

Mobile Campus Tour Guide for UTP

by

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15063

Dissertation submitted in partial fulfilment of
the requirements for the
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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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Approved by,

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UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

May 2014

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

NADHIRAH BINTI MOHD NASIR

ABSTRACT

In line with the advancement of current technology, popularity of mobile tour guide application for universities is growing rapidly among the universities outside of Malaysia. Local universities are currently trying to adapt to this new phenomena. Current method used in exploring places in campus is time consuming and not effective. Common workaround is to look for the signboards or ask around but there are cases where the direction given was wrong and confusing. The objective of this project is to develop an android mobile tour guide application, 'UTP Campus Tour Guide', for Universiti Teknologi PETRONAS that provide users with interactive map to help them in exploring UTP. A review of existing mobile tour guide applications reveals diverse design methods were used for developing these applications. The results of careful analysis of these applications informed the design of the proposed application. The application is developed using MIT App Inventor 2 as the platform. A customized map of UTP and specific routes from one location to another location was developed using Google Maps Engine and then tested continuously to ensure its functionality working flawlessly. Users are able to find their preferred destination easily and can have a self-guided tour on their own with the help of this mobile tour guide application. Potential target users for this system will be mainly new students, new staffs and visitors of UTP who are not familiar with places in UTP. This mobile application will act as a map navigator for them to find places in UTP easily.

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ABBREVIATIONS AND NOMENCLATURES

CMU	Carnegie Mellon University
UTP	Universiti Teknologi PETRONAS

CHAPTER 1

INTRODUCTION

In this new era, technologies have been evolved rapidly from time to time in the speed of light. From desk-based PC to laptop and now there are tablets and smartphones that have almost the same functions as the PC. With the existence of tablets and smartphones, there are many applications have been developed to meet the demand from the users. The demand has open many opportunities to the mobile application developer to develop more and more applications.

According to a UK-based report, it has been predicted that mobile applications will become the leader in terms of venture capital investment in 2014. VCPOST (2013) also mentioned that “Global State of Enterprise Mobility for the Past, Present and Future” report predicting that mobile application startup could be the top global investment among IT practitioners and enterprise mobility in the following year. Those predictions have supported that mobile applications have become something important today. The numbers of tour guide applications are also increasing as time goes by as it is found beneficial and useful to the users.

The mobile tour guide application can be either for outdoor or indoor used. As for outdoor, it can be divided to three big chunks which are for the worldwide map which cover the whole world, map for medium size area which cover cities and towns and lastly map for small or specific area like a theme park, zoo and campus. For indoor map, it will be used for location inside a building such as shopping complex, hospital and so on. The study and example of mobile tour guide application will be further discussed in this report.

1.1 Background of Study

According to Maps of India (2012), map is a visual representation of an entire area or a part of an area, typically represented on a flat surface and Congrove (1999) said that map is a visual representation on usually a flat surface of an area. Both of them have the same idea on the definition of map. Map has been illustrated to provide details on the features of that particular area such as buildings, roads, geographical properties like river, greenery and others. There are also many types of maps available starting from the static, two-dimensional, three-dimensional, dynamic and even an interactive map. Back then, people used to do cave painting and rock carvings. The current map that we are using has been evolved from those diagrams found from our ancestors.

In this era, maps has been produced and utilized by people as a necessary tool that help and ease them in their daily life. Map has been used to identify, understand and navigate their way around wherever they go. Therefore, it is found that map has been passed from generation to generation and helping us in our growth and development of our people, culture and society as mentioned by Maps of India (2012). Maps allow us to explore more places and learn about more things in this world. With presence of technology, we are now able to create and produce a map with fine details and more accurate which also leads to the creation of interactive map rather than a simple map only. Therefore, people can save the map in soft copy form without having the physical form of it and map has been able to be shared easily to everyone. The map can also be stored as an image in a format like JPG, PNG, GIF and others using their smartphone or tablets. However, as technology has become more advance, people used to associate maps with navigation or GPS (Global Positioning System) rather than a map in image format only.

The navigation refers to the option or method available for people to get information on how they able to go to their preferred destination easily. GPS is one of the prominent navigation technology that currently used by the whole world. Satellites are used for the GPS to able to capture the current location of the user and provide them the routes which allow them to navigate towards their destination on their own. The GPS can provide the information to the user in various different ways such as in

form of graphical map or instructions. At the moment, GPS is now available on smartphone in form of mobile application where it can be downloaded from the application store that available based on the operating system of the smartphone. There are existing navigation applications such as Google Maps and MapQuest which provide users with directions from one place to another. However, these applications must search along existing roads only. They are not able to provide routes that are as precise as an on campus path would require.

Nowadays, most of the people all around the world are connecting and searching for information through the smartphone as they can access it anytime and anywhere. According to Heggestuen (2013), at Business Insider Intelligence, a research has been done showing that on average, there will be two smartphones for every nine people on earth by the end of 2013 which means that the number of smartphone user has been increasing rapidly. The size of smart phone is also small which makes the user can easily bring it anywhere. According to Janssen (2014), smartphone is a mobile phone that runs on operating system which comes with highly advanced features, high-resolution touch screen display, powerful CPU, more storage space, greater connectivity options and larger screen than a regular cell phone. A smartphone would not be that great without awesome mobile applications to be used with it.

According to nuCloud (2014), people have come out with an interactive campus map that helps the students and staffs to explore places in the campus easily and also as a medium to improve student recruitment and retention. Therefore, it is found that it is important for UTP to come out with its own campus map in order to compete with other universities in recruiting students as well as to provide them with directions to places they want to go around UTP. Other than that, map is also helps to promote important places on campus to the students, staffs and visitors. Without knowing it, they will never know about it since they might be going to places that related to them only such as students will only going to the academic block and library only.

Currently, there is no exact application or system that able to provide directions to find places in UTP easily. The idea of developing this mobile application emerged to give direction to the targeted users in finding the directions to their destination in

easier and faster way on their own rather than have to ask the security guards or other people on the roadside for the directions to places that they are heading to. ‘UTP Campus Tour Guide’ is a free, android mobile application that enables students to navigate location around Universiti Teknologi PETRONAS (UTP) easily. This mobile application will be available in the Play Store and can be downloaded from any devices that support android application.

Among varieties of OS available for smartphone, Android OS is chosen because it is the most popular open source platform and the developer communities are very active and resourceful. “Android” (n.d.) describes android as an open-source software stack for a wide range of mobile devices with different form factors and a corresponding open-source project led by Google. Moreover, according to Lunden (2014), Gartner has predicted that there will be 2.5 billion PCs, tablets and mobiles will be shipped in 2014 and 1.1 billion of them are on android. There is also a positive prediction by Gartner on the future of Android OS by 2017 in the market as shown in Table 1.1.

TABLE 1.1 Worldwide Mobile OS prediction; Source: Gartner (April 2013)

Worldwide Devices Shipments by Operating System (Thousands of Units)

Operating System	2012	2013	2014	2017
Android	497,082	860,937	1,069,503	1,468,619
Windows	346,457	354,410	397,533	570,937
iOS/MacOS	212,899	293,428	359,483	504,147
RIM	34,722	31,253	27,150	24,121
Others	1,122,213	871,718	702,786	396,959
Total	2,213,373	2,411,796	2,556,455	2,964,783

1.2 Problem Statement

1.2.1 Problem Identification

It is found that students, staffs and visitors often get lost in UTP especially those who are not familiar with places in UTP at all. There is no proper map or navigation for the new students, new staffs and visitors to explore places in UTP. The common ways used to get direction to a location are by asking for direction instruction or follow the signboards that point to direction of a location. Whenever UTP management or students are organizing any events in UTP, they have to ask the security department to prepare a signage for the outsiders that are invited for the events to lead them to the venue of the events. As for the new students and new staffs, it is hard for them to find the venue for registration, offices, classes, cafeterias and others during their first day in UTP.

Despite the effectiveness of these methods, they are usually repetitive where requires more effort and time to accomplish. There are also situations where wrong and confusing information were given. As the result, the victim would feel frustrated and tired. If it were to happen to a new staff that has an important meeting early in the morning, he could be late for the meeting. Therefore, it would be much helpful to have an alternative in solving this problem.

1.2.2 Significant of the Project

This project will act as a guideline or navigator for the students, staffs and visitors of UTP that will assist them in finding direction to places in UTP based on specific destination that they want to go. The mobile application will help the user to overcome the problems that they currently faced with the current method used in finding directions to places around UTP. Provided with sufficient technology, this application with use GPS to locate the current position of user and the user will able to know where he is at the moment. From that information, the user can easily look for direction to his next destination.

1.3 Objectives and Scope of study

1.3.1 Objectives

This study will aim to achieve the objectives as below;

1. To develop an android navigator application that provide user with interactive map that will guide them in exploring UTP using MIT App Inventor 2.
2. To evaluate user experience on the developed application.

1.3.2 Scope of Study

Several scope of study has been discussed in order to develop this mobile application. The scopes are as follows:

1. This project will be focusing on few places that are most frequently visited by people that are not familiar with places in UTP only.
2. This project requires an understanding on the places in UTP and to know the most places that are frequently visited by the stakeholders of this project which are the new students, new staffs and visitors.
3. This application is available for devices that support Android OS application only.
4. This project will be developed using MIT App Inventor 2 platform which able to create mobile application for Android OS only and will be using Google Maps Engine in customizing the map of UTP.

1.4 Relevancy of the project

This project is relevant as this kind of tour guide application has been developed and used by other universities and it suits the current technology that we have such as GPS. Nowadays, many complicated things have been simplified to ease us in running our daily life. This project is by right may help the targeted users to find the direction to their preferred destination easily.

If the project is successfully developed, the mobile tour guide application can be readily used by UTP for future intake of new students, new staffs and visitors. With the success of the project, the process of exploring and finding places inside of UTP should definitely become easier and the user can enjoy the beautiful infrastructure and landscape of UTP more rather than struggling in finding the direction to their destination.

1.5 Feasibility study

Development of this mobile application is highly feasible towards completion in term of scope and timeframe for this project within the end of FYP 2 period which will be ended by the end of August 2014. The time allocated is 28 weeks which is very flexible for the author in developing this application. However, the Gantt chart needs to be followed accordingly as planned. The study on how to create a mobile application and skills needed must be done in order to develop the application and to achieve the objective of this project.

CHAPTER 2

LITERATURE REVIEW

Chapter two of this report will mainly discussed on the related works that had been done previously by researches and experts on topics that are related to this project. At the end of this chapter, the proposed solution for this project will be explained in order to solve the highlighted problem in the former chapter.

2.1 Mobile Technology

According to Daichendt (2014), mobile technology means that technology is portable which already explained by the word mobile. It is actually referred to devices that can be carried anytime and anywhere which able to perform wide variety of tasks. It is a form of technology that allows the user to perform many tasks by using the smartphones, PDA, laptops, tablets and other devices that support the functions. It is also explained as the technology used for cellular communication. This technology has been evolved rapidly over the past few years. Daichendt (2012) also mentioned that the mobile technology is not about the latest application that we have in our mobile device only, it is more than that where it changed the way how we live and how we run our businesses.



FIGURE 2.1.1 Example of mobile devices

Back then, a mobile phone was used as a medium to call and send text messages to others only. However, currently the mobile phone has been called as a smart phone that support GPS navigation system, web browser, instant messenger system, video gaming system and much more interesting functionality available. More advanced functions are available to meet the current demand by the users. This mobile technology is really blooming all over the world. According to Nielsen (2014), “Only a few years ago, they were still the minority of mobile phones around the globe, but already they’re beginning to transform how we engage in our everyday lives”. Nowadays, everyone is enjoying the technology, not only the youngsters but even the elderly, kids and someone from rural area is using a smartphone. There is no limitation in exploring and experiencing the beautiful of technology. However, it is important for parents to monitor the usage of internet by their children.



FIGURE 2.1.2 An old man is using a smartphone with his grandson

Furthermore, according to nibusinessinfo.co.uk (n.d.), mobile devices can be enabled to use many communication technologies by using the wireless fidelity which is known as Wi-Fi, Bluetooth, dial-up services, virtual private networks and others. It is also found that mobile computing helps in improving the service offered by company towards the customers. There are many advantages from the existence of mobile technology. Hopefully, the people will use it for the right purpose and ethically.

Nowadays, people found that life would be hard without having knowledge on the mobile technology. Since there are so many benefits can be retrieved from this technology, we should use our creativity to contribute in developing more and more applications that can be used using the devices that support this technology. This is aligning with the objective of this project in solving the problems faced by the stakeholders of this application.

According to a survey done by Experian Marketing Services in 2013, it shows that in the United States, smartphone owners spend about 58 minutes daily on their phones. As time goes by, more time will be spent by an individual on their smartphones as there are more works can be done using smartphones that comes with a lot of functionality.

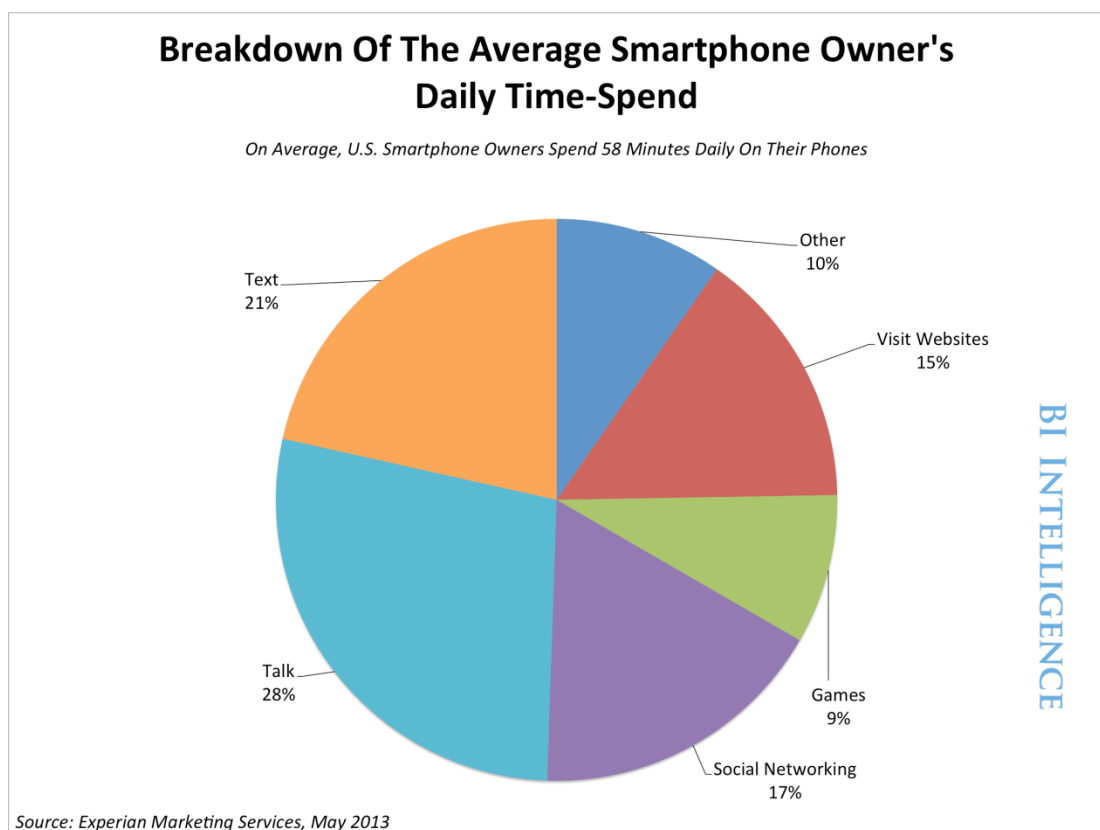


FIGURE 2.1.3 Breakdown of the average smartphone owner's daily time-spend

2.1.1 Mobile Applications Available

From the existing of smartphones, there are many mobile applications have been developed in meeting the demand from the user on specific things needed by them. The applications are created to solve problems faced by users in their daily life. It is also to prove the capability of the smartphone to be a device that allows the user to do everything with it which makes it worth to buy even though the price is quite expensive.

As for the applications that support that Android OS, according to AppBrain (2014) there are 1,261,568 applications available in the Play Store market with 18% percentage for low quality applications as updated by June 19, 2014. The low quality applications will be removed by Google from the store roughly once a quarter when the number of available applications is decreasing. The number of applications has been slightly increasing from 800,000 to these current total applications within 1 year only. All this applications are available in the Google Play Store where it makes free-of-charge applications available worldwide except for countries under US embargoes while there are also paid applications that available in 135 countries. From the total of over 1,200,000 applications available, 1,047,331 applications are free while 214,266 are paid as reported by AppBrain (2014).

