

3.3. SpecificRequirements

3.3.1 Functionality

AcceptUserInput

- The system shallprovideasimpleuserinterfacetoinput(type with keyboard)theirdestination.
- The system shall be able to send query for getting TTT for a specified route to the server and shall be able to accept and display the response from the server.

Output possible Route routes

- The system shall generate the Route by avoidingmismatches andconflictsinroutes such as traffic or any other delays as muchaspossible and outputs the route[s] with minimum to maximum TTT.
- Oncetheuserselectsa particularroute, the usershall be providedwithaviewof his/herroutewith thebestpossible(minimum) TTT andcurrent positionviaGooglemaps.

Database Server

- The system server shall always remain Up unless during maintenance break which should not exceed 24 hours.

- The Online server shall maintain of record of TTT for the neighboring Geo-Fence points according to the Time of Day with 1-hour interval in normal working hours and 15 minutes' interval on peak rush hours in its database.

Navigate with Route planner using GoogleMaps

- The system shall record the time taken by every user while he/she is travelling from geo-fence points en-route on any route specified by the user or when idle and send it to Online Route Planner database server.

3.3.2 Usability

Simple, Graphical User interface

- Theuserinterfaceshallbe simpleto use withfamiliar GUI as of Google maps.Textsare simple,clear andreadable.Colorsare usedaccordingtoa theme whichmakesitmoreusable.

Minimal surprise

- Interfaceisdesignedconsideringtheuserexperienceofusingandroida pplicationwithproviding minimalsurprise.

Ease of use

- Full screenisused withrightsizebuttonstosuitbigfingers.Easynavigationamongwindowsan d menus.

User Guidance

- Usersareprovidedwitha smallhelpguideandtooltips.

3.3.3 Reliability

Availability

- Theservershouldalways beUp on standbyto serveuserrequestsexceptthetimeof maintenanceor upgrade which should not exceed 24 hours.

Accuracy

- Theoutputshouldbeaccuratetothebestpossiblepercentageandshoul davoidconflictingand misleadingoutputswhentheinputsareconfusing.(Minimumdefectrate).i. ecriticalbugshaveto beeliminated.

Mean time to recover

- Ina caseoffailuresystemshouldbeabletorecover within1 dayor so(dependingonthetypeof damage)

3.3.4 Performance

Response Time

- Theoutputshouldbe generatedwithinamaximumof10 secondsdependingontheinternet connectionspeedandhandsetperformance.

Transactions per second

- Thedatabaseserver canhandle150transactionspersecond, i.e it can entertain 150 simultaneous users in one second.

Capacity

- Systemshall allow a minimum of 200 usersto connect to the server simultaneously via TCP connection.

Resource Utilization

- TheapplicationutilizesminimumamountofCPUandmemoryofthedevice.

3.3.5 Supportability

Coding standards and naming conventions

- Propercodingandnamingconventionsaremaintainedtosupportanylaterchangesor modificationsofcode.

3.3.6 DesignConstraints

Sincethisapplicationrunsonandroidplatform,theapplicationisboundedundersev eralconstraints.
DevelopmentismainlybasedonJavalanguageandhastorelyonAndroidAPI's,SD Ks,plug-inandtools. Googlemapsexternallibrarywillbe usedtoaddnavigationalfunctionalitytothesystem.EclipseIDE will bemainlyused fordevelopmentword.Majorchangestoanyofabovewillcause severalchangestothe system.

Forthefirstreleaseoftheapplication,onlycertainnumberofRoutescanbechosentotravel.Onlythe Routes inRawalpindiareas willbeimplemented.Furthermodificationandexpansionwillbedonein later releases.
Timeallocatedfortheprojectisabout4months.Alltheprojectanddocumentedwithinthetime constraintgiven.

3.3.7 On-lineUserDocumentationandHelpSystemRequirements

Userswillbeprovidedwithbothonlineandofflinehelpincaseofneed.Onlinehelpwillbeemailwithnecessarydocuments.Userscanalwaystakeadvantageofthehelpwhich comeswiththeapplicationitself.

3.3.8 Interfaces

3.3.8.1 UserInterfaces

Viewobjectsarethebasicunitsofuserinterfaceexpressionontheplatform.TheView classservesasthebasefor subclassescalled"widgets,"whichofferfullyimplementedUIobjects, liketextfieldsandbuttons.
TheuserwillstarttheapplicationprocessbyselectingtheapplicationiconintheAndroid
menu.Oncetheinputsare
given,thecanbeclearedandnewinputscanbeprovided.Additional options menuisaccessibleforfurthertasks.

3.3.8.2 SoftwareInterfaces

- AndroidAPI
- Google/GoogleMaps API

- Eclipsewillbe neededforthe developmentportionoftheproject,andit willbe utilizingthe Androidsoftwarepackages.

