# MOBILE APPLICATION FOR PUBLIC TRANSPORTATION

By

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# ABSTRACT

This project is a mobile application for public transportation developed based on android platform. The public transports in Malaysia have the least usage by the citizens in the Asian countries. This may because the lack of the quality of the service and system. The main problem will be the public transports always arrive late. Commuters cannot estimate the time of arrival for the public transports. These problems need to be solved before a greater problem arise such as air pollution and traffic congestion. This mobile application can solve the problem by allow tracking of the location of public transports using GPS and internet. The location of the driver of public transport is determined using GPS. The database storing the driver's location will be frequently updated to obtain the most current location of driver. The driver's location will be shared to the user for them to check the arrival of public transports. The estimated time can be then computed based on the data retrieved. The commuters then need no wasting of time to wait a public transport which arrives late. They can check the location of public transports before leaving their home. This mobile application also plans a suitable route for the users given the origin and destination. Users can choose a preferred route and mode of transports to use if there is any. For a better user experience, the mobile application provide the feature of requests of public transports at a station. The bus operators can plan more proper routes and do appropriate arrangement for the buses to fulfill the demand at the bus stations. Therefore, the commuters do not have to wait for a long time to get into a public transport while using public transports during peak hours.

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| | |
|---|---|
| *KL* | Kuala Lumpur |
| *LRT* | Light Rail Transit |
| *API* | Application Program Interface |
| *AGPS* | Assisted Global Positioning System |
| *GPS* | Global Positioning System |
| *WPS* | Wi-Fi Positioning System |
| *SSID* | Service Set Identifier |
| *MAC* | Media Access Control |
| *RSSI* | Received Signal Strength Indicator |
| *HTML* | HyperText Markup Language |
| *RSS* | Rich Site Summary |
| *3GPP* | 3rd Generation Partnership Project |
| *MPEG* | Moving Picture Experts Group |
| *WMV* | Windows Media Video |
| *AVC* | Advanced Video Coding |
| *FLV* | Flash Video |
| *MP4* | MPEG-4 File Format Version 2 |
| *AVI* | Audio Video Interleave |
| *GIF* | Graphics Interchange Format |
| *PNG* | Portable Network Graphics |
| *2D* | Two-Dimensional |
| *3D* | Three-Dimensional |
| *GUI* | Graphical User Interface |
| *KTM* | Keretapi Tanah Melayu |
| *KLIA* | Kuala Lumpur International Airport |

| | |
|---|---|
| *OS* | Operating System |
| *HTTP* | Hyper-Text Transfer Protocol |
| *ID* | Identifier |
| *SDK* | Software Development Kit |
| *XML* | Extensible Markup Language |
| *MySQL* | My Structured Query Language |
| *PHP* | Hypertext Preprocessor (HTML-embedded scripting language) |
| *IDE* | Integrated Development Environment |
| *CPU* | Central Processing Unit |
| *GPU* | Graphics Processing Unit |
| *RAM* | Random Access Memory |
| *FYP* | Final Year Project |
| *ERD* | Entity Relationship of Diagram |

## 1-1 Problem Statement

In present age, problems raised by public transportation have often been an issue in Malaysia. The rapid growth of economy and urbanizations in Malaysia result in a by-product which is a high income society in an urban area. This leads to the high demand in travel among the metropolitans. However, the public transport facilities are lack of planning and design, the concerns of pedestrians, bicycle users and bus users are also less considered. The public transportation facilities lack of service quality although it is modern (Almselati, Rahmat & Jaafar 2011). When the economy develops quickly but the public transportation system is poor, people choose to travel by private vehicle. Among most of the Asian countries, Malaysia has the lowest rate of public transport usage by their citizens. People prefer to travel in their own private cars because of the degree of freedom, accessibility, comfortability and negative perception for public transport (Almselati, Rahmat & Jaafar 2011). The flourish of private transport eventually leads to various problems arise such as air pollution and hazards in Malaysia and traffic congestion in the urban area. In a nutshell, the public transportation system in Malaysia is indeed a necessary to be improved in order to solve the problems stated above.