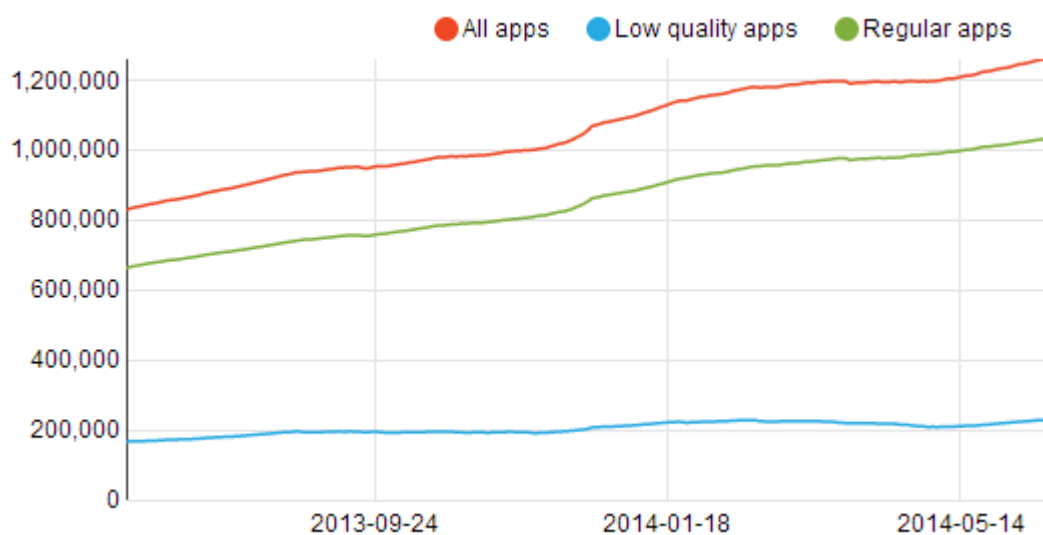


FIGURE 2.1.1.1 Number of available applications on Play Store

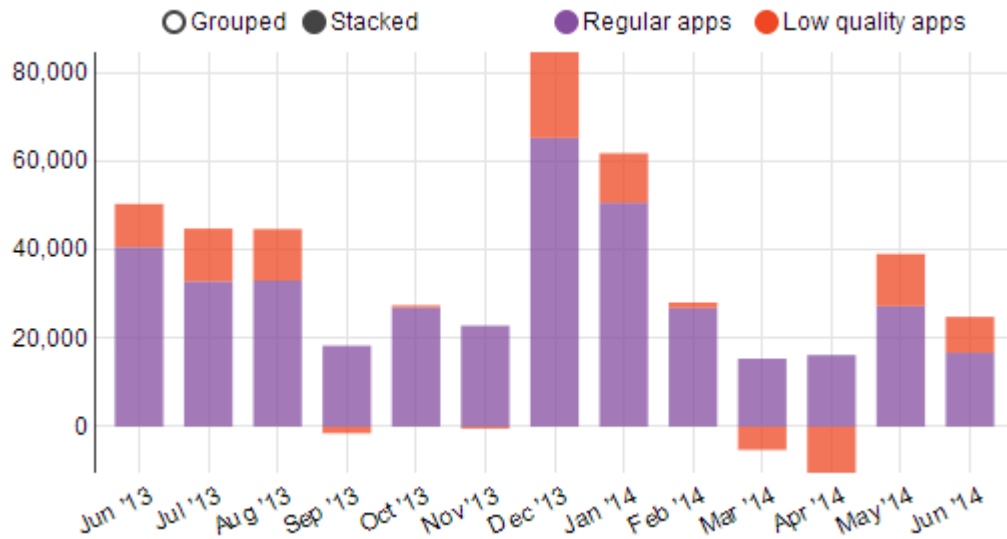


FIGURE 2.1.1.2 Number of new regular and low-quality apps that were added per month

There are 27 categories of applications available in the Google Play Store. There are games, tools, weather, widgets, transport, sports, travel and local, personalization and others. For mobile tour guide application, it is categorized under travel and local category. According to figure 2.1.3, it shown that Travel and Local category is ranked among the top 10 most popular Google Play categories. Hopefully, once this application for this project has been completed, it will be available in the market under travel and local category too.

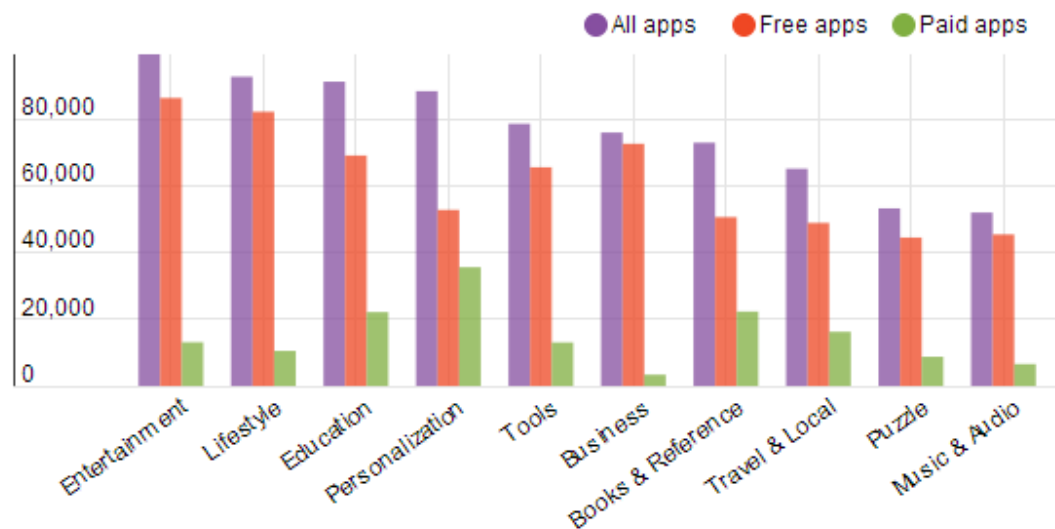


FIGURE 2.1.1.3 Total number of apps, free apps and paid apps per Google Play category

According to Perez (2014), the number of mobile application usage increases in 2014 and it shown that the mobile web surfing has declined as reported by Flurry. It shows how percentage of time spent has changed over the last 12 months between the mobile web and mobile apps. Therefore, it shows that there is a massive opportunity for new applications to enter the market.

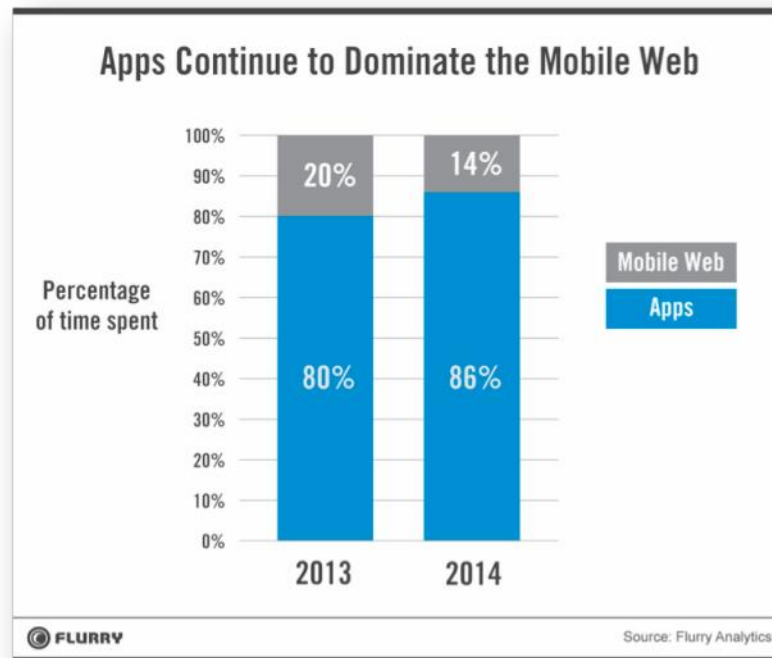


FIGURE 2.1.1.4 Percentage of time spent on mobile web vs apps

2.2 Tour Guide

According to Asubisye (2009), tour is often associated with the word travel and tourism which defined by World Tourism Organization and UNSTAT in 1994 as “the set of activities of a person traveling to a place outside his or her usual environment for at least one night, but less than a year, and whose main purpose of travel is other than the exercise of an activity remunerated from within the place visited”. It can simplified as someone is going to a place that is not familiar at all to that person where it comes the tour guide to help that particular person to explore the places easily. Therefore, assistance is greatly needed by them to help in finding the routes to their destination where explaining the meaning of guide. It shows how important is it to have a guidance from someone or something.

In this era of technology, there is tour guide system available in helping people to find direction to places easily. According to Kaplan (2001), a tour guide system is known as a self-guided tour system that includes signposts and marked walking paths in showing direction to the user. The user will follow the marks available which indicate the route to each exhibit and read the signs that have been displayed in retrieving information about the history and culture of the exhibit. The tour guide system can be classified into two types which are the outdoor and indoor.

For outdoor self-guided tour guide system, Kaplan (2001) explained that it will include the paths formed by dots or lines in the sidewalks or markets on buildings that will lead the user to points of interest. It depends on the preferred destination of the user either he is going to. For indoor self-guided tour guide system, it is more about finding places inside a building like inside a hospital, museum, shopping mall and others. It will be more significance to have such tour guide system for a building that is large rather than a small building. With the presence of such system, it will definitely help the user to find the direction to their location easily and able to know the points of interest available in a more interesting way.

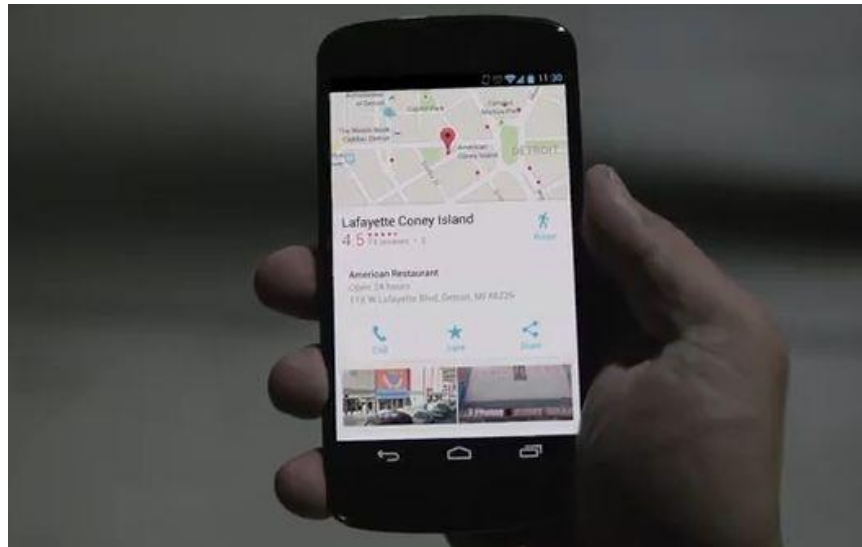


FIGURE 2.2.1 Example of outdoor tour guide application



FIGURE 2.2.2 Example of indoor tour guide application for museum

As for the exhibits, according to Kaplan (2001), rather than having signposts that displays text and graphics only, there is also some that use audio programming devices that provide speech and sound effects to the user that related to the exhibit. For example, the user can easily play the audio information about the exhibit using portable device provided. The user able to choose which exhibit that he preferred to know about and the system will respond to him by playing pre-recorded information regarding the exhibit. There is also audio tape recorded type of tour guide available where the user can insert the tape into the player and instructions will be given to be followed by the user. The user will know the information of the exhibits, directions to next exhibit and so on. It is quite interesting since it comes with sound effects and music as well as spoken material in effectively sharing the information regarding that places to the user.



FIGURE 2.2.3 Example of audio guide for museum

However, recently, there is Global Positioning Satellite (GPS) has been used with the existing of advanced technology. It able to retrieve the current location of the user and having other functions that is more advance compared to the other tour guide systems. The evolution of tour guide system will be properly explained in this chapter.

2.2.1 Traditional Tour Guide

Back then, before the existing of advanced technology with mobile maps and GPS, we used to have people as the tour guide. Rather than looking for the directions on our own with the help from technology, they are focusing more on communication where they help each other and that involves two ways of communication. According to Mancini (2001), a tour guide is a person who takes people on sightseeing tours of limited duration. Professional tour guides are often employed to conduct tours around cities, historical attractions and others by individuals, travel companies, visitor bureaus and others (Simm, n.d.). A tour guide plays an important role in ensuring one person to arrive to his destination safely and in a short time rather than having trouble to find the location on his own without assistance from others. According to International Association of Tour Managers, tour guide has the responsibility to guide groups of individual visitors to monuments, sites and museums of a city or region in order to interpret about cultural and natural heritage and environment in an inspiring and entertaining manner by using the language of visitor's choice (Wong et al., 1998).



FIGURE 2.2.1.1 Example of traditional tour guide using people

According to Simm (n.d.), one of the advantages from hiring someone as the tour guide, we can easily understand the direction given and we can simply ask the tour guide if we have any question related to the tour. We do not have to think hardly in finding the way to our destination as someone that already familiar with that particular location can show us the directions. Furthermore, we can know more about the history and other important things regarding that place from the tour guide. However, it is important to ensure that the tour guide can be trusted and really has the knowledge on that area or location. He cannot simply make an assumption and tell lies to the tourist or people that use him as a tour guide. It is also important for a tour guide to be able to communicate clearly with the tourist or people whom use the service. It will be a big problem if they cannot communicate to each other. The process in visiting or exploring places will not be effective and other problems might occur along the way.

Other than that, according to Garland (2014), tour guides help in terms of arranging the transportation, interpreting messages, handling every single problems, insulating travelers from difficulties and making the environment safe for tourists since they are acting as the middle person between the tourists and the environment that they are not familiar with. It shows that tour guide plays an important role in ensuring the tourists to enjoy their stay at that place and able to have a good memory in visiting that place. If the tour guide does not able to provide a good service, the people will have a bad memory at that place and makes them to lose the trust to the tour guide. Therefore, it is important for the tour guide to provide the best service to the tourists.

Other than having someone as a tour guide, back then, we used to have signboards on the road to show directions to places around before the existing of GPS. However, we are still practicing this old way till now. Usually, people are too dependable on the signboards to find direction to their destination. For example, in UTP, there are signboards placed in some places as shown below.



FIGURE 2.2.1.2 Example of signboard at Academic Complex, UTP

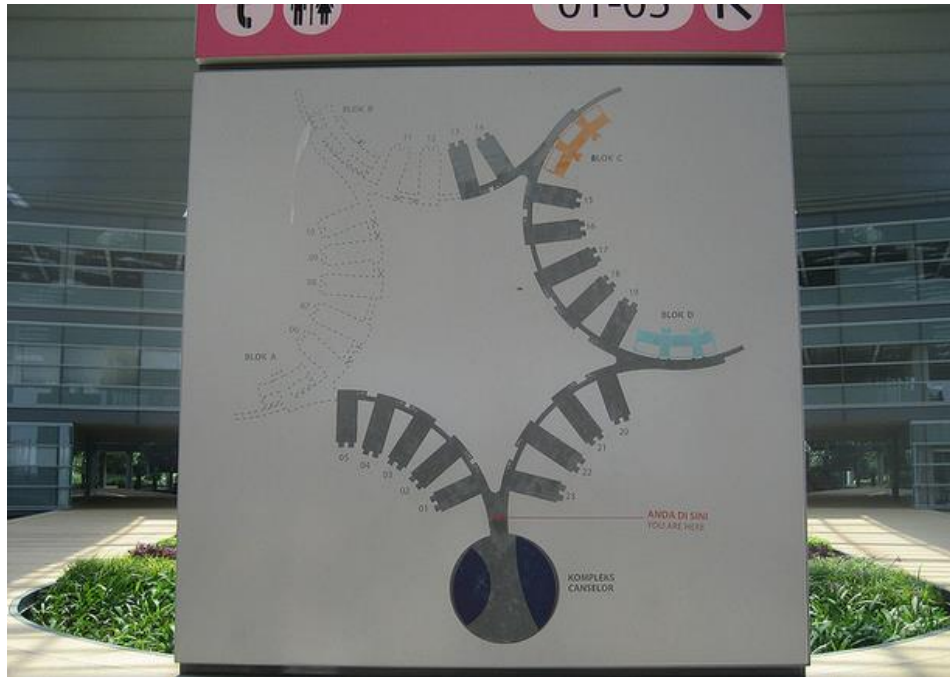


FIGURE 2.2.1.3 Ground plan with future expansion plans dotted in

Other than signboards that are used to show direction to places outdoor from one building to another, there are also floor plans provided to show directions to places inside buildings. The floor plans usually found in shopping complex, hospital, academic building in universities and others. In UTP, the floor plan provided is as shown below.

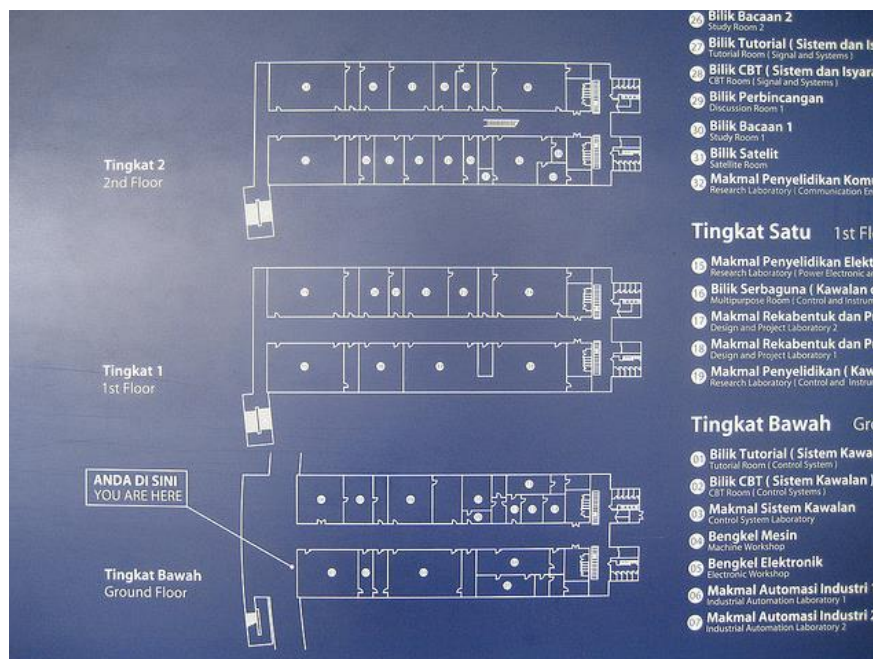


FIGURE 2.2.1.4 Discolored floor plan at one academic building in UTP



FIGURE 2.2.1.5 Information kiosk in Suria KLCC

As been mentioned in the problem statement, this current method used by relying solely on signboards is having a few drawbacks as sometimes people having difficulties in reading the building map or the signboards that they are looking for are nowhere to be found. Therefore, this kind of methods are not effective at all when it cause the victims to feel frustrated and make them involve in more problems instead of helping them.

As for the signboards or floor plan provided, it is not that easy to look for the information even though they are already provided by the owner of the building or place. It will take quite some time for the visitor to look for the information kiosk to get the floor plan of the building. Furthermore, it will be time consuming to go back to the location of the information kiosk if we got lost in the building once again or to look for direction to another location. Therefore, it will be much easier to have a map that is portable which can easily be downloaded using the smartphone and can be used anytime and anywhere. Nobody will have to run and ask people nearby for the signboards and floor plan. That will definitely become more effective and will ease people's life.