3.3.8.3 CommunicationsInterfaces

ClientneedstocommunicatewiththeremoteserverusingHTTP/HTTPS.

3.3.9 LicensingRequirements

3.3.9.1 Legal,Copyright,andOtherNotices

GPL–Generalpubliclicense

Chapter 4: Design and Development

4.1. Introduction

4.1.1 Purpose

Thischapterprovidesa comprehensivearchitecturaloverviewofthesystem,usinganumberofdifferent architecturalviewstodepictdifferentaspectsofthesystem.Itisintendedtocapturea ndconveythe significantarchitecturaldecisionswhichhavebeenmadeonthesystem.

4.1.2 Scope

Travelling has become a major requirement of people today. Roads have become one of the prime modes of transportation. For an ordinary traveler,

finding his/her Route in the minimum time to the destination is a difficult task specially in big cities of Pakistan. If the passenger has less experience in travelling by Route to a particular place it is difficult to correctly identify the Route which has the lowest cost in both time and distance.

This project addresses the above problem via an android application which ensures a reliable service to its users to find the desired Route, given the source and the destination.

4.1.3 Overview

The firstchapterofthedocumentistheintroductioncontainingthepurpose,scope,references andseriesof definitionofterms.Chapter2 includestheoverviewofthesystemtogetherwiththedescriptionofitsbasic functionality.Theoverallsystemdesignisdescribedinchapter3.Thissystemdesignincludesthefirstleveldecompositionofthesystemintofunctionalcomponentswithdiagrams. Startingfromchapter4, each chapterisdevotedtothedescriptionofa singlecomponent.Itincludeswhatthecomponentis,whatisthe purpose,whatitdoes,howitisdecomposed,theinterfacesandthedependencieswithothercomponents.

4.2. System architecture description

Thissectiondescribeswhatsoftwarearchitectureisforthecurrentsystem,andhowitisrepresented.Ofthe Use-Case,Logical,Process,Deployment,andImplementationViews,itenumeratestheviewsthatare necessary,andforeachview,explainswhattypesofmodelelementsitcontains.Theseare viewsonan underlyingUnifiedModelingLanguage(UML)model.

4.2.1Overview of modules / components

4.2.1.1 Android phone.

The world's most popular mobile OS. Android is customizable, easy to use and works perfectly with all your favorite apps. The user must be familiar with the android interface and the phone should have an AGPS with the connection of high speed internet (3G/Wifi).

4.2.1.2 AGPS

This is the hardware in the android phones which will directly connect to the satellite for getting the location of the phone.Assisted GPS (abbreviated generally as A-GPS and less commonly as aGPS) is a system that is often able to significantly improve the startup performance, or time-to-first-fix (TTFF), of a GPS satellite-based positioning system.

4.2.1.3 Google Maps

These are the already existing maps used to Find local businesses, view maps and get driving directions. We will use the Google Maps API for interacting with the application and use its features.

4.2.1.4 Route planner Server

This is an online server which will keep the database required for the application routing algorithm. The maps and the navigational information will not be stored in this server; it shall only contain the time to travel to a particular destination.

