INNOVATIVE PHONE APPS FOR THEME-PARK POSITIONING TECHNOLOGY

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SESSION 2016/2017

FACULTY OF COMPUTING AND INFORMATICS

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BY

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THIS PROJECT REPORT IS PREPARED FOR

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DECLARATION

I hereby declare that the work have been done by myself and no portion of the work contained in this thesis has been submitted in support of any application for any other degree or qualification of this or any other university or institute of learning.

_____

OH SOON KIT
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Date: 9th MARCH 2017

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Lastly, I am glad that I could get Final Year Project done before the due date. Aside from that, I would like to thank MMU for granting me the chance to experience new stuffs and cooperate with my supervisor and the people involved in this project.

Abstract

This Final Year Project introduced a mobile application that implemented using Android, Java and Mosquitto server. This is a application based project where a new platform is to created to develop application with location awareness that give more meaningful interactions between human, things, events and location. The established applications that are able to search user's current location and enable users to communicate with each other to obtain information of surrounding.

Management Summary

The title of this Final Year Project is ‘Innovative Phone Apps for theme park positioning technology’. This is a application based project where a new platform is to created to develop applications with location awareness that give more meaningful interactions between human, things, events and location. The established applications that are able to search user’s current location in a theme park, look for sites of interest and estimate the waiting time and get a suggestion on which events are about to start will be done by the users in this project.

In this project, Chapter 1 introduced the theme-park positioning which is known as indoor positioning in the theme park. Chapter 1 also discussed the project objective, project scope, and also problem statements.

In Chapter 2, background study on the theme park positioning has been done and similar type of applications that are using theme park positioning application have been checked, which are IndoorAtlas theme park positioning application, Senion theme park positioning application and Wifarer theme park positioning application. Explanation on the phone operating system, technologies, phone java that are used in theme park positioning system have been discussed as well.

In Chapter 3, Architecture and diagrams have been drawn to illustrate the flow of for theme park positioning application and the survey on theme park positioning application has been done via google form to collect respondent’s feedback towards how

theme park positioning application solves their problem and also rating from the respondent.

In Chapter 4, A brief explanation on the usages of Mi-ILP theme park positioning prototype which including the profile setup, data collection, data processing and positioning have been explained step by step, provided with the screenshot for clearer view. There is a problem encountered which is about the inaccurate of location positioning when locate me is clicked, the solution to this is to collect more fingerprint data to process, stand on the fixed location and rotate which collecting the fingerprinting data.

In Chapter 5, Implementation plan for Project II has been described in details. The content of the implementation plan is to create a server platform using Mosquito (MQTT) server to suggest event to the current Mi-ILP prototype. The Mi-ILP 1.1 tool sends the estimated location data and timetable data as message to the server and the server will broadcast messages sent from other users to Mi-ILP 1.1 tools as event suggestion.

In Chapter 6, Test plans and test results are demonstrated in order to show the functionality of the proposed solution for the prototype. While the last chapter discussed about the conclusion, limitation and future work.

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Chapter 1: Introduction

The Final Year Project – 'Innovative Phone Apps for Theme Park Positioning Technology' is a application based project where a new platform is created to develop application with location awareness that give more meaningful interactions between human, things, events and location. The established application that are able to search user current location in a theme park and enable users to communicate with each other to obtain information of surrounding. The explanation on the words related to this final year project such as phone application, indoor positioning application and theme park are as stated below :

1.1 Phone Application(Apps)

Based on the definition, the Phone app is defined as software applications that operate on mobile devices. Nowadays, Phone apps play a major role in our daily's lives as many of the events and matters are connected to phone apps to stimulate unity between peoples and also to solve problems. The number of people that using phone apps is increasing year over year and people tends to use phone apps to navigate through life with learning, reading, shopping, and more with their preferences. Despite the mentioned implicit advantages of the phone app, the general advantages of phone app are a convenience, accessible, interactive and able to provide better user experience than the website (Mobile Apps, 2016).

1.2 Indoor positioning application

Indoor positioning application is known as an application that used to track the location of objects or people indoors by using sonic information gathered via mobile devices, such as magnetic fields, radio waves, audio signals or others. Indoor positioning application uses several technologies like WIFI access points (AP), Bluetooth low energy (BLE) to track object's or people's location, measure and acquire the accurate position. (Indoor Positioning System, 2016) Aside from that, Indoor positioning applications can also track the direction while the devices are moving and provide the estimated accurate location for where the people locate at.

1.3 Theme Park

The theme park is a delight park where its context and architecture are based on a central theme. It can also be defined as a combination of entertainment elements, interest and other events for the joy of people, especially towards people of young ages. A theme park has several buildings, landscaping, views which are based on their specific description and it usually provides a fascinating view to attracting certain age groups of people, not only limited to young kids but also for older age of people (Amusement Park, 2016).

The project aims to create a new platform to develop applications with location awareness that give more meaningful interactions between human, things, events and location. Users that possessed the established applications are able to search their current

location in a theme park, look for sites of interest and estimate the waiting time and get a suggestion on which events are about to launch.

1.4 Project Objectives

This project aims to create a new platform to establish applications with the functionality of location detection that able to interact with human, things, events and location semantically. There are five objectives for this project as stated below:

a) To develop a simulated digital map plot of the sites of interest in a theme park on MMU Cyberjaya campus.
b) To create a building profile through the collection of wireless signal fingerprint data as known as pin details.
c) To develop positioning and location awareness through data processing using aggregation and triangulation of WIFI Access Points that collected in MMU Cyberjaya campus.
d) To develop functions that let users obtain information of his surroundings.

1.5 Project Scope

This project is focused on location detection. Location detection and data collection will be performed within several buildings in MMU Cyberjaya campus. Therefore, there are few requirements that need to be taken into consideration.

a) To establish a Mosquito server to broadcast user's messages.

b) To develop an external application to connect (mi-ilp) theme park positioning application and the Mosquito server

1.6 Problem Statement

Theme park positioning application plays a major role in detecting the location of user at the theme park as global positioning system doesn't works well inside buildings as compared to theme park positioning applications. Therefore, users are more relying on theme park positioning applications when they wanted to detect location inside the buildings. During the development of theme park positioning application, there will be several problems need to be considered:

a) Global Positioning System (GPS) cannot be used inside the building

GPS can only be used outside the building because the GPS relies on the satellite to track user's current position and the wave from the satellite will be reached until the surface of the building but cannot penetrate through it. Therefore, GPS cannot be used inside the building.

b) Wireless technologies like magnetic positioning are not available

Technologies that may be used for theme park positioning magnetic positioning are not available in Multimedia University Cyberjaya Area. Therefore, that cannot be used to collect fingerprint data and only wireless technology such as WIFI and Bluetooth are currently available at the moment.

c) Users are unaware of the nearby events

Users are usually able to see their current location on the indoor positioning map but they do not know what is the event happened nearby their location and hence missed it.

Chapter 2: Background Study

Indoor location estimation is a pragmatic function for many applications as it helps the user in time-saving in locations searching and acquiring accurate of location positioning. This chapter aims to provide a comprehensive, clearer and unambiguous background study for the Theme park positioning applications to the users. All mentioned technologies and existing system are evaluated based on their pros and cons for the deployment of theme park positioning application system.

The theme park positioning application is a smartphone based application. Therefore, It requires the operating system to execute the application. Those well known operating systems for smartphone such as android, iPhone OS, and window OS are needed to execute theme park positioning application.

2.1 Phone Operating System

2.1.1 Android

Based on Wikipedia, Android was founded by 4 persons which are Andy Rubin, Rich Miner, Nick Sears and Chris White in Palo, California in October 2003 and bought by Google Incorporated in July 2005. (Android, 2016) Google developed a Linux kernel based on android mobile operating system especially for touch screen mobile devices like smartphones and tablets. The user interface of android using a touch gesture to perform real life action such as touching, swiping and tapping.

2.1.2 IOS

Based on Wikipedia, IOS was founded by Steve Jobs in 2007 in California. Apple Incorporated developed a mobile operating system that is to present to the products under its company. (IOS, 2016) The user interface of IOS using multi-touch gesture to perform real life action such as touching, swiping and tapping and interface control elements such as sliders, switches, and button.

2.1.3 Window Phone OS

Based on Wikipedia, Window Phone Operating System is a mobile operating system was developed by Microsoft Incorporated to replace the successor of windows mobile and Zune (Window Mobile, 2016). It uses metro design language to create a new user interface that aims to compete in the consumer market.

2.1.4 Comparison of the operating system

Based on the Time website , Harry MacKracken (Mckracken, 2013)did a research on which phone operating system has the most embracement by the users and he found that Android operating system is most popular among the IOS and window Phone OS. The reason why people preferred Android is the flexibility of android OS that can be used in many mobile devices, not like IOS on iPhone and Window Phone OS on Lumia. The better android's customization and hardware are also added advantage for the user to choose it over the IOS and Window Phone OS.

2.2 Technology Used

Furthermore, Theme park positioning applications also use technologies like distance measurement to measure the known nearby nodes. For instance, WIFI access points (APs), Bluetooth low energy(BLE), and magnetic positioning.

a) WIFI APs

Wifi access point is a region beneath a Wi-Fi wireless access point. It is widely used in accessing the internet with the pre-condition of the user has to enter WI-FI access point with laptop, tablet, and smartphone that possessed of Wi-Fi function (WI-FI Hotspot, 2016). The user can connect to the internet providing the configured access point to demonstrate its existence with no authorization. The user also needs to know the login details if the authorization is being executed. Furthermore, all the shared folders can be accessed by the user that is to the same access point.

b) Bluetooth Low Energy

Bluetooth represents not entirely on the exact location but more towards on estimation of nearer location. Bluetooth is different from GPS as it does not provide pinned location. However, it is known as geofence solution which can be turned indoor proximity solution but not an theme park positioning solution and indoor-mapping and micro-mapping are connected to Bluetooth and to the Bluetooth LE-based and the power efficiency of Bluetooth with low energy

consumption benefits the devices that run for long periods of time. (Bluetooth low energy, 2016)The Bluetooth technology provides support to all major operating systems that benefit the development of the mobile application and connectivity for cloud computing and the social economy. There are several important features of BLE cover :

a) Its industry-standard wireless protocol grants multiple vendors to operate internally
b) less power consumption that prolongs the life of batteries
c) lower evolution and working cost due to its standard development structure for application

c) Magnetic Positioning

Magnetic positioning (Magnetic Positiioning, 2016) uses the magnetic sensor from smartphone and to locate people and objects wirelessly indoor. It benefits by providing accuracy without any prior hardware constraints and cost effective. Magnetic positioning makes use of consistency of magnetic disturbances that caused by steel structures and hence creating a magnetic fingerprint that is unique to a building location.

2.3 Phone java

Development tools like Java 2 Micro Edition(J2ME) is required to build Theme park positioning application. Android smartphones execute its app on java and it is not directly compatible with other versions of Java like J2ME. J2ME has decreased in popularity since the arrival of smartphones which can run more powerful apps than J2ME does. J2ME is designed for a simple phone that allows a user to download and use small software applications. There are other J2ME versions designed for other mobile devices and general-purpose applications such as games, specific functions or custom-written corporate applications. (Java Platform,Micro Edition, 2016) They can be Internet based so that a J2ME game enables the user to play over the Internet and in real time. It can be universal created by everyone but not just the carrier.

2.4 Outdoor navigation

Generally, outdoor navigation is known as global positioning system which is used to detect the location outside the buildings. There are several advantages of GPS. For instance, GPS is easy to navigate as it tells you to the direction for each turns that you have to take in order to reach your destination, GPS works all days and time no matter what weather it is, and GPS has a very low as compared to other navigation systems (Advantages and Disadvantages Global Positioning System.). It also helps you to search the nearby places that are convenience to you and easy to blend into other technologies like cell phone because of its low cost.

2.5 Location Algorithm

2.51 KNN Algorithm

k-nearest neighbors algorithm(k-NN) is a non-parametric method use for classification and regression. Input consists of k closest training example in feature space for both cases. The output depends on classification or regression of k-NN. In k-NN regression, the output is the property value for the object. This value is equals to the average of the values of k nearest neighbors. For the k-NN classification, the output is class membership. Object is set to the class most common among its k nearest neighbors then the object is classified by majority vote of its neighbors. If k is a positive value, the typically is small. The object is simply assigned to the class of the single nearest neighbor if k=1. Besides, k-NN is a type of instance-based learning or lazy learning and the function is only approximated locally and all computation is delayed until classification. Both of the classification and regression are used to assign weight to the dedication of the neighbors. So we can say that the nearer neighbors bring more to the average compared to the further one. When the class for k-NN classification or the object property value for k-NN regression is known, the neighbors will be selected from the set of object. Moreover, k-nearest neighbors algorithm is very sensitive to the local structure of the data. . (k-nearest neighbors algorithm, 2016).

2.51 Bayesian Algorithm

Naive Bayes classifier is simple technique for constructing classifiers or probabilistic classifier. Based on the Bayes' theorem, all the Naive Bayes classifier has a strong assumption of the value of particular feature is independent of other feature value. It has

been studied since the 1950s. Naive Bayes was presented under a different name into the text retrieval community in the early 1960s and remains a universal method for text categorization. Besides, the problem of decide documents which belonging to one category or the other such as spam and legitimate with condition of word frequencies are same as the features. Furthermore, Naive Bayes provides more advanced methods including support vector machines and finds application in automatic medical diagnosis. It also highly scalable and requiring a number of parameters linear in the number of variables in a learning problem. According to statistic and computer science literature, the simply Bayes and independence Bayes are included in Naive Bayes models.

2.6 Mosquito Server (MQTT)

MQTT is machine-to-machine(M2M) or "Internet of things" connectivity protocol. It was designed as a subscribe messaging transport or an extremely lightweight publish. It has a better connection with remote location where a small code footprint or network bandwidth is required for the process. It was useful for mobile application due to low power usage, efficient distribution of information to one or many receivers and also small size. MQTT was developed since 1999 with the exponential growth of internet of things and it need to connect between the low-powered smart devices. Besides that, MQTT used to be low-overhead protocol because it always considered the bandwidth and CPU limitation make sure they didn't exceed the limit. MQTT can run in an embedded environment causes it to be reliably and effective in providing an avenue for communication. (MQTT, 2016).

2.7 Overview of Current existing system

Overview of existing current system is to demonstrate unambiguously and clearly how the theme park positioning performs its function in the real life to help the user in tracking position and also track the nearby events.

2.7.1 IndoorAtlas

IndoorAtlas is an application that provides the developers an API to develop location detection apps for navigation indoors. It also provides features like industry-leading accuracy for indoor positioning, able to get floor level , able to link to cloud-based application data. Besides that, IndoorAtlas able to make use of some device hardware sensors like compass, gyroscope, and accelerometer to assist in indoor positioning. IndoorAtlas can also access Wi-Fi and Bluetooth location information and details for enhanced positioning performance. Most importantly, IndoorAtlas able to run on both android and IOS operating system and also provides benefits for the users, such as high scalability, freedom to operate, accurate positioning and cost reduction. The section below will be discussing its platform to build own location based services. (IndoorAtlas Application, 2016)

IndoorAtlas indoor positioning technology provides a wide range of location based services

Figure 2.1 Platform for indoorAtlas (IndoorAtlas_OurPlatform, 2016)

2.7.1.1 Direction Searching

Direction searching ability able to increase user satisfaction and support eventually as it provides several functions to help users in time saving for finding location and escaping from crowded areas, navigate user to the right buildings and create a safe environment to the user by giving them nearby information.

Figure 2.2: screenshot for direction searching (IndoorAtlas_OurPlatform, 2016)

2.7.1.2 Point Indication

Point of interest indicates a accuracy technology called blue dots that broaden a wide range of customer experience chance to track the where about of owner. It mainly helps users in locating a particular facility, search for a location at a strange place and gets spotted offers.

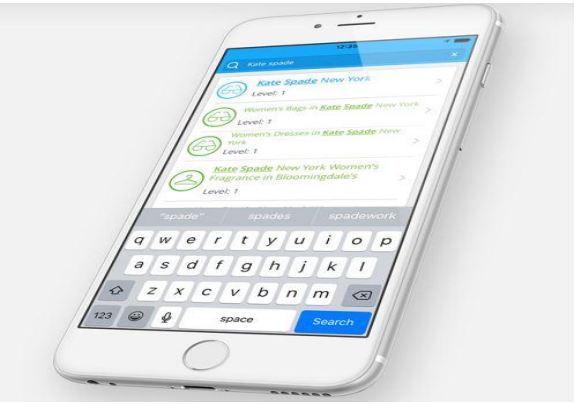


Figure 2.3: screenshot for direction searching (IndoorAtlas_OurPlatform, 2016)

2.7.1.3 Multiple Dots

Multiple Dots that provided by IndoorAtlas enables multiple users, mobile devices and object locations to be managed on the same map that can benefit the social networking and teams navigation because when mobile app is used then multiple devices can be located in real-time. As shown in figure 2.4, Multiple dots feature can help users to track and connect their friends or family in the same venue with safe.

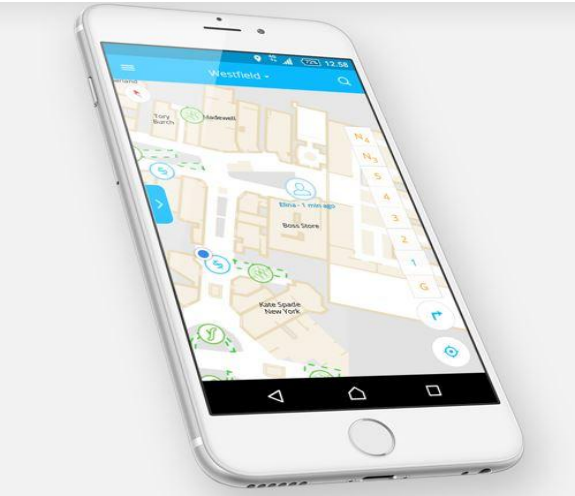


Figure 2.4 : screenshot for multiple dots (IndoorAtlas_OurPlatform, 2016)

2.7.1.4 Proximity Marketing

IndoorAtlas provides users a reliable platform to construct highly targeted proximity marketing. It provides features to help users in time saving, get relevant coupons and be more alert on product offers or comparisons.

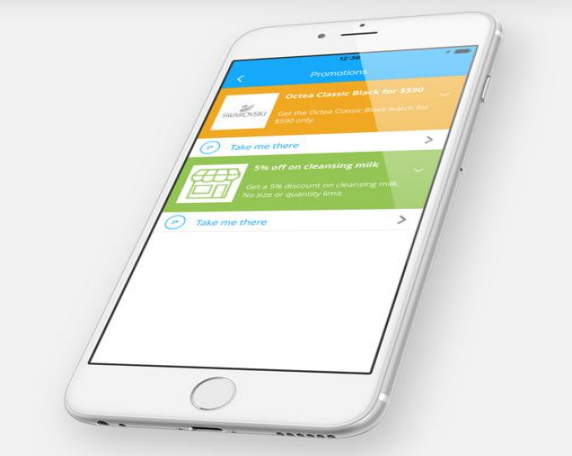


Figure 2.5 : screenshot for proximity marketing (IndoorAtlas_OurPlatform, 2016)

2.7.2 Overview of Senion Indoor positioning

Senion indoor positioning application has gradually become competitive product demand in the market. Senion applies a technology which is Stepinside to assist its product. Stepinside is a potential and complete hardware and software system for indoor positioning of mobile devices. The system is designed based on the need of the rapidly growth location based market. Senion indoor positioning application aims to eliminate navigational hurdles and allow location based notifications inside buildings like hospital and shopping mall (Senion, 2010). Furthermore, Senion also has its exclusive benefits for users like implementation of the complete system as StepInside is an integrated system where every part has been engineered to work in synergy and this approach results in potent indoor positioning, take full control of the beacon network, and also the least amount of maintenance , Ease of use as the system is efficient, effective and easy to

learn and long term solution as it is easy to extend and include supplement client side functionality.

2.7.2.1 Indoor positioning for retail

Indoor positioning for retail aims to increase the customer experience and engage visitors with a preferred shopping experience with Location-based services. Senion provides dynamic taking turn navigation for visitors, allow store management to crate location-based promotions and analyze visitor's action and gesture in a place.

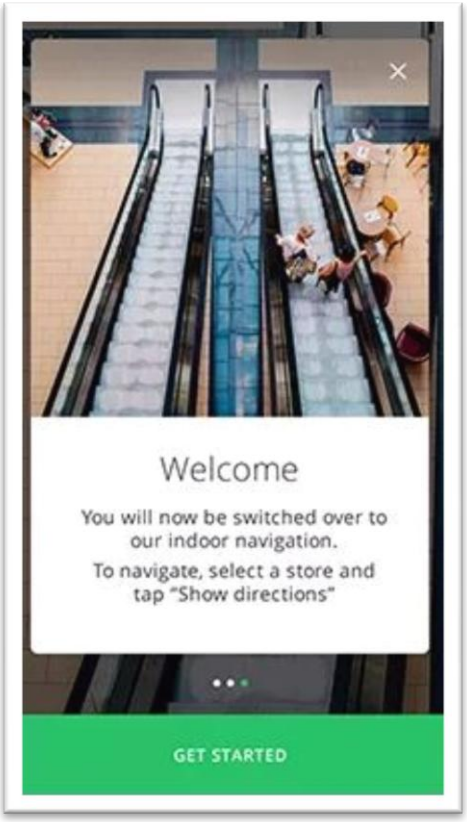


Figure 2.6 : Screenshot for indoor positioning for retail (Senion, 2010)

2.7.2.2 Indoor positioning for healthcare

Indoor positioning for healthcare also play a major role to help in locating staff and equipment and at the same time perform time saving and provide a preferred patient experience. Senion also provide dynamic navigation by taking for patient to go for their respective appointment , guide patient indoors, and check in option.