2.2.2 Virtual Tour Guide

A virtual tour guide exists during the existing and evolving of technology in this world. According to Webopedia (2014), a virtual tour that is also known as panoramic tour is a collection of panoramic images which played in sequence where allows the user to view it as a video with sounds and other effects. The purpose of having a virtual tour is to give the user more 3D experience on particular location that is presented on the tour. By viewing the virtual tour, the user can have life-like experience even though the user is not at that location yet. However, there are three different types of virtual tour have been found by the author. They are as follows;

1. A 360-degree virtual tour guide

There is software named Panotour Pro that allows user to create interactive 360-degree virtual tour. Examples of virtual tour application created using that software are as follows;

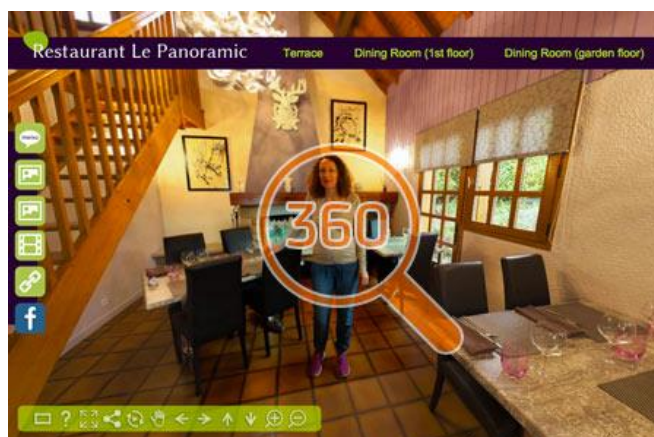


FIGURE 2.2.2.1 Restaurant virtual tour



FIGURE 2.2.2.2 University campus virtual tour

However, such map will not help at all for the user to find the direction to the available places. Therefore, a virtual map cannot help to solve the current problem for this project. It is more beneficial in promoting the places as the user can look around at the building and surrounding with the 3D experience. Someone who never went to that particular place can easily imagine how the place looks like. That someone does not need to go to the places on his own just to experience the view and enjoying the building. UTP also has come out with this kind of virtual tour where the viewer can easily exploring places in UTP using the virtual map which can be found at UTP main website; www.utp.edu.my. It has been found as an opportunity for UTP to promote the beautiful campus to the world.

2. A virtual tour guide works by identifying pictures

Apart from having a video like virtual tour guide system, there is a virtual tour guide where allows the user to get to know places around in a better way. For example, if there is someone walks in an area that he is not familiar with and while exploring the buildings using a static map, suddenly he found that there is a building in front of him but that building is not identified on the map. He will not be able to ask for the name of the building since he is travelling on his own. According to Pritt (2008), there will be a system that allows the user to know the name of the building by capturing the picture of that specific building and send it to the website. Therefore, such system must be having an algorithm on the website that allows the picture matched with database of images from the location.

Pritt (2008) explained that such a system allows the user having different practical applications. It can be a virtual tourist guide that able to identify interesting buildings and landmarks, either indoor or outdoor. That system will be able to act as a navigation system which found better than a GPS receiver. It is because, the virtual tour guide will simply provide the user with the information of the buildings and other things around by using a smartphone only where by scanning the images, the information will be displayed according to what have been saved earlier in the database. Such system does not require satellite access, only a phone that has camera feature where it is already a common to be owned today.

It will become an advantage for someone if he does not the map-reading skills since by using this kind of virtual tour guide application, the user can simply take a picture of something that he wants to know and send it to the web server that stores all of the information. Later, it will return the information and direction the user is facing as well as location of that particular place. It is simple and easy to be used.

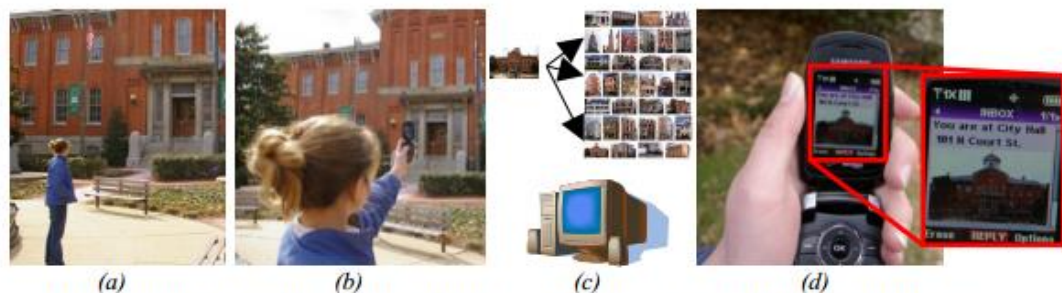


Figure 1. Virtual Tour Guide works as follows: (a) A tourist sees an unidentified building, (b) takes a picture with her cell phone, (c) emails the picture to a web server, which matches the photo to a library of images, and (d) receives a text message that identifies the building. (Photographs and images by Mark J. Pritt.)

FIGURE 2.2.2.3 Example of virtual tour guide works by identifying pictures

3. A virtual tour guide using artificial intelligence technology

There is also developer using artificial intelligence technology in developing the virtual tour guide application using platform like Junaio that allows the user to know the list of points of interest are located nearby. Rather than taking pictures and sending it to the web browser, this method is more nicer and easier since the user just need to scan the image in front of her and the application will shows the location as well as the distance to nearby points of interest. The user can easily plan his journey in visiting the places around or to know the distance to his next destination.



FIGURE 2.2.2.4 360 Virtual Tour Travel Guide using artificial intelligence

Therefore, it shows that by using a virtual tour guide, the user will have a better experience in exploring the places. By having a customize tour route by voice, video or graphics available from the application, will definitely enrich the experience of the user in using the virtual tour guide as well as in exploring the places around.

2.2.3 Mobile Tour Guide

Usages of mobile are very common in this era and it plays an important role in the users day to day activities. It comes with a lot advanced features where it also provides support for mobile map and GPS. Mobile devices have presented many unique characteristics that make them attractive as an electronic tourist guides (Kenteris, Gavalas, & Economou, 2006). The characteristics have been divided into three main parts as follows;

Firstly, they are convenience and ubiquity. Mobile devices are portable and it comes in varieties of shapes, colors and forms for the user to choose from. There are also different types of mobile devices available such as smartphones, PDA, tablet PCs and many more. However, according to Kray et al. (2003), mobile phones are still the most widely employed compared to the others. Secondly, it can be positioning by using technologies like GPS, Bluetooth, RFID and WiFi. According to Varshney (2003), the users will be able to receive and access information regarding to their location as well as their preferred destination. Lastly, it can be personalized. Usually, handheld devices will be operated by a single user where allows the provision of personalized services by wireless web portals (Ho, 2003). The owner of the devices able to decide which theme, applications and others things that suits them best.

However, there are also limitations of the mobile devices that need to be carefully evaluated by the developer of the application (Kenteris, Gavalas, & Economou, 2006). Mobile devices are having limited computing power, smaller amount of memory and storage space, limited color, limited bandwidth, expensive wireless connections, small screen and sometimes people found that it is hard to use the keyboard of the mobile devices compared to PCs. According to Cheverest et al. (2000), there are three main categories that fall under the field of commercial mobile tourism applications. They are as follows;

- 1) Navigational assistants, tourist or museum guides with pre-installed applications that do not allowed the users to customize according to their preferences (Micha et al., 2005). For example, MycityMate application in 2005.
- 2) Mobile devices that access mobile web portals in order to browse or to update content (Schwinger, 2006). For example, iNav in 2006.
- 3) Mobile electronic guide services with updated contents that can be updated via external devices when the user is in range of the tourist attraction (Cheverest et al., 2000) or via mobile network connections (Anegg, 2002) in order to access the context-aware services. For example, GPS application.

Firstly, for the first approach, it presents the weaknesses in which the content of the mobile application are not able to be changed easily or dynamically updated. It gives the user content or map that has an outdated data. It is similar to the weaknesses of paper guides and paper maps. Therefore, the developer has to ensure that the data has to be updated frequently to make the application will be up to date and useful for the user.

As for the second approach, it implies the use of mobile or wireless network to access internet resources in order to portray information to the user or to update information at regular intervals. It also requires constant connection of the mobile device with internet mobile network to offer access to the web content. Without internet, the user will not be able to access the information from the application available.

Lastly, as for the third approach, it assumes some type of network connection and tracking systems to provide location-based services to the user. A research shows that the current roaming charge has become the major factor that prevents the tourists from using their mobile phones while abroad. However, if the destination is within the same area, which would be easier since, there will be no problem in term of data roaming or anything else.



FIGURE 2.2.3.1 Example of latest mobile devices

As for the mobile tour guide, it covers various types of tour guide applications as long as it is using mobile as the platform. There are many mobile tour guide applications have been developed and shared in the Play Store by the developers. Although it shares almost the same functionality, there are many type of mobile tour guide still can be developed under this category. A tour guide application is not limited for tourists in travelling to big cities and other countries only. It can be used to develop an application for the outdoor map, as well as an indoor map. From a big area to a small area, depends on the objectives and reasons to develop such application. The example of existing mobile tour guide applications will be discussed below;

2.2.3.1 Indoor Mobile Tour Guide Applications

An indoor mobile tour guide application will cover any kind of map that is used inside a building or covered area. The examples are airports, department stores, malls, museums and others. This kind of map uses the building floor plans in creating the customizable map for indoor tour guide purpose. According to Conneally (2012), Google Maps already started to add indoor maps for buildings in few countries with total over 10,000 floor plans are already available. Unfortunately, Malaysia is not listed among the countries yet. There are also indoor map that is created by the developer on their own without using the Google Indoor Maps. The examples of the existing indoor mobile tour guide applications are as follows;

1. The National WWII Museum Guide application for New Orleans

Refer: <http://www.nationalww2museum.org/visit/app.html>

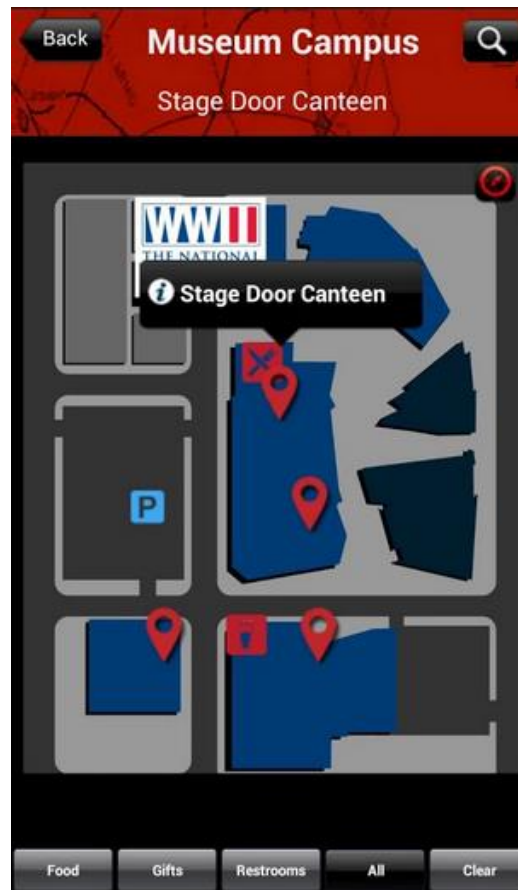


FIGURE 2.2.3.1.1 Location of stage door canteen in WWII Museum Guide

This application is the official visitor's guide to The National WWII Museum in New Orleans, LA that consists of multi-building campus tells the story of American Experience in the World War 2. As for the map of the buildings, it is using the GPS maps. However, it will not retrieve the current position of the user.

The user can easily navigate around the museum by knowing the location of specific points of interest in the building. It is an indoor type of mobile tour guide application. This kind of map is suitable for small size location which makes it easy to be used by the user and this application is also useful because it provides information of the points of interest available in the museum.

2. Mobile museum tour guide application for Egerland Museum

Refer: <https://play.google.com/store/apps/details?id=com.pmedien.egerland>

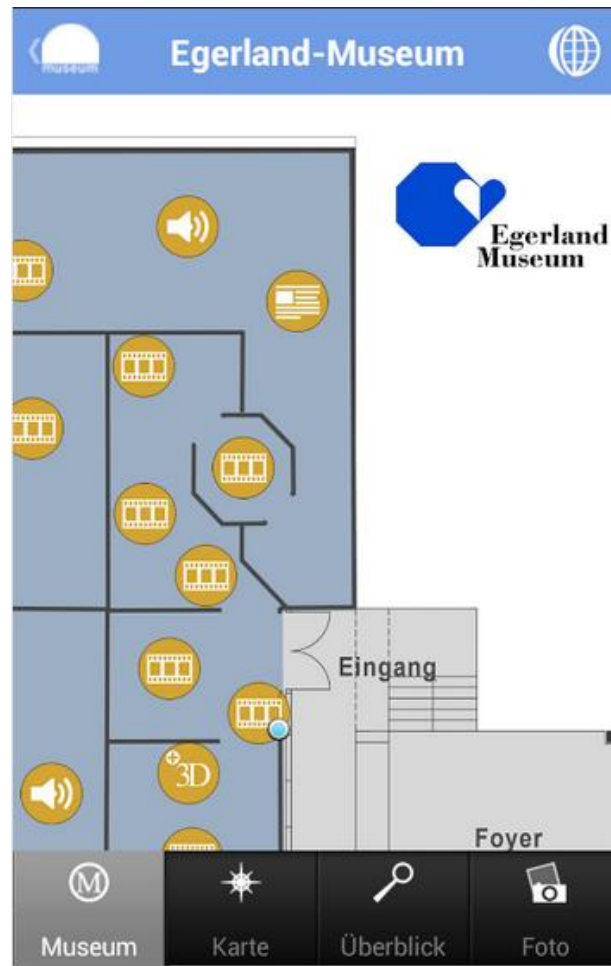


FIGURE 2.2.3.1.2 Main map for Egerland Museum application

This application is an indoor type of tour guide application that allows the user to have interactive tour inside the museum. It will use the GPS function in navigating the user to the points of interest available in the museum. There will be 28 points of interest available for offline access. This is an advantage for the users since they can easily find the direction to the points of interest without internet connection.

The floor plan available can be zoomed which helps the user to keep his bearings. A blue dot is used to indicate the last viewed point of interest by the user. The user can select the point of interest directly from the plan. It is believed that this application is really helpful and useful for the users. The floor plan used is easy to be read and understand.

1.2 Waze Social GPS Maps & Traffic

Refer: <https://www.waze.com/>

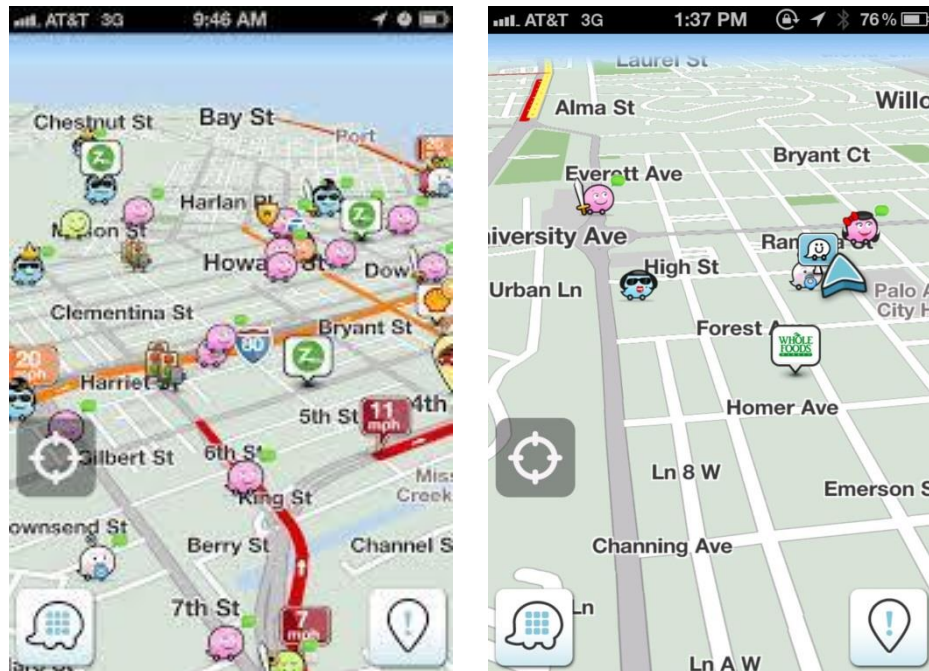


FIGURE 2.2.3.2.2 Example of Waze interfaces

Nowadays, more people are using Waze in finding directions to particular location using their mobile phone. It is one of the world's largest community based traffic and navigation applications. It is because this application is more interesting to be used and the user can create a profile with attractive emoticons and others. This application is also good because it will acknowledge the user on the traffics, if any accidents occur and others. The user also can see how many other Waze users are on the road and able to actively report any accidents, police and other hazards that they see on the road.

2. Medium size area or location such as cities or towns.

It is not too large and it is more focused at specific area only. This type of outdoor tour guide is suitable for those who are travelling to a place that he never went to. It suits travel and tourists concept rather than for a local people. The examples of existing application for this type of tour guide are as follows;

2.1 GuidePal City Guides application for over 50 major cities

Refer: <https://play.google.com/store/apps/details?id=com.guidopal.android>

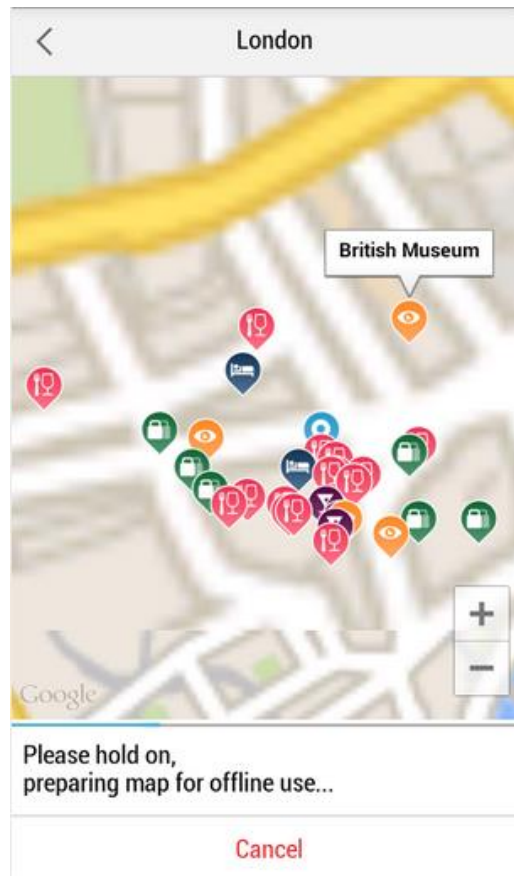


FIGURE 2.2.3.2.3 Location of British Museum in GuidePal City Guides

This application can be used by large number of users since it covers over 50 major cities especially in America and Europe. The existing of this application is hoped to make the user to feel like a local. This application allows locals and travel journalists to give recommendations to the user. It is using the Google Maps in providing direction to the user.

The advantage of this application is that it will constantly updated offline content without any roaming charges and it is fully offline maps that able to help the user in finding the direction to nearby places. As this application is focusing more on the tourist, it is definitely very helpful by requiring no data connection in using the map available.

