
# TBB 3012
# Final Year Project Project II

Title: Location Detection in Mobile Application

SUBMITTED BY:


| NAME | MATRIC ID | PROGRAM |
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SUBMITTED TO:
Dr. Yong Suet Peng @ Vivian

# Abstract

The purpose of this paper is to describe how to use mobile application on track your location during offline. The user can find the location without any Wi-fi and 3G. Nowaday, many people using android phone than iPhone in the market. It is because Android phone have more application can be used for free and swap in a memory card as your external storage. The memory card can store for music, video, application and many more.

In Google Play Store, it has 10 types of GPS. There are, Google Maps, Telenav GPS Navigator, NavFree, Waze Yandex, Sygic, Wisepilot, Route 66 Maps+, CoPilot GPS and Garmin Navigator. All the GPS are supporting by 3G or Wi-fi connection to tracking the current and destination location. The most popular android application for GPS is Maps Google. It provided maps with 3D and 2D. In the other hand, it can use it for driving, walking, biking and public transport to know how far between the current locations with destination location. Maps Google will provide the latest traffic information to avoid traffic jam.

Next, android applications provide offline GPS. There are Google Maps, OsmAnd and Navfree. Google Maps offline GPS, you need to download the map area for offline use. Google Maps Offline GPS can view details of the map of streets names and landmarks without any data connection. Sometimes, the Google Maps Offline GPS cannot figure out or a bit slow where current location due to some of the building and trees blocking is.

Finally, we expect that the this project going to be very helpful platform to UTP students, lecturers, parents, suppliers, travellers and many more.

# Introduction Background of Study

University Teknologi Petronas (UTP) is a big university in Perak. For outsider such as suppliers, guests and parents, it is hard for them to find out where is the location they have been parking. Sometimes, students cannot remember where they have been parking since many days he or she did not use the car.

Although UTP has CCTV, but sometimes it is not safe and secure. On Phone tracking car park location is going to assist students, parents, suppliers and lecturers can find out the car location using the mobile application. They can check is the car still at the same place or check where has he or she parking. It just like the mobile application take a snap picture to your phone and get the information where you have parking the car.

Then, it is useful for those parents and suppliers who first time step into UTP compound. The parents, guests and suppliers maybe do not know where the parking in UTP too. They can use this mobile application to view where the car park in UTP. It can save their time to seeking the cars have been parking. This project can help the users more convenience during in UTP. This mobile application needs to input your car number or your name for the information as data input.

Although we can use our brain to remember where we have parking in UTP, but something we will forget where we have parking. For the parents, guests and suppliers, UTP is too big for them and they cannot remember it.

Some of the travellers have a difficulty to find the place to check in the airport, railway station and bus terminal. Although they came early at the place, but cannot find the gate or counter to check-in due to the area of the place is too big and wide. In additional, the big and new shopping mall will make the customers hard to find the shop, department or toilet. However the shopping already provide them the floor map, but they still cannot find the place. Some of the customers cannot find the parking place after shopping; some of the customers take a long time to find the products that they want in the shopping mall. It makes the customers feel it is inconvenience.

## Objective

The aim of this project is to:

- Develops an android mobile application that would help for the students, lecturers, parents, suppliers and guests.

- Performs enhancement to the current android's mobile applications to adding up the functions.

## Problem Statement

We have problems when using GPS and smartphone navigation in indoor position or location. It will be no signal and network in indoor building. For example, in basement, shopping mall, airport, terminal bus, subway and many more.

## **Literature Review**

Mobile application is not only for gaming, searching website, communicating with friends and family member, it also can help us to searching the place where we want to go and how far the place if we take a car or walking to that destination. The users use smartphone for navigation with share the photo, video, social network. For example, when you are in outdoor jogging, you can use an mobile application to keep track which road you are going, where is the place and keep track you how far you have walk to the destination.

Network and infrastructure is a mobile wireless networks. It is called Mobile IP. It is a network with access points gateway and routing support. Wi-fi is not a [4] good device to tracking or searching outdoor positions. In the other hand, GPS is a good device to tracking or searching outdoor position because GPS is under satellite visibility conditions. Furthermore, [8] Zhu, Li and Chen found that the main role of GPS is to find out the between the distant routes. [6] Zogg also states that the GPS can capture the location and position anywhere as long as the satellite signal reception is can be use. In the other hand, [8] Zhu, Li and Chen found staying

longer in one place does not help GPS improve precision. In the indoor, [2] GPS signal will weak and take long time to search the location for incoming signal. [2] The authors mention that during the GPS service not available in in-door building, Wi-fi network is the good device to points us the location and position. Grace, Oliveira and Realinho agree that [1] GPS is not accessible use in inside a building and cannot locate the right position. [22] Authors stated that users usually will in indoor building and the GPS signal is not available due to coverage of area is wide and the cost of expensive.

The errors of satellite signal:

- ✓ Clock Errors - The GPS receiver will capture errors position due to the satellite's atomic clocks have little different. The master control station will monitor and correct the error.
- ✓ Orbit Errors - The altitude, position and speed of satellite orbits will cause the gravitational pull and solar pressure fluctuations. The master control station will monitor and correct the error.

- ✓ Satellite Geometry - When the satellites are closing together with others satellites, the calculate position triangulation error will increase. (Figure 1) During the satellites are positioned in a line or in a tight of group, the GPS receiver will get poor geometry results. The GPS receiver can receive accurate position when the satellites spread widely.

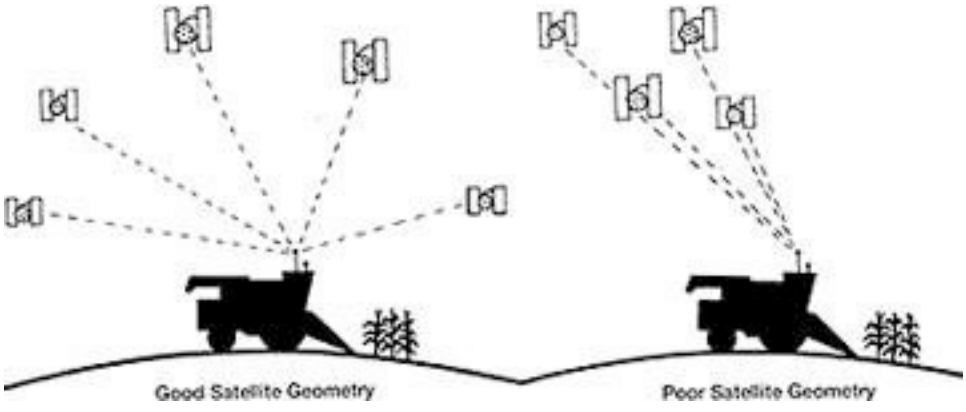


Figure 1: Good and Poor Satellite Geometry

- ✓ Multipath interference: The reflection signal from objects (trees, buildings, vehicles, power lines and etc) is called multipath interference, as show in Figure 2. The reflection signal spends more time to configure the location compare to direct signal.