In the concrete jungle such as KL and Penang, people choose to travel by private vehicle or taxi instead of public transport such as bus or LRT due to the time constraint. Even there are schedules for public transport, **the public transport always arrive late**. When the people choose to travel by public transport, their waiting is just like gambling, they would not know when the bus will be arrived. Given a scenario that a worker wanted to go to work by bus, he had been waiting at the bus station for half an hour as the bus are not arrived on time. When he was running out of time, he decided to hire a taxi. Unfortunately, the bus has arrived after he had make a phone call to the taxi company. This is a problem needed to be solved in order to avoid wasting time of passengers or driver of buses.

The bus stations in Malaysia usually **do not provide any proper route information** of buses. Unlike the government operators such as RapidKL and KL monorail, the normal bus operators only provide basic route information on the bus itself which means that unless you see the bus passes by, you will never know what the route for the

particular bus is. The route information can only be obtained from local people or the bus itself. This scenario leads to the problem that foreign tourists are inconvenient to use the public transport. Without the route information, people find the difficulty to plan the route for their journey.

The main issue of using public transport in Malaysia is the crowded condition, especially in the peak hours. The common situation is the commuters from different types of groups, including students and workers are waiting the same bus or public transport in a station during peak hours. Even when the public transport is arrived, some commuters may not manage to get into the public transport as the spaces and seats are limited. **The amount of demand is often greater than the availability of public transports**. Therefore, some commuters may need to waste their time to wait for the next-coming public transports.

Nowadays, advertisement on public transport becomes a popular choice among the large-size enterprises. **The main problem of advertisement on public transport is flexibility**. Adverts are often placed as basic rectangular motifs on the side or front of a bus. These may be applied directly to the bus. Additionally, adverts may be printed on placards known as boards, which are slotted into special guide fittings attached to the side of the bus (Rsrikanth 2015). Therefore, limited adverts can placed on the bus and altering of the adverts on bus is infeasible. Moreover, some advertisement such as cigarettes and alcohol are unsuitable to be placed on a bus due to some moral issues.

Thus, the deliverable of this project will be a mobile application for public transportation to improve the public transport service with the purpose of enhancing the commuter experience.

## 1-2 Motivation

There exist some mobile application for public transportation in Malaysia such as Transit MY and MYSPAD. However, these applications just include the features such as estimated time and fares, route information and schedule of LRT or rails in KL. These information are less vital as they can be easily obtained from the rail stations or the web sites.

The mobile application delivered in this project will improve the existing application and includes some new features like tracking the public transport, do the route planning and sending request for the transport at a bus station.

## 1-3 Project Scopes

The end product of this project is a mobile application for public transportation which could improve the convenience of using public transport. This project is developed based on the android platform. GPS and internet is needed for the device in order to track the user location. The mobile application targets the public transports in KL region. The users of this application are categorized into two groups which are passengers and drivers in where the passengers can use the features like route planning, tracking the public transport and requesting for transport while the drivers can share the location for the system to broadcast it to the passengers and view the request at the bus stations. The system should be able to:

i) Allow users to sign up as driver or passenger.
ii) Allow users to log in as driver or passenger.
iii) Allow drivers to share their location.
iv) Update the location of drivers in database and broadcast it to passengers.
v) Determine the speed of drivers.
vi) Allow drivers to view the status of the bus stations. (Number of requests)
vii) Calculate the estimated time for arrival, travelling and reaching destination.
viii) Track the user location using GPS.
ix) Allow passengers to set starting and destination points.
x) Provide route planning for passengers.
xi) Allow passengers to request for the transport when they are at a bus station.
xii) Publish the location-based advertisements.

## 1-4 Project Objectives

In order to solve the problems stated before, the mobile application developed in this project will be capable of tracking the location of public transport. The system provide a suitable route planning for the users and an estimated time is calculated. The number of requests of each bus station are tracked and broadcasted to the driver users. To attract the interest of users, suitable and location-based advertisements are provided to the users.

**To track the location of public transport**, the location of a public transport is determined and broadcasted to the users who are the passengers. The passengers can view the current location of the public transports.

The **routes are planned** for a user based on the origin place and destination provided. The information of each step of the planned route are provided to the users. The **estimated arrival time, travelling time and the time for reaching the destination are calculated**. Each stop point is shown to guide users step-by-step to reach the desired destination.

