



Sudan University of Science and Technology
College of Graduate Studies
Computer Science and Information Technology



**Best Path Determination for Police Public Service Centers in
Khartoum**

تحديد المسار الأفضل لمراكز خدمة الشرطة في الخرطوم

**A Thesis Submitted in Partial Fulfillment of the Requirements of Master
Degree in Computer Science**

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January 2022

الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى

ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً فَخَلَقْنَا الْمُضْغَةَ عِظَامًا
فَكَسَوْنَا الْعِظَامَ لَحْمًا ثُمَّ أَنْشَأْنَاهُ خَلْقًا آخَرَ ۗ فَتَبَارَكَ اللَّهُ أَحْسَنُ الْخَالِقِينَ

صَلِّ عَلَى اللَّهِ الْعَظِيمِ

سورة المؤمنون الآية (14)

DEDICATION

All praise to Allah, today we fold the days' tiredness and the errand summing up between the cover of this humble work.

To the utmost knowledge lighthouse, to our greatest and most honored prophet Mohamed - May peace and grace from Allah be upon him

To whose precious to my heart ... my mother, my father.

To my dear brother and my beloved sister.

To my supervisor and friends and all students who are interested in the field of GIS.

I dedicate this work to them all for the support, encouragement, love and prayers that they have always had for us. My Allah blesses them all and grants them happiness all through.

ABSTRACT:

Location Based Services (LBS) are mobile services that have the capability to provide real time information based on the user's location, Geographical Information System (GIS) has been the core of LBS in order to provide all the functionalities in LBS. They also open a new area for developers and cellular service network operators. Location-based services offer many merits to the mobile clients.

The main objective of this research is to understand the benefits of using GIS through mobile phone programs by designing a program to help citizens and visitors when they need to reach a police public Service center for citizens in Khartoum within the city, Explore the current technology capabilities of GIS and mobile phone systems such as android to link the spatial information of the user to help making decisions also Provides information when the user and visitors submit site queries and directories to the correct and best route to reach the destination.

The goal of the research is to enable new people or visitors to know the way and how to reach the desired places, enable people to find alternative routes they do not know to reach the destination and Enable people to find the best route.

The methodology of research used is very flexible and can be used and applied to many projects and applications and can be used especially to fine hospitals, universities, airports, buildings that constantly change according to the country to make decisions and follow the shortest and best bath to reach those places.

In this system, several software's was employed and used in order to complete the required production .

المستخلص:

الخدمات المستندة على الموقع (LBS) هي خدمات للهواتف المحمولة لديها القدرة على توفير معلومات في الوقت الفعلي بناءً على موقع المستخدم الحالي، كما نجد أن نظام المعلومات الجغرافية هو جوهر الخدمات المستندة على الموقع من أجل توفير جميع الوظائف في هذه الخدمات بالإضافة إلى أنها تفتح آفاق جديدة للمطورين ومشغلي شبكات الخدمات الخلوية، الخدمات المستندة على الموقع تقدم العديد من المزايا لمستخدمي الأجهزة المحمولة.

الهدف الرئيسي من هذا البحث هو فهم فوائد استخدام نظم المعلومات الجغرافية من خلال برامج الهاتف المحمول وذلك من خلال تصميم برنامج لمساعدة المواطنين والزوار عندما يحتاجون للوصول إلى مركز خدمات الشرطة للمواطنين داخل المدينة واستكشاف القدرات التكنولوجية الحالية لنظام المعلومات الجغرافية و أنظمة الهاتف المحمول مثل android لربط المعلومات المكانية للمستخدم للمساعدة في اتخاذ القرارات كما يوفر أيضاً معلومات عند قيام المستخدم بإرسال استعلامات الموقع والدلائل إلى الطريق الصحيح و افضل طريق للوصول إلى الوجهة.

الهدف من البحث هو تمكين الأشخاص أو الزوار الجدد من معرفة الطريق وكيفية الوصول إلى الأماكن المرغوبة ، وتمكين الأشخاص من العثور على طرق بديلة لا يعرفونها للوصول إلى الوجهة وتمكين الأشخاص من العثور على أفضل طريق.

أن المنهجية المستخدمة مرنة للغاية ويمكن استخدامها وتطبيقها على العديد من المشروعات والتطبيقات و يمكن الإستفادة منها خصيصاً في الوصول للمناطق الخدمية، تم استخدام عدة برامج للوصول للصورة النهائية للمشروع.

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LIST OF ABBREVIATION:

Definition	Abbreviation
OAU	<i>Omdurman Ahlia University</i>
BIM	<i>Building Information Management</i>
CAD	<i>Computer Aided Drafting</i>
CIM	<i>City Information Model</i>
CRP	<i>Close Range Photogrammetry</i>
COTS	<i>Commercial Of The Shelf</i>
DEM	<i>Digital Elevation Model</i>
DTM	<i>Digital Terrain Model</i>
GIS	<i>Geographic Information Systems</i>
GPS	<i>Global Position System</i>
LOD	<i>Level Of Detail</i>
LiDAR	<i>Light Detection and Ranging</i>
2D	<i>Tow Dimension</i>
3D	<i>Three Dimension</i>
VRM	<i>Virtual Reality Model</i>
WGS	<i>World Geodetic System</i>
webGL	<i>Web Graphics Library</i>

CHAPTER ONE

Introduction

- 1.1 Overview**
- 1.2 Problem Statements**
- 1.3 Research Hypothesis**
- 1.4 Research Objectives**
- 1.5 Research Significanc**

CHAPTER ONE

Introduction

1.1 Overview

(Location Based Services (LBS) are mobile services that have the capability to provide real time information based on the user's location.)

Geographical Information System (GIS) has been the heart of LBS in order to provide all the functionalities in LBS. They also open a new area for developers and cellular service network operators. Location-based services offer many merits to the mobile clients. The steps are involved for including Google maps are:

- First, sending location information to remote parties. This set of services are commonly used today, e.g., in location tracking applications.
- Secondly, use the location information to make communication decisions, e.g., a user agent may automatically disable instant messaging when driving.
- Thirdly, location changes can trigger communication actions, e.g., when a person's user agent gets a location notification indicating the person enters a room, the user agent may automatically turn on the light of the room.

Android is an operating system based on Linux with a Java programming interface. The Android Software Development Kit (Android SDK) provides all necessary tools to develop Android applications. This includes a compiler, debugger and a device emulator, as well as its own virtual machine to run Android programs. Android is currently primarily developed by Google. It allows background processing, provides a rich user interface library, supports 2 D and 3-D graphics using the OpenGL libraries, access to the file system and provides an embedded SQLite database. Android applications consist of different components and can re-use components of other applications. [1]

Google provides via Google Play Services a library for using maps. This library is the second attempt of Google Maps and this version provides significant improvements to the older API version. So, in this example, we are going to work with Google Maps v2 and see how we

will import a fully working map fragment in an Activity, as well as, we are going to work with basic Markers and Camera Positions on Google Map. [2]

Google Maps with embedding a location positioning system such as GPS are becoming very popular. There is a growing demand for location-based applications. It is easier, these days to utilize map information by connecting GPS receiver to PC and PDA. Corresponding to this momentum, GPS receivers are now embedded into mobile phones and applications using the location of the user in real-time are widely available. GPS chips are now included in many devices to analyze satellite signals and determine the user's location with high accuracy. In a large social event, such as a big conference, people come to communicate with each other. It is out of question and more likely that the attendants release their location information and the location privacy is not an essential concern. In addition, people usually need to register to join a conference, so a location server can easily get the participants' profiles. Hence, the server-centric mode is an economic way to handle location detection for big conferences. [1]

"Service centers for citizens" are service centers established to serve the citizens in the extraction of all official papers by the Ministry of the Interior using the national number and a driver's license, passport and car license and any legal procedure that concerns citizens.

1.2 Problem Statements

With the evolution of the means of transport and the opening of business, investment and tourism, the movement of people between the states and cities are regular appearances, but they encounter some of problems. If the people in place do not know, that there is a difficulty to finding services and shortest path sites such as restaurant, hotels, hospitals, police stations, Service centers for citizens, banks and ATMs and places to be in considerable need to know and access those services places way "Service centers for citizens in Khartoum"

1.3 Research Hypotheses

The following research hypotheses are formulated:

- Due to the modern development in the cities and the constant change there must be a way to facilitate knowledge of places of services, according to the development of modern technology in the field of mobile phones and GIS.
- Location Based Service (LBS) are mobile services with the capability to provide real time information based on the user's location and using mobile android and Global Position Service (GPS). These will help clients to find the nearest location and shortest path to Service centers for citizens.

1.4 Project Objectives

- The main objective of this research is to understand the benefits of using GIS through mobile phone programs by designing a program to help citizens and visitors when they need to reach a Service center for citizens within the city.
- Explore the current technology capabilities of GIS and mobile phone systems such as android to link the spatial information of the user to help make decisions
- Provides information when the user and visitors submit site queries and directories to the correct and shortest route to reach the destination.

1.5 The Significance

Mobile phone maps are useful tools in helping and guiding users to access places across applications. When used effectively, map-based applications are a time-saving tool that increases awareness of places. Generally, benefits associated with mobile mapping software include:

- Enable new people or visitors to know the way and how to reach the desired places.
- Enable people to find alternative routes they do not know to reach the destination.
- Enable people to find the shortest route to reach the destination.

CHAPTER TWO
Literature Review

2.1 Theoretical Framework.

2.2 Literature Review.

2.3 System description

2.4 Research community

CHAPTER TWO

Literature Review

2.1 Theoretical Framework

In the following are used methods of computer graphics, Geographic Information Systems and photogrammetry to solve the problem of constructing Virtual Reality 3D models and to convert them into GIS objects allowing for spatial analyses, such as short path analysis, buffering etc. Therefore, the strength of these three fields is presented first.

2.1.1 Location-based Service (LBS)

LBS is critical to many businesses as well as government organizations to drive real insights from data tied to a specific location where activities take place. The spatial patterns that location-related data and services can provide is one of its most powerful and useful aspects where location is a common denominator in all of these activities and can be leveraged to better understand patterns and relationships. Banking, surveillance, on-line commerce, and many weapon systems are dependent on LBS [3].

A. LBS Definition

A location-based service (LBS) is the name for a general class of policies in software-level services that provide for accessing data, files, pipes, memory objects, streams and other or online services. Access policies are controlled by location data and/or time-of-day constraints, or a combination thereof. As such, an LBS is an information service and has a number of uses in social networking today as information, in entertainment or security, which is accessible with mobile devices through the mobile network and which uses information on the geographical position of the mobile device [3].

2.1.2 Geographic information systems (GIS)

While many consider Geographic Information Systems (GIS) to be software programs that manipulate spatial data, this definition is very restrictive. As the name implies, GIS are systems designed to input, store, edit, retrieve, analyze, and output geographic data and information.

Like all systems (e.g., ecosystems, digestive systems, ventilation systems, etc.), the GIS is composed of an orchestrated set of parts that allow it to perform its many interrelated tasks. These parts include also computing facilities [4].

A. GIS Definition

GIS is a computer-based system that provides the following four sets of capabilities to handle georeferences and data (see Fig. 2.1):

1. Data capture and preparation (input).
2. Data management, including storage and maintenance (database).
3. Data manipulation and analysis.
4. Data presentation (output).