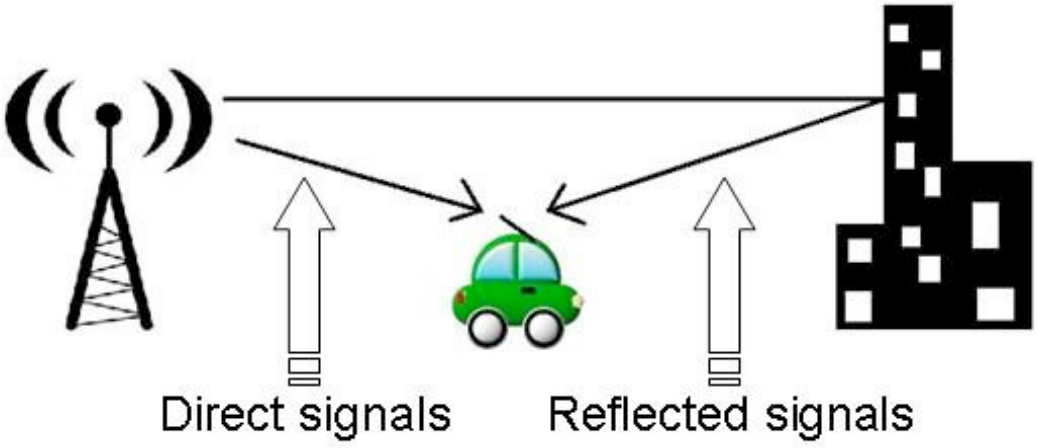


Figure 2: Multipath Interference – Direct signals and reflected signals

Inside the android phone devices, the [1] accelerometer sensor and magnetic sensor can search the location and direction. There are (Figure 3) 3 axis (X, Y and Z) to support values of the phone is facing frontwards or backwards. [9] Axis X will point at the front; Axis Y will point at the right; Axis Z will face the sky.

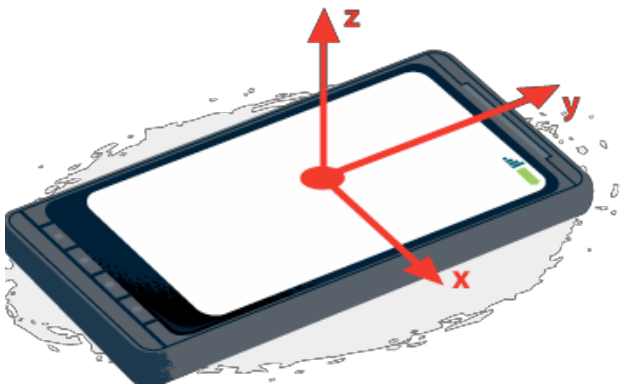


Figure 3: Three axis (X,Y and z) on mobile phone

In addition, the [5] axis system shows the mobile phone in portrait position or landscape position so that the mobile phone can complete some action such as, video, music, pictures and information to flipping the mobile phone interface. Inside the mobile phone device, it has a magnetic sensor to show direction of facing such as a compass. Next, the magnetic sensor also support value of degrees from 0 to 360 degrees and show in north position. In horizontal or vertical projection, the angle of view is 45 degree. [10] Accelerometer will support the screen turn into landscape mode with using axis x,y and z (Figure 4).

| Position | X | Y | Z |
|---|---|---|---|
| Vertical upright position | 0.0 | -1.0 | 0.0 |
| Landscape Left | 1.0 | 0.0 | 0.0 |
| Landscape Right | -1.0 | 0.0 | 0.0 |
| Upside Down | 0.0 | 1 | 0.0 |
| Flat Up | 0.0 | 0.0 | -1.0 |
| Flat Down | 0.0 | 0.0 | 1.0 |

Figure 4: Various Readings of the Axis X, Y, and Z

According [15] GSM Association, 80% of the global mobile market uses the standard. Furthermore, [16] over 1.5 billion people in the world, 212 countries is using the GSM. Selina [11] mentions that GSM (Global System for Mobile Communication) is a 2G system to manage voice efficiently, but supports limited data and Internet application. Khan and Mishra [12] argue that GSM and GPS can provide a system to keep track the object and latest information is updated. Additionally, A complete GPS and GSM system to track the vehicles (car, van, taxi, bus and etc) are using Google Earth Application. [13] Google Earth can visual the location information that send by GPS system. GPS can route the vehicles current location. [12] Short Message Service (SMS) is support GSM with active sim card that able to connect the network access. Khan and Mishra state that the latest information can monitoring the process such as location information, tracking activity, tracking object in real time then it will send SMS to the users. GPS will send the data then it will use the latitude and longitude indicating the position of the vehicle or object.

Based from the survey (Figure 5), from the author, they found out that favorite position that users like most are carrying the smartphone inside the jacket / pants pockets and hand holding during tracking the user's movement. To define a movement, Chon and Cha [23] stated that moving can be walking, running, moving in a car. Standard deviation of acceleration is calculating the user's movement. It will use vector (v), window (w) and time (t) to calculate the accelerometer. Additionally, to decide the direction is the velocity. The velocity can decide the forward axis and backward axis. If the value is greater than 0.49m/s, it means the user is moving. If the value is less than 0.49m/s, it means the user is stationary (not moving). Stationary define as standing in one place or location. The place that the user stays there quite some time, is called a POI. During the peak detection, it can be miscounting during the user is swaying and vibrating. For example, the user is messaging during on the phone with friends. Figure 6 shows the result of the peak detection scheme.

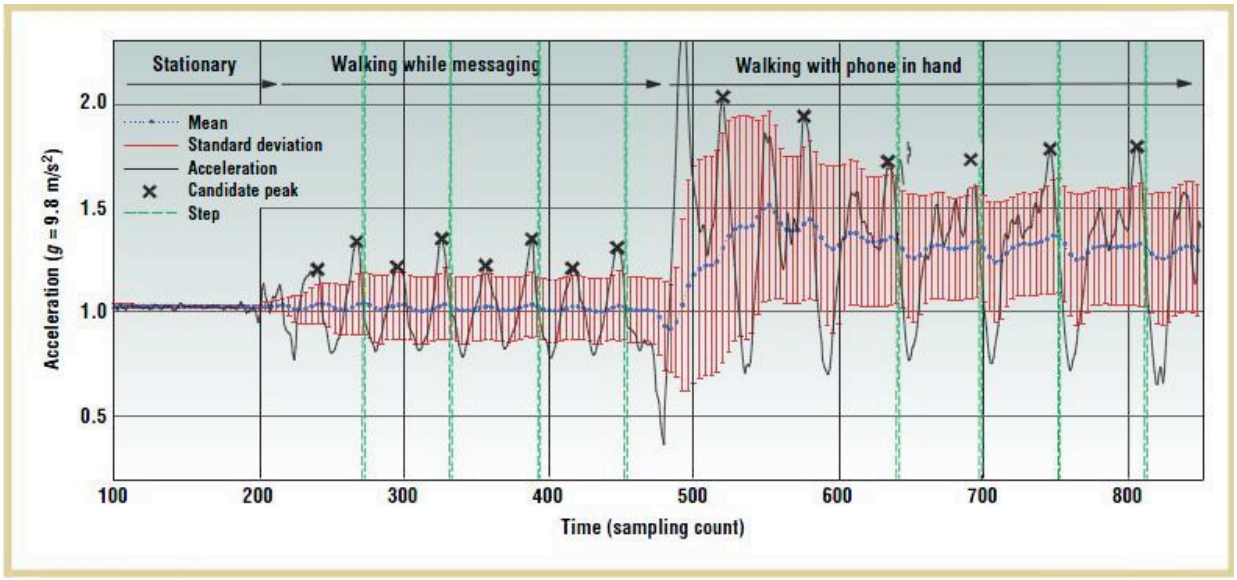


Figure 6: [22] The Peak Detection Scheme

For detecting the peak, it needs use max axis and forward axis. In accelerometer, max axis is axis perpendicular form the similar axis. Max axis will not generate to a large value of acceleration than the acceleration of gravity. The forward axis is to detect the current and previous peak. Then, it can be influences the direction of movement and extract direction. Such as, the user is walking on the street. Multiplying the step count and the step length can detect the moving distance. When inside indoor building, once the users start moving, accelerometer and digital compass will start calculate the movement of the user.