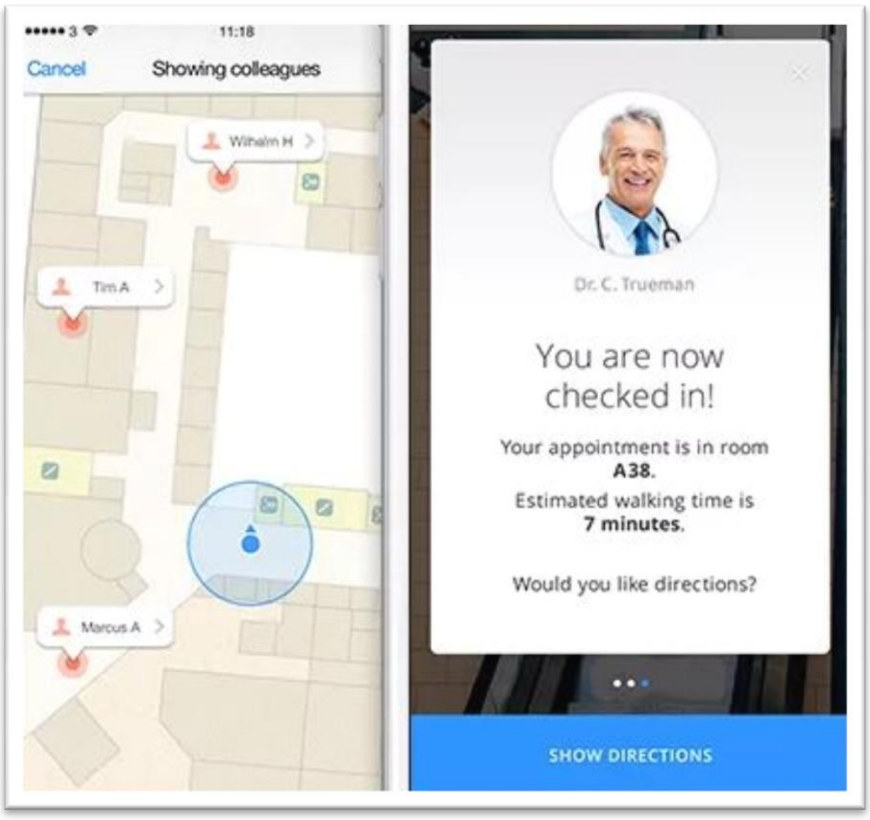


Figure 2.7 : Screenshot for indoor positioning for healthcare (Senion, 2010)

2.7.2.3 Indoor positioning for industry

Indoor positioning application for industry aims to analyze and manage operations. Aside from that, It also helps in tracking the hidden costs, increasing productivity, and analyzing the location of things inside the buildings to reduce waste and streamline operations. Senion also able to provide real-time fleet management ,location-based optimized pick lists and study the resources and manpower that flow throughout the value chain.

2.7.3 Overview of Wifarer Indoor positioning Application

Wifarer is an indoor location navigator that provides accessible location-based content to help users to explore indoor places without getting lost. Besides that, Wifarer is widely used in indoors buildings such as hospitals, museums, shopping centers, airports, universities, and stadiums. Wifarer provides certain important features such as accurate indoor navigation, navigation from user's current location to the destination, maps that are up-to-date, interactive directories, and helpful contents to make its application well performed (WIFARER, 2016). Wifarer is able to track user's status and behavior with its analytics platform and also available for IOS and Android operating system.

2.7.3.1 Indoor positioning for Airports

Wifarer allows airports to help their passengers in navigation to terminals and to acquire useful information by providing passengers correct flight information to warn them when there's a change in flight status, smart coupons to pinpoint location of passengers and provide local content to them, passenger insights to track passenger's status and

behavior, turn by turn paths to provide travel details to avoid missing flights, interactive directories to allow passengers search extra information that will delight their vacation, and wheelchair accessibility to make the disabled people's life easier.

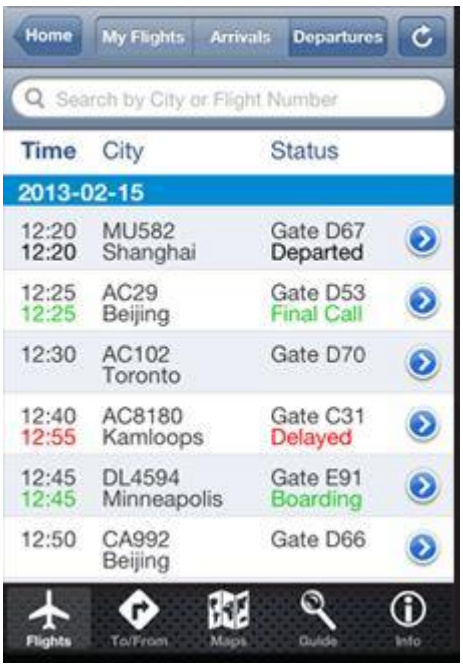


Figure 2.9: Screenshot of indoor positioning for airports (WIFARER, 2016)

2.7.3.2 Indoor positioning for Hospitals

Wifarer allows hospitals to help their patients in navigation by providing patients indoor and outdoor navigation to direct their ways inside and outside the hospital complex with ease, visitor insights to track patient's status and behavior, turn by turn paths to direct visitor to patient's room or clinic in order to avoid missing appointments, interactive directories to allow visitor to search extra information that will delight their visit and wheelchair accessibility to make the disabled people's life easier.

Figure 2.10: Screenshot of indoor positioning for hospitals (WIFARER, 2016)

2.7.3.3 Indoor positioning for Museums

Wifarer allows museums to help their visitors in indoor navigation and tour guidance by providing visitors location based information to sense their location and notify them about the nearby events, visitor insights to track visitor's status and behavior, turn by turn paths to help visitor to search for place to relax, interactive directories to allow visitors to acquire event timetable and gallery details, and indoor positioning to prevent visitor from getting lost.

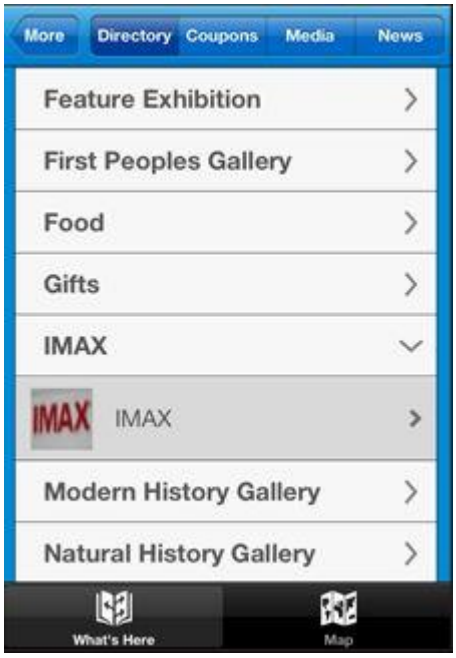


Figure 2.11 : Screenshot of indoor positioning for museums (WIFARER, 2016)

2.7.3.4 Indoor positioning for Retail

Wifarer allows retail to help their customers in getting local content and coupons by providing customers insights to track customer's status and behavior, smart coupons to provide product suggestion for customers, turn by turn paths to navigate customer to their demanded place, wheelchair accessibility to make the disabled people's life easier and location saving that allows customers to save their favourite location for next patronize.

2.7.3.5 Indoor positioning for Stadiums

Wifarer allows stadiums to help their fans in navigation and updating them with special offers around by providing smart coupons to prepare product suggestion for fans, turn by turn paths to navigate fans to the right place, indoor positioning to prevent visitor from getting lost, interactive directories to allow fans to gain access to beverage options, transit information for them to return home easily and customers insights to track customer's status and behavior.

Figure 2.13 : Screenshot of indoor positioning for stadiums (WIFARER, 2016)

2.7.3.6 Indoor positioning for Universities

Wifarer allows universities to help their students, staffs and visitors in navigation throughout the campus and acquire semantic information by providing turn by turn paths for navigating students to the place within the campus, indoor positioning to prevent student from getting lost, location saving to help students to save key locations in the campus, hyper-local content to sense location of students, deliver location-based content and wheelchair accessibility to make the disabled people's life easier.

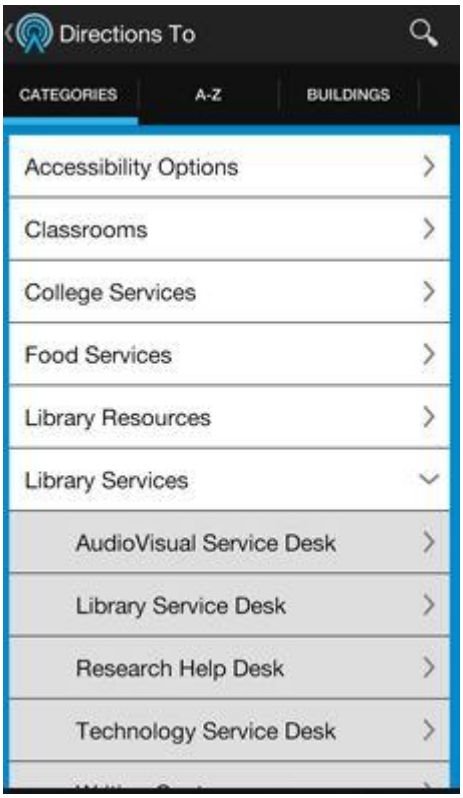


Figure 2.14: Screenshot of indoor positioning for universities (WIFARER, 2016)

Chapter 3: Theoretical Framework

3.1 Introduction to MI-ILP

Mi-ILP is basically a theme park positioning application that allows all application to retrieve existing user's location indoors. Besides that, Mi-ILP uses indoor positioning technology like fingerprinting approach to collect fingerprinting data. There is a tool in Mi-ILP that is used to understand and configure indoor environment and also to test the accuracy and the output correctness of Mi-ILP application. In general, Mi-ILP is currently applicable on Android only and temporary not available on another mobile platform like IOS and window OS.

3.1.1 Overall Flow of the system

3.1.1.1 Description

Figure 3.2 shows the overall procedure of the flow for Mi-ILP theme park positioning application. Details of the step are as stated below:

Step 1: User setups a building profile then follow by adding a map into the building profile.

Step 2: From the building profile, the user clicks to calibrate the building profile and particular map will shows for the user to pinpoint location.

Step 3: For each labeled location pinpointed, the user has to collect at least 10 fingerprint data by using either WIFI aggregation or BLE aggregation.

Step 4: After collecting the fingerprint data, the user shall proceed to the data processing option

Step 5: Either kNN algorithm or Bayesian algorithm is used in processing the fingerprint data collected.

Step 6: After the fingerprint data being processed, User should be able to track their current location

3.1.1.2 Flow chart of Mi-ILP theme park positioning application

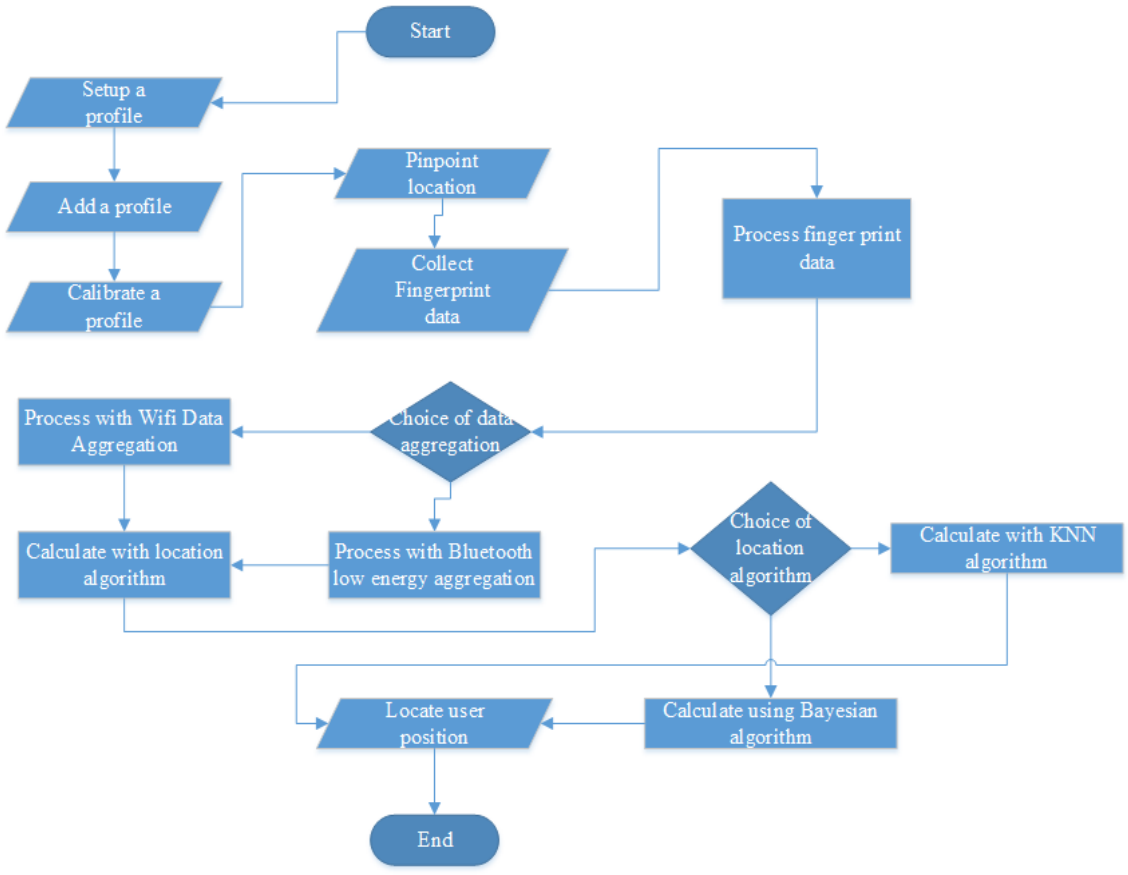


Figure 3.2: Flow chart of Mi-ILP theme park positioning application

3.1.2 Overall Flow of the chat function

3.1.2.1 Description

Figure 3.3 shows the overall procedure of the flow for chat function. Details of the step are as stated below:

Step 1: User selects the chat option from the positioning page.

Step 2: User enters the provided server ip address and name in order to connect to the server.

Step 3: User subscribes to a topic and send messages under his/her subscribed topic.

3.1.2.2 Flow chart of Mi-ILP theme park positioning application

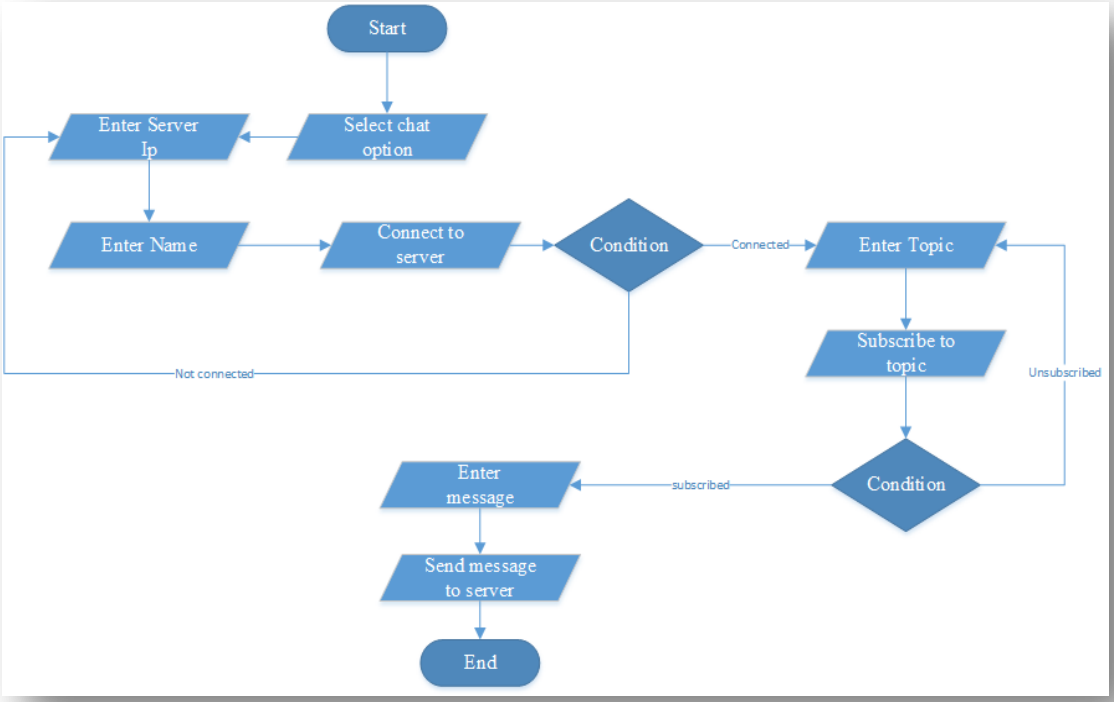


Figure 3.3: Flow chart of chat function

3.1.3 Use Case

3.1.3.1 Description

a) Administrator can sets up a profile. After setup, administrator can proceed with profile adding, follow by calibrating a profile, pinpoint a location and collect fingerprint data.

b) Administrator can process fingerprint data by using either WIFI or BLE aggregation and then only can pre-process the raw fingerprint data for location algorithm. Lastly only follow by locating position.

c) The user can request location. He/ She can also communicate with other users by connecting to the server and subscribe to a topic. Upon subscription, He/ She can only send messages to other users under the specific topic and the server will broadcast the message sent from one user to another users.

3.1.3.2 Use Case of the Theme park positioning system

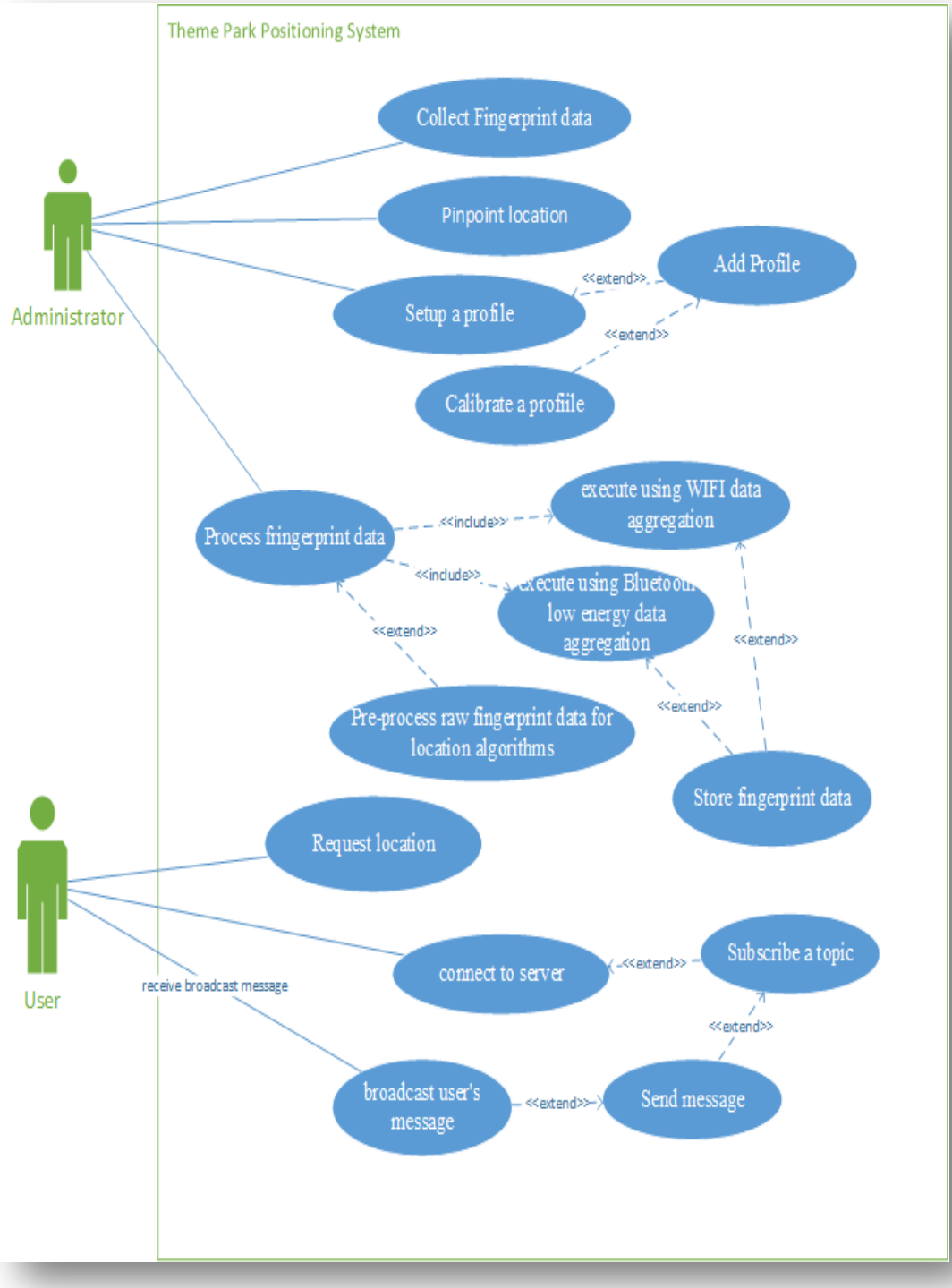


Figure 3.4 Use Case of the Theme park positioning system

3.1.4 Sequence Diagram

3.1.4.1 Description:

Based on figure 3.5, Sequence diagram is to illustrate the step for setting up a profile. Administrator selects the ‘add’ option on profile list page and follow by selecting the search option on profile setup page. After that, image folder will pop out and administrator selects map from it and follow by labeling the map information on profile Setup page. Lastly, the complete map image details will be displayed on profile list page.