2.2 City Guides Catalog, a personal advisor that covers more than 60 cities.

Refer:

<https://play.google.com/store/apps/details?id=com.tripadvisor.android.apps.cityguide.catalog>

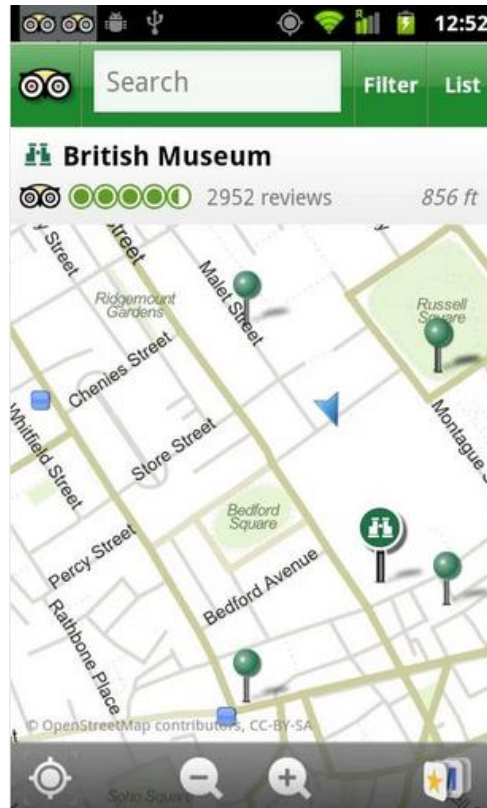


FIGURE 2.2.3.2.4 Location of British Museum in City Guides Catalog

This city guide application works as a personal advisor to the user that helps in planning a perfect trip. The user can download separately the application for the city that he wants. It works offline where it does not need a live data connection since everything will be stored on the user's phone after the initial update has been done. However, it will take a large space to store all the information. Other than that, all places that have been listed on TripAdvisor.com are included in this application.

By using the phone's GPS, the user can follow along the map and read about the interesting sights along the route. This application also guides the user to their preferred destination that they choose from the listed points of interest using GPS and compass. This application leverages the GPS in the phone to show the user the best attractions nearby including restaurant, hotel and others.

3. Small size area or location.

The last type of outdoor mobile tour guide will be a place or area that is small and very specific. It can be either a map for zoo, theme park, campus or many more. As for this project, the application will be categorized under this category. Even though UTP is not as large as other universities in Malaysia like UiTM, UTM and USM, however, it would be necessary and helpful to have this kind of applications especially for those who are not familiar at all with places around UTP. The examples of existing mobile tour guide application for this category are as follows;

3.1 Henry Vilas Zoo


Refer: <https://itunes.apple.com/us/app/henry-vilas-zoo/id576949364?mt=8>






FIGURE 2.2.3.2.5 Example of Henry Vilas Zoo interface


This application will bring the zoo to the users no matter where they are. It allows them to learn about the animals, discover the attractions, view the zoo map, discovers the history and much more. This GPS enabled application will automatically display the information for outdoor animals and attraction as the users walk throughout the zoo. This application helps the users to prepare their visit to make it more efficient and enjoyable.

As this project is about developing a mobile campus tour guide application, detailed comparisons are necessary for the author to be able to know how to create and develop a good application for UTP. Below are the lists of some existing mobile campus tour guide applications.

No	Name of the application	Description	Comments
1	<p>Mobile tour guide application for Carnegie Mellon University (CMU), United States.</p> <p>Refer: http://www.mapyst.com/</p> 	<p>Mapyst has the functionalities for the users to enter the starting point and destination in order to know the directions to their preferred destination. It will show the user the fastest route between any two places on campus. It is also has the preferences options that allows the user to choose the mode of travel, even for the disabilities and the current weather in order for the application to give the most suitable routes for the users.</p>	<p>It will be easier to develop this application since the campus map already exists in the Google Maps. The developer just uses the existing map for this application with some additional functions. It is one the best tour guide application with shortest path provided and options available for the user based on their preference whether they are taking the stairs, lift and others. It is really helpful.</p>
2	<p>Mobile tour guide application for Purdue University, Lafayette, Indiana.</p>	<p>This application consists of five self-guided tour options; North Campus, South Campus, Athletics, Student Life and</p>	<p>The user must have internet connection in order use this application. It is not working in offline mode. The developing</p>

	<p>Refer: https://play.google.com/store/apps/details?id=com.barz.tourguide.purdue</p> 	<p>Colleges and Schools (coming soon). It has an interactive and GPS map that able to be zoomed which allows the user to know his current location and points of interest in the area. The application also has tour stop images that will help to orient the user to the surroundings and find the points of interest more quickly. It is using the Google Maps since there are already available routes for this university that have been acknowledged by Google.</p>	<p>part for the navigation is easier since the routes are already available in Google Maps. All of the points of interest are marked in black in color which makes it quite confusing for the user to differentiate the available locations. It will much better if the points of interest can be marked using significant symbols and colors.</p>
3	<p>Ball State University Campus Map</p> <p>Refer: https://itunes.apple.com/us/app/ball-state-university-campus/id353148218?mt=8</p>	<p>This application is available for iPhone users only. It helps the user to find hotspots, buildings, departments and others. The features of this application are GPS and Wi-Fi location pinpointing, searchable buildings and landmarks, eight</p>	<p>With stable Wi-Fi available all around campus, which makes their application can be used by anyone without worrying about the internet connection. This application is good as it covers almost all important locations in the</p>

		<p>categories of hotspots across campus and detailed information on dining locations and ATMs. The university is ranked as the most unwired campus where it has one of the best wireless networks.</p>	<p>campus. This application also allows the users to know their current location where it is one of the most important functionality for a map.</p>
4	<p>Campus Maps Application</p> <p>Refer: https://play.google.com/store/apps/details?id=com.campusmaps</p> 	<p>This application offers more than 20 campus maps. The features are real-time location updates to show user current location, acronyms for every building, satellite imagery that can be zoomed and color-coded map. It provides options for the user to follow the fastest path from one point to another point and also alternative path.</p>	<p>This application received few good comments from the new students where it helps them to find their classes on the first day. Even though that it is using the Google Maps, but the interface is quite complicated and not really readable. One of the best functions that this map has is the shortest path and alternative path provided for the user.</p>
5	<p>Penn State's University Park campus</p>	<p>This application is not the official campus map app from Penn State.</p>	<p>This application is very helpful since the campus is huge. The</p>

	<p>Refer:</p> <p>https://play.google.com/store/apps/details?id=com.camposmaps.psu</p> 	<p>However, it is accurate and allows the users to know their current location on the map. It also provides information for 289 buildings for the university. There is review from Papa John's Delivery guy saying that he uses this application to deliver the pizza to the students who live inside the campus.</p>	<p>map is simple and readable. This app is perfect for any new student at PSU or people visiting PSU for the first time. It is also good since it able to provide information for all the buildings to the user.</p>
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2.2.3.3 Reflection

Based on the applications discussed above, it shows that many universities outside of Malaysia already have campus tour guide application for their universities. Reviews from the users shows that the applications are very helpful and beneficial even though there are also some negative comments given by the users. Those criticisms are good since they help to inform the developers on how they should improve their applications. Therefore, it is relevant for UTP to have its own mobile tour guide application which can be used by many stakeholders, not only the students. The problems mentioned earlier can be resolved easily with the existence of campus tour guide application. Example of the user reviews for existing campus tour guide applications are as shown below;

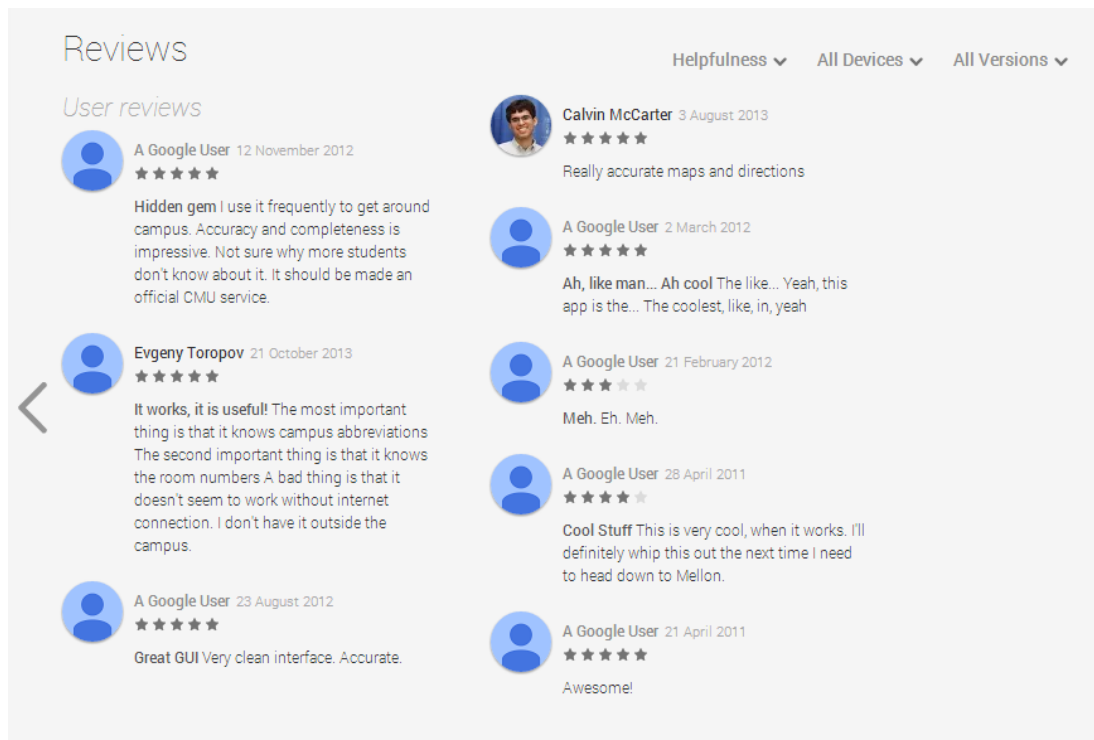


FIGURE 2.2.3.3.1 User reviews for Mapyst application

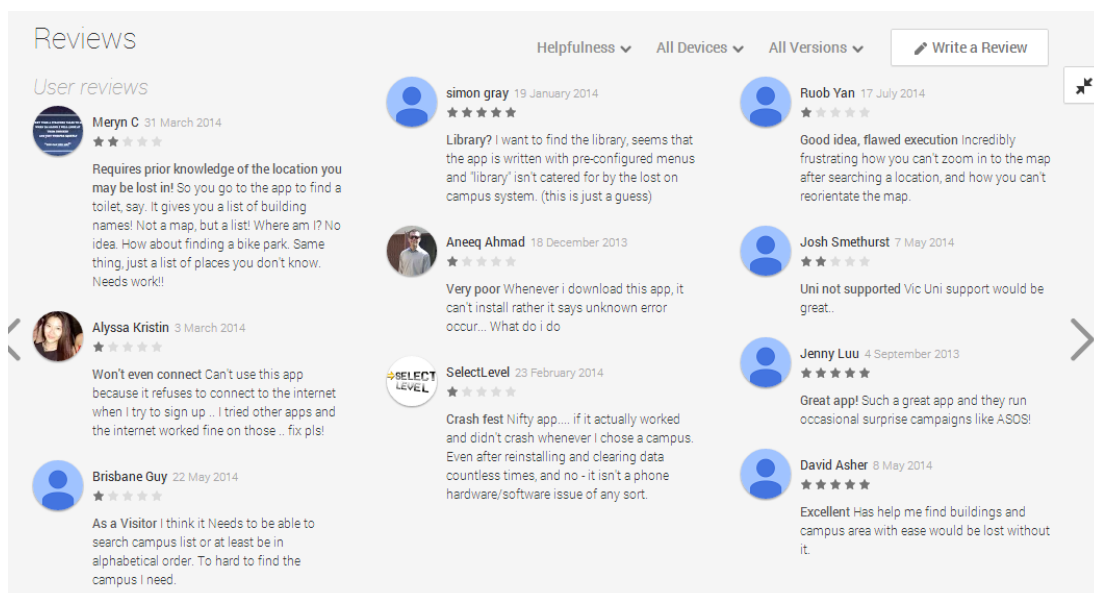


FIGURE 2.2.3.3.2 User reviews for Lost on Campus application

It is also found that it is better for the author to focus on a few locations first in developing the prototype for this project. It will be much easier to focus on locations that are really important in solving the problems based on the needs of the stakeholders of the project. It also helps in running the pilot test later on once the application has been completed.

Other than that, it is found that it is easier for the applications to be developed if the roads inside the campus are already acknowledged by Google Maps especially on the navigation part. Unfortunately, the roads inside of UTP are not acknowledged yet by Google Maps at this moment even though there is map of UTP in Google Maps. As for the application that provides shortest route for one point to another, it is found that it would require knowledge on android programming language since it involves a lot of coding. That is part of the limitation of the author since it is new and never been taught before in the syllabus learned on programming languages. Therefore, a different method will be used in developing the application for this project based on the characteristics and features found in the existing applications that suits the capability of the author and also able to meet the objectives of the project.

2.3 Proposed Solution

MIT App Inventor 2 has been chosen as the platform for the author to develop the UTP Campus Tour Guide Application. It has been chosen because it is a good solution to develop this tour guide application since the functions are learnable compared to other platform due to the limitation of the author on the other languages available to build an android application. The application will have a function that allows the user to know their current location since they are not familiar with places around UTP. As for the map of UTP, the author uses Google Maps Engine as the platform to create a customizable map to be used for this application. It is because, currently there are no routes inside of UTP has been acknowledged by Google Maps. Therefore, the current Google Maps cannot be used to navigate directions to places around UTP.

This application will be able to guide the stakeholders of this project around the campus by just using their smartphone which is portable and easy to handle. By knowing their current location, they can easily get the directions to any places by choosing the routes available based on their preferred destination. The directions given will be very specific in order to ensure that the user will be able to arrive at their destinations easily and without too much time consuming.

In the view of the author, this project will be useful and beneficial to the user since it will help the user in exploring UTP easily and allow them to enjoy the view of beautiful landscape of UTP more rather than busy looking for the right direction to their destination. The author also believes that this application will receive a good user acceptance from the community as people nowadays are always updated with the latest technology. More details of this project will be further discussed in Chapter 4; Results and Discussion.

CHAPTER 3

METHODOLOGY

3.1 Project Methodology

There are a few methods suggested in order to develop a mobile application. The author decides to use evolutionary prototyping methodology model for this project in order to achieve its purpose. The chosen model involves a series of prototype iterations towards completing the application. The current prototype has experienced a sequence of modifications until the result that will be shown in Chapter 4. **As the project is still ongoing, more changes will be done on the prototype in order to ensure that the final product will be able to give the best user experience to the user.**

This prototyping model chosen is typically used for most mobile applications where as time goes by, the applications will be updated to new versions in order to compete with the rivals. They will improve the application based on the feedback received from the user. This method has been segmented into five main phases. The steps involved are as shown below;

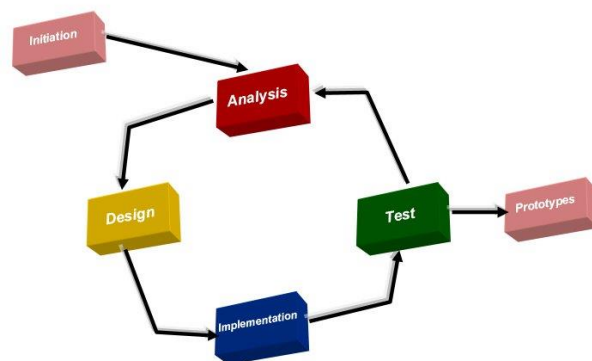


FIGURE 3.1.1 Evolutionary prototyping model

1. Initiation or Planning phase

During the first stage, all important and related project background information has been gathered together as been described and explained in Chapter 1. In the early phase of the development of this application, the author defined the actual problem that lead to the idea in developing a mobile navigation application for UTP. The requirements are gathered through observations of the author and some interviews done with the affected parties based on the problem statement stated. The scope for this project has been determined during this requirement phase. The author also came out with the feasibility study, functional and non-functional requirements of this project at this stage.

It is important for this stage to be performed earlier before the author starts to develop the application for this project. Other than that, it is also important for the author to study on the time management in order to know the feasibility of the project within the given time, which is approximately around 6 months only.

2. Requirement Analysis phase

All information that has been gathered in previous phase was analyzed in this phase as mentioned and explained in section 3.3. The published papers, journals and earlier researches on related topics and scopes to this project were studied by the author carefully and any techniques used by other developer will be considered in order to develop the application later on. There are a lot of existing applications that are quite similar to this project. All those applications acted as a guide for the author in developing the application. The effective tools to be used were also decided during this phase where some studies and comparisons were made between available platforms that can be used to develop a mobile application.

3. Design phase

At this phase, the diagrams, interfaces, storyboard and flow of the project were described in details. The label to be used in developing the customizable map of UTP has been discussed at this phase. The designs for each screen of the application need to be properly designed so that it will give the user good user experience while using the application later on. It should not be too messy and complicated.

4. Implementation phase

During this phase, the author started to develop the application. Each of the prototype iteration was built based on the analysis and design set earlier in previous phases. If there is any recommendation given or mistakes found, changes will be done to the prototype at this phase. The author has to ensure that the prototype will be functioning and can be used for the pilot testing. Each function available in the application should work. All steps taken in developing the application will be explained in section 3.2.

5. Testing

At the last stage, System Usability Scale test and Generic Use Interface Questionnaire were carried out to the pilot users in order to ensure that the application meets the requirements of this project. Feedbacks from the pilot users were analyzed and will be taken into consideration in improving the application. The testing and iteration on the application will be done until it reaches a satisfactory outcome in order to ensure that the final user can use the application easily without any problems or errors. The results of the testing will be discussed and explained in chapter 4.

3.2 Project Activities

3.2.1 UTP custom map

During the earlier development phase, the author has tried a few platforms in developing the customizable map of UTP. The author tried to create a map together with custom routes from one point to another which allow user to navigate around in UTP via a real time map. The author found that Google Map Maker allows the user to add places and roads. It suits the requirement needed by the author. Unfortunately, currently the Maps Marker is not applicable for Malaysia. Therefore, the author cannot use it to create the custom routes.