4.2.2 Basic System Architecture

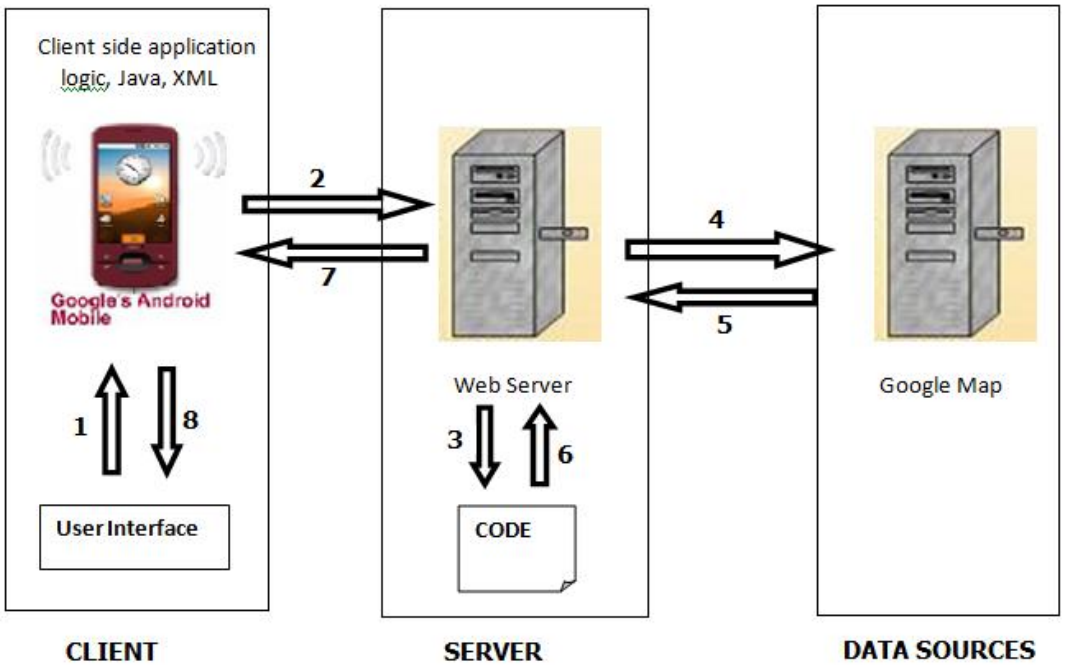

Figure 3 Basic System Architecture

4.2.3 Use-CaseRealizations

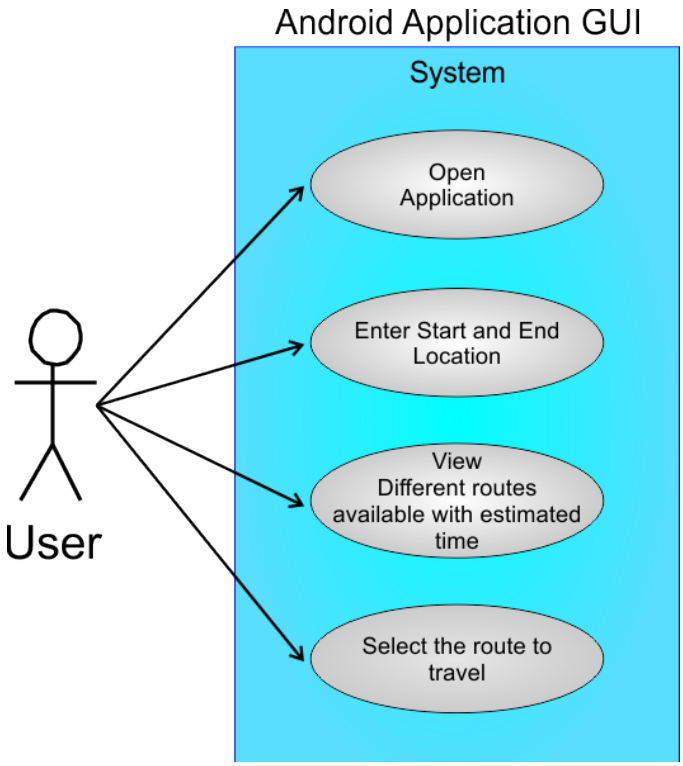

FIGURE 1 (USE CASE DIAGRAM)

This application Takes the users starting placeusing the AGPS and prompts to enter the destination inthe user interface simply by searching for the place or by selecting a random point on the map, as one would do inGooglemaps. The outputwillconsist ofavailable options/routes with the estimated TTT from the server where user can select from.Interface willbe madeto havea similar look and feelthatis consistent with android applications. The system is expected to evolve several iterations overseveral releases.

