ATM LOCATOR MOBILE APPLICATION

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ATM LOCATOR MOBILE APPLICATION

LIM YEN LENG

A thesis submitted in fulfillment of the
requirements of the award of the degree of
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Faculty of Computer Systems & Software Engineering
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JUNE 2012

DECLARATION

I declare that this thesis entitled "ATM Locator Mobile Application" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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SUPERVISOR'S DECLARATION

"I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer Systems and Networking)"

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ABSTRACT

Global Positioning System (GPS) is has been widely used in many fields. At first, it is used for the purpose of military forces needs. Then, the uses of GPS has extended into people's lifestyle, where they can use it for hiking purpose, as traveling direction, and etc. Besides that, it is useful for user to search for nearby amenities – restaurants, petrol stations, banks and more, especially for someone who is unfamiliar to new location. Therefore, the aim of this paper is to propose an ATM locator for mobile application. Developed methods are entirely mobile web-based. This system will instantly tells the user where does the closest ATM located from their current location. Hence, this system is developed slight similar to the existing system like Maybank ATM locator, where this proposed system can locate all kind of Bank company's ATM instead of only the Maybank ATM. Besides that, it is a hybrid mobile application. Hybrid app is a native, downloadable app and it uses both browser interfaces and native mobile components. With HTML5 and JavaScripts, the browsers are becoming capable of accessing a phone's built-in features like contacts, camera etc. In order to keep the timeline for this system to be finish at the appointed time. So, a System Development Life Cycle (SDLC) was referred.

ABSTRAK

Sistem Kedudukan Sejagat telah digunakan secara meluas dalam pelbagai bidang. Pada mulanya, tujuan sistem ini adalah untuk keperluan angkatan tentera. Kenudian, penggunaan sistem ini telah diperluaskan dalam gaya hidup rakyat, di mana mereka ianya digunakan untuk tujuan mendaki, sebagai perjalanan hulu tuju dan lain-lain. Selain daripada it, ianya amat berguna kepada pengguna terutamanya kepada mereka yang tidak biasa dengan tempat tersebut, bagi mencari kemudahan berdekatan seperti restorant, minyak station, bank dan sebagainya. Oleh itu, tujuan kertas ini ada untuk mencadangkan satu lokator ATM untuk aplikasi mudah alih. Kaedah yang digunakan bagi membangunkan sistem ini adalah berasaskan web. Sistem ini akan serta-merta memberitahu pengguna dimana ATM terdekat terletak dari lokasi semasa mereka. Oleh demikian itu, sistem ini dibangunkan seumpama kepada sistem yang sedia ada seperti ATM Maybank lokator, tetapi sistem yang dicadangkan ini boleh mengesan semua jenis ATM syarikat Bank bukan hanya ATM Maybank. Selain itu, ia adalah satu aplikasi mudah alih yang hibrid. Hibrid aplikasi asli adalah boleh dimuat turun dan ia menggunakan kedua-dua *browser* dan asli komponen mudah alih dalam antaramuka. Dengan menggunakan HTML5 dan JavaScripts, *browser* mampu mengakses ciri-ciri terbina dalam telefon seperti kenalan, kamera dan sebagainya. Dalam usaha untuk memastikan sistem ini tamat pada waktu yang ditetapkan dengan merujuk kepada System Development Life Cycle (SDLC).

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LIST OF ACRONYMS

GPS	Global Positioning System
LBS	Location-Based Service
ATM	Automated Teller Machine
U.S.	United State
SV	Satellite Vehicles
PRN	Pseudorandom Noise
DOP	Dilution Of Precision
PVT	Position, Velocity and Time
I/O	Input/Output
RAM	Random access memory
ICs	Integrated Circuits
FCC	Federal Communications Commission
PDA	Personal Digital Assistant
iOS	iPhone Operating System
M2U MAP	Maybank ATM and Bank Branch Locator
mLot	Toyota Shopping Tool
AT&T	American Telephone and Telegraph
SDK	Software Development Kit
CSS	Cascading Style Sheets
apps	Applications
APIs	Application Programming Interfaces
SDLC	System Development Life Cycle
HTML5	HyperText Markup Language
JSON	JavaScript Object Notation
AJAX	Asynchronous JavaScript and XML
COO	Cell of Origin
AOA	Angle of Arrival

TOA	Time of Arrival
EOTD	Enhanced Observed Time Difference
A-GPS	Assisted GPS

CHAPTER 1

INTRODUCTION

1.1 Background of Study

In this modern informatics life, technological advancement has completely revolutionized the world causing humans are too integrates on them in their lifetime especially mobile phone. Moreover, the mobile gadgets are much sophisticated nowadays that is it looks much alike a computer with more compact and tinier but allowing information to be stored on the mobile devices [1]. In addition, a Global Positioning System (GPS) navigator device has been replace by the mobile gadget as well. This is due to the importance of the location information that helps people to search for things or places such as locating they current place and looked for what they want or needed. Therefore, Location-Based Service (LBS) concept is needed to fulfill this problem.

LBS is an information or entertainment service, which is accessible with mobile devices through mobile network and utilizing the ability to make use of the geographical position of the mobile device [2][3][4]. LBS comes with GPS tracking because GPS tracking is a major enabling ingredient, utilizing access to mobile web. Therefore, without the needs of manually specify the location identifier mobile user can still locate their requested location such as stores, restaurants, banks, etc.

1.2 Problem Statement

An automated teller machine (ATM) is a computerized telecommunications device that provides the clients to have financial transactions in public space using non-cash media card without the need of going to the bank. Therefore, people can easily have their transaction done by using the ATM. However, for those who are not familiar with Kuantan area, will found out that they hardly to find an ATM that is nearby to their current location. So, it will bring difficulty in searching for ATM when someone who is out of cash and needed it urgently for emergency use. On the other hand, even if that person has a map that leads them to the location of ATMs that is provided in the travel maps, it is still hardly to get to the accurate location of the ATMs in Kuantan. Stu Fisher, senior vice president of eCommerce at Addison Avenue Federal Credit Union, stated *"Even with more than 300,000 ATMs across the country, finding one when you need it can be a challenge. The visual ATM locator solves this problem and shows people, which ATMs are free vs. fee by looking at the horizon through a mobile device."*. Moreover, people easily get lost if they refer to the unclear road sign to get themselves to their wanted destination. As the result, with a device that can locate the ATMs for different type of banks in Kuantan are in the user's fingertips.

1.3 Objective

The objectives for the ATMs Locator in using GPS on Mobile App are as below:

     i.   To develop an ATM location tracker using Global Positioning System (GPS) in web-based form that supported in iOS platform.

    ii.   To locate the nearby ATM location from the user's current position.

   iii.   To show the ATM location on Google Maps.

1.4 Scope

This proposed system is developed for a mobile application in hybrid apps that is supported in iOS platform. The main purpose of this system is to track the ATM Bank those are available in Kuantan, Malaysia. However, it is limited to around 20 ATM Bank that are available in Kuantan. Besides that, this system can store the previous searching data. In additional, it can calculate the distance from the user's current destination to the nearby ATM Bank. Lastly but not least, this system is developed mainly for general people with the condition they must own an iPhone.

1.5 Thesis Organization

This thesis consists of five chapters ranging from Chapter 1 until Chapter 5. Chapter 1 gives an overview of the study conducted. It also supply with the problem statement, objective and the scope of the study. Meanwhile, Chapter 2 reviews the previous research works that was conducted by other researches. All the relevant technical paper, journals, and books taken from those researches will be discussed in detail. Chapter 3 reveals the techniques and the algorithms that will be used in performing this study. It will discuss about the process flow in detail of this research. Details of the implementation of the study will be discussed in Chapter 4. Results of the testing are to be expounding in Chapter 5 along with conclusion of the entire thesis.

CHAPTER 2

LITERATURE REVIEW

2.1 History of Global Positioning System (GPS)

During prehistoric times, people have been thinking how to get to their destination and back home. Firstly, they marked trails along the way they have used so that they wont lost on the way back home. Later on, they began making maps and developed the use of latitude and longitude as a way of location places during Classical Age of Greece. The navigator determines his latitude by observing the height of the sun during the day and the North Star at night (Boat Safe Kids, 2009). On 13th Century, a mariner's compass – magnetic compass, was the earliest man-made navigation tool. However, it is not much accurate when navigating an unknown area (Boat Safe Kids, 2009). In 1484, a sextant was used to determine latitude by measuring the angle above the horizontal of the sun and stars.

Global Positioning System (GPS) was initiated in 1973, a worldwide radio-navigation system that is formed from a constellation of 24 satellites and the ground stations. It provides location and time information in all weather, anywhere on or above the Earth to within 20 to 30 feet from GPS receiver (Rai, 2010). Australian Government's National Innovation Awareness Strategy stated that there is some weakness in GPS because it is similar to all radio-navigation systems where the signals coming from the satellites are vulnerable to interference accidental by the

electromagnetic interference around communication towers. That's why, sometimes the GPS receiver signal may not strong.

On the other hand, GPS was developed to meet the United State (U.S.) military forces needs. This is because, GPS system has become a new way to use its capabilities in people's everyday life (U.S. Aerospace Corporation, 2005), where consumers use GPS system for two purposes that are positioning and navigation depends on their needs. For example, GPS systems provide some standard and useful information such as the distance traveling, time traveling, speed traveling, maps of the user's trail and etc., which it has become importance to people's lifestyle since it can brings easier lifestyles to everyone.