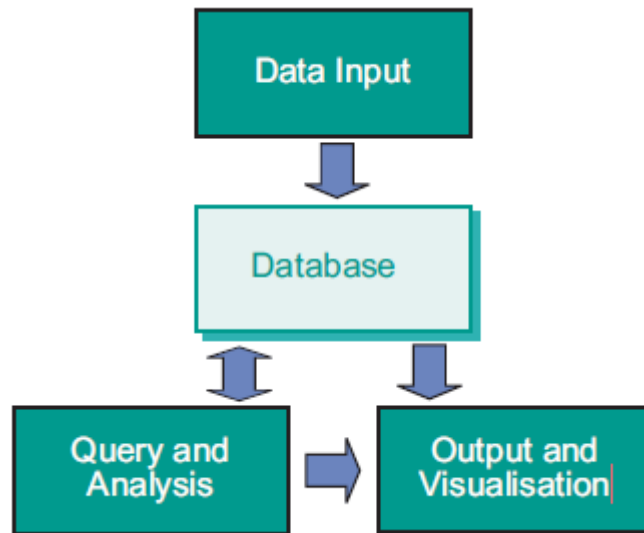


Fig. 2.1 Functional component of GIS. [5]

GIS provides spatial representation and analysis of information (attribute data) that is positioned to correspond to the same X, Y coordinates throughout the various map layers (see Fig. 2.2). [5]

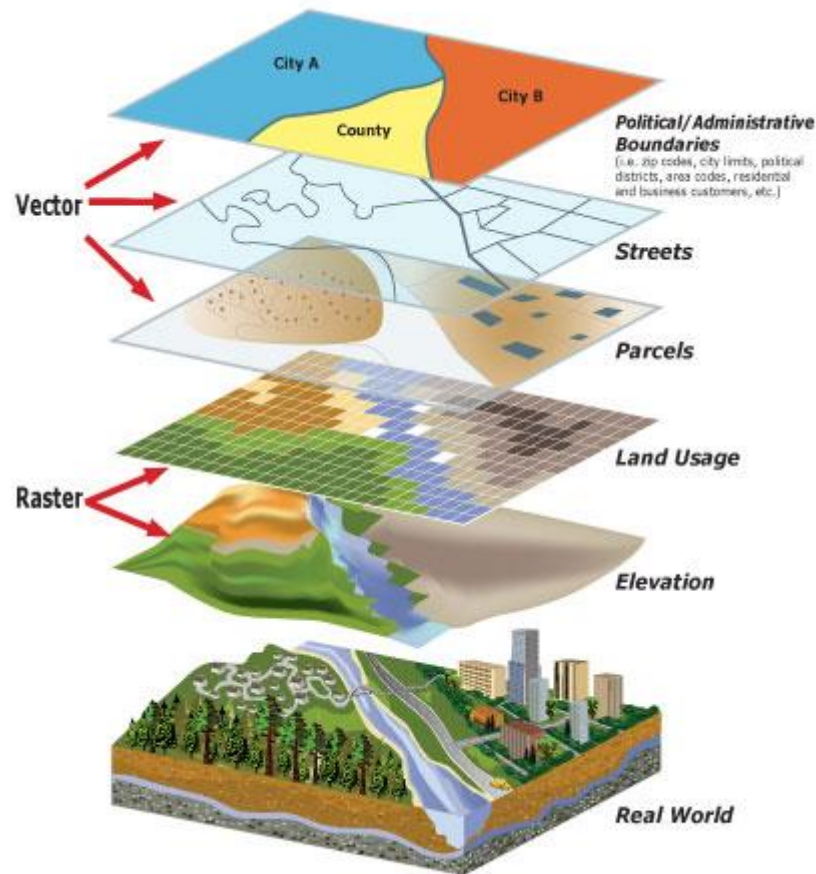


Fig. 2.2 An example of map layers used altogether in GIS. [6]

One of the main uses of GIS is to assist in decision-making. And reflect the fact that parts of the real world represent only modest expectations of bringing the system out. The information that can be generated in the future depends on those data provided to the system in the past and present. [5]

2.1.3 Application Programming Interface (API)

An API is a contract between the service and its clients. Regardless of your choice of IPC mechanism, it's important to precisely define a service's API using some kind of interface definition language (IDL). There are even good arguments for using an API-first approach to defining services. You begin the development of a service by writing the interface definition and reviewing it with the client developers. It is only after iterating on the API definition that you implement the service. Doing this design up front increases your chances of building a service that meets the needs of its clients. As you will see later in this article,

the nature of the API definition depends on which IPC mechanism you are using. If you are using messaging, the API consists of the message channels and the message types. If you are using HTTP, the API consists of the URLs and the request and response formats. Later on, we will describe some IDLs in more detail. [7]

Evolving APIs invariably changes over time. In a monolithic application, it is usually straightforward to change the API and update all the callers. In a microservices-based application, it is a lot more difficult, even if all of the consumers of your API require other services in the same application. You usually cannot force all clients to upgrade in lockstep with the service. Also, you will probably incrementally deploy new versions of a service such that both old and new versions of a service will be running simultaneously. It is important to have a strategy for dealing with these issues [7].

How you handle an API change depends on the size of the change. Some changes are minor and backward compatible with the previous version. You might, for example, add attributes to requests or responses. It makes sense to design clients and services so that they observe the robustness principle. Clients that use an older API should continue to work with the new version of the service. The service provides default values for the missing request attributes and the clients ignore any extra

response attributes. It is important to use an IPC mechanism and a messaging format that enable you to easily evolve your APIs [7].

Sometimes, however, you must make major, incompatible changes to an API. Since you cannot force clients to upgrade immediately, a service must support older versions of the API for some period of time. If you are using an HTTP-based mechanism such as REST, one approach is to embed the version number in the URL. Each service instance might handle multiple versions simultaneously. Alternatively, you could deploy different instances that each handles a particular version. [7]

When using a synchronous, request/response-based IPC mechanism (see fig 2.3), a client sends a request to a service. The service processes the request and sends back a response. In many clients, the thread that makes the request blocks while waiting for a response. Other clients might use asynchronous, event-driven client code that is perhaps encapsulated by

Futures or Rx Observables. However, unlike when using messaging, the client assumes that the response will arrive in a timely fashion. There are numerous protocols to choose from. Two popular protocols are REST and Thrift. [7]

Today it is fashionable to develop APIs in the RESTful style. REST is an IPC mechanism that (almost always) uses HTTP. A key concept in REST is a resource, which typically represents a business object such as a Customer or Product, or a collection of business objects. REST uses the HTTP verbs for manipulating resources, which are referenced using a URL. For example, a GET request returns the representation of a resource, which might be in the form of an XML document or JSON object. A POST request creates a new resource and a PUT request updates a resource. [7]

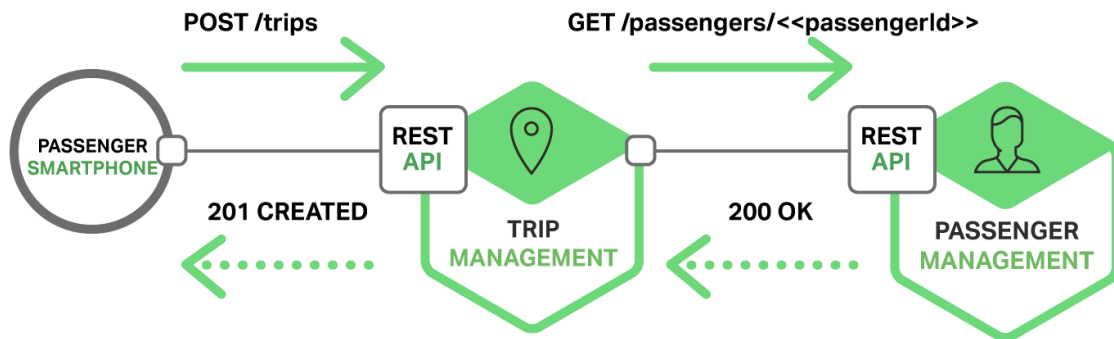


Fig. 2.3 Application use REST. [7]

2.2 Literature Review

Extensive research and developments have been carried out in the last years. Here an excerpt is cited in more details.

2.2.1 Review of prior studies:

Case 1:

Title of Study: Shortest Path Analysis Based on Dijkstra's Algorithm in Emergency Response System

Name of researcher: Ni Kai*, Zhang Yao-ting, Ma Yue-Peng

Study objectives: Finding suitable routes to reach destination is critical issue.

The purpose is to reduce the degree of damages induced by public emergencies, to prevent the event's derivation or further expansion. [8]

All such situations might be carried out from fires, explosions, traffic, accident, terrorism, and natural disasters. Universal purpose of any disaster management system is to deliver emergency services such as police, fire brigade and medical service as quickly as possible in affected. [8]

During an emergency it is very essential to have accurate data and take prompt actions. An effective emergency response mechanism might be possible to minimize and control hazardous events by preparing for such events prior to such an occurrence, and by a rapid response afterwards. Owners. [8]

The Methodology and Project Planning In the following paper discussed the shortest path analysis based on implemented an emergency response system with web application, Dijkstra's algorithm, Ajax technology, Web service and GIS web services (C#.NET, ASP.NET, JavaScript and HTML code. Microsoft Visual Studio). [8]

The Scope of study is an integrated emergency response system with an embedded decision support system that supports the emergency manager in planning, coordinating, and implementing rescue and assistance and other support operations during the response processes. In our emergency response system, the web application contains tools to either select the Start/End location directly on the map [8].

A shortest path analysis is used to analyze the shortest route between users' defined origin and destination on the server, and its resultant route is rendered on top of the map service in graphical format using a map control graphics layer. Figure 2.4 shows the shortest path in the emergency response system. Emergency managers can use the shortest path function to search the rescue route and then determine quickly as to which rescue team should move to the accident location and which path should be followed. [8]

The results of the paper are design and the definition of the length of the road to calculate the shortest path from one node to the target node in a map (see fig 2.4), and then select the optimal path among the road based on the minimum weight. In emergency response systems,

the shortest path analysis does not consider other contributing factors (road width, speed limit, surface condition, and turn restrictions), which should be defined in the database to identify more realistic routes.

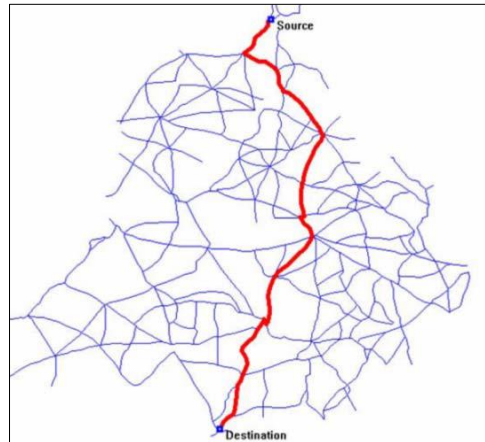


Fig. 2.4 Shortest path from one node to the target node. [8]

The conclusions and future work all about when an accident was happened, finding a path which takes minimum time to reach the destination is important for rescue. Finding shortest path is not a solution all the time because there are several factors affecting travel time. The paper discussed the shortest path analysis based on Dijkstra's algorithm and implemented an emergency response system based on GIS, which can be widely used in all sorts of services that in any way handle sources and consequences of emergencies. Currently, the application provides the optimal route without considering road conditions and traffic congestion. Further research is focused on integrating this system with real time on-road traffic count to display more dynamic, reliable and accurate routes to emergency managers. [8]

Case 2:

Title of Study: Mobile Banking with Location Tracking of Nearest ATM Center Using GPS.

Name of researcher: GUGAPRIYA A, VAITHEKI J and KAVIYARASI S

Study objectives: Design android application to find the nearest ATM center by using the Location Based Services.

Generally, the paper deals with mobile banking as a system for some financial institutions. It provides the facilities to the number of customers by financial transactions through mobile devices. Mobile banking started with the creation of services by banks which could be accessed through the use of mobile phones. These facilities for the customers can access information relating to their accounts. Mobile banking takes several dimensions of execution. All are representing a new distribution channel that allows financial institutions and other commercial actors to offer financial services outside traditional bank premises. [9]

The Methodology and Project Planning to provide transaction transfers to another account can be viewed by the mobile user. Another technique involved in this work is to find the nearest ATM center by using Location Based Services, the Android operating system, the Global Positioning System (GPS) and google maps. The GPS is used to identify the current location and then the current location is calculated by GIS (see fig 2.5). [9]