For vector transformation in 3-D (Figure 7) will reduce to 6 directions either the user move to the backward or forward. [22] From the Figure 8, the acceleration cannot solve the problem due the gravity cannot be remove when the smartphone detect from noisy sensor. [23] To improve the accuracy for tracking the position, the smartphone should build in gyroscope but due to the high cost of the gyroscope the smartphone did not use it.

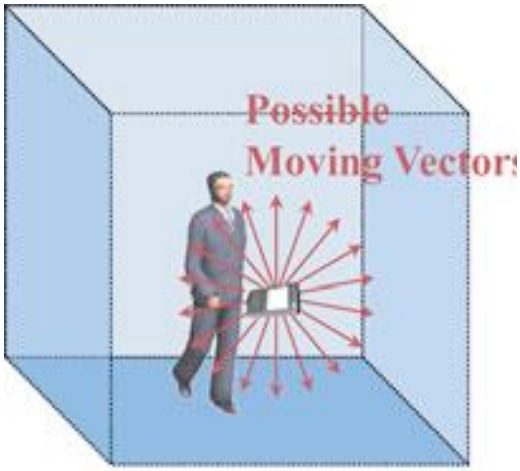


Figure 7: Detecting The 3-D Direction for The User's Movement

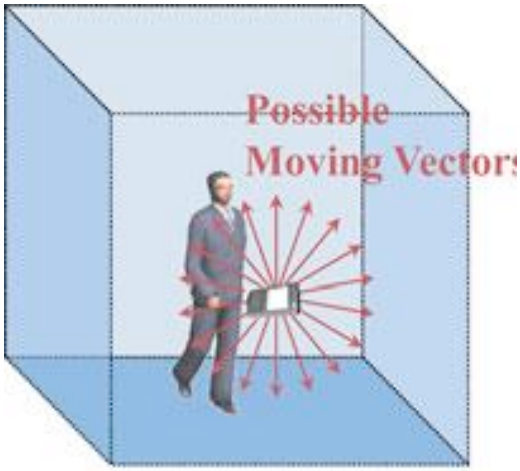


Figure 8: When the Smartphone The Noisy Signal

When the smartphone in hand-held position, Strapdown down position and swing phase in the pocket, the variance tends will increase in large value. The variance tends will increase to the maximum when the smartphone inside the pocket.

(a) Hand Holding: If the user is calling, messaging or watching video from the smartphone, it is easy to detect the users' extract movements.

(b) Swing Phase: Acceleration will shorter than stepping time while human. Therefore, the smartphone will detect the skewness from the body to detect the movement.

(c) Strapdown Position: For example, put the smartphone inside the bag or jacket pocket. The smartphone is hard to detect position by gait cycle and will use skewness to detect the movement with inaccurate position.

The length of the step by users can control by the user. If the GPS in no signal situation, the previous accuracy and the measure of the movement will error bound. To calculate the movement distance is multiplying the step count by step length. Therefore the GPS signal gives the direction of the information.
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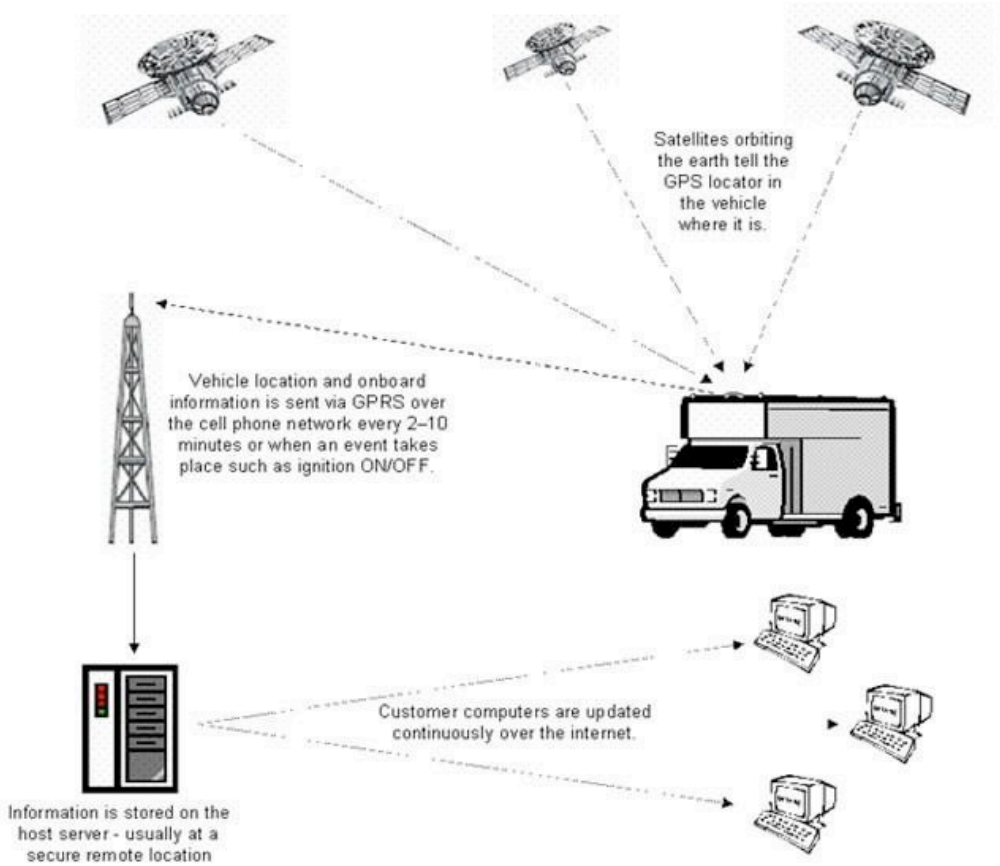



Figure 9: Various Readings of the Axis X, Y, and Z

Figure 9 shows that the GPS receiver will pick up the information and send it to the three satellites from the sky. The GPS will calculate the position in latitude and longitude of the vehicle's location. Every 2-10 minutes, the tracking system will send the location and information back to the mobile phone network using GPRS. In the end, the customer can keep track the latest update of the vehicle from the Internet.

[18] [2] Android provides the mobile map and location service and many developers use android open source due to easy to control so that Google map or Google Earth acan easy to implement location based mobile service with lost cost. [19] Location-Based System (LBS) is use different technologies (Wi-fi, GPS) to calculate the latitude and longitude and find out the objects or items in current location to pinpoint the geographic. [21] Consortium defines LBS service is a wireless – IP service that can search mobile user, application services through geographic information to accurate the position or location. In LBS, it has 2 types of elements:

- ✓ Location Manager: Support hooks to the location-based system.
- ✓ Location Provider: Different device to detect the current location.

The advantage of LBS is for pack tracking, vehicle tracking and transport tracking. By using the Location-Based System, users will know where you are, where the nearest place from the current location is, where is the destination and how do users get to that destination. For example, users can find out the nearest police station, petrol station or hospital during the emergency. Users can get the latest real time traffic information and can estimate how long can arrive the destination using the route maps. The LBS will not require the user input the address or postcode due to the satellite positioning and cellular network positioning can find out the location. During the users send back or receive the request information, servers calculate positions and search for location is depending the user's position.

From Figure 9, the first step is user uses mobile phone's application to sends a request using application that support from mobile device. After the requests send, the GPS data will configure the user's current location information then send to the communication network. Next, the service server will get Geographic database to get the request information. Finally, the request information will send back to the

mobile phone through mobile network.