According to U.S. Aerospace Corporation (2005), GPS systems are fundamentally consists of three elements, which are a constellation of satellites, receiver and ground stations. The following figure shows how the GPS comprises a control, space and user segments.
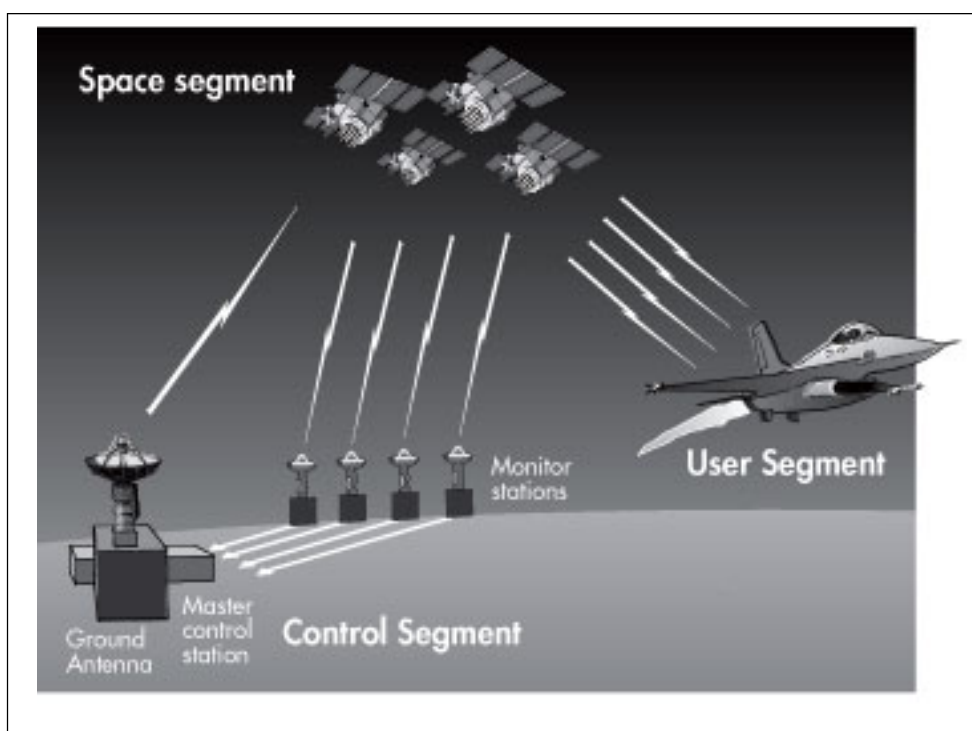

Figure 2.1 GPS comprises a control, space and user segments.

(U.S. Aerospace Corporation, 2007)

2.2 GPS Elements

GPS has three element parts that are the space segment, the user segment and the control segment. The space segment consists of constellation of 24 satellites, each are located in its own orbit 11,000 nautical miles above the Earth which users make ranging measurements. Dorsey, et al. (2006) states that the satellite vehicles (SV) i.e., satellites transmit a pseudorandom noise (PRN) coded signal from which the ranging measurements are made. Unlimited users can simultaneously use GPS because user with signals only being transmitted and the user passively received the signals.

The GPS receiver comprises the user segment where the receivers connected to the satellites all of the time. The receivers are known as passive. They only need to receive "order" from the Space Segment and does not have the ability to broadcast anything. Therefore, it is accessible to unlimited users at the same time without being interfering each other. This view has been supported in the work of Carter (1997). Nowadays, more than a hundreds of receiver models are being use. The most typical hand-receivers are the mobile phone.

Lastly, the control segment consists of six ground stations and is located around the world. The purpose is to make sure the satellites are working properly and track the navigation signals and send their data back to the master control station. This is because the Control Segment updates each of the satellite's clocks, ephemeris and almanac and the navigation signals.

2.2.1 Space Segment Description

It consists of two principal aspects that are the constellation of satellites and the features of the satellites that occupy each orbital slot.

2.2.1.1 GPS Satellite Constellation Description

As discussed in Section 2.2, 24 satellites are positioned in six Earth centered orbital planes. It provides 24 hours global user navigation and time determination capability. The following figure shows the satellites orbits in a planar projection referenced to the epoch time stated by Carter (1997).
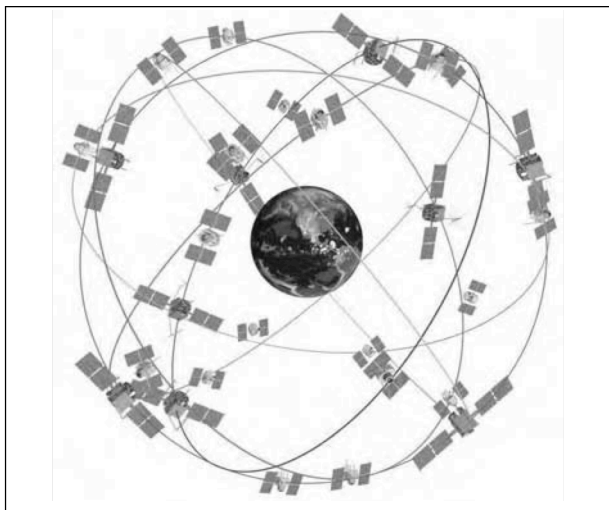
Figure 2.2 GPS satellites constellation. (Source: Lockheed Martin Corp.)

The orbital plane locations with respect to the Earth are defined by the longitude of the ascending node, while anomaly defines the location of the satellites. The longitude is the geographic coordinate that intersects on each orbital plane with the equatorial plane. Meanwhile, anomaly is angular position of each satellite within the orbit, with the Earth's equator as the reference with a zero value.
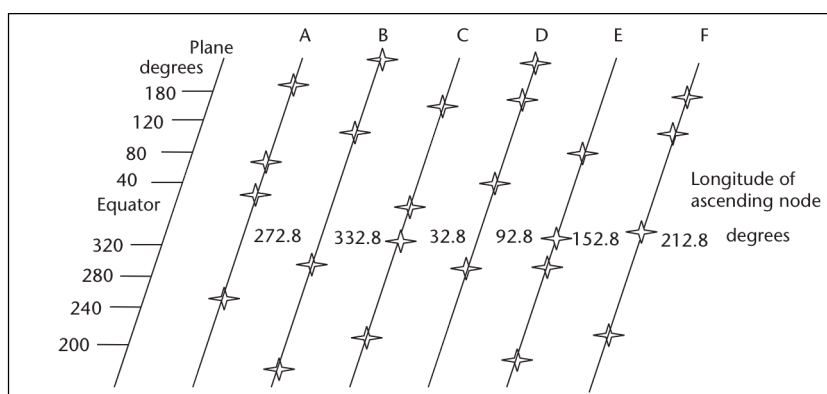
Figure 2.3 GPS constellation planar projection. (Source: Carter, 1997)

2.2.1.2 Constellation Design Guidelines

The geometric sufficiently diverse provides good observe-ability to users throughout the world by measuring its geometric with a parameter called dilution of precision (DOP). Another design consideration is the ground stations to maintain the ephemeris of the satellites and the uploading of data.

2.2.2 User Segment

A GPS receiver processes the L-band signals transmitted from the satellites to determine PVT (Position, Velocity and Time). The following section will discuss on its characteristics.

2.2.2.1 GPS Set Characteristics

The GPS set consists of five principal components, which are antenna, receiver, processor, input/output (I/O) device and power supply.

Figure 2.4 Principal GPS receiver components. (Source: Carter, 1997).

The antenna is designed to transfer respond where the position that is computed with GPS receiver is actually is the position of the electrical phase center. Then it detects the electromagnetic signal transmitted by the GPS satellite and converts it to electric current, amplifies the signal strength and sends them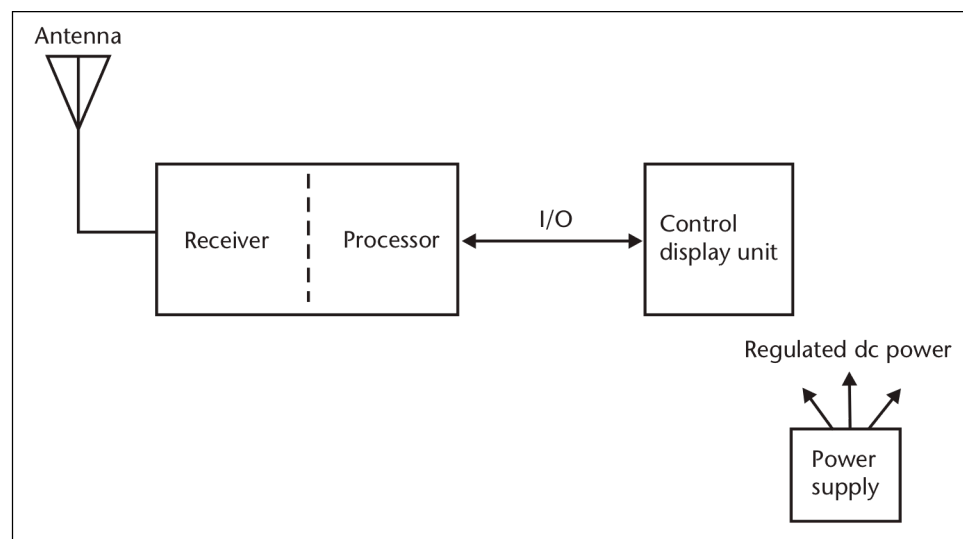 to receiver electronics. It. The antenna and receiver front end must have sufficient bandwidth to pass the signals for interest.

GPS receivers designed for use in handheld devices need to be power efficient. These receivers may trade off susceptibility to high-power in-band interferers to achieve minimum power supply drain depending on the implementation (Carter, 1997).

A receiver processor is required to control and command the receiver with channel signal acquisition and by signal tracking and data collection. The processor that refers to the receiver measurements may form the PVT solutions. Most of the processors provide an independent PVT solution on a 1-Hz basis. However, some applications may be dedicated to the computation of both PVT and associated navigation functions. For example, an auto-land aircraft require computation of independent PVT solutions at minimum of 5Hz.

Based on the Figure 2.4, The I/O device is the control display unit interface between GPS set and the user. It allows operator data entry, display status and navigation solution parameters. As for those onboard an aircraft or ship may have the I/O device integrated with existing instruments or panels.

Lastly, the power supply can be integral, external or both. Most receivers have an internal rechargeable Nickel-Cadmium battery in addition to an external power input. The internal battery is use to maintain data stored in volatile random access memory (RAM), integrated circuits (ICs) and to operate a built-in-timepiece when it is not connected to the power.

2.2.3 Control Segment Description

Control segment is the vital link in GPS technology. Its main functions are monitoring and controlling the satellite system continuously, determine GPS system time, predict the satellite ephemeris and the behavior of each satellite clock and update periodically the navigation message for each particular satellite.