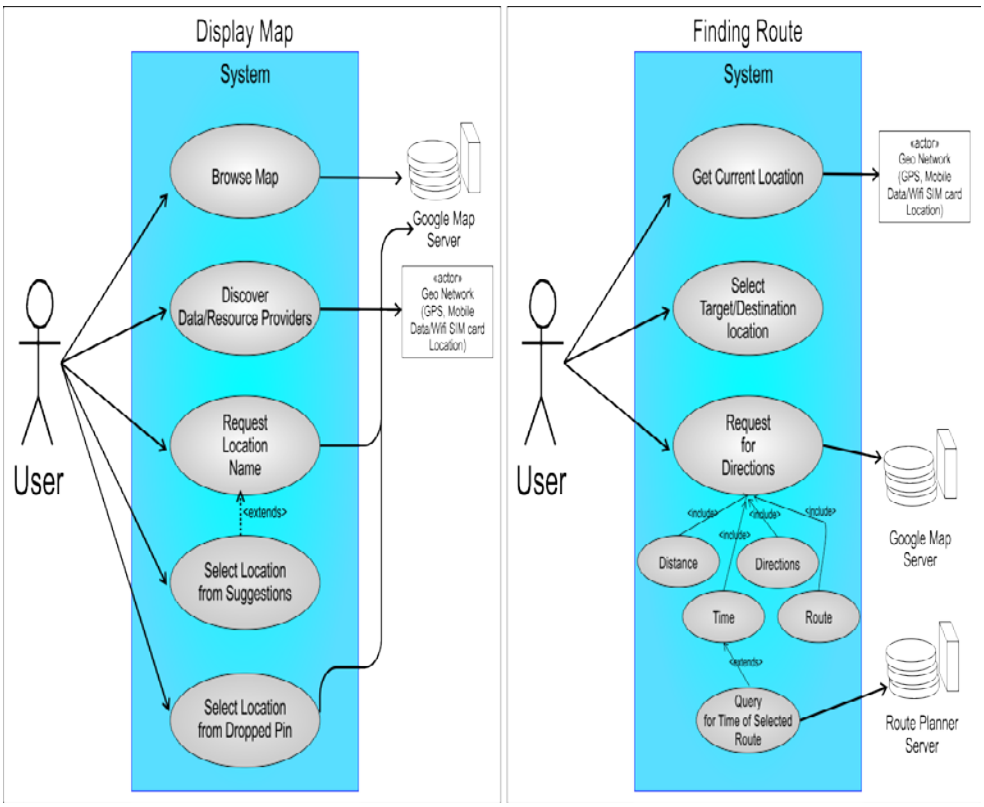

FIGURE 2 (USE CASE DIAGRAM)

Developer should be responsible inaccessing Android API's, otherrelated documentation to gather knowledge onandroid application development and develop the application.Developer can contribute to releasemodifiedversions and make updates onthe server/database side. Updates willbe ondeveloping the Routing algorithm and add new locations and buses to the database.