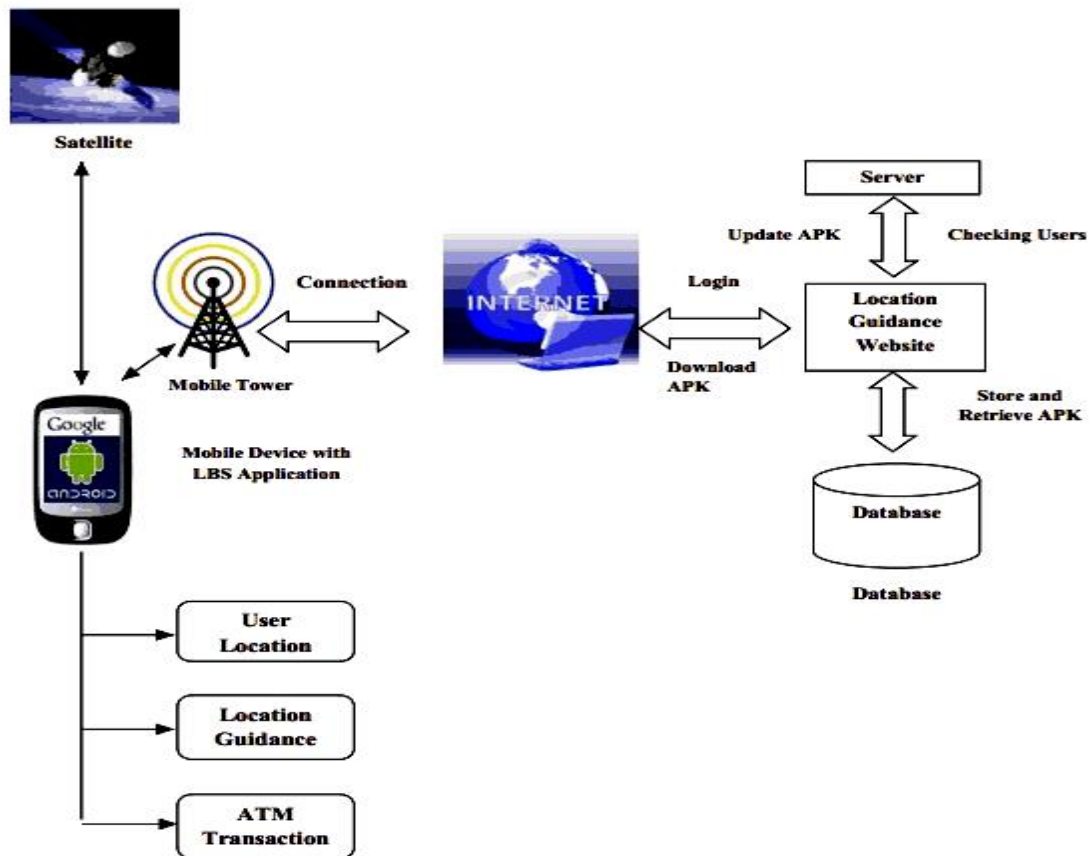
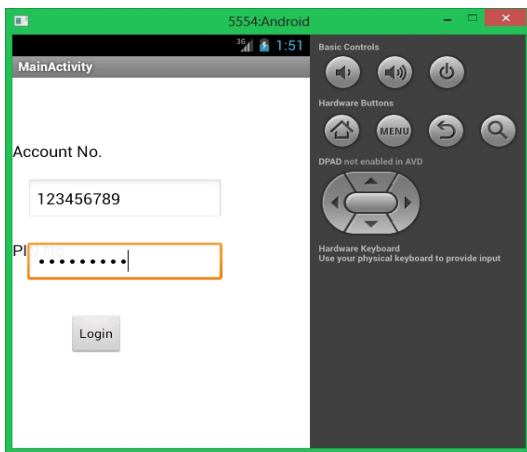


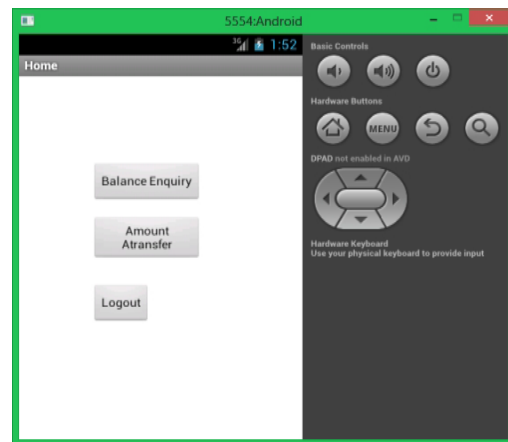
Fig. 2.5 Proposed Architecture. [9]

In system implementation, the account is created once and it will automatically generate an Account number and PIN number. The main activity it provides is as follows: The user can verify the account details such as balance enquiry, and transaction details will be automatically verify the relevant user account details it anytime anywhere through the mobile device. In transaction processes, the system responds immediately to the user requests. GPS is used to provide the exact location of the mobile user. By using this technology the user can update the location by using Google Maps. Location Based Service is used to identify location and navigates you to the directions to the nearest Bank or ATM. [9]

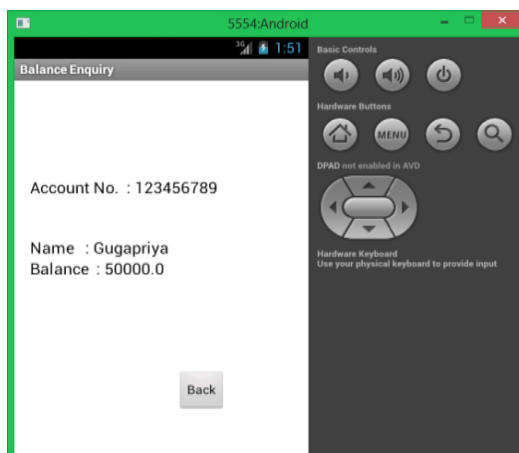
The results of this paper showed in Fig 2.6



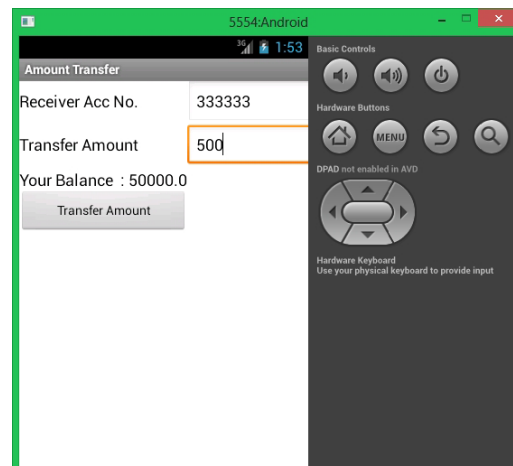
Results Of Login



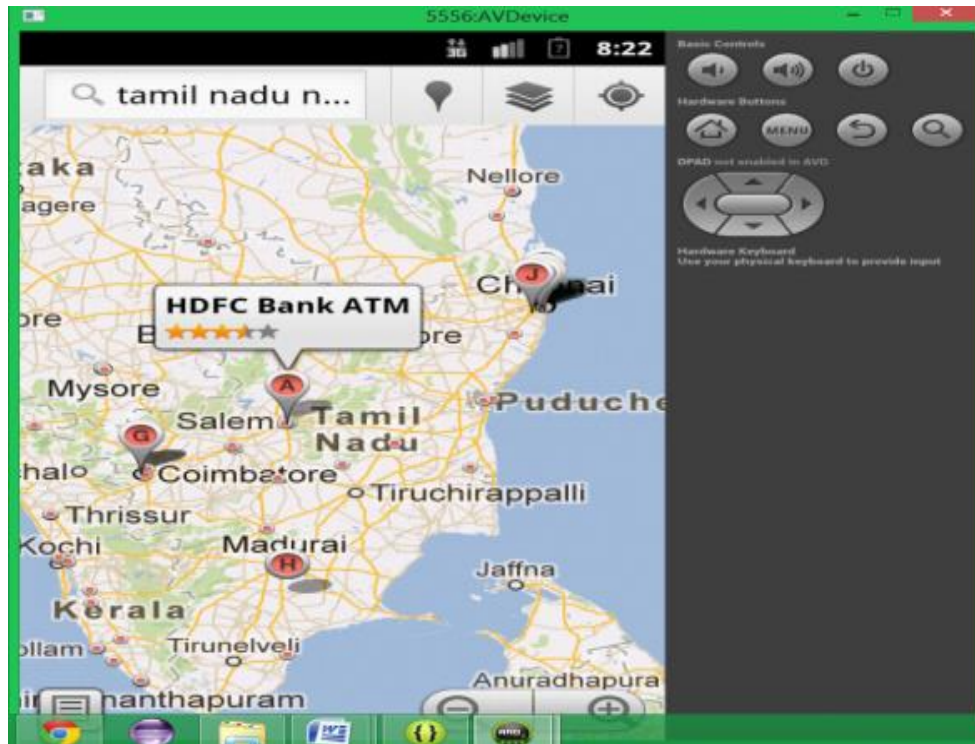
Results of transaction



Results of Balance Enquiry



Results Of Transfer Amount



Result of Map View

Fig. 2.6 a, b, c, d and e, show the screen of proposed system and the result of implementation. [9]

Conclusions of This proposed work is design for provide a new way to access the bank transaction by android mobiles. So, it is an easy way to access the banking transaction in ubiquitous access. Here, a Location based service is used to identify the Nearest ATM Centers by using GPS. Hence ATM Location and Fund transactions becomes easier.

Case 3:

Title of study: Optimization on shortest path finding for underground cable transmission lines routing using GIS.

Name of researchers: VISWARANI.C. D, VIJAYAKUMAR.D, SUBBARAJ.L, S. UMASHANK, AR, KATHIRVELAN.J.

Study objectives: Optimization on shortest path using GIS to trench construction of cable.

The following study discusses the development of GIS-based customized system to automate the process of optimum shortest path finding for routing of underground power supply cable between any two substations. It combines the spatial analysis capabilities of GIS with the sophistication of one of the Artificial Intelligence techniques “Simple Ant Colony Optimization” to deal with the complexity inherent in optimum shortest path finding.[10]

The Methodology and Project Planning, based upon the Ant colony system (ACS) algorithm, is proposed for the planning of electric energy distribution systems. The methodology is very flexible and calculates the location and the characteristics of the circuits minimizing the investment and operation costs while enforcing the technical constraints such as the transmission capabilities and the limits on the voltage magnitudes, allowing the consideration of a very complete and detailed model for the electric system.

The following steps are implemented for this project:

Data Analysis: study area gets the route plan for Anna University in the campus.

Data: Data needed are spatially referenced site geometries in line, polygon and point feature classes and are created by keeping the Ikonos images as the background in GIS, which are routes. [10].

Route network analysis: The most preferable and conventional place for cable laying is any one side of the road. And therefore, the major routes in the route network are roads. In the route network analysis, the routes which are unsuited for the project are selected using the select by attribute tool in the GIS software and delete it manually. Hence search space for the proposed algorithm is reduced [10].

The scope of the study is to get the route plan for the 110 KV cable line connecting R.A. Puram 110/33/11 KV substation and a substation which is assumed to be situated for Anna University in the campus. [10].

A panchromatic image of the IKONOS satellite covering the study area Fig 2.7 is collected for interpretation and digitization of thematic layers. [10].

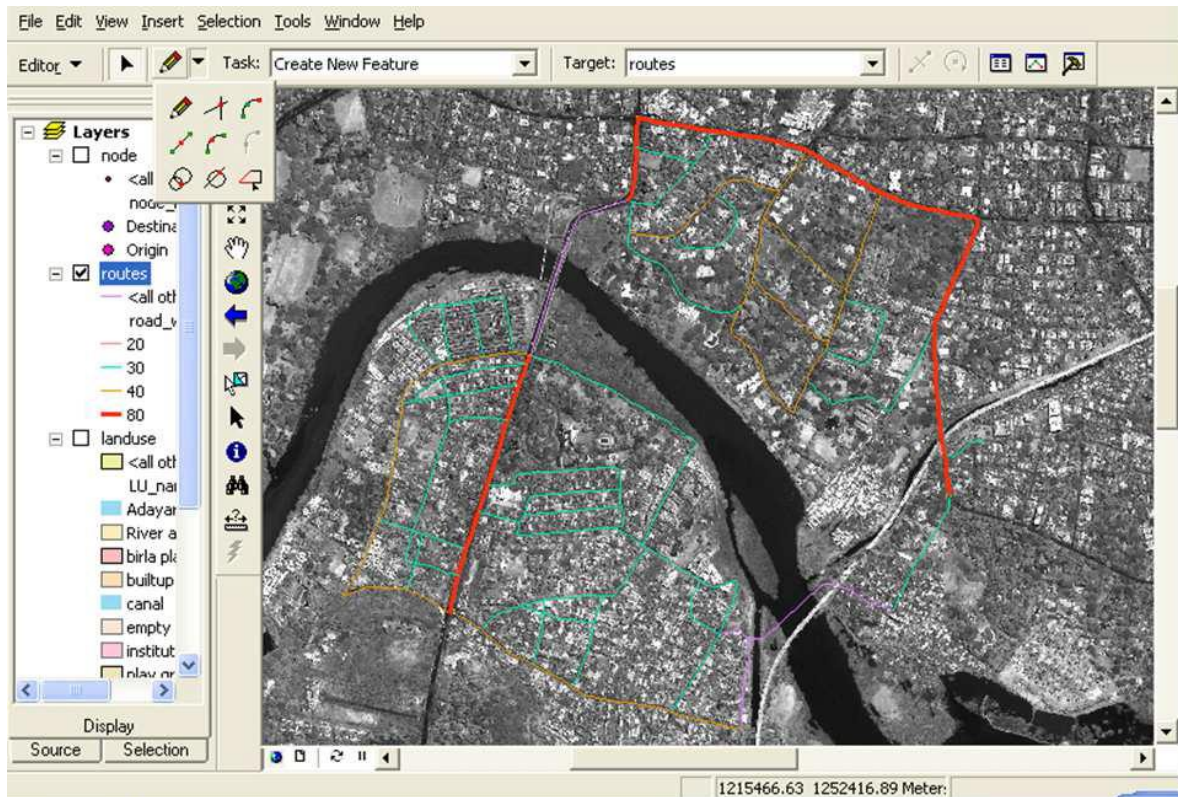


Fig. 2.7 Study Area - Panchromatic image of IKONOS satellite with thematic layers for routes and its nodes obtained after Route Network Analysis. [10]

The results of this project are validated and compared with an inbuilt tool Network analyst of GIS software ArcGIS and explained in the result and discussion of this paper. In this project only optimum shortest path finding is aimed and this will be one of the main input data in my future work of improving distribution efficiency using GIS (see fig 2.7).