Figure 2.5 Elements in operation control system. (Source: Carter, 1997)
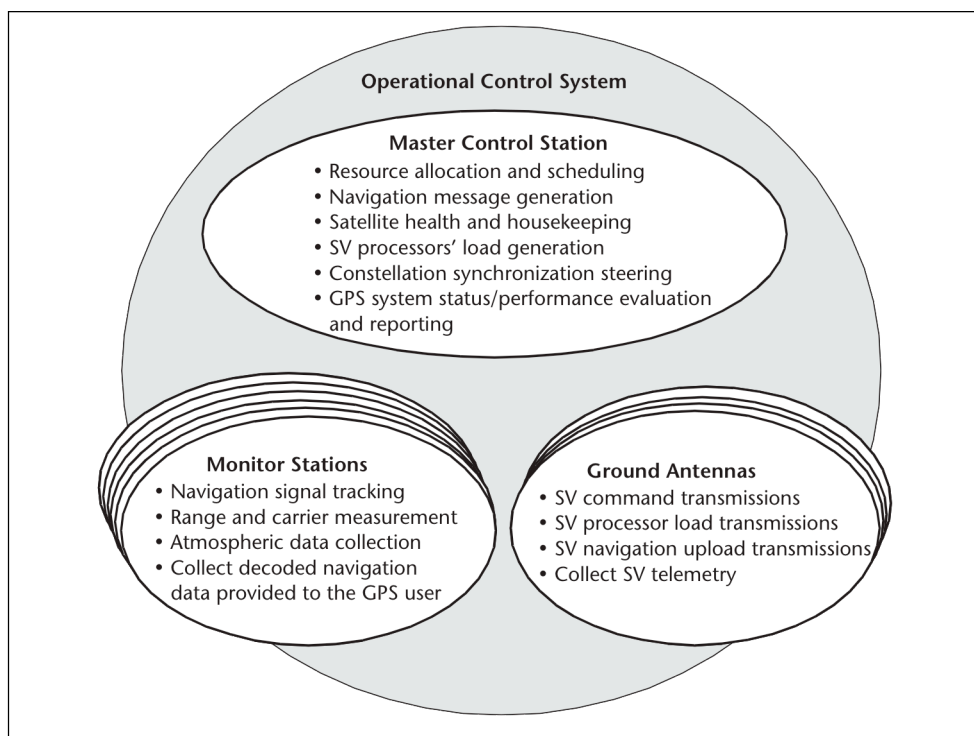
Table 2.1 Comparison of GPS elements. (Source: Raju, Geo-informatics Division, Indian Institute of Remote Sensing, Dehra Dun)

Segment	Input	Function	Output
Space	Navigation message	Generate and transmit code and carrier phases and navigation message	P-Code C/A code L1, L2 carrier Navigation message

Table 2.1 Comparison of GPS elements. (Source: Raju, Geo-informatics Division, Indian Institute of Remote Sensing, Dehra Dun) (continue)

Segment	Input	Function	Output
User	P-Code Observations Time	Produce GPS time predict ephemeris manage space vehicles	Navigation message
Control	Code observation Carrier phase observation navigation message	Navigation solution, surveying solution	PVT (position, velocity and time)

2.3 Advantages and Disadvantages of GPS Systems

In the past, GPS was used by the U.S. Department of Defense to allow the military to navigate under any condition, anywhere in the world. Today, consumers use GPS systems that using the same satellites signals as the military uses. Therefore, consumer GPS devices can offer many significant advantages yet there are a few disadvantages using GPS systems.

GPS has bunch of useful depends on the users' need. For example, it is extremely handy especially for those who like hiking. Consumers can deviate from a path without worrying getting lost on finding their way back. Or, for vehicle drivers, consumers can get themselves to their destination by the turn-by-turn instruction in GPS-based navigation systems. Therefore, it is helpful to those who are unfamiliar to the places that they departed to. It also allows consumers to search the local area for nearby amenities such as; banks, gas station, restaurant etc. by providing the information and the direction of the selected amenity. For boaters, GPS systems can help them to figure out their current position on the maps.

Although GPS systems are helpful in people's living style still, it has a few of failure. The main failure is when the GPS receiver fails to receive updates due to the signals are bounces off of objects, such as tall buildings or large rock surfaces of the area or bad weather. Therefore, consumers need to backup the maps and

direction in case the error occurred. Besides that, GPS signals are not completely accurate. This may occur due to the orbital errors. So, GPS systems do helpful sometimes depending on the surrounding situations.

Table 2.2 Advantages and Disadvantages of GPS systems.

Advantages	Disadvantages
Ease of navigation	Possible failure
Search nearby area	Signal multipath
Water navigation	Inaccuracy

2.4 GPS Services in Mobile Phones

Recently, in the field of activity-travel surveys, positioning technologies such as GPS for mobile communications have been widely applied to collect detailed information on travel trajectory. Nowadays, people can use their cell phones to get direction, track their friends, searching the nearest amenities or keep an eye on their kids. According to Carter (2006), the U.S. FCC (Federal Communications Commission) has mandated the E911 (Enhance 911), which requires that the location of any mobile phone used to call 9-1-1 can be determined. This will require that the manufacturers to install a GPS receiver in all mobile phones. As the result, people able to use their mobile phone to get driving directions.

2.4.1 System Platform

Mobile phone, PDA (personal digital assistant) and laptop PC are possible options of mobile electronic devices for GPS navigation. According to Ohmori, Harata and Nakazoto (2005) research, the laptop PC is the best for respondents to enter activity information in terms of the size of monitor display but less convenient for respondents both to carry and to enter activity information anytime and anyplace. Mobile phone and PDA are smaller devices and easier to be carried. The mobile phone has a smaller monitor and less flexibility for the design of data entry form

than PDA, but the number of mobile phone users is much higher than PDA user in Japan.

Table 2.3 Comparisons among Devices as the GPS Systems Platform.

	Mobile Phone	**PDA**	**Laptop PC**
Size of monitor	Small	Moderate	Large
Easiness to be carried	Easy	Moderate	Difficult
Flexibility for the design of data entry form	Low	Moderate	High
The dissemination in people	High	Low	High

2.4.2 Smartphones with built-in GPS

Naturally, navigation is used on most smartphones since it has full GPS capability onboard with an app that handles the mapping and navigation. There are many options for all smartphone platforms such as iOS (iPhone Operating System), Android, Windows Mobile, and etc. The following sub-sections are the study cases that are use in smartphones nowadays.

2.4.2.1 Maybank ATM and Bank Branch Locator (M2U Map)

This application is a free application that can be downloaded onto iPhone. It is designed to experience mobile banking services, navigate the nearest ATM or branch, and even look out for the best dining treats outlets in both Singapore and Malaysia. However, this application is develop typically only for Maybank customers particularly for those who are using iPhone. M2U Map is a native application, which means it is an application that is developed for iPhone will need to run on iOS platform, or on Symbian for many Nokia devices and etc.

2.4.2.2 Toyota Shopping Tool (mLot)

Toyota has introduced a new way to shop for new Toyota vehicle by using mobile gadgets. With this application, user can get instant information on any new vehicle with the innovative and easy-to-use mLot feature instead of shopping at the local dealership. Besides that, it is also included with the feature turn-by-turn directions using GPS location to find a dealer. mLot is convenient linking to Toyota's Mobile Website, which means it is a web-based application where is typically coded on a browser-rendered language such as HTML (HyperText Markup Language) combined with JavaScript.

2.4.2.3 TeleNav

This application launches a browser-based GPS navigation solution, complete with voice guidance, turn-by-turn directions and an API for other apps to integrate with. This application is similar to a navigation device that is compatible in a smartphone. TeleNav GPS Navigator accesses the maps via AT&T (American Telephone and Telegraph). AT&T is the second largest provider of mobile telephony and fixed telephony in the United States. It could support up to five devices by offering wireless hot spot with a simple and relatively speedy way to get online, stated by German, 2011.

2.5 Mobile Applications

Mobile applications are a rapidly developing segment of the global mobile market. They consist of software that runs on a mobile device and performs certain tasks in the mobile phone. Besides that, it is a downloadable onto most phones, including inexpensive, entry-level models. Most of the mobile applications has pre-installed on mobile phones, such as SMS/MMS clients, browsers and music players. For external applications, user can download it and installed them via wireless network, or they can have them loaded and installed in the mobile operator's store.

Mobile applications can be categories into native platforms, mobile web runtimes, hybrid mobile applications and etc.

2.5.1 Mobile Native Application

Native applications are very common designed to run on a device's operating system and machine firmware. It is a first mobile application development. Most of the mobile application developer prefers native apps because of the superior user interface and commercial opportunities offered by e.g. the iPhone App Store. In additional, native apps offer a best-in-class user experience by offering a rich design and tapping into device features and offline use. It is installable into user's cellphone and launched it directly from there, which stored within their mobile. Besides that, native apps are more secure as they do not need to connect to the network frequently. An application is like a portfolio that can be created within the phone and store in it. As to update the application, there is no need to download the entire portfolio because user is only required to update the stock prices.

The disadvantage of this type of mobile application is obviously the development cost because it can be used only on a mobile platform. So, to share the same mobile application on different mobile platforms, a unique programming language and SDK are required. However, it can be costly to develop, test and support on multiple mobile platforms.

Table 2.4 Advantages and Disadvantages of Mobile Native Apps

Advantages	Disadvantages
• Much secure. • Can directly update the portfolio instead of re-downloads the entire portfolio.	• Have to use different platforms, SDK's, languages for different mobile platforms. • Developing, testing, and supporting multiple devices platforms can be costly.

2.5.2 Mobile Web Application

Lately, mobile Web app has been popular in mobile applications trend. A Web app or browser application is one in which all or some parts of the software are downloaded from the Web each time it is run. Comparing to mobile native apps, the development cost of mobile Web apps is lower since, the developer only needs to consider how to make it compatible with most mobile browsers instead of type of cell phone. Web apps can be written in HTML, CSS and JavaScript. Just like a browser in the computer, mobile Web apps can be bookmarked for future use.

However, mobile Web applications are slow due to the bandwidth limitations and will used up the data usage of the phone. According to Mobithinking study, news and weather publisher dominates most of mobile Web apps users. This is due to many major publishers with origins in both print media and broadcast have shown strong interest, it was stated by Mobithinking. In additional, mobile Web apps are less secure since it has to be connected to the network to runs the application.