3.1.4.2 Sequence Diagram for setting up profile:

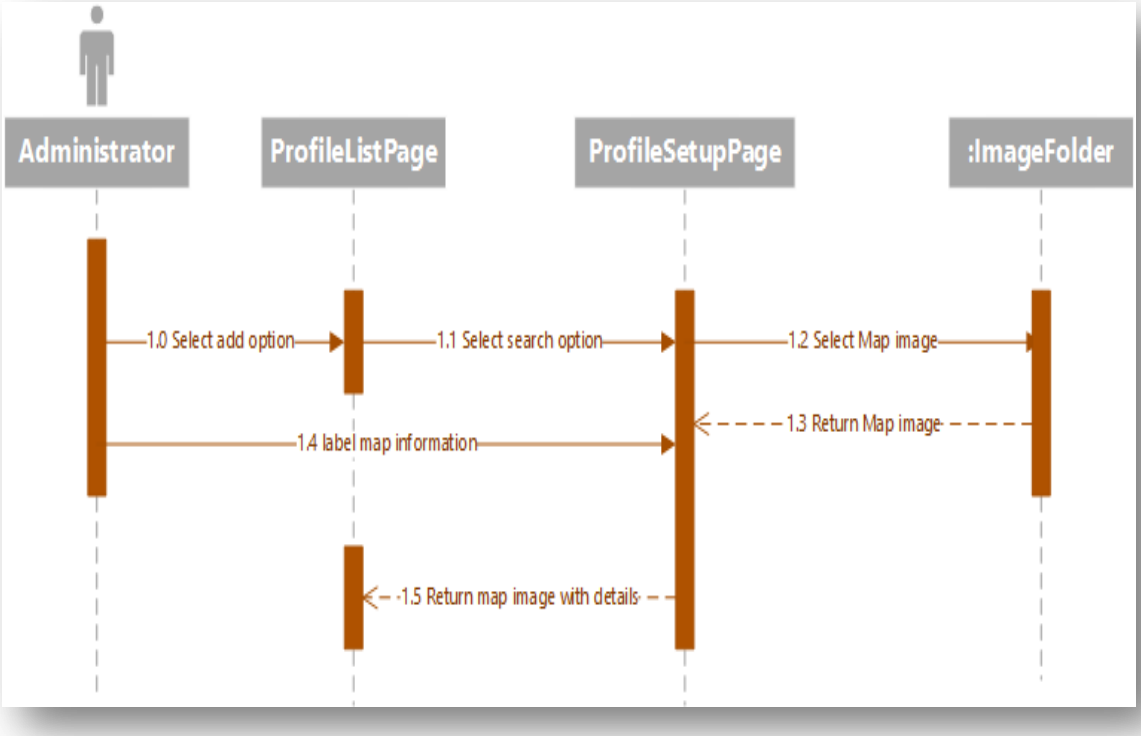


Figure 3.5 Sequence diagram for Setting up profile

3.1.4.3 Description:

Based on figure 3.6, Sequence diagram is to illustrate the step of collecting the fingerprint data. The administrator selects the calibrate option on ProfileListPage then only proceed to calibration but there are conditions in the proceeding. If the map is valid, then the administrator can proceed to calibration else then return back to ProfileListPage. After that, Administrator has to select a pinpoint within the map and follow by clicking on 'Play' button to start collecting fingerprint data.

3.1.4.4 Sequence diagram for collecting fingerprint data:

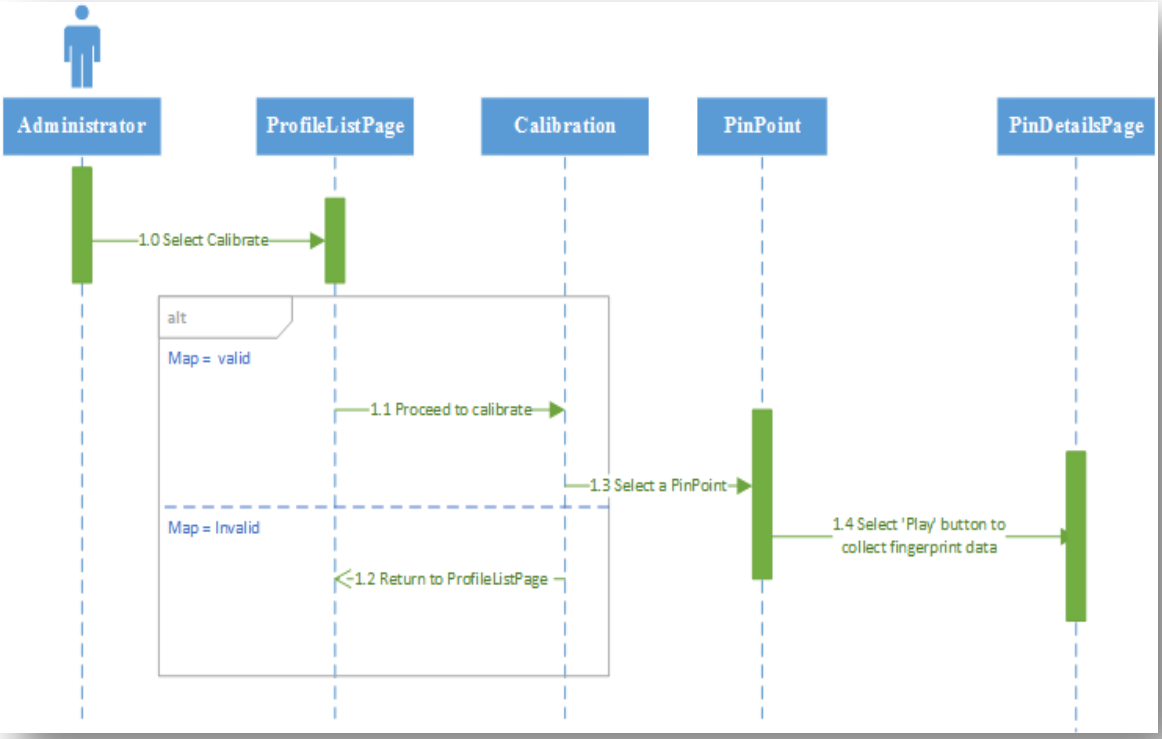


Figure 3.6 Sequence diagram for collecting fingerprint data

3.1.4.5 Description:

Based on figure 3.7, The sequence diagram illustrates the steps required for data processing. First selects the process data option from the Mi-ILP application and then followed by selecting either WIFI or Bluetooth data aggregation based on the condition to perform the calculation for fingerprint data. If the WIFI signal exists then user shall proceed with the calculation by using WIFI signal else administrator has to perform calculation by using BLE signal. After the calculation is performed, the computed location data will be sent and stored in the database.

3.1.4.6 Sequence diagram for data processing:

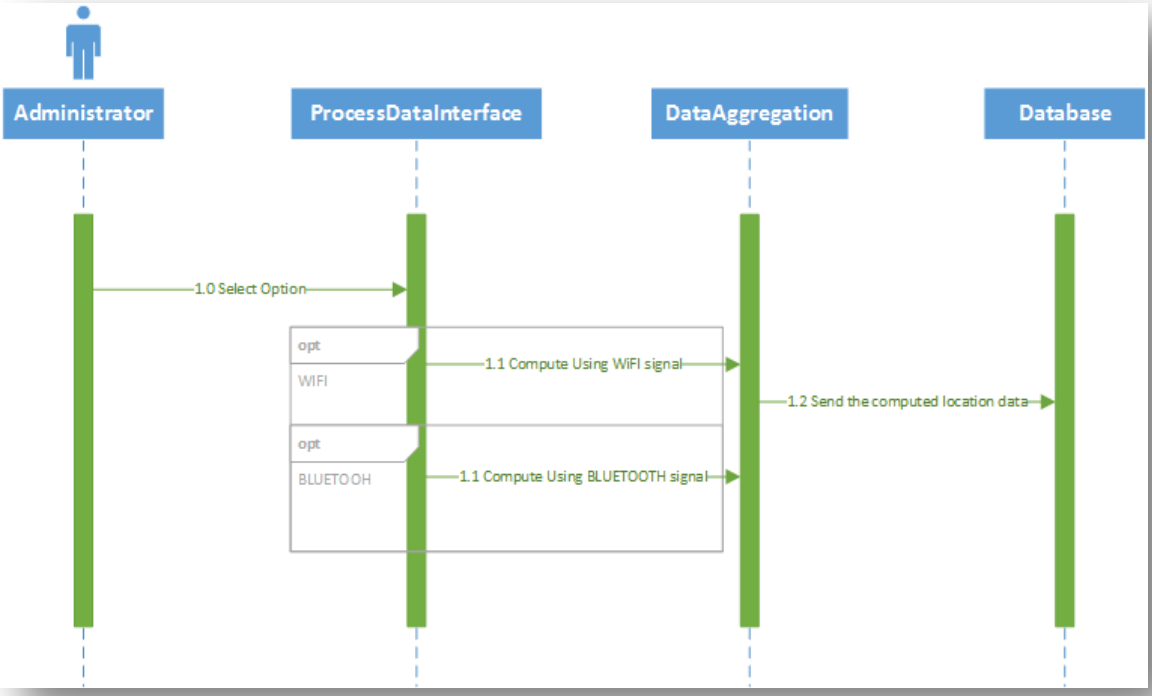


Figure 3.7 Sequence diagram for data processing

3.1.4.7 Description:

Based on figure 3.8, Sequence diagram illustrates the steps for location request. First, the user request location from Mi-ILP 1.1 tools then the Mi-ILP request location data which included the event timetable data from the database. Database proceeds to return location data to Mi-ILP Tool upon request.

3.1.4.8 Sequence diagram for location request:

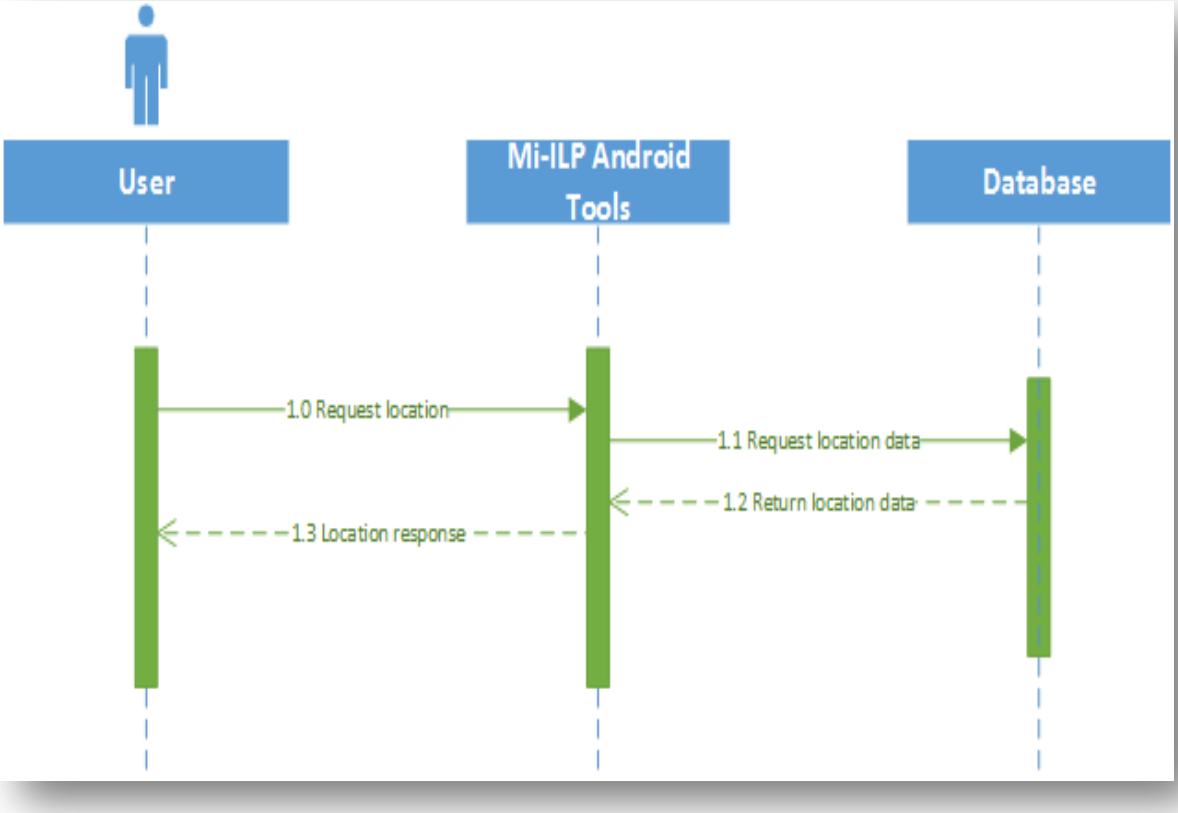


Figure 3.8 Sequence diagram for location request

3.1.4.9 Description:

Based on figure 3.9, Sequence diagram illustrates the steps for communication between users. First, User selects ‘chat’ option on the ‘positioning’ page and followed by connecting to server by entering server IP and name. If the user connected to the server then he/she can only enter topic name and subscribe to a topic else he/ she is not allowed to subscribe to topic. Furthermore, If the user subscribed to a topic then only can send message to the server. When user sends message the server, his/her message will be broadcast to other users to see and user needs to subscribe under the same topic in order to communicate with each other.

3.1.4.10 Sequence diagram for communication between users:

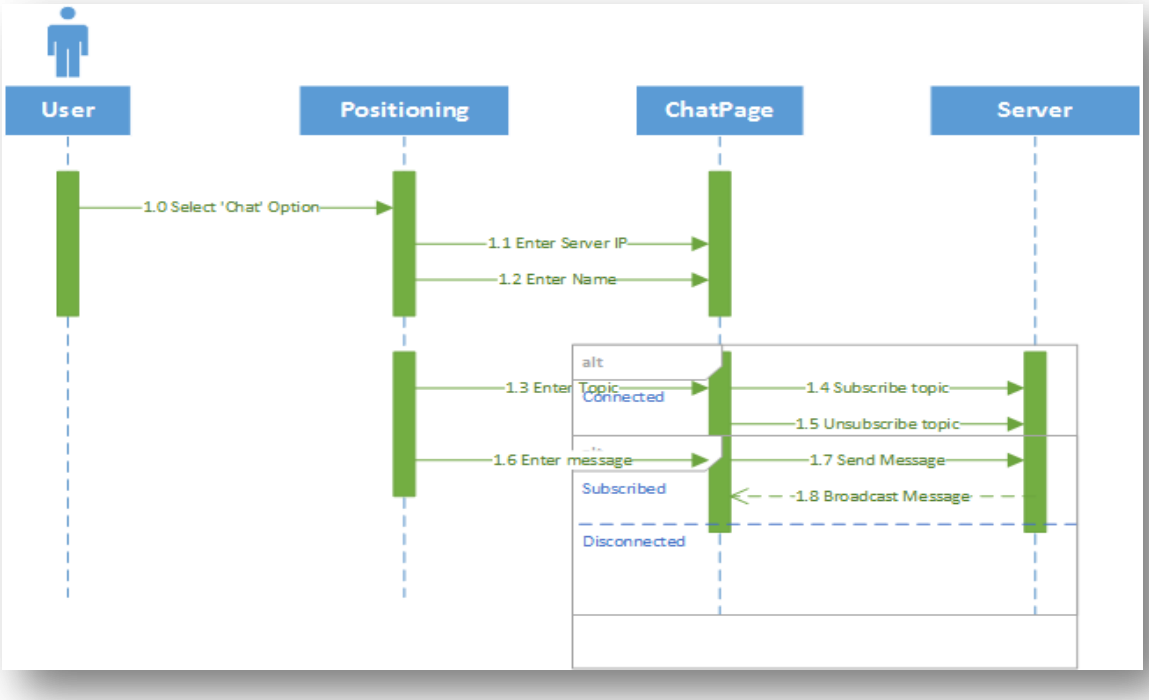


Figure 3.9 Sequence diagram for communication between users

3.1.5 Data Flow Diagram

3.1.5.1 Description

Based on figure 3.10, the data flow diagram illustrates the overall flow for theme park positioning system. Administrator enter data while both data process and calibration process state are processing the data and send to the theme park positioning system whereas the theme park positioning system sends location confirmation and event timetable data as a message to the server and the server broadcast message to the theme park positioning system. From that, theme park positioning system sends the computed data to the database and directs the computed location and event suggestion to the user.

3.1.5.2 Context diagram for theme park positioning system

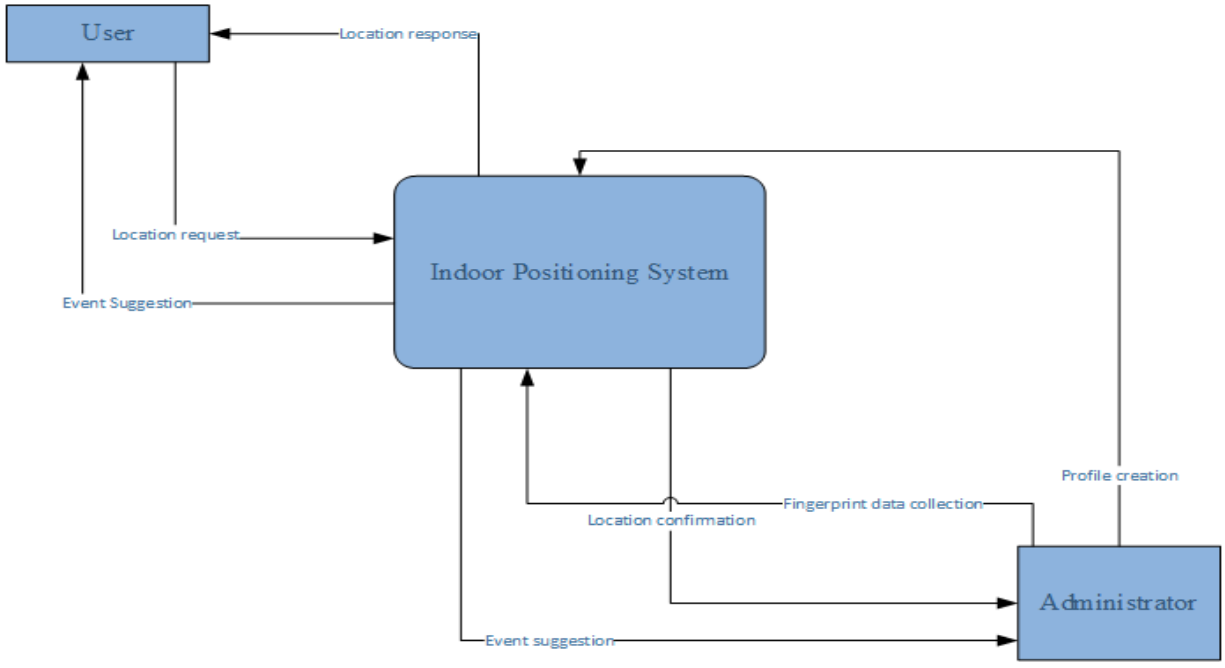


Figure 3.10 Context diagram for theme park positioning system

3.1.6 Data Flow Diagram for Theme park positioning System

3.1.6.1 Description

Based on figure 3.11, the data flow diagram illustrates the overall flow for the theme park positioning system. Administrator enters data while both data process and calibration process state are processing the data and send to the theme park positioning system whereas the theme park positioning system sends location confirmation and event timetable data as messages to the server and the server broadcast the message back to the theme park positioning system. From that, theme park positioning application sends computed data to the database and direct the computed location and event suggestion to the user.