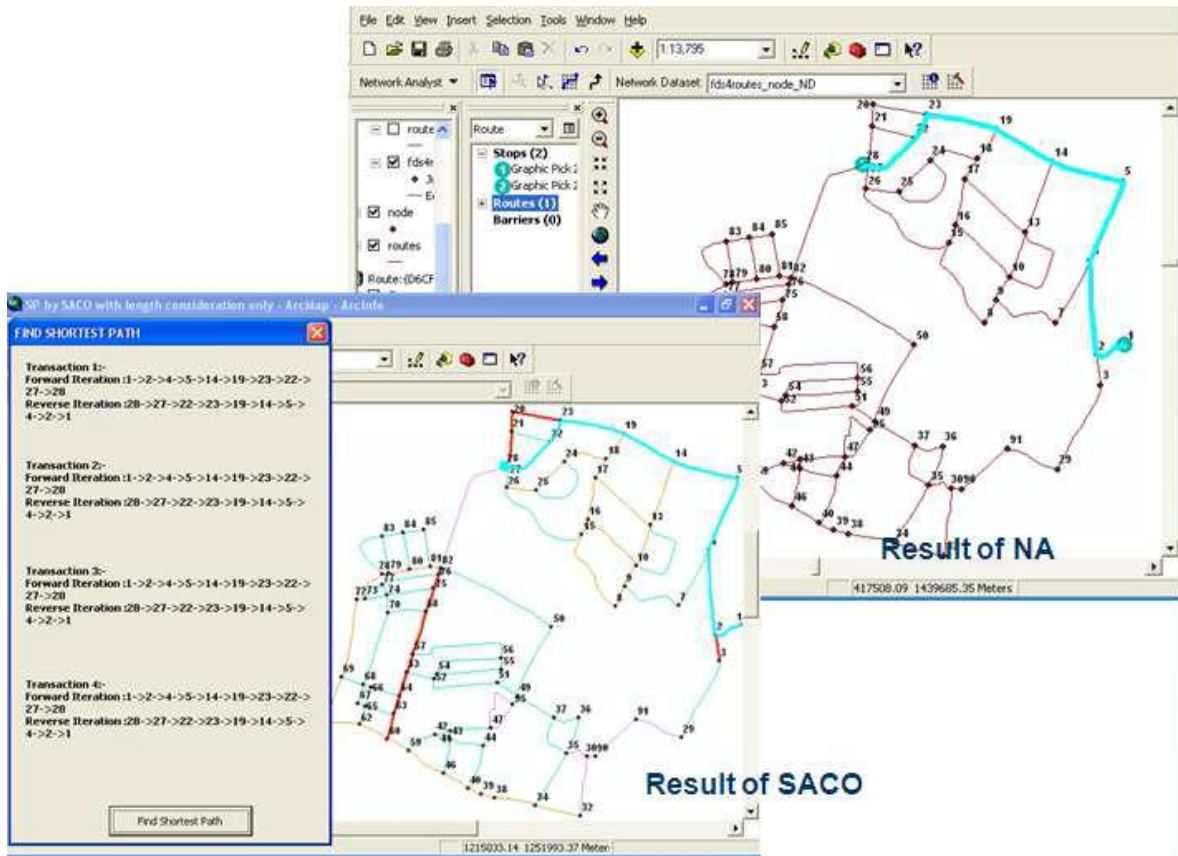


Fig. 2.8 Result of the algorithm and The Network Analyst for The Shortest Path Finding Based on Only the Length of The Routes Between the Origin and Destination. [10]

2.3 System description

2.3.1 Current System

There is no system currently available in Sudan to guiding to Service centers for citizen's locations. People just know the area or address of these centers. Therefore, the traditional methods may not be useful especially for people who do not know the areas very well.

2.3.2 Proposed System Description

The main objective of the system developed by this thesis is to serve as an application to make information accessible about the right locations of those centers for all people whom need to reach it.

2.3.3 Scope of system

The proposed system offers a LBS for Service centers for citizens in Khartoum state.

2.4 Research community

Sudan has known the system of police and security since the Kingdom of Kush when the king's guards were in charge of maintaining security within the walls of cities, and the fall of the last Christian kingdom by the armies of Fung, reduced the role of police before the influence of tribal sheikhs until Mohammed invaded Sudan in 1821, For two forces, one known as the Jihadist and the other Albshbzq, and in the era of Mahdia, where it was divided into a power of companions and missionaries and Almzmin and Khial. [11]

Sudan was the modern form of police for the first time in 1821 when the Turks invaded the Sudan, under other names such as Jihadi and Beshbiz, a Turkish word meaning "Pasha men." The king was the king of Chaikish who was defeated in the Battle of Korti, Or police in Sudan. The tasks of these forces at that time were limited to the maintenance of the system and the collection of taxes and the imposition of policies of the Turkish government and track opponents and secure roads and others, the Governor General of Sudan, Weng Pasha, established the district directorates and also used tribal chiefs to extend security and order in the towns. With the independence of the Sudan in 1956, the Sudanese police joined Interpol.[11]

Since 1990, the police have undergone a major change in structure, where the forces of the Ministry of the Interior have been integrated into a single force known as the Unified Police, the People's Police, the Economic Establishments Police, the Tourism and Antiquities Police, the Civil Aviation Police and the Security Police). In 1992, the Police College was upgraded and renamed the Police Academy, which was annexed in 2000, to the National University of Rabat. The force of the fire brigade became a new institution in the name of civil defense to provide civil protection to citizens in times of peace and war. Other developments include the introduction of the Civil Registry, including the national number, as well as the application of electronic traffic control. [11]

In the year 2017, public service centers were opened in the state of Khartoum by assembling all the services provided by the Ministry of Interior in one place.

CHAPTER THREE

Methodology and Research Planning

3.1 Methodology and Research Planning.

3.2 Selected Methodology and Techniques.

CHAPTER THREE

Methodology and Research Planning

3.1 Methodology and Research Planning

The main centers were selected to be generated as an application, which would include not only the direction of each center, but also the information about nearing place such as ATM, banks, stores, etc.

In this study, the implementation of application consists of the following steps: data acquisition, generation of application. In the following the implementation steps required to build given Data Modeling and Data Measurements, Processing and Preparation, For this purpose, several software will be employed and used completely in the required production workflow, which are the following:

A. Google map APIs:

Google APIs is a set of application programming interfaces (APIs) developed by Google which allow communication with Google Services and their integration to other services. Examples of these include Search, Gmail, Translate or Google Maps. Third-party apps can use these APIs to take advantage of or extend the functionality of the existing services.

The APIs provide functionality like analytics, machine learning as a service (the Prediction API) or access to user data (when permission to read the data is given). Another important example is an embedded Google map on a website, which can be achieved using the Static maps API Places API or Google Earth API. [12]

B. Android Studio:

Android Studio is the official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA. On top of IntelliJ's powerful code editor and developer tools, Android Studio offers even more features that enhance your productivity when building Android apps, such as: a flexible Gradle-based build system, A fast and feature-rich emulator, A unified environment where you can develop for all Android devices, Instant Run to push changes to your running app without building a new APK, Code templates and GitHub integration to help you build common app features and import sample code,

Extensive testing tools and frameworks, Lint tools to catch performance, usability, version compatibility, and other problems and C++ and NDK support.

Built-in support for Google Cloud Platform, making it easy to integrate Google Cloud Messaging and App Engine. [13]

3.2 Methodology of Research:

Currently, the methodology used to develop mobile phone programs consists of Five stages:

- A.** Requirement analysis: Study the app in detail and list down the features that your app requires. Look into the requirements about what could be the best tools for developing an app. Prepare the list of required items and install the necessary software on your system.
- B.** UX/UI designing: Prepare use case and flowcharts. Break each element into deliverable and lay down a strategy to go ahead with. Work on designing part (UI/UX) and prepare a design that delivers the best user experience. Test it on different devices. Ensure smooth navigation on the Mobile App.
- C.** Coding: While working on designing, Start implementing back-end Processes. Deploy each functionality one by one and keep testing it. The coding part eats your time here but as you have your plan defined, coding will not be a burden.
- D.** Testing and modifications: Test the functionalities and make necessary changes. Ask dummy users to use the app and make necessary changes according to their inputs.
- E.** Launching: Once you are through with all the above steps, you can now launch your Mobile app

CHAPTER FOUR

System Analysis and Design

4.1 Application Requirements.

4.2 Analysis and Design.

CHAPTER FOUR

System Analysis and Design

4.1 Application Requirements

4.1.1 Functional Requirements

1. The Application provides the information about nearest place and direction of a police service complex.
2. Also, its aims to represent all places nearest to the user.

4.1.2 Technical Requirements

For building an Android program we usually use the Android Studio program of Google that specializes in the construction of the software Android. This fact should be carefully considered.

The processing of the software construction comprises the following main system requirements:

- Minimal configuration: Operating system Windows XP or later (32 or 64 bit), Mac OS X Snow Leopard or later, Debian/Ubuntu (64 bit), processor intel Core 2 Duo processor or equivalent and 2GB of RAM.
- Recommended configuration operating system Windows 7 or later (64 bit), Mac OS X Snow Leopard or later, Debian/Ubuntu (64 bit), processor Intel Core i7 processor and 16GB of RAM.

4.1.3 Nonfunctional Requirements

In order to obtain better model visualizations, the system has to achieve the following specified requirements:

- A. Performance: The most important requirement is the performance of the system which includes Query and Reporting time: The response time between the mouse action and retrieving object information and Response time: also, the time of loading the model, which is subject to the screen refresh times or orientations.
- B. Availability: The Application needs to be available all the time, for every user over smartphone platforms.

C. Maintainability: The Application also has to be updated due to the ongoing renewal of platform

CHAPTER FIVE
System Analysis and Design

5.1 Analysis and Design.

5.1 Analysis and Design

5.1.1 Application Requirements

Public service centers are distributed over the Khartoum state in three cities: Khartoum, Omdurman and Khartoum north.

Each one has its own buildings content: The Center for the licensing of vehicles and the Center for the extraction of national cards and the Center for the extraction of passports and the extraction of driving licenses and all other services related to the public.

5.1.2 Application Design

The Software Development Lifecycle is crucial in Desktop or web application development. Mobile applications are being developed for deployment in smart phones. Looking at the rising need of mobile applications and the associated development complexity, it is imperative to have a dedicated framework lifecycle for mobile application - Mobile Application Development Lifecycle (MADLC).

As the mobile applications have complex functionality and are different from the desktop applications, the following Mobile Application Development Lifecycle model (MADLC) is proposed to enable a systematic approach in development, in this application I use prototype lifecycle. [13]

Identification Phase

In the first phase, ideas are collected and categorized. The main objective of this phase is to come out with a new idea or improvements to the application. The ideas can come from the developers.