Table 2.5 Advantages and Disadvantages of Mobile Web Apps

Advantages	Disadvantages
• Low development cost • Compatible with most mobile browser • Supports HTML and user can zoom in and out	• Bandwidth limitations • Slow and cause data usage increases • Less secure.

2.5.3 Mobile Hybrid Application

Hybrid apps are downloadable app that runs all or some of its user interface in an embedded browser component. It runs in web view but not in native browser. As an application user, hybrid app is almost indistinguishable from a native one, similar to a native app, it is downloaded from the app store or marketplace, it stored on the cell phone and it launched just like a native app. However, its application code is written in HTML, CSS and JavaScript. The purpose of introducing this

mobile application platform is to combining the advantages of native apps and Web apps and its save cost to developing a separate Web and native applications.

PhoneGap, an HTML5 app platform that allows developers to author native applications with web technologies for iOS, Android, BlackBerry, Windows 7, WebOS, Symbian and more. Besides that, it is typically have APIs as well, which allows user to access the device's hardware and features that are locked out from the browser, stated by Jones, 2012. Although a hybrid app is similar to a native app, it still can't take the advantages of functionality because the app's performance is still dependent on the device's browser capabilities.

Table 2.6 Advantages and Disadvantages of Mobile Hybrid Apps

Advantages	Disadvantage
• Bring together features of both Web and native apps • Cost saving in developing both Web and native applications	• Can't fully take advantages of functionality because the hybrid app's performance is still dependent on the device's browser capabilities

2.6 Comparison of Mobile Application

From the studies of the three types of mobile application, it can be concluded as shown in Table 2.7

Table 2.7 Comparison Types of Mobile Application

	Native	**Hybrid**	**Web**
Specialty	Has superior user interface	Consists features of both Web and native apps	Compatible with most of mobile's browser
Cost development	High	Moderate	Low
Security	High	Moderate	Low
Commercial opportunities	High	High	Low

2.7 Location-based Services

Location-based services (LBS) are used to integrating the geographic location to applications with general notion of services. Applications that use location-based services for information delivery are such as emergence services, car navigation system, tourist tour planning, or yellow maps. Since LBS has been tremendous in market, then is is widely used in conventional services such as telephony and related added-value features, e.g. to realize location-based routing of calls or location charging.

However, wireless network operators are needed in the application to provide public emergency services with the user's location. This is because the Federal Communication Commission of US laid the foundation stone of LBS. Thus, the network operator is required to locating the user within 125 meters (Prasad, 2006).

Nowadays, LBS has been benefiting both the consumers and network operators where the consumers can increase communication convenience, having greater personal safety and more personalized features. Meanwhile, the network operators will address discrete market segments based on the different service portfolios.

2.7.1 Architectural based on Mobile Location Centre

There are several types of provider to locating the device that are location-finding equipment vendors, both handset- and network-based solution. Handset Centric Technology solutions includes those of GPS, Overlay Triangulation technologies and Cell of Origin information. As Cell of Origin, although not so accurate, yet it is the most widely used by the network operators. Accuracy of location will allow the introduction of new services and improve the current services.
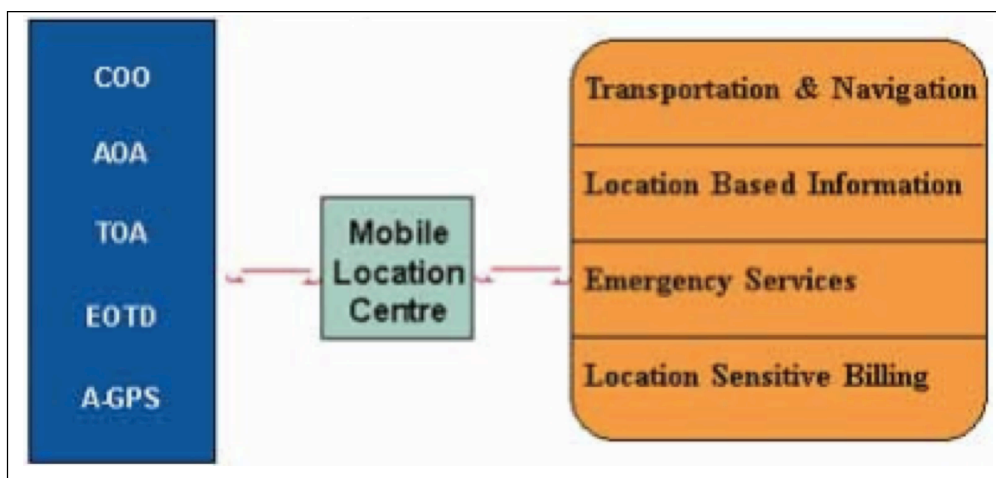

Figure 2.6 Architectural based on Mobile Location Centre

Figure 2.6 shows the architectural based on mobile location Centre for information delivery such as cell of origin (COO), angle of arrival (AOA), time of arrival (TOA), enhanced observed time difference (EOTD) and assisted GPS (A-GPS).

Table 2.8 Description of Information Delivery

Information	Description
COO	Uses network-based station to identify the location of the caller.
AOA	A complex antenna is needed to determine the angle from which a cellular signal originated.
TOA	Required synchronization of cellular network using GPS at each base station to calculate the time of arrival of the signal from the mobile to more than one base station.
EOTD	Offer greater positioning accuracy than COO but it has a slower speed of response.
A-GPS	More accurate compared to COO and EOTD in positioning. However, GPS handset needs to be in sight of three or more satellites, hence it is difficult to be used indoor areas.

2.8 Google Places API

Google Places API is very useful in finding nearby places across a wide range of categories. Therefore, it is used on location-based application to have a fast look for nearby places. Besides that, it has features over 50 million businesses and point of interest which is updated daily with the owner verified and user-moderated contributions.

There are several requirements that are needed before developing a location-based application. In order to use Google Places API, developer will need to register to obtain a Google Map API key, where it can be found from the Google's developer console. The key is used to request to certain Maps API web services.

Then, using the key to to the URL authentication calls the Places API using JSON request. "https://maps.googleapis.com/maps/api/place/search/json?location=-33.8670522,151.1957362&radius=500&types=food&name=harbour&sensor=false&key=*AddYourOwnKeyHere*" is an example of showing a search for places of type

'food' within a 500m radius of a point in Sydney with containing the word 'harbour' in their name. The result of this example is as follows:

```
{
  "html_attributions" : [
    "Listings by \u003ca
href=\"http://www.yellowpages.com.au/\"\u003eYellow
Pages\u003c/a\u003e"
  ],
  "results" : [
    {
      "geometry" : {
       "location" : {
         "lat" : -33.8719830,
         "lng" : 151.1990860
        }
      },
      "icon" : "http://maps.gstatic.com/mapfiles/place_api/icons/restaurant-
           71.png",
      "id" : "677679492a58049a7eae079e0890897eb953d79b",
      "name" : "Zaaffran Restaurant - BBQ and GRILL, Darling Harbour",
      "rating" : 3.90,
      "reference" :
         "CpQBjAAAAHDHuimUQATR6gfoWNmZlk5dKUKq_n46BpS
         zPQCjk1m9glTKkiAHH_Gs4xGttdOSj35WJJDAV90dAPnNnZ
         K2OaxMgogdeHKQhIedh6UduFrW53wtwXigUfpAzsCgIzYNI0
         UQtCj38cr_DE56RH4Wi9d2bWbbIuRyDX6tx2Fmk2EQzO_lVJ
         oq4ZY5uI6I75RnxIQJ6smWUVVIHup9Jvc517DKhoUidfNPyQ
         ZZIgGiXS_SwGQ1wg0gtc",
      "types" : [ "restaurant", "food", "establishment" ],
      "vicinity" : "Harbourside Centre 10 Darling Drive, Darling Harbour,
Sydney"
    },
    ...additional results...
  ],
  "status" : "OK"
}
```

Figure 2.7 Response formatted in JSON

In addition, the Google Maps key will be use for showing the places searched in the map. Therefore, register for the key is a must before developing a location-based application.

JSON is a lightweight data interchange format. It is special designed for human-readable data interchange. In additional, JSON is a completely language independent. However, it uses conventions that are familiar to programmers of the C-family of languages including C, C++, C#, Java, JavaScript and etc. Figure 2.7 is an example of JSON. In JSON basic types, there are number, string, Boolean, array, object and null.

Table 2.9 JSON Basic Types

Types	Description
Number	Double precision floating-point format in JavaScript, generally depends on implementation
String	Double-quoted Unicode, with backslash escaping
Boolean	True or False
Array	An ordered sequence of values, comma-separated and enclosed in square brackets; the values do not need to be of the same type
Object	An unordered collection of key:value pairs with the ':' character separating the key and the value, comma-separated and enclosed in curly braces; the keys must be strings and should be distinct from each other
Null	Empty

CHAPTER 3

METHODOLOGY

In this chapter will explain about the methodology that is used for ATM Locator Mobile Application during development. This chapter will explain on the Software Development Life Cycle methodology in detail. The next section discuss about the flow of design of the system. The last section would cover on the hardware and software that use throughout the development stage.

3.1 Introduction

Methodology is a general guideline for how this system is conducted and solving a problem with specific components such as phases, tasks, methods, techniques and tools. A wide variety of such frameworks have evolved over the years, each with its own recognized strengths and weaknesses. The system development life cycle (SDLC) has been chosen as the methodology for this system.