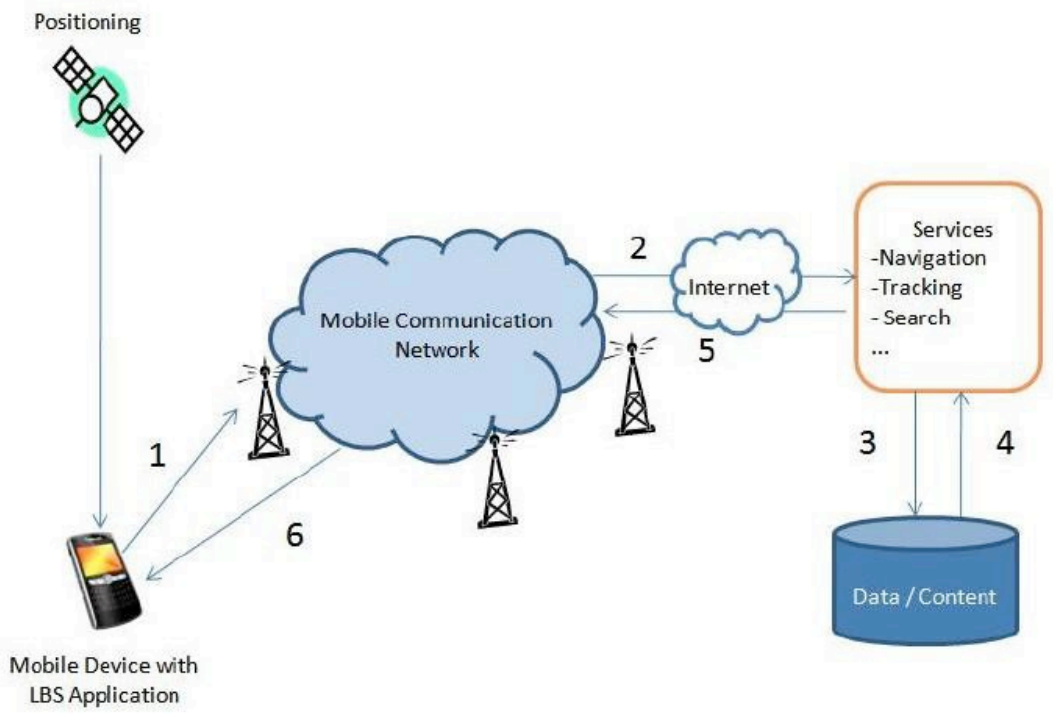



Figure 10: Process of the Location-Based System (LBS)

The component of Location-Based System (LBS) (Figure 11) is including LBS Tracking, LBS Middleware and LBS Application. LBS Application can be android or IOS application. The smartphone's sensors are including some server component to apply some specific data. Next, LBS Middleware is the main LBS Features, it has combining location tracking, [20] Geographic Information System (GIS) provider and location collection service to support a consistent interface to LBS application. The location tracking is stores the location trace of the user. The location tracking would support:

- ✓ Keeping records the current and past location from the users.
- ✓ Moving in or out area from the users and send the notification or information out.
- ✓ Tracing the location to generate user movement models.

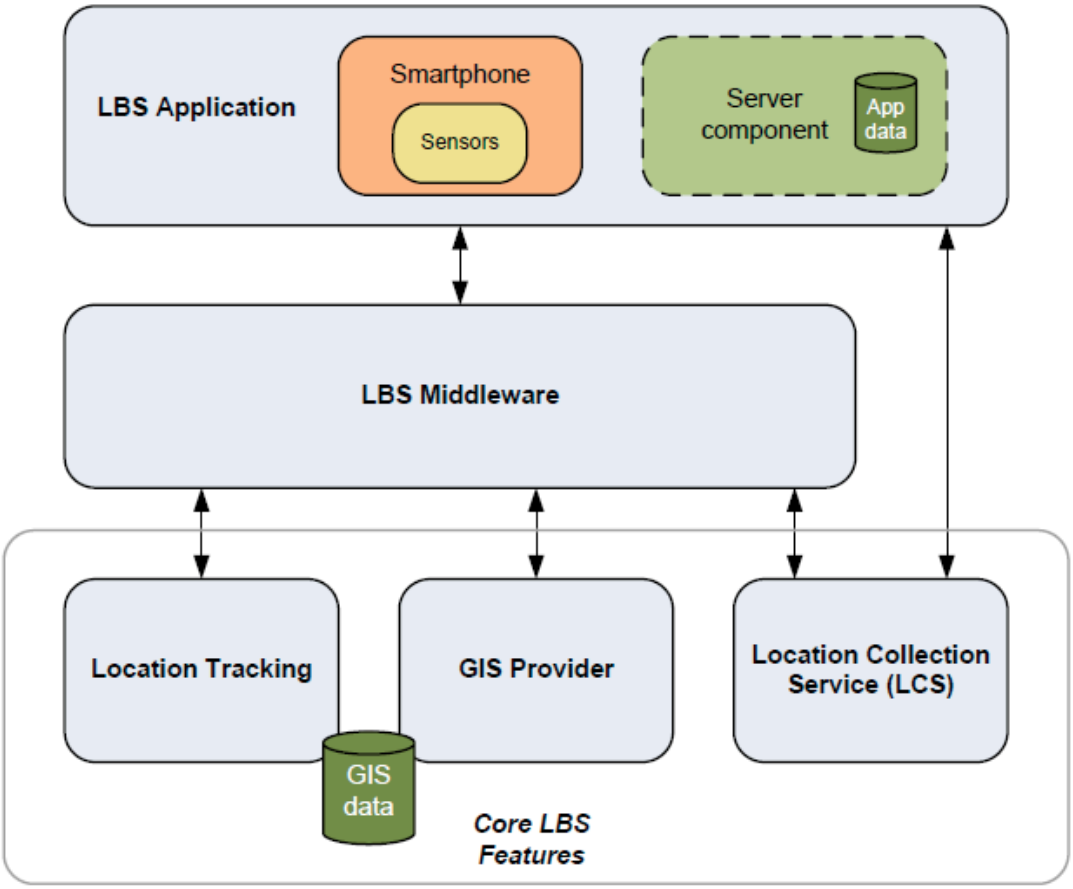



Figure 11: Component of Location-Based System (LBS)

Google Map considers a GIS Provider, it supports many LBS including map information, map visualization and directory services. Location Collection Service such as GPS receiver in the smartphone to collect the latitude and longitude from user.

## Methodology Research

Before the designing and implementation, intensive study regarding literature review and background studies will be carried out via various available sources such as internet sources, books, journals, papers and many more. These sources are from our IRC (Information Resources Center). Interviews and questionnaires are regarding the purposed topic in UTP, other universities and colleges students. Data gathering and analysis is to be performed intensively to support the study before the project is to be implemented. Lastly, after the implementation of the system, feedbacks and comments are to be collected from users also, to ensure that the system is beneficial.

During the design and implement the Android application, I will choose the software development life-cycle (SDLC). It is because the application can be hard and complex. The SDLC can be as a framework to guide to implement the application to make it more efficient and systematic. SDLC can guild how long it will make to complete the application, to test or release.