4.2.4 Sequence Diagram

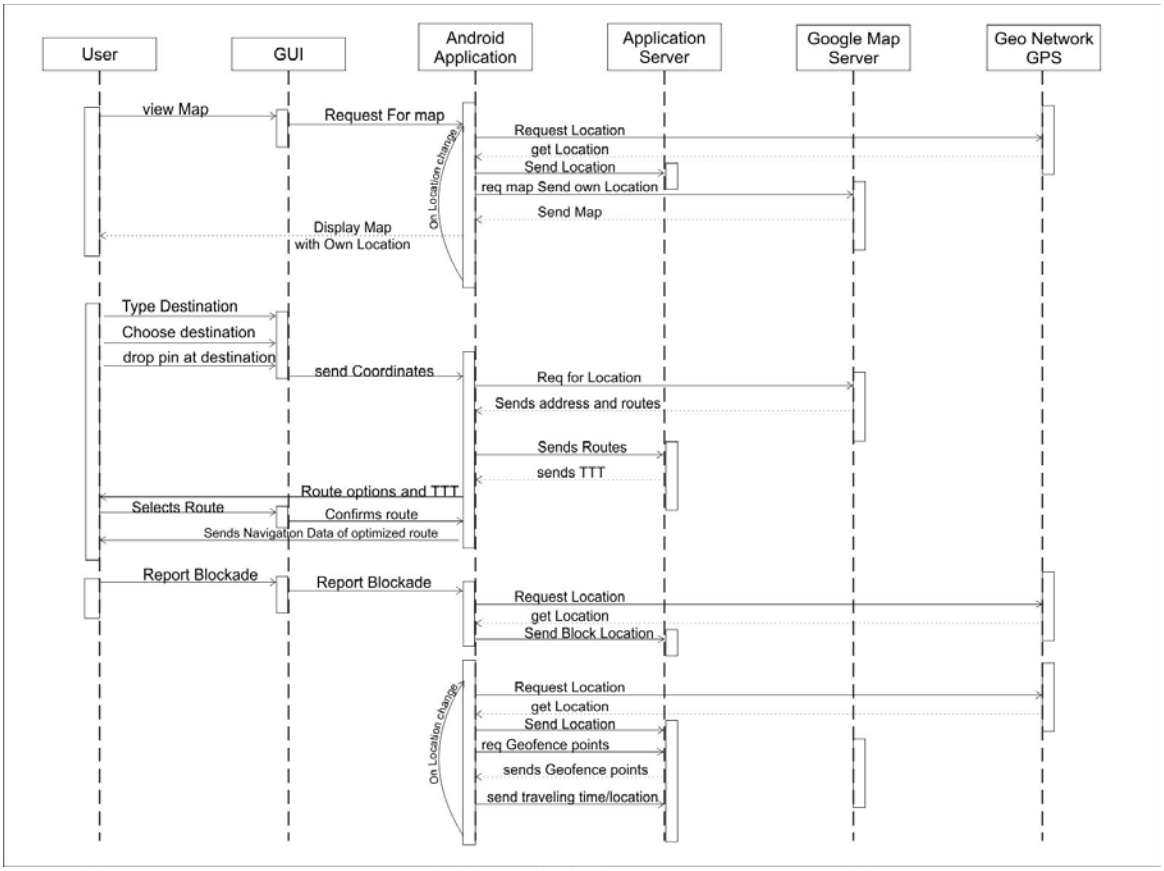

FIGURE 4 – SEQUENCE DIAGRAM

4.2.5 UMLClass Diagram

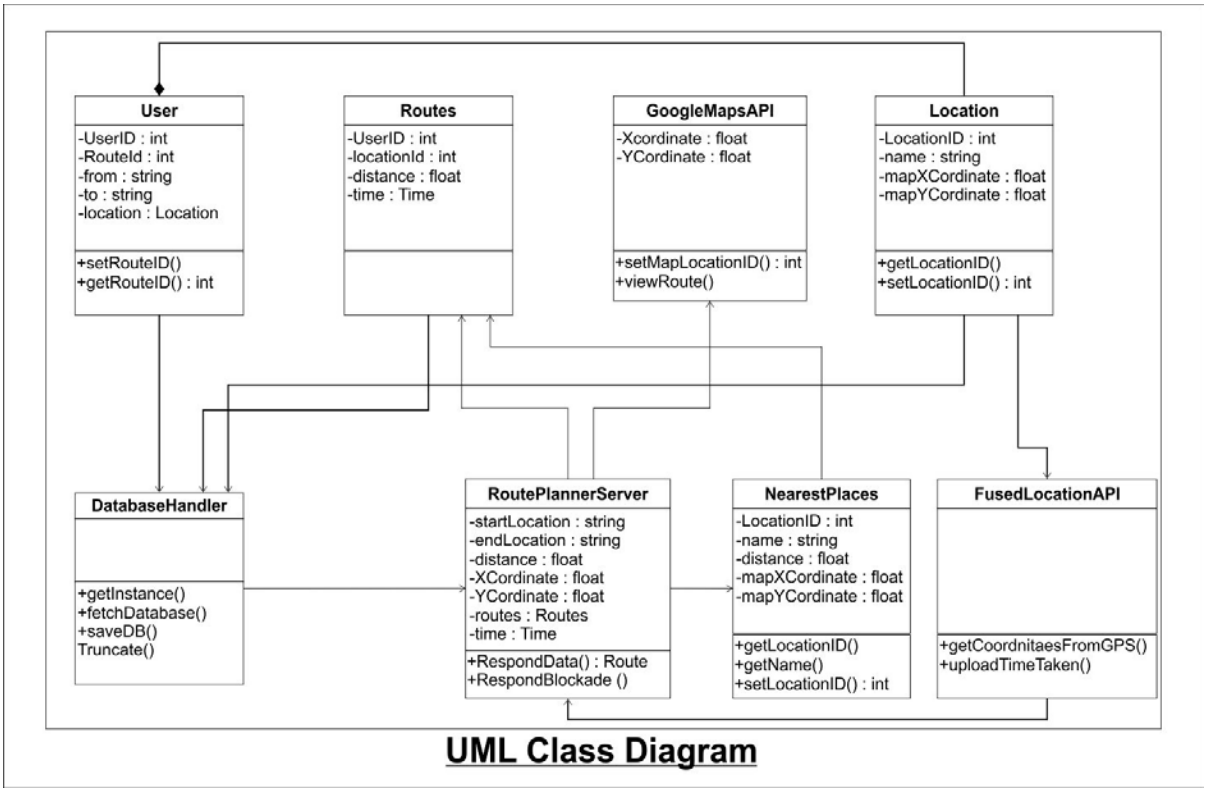

FIGURE 5 – CLASS DIAGRAM

4.2.6 Activity Diagrams

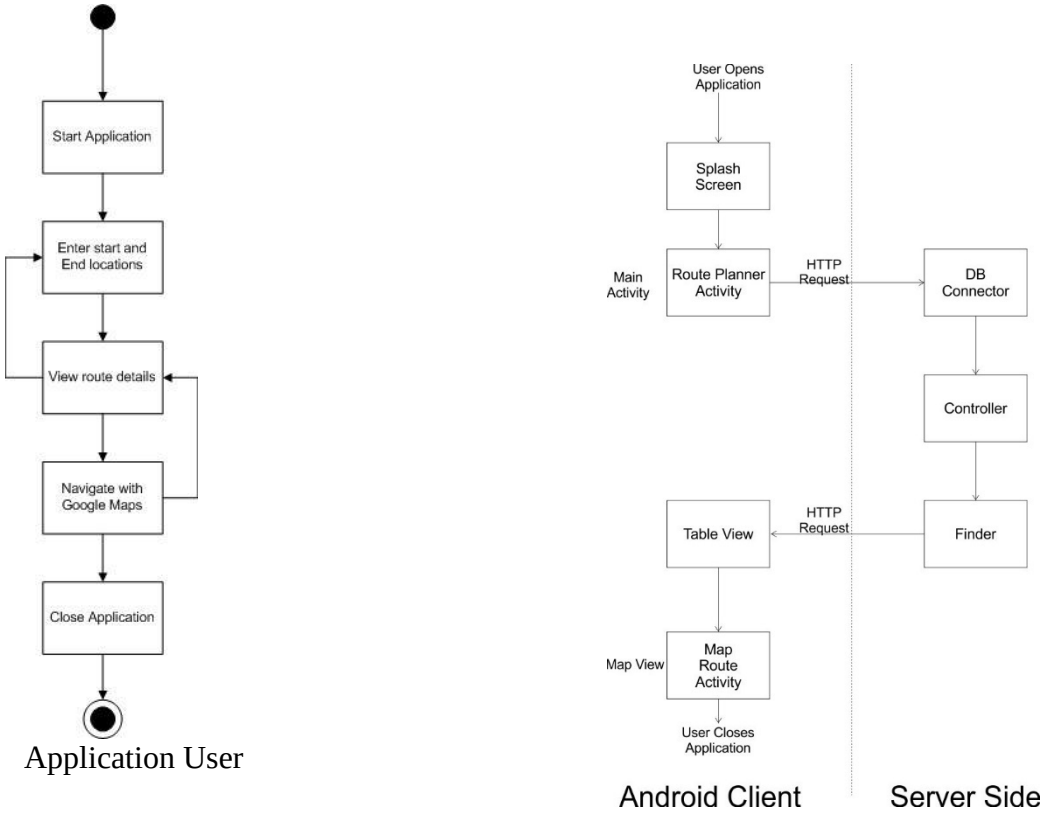

Figure 6 – Activity Diagrams

1. Userstartstheapplicationandentersthestartandendlocationstotheapplication.
2. Applicationthensendstheuserrequesttothe serverviaHTTPrequest.
3. PHPserverreceivestherequestandDBHandleropenstheDBandpassesittothecontroller.
4. Controllerthenhandlesthequeriesandoutputsdatato Finderwhichcontainsthelogicpart.
5. Finderthengeneratesthebestrouteandrespondstotheclientagainasa HTTPresponse.
6. TableViewdecodesthe serverresponseanddisplaysit.
7. TableViewpassesthelongitudesandlatitudesofthelocationstothe MapRouteActivityto display intheGoogleMap.
8. MapRouteActivityobtainsthecoordinatesanddisplaysitintheMap withtheuser'scurrent locationobtainedbyGPS.
9. Usercantheclosetheapplication.

4.3. Detailed description of components

4.3.1 Architecturally Significant Design Packages

*DatabaseHandler*is a local database in the mobile phone which assists ininsertion,deletionandmodificationofSQL databaseandmakinga connection withthedatabase on the *RoutePlannerServer*.Whenuserconnectstotheserveruserinputs(startanddestination locations) arefedtothe *NearestLocation*via*DatabaseHandler*.*NearestLocation*thentakesthe*locationID*softhetwo locationsanddoesa databaselookupvia*RouteClass*.Relevanttime entriesarefetchedfromtheRoute planner server databaseand manipulationsaredonebasedona pathselectionalgorithm.SelectedroutesarethemappedtotheGoogle Maps.
*FusedLocationAPI*class provides the functionality of recording the time taken by the user on any path he is travelling. It keeps tracking the user on his route and calculates the time. This time taken by the user is uploaded to the application server.

4.3.2 Browse Map

Identification	**Browse Map, it will be displayed on the front interface at the top**
Type	Sub Program
Purpose	Displays the map and your current location
Function	Browse the map, Near locations,
Subordinates	Google Maps API
Dependencies	The entire application depends upon this component, it displays the map to the user for further navigation and any other function