3.2 System Development Life Cycle

System development life cycle (SDLC) can be considered to be the oldest formalized methodology framework for building information systems. The main idea of the SDLC has been "to pursue the development of information systems in a very deliberate, structured and methodical way, requiring each stage of the life cycle from inception of the idea to delivery of the final system, to be carried out in rigidly and sequentially" within the context of the framework being applied. The six phases are as below planning, analysis, design, implementation, testing, and operation and maintenance.
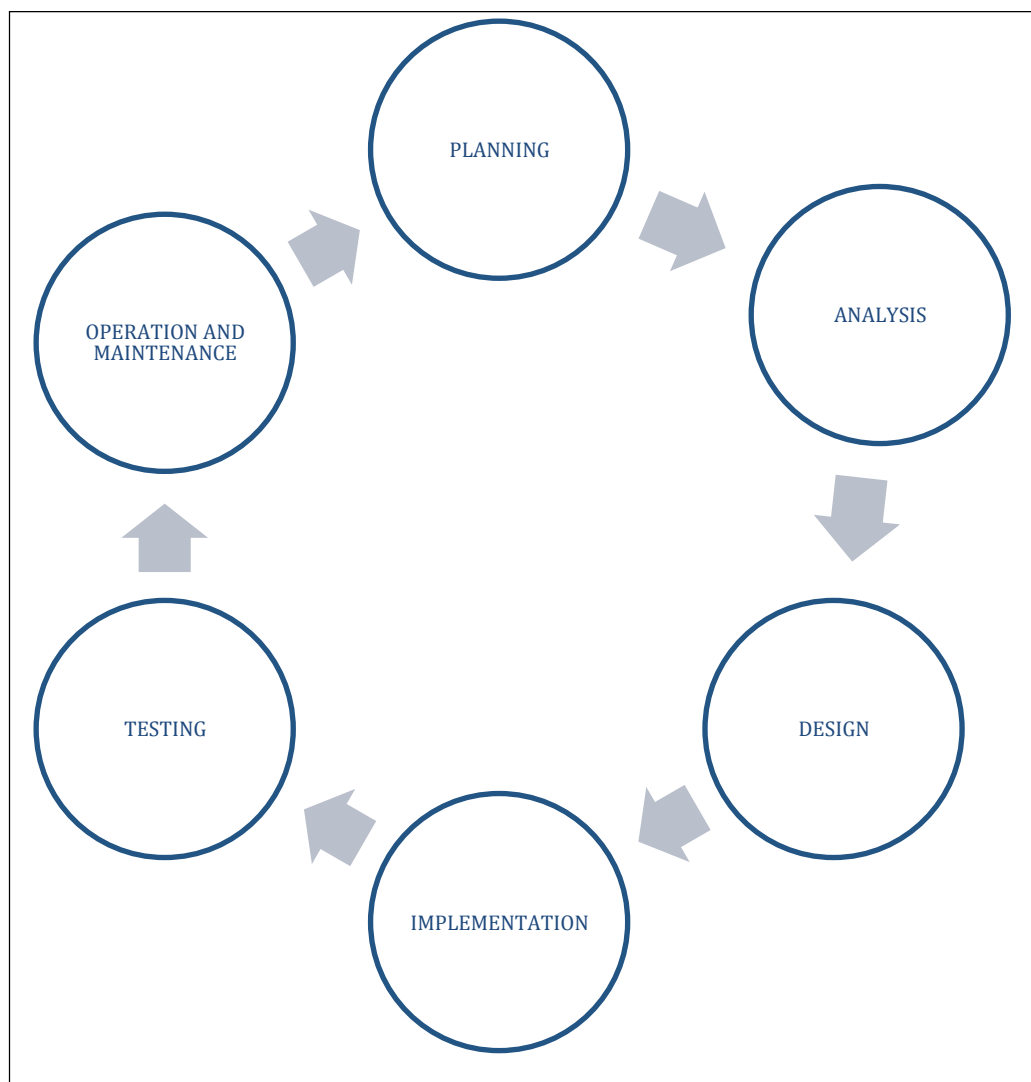
Figure 3.1 System Development Life Cycle

3.2.1 Planning

Planning phase is the brainstorming stage of this proposed system, where the background, objectives, problem statements and scope of proposed system are identified. Then, by doing research on journals or articles to get the information about the system we need to develop. All of the important information is collected and noted. Lastly, a Gantt chart is a scheduling of the tasks that need to be done form time to time.

3.2.2 Analysis

The second phase of system development life cycle is analysis. It refines project goals into defined functions and operation of the intended application. On this phase, we will analyze what can this proposed system be useful to the end-user? How important is a knowing someone's position in people's life? Why do we need to develop this system? Therefore, to answer those questions, we need to do some studies on the proposed system's technology by searching the information through Internet, journals, articles, books and more. The goal of system analysis is to determine where the problem attempted to be fixed. This step involves breaking down the system in different pieces to analyze the situation, analyzing project goals, breaking down what needs to be created and attempting to engage users so that definite requirements can be defined.

3.2.3 Design

This phase will discus on the design of the functions, features and operations. All the functions, features and operations are described in detail, including screen layouts, process diagrams and other documentation.

3.2.3.1 Process Flow of ATM Locator Mobile Application.

The ATMs Locator is a mobile application that allows the user to locate the nearby ATMs that is available in Kuantan efficiently and easily. This application can be use for locating any kind of Bank Company in Kuantan instead of only a Bank Company. First of all, a full view of all ATMs that is located will be shown in the user's smartphone Then, user can either decide to proceed with the selected ATM location to get the location in the map or return to the result list.
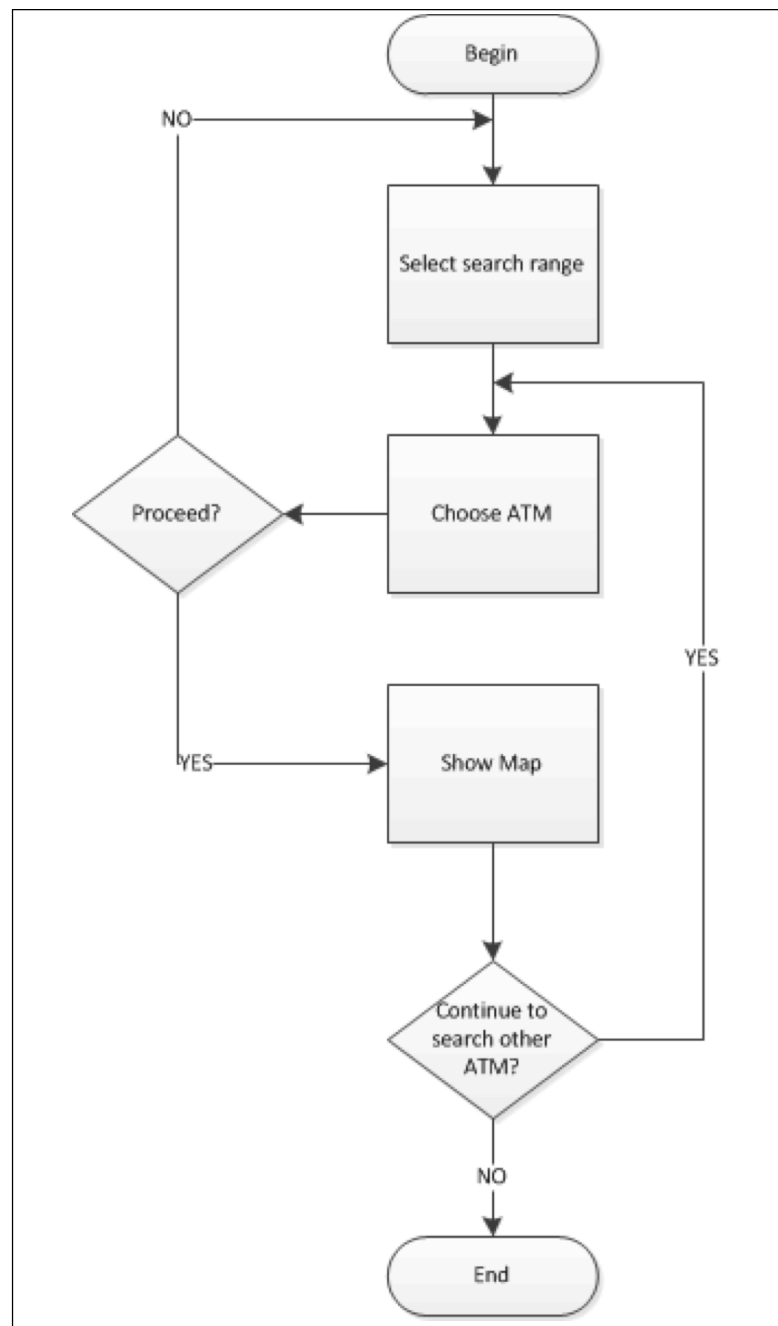
Figure 3.2 Flow Chart of ATM Locator Mobile Application

3.2.3.2 System Design

The goal of system design is to plan on developing an ATM locator mobile application that is available in Kuantan. It is to ensure how the proposed system will work and satisfy all documented requirements. In this sub-section, design elements describe the desired system features in detail that consists of architectural diagram of the system and use case diagram.

Figure 3.3 shows the overall relationship of the ATM Locator Mobile Application. The location service provider is the developer of this system will provide the registered ATM location to the mobile application. By then, when an end user requested an ATM location, the system can provide the respective location to the end user.
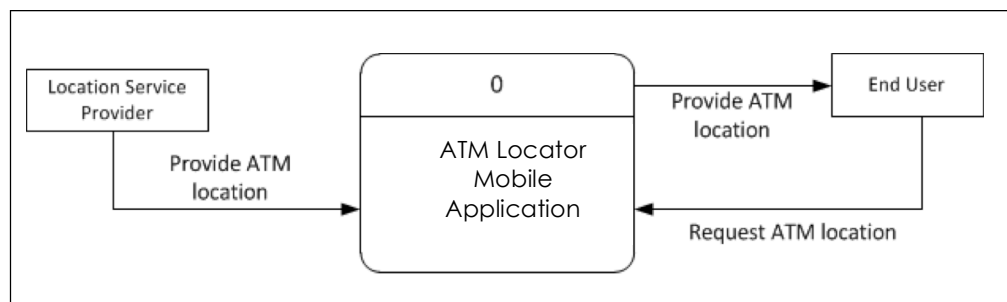
Figure 3.3 Context Diagram of ATM Locator Mobile Application