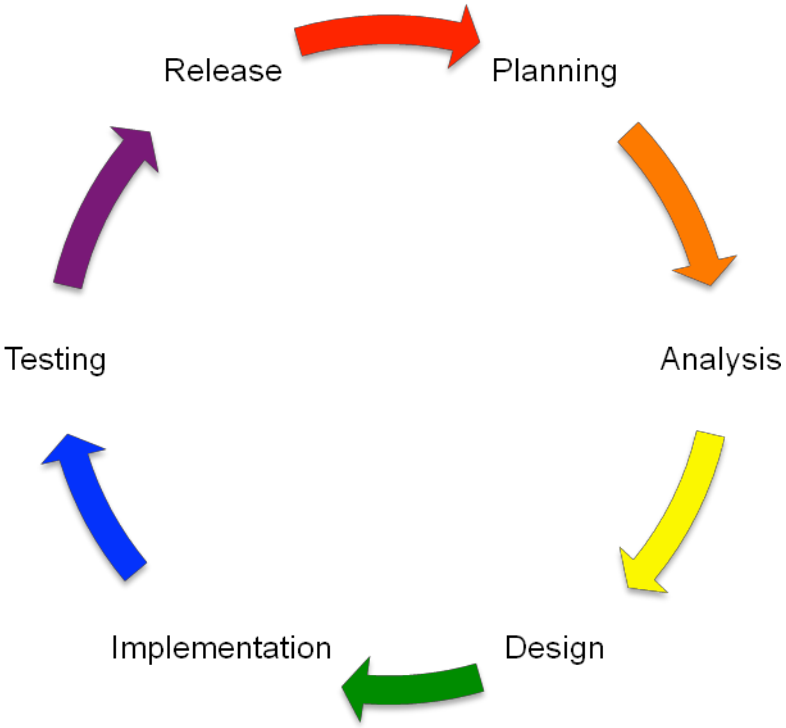
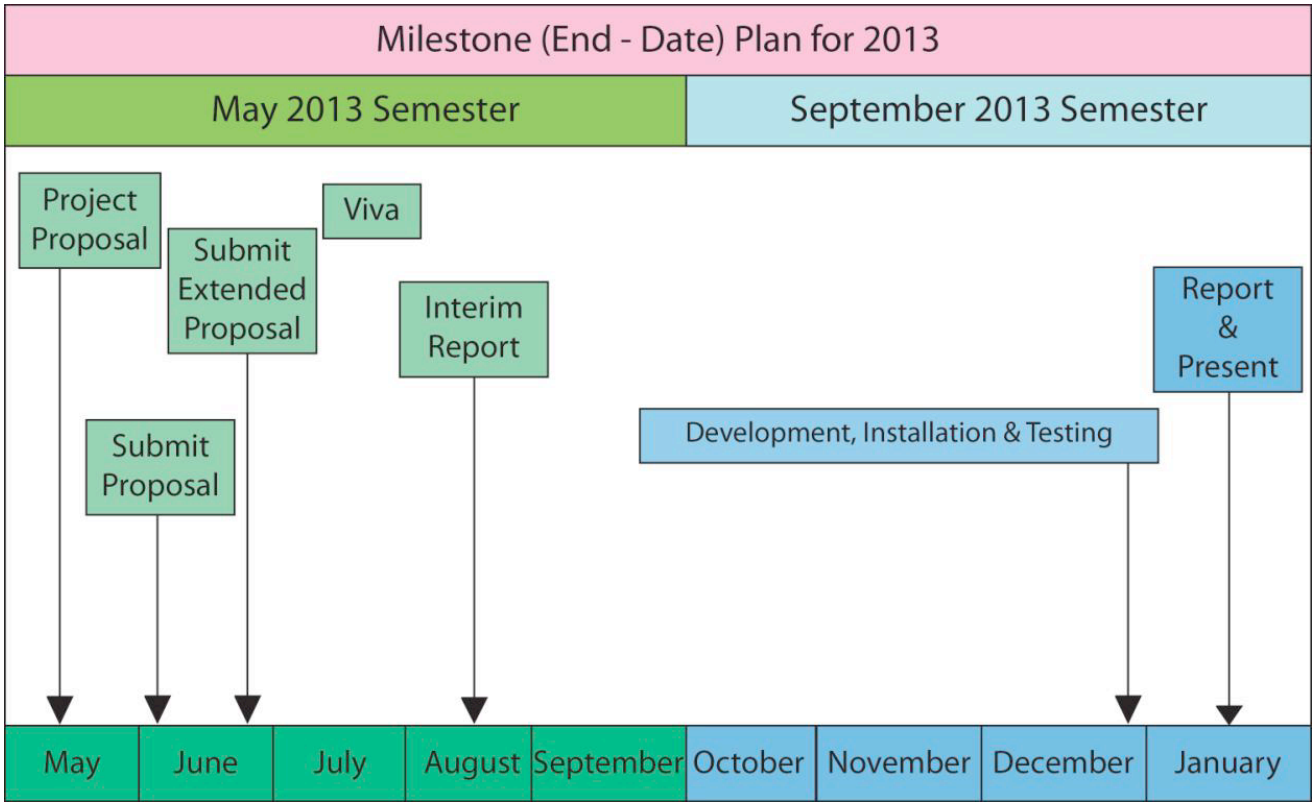



Figure 12: Software Development Life-cycle (SDLC)

## Key **Milestone**



## Project Activities

Project activities indicate the key milestone for this project process and specified data to deliver it. The project is divided into two sessions. The first session is done in FYP 1 and the second session will continue from FYP1 with some specified milestone in FYP 2.

| Task No | Task Name | Duration (In Days) | Status |
|---|---|---|---|
| 1. | Identify a topic area and define title | 5 | Completed |
| 2. | Discuss with supervisor on the next step | 3 | Completed |
| 3. | Prepare for literature view, background studies, objectives and methodology | 7 | Completed |
| 4. | Create work plan and Grantt Chart | 2 | Completed |
| 5. | Analyze as-is process and define to-be process | 4 | Completed |
| 6. | Gather requirements and data necessary for the analysis | 7 | Open |
| 7. | Finalize the functions (system specification) | 3 | Open |
| 8. | Create Functional, structural and behavioral models | 7 | Open |
| 9. | Develop Design Strategy | 3 | Open |
| 10. | Architecture and Interface Design | 5 | Open |
| 11. | Program Design | 5 | Open |
| 12. | Development of the system | 90 | Open |
| 13. | Testing | 5 | Open |
| 14. | Provide Feedback to and fro Users and Modify requirement if any | 5 | Open |
| 15. | System Implementation and Documentation | 14 | Open |

## Gantt Chart

This Gantt Chart shows the estimation of time needed for each tasks in order to complete the project. As shown, the project will be completed in about 7 months (two semesters).

| No | Task | Duration | Week |
|---|---|---|---|
| | | | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 18 19 20 21 22 23 24 25 26 27 28 |
| | Planning Phase | | |
| 1 | Identify Topic Area and Define Title | 1 Week | |
| 2 | Project Feasibility Study | 1 Week | |
| 3 | Project Plan | 2 Week | |
| | Analysis Phase | | |
| 4 | Methodology Analysis | 2 weeks | |
| 5 | Intensive Literature Review and Information Data Gathering | 2 Weeks | |
| 6 | Result and Analysis | 2 Weeks | |
| 7 | Requirements Gathering | 2 Weeks | |
| | Design | | |
| 8 | System Design | 4 Weeks | |
| 9 | Architecture and Interface Design | 4 Weeks | |
| 10 | Database Design | 4 Weeks | |
| 11 | Program Design | 4 Weeks | |
| | Implementation | | |
| 12 | System Construction | 13 Weeks | |
| 13 | Installation | 13 Weeks | |
| 14 | Testing and obtain user's feedback | 1 Week | |
| | Report and Presentation | | |
| 15 | Support Plan and Documentation | 2 Weeks | |