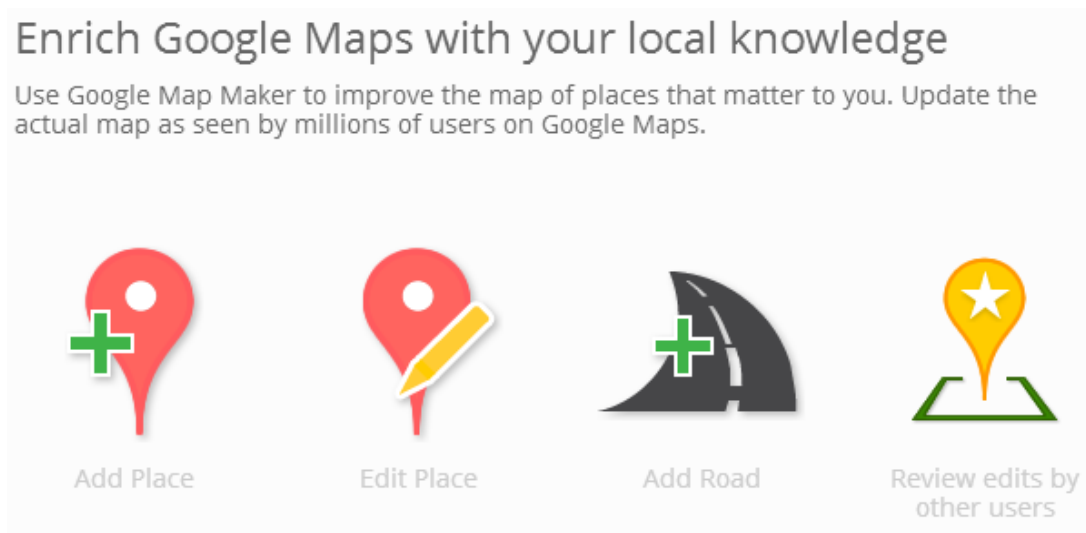


FIGURE 3.2.1.1 Functions available for Map Maker

After that, the author had tried Waze in creating customizable map for UTP. The author managed to add the roads and make the map as a real time map. Unfortunately, when the author add marker on the buildings around UTP, the markers are not displayed. Without knowing which buildings available in UTP, how can the user know their current location and what are the names of the buildings and other POIs available in UTP. Therefore, it is not suitable for the target user of this project as they are new to UTP and they need to be guided properly in finding direction to their destination.

Unfortunately, there is no other platform that allows the author to create a real time map for UTP. Other platforms tried by the author are Google Maps Engine and Open Street Map. Even though we can view the UTP map using Google Maps, however, the roads inside of UTP are not acknowledged by the map. Finally, the author decided to use the Google Maps Engine to develop the customizable map for UTP which shown in Section 4.1.4. The map will be linked into the application using MIT App Inventor 2 where the user will be able to know their current location. They can also view other locations nearby. Original picture of the places will be uploaded by the author at each location that has been labelled. Therefore, the user can easily identify the buildings around them based on the map and pictures available.

At the moment, the routes from one direction to another direction will be created manually by the author which is it will not be a real time map. The user can choose

the direction from the current location to another location. The directions will be showed by using arrows from the current location to the destination together with instructions showing all the steps need to be taken by the user in order to arrive at the destination. Once the user arrived at the destination, the user can check his new current location and view the places nearby using the customizable map of UTP.

The routes was planned to be developed using the soft copy of UTP map received from the Maintenance Department of UTP which is in high quality resolution. However, it is found that the map is quiet confusing and not really suitable to be used. Therefore, the author decided to use the customizable map designed by the author using Google Maps Engine. It is because to ease the user since they will be referring to the same map for the current location as well as the route to their destination. Rather than having two different version of map, it is better to use one map only. The map received from the Maintenance Department is as follow;

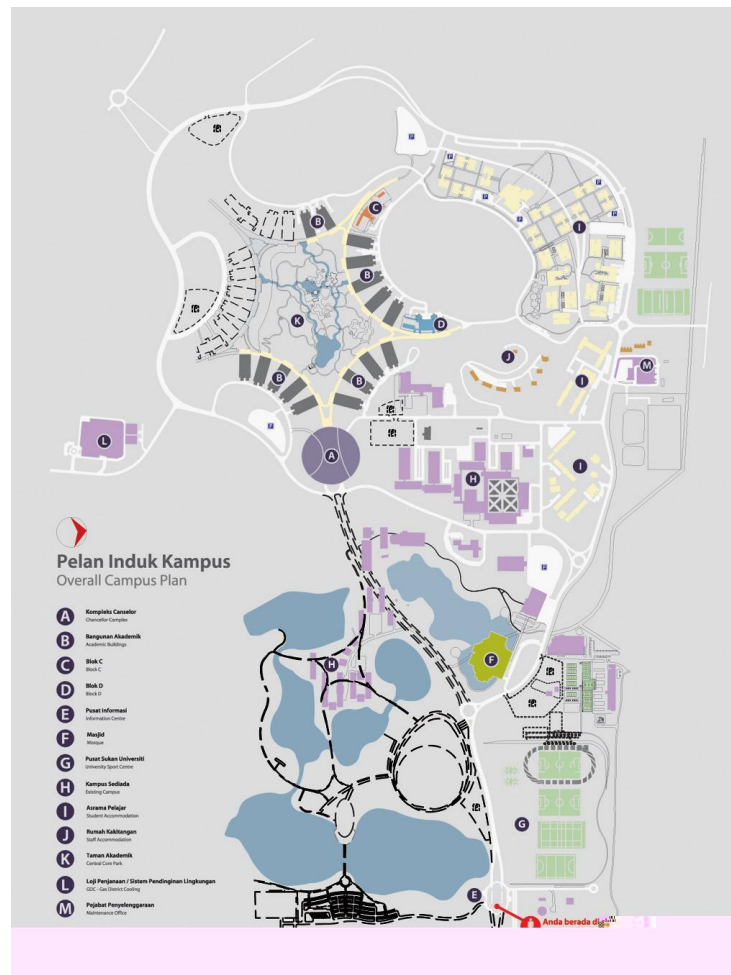


FIGURE 3.2.1.2 Overall UTP Campus Plan

3.2.2 Initial design

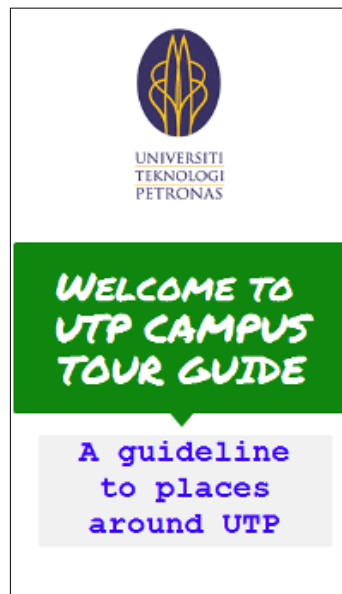


FIGURE 3.2.2.1 Initial homepage design

The developer has designed the homepage as shown in the above figure at first. However, it is found that the design does not represent the application. Therefore, the design has been changed to a better interface which can be found in section 4.1.4.

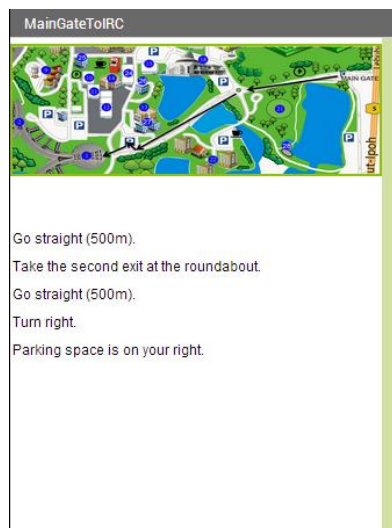


FIGURE 3.2.2.2 Initial route screen design

Figure above is the initial route screen design in showing direction from one location to another location. However, it is found that it is hard to view the direction in portrait orientation. The design has been improved as shown in section 4.1.4.

3.2.3 Prototype

Initially there were two prototypes have been completed. Both are having differences for the 'Current location' section only. For the first version, the users have to install Google Maps Engine application first in order to have a good user experience in viewing the customizable map since it is linked to the application only, not synced with it. Below is the instructions given to the user on how to use the application.



FIGURE 3.2.3.1 Initial design for the instructions

Apart from requiring the user to download external application first which is quite time consuming, this prototype is also having a few drawbacks compared to the second version. This version does not able to display the list of all POIs available in UTP to the user. Therefore, the user will not be able to see all the POIs available in the map. The user needs to check on the POIs name manually by clicking on the marker shown in the map.

Other than that, when the user clicks on the POI, it will just display the information as shown in figure 3.2.3.2. No pictures will be displayed even though the author already uploads a picture for each of the POI. Even though the map will be clearer if viewed using the Google Maps Engine application, the weaknesses of the system make it less favorable among the pilot users. Both versions were introduced to the first group of pilot users.

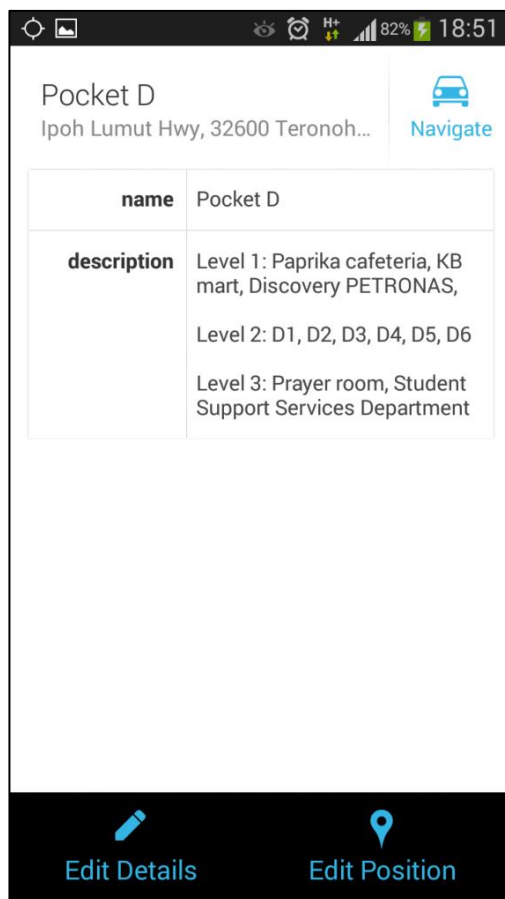


FIGURE 3.2.3.2 Information shown from prototype A

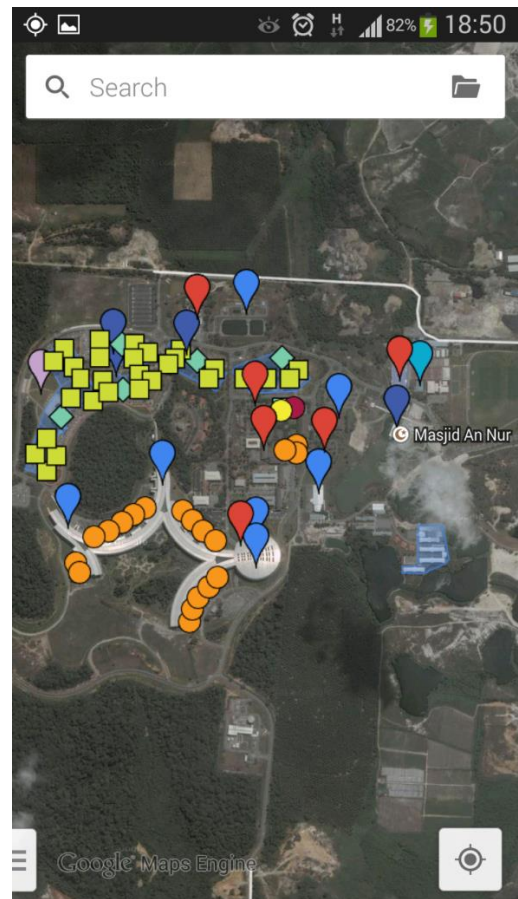


FIGURE 3.2.3.3 UTP customizable map viewed from prototype A

As for prototype B, it is the better version of prototype A. It is because; the map has been synced with the application. When the user clicks on the ‘Current location’ button, the user will be directed to the customizable map of UTP without requiring any external application to be downloaded first. Other than that, using this version of prototype, the user will be able to view the list of POIs available in UTP. Example of the list is as shown below in figure 3.2.3.4.

This version of prototype is also able to display the picture for each of the POI as shown in figure 3.2.3.5. The pictures help to give a brief view to the user on how the location looks like. As for the customizable map, even though the resolution is not as good as the one from prototype A, it is still readable and able to function perfectly in showing the current location of the user and other information about the POIs in UTP.

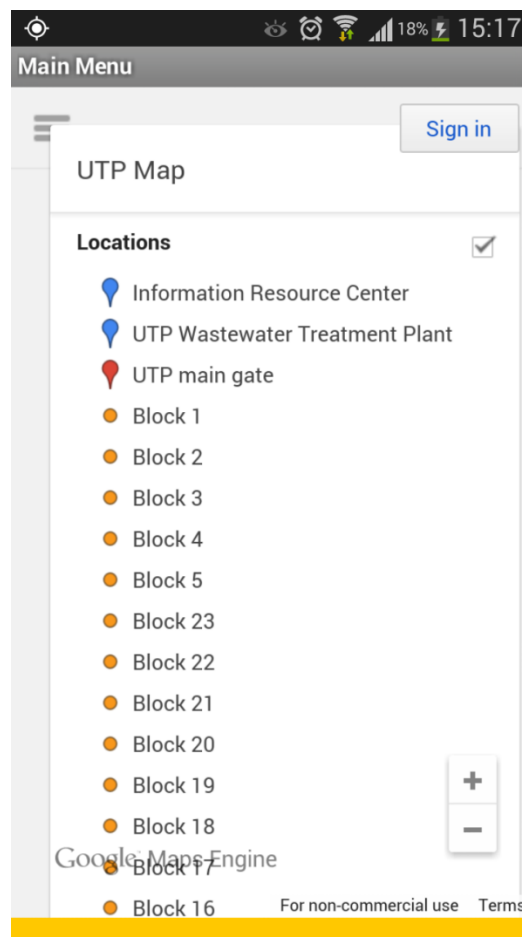


FIGURE 3.2.3.4 List of POIs

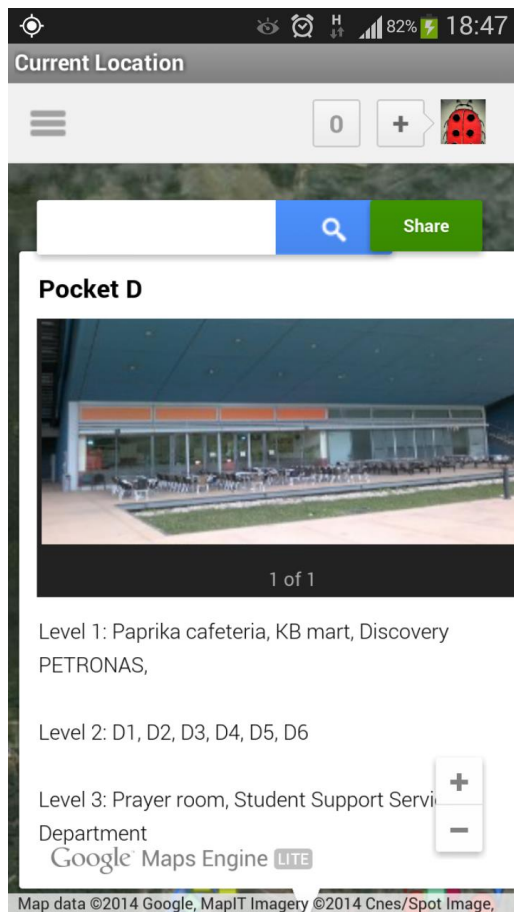


FIGURE 3.2.3.5 Information shown from prototype B

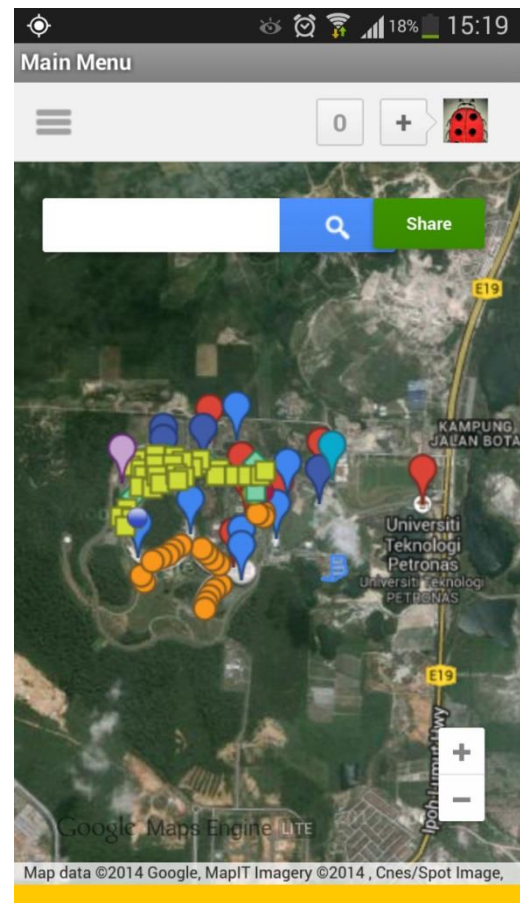


FIGURE 3.2.3.6 UTP customizable map viewed from prototype B

Based on the explanations given, it is proven that prototype B is better than prototype A. More interfaces of prototype B will be discussed and explained in section 4.1.4 from chapter 4. Prototype B has been used in the pilot study for the testing purposes to evaluate the performance of the application and the perception from the users toward the application.

3.3 Requirement Analysis

3.3.1 Stakeholders

The stakeholders of this system are as follows;

- Students of UTP
- Staffs of UTP
- Visitors of UTP

3.3.2 Information Gathering

Data for this project are collected by interviewing and questionnaires to targeted users and related parties as well as observation on other universities' existing mobile navigation application and comments from the pilot users from their experiences in using the prototype version of this mobile application later on. The author had done an interview with a security guard at the main entrance of UTP to know the process of giving direction to the outsiders that come to UTP. Several questions had been asked in order to gather the information for this project. Currently, the current method used in giving directions to the outsiders when they come to UTP is by providing signage at a few locations that leads them to their destination or venue of the events that they are attending in UTP. Any event organizer that required any signage for the directions to the venue of the event has to request for the signage from the security department located at the basement in Chancellor Complex. The person in charge is Mr Azhar bin Mohd Isa, the administrative supervisor of security department. However, if the outsiders are coming to UTP without specific events that already have prepared signage, they have to ask for the direction from the security guard at the main entrance of UTP and they will explained the direction verbally.