Interfaces	It is using API of google maps and has no extended interface for other components, other components interact with it using the same Google maps API
Resources	It takes permissions to use the AGPS of your phone, the internet connection, the connection with the google maps server
Processing	Sends own location of the phone from AGPS to the maps server and requests the neighboring map of the area. Displays the map to the user
Data	It uses the data provided from the google server.

4.3.3 Discover Data Resource providers

Identification	**Discover Data Resource providers**

Type	Service
Purpose	Connects with the Satellite to get the location, checks the Wifi or 3G internet state.
Function	Gets location, connects to servers
Subordinates	AGPS, Wifi Module, 3G
Dependencies	The application is of no use without this component, the locations are fetched using this module and the internet is accessed using this.
Interfaces	AGPS permission and API, Wifi API, 3G API
Resources	Internet (Wifi / 3G), AGPS
Processing	Uses AGPS to find the location from the satellites which gives the X and Y coordinates of the mobile.
Data	Initially there are no values and the application cannot run until it completes its action, the Coordinates are in float

4.3.4 Select Location

Identification	**Select Location, from the browsed map, by suggestion, by dropped pin**
Type	Class
Purpose	Allows the user to select a destination
Function	Gets location from the user, user can type the address, select from suggestions or drop pin on any point on the map.
Subordinates	It is the requirement of the user to interact with application and give an address to it for the route. It requests the google server through the internet for getting the addresses coordinates
Dependencies	This function is essential to the application as without this only the browsing of map will be possible but not the route calculation
Interfaces	Sends message/coordinates to server for route details.
Resources	Internet (Wifi / 3G), AGPS
Processing	The selected locations coordinates are sent to the google server for the route details
Data	Float coordinates of the destination

4.3.5 Request for directions

Identification	**Request for Directions**
Type	Service
Purpose	Connects with the Satellite to get the location, checks the Wifi or 3G internet state.