Figure 3.4 is the data flow diagram of ATM locator mobile application. This diagram describe the relationship and interaction among the system and the end user in more details. Firstly, the developer of this system will store all of the regiseterd ATM location to the database of the system. Then, end user can easily obtain the details of the requested ATM location.
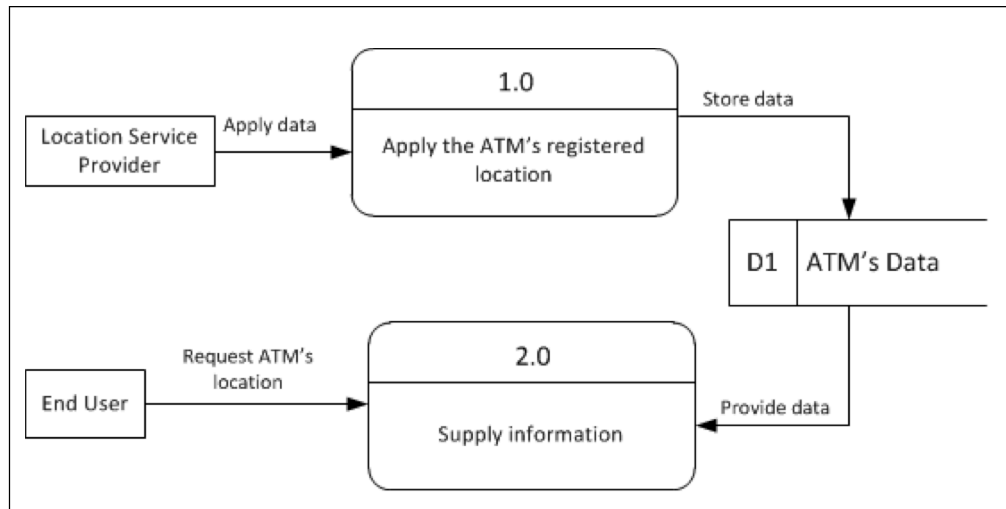
Figure 3.4 Data Flow Diagram ATM Locator Mobile Application

The following Figure 3.5 is the use case diagram. A use case diagram is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. The location service provider provides services to the user. Meanwhile, the end user can get the result list for his selected range.
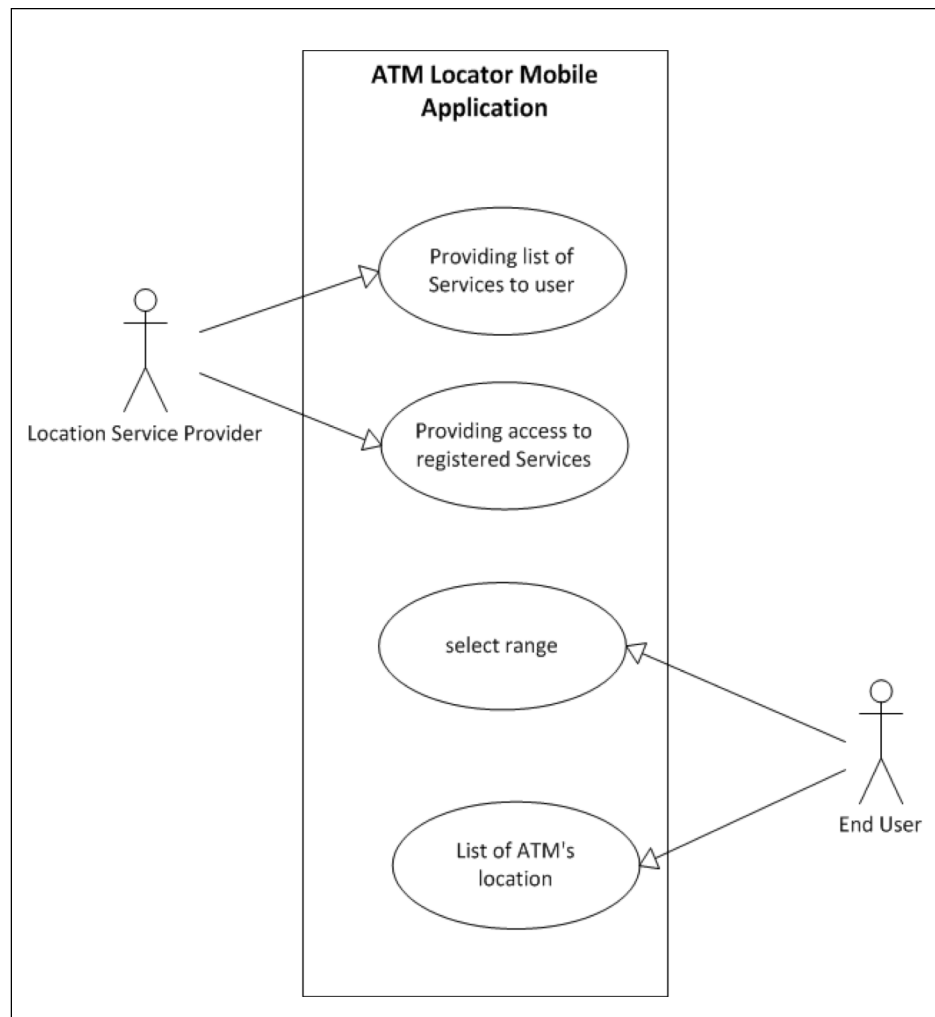
Figure 3.5 Use Case Diagram of ATM Locator Mobile Application

3.2.3.3 Interface Design

This sub-section will discuss on the system interface design. Firstly, when the application is launched, a splash-screen will be shows before entered to the home page of the system. Then, the home page consists of slider for user to adjust the range of search and a search button. The search button will send request to the service provider to get the result list of ATMs in the result page. Lastly, when user select one of the ATM from the result page, it will show the location of the ATM in the map page.
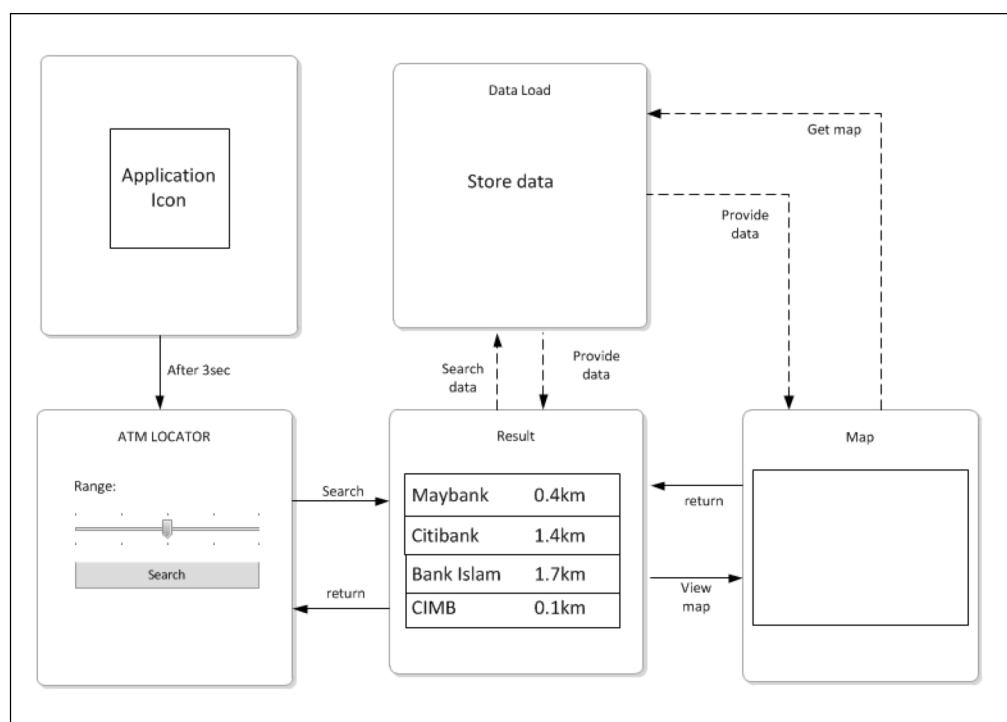
Figure 3.6 Storyboard Sketching of ATM Locator Mobile Application

3.2.4 Implementation

In this phase, the ATM locator will be implemented and use it as a real system for mobile application. The first step to implement the system is identifying the language to be used. In this system, the HTML5 together with jQuery will be used to build the interface of the system. HTML5 is chosen is because it can bypass uses of Objective-C in developing and it is supported on other smartphone's operating system such as Android, Windows Mobile, Blackberry and etc. Besides that, JavaScript is a programming language that is used for the functionality behavior.

Table 3.1 Software requirements for ATM Locator Mobile Application

No	Software	Purpose
1.	Xcode (included iPhone SDK)	For system development and testing
3.	PhoneGap	To bypass Objective-C programming language.

3.2.5 Testing

During this phase, systems are developed or acquired based on detailed design specifications. The system is validated through a sequence of unit, integration, performance, system, and acceptance testing. The objective is to ensure that the system functions as expected and that sponsor's requirements are satisfied. So, the hardware that is required for testing on real device that is the Apple device with operating system of iOS 5.

Table 3.2 Hardware requirements for ATM Locator Mobile Application

No	Hardware	Requirement
1.	Apple Device	Operating system: iOS 5

3.2.6 Operation and Maintenance

The system becomes operational during this phase. The emphasis during this phase is to ensure that sponsor needs continue to be met and that the system continues to perform according to specifications. Routine hardware and software maintenance and upgrades are performed to ensure effective system operations. User training continues during this phase, as needed, to acquaint new users to the system or to introduce new features to current users. Additional user support is provided, as an ongoing activity, to help resolve reported problems.

CHAPTER 4

IMPLEMENTATION

In this chapter will discuss about the implementation done based on the proposed methodology. The first part will give a short description on implementation programming language. Then followed by the implementation of the system. This helps user to understands on how to build a location-aware based system on mobile.

4.1 Introduction

Implementation is where the coding was done to develop the system based on the written purposed objectives and the methodology in chapter 3.

4.2 Implementing HTML5, JavaScript, jQueryMobile

As for the purpose of coding the system, HTML5, JavaScript and jQueryMobile programming language were used. The HTML5 and jQueryMobile provide the user interface of the system while JavaScript provides on the function behavior. Using these programming languages is to bypass the pure iOS programming language, which is the Objective-C, an object-oriented language. Besides that, it can support multiple devices compared to native SDK.