The problems in dealing with the current method are that the signage needs to be placed manually at specific location and more signage need to be prepared and placed if there are more locations involved. As for the verbal directions given by the security guards, it might not be accurate and it will took more time for that person to arrive at the destination. Therefore, it will be easier and helpful for those who are not familiar with places in UTP to find their destination on their own with the help of a navigation application that works like a Google Maps in giving direction. The author will provide directions to a few places that are most frequently visited by the stakeholders of this application such as registry department, mosque, chancellor complex and others.

3.3.3 Tools

The tools that have been used in developing this project can be categorized into two main categories, software and hardware. The software and platform used for this application are as follows;

3.3.3.1 Software and Platform

1. MIT App Inventor 2

This platform allows the user to create the application using the blocks editor rather than typing the codes from scratch. Due to limitation of knowledge in programming, this platform has been chosen by the author as it is the best platform to develop an android mobile application for those who are not good in programming. The flow on how the author can develop the mobile application using this platform is as follow;



FIGURE 3.3.3.1.1 System architecture for MIT App Inventor 2

2. Google Maps Engine

Since the points of interest in current maps of UTP in Google Maps are not fully labelled, this platform is chosen by the author to label all relevant points of interest such as cafeterias, academic blocks and hostels.



FIGURE 3.3.3.1.2 Example of functions available for Google Maps Engine

3. MIT AI 2 Companion

This application is installed in the device that is used by the author. It allows the author to test the functionality of the application while developing it right away. It can be connected via Wi-Fi.



FIGURE 3.3.3.1.3 Interface of the MIT App Inventor 2 companion application

3.3.3.2 Hardware and Equipment

The hardware used in developing this mobile application is a Lenovo laptop with duo core processor and windows 7 operation system.



FIGURE 3.3.3.2.1 Lenovo laptop

This mobile application will be able to run on any devices that support android operating system. The equipment used in developing this application is Samsung Galaxy S3 smartphone which is owned by the author. It is chosen because it supports Android OS and it supports the MIT App Inventor 2 companion application. The device consists of built-in GPS, supports Wi-Fi and uses Android OS 4.3.



FIGURE 3.3.3.2.2 Samsung Galaxy S3

3.3.4 System Architecture



FIGURE 3.3.4.1 System architecture for UTP Campus Tour Guide app

In order to run the prototype, the users should use any devices that support Android operating system either smartphone or tablet. There are two elements that are necessary for the application to successfully run, which the device used must have internet connection and the GPS has to be enabled. Without internet connection and GPS, the user will not be able to retrieve his current location. The UTP Campus Tour Guide application will interact mainly with Google Maps Engine server to retrieve the current location of the user and also for the user to view the POI available in UTP. The application's local database will store and provide the routes from current location to the destination.

If one of the components is not available or not functioning, the application will not be running smoothly and there are some problems will be occurred. Therefore, in order to ensure that everything will be successfully functioning, all requirements must be fulfilled.

3.4 Evaluation

The author had chosen the usability testing to evaluate the prototype built in order to improve the application, the ease of use of this application from the user side and to ensure that it meets the requirements from the user. It is also chosen to evaluate the usability of the application itself. According to Nielsen (2000), the total number of usability problems can be found in a usability test with minimum 15 numbers of users based on this formula;

$$U = N(1 - (1 - p)^n)$$

N is the total number of usability problems in the design, p is the proportion of usability problems discovered by testing a single user while n is the number of subjects tested. However, it is also recommended to test 5 persons only with three different tests because the same result can be generated by using this method. Since the author will be having more than 1 prototype, therefore more testing will be done. The author had decided to run three tests with 5 persons per test.

Other than the usability testing, the author also will do an observation on how the users will use the application in order to ensure that they can use it easily and able to find the directions to their destination on their own. It is important for the author to know the result of using the prototype from the user to help the author to improve the application and come out with a usable and helpful application at the end of this project. Any comments from the users will be more helpful in improving the application.

The testing evaluation of usability of this project is done in several parts. The first part will consist of questions asking for demographic information of the users. Part B will consist of System Usability Scale (SUS), part C uses the Generic User Interface Questionnaire (QUIS) and part D will get the user comments and feedbacks on the application for further improvement on the project.

The questions are as follows;

TABLE 3.4 Questionnaires for pilot user testing

Part A: Background Information of The User

1. Age:

18 - 25 ☐ 26 - 35 ☐ 36 - 45 ☐ 46 - 55 ☐

2. Gender:

Male ☐ Female ☐

3. Do you own a smartphone?

Yes ☐ No ☐

4. If yes, please choose your smartphone type:

Android ☐ iPhone ☐ Windows ☐ Blackberry ☐
Others; _____

5. Your status:

Student ☐ Staff ☐ Visitor ☐

Part B: System Usability Scale

Questions	Strong disagree – Strong agree				
	1	2	3	4	5
1. I think that I would like to use this system frequently					
2. I found the system unnecessarily complex					
3. I thought the system was easy to use					
4. I think that I would need the support of a technical person to be able to use this system					
5. I found the various functions in this system were well integrated					
6. I thought there was too much inconsistency in this system					
7. I would imagine that most people would learn to use this system very quickly					
8. I found the system very cumbersome to use					
9. I felt very confident using the system					
10. I needed to learn a lot of things before I could get going with this system					

Part C: Q.U.I.S Generic Use Interface Questionnaire

OVERALL REACTIONS TO THE SOFTWARE										
<i>terrible</i> 0 1 2 3 4 5 6 7 8 9					<i>wonderful</i> 0 1 2 3 4 5 6 7 8 9					
<i>difficult</i> 0 1 2 3 4 5 6 7 8 9					<i>easy</i> 0 1 2 3 4 5 6 7 8 9					
<i>frustrating</i> 0 1 2 3 4 5 6 7 8 9					<i>satisfying</i> 0 1 2 3 4 5 6 7 8 9					
<i>inadequate power</i> 0 1 2 3 4 5 6 7 8 9					<i>adequate power</i> 0 1 2 3 4 5 6 7 8 9					
<i>dull</i> 0 1 2 3 4 5 6 7 8 9					<i>stimulating</i> 0 1 2 3 4 5 6 7 8 9					
<i>rigid</i> 0 1 2 3 4 5 6 7 8 9					<i>flexible</i> 0 1 2 3 4 5 6 7 8 9					

SCREEN										
<i>Characters on the computer screen</i> hard to read 0 1 2 3 4 5 6 7 8 9					<i>Sequence of screens</i> confusing 0 1 2 3 4 5 6 7 8 9					
<i>easy to read</i> 0 1 2 3 4 5 6 7 8 9					<i>very clear</i> 0 1 2 3 4 5 6 7 8 9					
<i>Highlighting on the screen simplifies task</i> not at all 0 1 2 3 4 5 6 7 8 9					<i>Organization of information on screen</i> confusing 0 1 2 3 4 5 6 7 8 9					
<i>very much</i> 0 1 2 3 4 5 6 7 8 9					<i>very clear</i> 0 1 2 3 4 5 6 7 8 9					

• LEARNING										
<i>Learning to operate the system</i> difficult 0 1 2 3 4 5 6 7 8 9					<i>Tasks can be performed in a straight-forward manner</i> never 0 1 2 3 4 5 6 7 8 9					
<i>easy</i> 0 1 2 3 4 5 6 7 8 9					<i>always</i> 0 1 2 3 4 5 6 7 8 9					
<i>Exploring new features by trial and error</i> difficult 0 1 2 3 4 5 6 7 8 9					<i>Remembering navigation / use of commands</i> difficult 0 1 2 3 4 5 6 7 8 9					
<i>easy</i> 0 1 2 3 4 5 6 7 8 9					<i>easy</i> 0 1 2 3 4 5 6 7 8 9					

• SYSTEM CAPABILITIES										
<i>System speed</i> slow 0 1 2 3 4 5 6 7 8 9					<i>Correcting your mistakes</i> difficult 0 1 2 3 4 5 6 7 8 9					
<i>fast enough</i> 0 1 2 3 4 5 6 7 8 9					<i>easy</i> 0 1 2 3 4 5 6 7 8 9					
<i>System reliability</i> unreliable 0 1 2 3 4 5 6 7 8 9					<i>Experienced and inexperienced users' needs are taken into consideration</i> never 0 1 2 3 4 5 6 7 8 9					
<i>reliable</i> 0 1 2 3 4 5 6 7 8 9					<i>always</i> 0 1 2 3 4 5 6 7 8 9					

Part D: User Feedback

1. I think UTP Campus Tour Guide application should be implemented in our university.

Extreme Likely	
Slightly Likely	
Neither	
Slightly Unlikely	
Extreme Unlikely	

2. Do you have any other comments or suggestions?

3.5 Key Milestone

TABLE 3.5 Key Milestones

Milestone	Completion Week
Extended Proposal submission	Week 6
Proposal defense	Week 9
Interim Report submission	Week 13
Progress Report submission	Week 18
Pre-SEDEX	Week 24
Dissertation submission for external examiners	Week 26
Oral presentation @ Viva	Week 27
Final dissertation and Technical Report submission	Week 29

3.6 Gantt Chart

TABLE 3.6 Gantt Chart

	Activities	Week														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Final Year Project 1	Selection of Project Topic	■	■													
	Preliminary Research Work		■	■	■	■	■	■	■							
	Submission of Extended Proposal						■									
	Proposal Defense									■						
	Project Work Continues										■	■	■			
	Submission of Interim Report													■		
Final Year Project 2	Project Work Continues	■	■	■	■											
	Submission of Progress Report				■											
	Project Work Continues					■	■	■	■	■	■	■	■			
	Pre-SEDEX										■					
	Submission of Dissertation (soft bound)												■			
	Viva / Oral presentation													■		
	Submission of Technical Report															■
	Submission of Dissertation (hard bound)															■

CHAPTER 4

RESULTS AND DISCUSSION

Chapter 4 is the most important section for this project. It encompasses of the results of this project.

4.1 Prototype of the project

A prototype has been developed in the completion of this project and it has been installed on an Android device to test the functionality of the application. Details of the application will be further discussed below.

4.1.1 Flow of the application

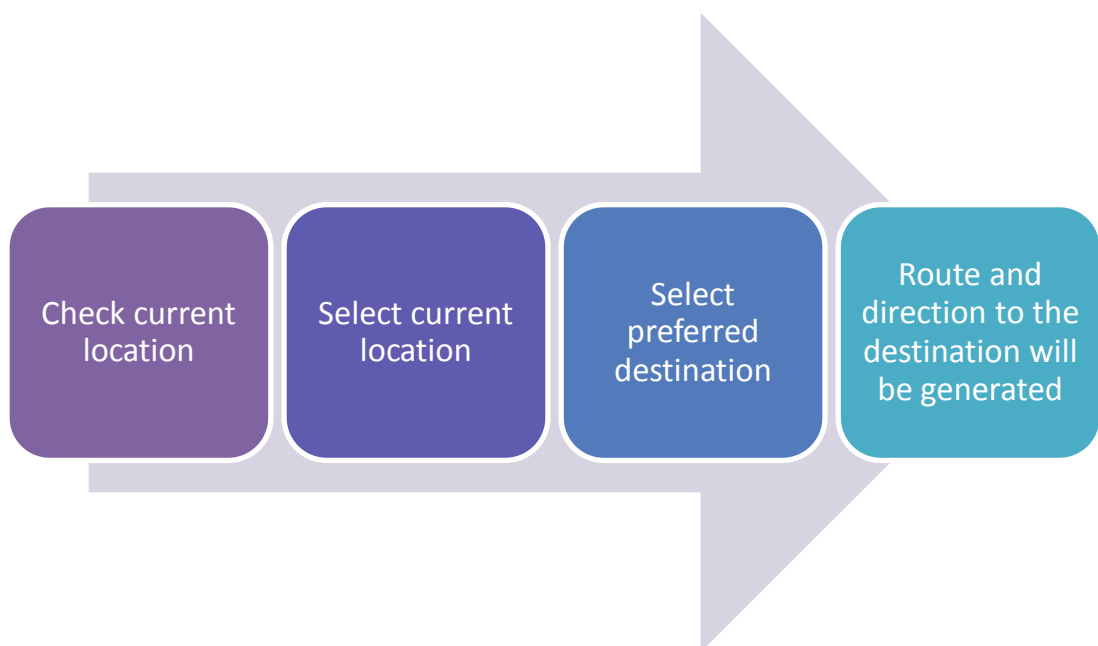


FIGURE 4.1.1.1 Flow of the application

4.1.2 Application Structure & Storyboard

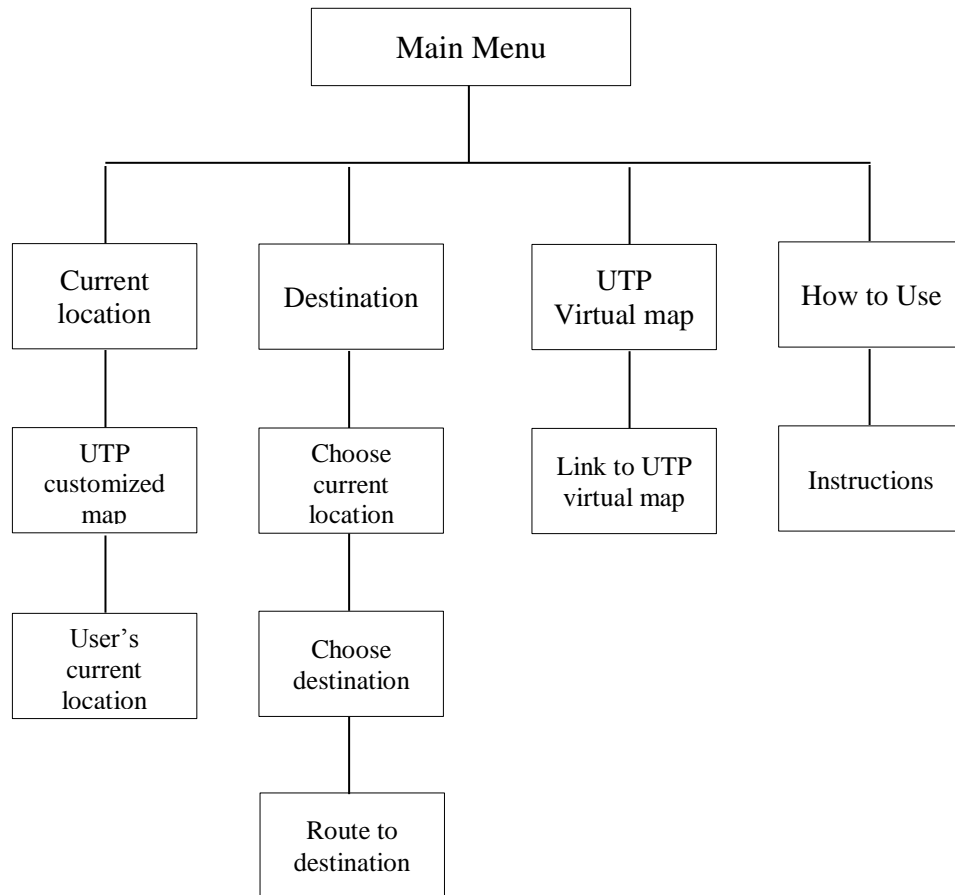


FIGURE 4.1.2.1 Structure of the mobile application

According to the application structure, in order to get the routes to preferred destination, there are a few steps need to be followed by the user. If the user had no idea on how to use the application, the user can click on the 'How to Use' button to get the instructions on how to use the application. The steps are as follows. Firstly, the user needs to click on the 'Current location' button in order to view the customizable map of UTP and to view the current location. The user can also view all POIs that are available in UTP. Then, the user needs to click on the 'Destination' button. From there, the user needs to choose the current location and the preferred destination. Lastly, the route from user's current location to the destination will be generated. The user can easily navigate to the preferred destination by following the given direction.

4.1.3 Use case diagram

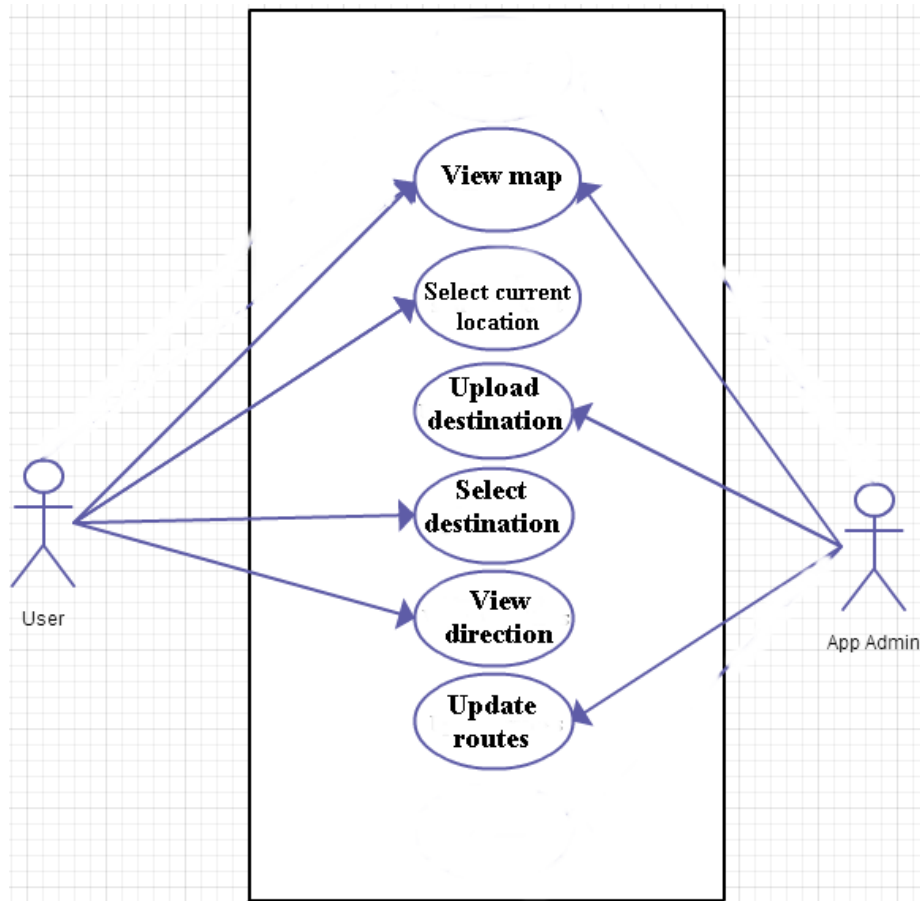


FIGURE 4.1.3.1 Use case diagram

The use case diagram shows the functionalities of this project from the user part and the developer part which represented by the actors. Both user and the application admin can view the map of UTP from the application. By viewing the map, the user can know his current location. Then, users have the ability to select the current location and destination in order to get the directions to user's preferred destination.