Function	Gets location, connects to servers
Subordinates	AGPS, Wifi Module, 3G
Dependencies	The application is of no use without this component, the locations are fetched using this module and the internet is accessed using this.
Interfaces	AGPS permission and API, Wifi API, 3G API
Resources	Internet (Wifi / 3G), AGPS
Processing	Uses AGPS to find the location from the satellites which gives the X and Y coordinates of the mobile.
Data	Initially there are no values and the application cannot run until it completes its action, the Coordinates are in float

4.3.6 Time Query

Identification	**Time Query**
Type	subprogram
Purpose	Connects with the route planner application and fetches the time for the selected route
Function	Gets the Real time data from the route planner server and estimates the time to travel on the route. If no time is available on Route planner server then it gives the default time from the Google maps server
Subordinates	Major addition to the existing google maps server. it uses the database form the application server and gives the user the estimated time according to the time of day.
Dependencies	As it is the major functional point of the application, the application only provides this add on to the users' other than the already existing Google Maps.
Interfaces	Connects to the Application server (Route planner) for fetching Time. Displays the time to travel to the user
Resources	Internet (Wifi / 3G), AGPS
Processing	When the user selects any location, it requests for the Directions from Google Maps Server, the TTT provided by the google maps is discarded and a request for time for the particular route is queried from the route planner server which in return provides the Real time to travel to the destination.
Data	Time is returned in H:M:S format

4.4. Reuse and relationships to other products

4.4.1 Google Maps

Project is mostly based upon Google Maps, Although the complete working and functionality is not known neither is available but it is extensively used in our application using the API provided by Google.

4.5. Design decisions and tradeoffs

1. There are some key requirements and system constraints that have a significant bearing on the architecture. They are:
2. The ‘Route Planner’ will be implemented as a client-server system. The client portion resides on Android device (handset) and the server portion must operate on the web server. The server should be able to handle a minimum of 200 users to connect simultaneously
3. Although there is no user authentication in the application, but the application needs to authenticate itself with the Google maps, we will use the free API key from google for our application.
4. The application does not keep any private data. Therefore, there is no issue in safety or privacy of the user and data integrity is not affected.
5. All performance and loading requirements, as stipulated in the Project Vision Document and the Requirements Specification, must be taken into consideration as the architecture is being developed.
6. System will be developed for Android API and will have to be within the constraints of android platform.
7. System development will be in lined with the project schedule and any architecture which is being proposed has to be implemented within the time constrains of the project.
8. Product should be freely available for Android users to download via Android Market and Google Code.

4.6. Pseudo code for components

4.6.1 Route Planner Server

Maintains the database. The database has no entity relationship.

Locations

Location_id	From	To	Time	day	time_of_day

Blocked Location

Block_Loc_id	loc_name	Date	Time

Table 1 Databases on server

receives data from the users

update Database
receive time query
send time for the route
respond to blocked routes

4.6.2 Fused Location API

GetLocation – gets the location of the phone from GPS
Record time – starts to record time upon getting location
Observe change in location – keeps on listening to the change in the location
Get new location – get the
Save time – record the time between the two locations
Send path & time to server

4.6.3 User

view map – user can browse map as in google maps
Set destination – select a destination for which the route and time is required
getLocation – user can get his own location on the map

4.6.4 Location

getLocationID() – gets the current location of the user and save it to keep track
setLocation – sets the destination address of the user to his phone to draw and navigate on the track

4.6.5 Database Handler

It is a local database in user's phone which will keep a record of online server if the user wants. It also acts as cache for the continuous recording of data of user while travelling.
Fetchdatabase() gets the updated data from the server
saveDB() it sends all the data in the cache of the phone to the server.
truncate – deletes the data after uploading it to the server

4.6.6 Nearest Places

It is the point of interest (POI) places nearest to the user within a radius of 5km.
GetlocationID gets the users current position
getName gets the names of Mosques, café, restaurants, hotels, ATMs, Banks etc. nearest to you and you can select one from them.
getlocationID will get the coordinates of that selected location for shortest route and navigation.