Table 4.1 Implementation of the System

Implementation	Purpose
i. Xcode	To build a iOS apps.
ii. PhoneGap	To integrate a web apps into a native apps.
iii. JavaScript	To control the function behavior
iv. HTML5	To decorate the interface
v. jQuery	To provide user interface to mobile developer

4.3 Implementation of the System

This section is to discuss on the implementation on each function of this system.

4.3.1 Overall Layout of the System

On this part, I will describe on the layout of the system, that consists of three pages in the system, which are the search page, result page and map page.

Table 4.2 Description of each pages in the system

Pages	Description
Search Page	The main page of the system, where allow user to search ATMs within a certain range from their current position
Result Page	The page that shows the list of ATMs that can be located from the current position
Map Page	The page that shows the ATMs location on a map view

4.3.2 Searching for Banks ATM

In order to search for ATMs, I am using Google Maps Places API. Making a restful call to the Google Maps Places service end point can search places of interest. There are many parameters required to make this restful call. In table 4.1 and table 4.2 shows the Google Places API parameter and its description.

Table 4.3 Google Places API Parameter

Parameter name	Description
API key	To tell Google that the system is making rest calls. The key can be obtained at https://code.google.com/apis/console
Latitude and longitude	Since Google Maps Places is a Geo Service, it requires your coordinates.
Radius	To determine the scope of search. (in meters)
Types	The category of places. "atm" is the types of places that is used in this system.
Sensor	Indicates whether or not the Place request came from a device using a location sensor (e.g. a GPS) to determine the location sent in this request.

4.3.3 Fetching and Showing the Results

The function-initiated search binds the search button event with the function that actually performs the search. The following is the flow of events for a search:

1. Get the current position of the user using PhoneGap function.

```
navigator.geolocation.getCurrentPosition(successCallback,
failurecallback);
```

Figure 4.1 Get the current position.

2. In the successCallback that shows in Figure 4.1, a JSON request to Google Places with the following parameters is done:

a. Geo-location

b. Radius of search from the geo-location

c. Google Places API key

d. All of this can be written in the form as follows:

```
var urlDyn =
"https://maps.googleapis.com/maps/api/place/search/json?location=" +
position.coords.latitude + "," + position.coords.longitude +
"&radius=" + radius +
"&types=atm&sensor=true&key=AIzaSyB6M9Rs01Ge9x98SwjkRrHiudPTiduhZBE";
```

Figure 4.2 JSON request to Google Places

3. jQuery's $.getJSON() is used to make a AJAX call to Google Places to fetch a JSON response.

```
$.getJSON(urlDyn, function (data) {
   if (data.status == "OK") {
     //success callback
   } else {
     alert("No ATM within the search range. Please search
     with a wider range.");
     $.mobile.changePage("index.html");
   };
   $.mobile.hidePageLoadingMsg();
});
```

Figure 4.3 AJAX call to fetch JSON response

4. In the successCallback function, the places response are fetched and appended to the "ul" element whose id is "result-list". This "ul" element is annotated in the HTML code as a jQueryMobile list view. Once the necessary "li" element has been added to the "ul" element, the $("result-list").listView("refresh") is called to redraw the "ul" element as a jQueryMobile list.

```
var i = 0;
for (i=0; i<=20; i++) {
   var eleOpn = "<li><a>";
   var eleNam = "<p><strong>" + data.results[i].name
   + "</strong>";
   var eleLoc = data.results[i].vicinity + "</p>";
   var jvScrp =
   "<script>
     $(\"li\").click(function () {
     window.location = \"map.html?nam=" +
     data.results[i].name + "&vic=" +
     data.results[i].vicinity + "&lat=" +
     data.results[i].geometry.location.lat +
     "&lng=" + data.results[i].geometry.location.lng + "\"
     });
   </script>";
   var eleCls = "</a></li>";
   var cmbStr = eleOpn + eleNam + eleLoc + jvScrp;
   $(cmbStr).appendTo("#resultlist");
}
```

Figure 4.4 Fetch the data and append into listview.
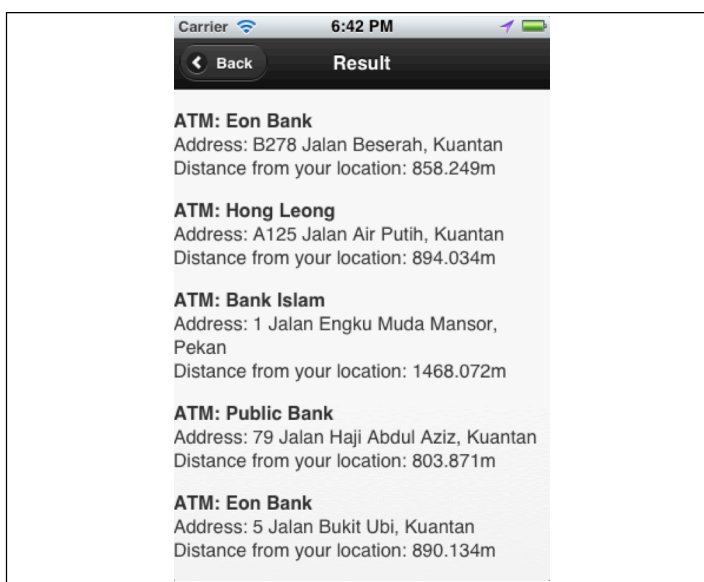
Figure 4.5 Result List Interface

4.3.4 Showing Search Result on a Map

        The last part of this system is to show the search result on a Google Maps. This is to help the user get better idea of where the ATM is located.

```
function showPosition(position) {
    var lat = mapLat;
    var lng = mapLng;
    initialLocation = new google.maps.LatLng(lat, lng);
    map = new google.maps.Map(document.getElementById("content"),
     mapOptions);
    map.setCenter(initialLocation);
    infowindow.setContent(mapNam + ", " + mapVic);
    infowindow.setPosition(initialLocation);
    infowindow.open(map);
};
```

Figure 4.6 Show Position in Google Maps
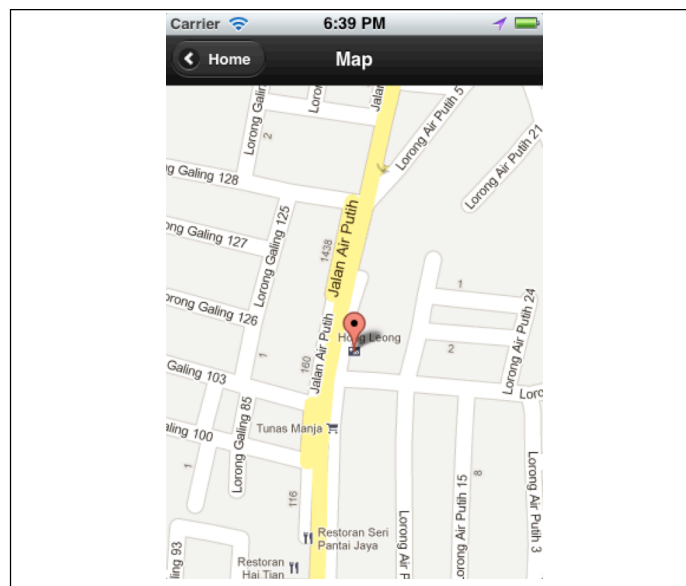
Figure 4.7 Map Interface

CHAPTER 5
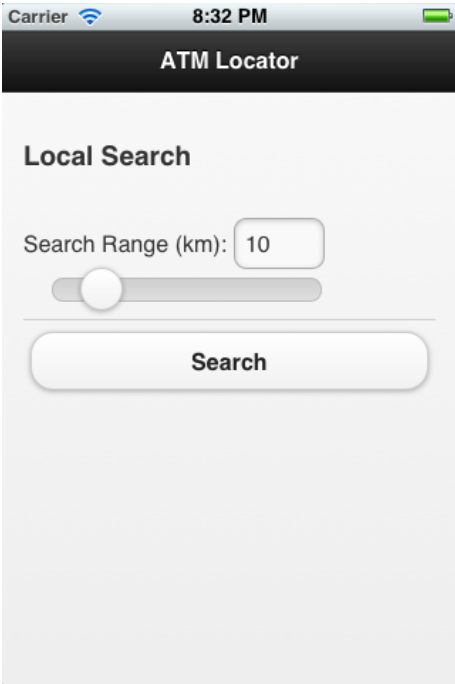
RESULT, DISCUSSION AND CONCLUSION
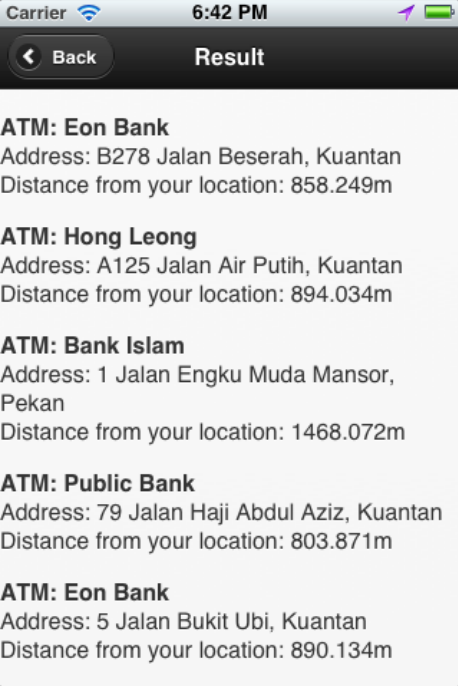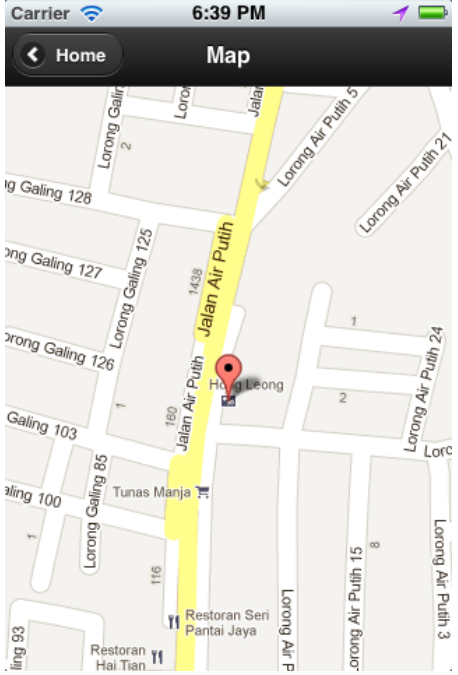
5.1 Introduction

Result is the final output of the system. It was differ from the expected result that was stated on the proposed expected result. This is because the proposed expected result was based on the theory and ideal case. Therefore, sometimes the actual result that is obtained can be slightly differ or differ a lot from what I had expected. In this section, I will show the system user interface with the results from Google Places API with some descriptions.