The existing applications on any of the standards platforms are searched to establish the novelty of the idea. If a similar application exists in the market, the popularity of the application and the features supported are studied and compared. The differences with the existing application(s) are documented. If no similar application exists on any mobile platform, then the idea with its core functionality should be documented. The other important task in this phase is to define the time required to develop the application. The initial

requirement gathering should also be completed. The work done by the mobile application idea should then be documented and forwarded to the design (see fig. 4.1). [14]

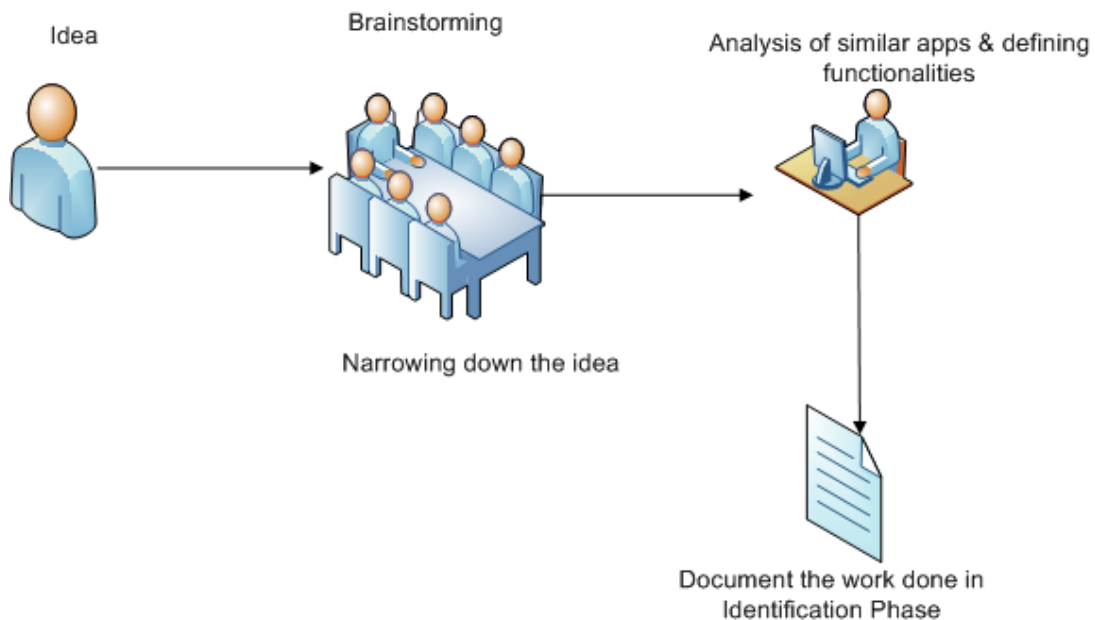


Fig. 4.1 Identification Phase

Design Phase

In this phase, the idea from the mobile application is developed into an initial design of the application, the feasibility of developing the application on all mobile platform is determined. Alternatively, the specific target mobile platform is identified. A decision has to be made on whether the developed application is to be released as a free version or trial version with limited features or released only as a premium version.

The functional requirements are defined. The software architecture of the application is created. Then the prototypes and associated modules are defined. A very important part of the design phase is to create the storyboard for the user interface interaction: this storyboard describes the flow of the application (see fig. 4.2), The design team's work is documented and forwarded to the development team for coding.

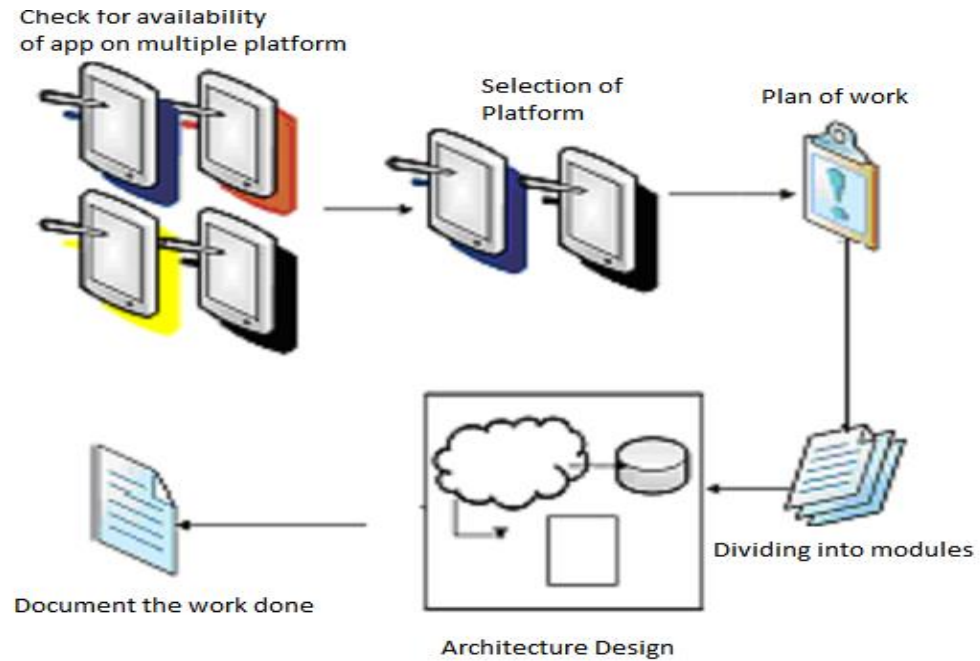


Fig. 4.2 Design Phase

Development Phase

In this phase, the application is coded. Coding for different modules of the same prototype can proceed in parallel. The development process can be in two stages: Coding for Functional Requirement and Coding for UI requirements. [14]

In the beginning in the process of encoding the program has to be able to deal with the language of Java and the program android studio and knowledge is not a few in the language of the XML for the work of the interfaces, but because the program is calling Google Maps must be dealing with the Google Maps APIs of the place and direction (see fig. 4.3).

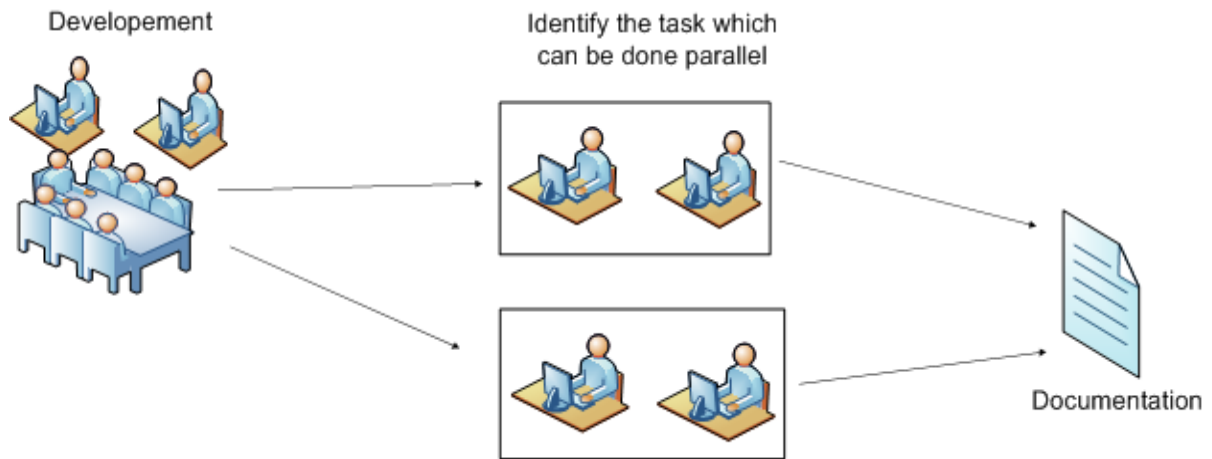


Fig. 4.3 Development Phase

Prototyping Phase

In this phase, the functional requirements of prototype are analyzed; the prototypes are tested and possibly we get feedback. After feedback, the required changes are implemented through the development phase (see fig. 4.4) [14].

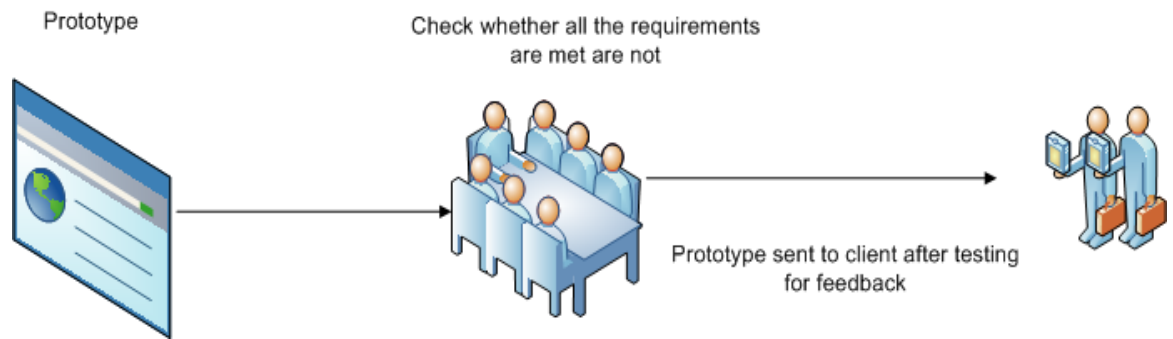


Fig. 4.4 Prototyping Phase

Testing Phase

Testing is one of the most important phases of any development lifecycle model. The testing of the prototype types is performed on an emulator/simulator followed by testing on the real device. The emulator/simulator is often provided in the SDK. The testing on the real device, for example in the case of Android operating system development, should be performed on

multiple operating system versions, multiple models of handsets with variable screen size. The test cases are documented and forwarded to the client for feedback (see fig. 4.5) [14].