3.1.6.2 Data flow diagram for theme park positioning system

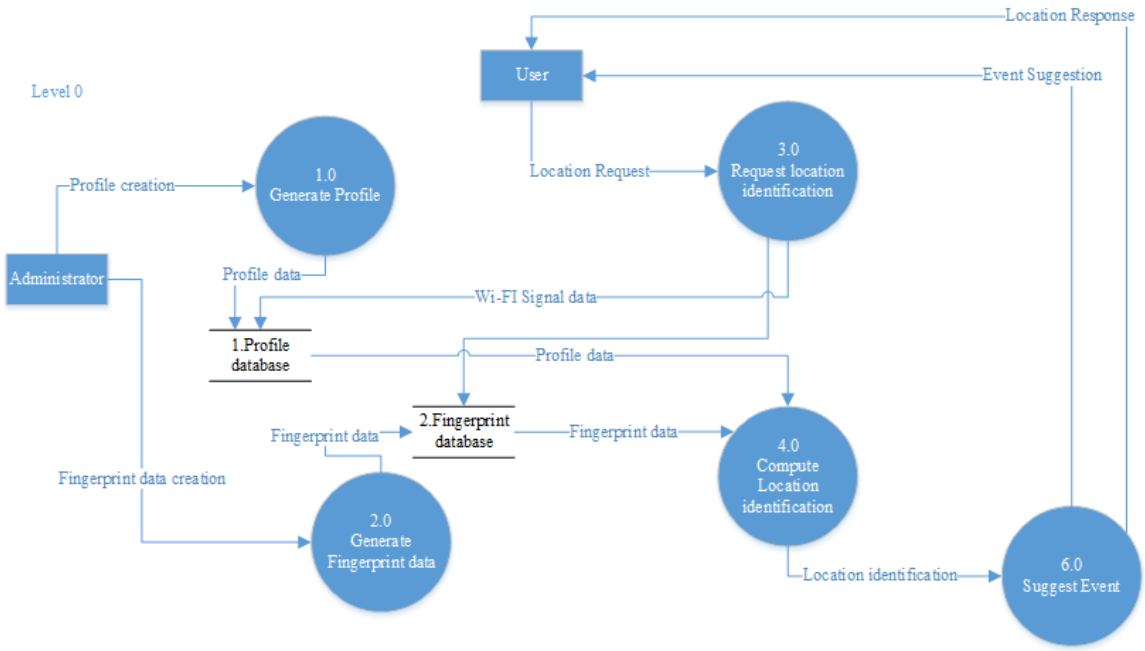


Figure 3.11 Data flow diagram for theme park positioning system

3.1.7 System Requirement

There are few system requirements that needed to be taken into consideration which are as stated below:

a) The minimum software requirement for this project is to use Smartphone-based mobile devices to collect fingerprinting data and at least Android 4.3 (Jelly Bean) of the operating system.

b) The minimum hardware requirement for this project is to use dual-core 2.3GHz of hardware processor, 1GM RAM of memory and 8GB of storage.

3.1.8 Survey on Theme park positioning application in a theme park

A survey on theme park positioning application in a theme park is being carried out in the public. The result below shows the response and feedback from the public.

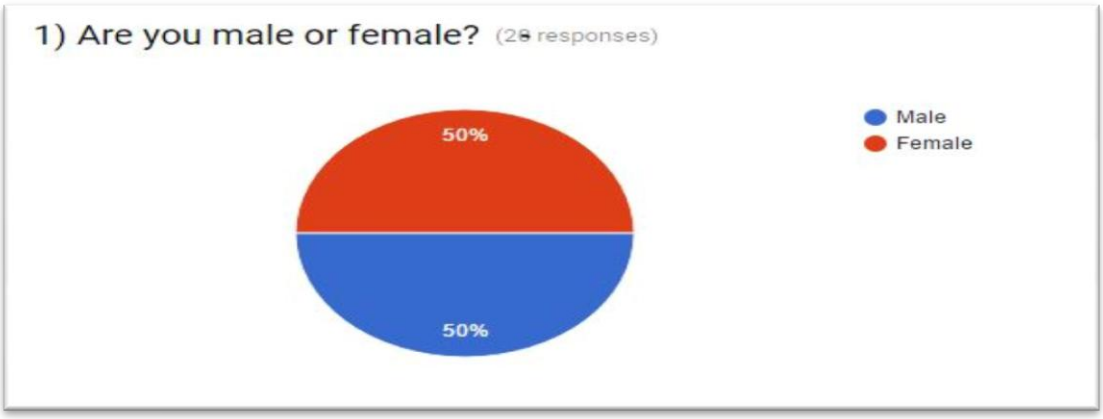


Figure 3.12: Are you male or female?

From the pie chart above, it can be clearly seen that 28 respondents are participated in this survey. 50% of the respondents are male and another 50% are female.

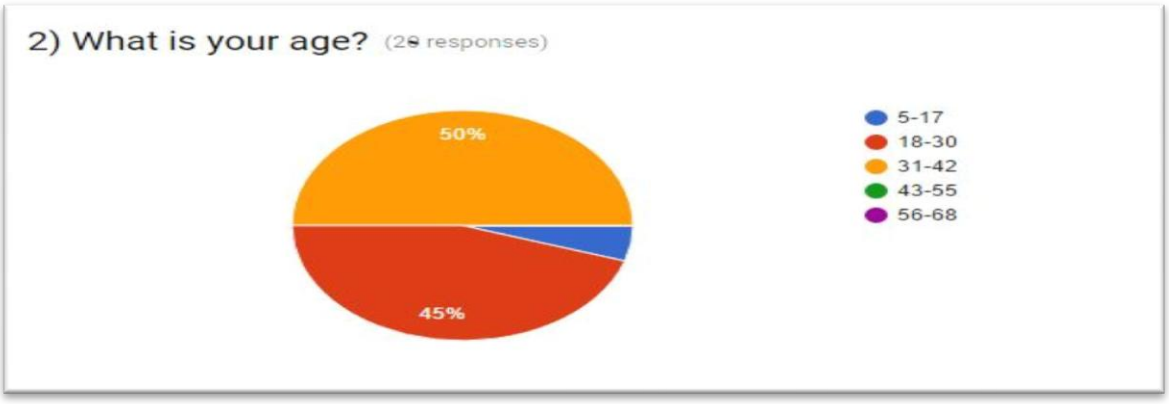


Figure 3.13: What is your age?

From the pie chart above, it can be clearly seen that 50% of respondents have an age ranged from 31 to 42, 45% of respondents have an age ranged from 18 to 30, and only a small amount of 5% of the respondents have an age ranged from 5-17.

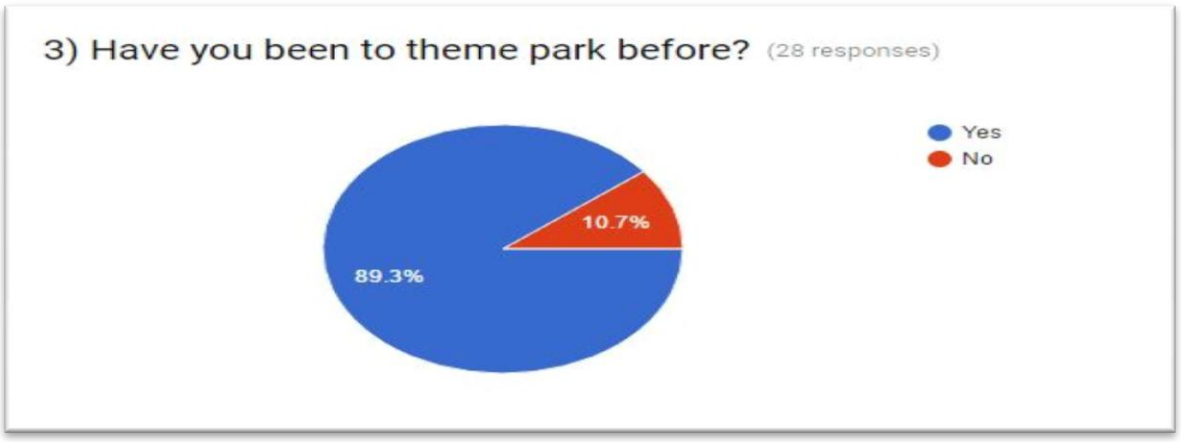


Figure 3.14: Have you been to theme park before?

From the pie chart above, Majority which is 89.3% of the respondents have been to theme park before while only 10.7% of the respondents have not been to theme park.

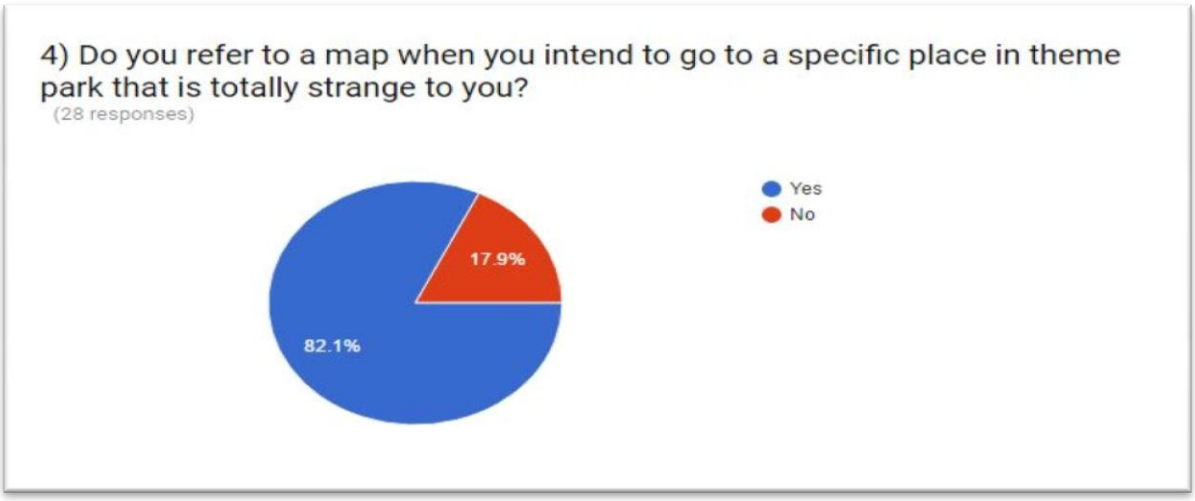


Figure 3.15: Do you refer to a map when you intend to go to a specific place in theme park that is totally strange to you?

From the pie chart above, it can be clearly seen that 82.1% of the respondents will refer to a map when they are planning to go to a strange place in theme park while only 17.9% of the respondents will not refer to a map

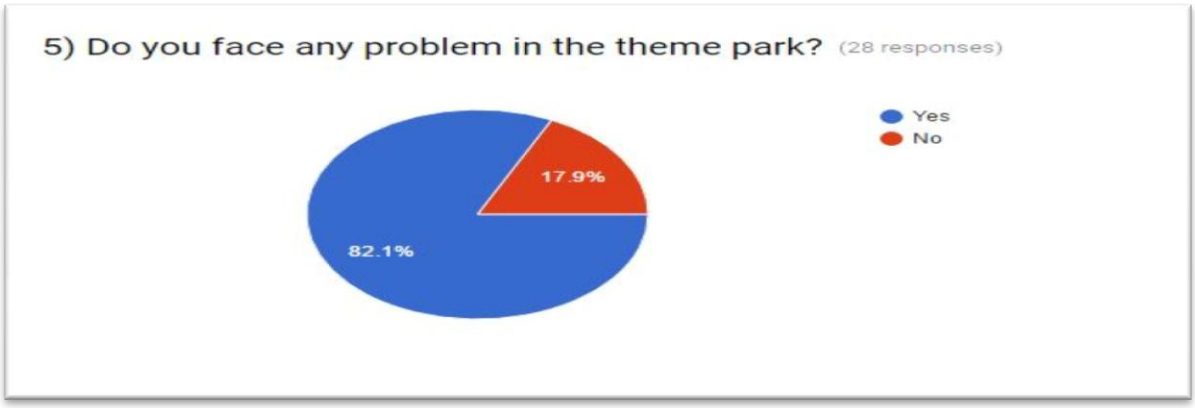


Figure 3.16: Do you face any problem in the theme park?

From the pie chart above, it can be clearly seen that 82.1% of the respondents are facing problems in the theme park while only 17.9 of the respondents are not facing any problems.

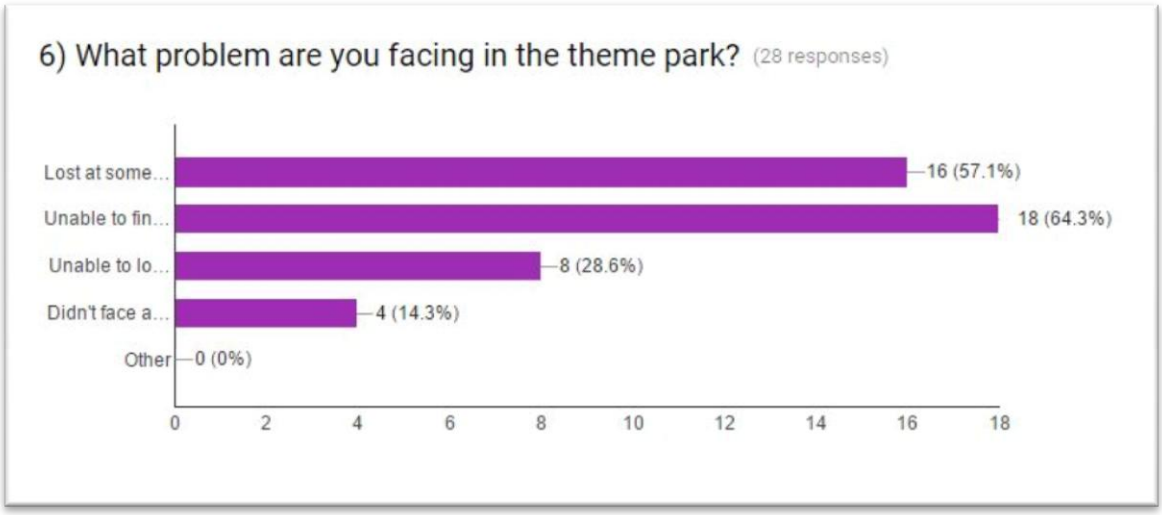


Figure 3.17: What problem are you facing in the theme park?

From the pie chart above, it clearly shows that 57.1% of the respondents lost at somewhere in the theme park, 64.3% of the respondents are unable to find the nearby events, 28.6% of the respondents are unable to locate their friends or family members in the theme park, and only 14.3% of the respondents didn't face any problem in the theme park. There is no respondent face other problems that are not stated in the list.

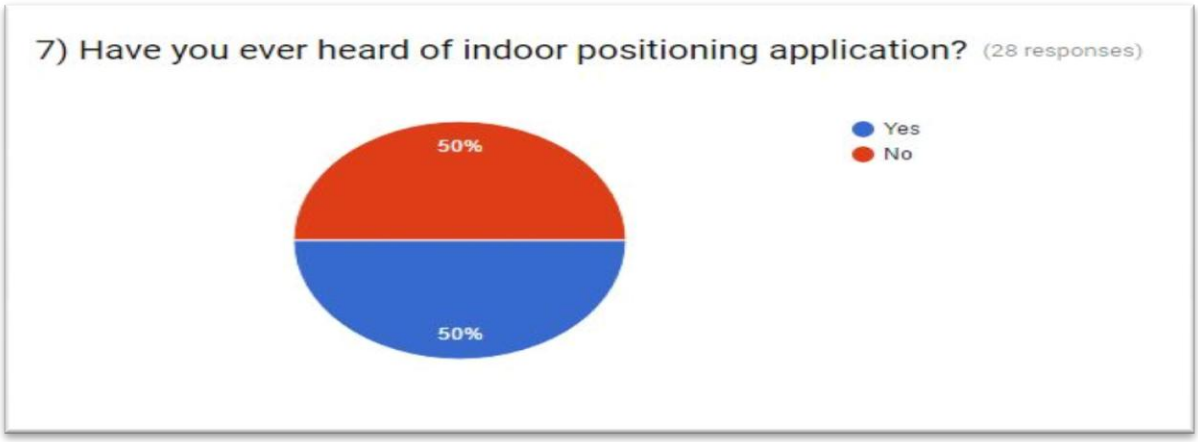


Figure 3.18: Have you ever heard of theme park positioning application?

From the pie chart above, It clearly shows that 50% of the respondents have heard about the theme park positioning application while another 50% of the respondents have not heard about the theme park positioning application.

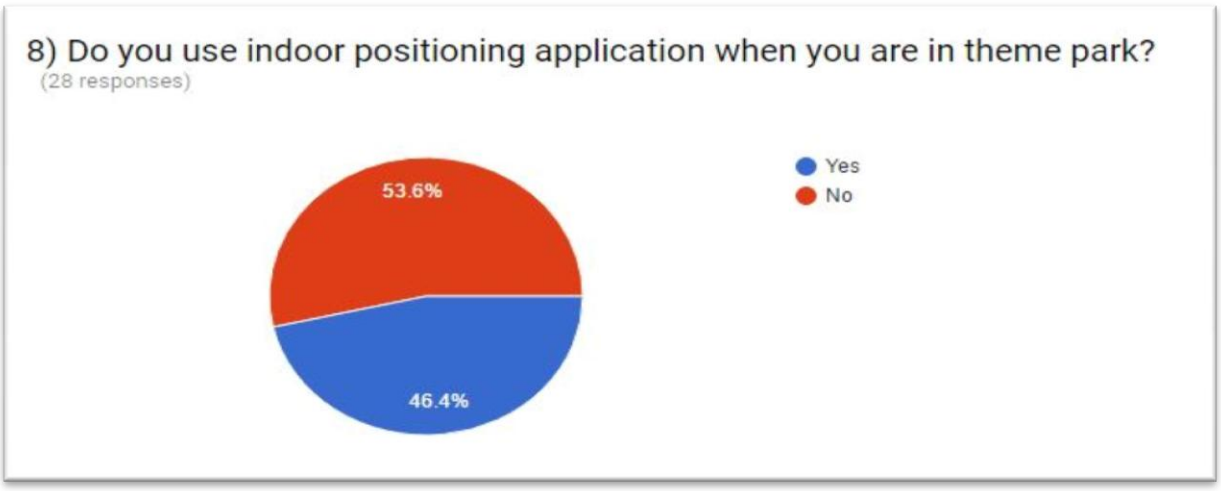


Figure 3.19: Do you theme park positioning application when you are in a theme park?

From the pie chart above, It clearly shows that 46.4% of the respondents use theme park positioning application when they are in the theme park and 53.6% of the respondents are not using it in them park.

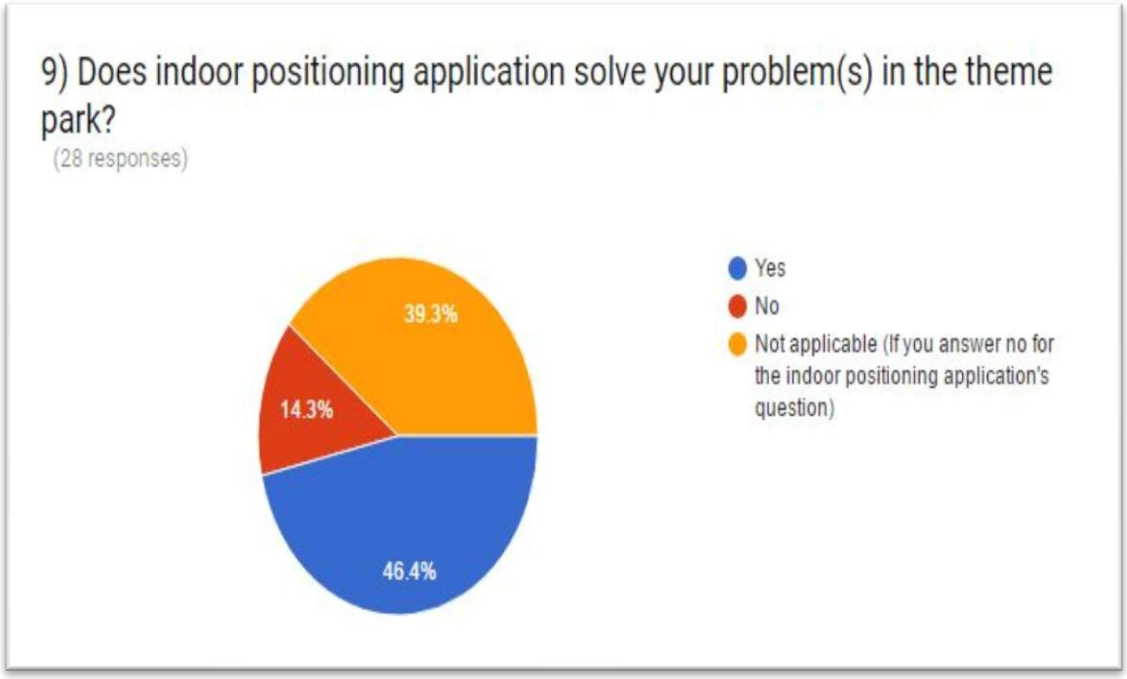


Figure 3.20 Does theme park positioning application solves your problem(s) in the theme park?

From the pie chart above, it clearly shows that theme park positioning application solves problems that faced by 46.4% of the respondents in the theme park but it does not solve another 14.3% of the respondent's problem. Theme park positioning application is not applicable for the rest of 39.3% of the respondents as they answered no in the 'do you face any problem in the theme park' question.

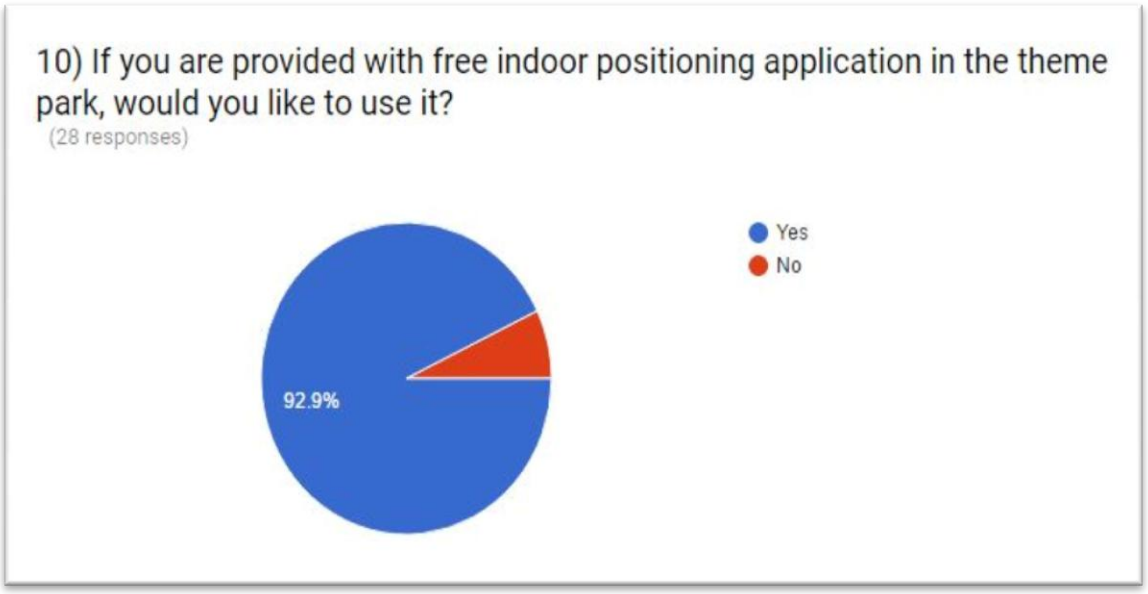


Figure 3.21: If you are provided with free theme park positioning application in the theme park, would you like to use it?