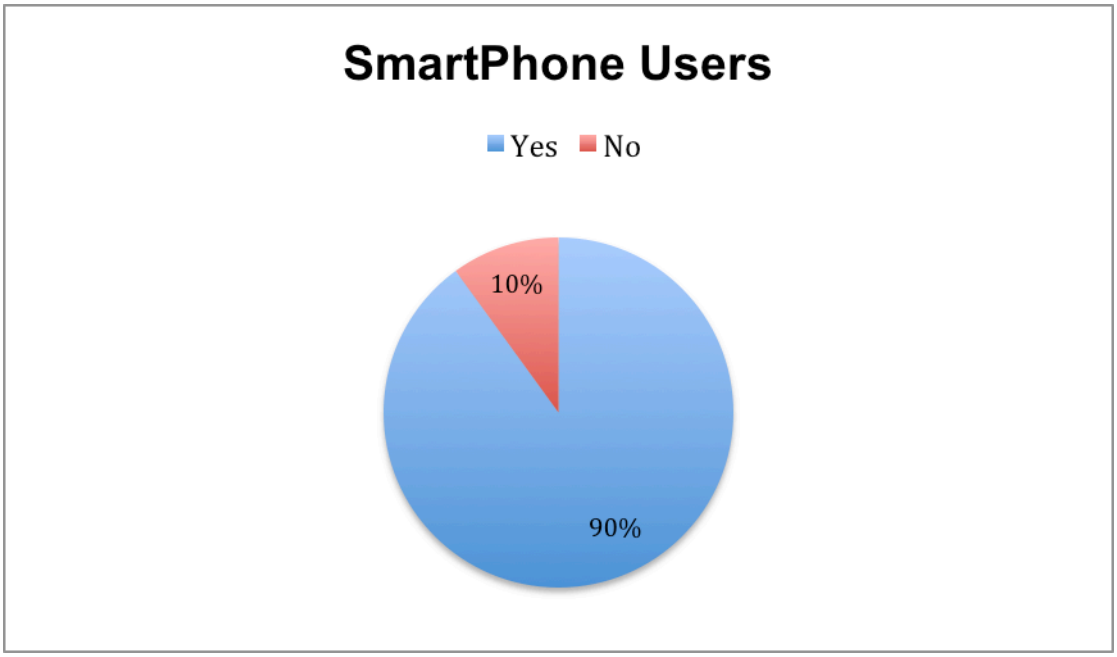
## Tools Required

As at this stage, the detailed technical aspects of the project is not yet in the concern, but roughly the system will be Android SDK, using several programming languages such as:

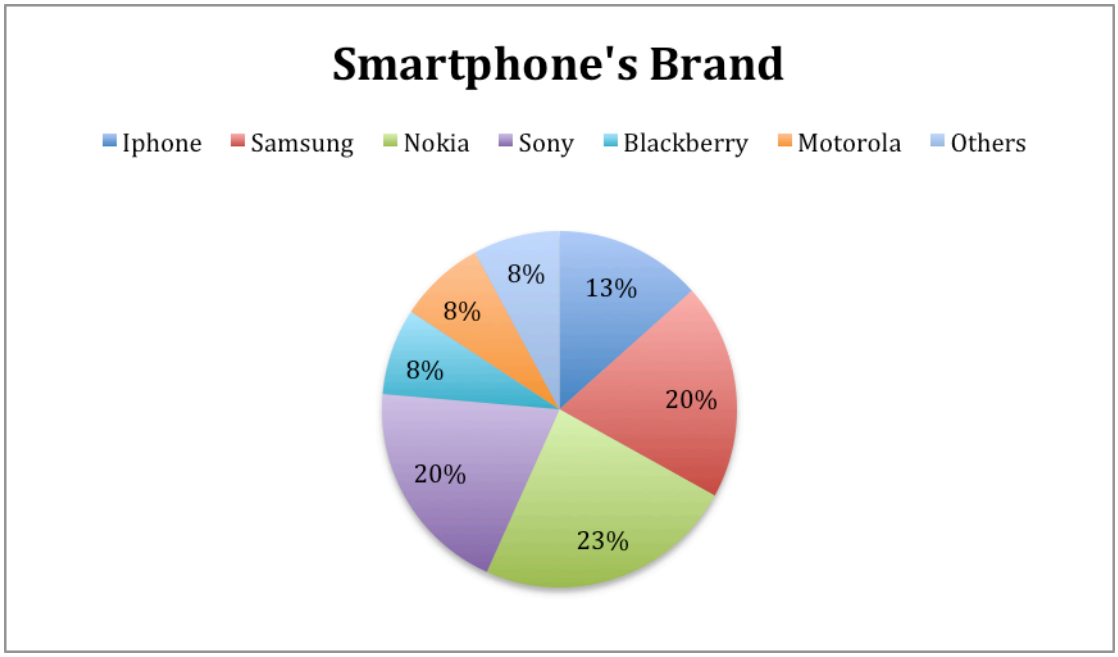
- Android Development Tools plug-in for plugin the Eclipse IDE.
- Android NDK to implement parts of application using native-code languages for examples C and C++.
- JavaScript to enhanced XML editors for Android XML resources for supporting complex projects.

## Result and Discussion

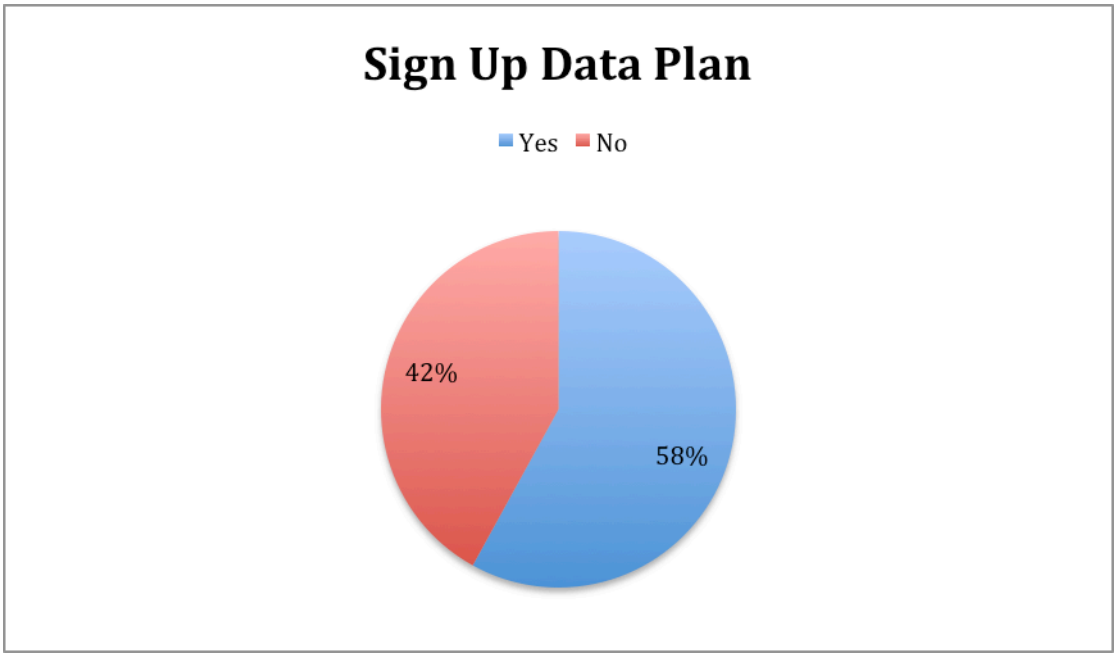
From 62 participants, 10% of participants are using smartphone. In the other hand, 90% of participants are not using any smartphone. The pie representation is provided as below:



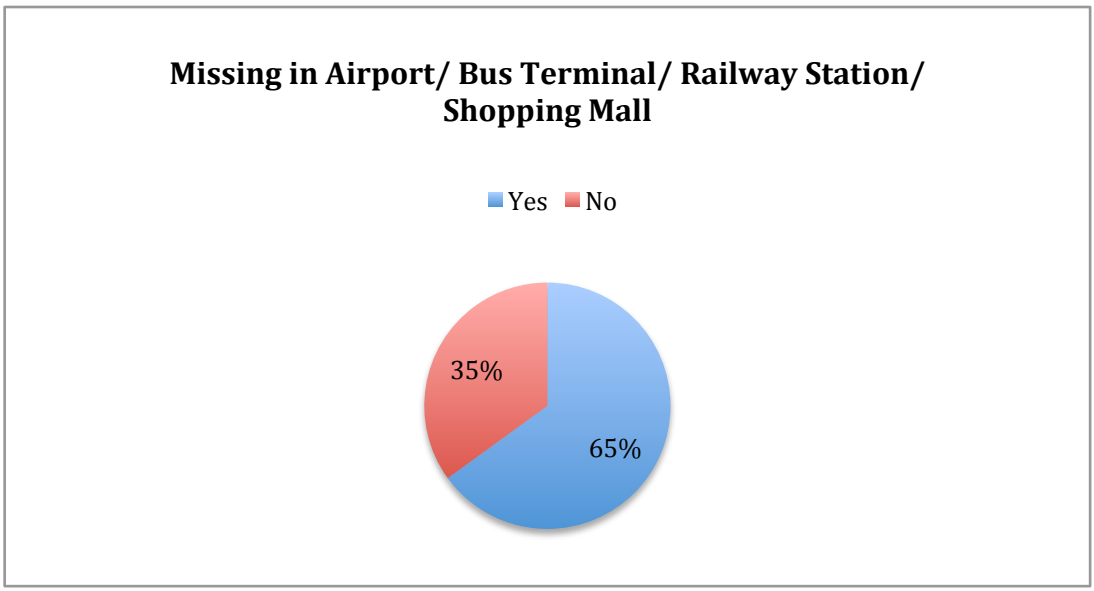
Based on the survey, 31 participants are using Samsung smartphone. From this pie, only 20% of participants are using iPhone. The pie representation is provided as below:



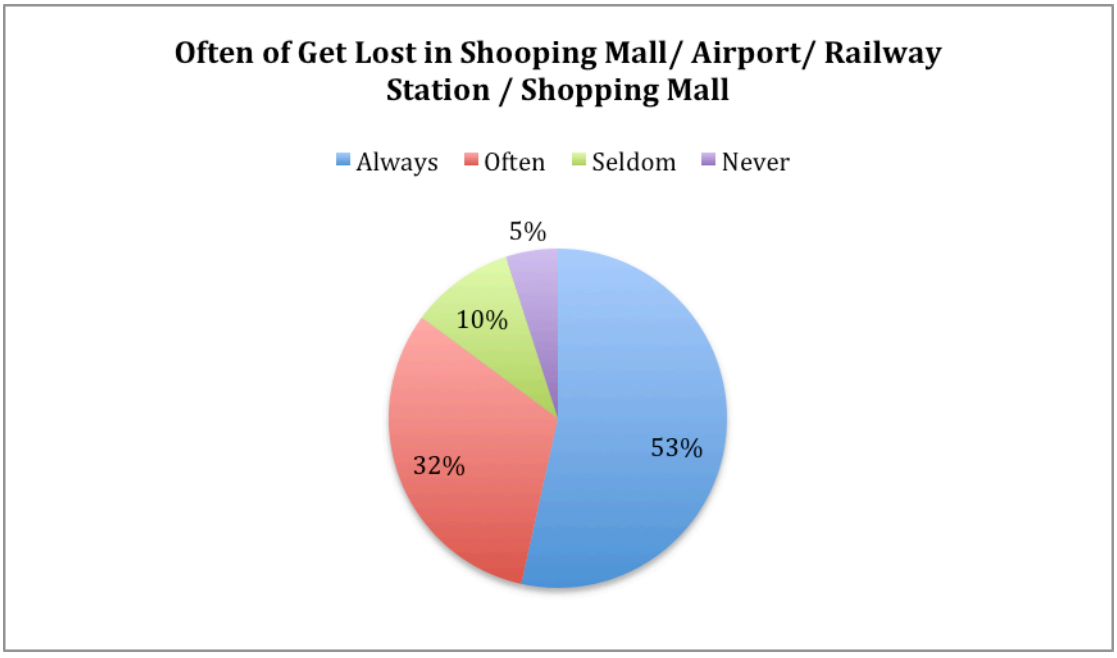

From the pie chart, the participants voted for signing up the data plan. 58% of the participants are signing up the data plan for their smartphone. But, 42% of the participants are not signing up the data plan for their smartphone. The pie representation is provided in below:



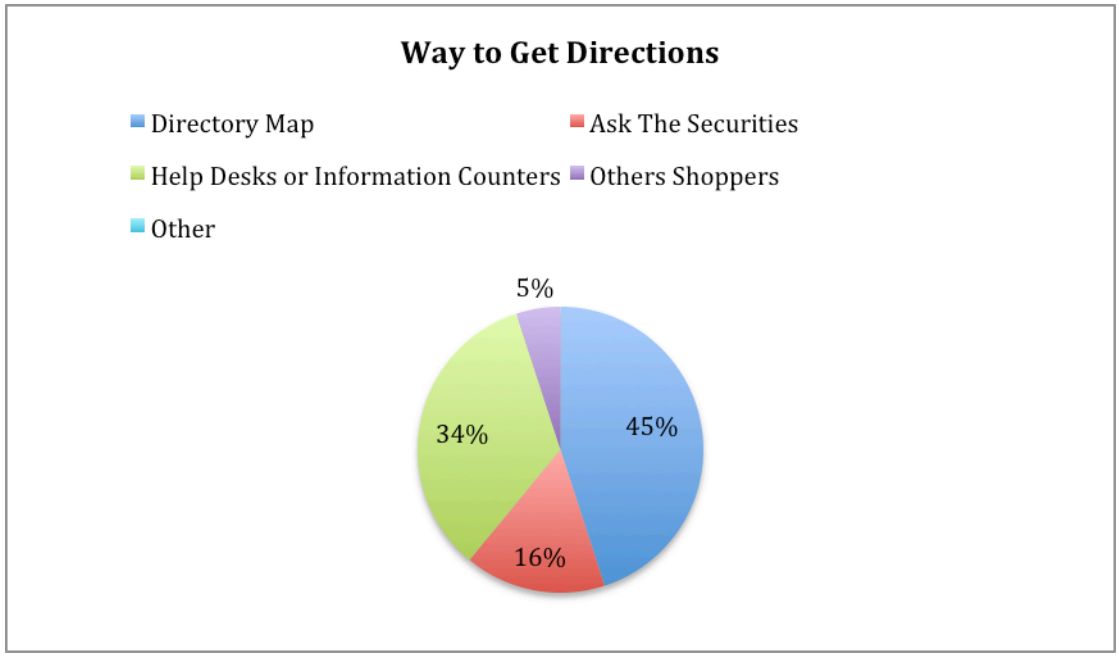
From the pie chart, 65% of the participants voted that they will lost in shopping mall, railway station, bus terminal and airport. Again based on the survey, 35% of the participants will not lost in shopping mall, railway station, bus terminal and airport. The pie representation is provided as below:



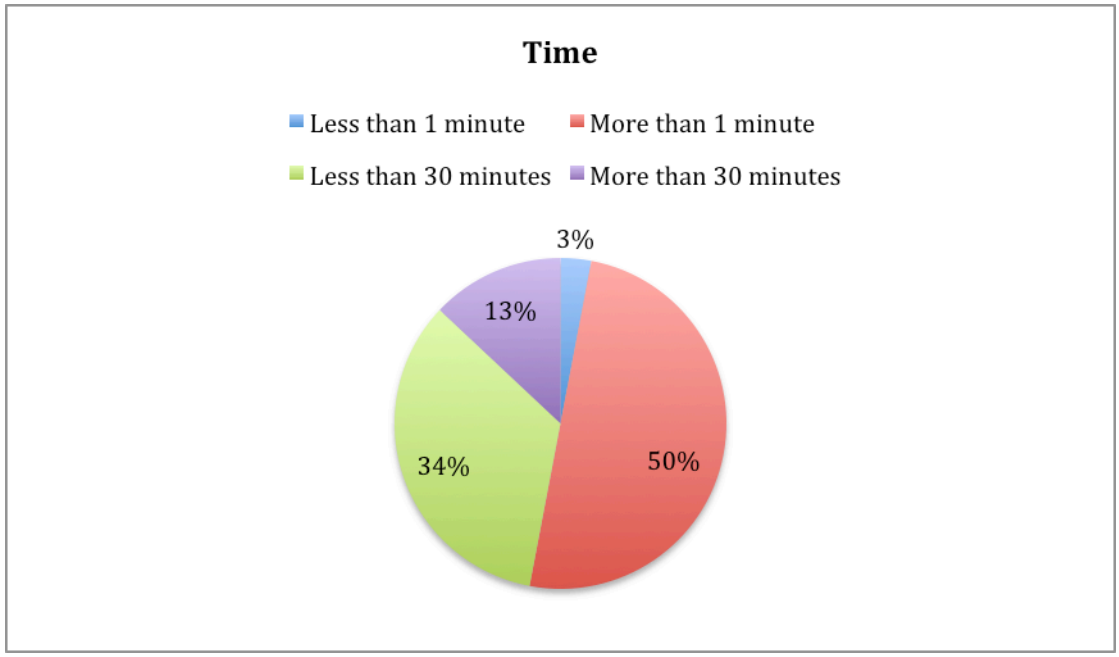

From the pie chart, 53% of participants will always missing in airport, bus terminal, railway station and shopping mall. Only 10% of the participants will seldom lost in the airport, bus terminal, railway station and shopping mall. The pie representation is provided as below:



From the pie chart, 45% of the participants will use directory map when get lost. 34% of the participants will find help desks or information counter to ask the direction. Only 16% of the participants will ask the securities for the direction. The pie representation is provided as below:

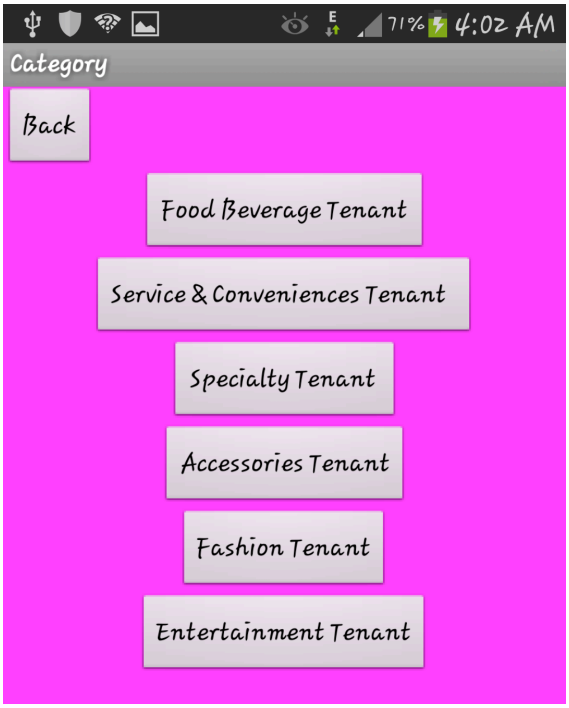



From the pie charts, 21 participants used less than 30 minutes to get their way or direction to the destination. Only 8 participants used more than 30 minutes to get their way of the destination. The pie representation is provided as below:



# Prototype:

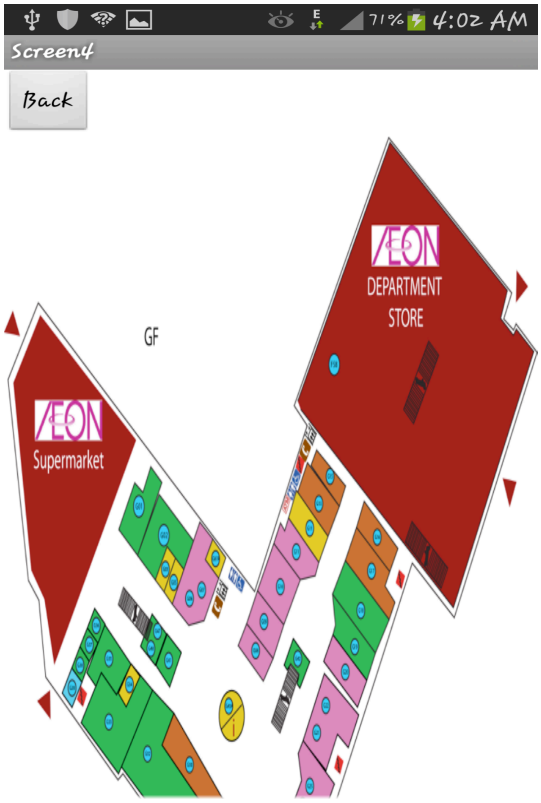

71% 4:09 AM
About
Aeon Kinta City, Ipoh, Perak
KINTA CITY
Opening Time: (Sun – Thu) 10.00am – 10.00pm (Fri – Sat) 10.00am – 10.30pm
Address: No 2, Jalan Teh Lean Swee, Off Jalan Sultan Azlan Shah Utara, 31400 Ipoh, Perak
Careline: 1-300-80-3535
Email: feedback@aeonretail.com.my
Category
Floor Map


71% 4:02 AM
Category
Back
Food Beverage Tenant
Service & Conveniences Tenant
Specialty Tenant
Accessories Tenant
Fashion Tenant
Entertainment Tenant


71% 4:02 AM
Jusco_Kinta_City
G01 Kenny Rogers Roasters
G02 Pizza Hut
G18 Sushi King
G19 Jonny's Restaurant
G28A The Coffee Bean
G32 MCDonald's
G33 K.F.C
G35 The Baker's Cottage


71% 4:02 AM
Food Beverage Tenant
Back
G01 Kenny Rogers Roasters
G02 Pizza Hut
G18 Sushi King
G19 Jonny's Restaurant
G28A The Coffee Bean
G32 MCDonald's
G33 K.F.C
G35 The Baker's Cottage
G36 Auntie Anne's
G37 Lo Hong Ka


71% 4:02 AM
Sushi King
Back
SUSHI KING
GROUND FLOOR 24
Floor Plan


71% 4:02 AM
Screen4
Back
GF
AEON
DEPARTMENT
STORE
AEON
Supermarket

## Conclusion:

In this project, I will present the design, implementation and evaluation that develop an advanced Android application would help the users, such as students, suppliers, guests, travellers and many more. The core component is to provide indoor location information to the users. This application will take important step to expand the mobile service in indoor environment.

## Recommendation:

This mobile application will be helpful for the parents, guests, travellers and suppliers in a very wide space. Some mall or building will have many floor or zone. The parents can track their children where they go in the shopping mall. The guests in the shopping mall can track where they park their car.

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