Fig. 4.5 Testing Phase

CHAPTER SIX
Simulations and Results

6.1 Android Studio

6.2 Google Maps API

6.3 Application Interface

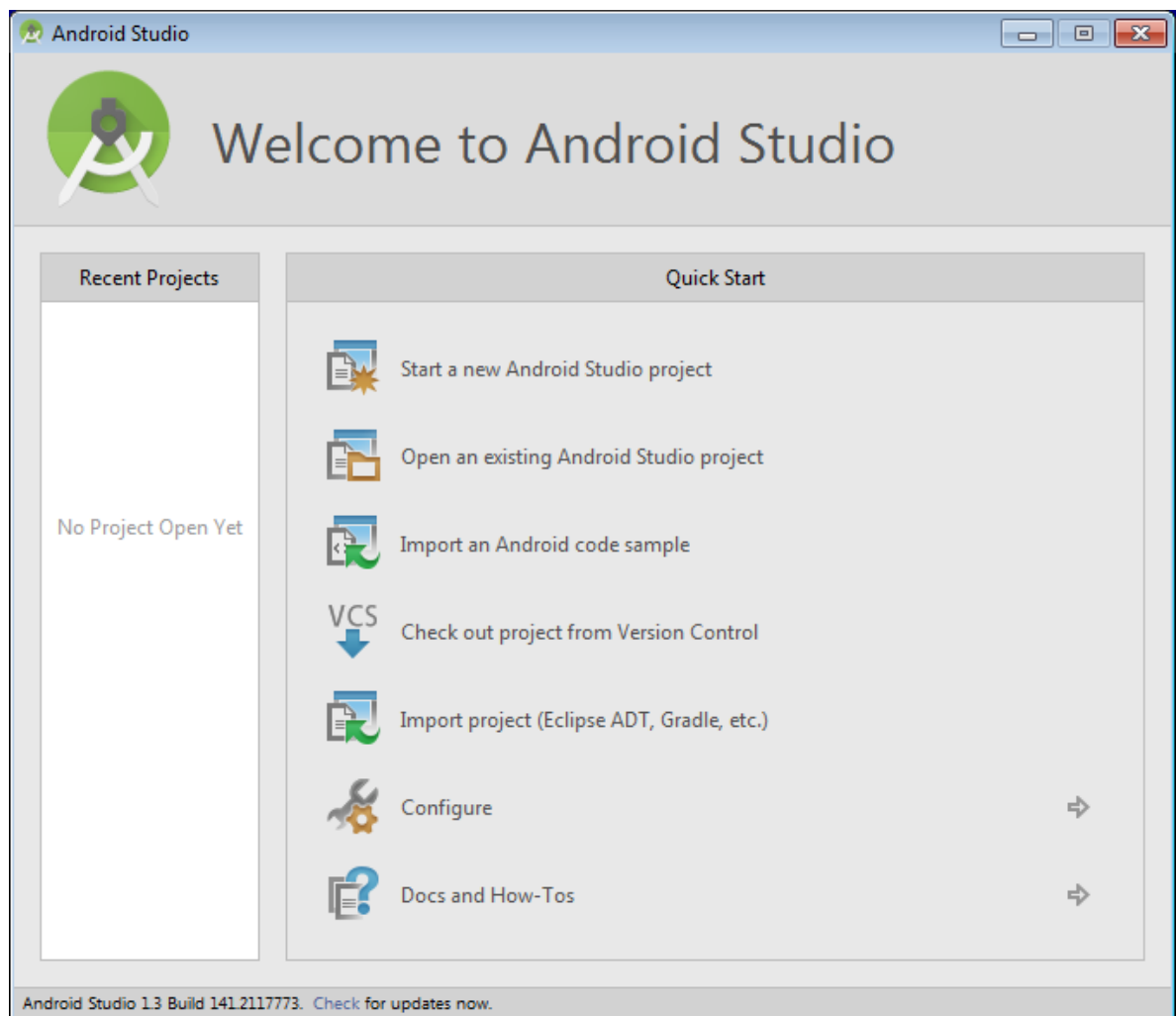
CHAPTER FIVE

Simulations and Results

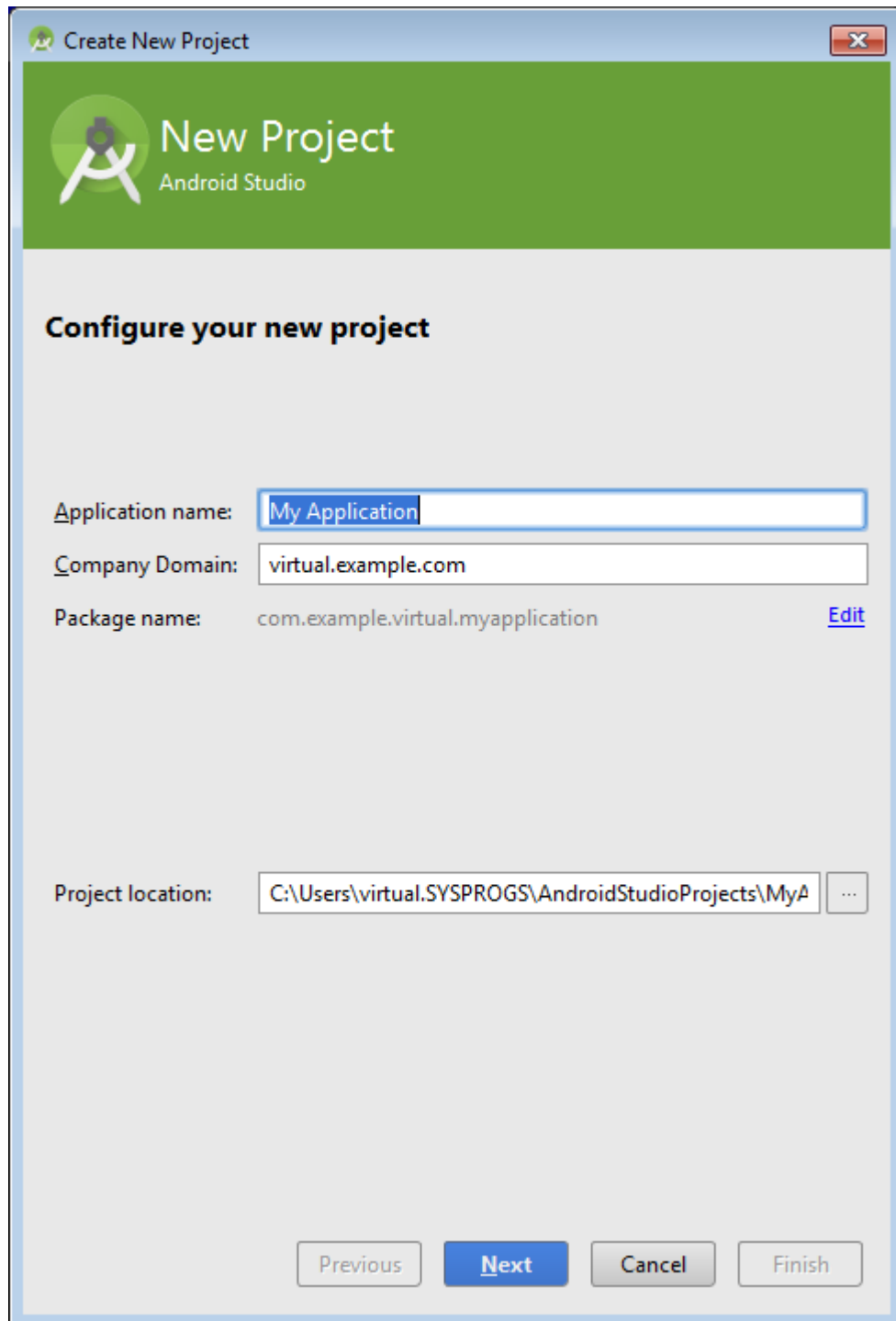
6.1 Android Studio

This pictures below shows how to develop an Android Studio project using and show how to use the Gradle flavors and translate them into Visual Studio configurations for better usability.

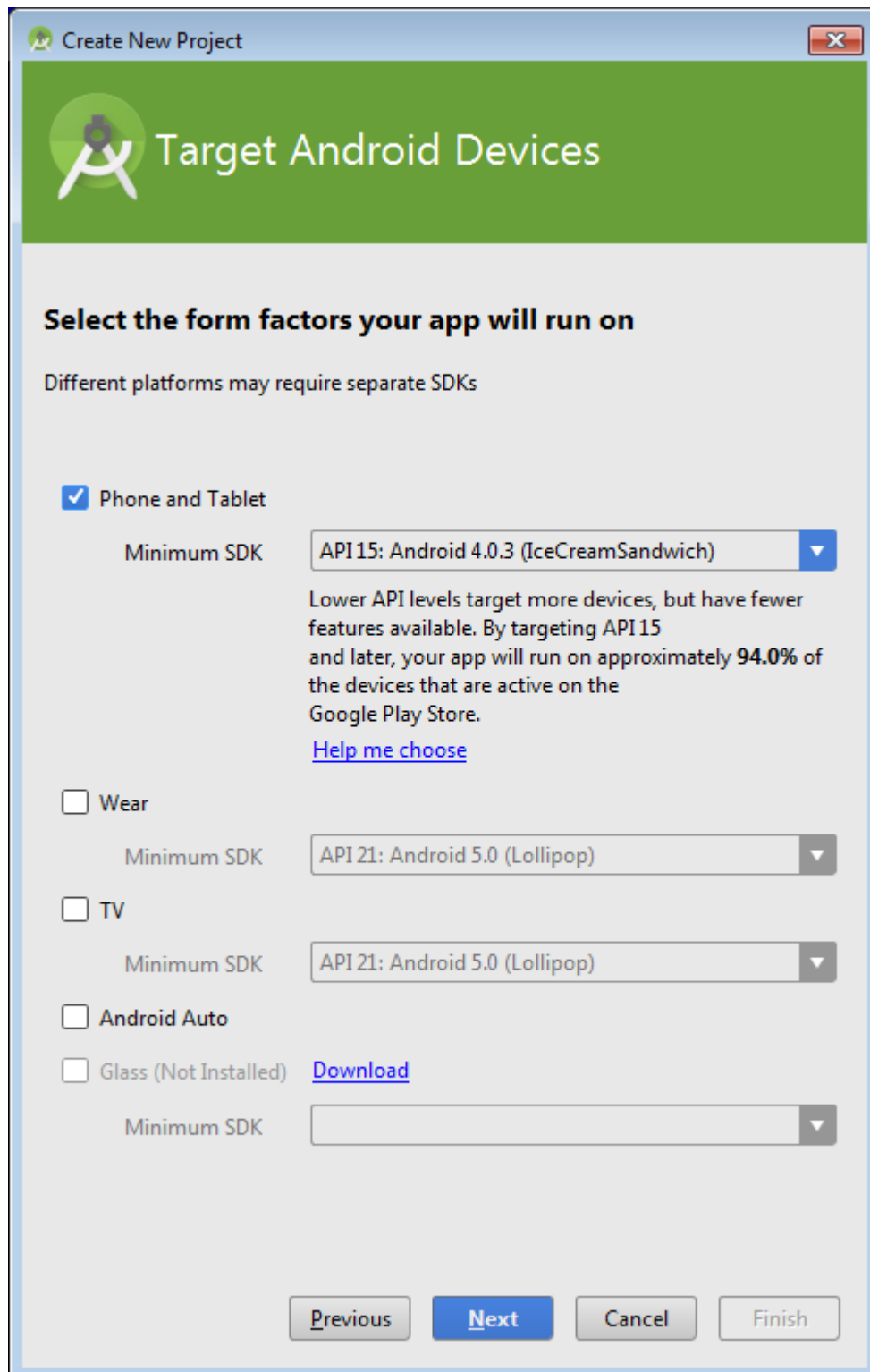
Android provides facility to integrate Google map in our application. Google map displays your current location, navigate location direction, search location etc. We can also customize Google map according to our requirement.



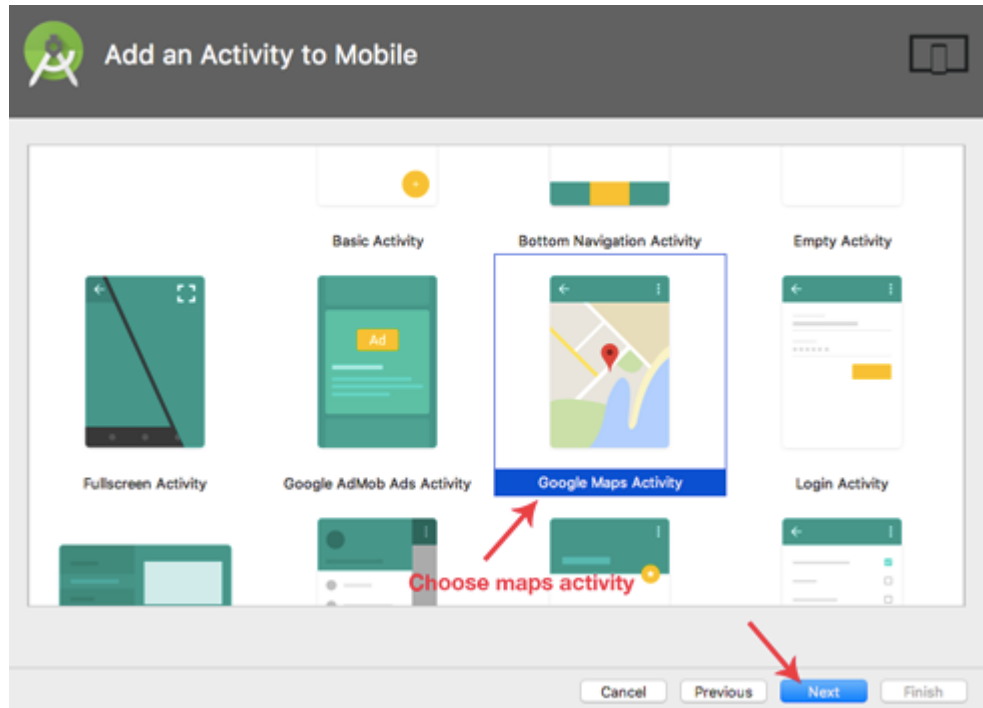
Start Android Studio and click “Start a new Android Studio project



Specify your app name and domain



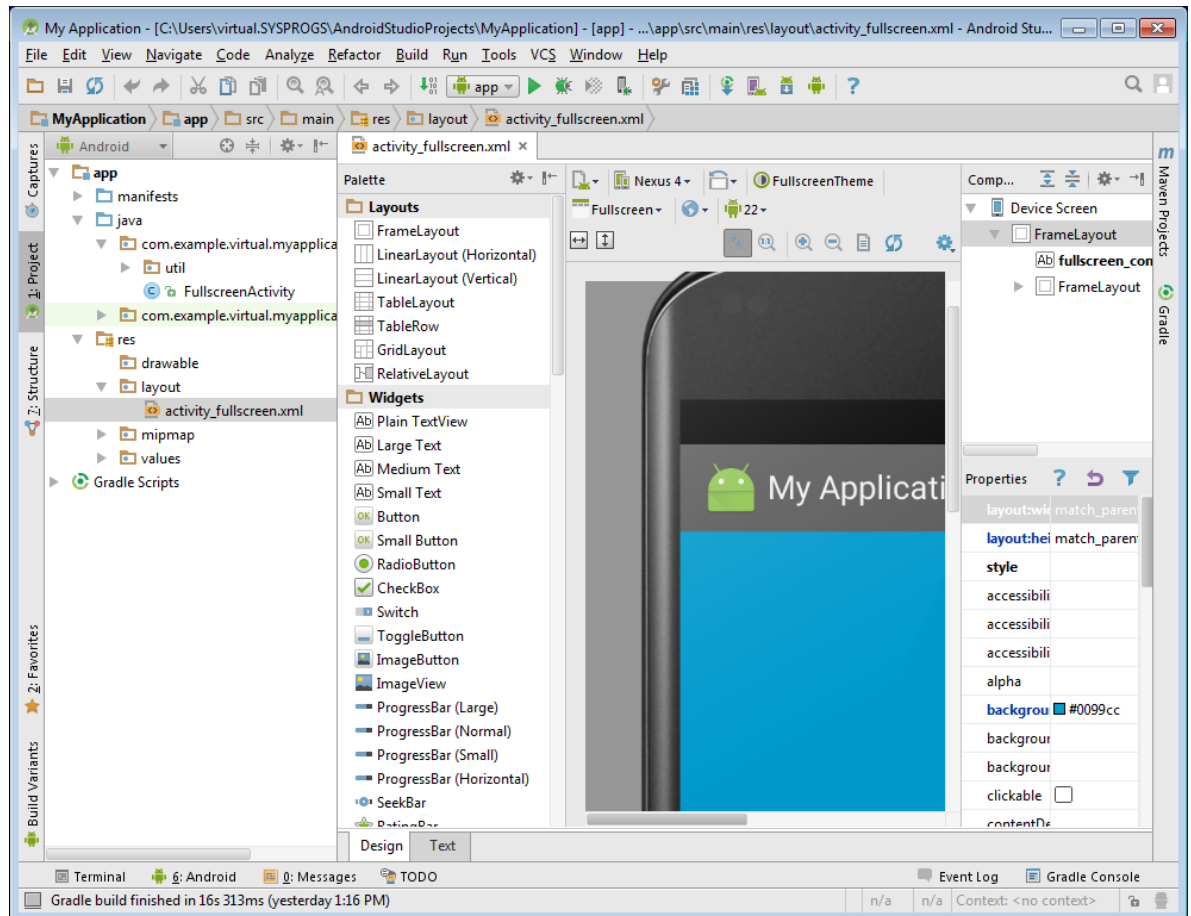
Select the SDK you want to use with application



Select the template for the first activity. In this tutorial we will use the Fullscreen Activity and we chose Google Maps Activity to add google map to application.