From the pie chart above, it clearly shows that 92.9% of respondents will use the theme park positioning application if it is provided free to them while 7.1% of the respondents will not use it even though it is provided free.

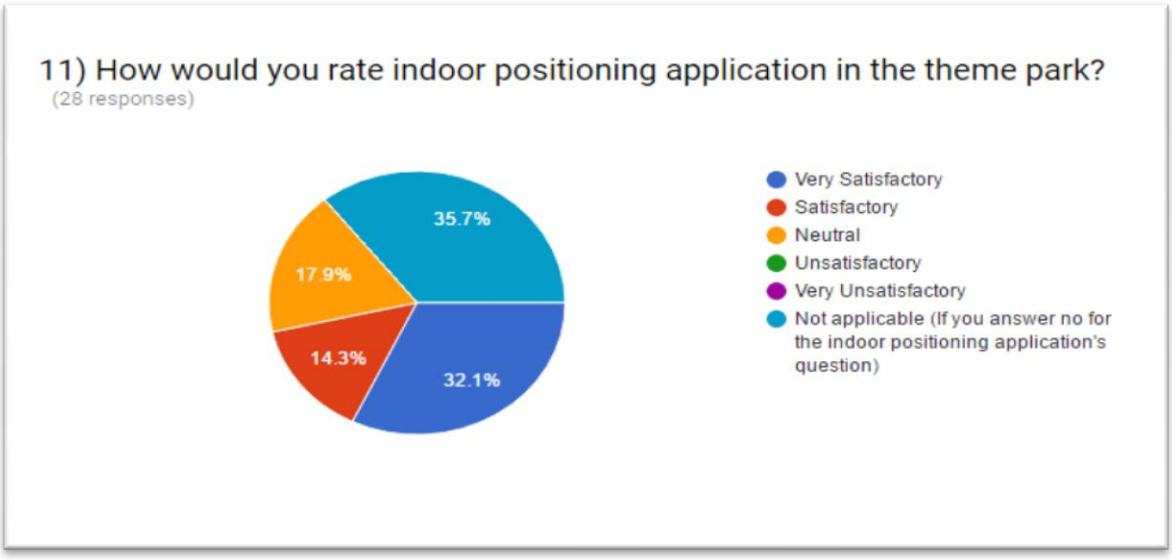


Figure 3.22: How would you rate theme park positioning application in the theme park?

From the pie chart above, it clearly shows that 32.1% of the respondents rated very satisfactory for theme park positioning application, 14.3% of the respondents rated satisfactory, 17.9% of the respondents rated neutral and 35.7% of the respondents rated not applicable as they answer no in the ‘do you face any problem in the theme park?’ question.

In conclusion, based on the result of the survey, Most of the respondents are unaware of theme park positioning application but also needed it to solve their problem found in the theme park. Therefore, theme park positioning plays an important role in helping the respondents to solve their problem in the theme park.

Chapter 4: Methodology

4.1 Overview of the implementation plan

In this project, there are 3 major steps to be executed in order to acquire correct output for locating the position of the user. The 3 major steps are profiles setup, data process, and location positioning. All these steps are executed on an android application called Mi-ILP 1.1 Tools. Aside from that, there is a function called ‘view sensors’ which is used to detect nearby sensors, WI-FI and Bluetooth low energy signal. The figure below shows clearer steps on the ways of proper execution of the location positioning using Mi-ILP 1.1 Tools.

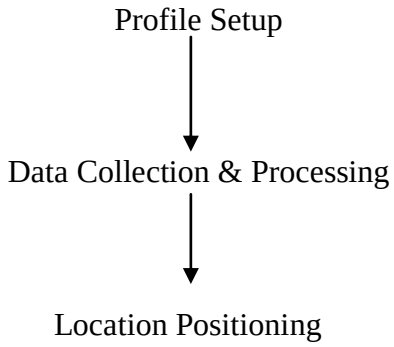


Figure 4.1 Flowchart of the steps for location positioning

4.1.1 Profile Setup

- Step 1 : Open Mi-ILP 1.1 Tools

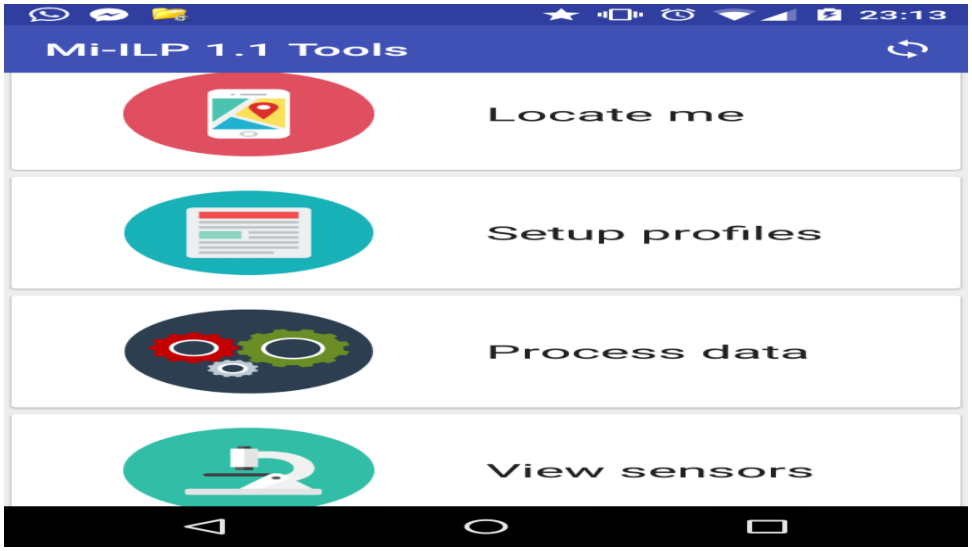


Figure 4.2 Mi-ILP 1.1 Tools Interface

- Step 2 : Select Setup profiles

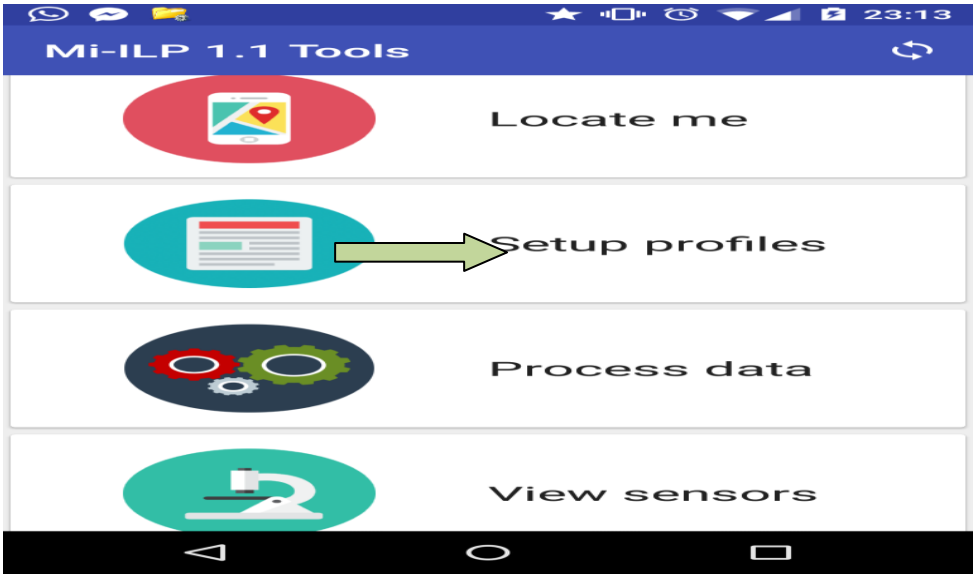


Figure 4.3 Setup profile in Mi-ILP 1.1 Tools interface

- Step 3 : Select '+' option to insert map into the profile

Figure 4.4 Setup profile's interface

- Step 4 : Select 'search' option to get the map

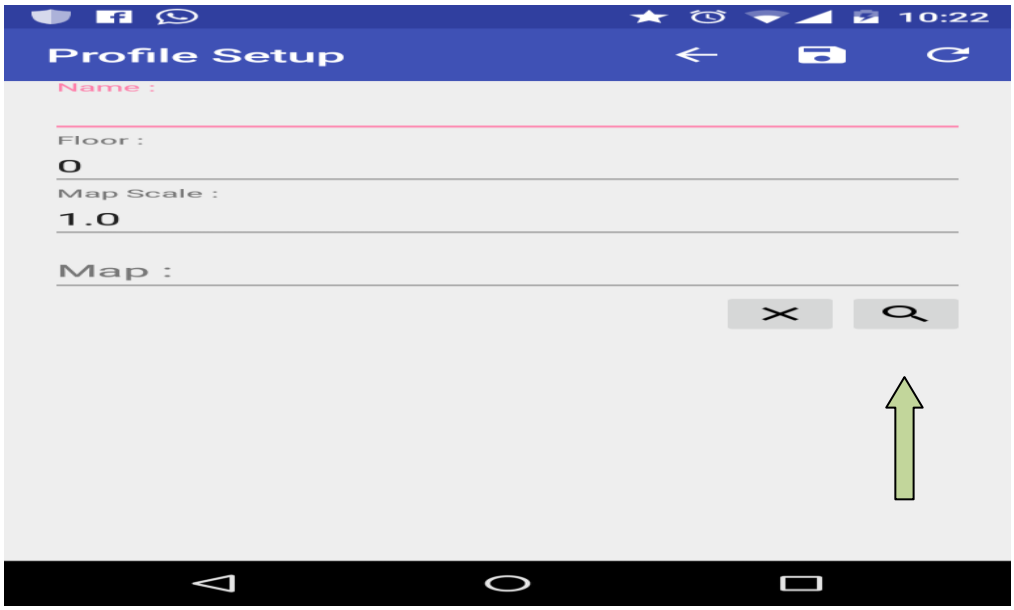


Figure 4.5 interface of '+' option'

- Step 5 : Select map from the file manager

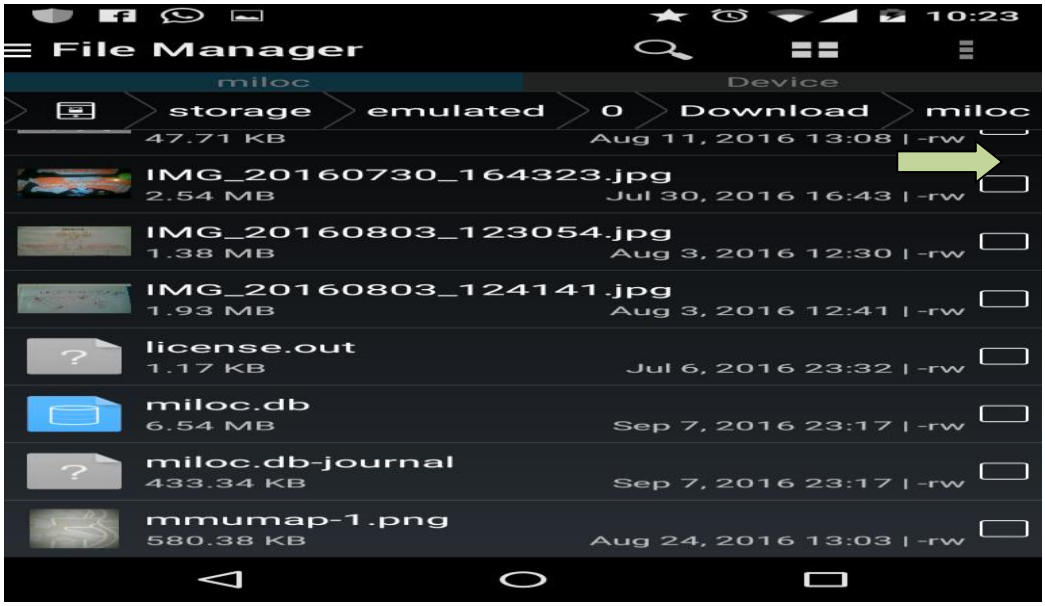


Figure 4.6 interface of search option via file manager

- Step 6 : Select ‘save’ option after selecting the map

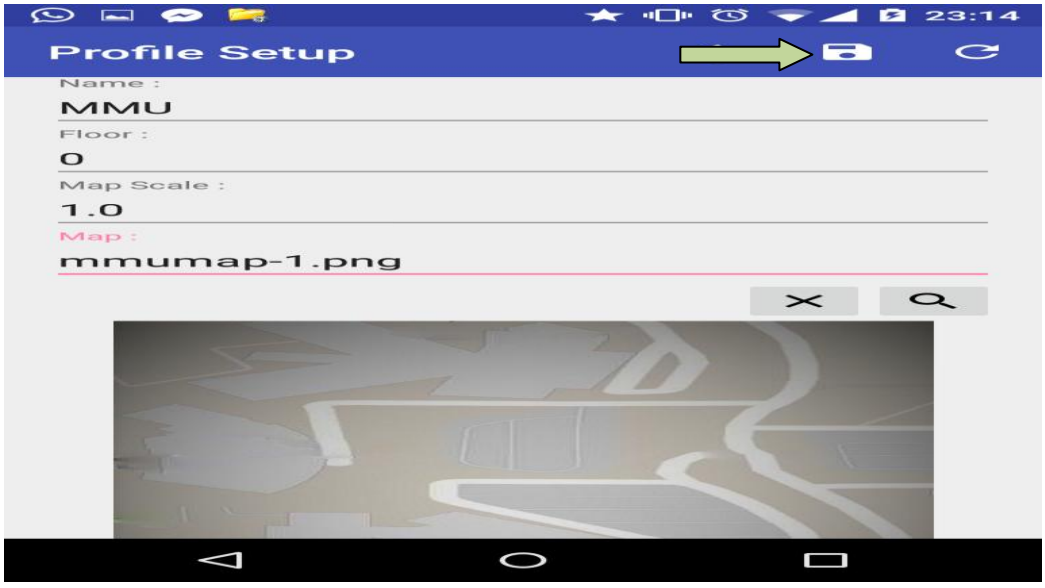


Figure 4.7 Interface of profile setup

4.1.2 Data Collection & Processing

- Step 1 : Back to setup profile interface and select ‘calibrate’ option

Figure 4.8 Interface of profile setup

- Step 2 : Map appears and pinpoint on a fixed spot then a red dot will shows

Figure 4.9 Interface of map calibration

- Additional step : if the pinpoint is wrong , there is a remove option.

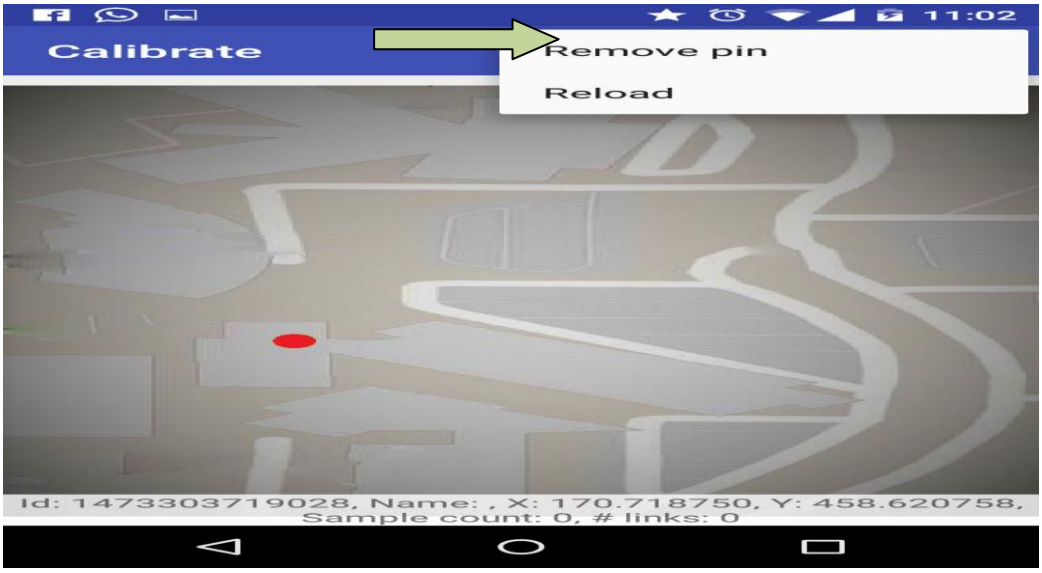


Figure 4.10 Interface of map calibration

- Step 4: Select the ‘label’ option and place a label on the correct pin.