As for the owner of the application, the developer will be able to upload the routes for the directions from one place to other places. The users can view the directions based on the starting point and destination chose by them. Lastly, the admin will have the authority to update the routes for the UTP map. It will be more useful and effective if more routes can be provided to the users.

4.1.4 Interfaces

1. Homepage screen

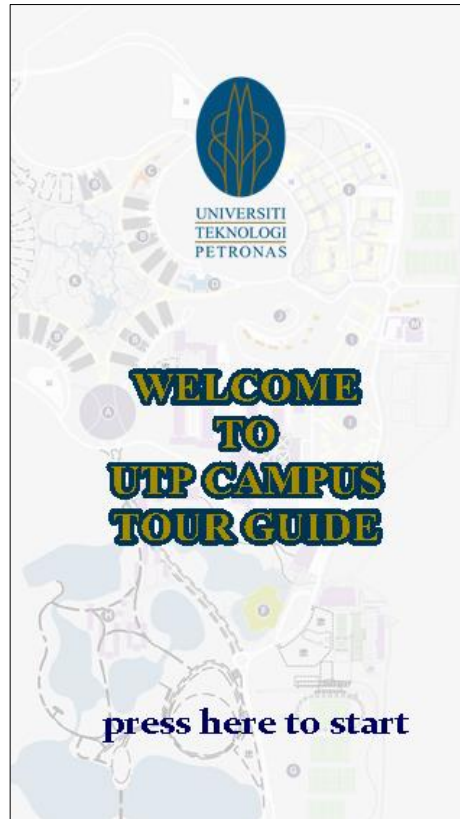


FIGURE 4.1.4.1 Interface for homepage

For the homepage screen, the user will receive a welcoming message and short information regarding the application. When the user clicks the screen, the user will be directed to the next screen which is the main menu. The background of the screen is a faded picture of UTP map. It has been chosen as a background to give a brief idea to the user on what kind of application it is. The first impression is always important. The colors chosen represent the official color of UTP which are gold and dark blue.

2. Main Menu screen

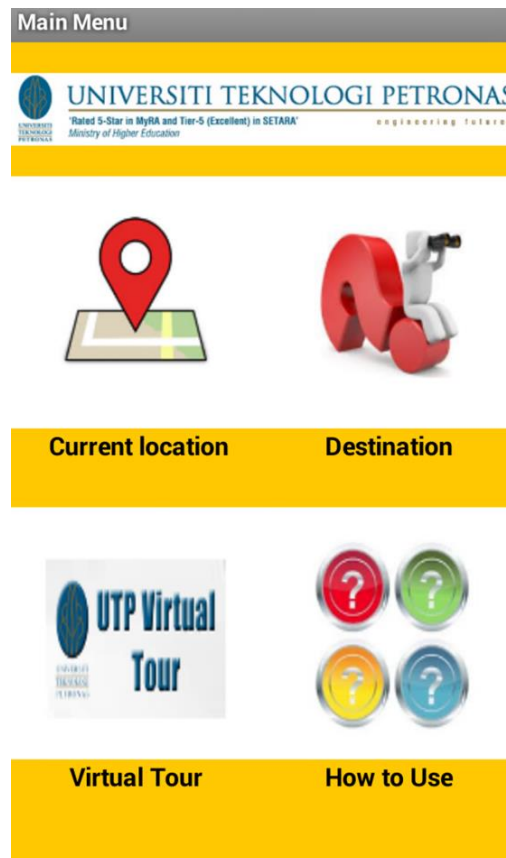


FIGURE 4.1.4.2 Interface for main menu

For Main Menu screen, there are four different buttons available where will bring the user to four different page. For the first button, 'Current location', the user will be able to retrieve their current location. By clicking the button available, the user will be directed to Google Maps Engine that has been chosen as the platform to develop the customize version of UTP maps. Once the user knows the current location, the user can get the route to the preferred destination by clicking on the second button, 'Destination'. For 'Virtual Tour' button, all users can explore UTP virtually from their devices. The map is linked to this application and it is available at UTP main website. The last button consists of instructions for the user on how to use this application.

3. Campus map screen (under 'Current location' section)



FIGURE 4.1.4.3 Customized version of UTP map

This map is using the Google Maps Engine platform where requires internet connection and GPS function for the users to know their current location. Each of the points of interest has been labelled. When the user clicks on any of the labelled location, it will provide the user with the information regarding that place including the real picture of the location or building.

Unfortunately, the user cannot navigate to the destination using this platform since the Google Maps has not acknowledge the roads inside of UTP yet and the marker function is not available in Malaysia at the moment. Therefore, the author cannot simply create the direction inside UTP using this platform.

4. Current location screen (under 'Destination' section)

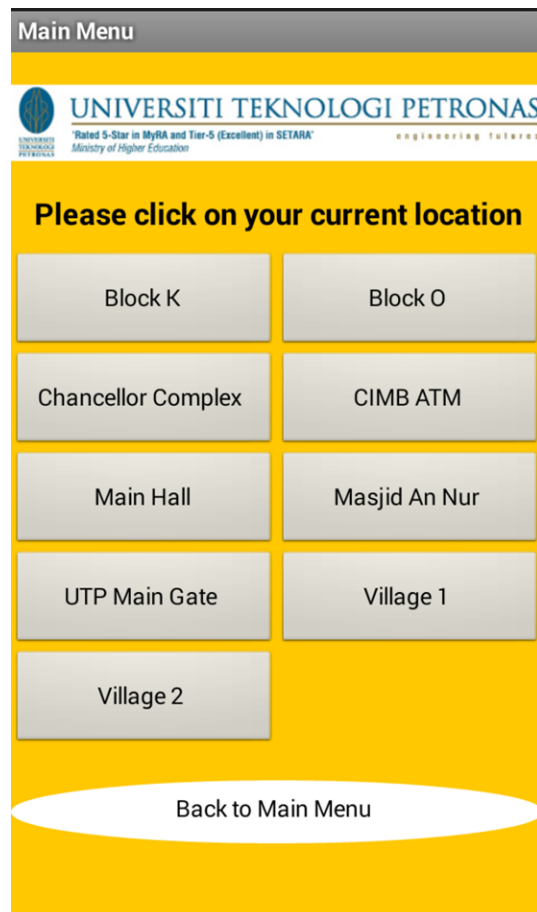


FIGURE 4.1.4.4 Current location available

The author is focusing on 9 POIs only for this prototype due to size limitation of the application that can be built using MIT App Inventor 2 which the size of the application must be less than 5mb. The POIs chose are as shown in the figure above. Once the user knows the current location, the user can easily select the current location based on the list shown on the screen.

5. Destination screen (under 'Destination' section)

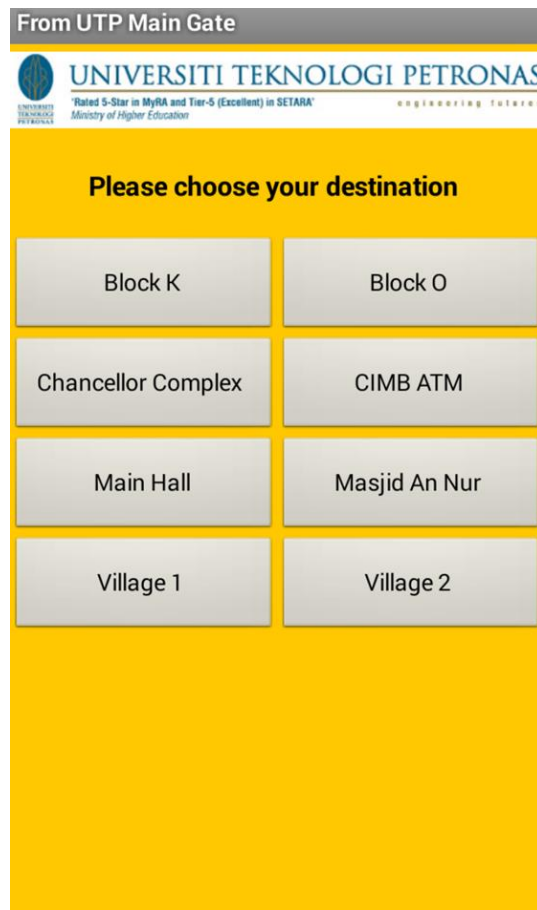


FIGURE 4.1.4.5 Destination available from UTP Main Gate

Once the user select the current location, the user can select the preferred destination in order to get the route or directions to that place. For this prototype, the routes provided are only for two destinations for each current location due to the size limitation. The lists of the destinations chose for each location are as follows;

TABLE 4.1.4 Destination available for each current location

Current location	Destination	Current location	Destination
Block K	Block O & Chancellor Complex	Masjid An Nur	CIMB ATM & Main Hall
Block O	Village 1 & Village 2	UTP Main Gate	Block K & Main Hall
Chancellor Complex	Block K & CIMB ATM	Village 1	Block O & Main Hall
CIMB ATM	Block K & Main Hall	Village 2	Block O & CIMB ATM
Main Hall	Block O & CIMB ATM		

6. Route screen (under 'Destination' section)

As for the route screen, directions will be given to the users from their current location to their destination based on what they have chosen from the previous screen. The directions are shown using black arrows from one point to another while the instructions are given in form of text and it is very simple and understandable to ensure that the users can easily arrive at the destination without having any difficulties. The lists of routes provided are as shown below;



FIGURE 4.1.4.6 Route from Block K to Block O

From Block K



- 1) Go to the main road from parking space.
- 2) Turn left. (200m)
- 3) Turn right at the parking space area and kindly park your vehicle.
- 4) Follow the pedestrian path to Chancellor Complex main entrance.

[Back to Destination list](#)

FIGURE 4.1.4.7 Route from Block K to Chancellor Complex

From Block O



- 1) Go to the main road from the parking space.
- 2) Turn left. (30 m)
- 3) Turn right at the junction. (50 m).
- 4) Take the first right. You have arrive at your destination. Kindly park your vehicle and nearby parking space.

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FIGURE 4.1.4.8 Route from Block O to Village 1

From Block O



- 1) Go to the main road from the parking space.
- 2) Turn left. (30 m)
- 3) Turn right at the junction. (100 m).
- 4) Turn left at the junction (50 m)
- 5) Take the first left. You have arrived at your destination! Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.9 Route from Block O to Village 2



- 1) Walk from the main entrance to parking lot. (50m)
- 2) Go to the main road.
- 3) Turn left. (150m)
- 4) Take the fourth right. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.10 Route from Chancellor Complex to Block K

From Chancellor Complex



- 1) Walk from the main entrance to parking lot. (50m)
- 2) Go to the main road.
- 3) Turn left. (300m)
- 4) Turn left at the junction. (50m)
- 5) Take the first left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.11 Route from Chancellor Complex to CIMB ATM



- 1) Go to the main road from your parking space.
- 2) Turn right. (50m)
- 3) Turn right at the junction. (150m)
- 4) Take the second left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.12 Route from CIMB ATM to Block K

From CIMB ATM



- 1) Go to the main road from your parking space.
- 2) Turn right. (50m)
- 3) Turn right at the junction. (50m)
- 4) Take the first left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.13 Route from CIMB ATM to Main Hall

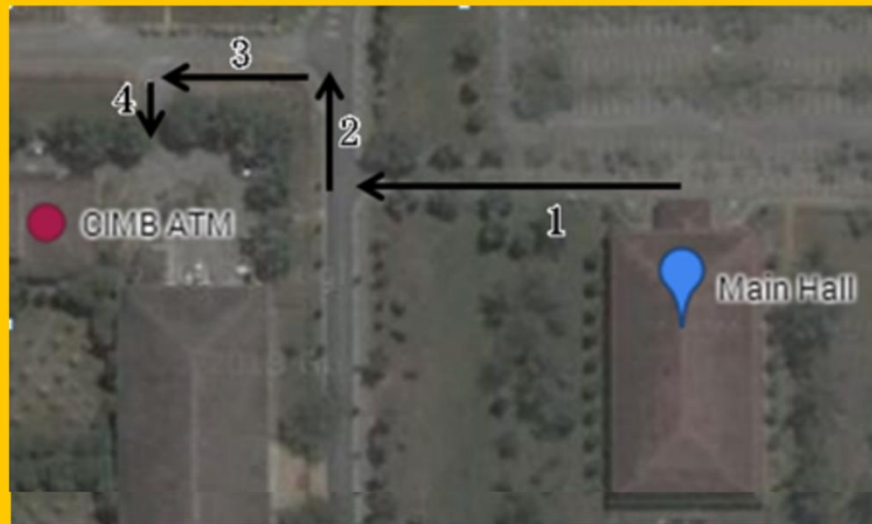
From Main Hall



- 1) Go to the main road from the parking space.
- 2) Turn right. (50m)
- 3) Turn left at the junction. (200m)
- 4) Take the second left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

FIGURE 4.1.4.14 Route from Main Hall to Block O

From Main Hall



- 1) Go to the main road from the parking space.
- 2) Turn right. (50m)
- 3) Turn left at the junction. (50m)
- 4) Take the first left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.15 Route from Main Hall to CIMB ATM

From Masjid An Nur



- 1) Go to the main road from the parking space.
- 2) Turn left. (200m)
- 3) Take the second exit at the roundabout.
- 4) Take the first right. (50m)
- 5) Take the first left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.16 Route from Masjid An Nur to CIMB ATM

From Masjid An Nur



- 1) Go to the main road from the parking space.
- 2) Turn left. (100m)
- 3) Take the second left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.17 Route from Masjid An Nur to Main Hall

From UTP Main Gate



- 1) Go straight. (300m)
- 2) Take the third exit at the roundabout. (300m)
- 3) Take the first exit at the roundabout. (200m)
- 4) Take the second left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.18 Route from UTP Main Gate to Block K

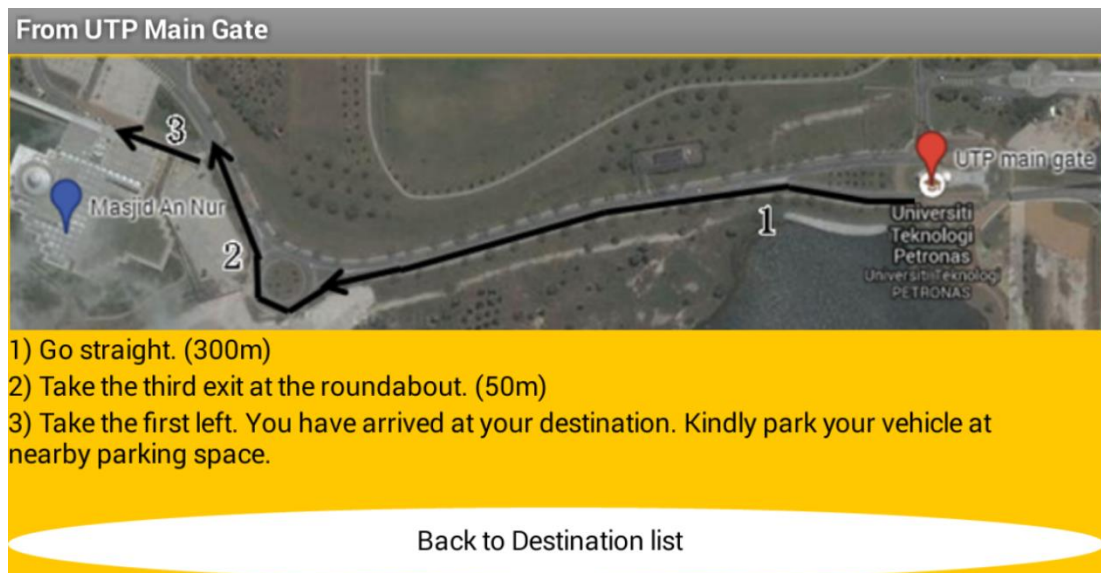


FIGURE 4.1.4.19 Route from UTP Main Gate to Masjid An Nur



FIGURE 4.1.4.20 Route from Village 1 to Block O

From Village 1



- 1) Go to the main road from parking space.
- 2) Turn left. (50m)
- 3) Turn right at the junction. (50m)
- 4) Take the first left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.21 Route from Village 1 to Main Hall

From Village 2



- 1) Go to the main road from the parking space.
- 2) Turn right. (100m)
- 3) Take the first right at the junction. (200m)
- 4) Take the second left. (30m)
- 5) Take the first left. You have arrived at your destination! Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.22 Route from Village 2 to Block O

From Village 2



- 1) Go to the main road from the parking space.
- 2) Turn right. (100m)
- 3) Take the first right at the junction. (200m)
- 4) Take the second left. (200m)
- 5) Take the second left. You have arrived at your destination. Kindly park your vehicle at nearby parking space.