After chose the import now start the project



The min Interface of Android Studio project show layout and design tools and button , also show how add directory and module

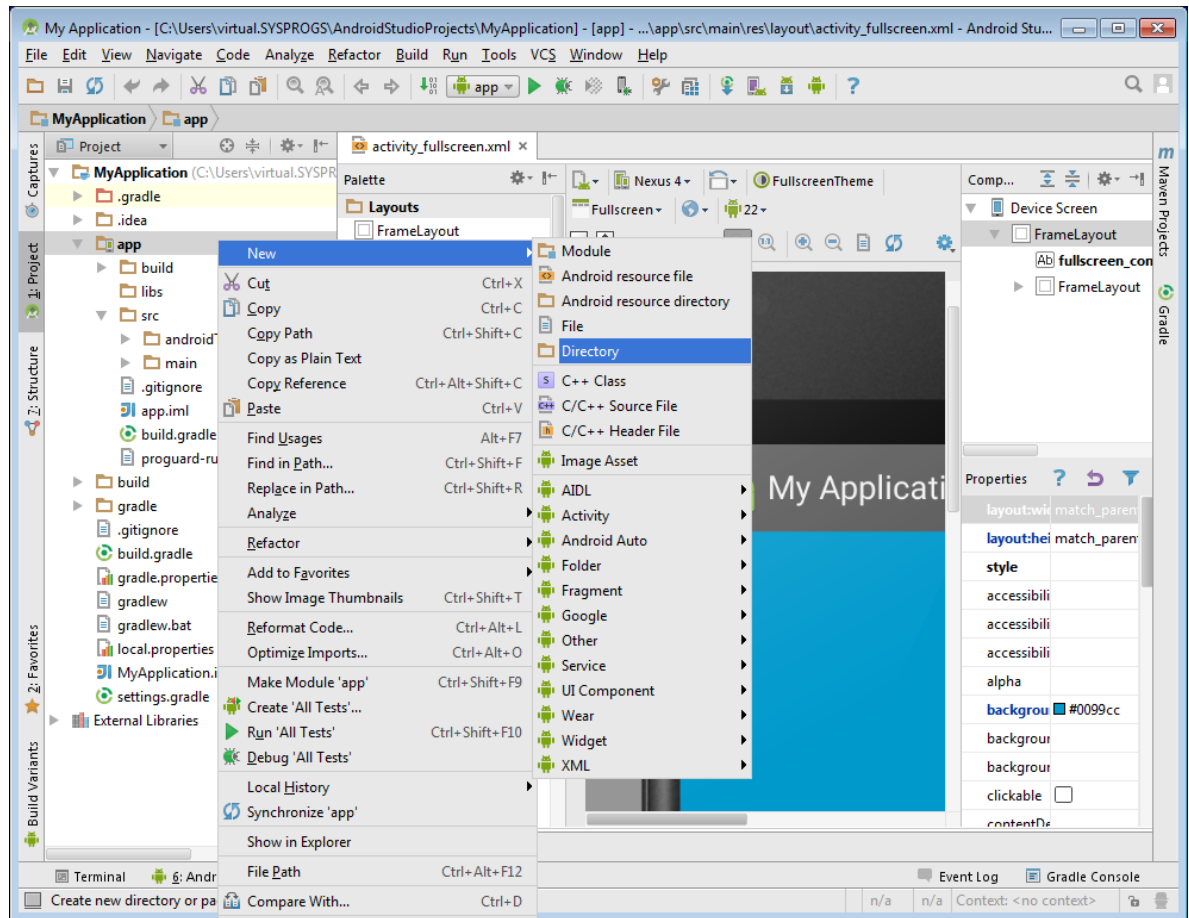
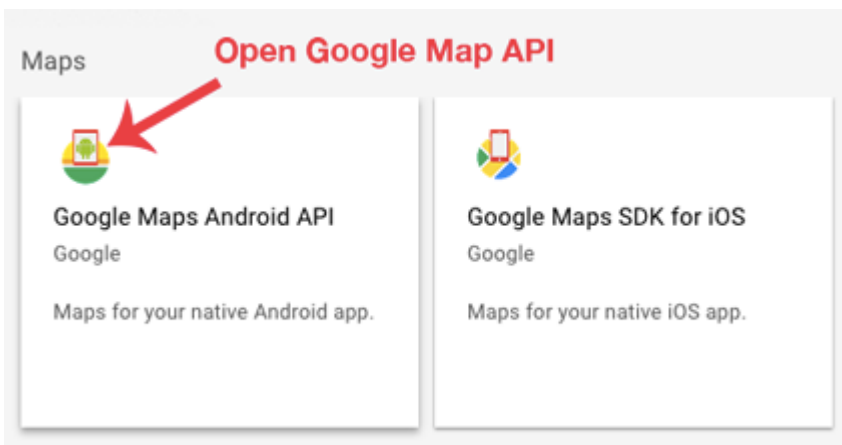
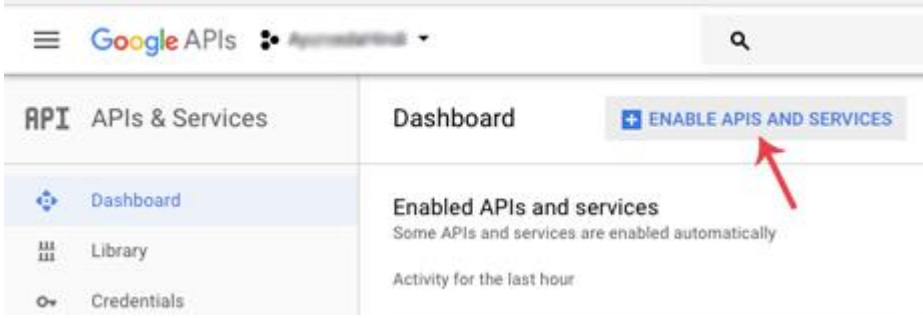
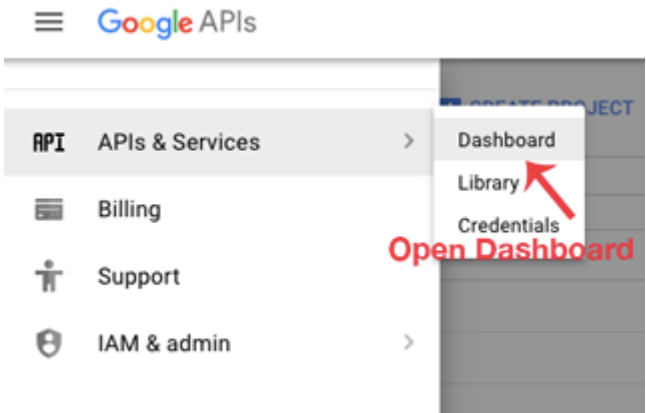
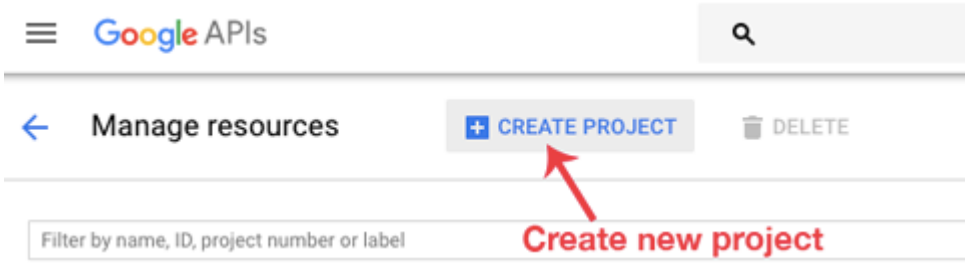


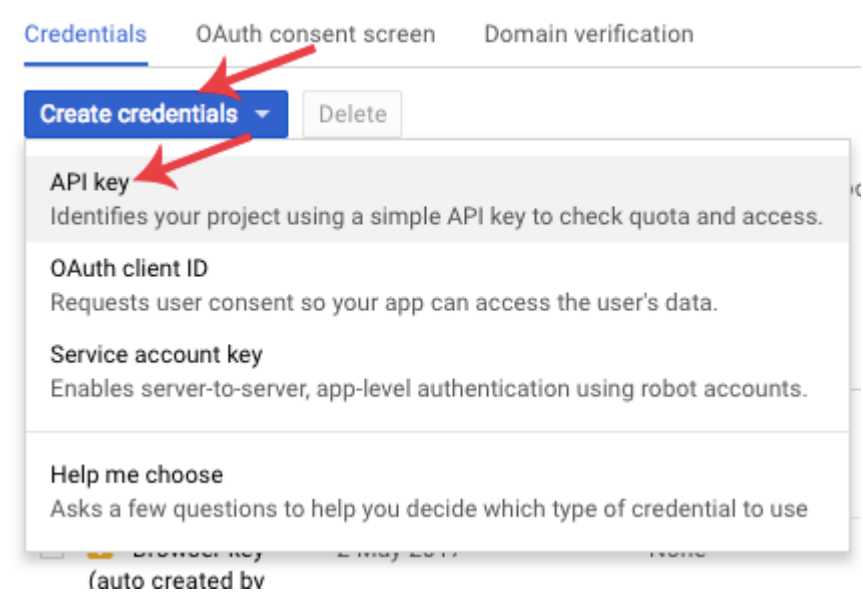
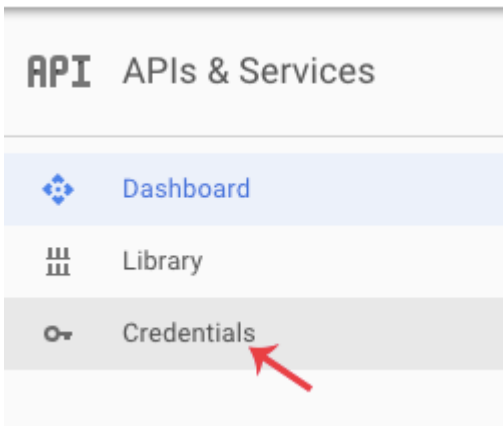
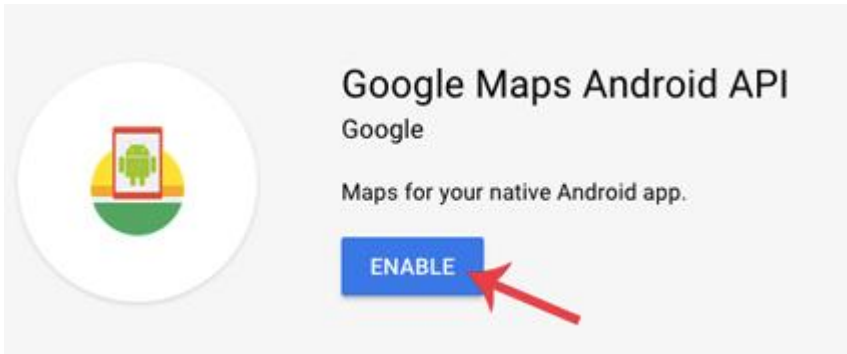
Fig 5.1 Several Photos showing Android Studio create new project

6.2 Google Maps API

Android Studio allows us to integrate Google Maps in our application. For this Google provides a library via Google Play Services for using maps. In order to use the Google Maps API, and it need register the application on the Google Developer Console and enable the API, An API key is needed to access the Google Maps servers. This key is free and it's can use with any applications.

This pictures below show how create an API key from Google developers.