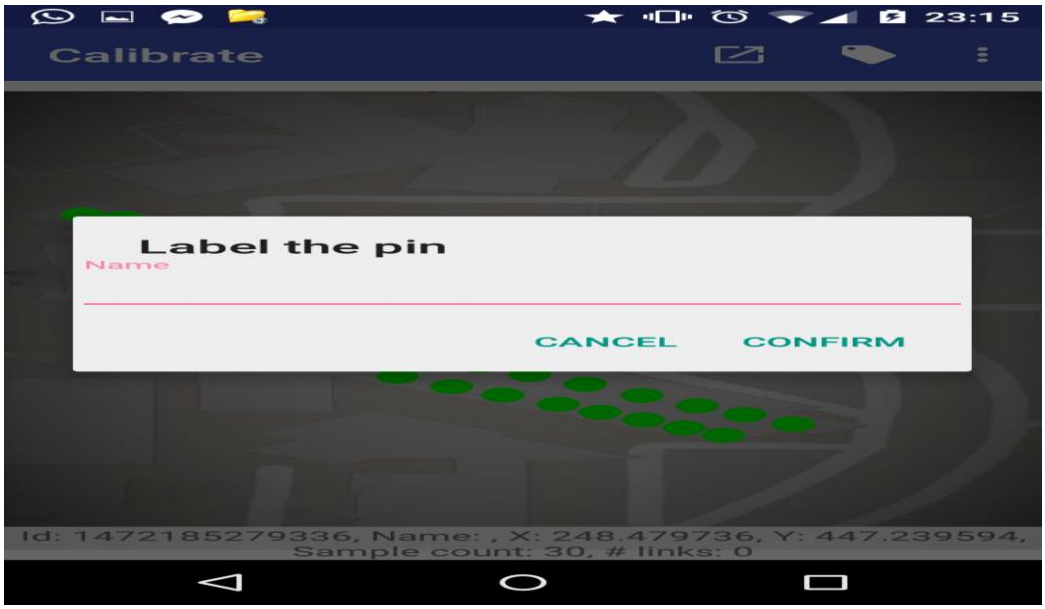


Figure 4.11 Interface of map calibration

- Step 5 : Select ‘calibrate’ option to collect fingerprint data

Figure 4.12 Interface of map calibration

- Step 6 : Select ‘play’ option to start collecting fingerprint data using WI-FI

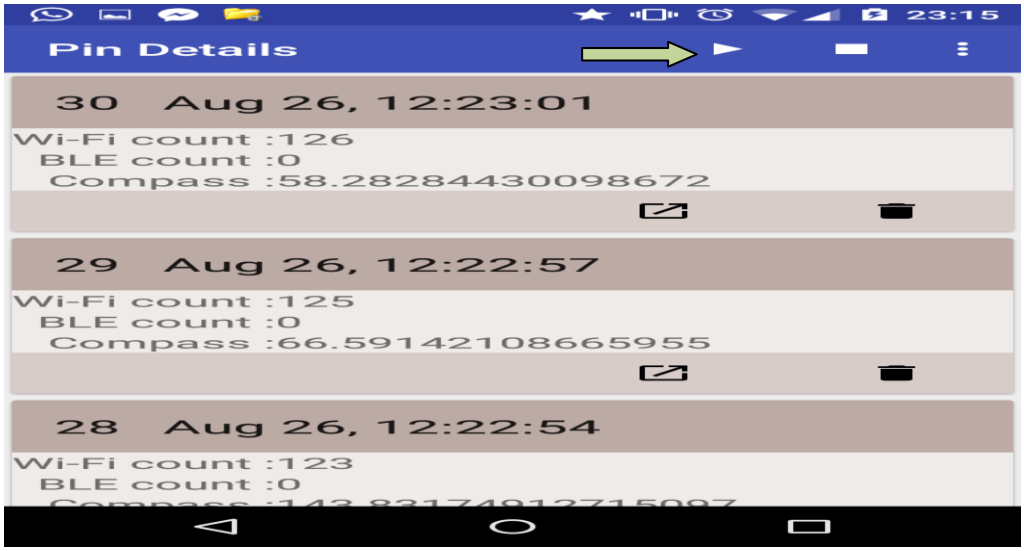


Figure 4.13 Interface of pin details

- Step 7 : Back to main interface and select process data

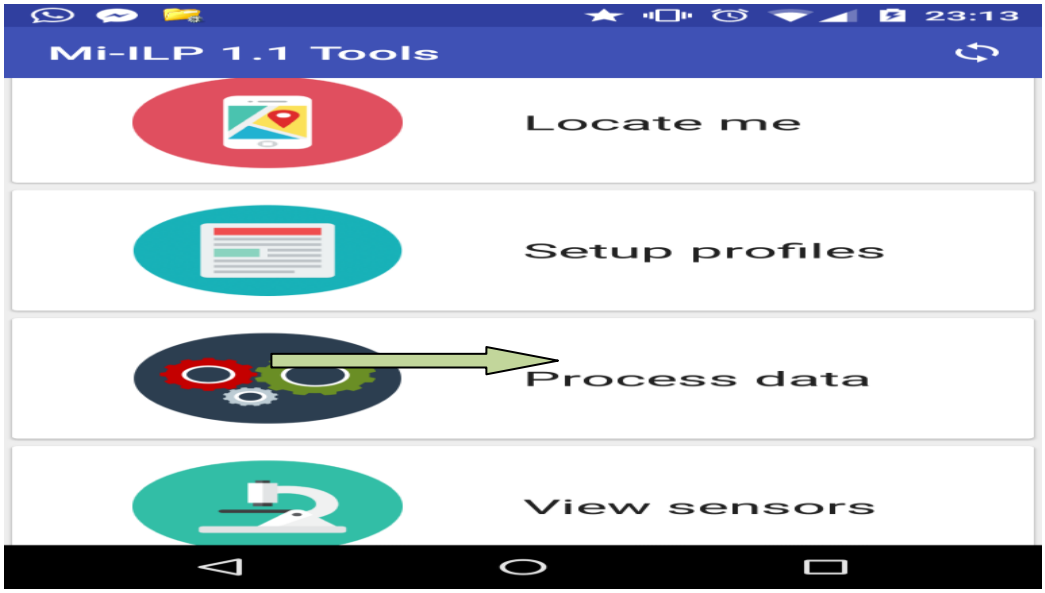


Figure 4.14 Interface of Mi-ILP 1.1 Tools

- Step 8 : Select ‘play’ option on the interface of process data

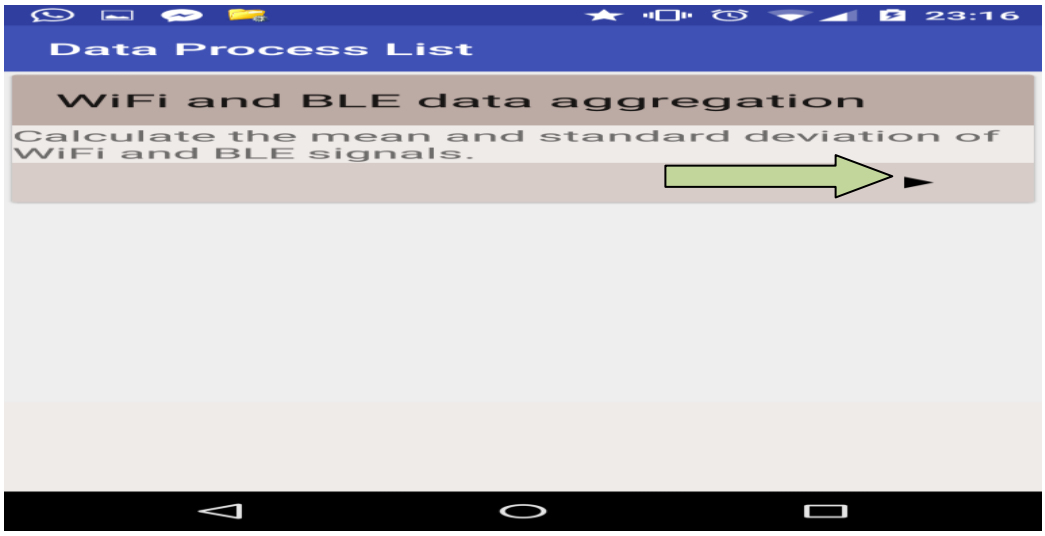


Figure 4.15 Interface of process data

- Step 9 : process fingerprint data

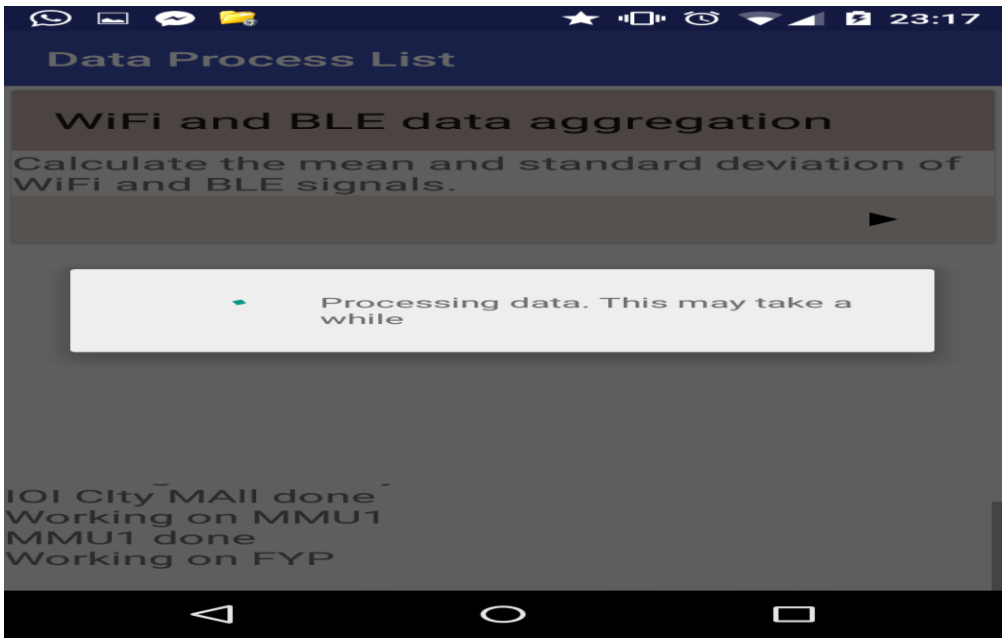


Figure 4.16 Interface of process data

- Step 10 : complete processing of fingerprint data

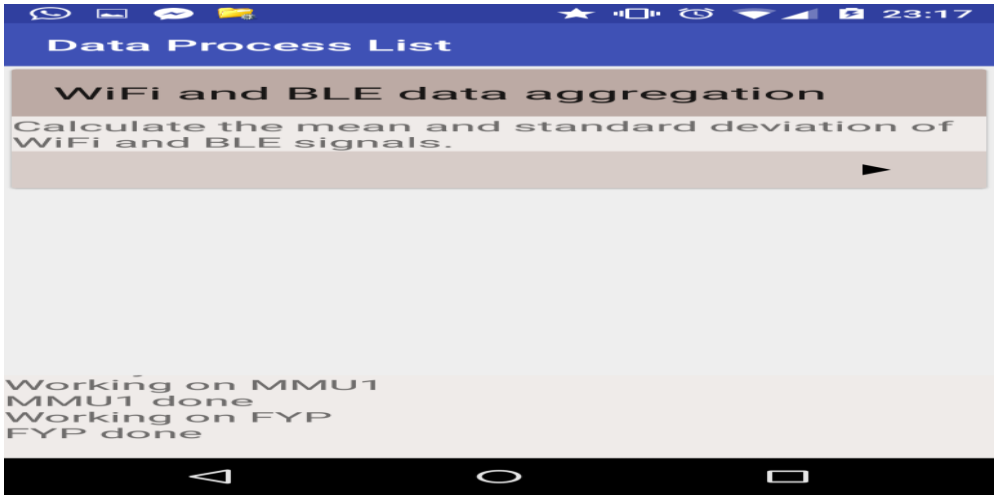


Figure 4.17 Interface of process data

4.1.3 Location Positioning

- Step 1 : Select ‘Locate Me’ from the Mi-ILP main interface

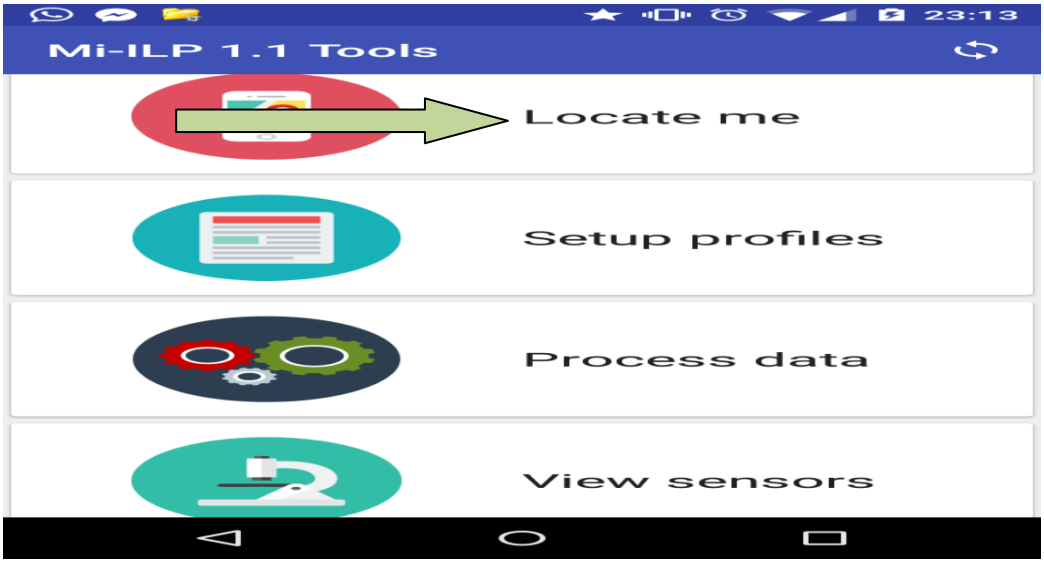


Figure 4.18 Interface of Mi-ILP 1.1 Tools.

- Step 2 : Select pinpoint to get location.

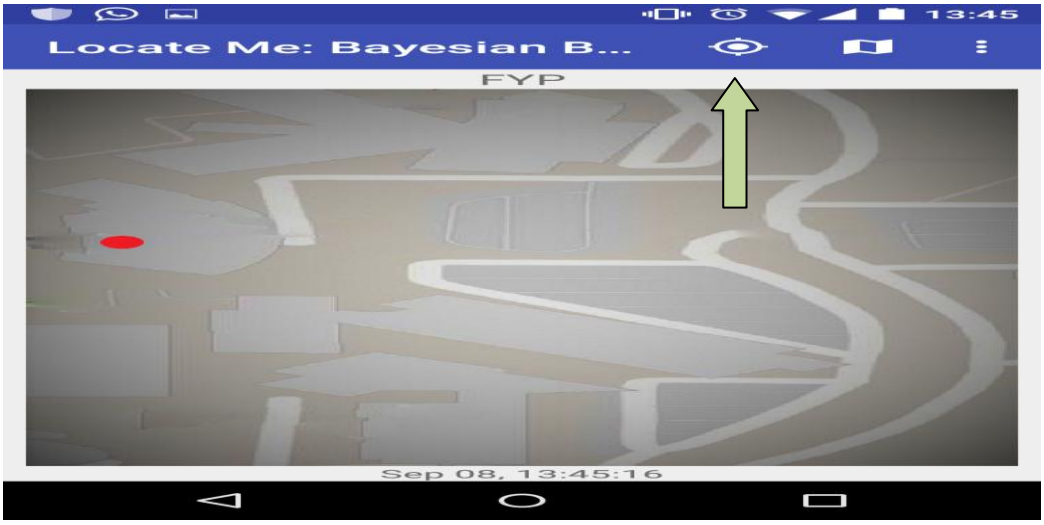


Figure 4.19 Interface of ‘Locate Me’

4.1.4 Extra function for Mi-ILP 1.1 Tools

4.1.4.1 Change of algorithm to estimate location

- Step 1 : Select the ‘triple dots’ option

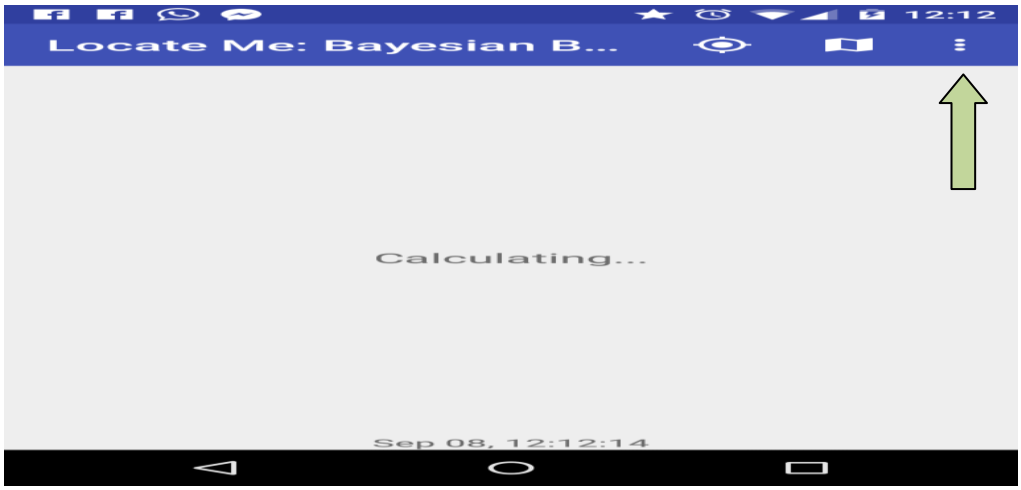


Figure 4.20 Interface of ‘Locate Me’

- Step 2 : Change Bayesian Algorithm

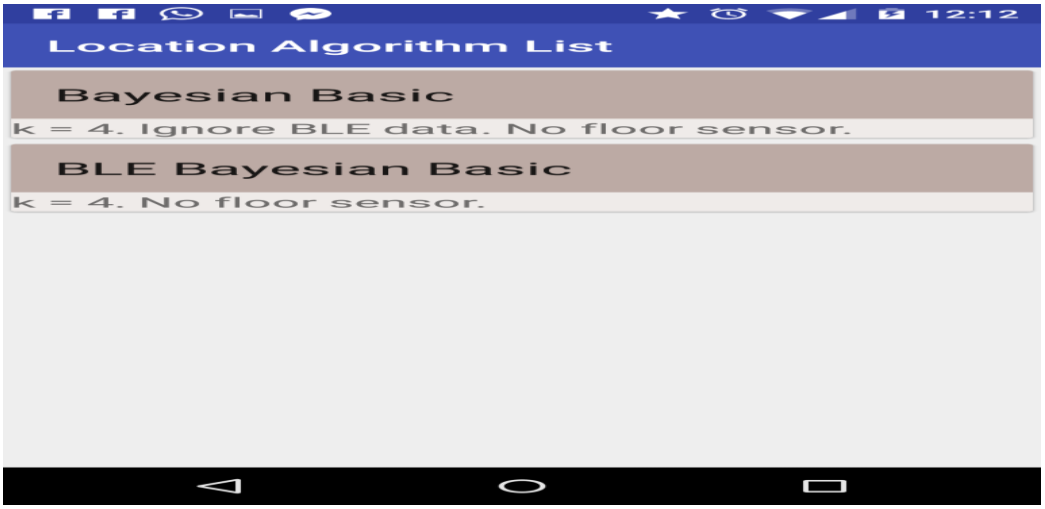


Figure 4.21 Interface of Location Algorithm list

4.1.4.2 View sensors

- Step 1 : Select ‘View Sensors’ from the Mi-ILP main interface

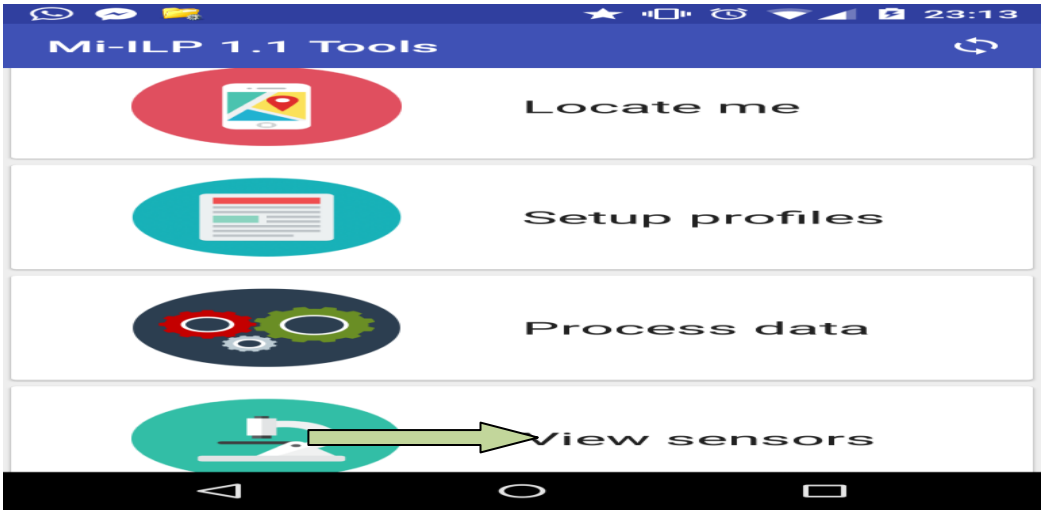


Figure 4.22 Interface of Mi-ILP 1.1 Tools

- Step 2 : Select either WI-FI,BLE or sensors to view

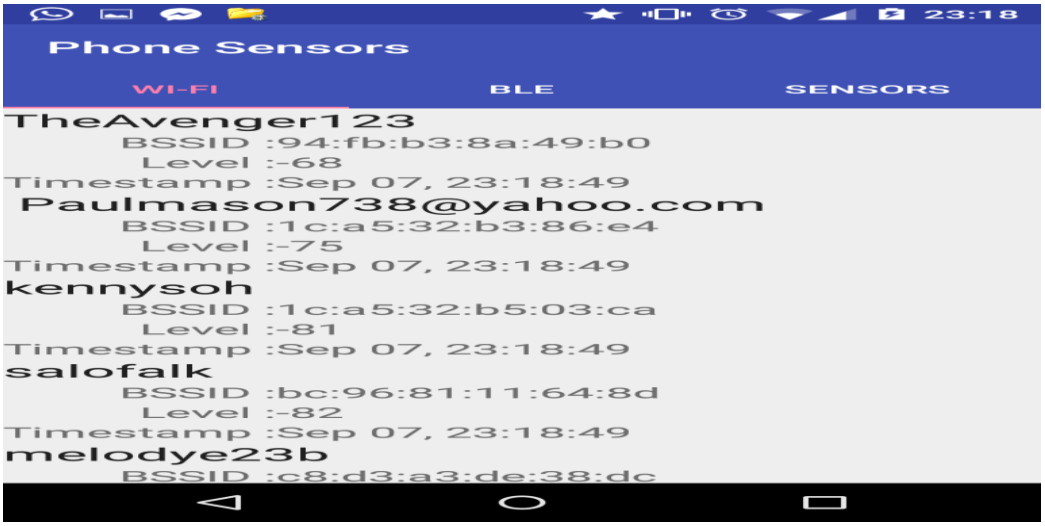


Figure 4.23 Interface of Phone Sensors

4.1.4.3 Switch Profile

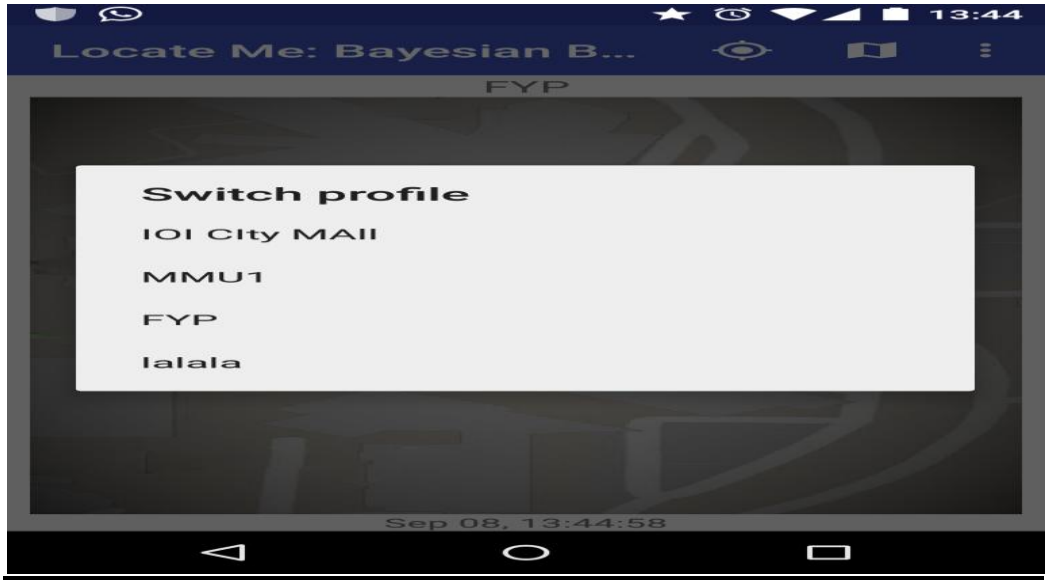


Figure 4.24 Interface of profile switching

4.1.5 Pin Point Done In MMU Theme park

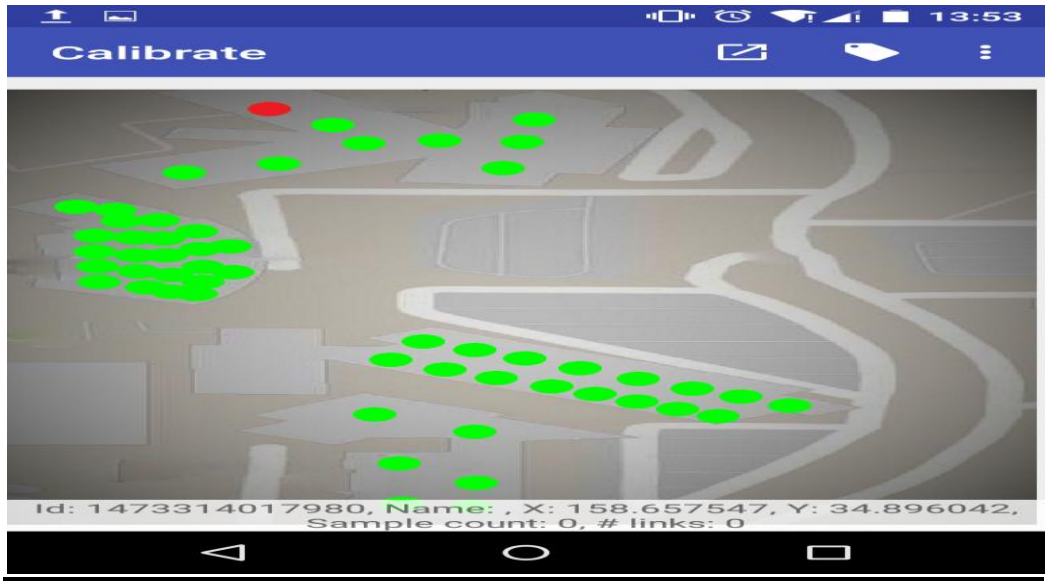


Figure 4.25 Interface of PinPoint done in MMU Theme Park

4.1.6 Chat

- Step 1 : Select ‘Chat’ from the dropdown on main interface

Figure 4.26 Interface of Chat selection

- Step 2: Enter server IP address, client name, Topic, and messages to communicate with other clients.