Chapter 5: Project Analysis and Evaluation

Test Case Name	Open Application
Test Case No	01
Description	The application opens correctly and loads the map
Testing Technique Used	function testing
Preconditions Input	User meets the minimum hardware requirements for the application
Valid Inputs	User has AGPS supported android phone with android version greater than 2.1
Steps	open application, load map
Expected Output	It displays map with own location

Test Case Name	Enter locations
Test Case No	02
Description	Input destination
Testing Technique Used	function testing, Black box testing
Preconditions Input	Working 3G connection, GPS connected
Valid Inputs	The destination address is typed correctly
Steps	Press search, enter destination, select

	destination, select route
Expected Output	Accepts user input

Test Case Name	Find Shortest Route
Test Case No	03
Description	To find the shortest possible route for the provided destination
Testing Technique Used	Black box testing
Preconditions Input	User has given a valid input and connected to 3G and GPS
Steps	Press search, enter destination, select destination, select route according to time
Expected Output	Shortest route and path drawn on the map
Actual Output Status	Displays the route on map and navigates
Test Case Name	Near POIs
Test Case No	04
Description	Nearest Point of Interests and their timings
Testing Technique Used	Black box testing
Preconditions Input	User has given a valid input and connected to 3G and GPS
Steps	Click on any of the POI from the interface
Expected Output	Gives the list of nearest Point of Interests and their timings

Actual Output Status	Displays the route on map and navigates
Test Case Name	Database Queries
Test Case No	05
Description	The data is properly sent and downloaded from the database and is maintained
Testing Technique Used	White box
Preconditions Input	User has given a valid input and connected to 3G and GPS
Steps	Automatically done by the application
Expected Output	Database is maintained on the server

5.1 Environmental needs

Sincetheamountof memoryandspaceislimitedinanandroidphone,thedatabasewillnotgetinstalled locally;insteaditwillconnecttoa remoteserver viainternetandfetchrequireddata.Theapplicationmay requirea bitofprocessingpower anddatabase mayneedtobe updatedandexpandedfurther.Sothere shouldbea good always upinternetconnection (3G)whichwillalsobe used whenconnectingtoGoogle maps.

Furthermore, the application requires a constant GPS connection which would get the users location for getting the start point and subsequently throughout the route. Oneoftheotherconstraintsisthattheapplicationwill notworkonotherplatformsandwillonlyworkon android2.1andlateroperatingsystems.

5.2 Staffing and training needs

The staff and training need for this application is not as such required as it is easy to use and user friendly, further, we assume that the user is already familiar with the Google Maps

Users are provided with a small help guide and tool tips.

General development & testing techniques.

All development and manual testing that required to use.

5.3 Risks and contingencies

The following seeks to identify some of the more likely project risks and propose possible contingencies

a) Google Maps becomes unavailable -- Testing will be delayed until this situation is resolved.
b) API Doesn't provide the needed functionality.
c) Internet is not available-- testing will also affected due to this reason.
d) Not enough time to complete all test cases. If time cannot be extended, individual test cases will be skipped, starting with the lowest priority.

Chapter 6: Future Work

1. A need for integrating the application with a Weather forecast system. It will get the forecast of the area and will add a certain amount of delay within the route if there is a chance of rain/flood etc.

2. The system will get connected to Social media (Facebook, Twitter, G+, Phone contacts) and will get to know the location of friends on the map and will also inform you if your friend is nearby.
3. With the hospitals it will register the volunteer blood donors of the area and will allow the needy ones to approach the blood donors of their area in any emergency.
4. Adding encryption and using it with military convoys will help to trace the location of convoys and it will be integrated with mobile camera to see what actually is happening on the ground.
5. It will help against terrorism when it will be connected to the police stations and law enforcing agencies, people can report a potential threat, the exact location and the nature of threat supplemented with photographs. This will not disclose the identity of the informer but will help in eliminating crime.
6. School timings of different schools will be allowed to upload their starting and ending schedules which will help in knowing the potential road blockage due to mass traffic.

Chapter 7: Conclusion

AsBachelorsStudents,developingafully implementedsystemfortraffic controlwasanewexperienceforus,especiallysincedevelopmentinthisfield (i.e.the fieldofandroidmobile application). Butthe successful completionof this projecthasgiven ustheconfidence andknowledge towork the practicalfieldas professional developers.

During thedevelopmentofthefollowing projectwegotachancetopractically implementwhatwehavelearnedduring ourbachelor'sprogram.Whiledoing our projectwe haveachievedtheseveralbenefits.Someofthemwhichwillhelpusin future as asuccessful professional are as follows.

- Project managementandscheduling.
- Analyzingasystem andcollectingdata.
- Learned how to designsoftware.
- In testingphaselearned how to debug and newwaysof implementingthe test.
- Themostimportant one, which is notbothered toomuch in our education environment, is how to document properly.
- Finally,we chooseAndroid application and selectJAVA and got expertise in it.

This will not help us to enterinto industryand proveour self but will also help travelers all over Pakistan while traveling.

Chapter 8: References

- Android Developers web
  http://developer.android.com/index.html
- Google Maps API
  https://developers.google.com/maps/documentation/android-api/

- The Unified Modeling Language Reference Manual. James Rumbaugh, Ivar Jacobson, AND Grady Booch. 1998. P.81. ISBN: 0-201-30998-X.