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FIGURE 4.1.4.23 Route from Village 2 to CIMB ATM

7. How to Use screen

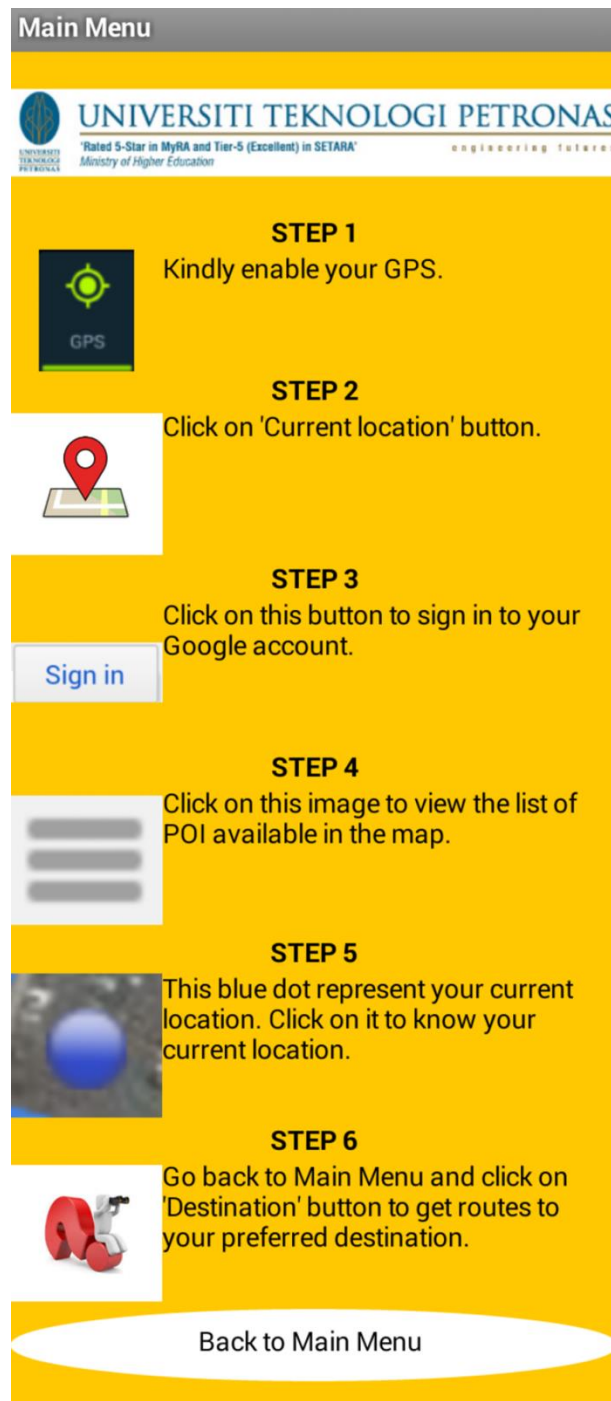


FIGURE 4.1.4.24 How to Use screen

Above are the instructions given for the user under 'How to Use' section. It can be referred if the user does not know on how to use the application. Each of the instruction comes with a picture which helps the user to easily understand on how to run the application.

4.2 Pilot Study

Pilot study has been done by the author on 15 pilot users. There were 3 different tests done with 5 users per test. Firstly, they were explained on the purpose of the test, how to use the application and they were informed that they need to answer the usability test and feedback form after they used the application.

1. For the first test, the author run the pilot test on 5 UTP students that currently undergoing their internship. They were away from campus around seven months. The results from the first pilot test were used during Pre-SEDEX presentation.
2. The second pilot test was done on foundation students. They are from the May 2014 intake. They have become a part of UTP less than two months.
3. The final pilot test was done on the outsiders. The range of their age is quite diverse. One of them is 51 years old, one is 42 years old, one is 33 years old, one is 22 years old and the last one is 18 years old. Based on the category, there is at least one person for each category.

The final results of the user testing are as follow;

4.2.1 System Usability Scale (SUS)

One of the reasons why System Usability Scale testing has been chosen to measure the usability of this application is because it can be used on small sample sizes with reliable results and it is a low cost usability testing which can be used for global assessments on system usability. It is originally created by John Brooke in 1986. The results of this testing have been illustrated from ten questions answered by all pilot users. The users need to answer the question with five response options from strongly agree to strongly disagree as shown in Table 3.4 from chapter 3.

The total SUS score for this application is 61.5% which makes the usability of this application belongs to grade B and considered as below average. In order to get grade A, the score must be 68% and above. The questions asked to the users and the results are as follows;

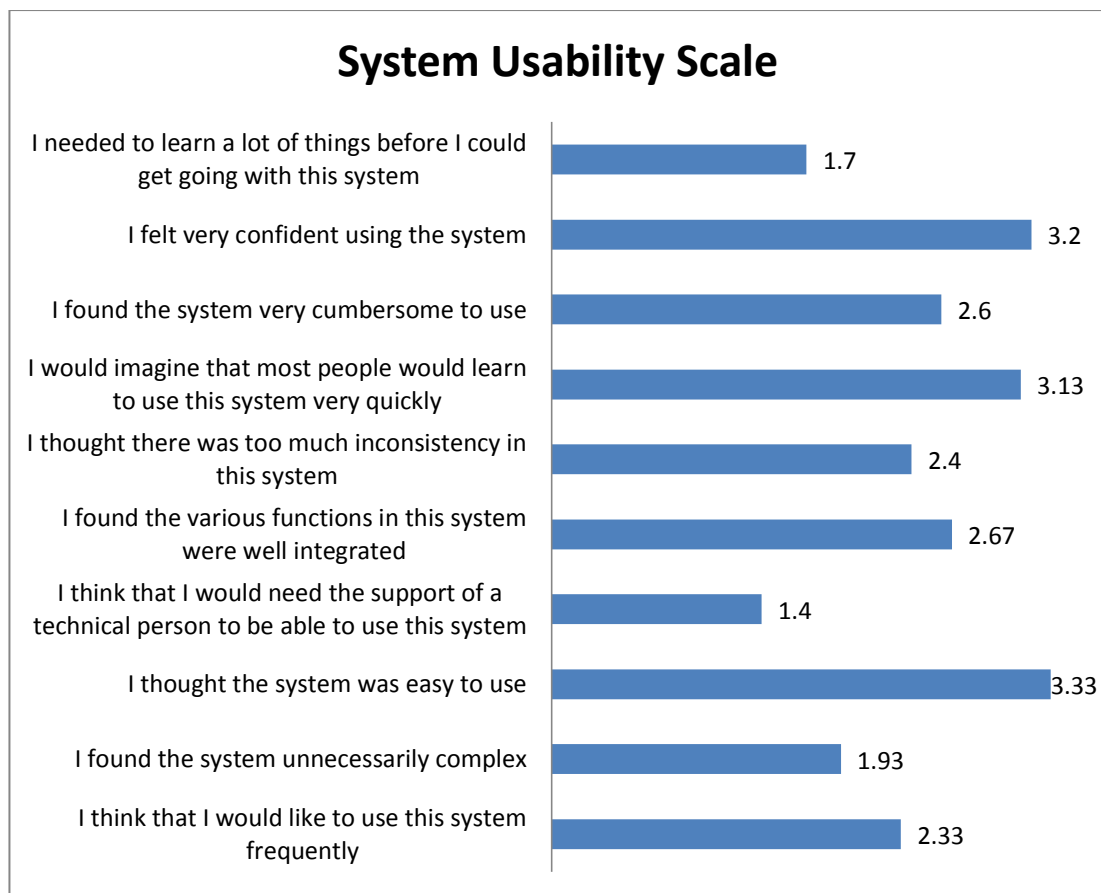


FIGURE 4.2.1.1 SUS result

4.2.2 Generic User Interface Questionnaire (QUIS)

These questionnaires are mainly focus on the interface representation of the system to the user. In this survey questionnaire, there are four main sections been focused in order to rate the application. The results are as follows;

1. Overall reactions of the system

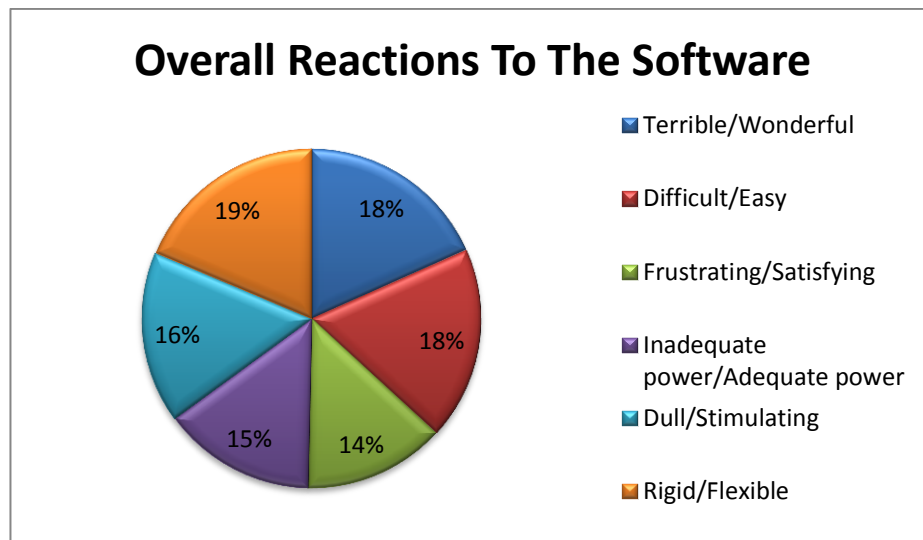


FIGURE 4.2.2.1 Overall Reactions to the Software result

2. Screen

The screen testing shows that the character display on the screen is good and readable followed by the sequence of the screen that helps in simplify the tasks. All four elements have quite a fair weightage as shown in the pie chart below.

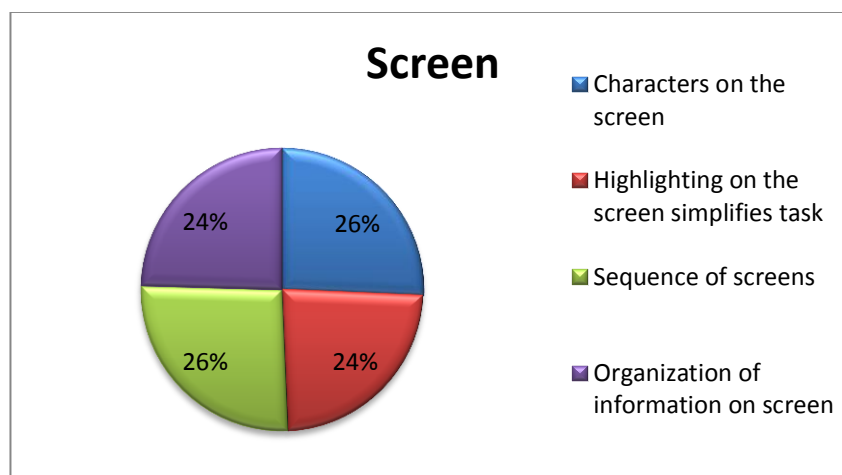


FIGURE 4.2.2.2 Screen result

3. Learning

The learning testing results shows almost similar results as the screen testing where all the elements share almost the same weightage. The illustration of the result is as shown below.

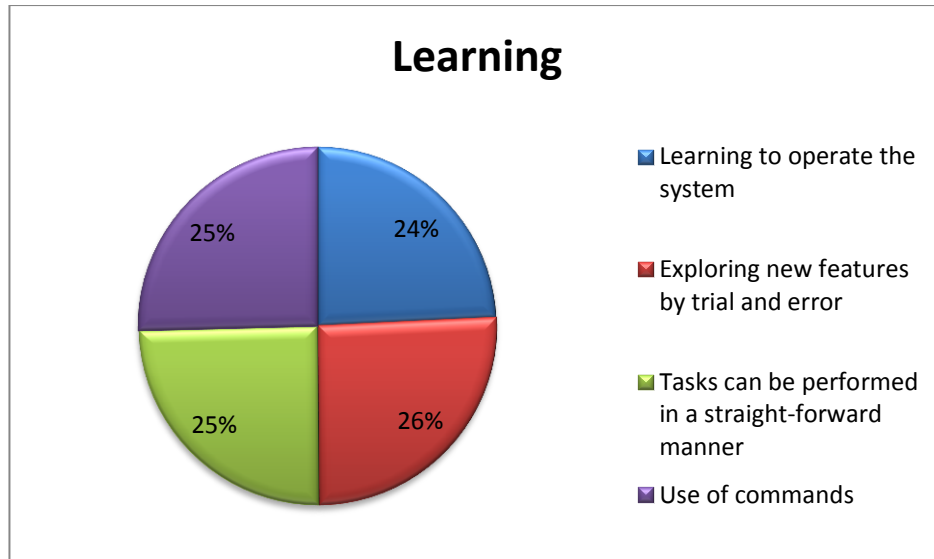


FIGURE 4.2.2.3 Learning result

4. System capabilities

As for the last section, the system capabilities show a positive value for all four elements. The results are as follows shown by the pie chart below.

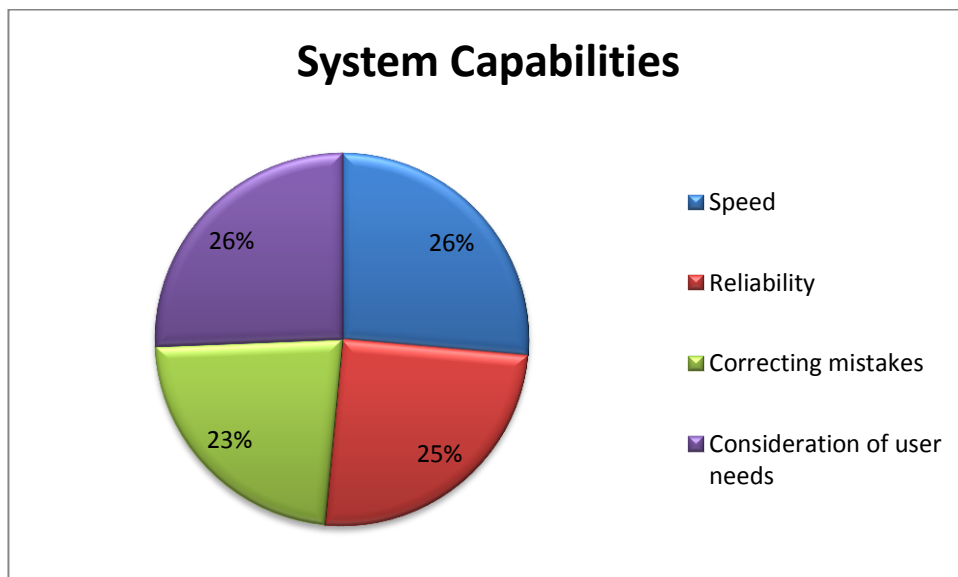


FIGURE 4.2.2.4 System Capabilities result

4.2.3 User Feedback

1. I think UTP Campus Tour Guide application should be implemented in our university

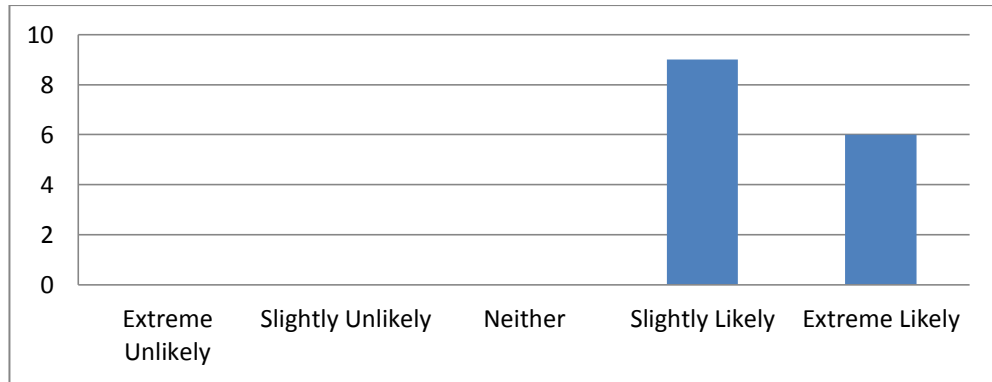


FIGURE 4.2.3.1 User feedback on implementation of application

Figure above shows the graph on last question asked which is either the respondents think that the application should be implemented in UTP or not. Based on the result, it shows that 6 of them rated scale 5 which is extreme likely supporting the application should be implemented while the remaining 9 persons rated scale 4 which is slightly likely.

2. Comments / Suggestions

Below are the some of the comments and suggestions given by the pilot users.

- “Directions given are nicely explained. Simple and helpful.”
- “Use more significant symbols for the map to make it more understandable.”
- “It would be nicer if the pictures can be enlarged.”
- “Routes provided are helpful. Do provide more routes for the next version.”
- “Nice application but if the map is real time, then it would be fabulous.”
- “Good idea. The new intake students would love it.”
- “Would be useful for the visitors.”
- “I love it. I would use it if the application was there during my orientation week.”

4.3 Discussion

Based on the results from the pilot tests done, there are many points can be considered by the author in improving the application. The results do help in supporting the developed application for further improvement and alteration on the application.

For the System Usability Scale, the results gained from the pilot users shows that the usability of the application is below average. Therefore, this application cannot be considered really well in term of the usability yet. Some alterations need to be done toward the application based on the comments and suggestions received from the respondents. As for the Generic User Interface Questionnaire result, all elements tested shared a fair value. The portions for each element are almost the same. It shows a positive result for all of the elements as well as the interface of the application as a whole.

Lastly, for the user feedback, none of the respondents disagree on implementing this UTP Campus Tour Guide application. Therefore, the author believe that such application will be really helpful and it can implemented for real with a few alteration and improvement on the current prototype to cover the needs of the users. From the comments and suggestions received from the respondents, there are positive comments and there are also negative comments which are more to suggestions in improving the application. It is good to know how others think about the application because that definitely helps the developer to know how the performance of the current prototype.

In conclusion, the pilot tests done for the prototype of this project was successful and the results gained from this study helped to know and prioritize the improvement and alteration to be done for future work. The future recommendations will be further discussed and explain in next chapter.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

Relevancy of the objectives is again evaluated after doing several project activities. The relevancy is confirmed when the project has the possibility to be completed according to the Gantt chart planned. Therefore, the project activities will be proceeding as usual according to the planner. It can be concluded that this project had achieved 90 percent of the objective in term of early development phase.

As the conclusion, in developing mobile application for this project, the author believes that this mobile navigation application could benefit the targeted users in finding directions to places in UTP easily on their own. UTP Campus Tour Guide mobile application has been found as a good start in helping and guiding new students, new staffs and visitors to find directions to places around UTP easily, within shorter time compared to before.

However, there are a lot of recommendations need to be considered in order to improve this project. Firstly, it will be more useful if more routes can be included in giving directions to the users. Since the current platform used has limit on the application size, it is recommended for the developer to store all of the media separately from the application database or to use another platform in developing the android mobile application. However, knowledge on the new android language needs to be learned first. The mobile application will be fully utilized in term of its usability when the application able to cater bigger scope of users and their needs in the future.

As for the non-functional requirement, more attention can be given in the maintainability of this application in the future. The routes can be improved with clearer version of UTP map. Based on the testing done on the pilot users, the application can be improved by improving the design of the application, font used, colors and others. That will help in improving the user experience. It is also recommended for the application to be developed for devices that support other operating systems like iOS in order to allow more stakeholders to be able to use this application. It will be really helpful if all targeted users are able to try and use this application even though they are using different type of devices that support various types of operating systems.

As the ultimate purpose of this project is to provide directions to places around UTP to the stakeholders, it will be more helpful for the future works to try providing the users with a real time map. A real time map able to guide users from their current location to their preferred destination accurately compared to this application. However, it is not easy to build such system. Therefore, it is recommended for the developer to learn on how to create a real time customizable map in improving the application for the new version of this UTP Campus Tour Guide application in aligning with the latest technology.

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