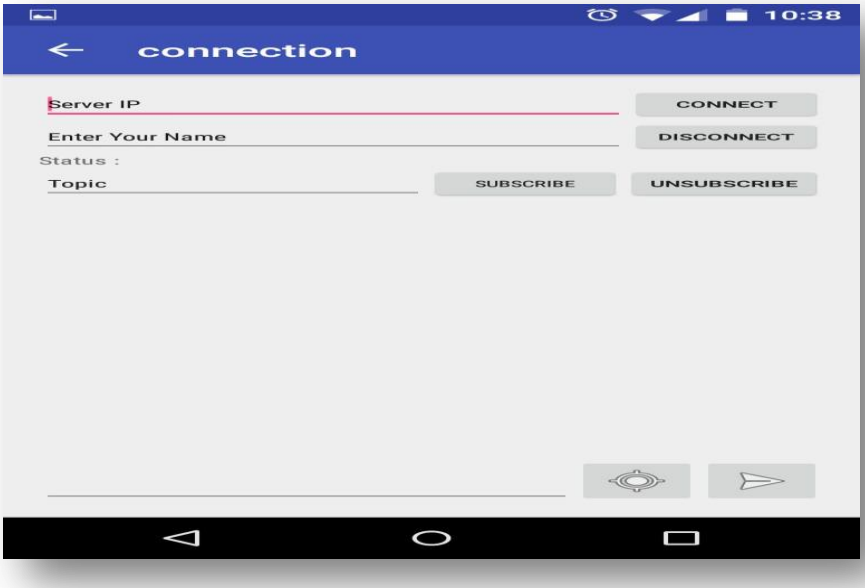


Figure 4.27 Interface of MQTT client

4.1.7 Collection of fingerprint data and problem stated

There is a problem encountered which is about the inaccurate of location positioning when locate me is clicked, the solution to this is to collect more fingerprint data to process, stand on the fixed location and rotate which collecting the fingerprinting data as shown in the snapshot below.

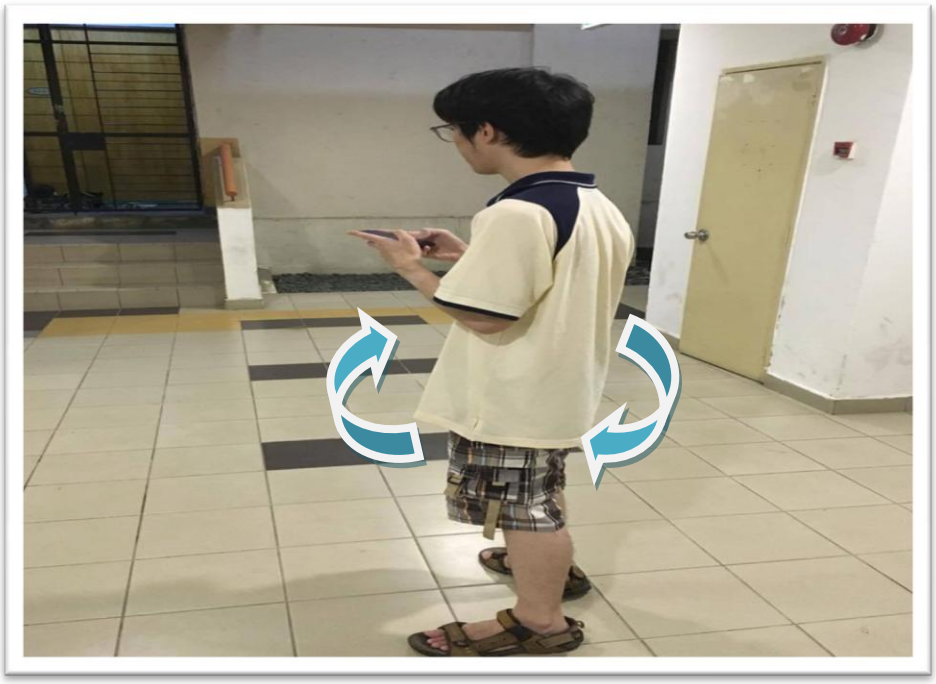


Figure 4.28 Snapshot of the collection of fingerprint data

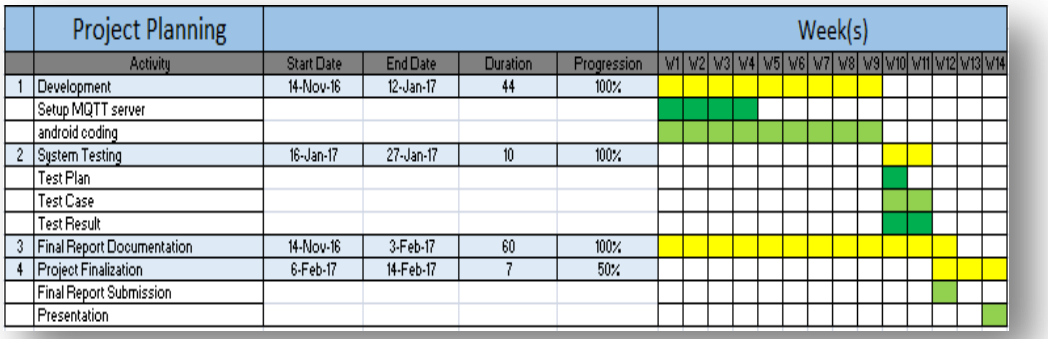
Based on figure 4.28, The snapshot illustrates the right way to collect fingerprint data. Administrator has to collect fingerprint data by standing on the fixed position and rotate about certain degree. Administrator has to rotate to different degree for each fingerprint data in order to acquire more accurate result on the specific pinpoint. This step has to be applied on other pinpoints for the same purpose.

Chapter 5: Implementation Plan

5.1 Project Planning

5.1.1 Gantt Chart

Proper time management and well manage of resources are necessary actions to be taken to complete this project. The Gantt charts below demonstrate the expected and actual planned time for the project development.



	Project Planning					Week(s)													
	Activity	Start Date	End Date	Duration	Progression	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
1	Development	14-Nov-16	12-Jan-17	44	100%														
	Setup MQTT server																		
	android coding																		
2	System Testing	16-Jan-17	27-Jan-17	10	100%														
	Test Plan																		
	Test Case																		
	Test Result																		
3	Final Report Documentation	14-Nov-16	3-Feb-17	60	100%														
4	Project Finalization	6-Feb-17	14-Feb-17	7	50%														
	Final Report Submission																		
	Presentation																		

Figure 5.1 Expected Gantt Chart for Final Year Project II Trimester 2 2016/2017

Based on figure 5.1, The 3 major activities which include development, system testing, final report documentation and project finalization have been progressed in Final Year Project II. Until the eve of project submission, there are 3 activities that are expected to be finished in time with a full progression. For the project finalization, the progression is 50% because of the coming presentation on week 14, after the presentation can only consider the project finalization as finished.

While for the implementation plan for Final Year Project II, The content of the implementation plan is to create a server platform using Mosquito (MQTT) server to suggest an event to the current Mi-ILP prototype. The Mi-ILP tools send the estimated location data and timetable data as a message to the server and the server will broadcast to Mi-ILP application with event suggestion. Figures 5.2 below show the connection between Mi-ILP tools and MQTT server.

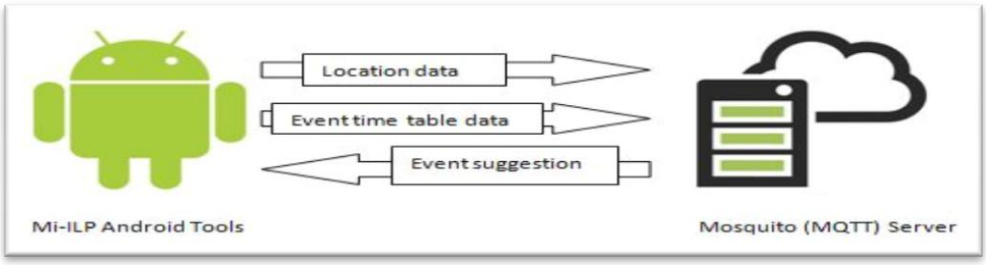


Figure 5.2 Connection between Mi-ILP tools and MQTT server

	Project Planning					Week(s)												
	Activity	Start Date	End Date	Duration	Progression	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
1	Development	14-Nov-16	16-Jan-17	46	95%														
	Setup MQTT server																		
	android coding									B									
2	System Testing	17-Jan-17	27-Jan-17	9	100%					R									
	Test Plan									E									
	Test Case									A									
	Test Result									K									
3	Final Report Documentation	6-Dec-16	3-Feb-17	44	100%														
4	Project Finalization	6-Feb-17	14-Feb-17	7	50%														
	Final Report Submission																		
	Presentation																		

Figure 5.3 Actual Gantt Chart of Final Year Project II for Trimester 2 2016/2017

Based on figure 5.3 above, Actual gantt chart illustrated the exact time used for project planning which has a different with the expected gantt chart in term of progression.

5.2 Software Development Process

5.2.1 Prototyping

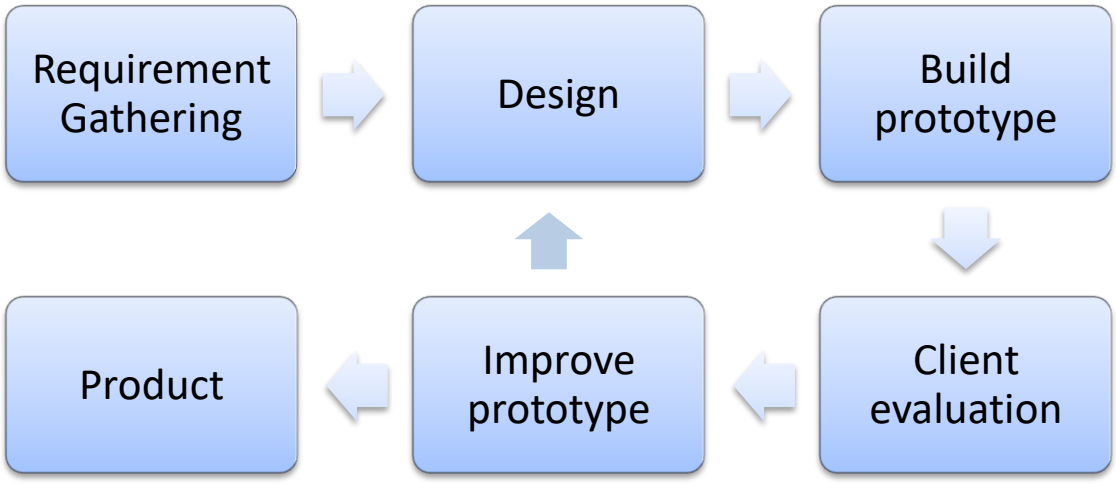


Figure 5.4 Prototyping Model (Intro-To-SDLC, 2016)

Prototyping model is used throughout the development of theme park positioning application. It is a model that is used to build a prototype which can be tested by the client and this prototype is then keep refining based on client's requirement until an acceptable prototype is achieved.

There are few steps to be executed in designing a prototype. The first step is requirement gathering which the requirement gathered has to focus on the main function of the prototype while others requirement than main function can be ignored in this stage.

The next step is to design and develop the draft prototype. In this stage, User interface of prototype is first designed then followed by developing the prototype. The prototype should possess all the necessary requirements.

After the prototype is developed, the following step is the evaluation of the prototype. The prototype is to demonstrate to the client and other stakeholders that involved in the project. Client and stakeholders will give feedbacks for further improvement on the prototype.

The last step is to refine the prototype based on the feedbacks that collected from the client and stakeholders. If there is any feedback that is unachievable, developer will negotiate with the client and stakeholders until the feedbacks agreed by both parties. This cycle will be repeated until the prototype satisfies the requirement of the client.

In a nutshell, Prototyping model is quite popular nowadays and it is widely used by most of the software developer because of the interaction of developer and client to acquire better understanding on requirements of client. The feedback from the client helps to clarify what is needed for the product and the process of the prototype is visible to client that can help client in understanding the flow of prototype. This model reduces time and cost significantly due to the lessen work during maintenance phase as any missing or unambiguous function can be detected immediately.

5.3 Part of Solution

5.3.1 Connection to the server

5.3.1.1 Description

Based on figure 5.5, the code explained the connection to the MQTT server. The code is to read the MQTTHOST and clientId text entered by the user and then followed by performing matching between server IP address and the keyed in text. If the text entered matched the server IP address then only the user can connect to the server else the user fails to connect to server.

5.3.1.2 Screenshot for connection code:

```
public void pub(View v) {
    e1 = (EditText) findViewById(R.id.editText1);
    e2 = (EditText) findViewById(R.id.editText2);
    // e3 = (EditText) findViewById(R.id.editText4);

    String MQTTIP = e1.getText().toString();
    //  String MQTTPort = e3.getText().toString();
    String MQTTHOST = "tcp://"+MQTTIP+":1883";
    String clientId = e2.getText().toString();

    client = new MqttAndroidClient(this.getApplicationContext(), MQTTHOST,
            clientId);

    options = new MqttConnectOptions();
    options.getServerURIs();
    options.setCleanSession(true);
    options.setKeepAliveInterval(200000);

    try {
        IMqttToken token = client.connect(options);
        token.setActionCallback(new IMqttActionListener() {
            @Override
            public void onSuccess(IMqttToken asyncActionToken) {
                textView = (TextView) findViewById(R.id.textView);
                textView.setText("connected");
                textView.setBackgroundResource(R.color.colorConnected);
            }

            @Override
            public void onFailure(IMqttToken asyncActionToken, Throwable exception) {
                textView = (TextView) findViewById(R.id.textView);
                textView.setText("Not connected");
                textView.setBackgroundResource(R.color.colorDisconnected);
            }
        });
    } catch (MqttException e) {
        e.printStackTrace();
    }
```

Figure 5.5 Screenshot for connection code

5.3.2 Subscription to a topic

5.3.2.1 Description

Based on figure 5.6, the code explained the subscription to a topic. The code is to subscribe the topic's text entered by user to the server while the callback is used to receive the messages sent by other user under the same topic.

5.3.2.2 Screenshot for subscription code

```
public void sub1(View v){
    e3 = (EditText) findViewById(R.id.editText3);
    final String topic = e3.getText().toString();
    try{

        final CountDownLatch latch = new CountDownLatch(1);
        client.setCallback(new MqttCallback() {

            public void messageArrived(String topic, MqttMessage message) throws Exception {
                System.out.println(topic+","+ new String(message.getPayload()));
                latch.countDown(); // unblock main thread
            }

            public void connectionLost(Throwable cause) {
                System.out.println("Connection to broker lost!" + cause.getMessage());
                latch.countDown();
            }

            public void deliveryComplete(IMqttDeliveryToken token) {
            }

        });
        client.subscribe(topic, 0);

    }catch(MqttException e){
        e.printStackTrace();
    }
}
```

Figure 5.6 Screenshot for subscription code

5.3.3 Publish Message

5.3.3.1 Description

Based on figure 5.7, the code explained the publishing of messages. The code is to send the message entered by a user and display on the chat screen.

5.3.3.2 Screenshot for publish message code

```
public void publish(View v){
    e3 = (EditText) findViewById(R.id.editText3);
    final String Topic = e3.getText().toString();
    e4 = (EditText) findViewById(R.id.editText4);
    String msg = e4.getText().toString();
    MqttMessage message = new MqttMessage(msg.getBytes());
    String[] Items = {msg};
    ListView listView = (ListView) findViewById(R.id.listview);
    arrayList = new ArrayList<>(Arrays.asList(Items));
    adapter = new ArrayAdapter<String>(this, R.layout.layout, R.id.textView2, arrayList);
    listView.setAdapter(adapter);

    try{

        client.publish(Topic, message);
        e4.setText("");
        String newItems = e4.getText().toString();
        arrayList.add(newItems);
        adapter.notifyDataSetChanged();

    }catch(MqttException e){
        e.printStackTrace();
    }

}
```

Figure 5.7 Screenshot for publish code

5.3.4 Locate Position

5.3.4.1 Description

Based on figure 5.8, the code explained the location positioning. The code is to display user's location on the map when the user location matched the map profile. For the float scale means the user's location will be moving to another location on the map profile based on user current coordinate.

5.3.4.2 Screenshot for Locate Position code

```
private class ShowMyLocation implements Runnable {
    private IProfile currShowProfile;
    private PointF currShowPoint;

    public ShowMyLocation(IProfile currShowProfile, PointF currShowPoint) {
        this.currShowProfile = currShowProfile;
        this.currShowPoint = currShowPoint;
    }

    @Override
    public void run() {
        if (currShowPoint == null) {
            if (prevShowPoint != null) {
                tvName.setText("");
                mapView.setImage(null);
                noLocationText.setVisibility(View.VISIBLE);
            }
        }
        else {
            if (prevShowPoint == null) {
                tvName.setText(currShowProfile.getName());
                mapView.setImage(currShowProfile.getMap());
            }
            else if (!prevShowProfile.getId().equals(currShowProfile.getId())) {
                tvName.setText(currShowProfile.getName());
                mapView.setImage(currShowProfile.getMap());
            }
            float scale = currShowProfile.getAfterMapScale();
            mapView.setPointSelect(new PointF(currShowPoint.x * scale, currShowPoint.y * scale));
            noLocationText.setVisibility(View.INVISIBLE);
        }
        tvTimestamp.setText(df.format(new Date()));

        prevShowProfile = currShowProfile;
        prevShowPoint = currShowPoint;
    }
}
```

Figure 5.8 Screenshot for Locate Position code

Chapter 6: Testing

6.1 Introduction

Testing has long been considered an integral part of software development and its importance has only grown throughout the years. This can be seen in the way software development life cycles have matured: while the waterfall model executes testing only after the entire software has been built, more modern methods, such as the agile model, incorporates testing early on by including it in its iterative software building phase. Generally, testing is executed with two objectives in mind, namely, to find bugs within the software being developed and to verify that the software being developed conforms to the requirements imposed on the software.

Due to the large number of inputs, outputs, modes and configurations possible for even a small piece of software, it is impossible to exhaustively test software. This has given way to the invention of a variety of testing techniques, such as static and dynamic black-box and white-box testing, and also a variety of test design techniques, such as equivalence partitioning and boundary value analysis. These methods aim to minimize effort required to test the software while allowing for the tests to still be reasonably effective at finding software defects.

Tools which test software efficiently is highly relevant for the mobile application development sector, due to the growing demand for mobile applications that are of high quality in terms of usability, reliability, robustness, interoperability and security (Di

Lucca et. al., 2002). These demands are largely due to the fact that mobile applications have become a core component of many businesses, and the failure of these applications could potentially cost organizations millions of dollars (Sampath et. al., 2008). These factors, coupled with the short time-to-market time of a typical mobile application means that software testing today must not only be done well, but also done fast.

In the present day, the development of software testing tools and test management tools are positive steps towards fulfilling this need. By giving testers a way to automate and standardize the structure of the execution and documentation of tests, it is becoming increasingly possible to conduct comprehensive tests in short amounts of time, which in turn leads to defect fixes being able to be conducted earlier and ultimately the quick production of high quality software.

In this project, manual testing is used to manage the evaluation of a developed theme park positioning application. The results of the testing procedure are discussed.

6.2 Test Plan

In this project, Functional testing will be conducted to ensure the quality of the targeted application meets the documented requirements. In order to achieve high test coverage, functional testing method is designed to cover different perspective of the targeted application.