5.2 Results and Discussions

Table 5.1 Lists of Modules

Interface	Descriptions
Home Page	Users are required to use the slider-bar to adjust the search range that they wanted. The default search range is 10km. Image:

| List Page | This is the result from the searching function.

Image:

 |
|---|---|
| Map Page | Show the location of the ATM in the maps.

Image:

 |

5.3 Result Analysis

To developed application, ATM Locator Mobile Application has met the objectives of this project, which are as follows:

i. **To develop an ATM location tracker using Global Positioning System (GPS) in web-based form that supported in iOS platform.**
By using HTML5, JavaScript and jQuery, this system has been successfully developed. Besides that, with the help of PhoneGap, this application has been author native applications with web technologies and gets access to APIs.

ii. **To locate the nearby ATM location from the user's current position.**
By developing this prototype application, the user can locate the nearby ATM within a certain radius from their current position.

iii. **To show the ATM location on Google Maps.**
This function is to let the user know well the location of the ATM on the map.

5.4 Constraints

In this section would discuss on the constraints that affecting the system to be achieved. The factors that effecting during the completion of this project are as follows:

Table 5.2 Constraints that affecting the system to be achieved

Constraints	Descriptions
i. The searching looping function	It took a lot of time to process the searching.
ii. Knowledge	Not enough knowledge gained when developing this system.

5.5 Advantages and Disadvantages of the System

This section will discuss on the pros and cons of the system. It is illustrated in the following table.

Table 5.3 Pros of the system

Pros	Descriptions
i. Usage of JavaScript	JavaScript is an open source with light weighted and easy to integrate to the system. Also, it is supported on most of the modern web browsers.
ii. Usage of HTML5	HTML5 is the latest technology of web that is created by W3C. The W3C Geo-location API allows for scripted access to geographical location information associated with a device's browser.
iii. Usage of PhoneGap	PhoneGap is a cross-platform tool for mobile application development. Therefore, we can develop this system on other smartphone platforms using the web development language.
iv. Usage of jQuery	jQuery is a cross-browser JavaScript library. It is specially designed to simplify the scripting of HTML in the system.

Table 5.3 Cons of the System

Cons	Descriptions
i. Security issues	Possibly being hacked during requesting to get data from the Google server using JSON.
ii. Speed of the system	Since it runs in a smartphone, it has limited processing speed compared to personal computers.

5.6 Future Works

This system can be can be improved by extending the scope of searching to search ATMs for whole Malaysia. Since the scope of this project's was focus in Kuantan only.

Another suggestion is to adding a financial management function. This is to help the user to organize their accounts, manage spending, savings and etc. easily.

In addition suggestion is to support all devices such as Desktop and multiple smartphone platforms making it a very portable system. The system could be run as long as the device has a web browser that can support HTML5 specification.

Lastly but not least, the processing speed should be increased since the current system took about 5 to 10 seconds for the searching process. Perhaps, in the future technology would have better processing speed to fulfill this requirement.

5.7 Conclusion of the Project

As a conclusion, it could be stated that this study has successfully met its objectives that is mainly to develop a location-based mobile application for findings ATM. However, the usability of this application was restricted due to the disadvantages and constraints as discussed above. Thus, future works for enhancement this system is highly encouraging.

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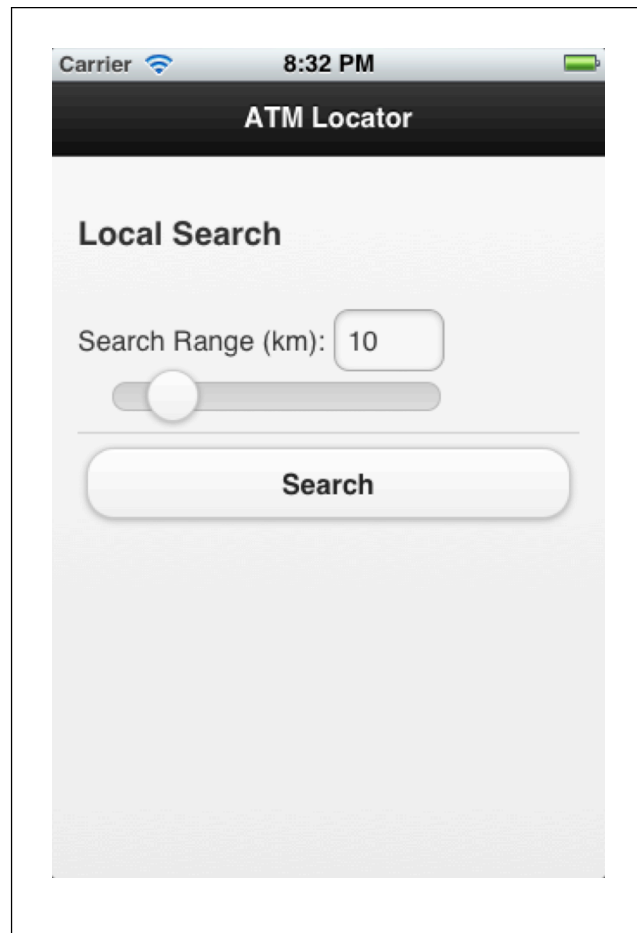
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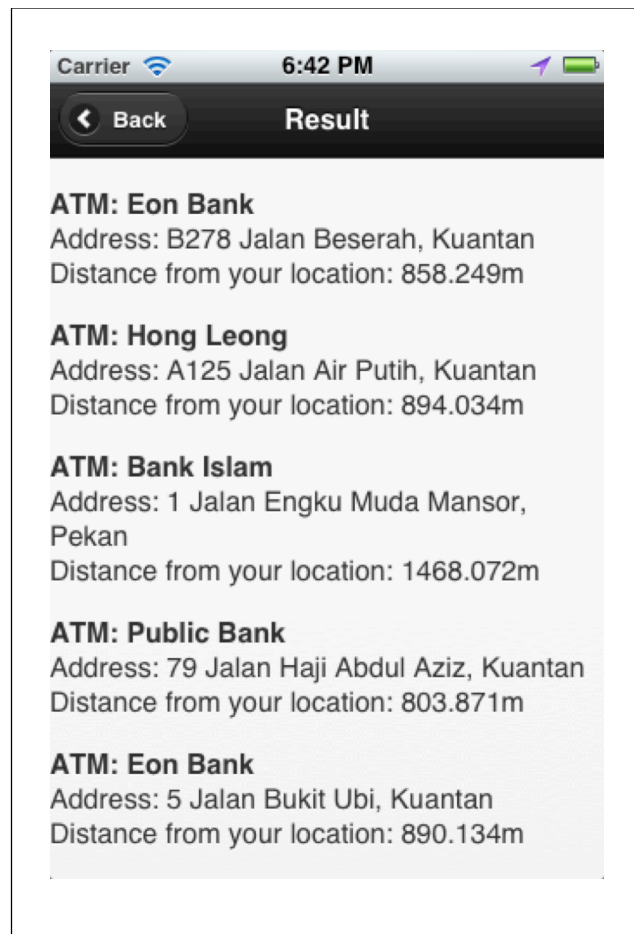
APPENDIX A

GANTT CHART

APPENDIX B

USER MANUAL

SYSTEM'S NAME: ATM LOCATOR MOBILE APPLICATION

1   Get started to the main page of the system

C1: Main Page

i.   Select the application icon in the iPhone/iPod Touch home screen

ii. Adjust the search range that you wants

iii. Click the search button
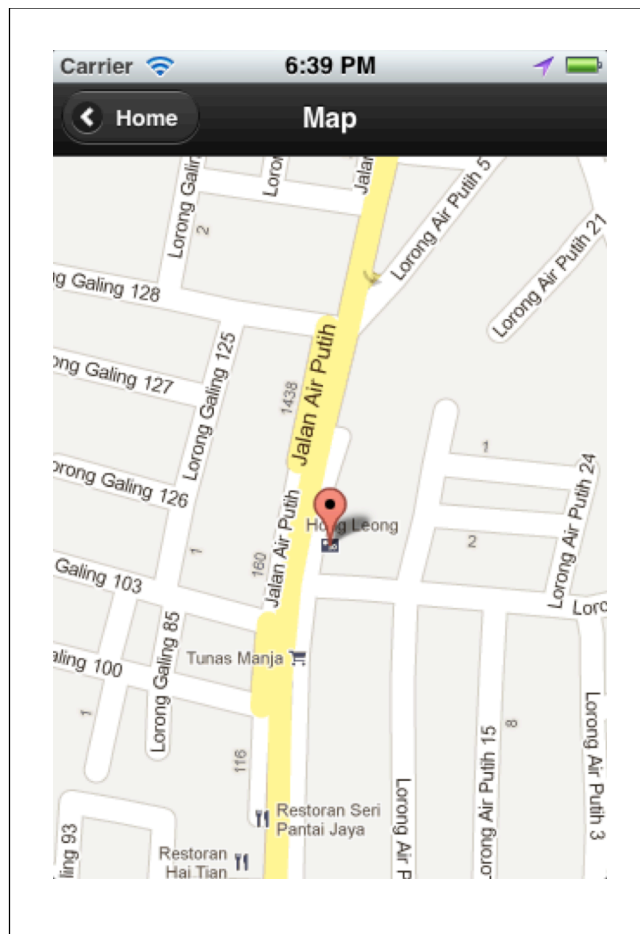
iv. Allow your device for geo-location request

2   Result page

C2: Result Page

i.   Select one of the result to proceed to the map page

ii.   Click back button return to the main page for continue searching or to quit the application just click on the iPhone/iPod Touch home button.

3   Map page

C3: Location shown in map

i.   Click home button to continue or to quit the application just click on the iPhone/iPod Touch home button.