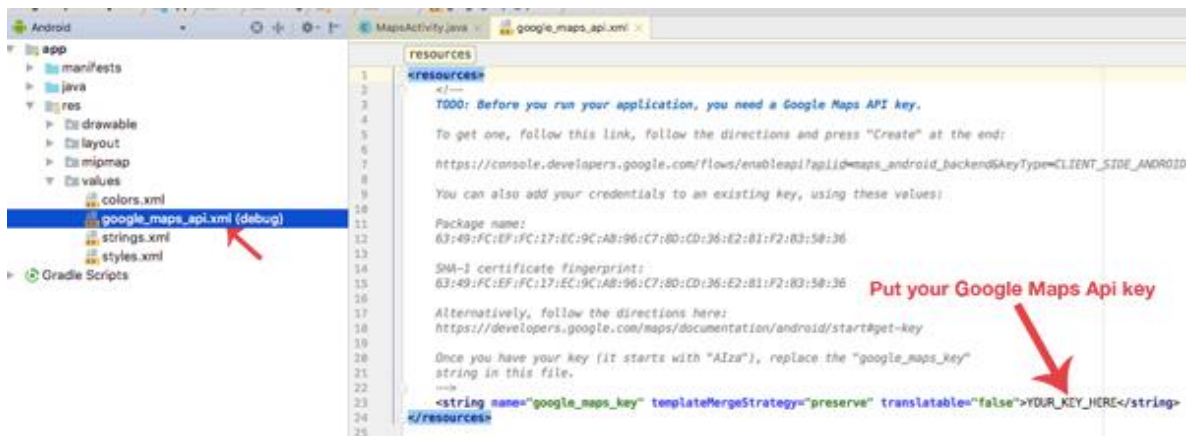
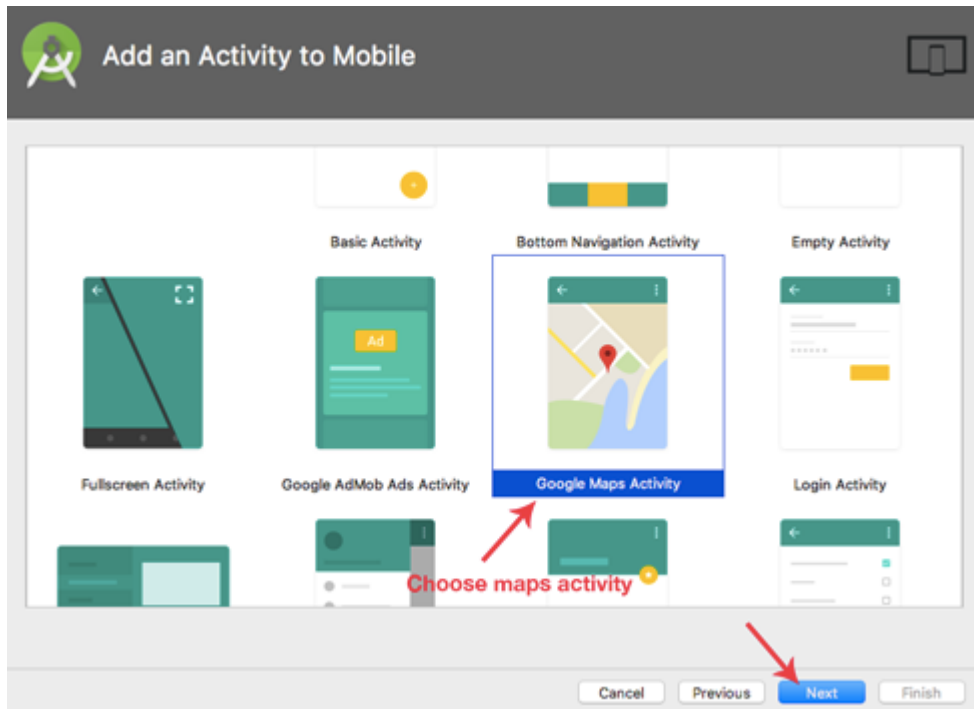
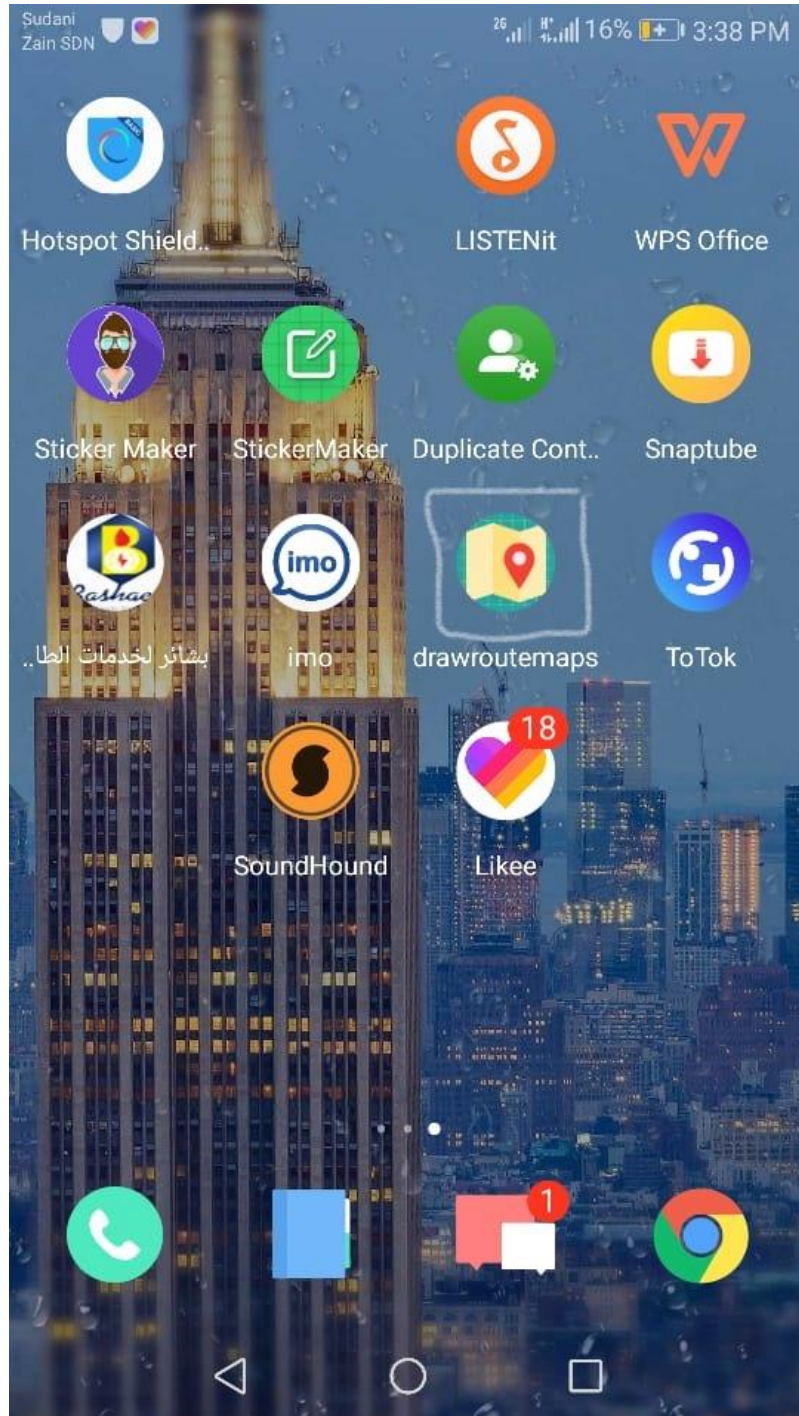


Fig 5.2 Several Photos showing how register application and get google map API via Google Play Services

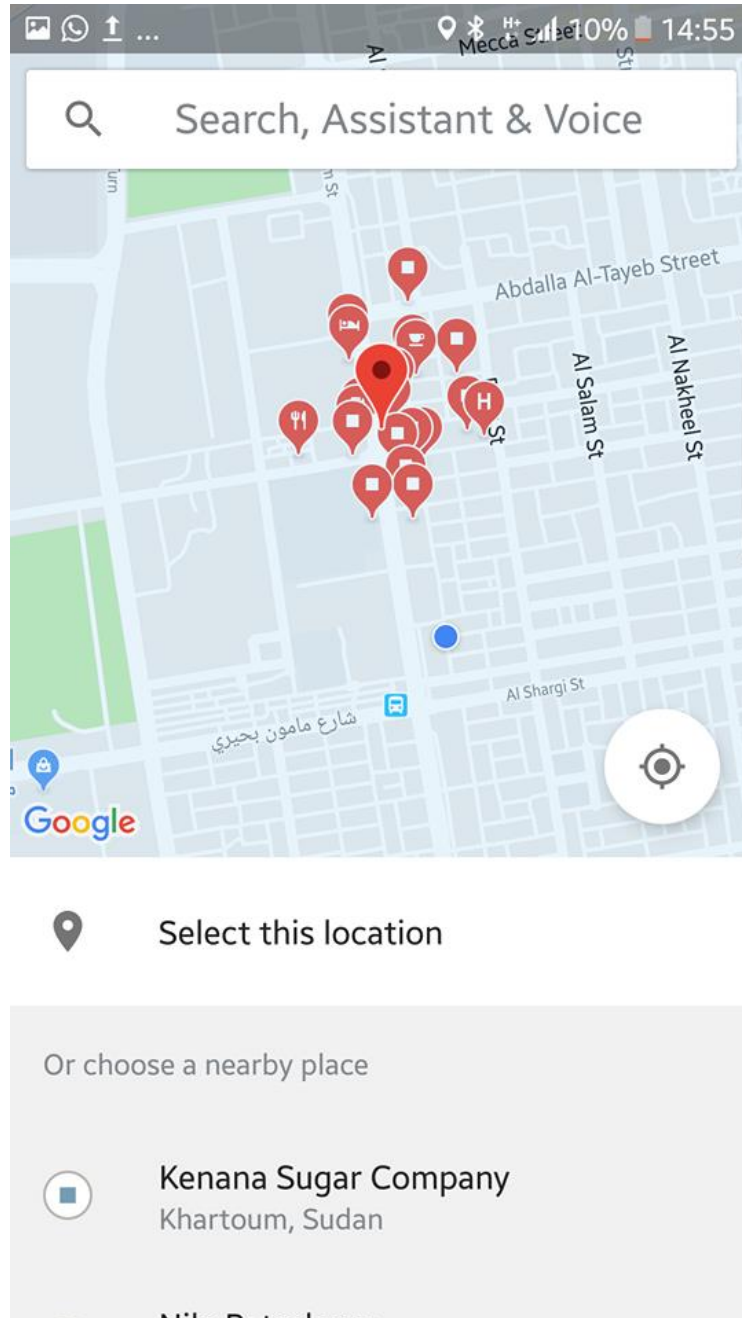
And there is add google map API key in the project in Android Studio.

6.3 Application Interface

The result of the project this application below



This picture show the application “drawroutemaps” in the emulator



The main inter face of application



Enter the name in search par



Fig 5.3 Several Photos showing the application work

And this is the result off search of the service center

CHAPTER SEVEN

Conclusions and Recommendations

7.1 Conclusions

7.2 Recommendations

CHAPTER SEVEN

Conclusions and Recommendations

7.1 Conclusions

Geographic Information Systems (GIS) was designed to support geographical inquiry and, ultimately, spatial decision making. The value of GIS in emergency response arises directly from the benefits of integrating a technology designed to support spatial decision making into a field with a strong need to address numerous critical spatial decisions.

When we need reach specific places, finding right path which takes minimum time to reach destination is important for rescue. Finding shortest path is not a solution all the time because there are several factors affecting travel time. The research discussed the shortest path analysis based on GIS, which can be widely used in all sorts of services that in any way handle sources and consequences. Currently, the application provides the optimal route without considering road conditions and traffic congestion. Further research is focused on integrating this system with real time on-road traffic count to display more dynamic, reliable and accurate routes to distance.

The approach used in this work presents a simple strategy that is suitable for the development of find best path and show way to Places to reach.

This research corresponds to the complete production workflow of the new trend in design best path application using GIS techniques and google map API.

This thesis essentially aims at using GIS technology to guide people in their navigations without wasting time and efforts.

It provides best path about all police public Service Centers in Khartoum, when new people make location queries and guides them to the right direction, especially there who are coming for the first time haven't to ask every time when they want to reach it.

In this proposed system, several software's was employed and used in order to complete the required production

7.2 Recommendations

In the following, some recommendations for using the work of this thesis and future work are given

- First of all, taking advantages of GPS properties for user positioning. In future with many Global Navigation Satellite Systems (GPS, Glonass, Galileo, Baidou, etc.) for navigation, thus, it becomes a daily service for any outdoor positioning with high accuracies.
- Furthermore, and add 3D of The Service Centers in Khartoum to application.
- Another important issue would be to connect the application directly with the web site of Service Centers in Khartoum.
- Add information about the service that provided in The Service Centers in Khartoum
- In future, this research can also be used in robotics to access the destination and help people quickly.
- And finally, add part Frequently asked questions.

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