All the documented function in the targeted application will be identify and tested manually.

Test risk analysis is conducted by the tester team during the test design phase. The test risk for the testing methods is documented in test design specification. All the identified test risk will be quantified and prioritized. After all the test risk is identified and documented, a test risk mitigation plan will be made to handle the situation.

6.3 Test Design

6.3.1 Functional Testing

6.3.1.1 Test Risks / Issues

Risk/Issues	Probability	Impact	Risk Mitigation plan
Miss up some important function.	Medium	Medium	Tester 1 and 2 will build the test case together and compare. The final test cases must be approved by the test manager before start testing.

6.3.1.2 Items to be tested

No.	Item to Test	Test Description	Test Date
FTI1	Function of the targeted application.	All the existing function of the targeted application.	1st Feb 2017

6.3.1.3 Test Approach(s)

Test case will be created according to the test item and will be tested manually.

6.3.1.4 Test Regulatory

Test regulatory is to be determined.

6.3.1.5 Test Pass / Fail Criteria

Test Item Number	Pass	Fail
FTI1	The function able to produce output that is expected.	The function unable to produce the output as intended.

6.3.1.6 Test Entry / Exit Criteria

Test Item Number	Entry	Exit
FTI1	The test will start when the test case are approved.	The test will be end when the test achieve the pass or fail criteria.

6.3.1.7 Test Deliverables

The result will be screenshot and documented according to the test cases. The test case of the functional testing will be combined with the test cases of unit testing due to the similar method and functionality of the test item.

6.3.1.8 Test Suspension / Resumption Criteria

There are no criteria for test suspension and resumption. The test only can end if only achieved the exit criteria.

6.4 Test Cases (Functional Testing)

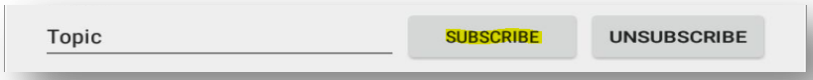
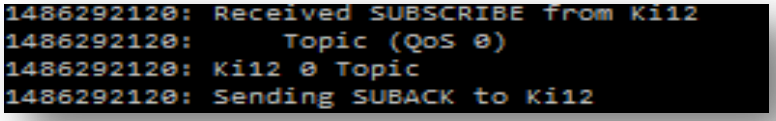
6.4.1 Test Case 1:

Test Case ID	0001
Test Case Scenario	Test 'Connect' Function
Test Procedure	1. User enters appropriate server IP address and Client Name. 2. User clicks on the 'Connect' Button on MQTT page.
Precondition	User has to create server to acquire connect identity.
Result	User connects to the server successfully.
Status	Pass
Screenshot	
Result	

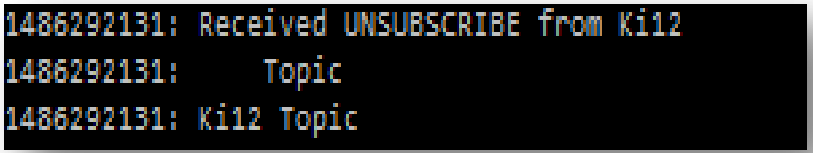
6.4.2 Test Case 2:

Test Case ID	0002
Test Case Scenario	Test ‘Disconnect’ Function
Test Procedure	1. User clicks on the ‘Disconnect’ Button on MQTT page
Precondition	User has to connect to the server.
Result	User disconnects to the server successfully.
Status	Pass
Screenshot	
Result	

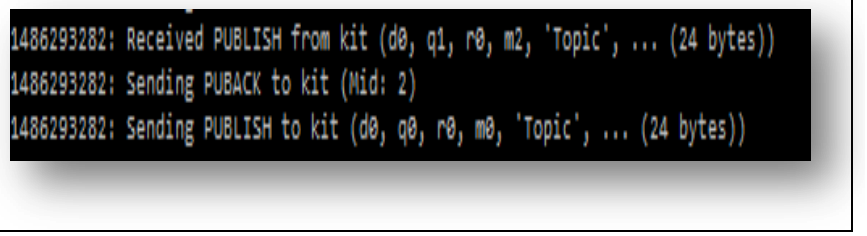
6.4.3 Test Case 3:

Test Case ID	0003
Test Case Scenario	Test ‘Subscribe’ Function
Test Procedure	1. User enters topic name. 2. User clicks on the ‘Subscribe’ Button on MQTT page.
Precondition	User has to connect to the server.
Result	User subscribed to a topic successfully.
Status	Pass
Screenshot	
Result	

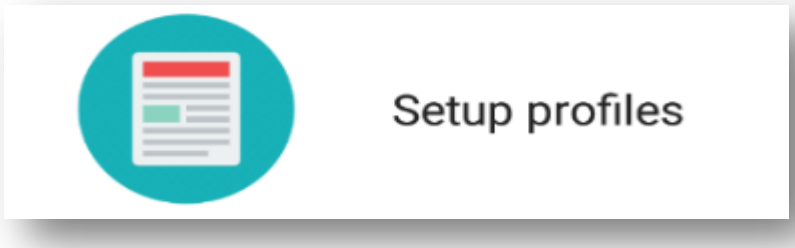
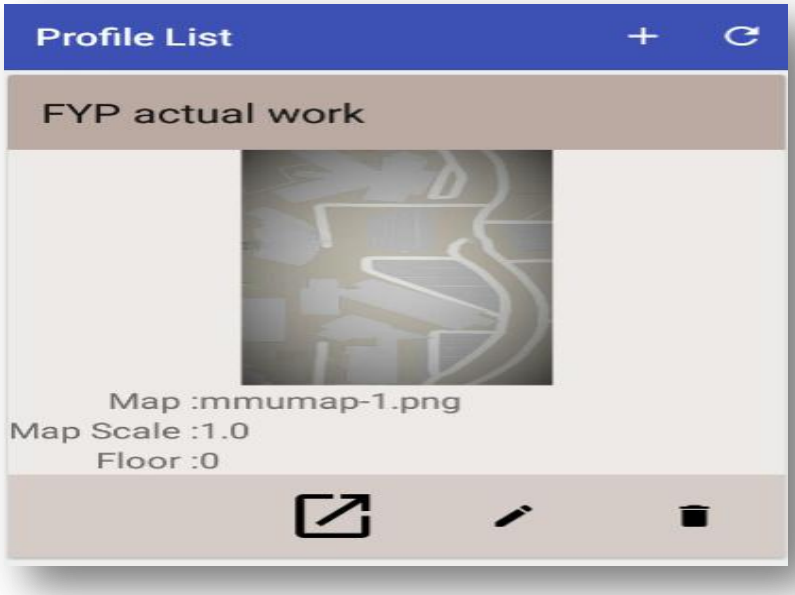
6.4.4 Test Case 4:

Test Case ID	0004
Test Case Scenario	Test ‘Unsubscribe’ Function
Test Procedure	1. User clicks on the ‘unsubscribe’ Button on MQTT page.
Precondition	User has to connect to the server.
Result	User unsubscribed the topic successfully.
Status	Pass
Screenshot	
Result	

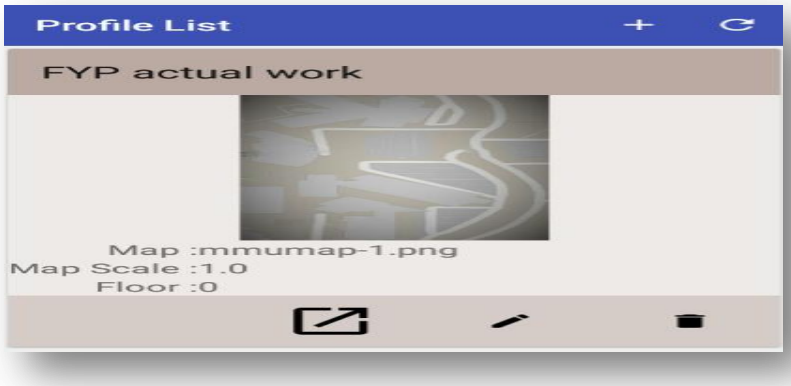
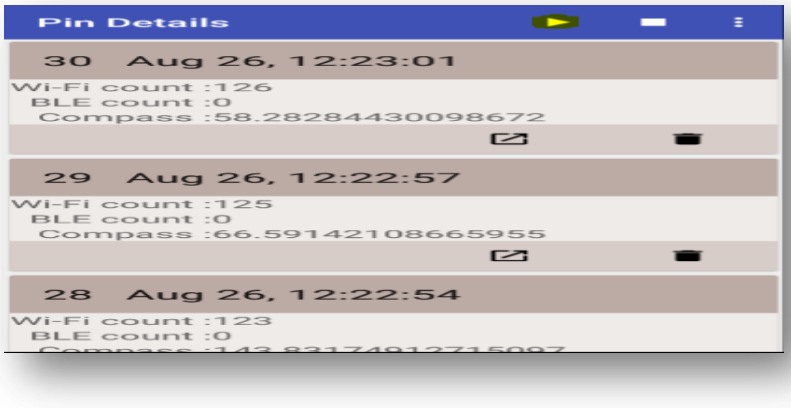
6.4.5 Test Case 5:

Test Case ID	0005
Test Case Scenario	Test 'Send' Function
Test Procedure	1. User enters message on the textbox. 2. User clicks 'send' button on the MQTT page.
Precondition	User has to connect to the server and subscribe to a topic.
Result	User sent messages successfully.
Status	Pass
Screenshot	
Result	

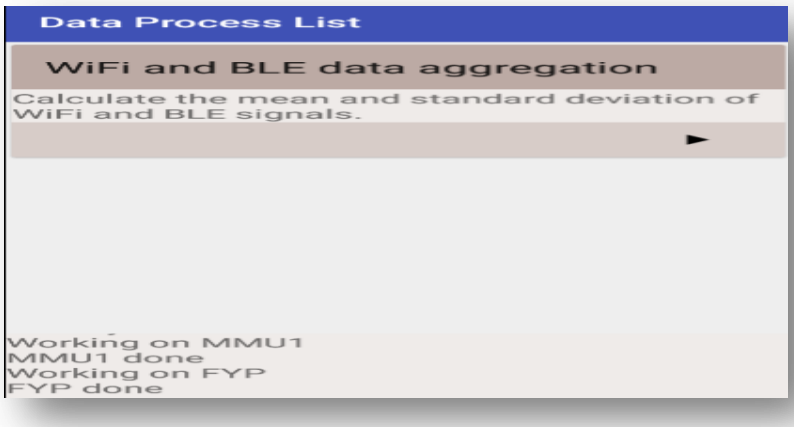
6.4.6 Test Case 6:

Test Case ID	0006
Test Case Scenario	Test 'Setup Profile' Function
Test Procedure	1. User clicks on the 'Setup Profile' option on dashboard page. 2. User enters the profile information and then save it.
Precondition	User has to acquire profile details.
Result	User set up a profile successfully.
Status	Pass
Screenshot	
Result	

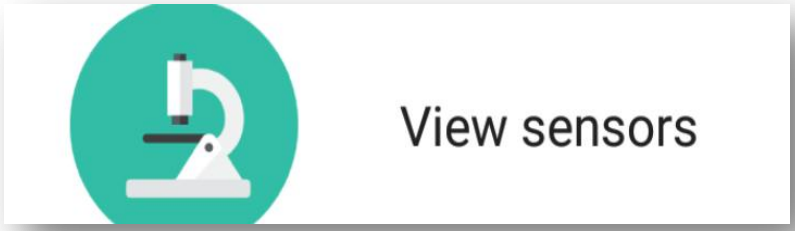
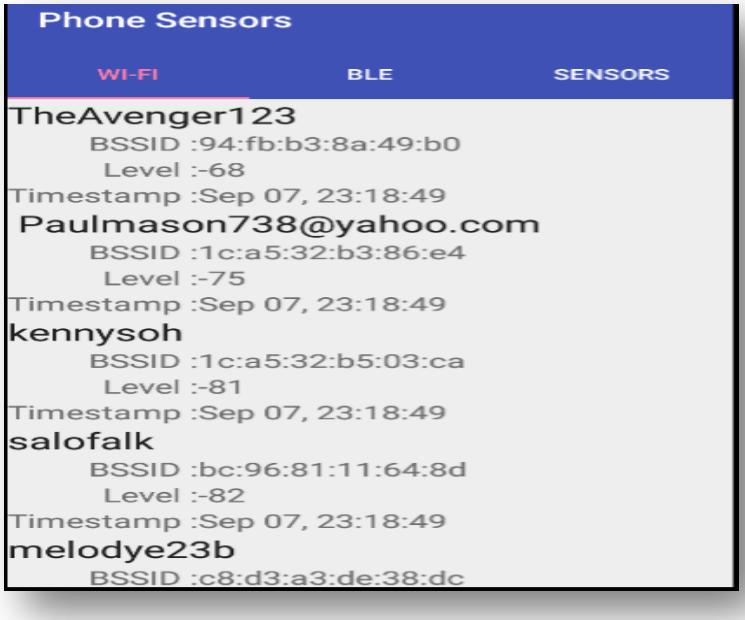
6.4.7 Test Case 7:

Test Case ID	0007
Test Case Scenario	Test 'Calibration' Function
Test Procedure	1. User clicks on the 'Calibration' Button (box with arrow symbol) on profile list page. 2. User presses a dot on specific point of the map and press calibration option again to collect fingerprint data through WIFI.
Precondition	User has to enter the profile information.
Result	User calibrated pinpoints successfully.
Status	Pass
Screenshot	
Result	

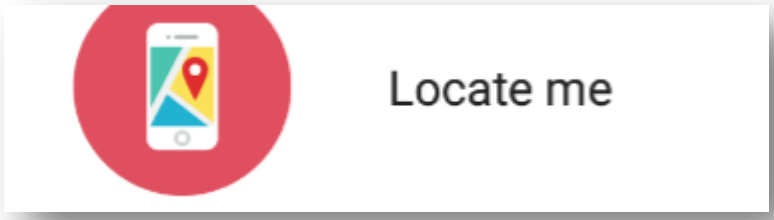
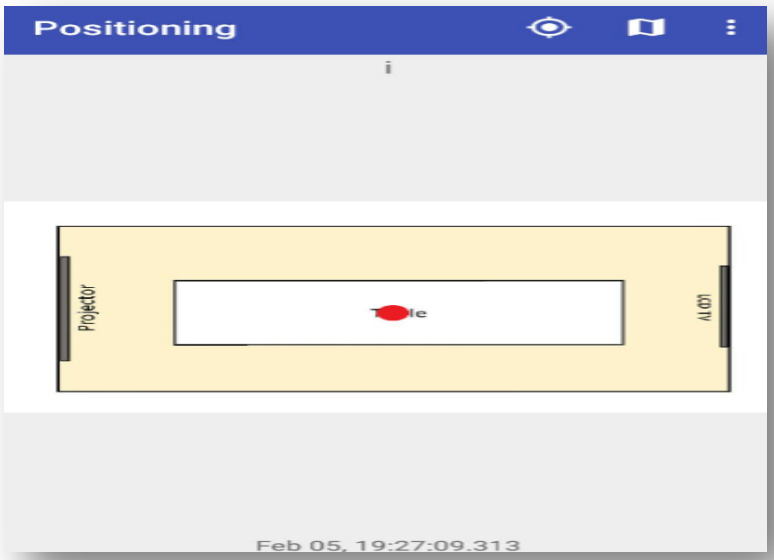
6.4.8 Test Case 8:

Test Case ID	0008
Test Case Scenario	Test 'Process Data' Function
Test Procedure	1. User clicks on the 'Process data' Option on dashboard page. 2. User presses the play button to process the fingerprint data collected through calibration.
Precondition	User has to finish the calibration of the collected pinpoint.
Result	User processed data successfully.
Status	Pass
Screenshot	
Result	

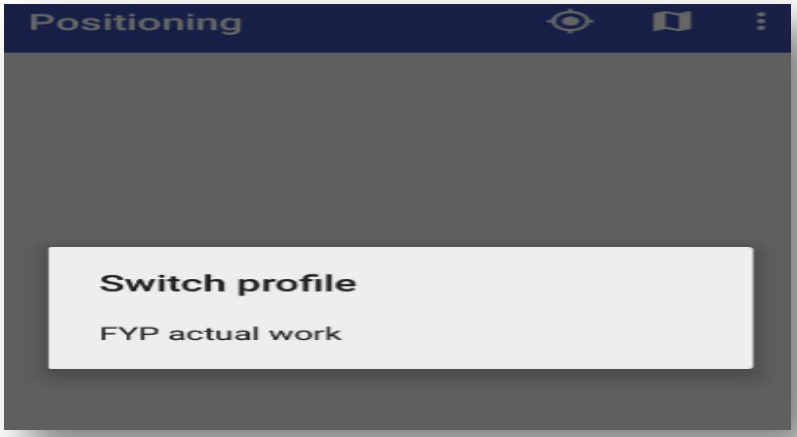
6.4.9 Test Case 9:

Test Case ID	0009
Test Case Scenario	Test 'View Sensors' Function
Test Procedure	1. User clicks on the 'View Sensors' option on dashboard page.
Precondition	-
Result	User viewed sensors successfully.
Status	Pass
Screenshot	
Result	

6.4.10 Test Case 10:

Test Case ID	0010
Test Case Scenario	Test 'Locate Me' Function
Test Procedure	1. User clicks on the 'Locate Me' option on dashboard page. 2. User presses a location dot to display his/her pinpoint on the map.
Precondition	1. User has to complete the calibration of the profile information. 2. User has to connect to WIFI.
Result	User displayed his/her location successfully.
Status	Pass
Screenshot	
Result	

6.4.11 Test Case 11:

Test Case ID	0011
Test Case Scenario	Test 'Switch Profile' Function
Test Procedure	1. User clicks on the 'Switch Profile' Button on 'Locate Me' page. 2. User selects on the profile which he/she wanted to change.
Precondition	User has to enter the profile information.
Result	User switched profile successfully.
Status	Pass
Screenshot	
Result	

Chapter 7: Conclusion

7.1 Conclusion

The main objective of the this final year project is to create a theme park positioning application which is an application-based software that helps in providing location positioning inside the buildings. It helps users in searching their current location in a theme park without getting lost. Besides that, Theme park positioning application also provides a function to let users to communicate with each other in order to obtain information of surrounding. The objectives are accomplished by developing a simulated digital map plot of the sites of interest, positioning and location awareness through data processing using aggregation and triangulation of WIFI access points collected in MMU Cyberjaya Campus, creating a building profile through the collection of wireless signal fingerprint data which is known as pin details, establishing a mosquito server to broadcast user 's messages to others user's devices, developing client application to connect to the mosquito server and functions that can let users to obtain surrounding's information.

In this project, Map of limited areas in MMU Cyberjaya such FCI, FOM, FOE and library are considered to be taken as a digital map plot in the implementation plan. From there, pin point is pinned on the desired location and the fingerprint data are collected through the WIFI signal in MMU Cyberjaya. After the collection of fingerprint data, Data processing step is required to be done in order to obtain current user's location on the map , the red dot on the map indicates the user's location. While for the

communication's function, A mosquito server is set up and configured to receive message sent from one user's device and broadcast to another user's devices. After the set up of server, connection, subscription and messaging function are developed for user to communicate with each others. In a nutshell, all the objectives stated in this project are managed to be accomplished.

Last but not least, The developed application with the provided and implemented basic function gave me ideas on enhancing a better version of the application with more semantic functions in the future work.

7.2 Limitation

The discovered limitation is the coordinate of other users sent from the chat function unable to display on the map. The map can only display the current user's location.

7.3 Future Work

There are few works need to be done in the near future to enhance the existing prototype which is stated as below:

- Other user's coordinate to be displayed on the map
- Navigation from current user's location to other user's location

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APPENDIX:

Survey Question

Survey on indoor positioning application in a theme park

Indoor positioning applications with location awareness that give more meaningful interactions between human, things, events and location. Users that possessed the established applications are able to search their current location in a theme park, look for sites of interest and estimate the waiting time and get a suggestion on which events are about to launch.

(Please answer the following questions.)

* Required

1) Are you male or female? *

- ◯ Male
- ◯ Female

2) What is your age? *

- ◯ 5-17
- ◯ 18-30
- ◯ 31-42
- ◯ 43-55
- ◯ 56-68

3) Have you been to theme park before? *

- ◯ Yes
- ◯ No

4) Do you refer to a map when you intend to go to a specific place in theme park that is totally strange to you? *

- ◯ Yes

- ○ No

5) Do you face any problem in the theme park? *

- ○ Yes
- ○ No

6) What problem are you facing in the theme park? *
(You can select more than 1 option)

- ☐ Lost at somewhere
- ☐ Unable to find events happened nearby
- ☐ Unable to locate your friends or family members
- ☐ Didn't face any problems
- ☐ Other:

7) Have you ever heard of indoor positioning application? *

- ○ Yes
- ○ No

8) Do you use indoor positioning application when you are in theme park? *

- ○ Yes
- ○ No

9) Does indoor positioning application solve your problem(s) in the theme park? *

- ○ Yes

- ○ No
- ○ Not applicable (If you answer no for the indoor positioning application's question)

10) If you are provided with free indoor positioning application in the theme park, would you like to use it? *

- ○ Yes
- ○ No

11) How would you rate indoor positioning application in the theme park?

- ○ Very Satisfactory
- ○ Satisfactory
- ○ Neutral
- ○ Unsatisfactory
- ○ Very Unsatisfactory
- ○ Not applicable (If you answer no for the indoor positioning application's question)

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