The system allows the user as a role of passenger to check-in and **send requests from a bus station** when he/she is nearby the bus station. The number of requests are updated to the server. The drivers are then able to **view the number of requests of the bus stations**.

For the advertisements on public transports, no more rectangular board painted with the advertisements is placed on the public transport. The advertisements can be mobility which is published on the mobile application. Suitable advertisements have to be chosen for each user to avoid the displeasure of the user. Besides, **location-based advertisements** is an innovative way to provide commuters relevant ads that they desire at that very time.

## 1-5 Impact, significance and contribution

With this mobile application, it will improve the user experience of the public transport. Passenger can use the public transport in a more convenient way with the aid of this mobile application. For instance, a student does not need to wake up earlier and wait at the bus stop for a long time to avoid missing of the bus. He/she can get the location of the bus and the estimated time for it arrives from the application, then leaves home in appropriate time.

The application provides good functions such as route planning for various public transportation and sharing of transportation information to users. This promotes the usage of the public transport by gaining the confidence of people in using public transport in Malaysia. Besides, the application can solve the problem of the crowded situation on using the public transport in peak hours. The bus operators can check the number of requests of each station before sending the buses to the stations. The arrangement of sending more buses to a bus station could be done if there is a large number of requests at the particular bus station.

The application contains information for various types of public transports with commuter advertising. The transit companies earn more revenues and the advertiser benefits from innovative commuter advertising. Everyone get benefits!

## 1-6 Background

Public transport is a shared transport service that can be used by general public. Public transport provides the lowest rate of travelling fares for public and at the same time greatly reduce the environmental pollution by increasing the energy efficiency. However, public transport in Malaysia is less used by the citizen due to the lack of quality of service and system. The end product of this project will be a mobile application for public transportation with the purpose of promoting the usage of public transport.

This project will target the user in KL. KL has the most various type of public transports in Malaysia including KTM Komuter, KLIA Ekspress, KLIA Transit, LRT, monorail and RapidKL. The mobile application will guide the foreigner or tourist to use the public transport in KL in a more convenient way. The application provide the basic information of public transports in KL such as schedule and fares.

In order to improve the user experience, the mobile application includes features such as tracking the public transports. This tracking feature requires GPS in the mobile device. GPS is a system that uses satellite to get user location. At least three satellites are needed to pinpoint the location through trilateration process. The location of driver of public transport is tracked using GPS and is shared to the passengers. The location of drivers will be updated periodically so that the passengers can obtain the actual current location of public transport from the application. This process will only be possible when the application is allow to access to the internet. The internet is needed for the application to access and retrieve data from the database of the server. The estimated time will also be calculated based on the speed of drivers and the distance.

The mobile application allows users to choose their starting and destination points in order to do route planning for them. Users are able to send requests for bus when they are at a bus station. The number of requests at each bus stations are tracked and be shown to driver users.

In this project, some techniques are needed to be performed to fulfill the objectives and complete the development of project. Some literature reviews had been done after doing the studies and researches on current technology. These reviews include location based techniques, techniques to obtain social information from individual mobile devices, types of multimedia that are suitable for mobile sharing, Google Map APIs and similar mobile applications.

## 2-1 Location based Detection Techniques

### 2-1-1 Introduction

In the mobile application of this project, the users' locations would need to be obtained in order to provide a location-based advertisement to them. Other than that, the real-time location of passenger and public transportation would need to be tracked to inform the user of the current location. There are several techniques available in order to track a user's current location such as using AGPS, Wi-Fi or Cell ID.

AGPS and Wi-Fi can obtain a more accurate result than Cell ID but the power consumption is high. This is because AGPS can only track a person's location while mobile network resource is available and the AGPS location fixes are performed periodically. In addition, AGPS is not available for indoor positioning. Wi-Fi can localize a person at indoor but Wi-Fi coverage is often spotty (Wang, Wong & Kong 2012). Cell ID is power-saving and also available both at indoor and outdoor but the drawback is the location tracked is less accurate because the cell tower can cover a radius of hundreds meters to kilometers.

In this review, the three popular location based detection techniques will be studied and compared.

### 2-1-2 AGPS

With assistant servers such as mobile network cell sites, AGPS brings the GPS technology to the mobile devices. Many people know what GPS is but minority of them are aware of the existence of AGPS.

A GPS device communicates with at least three satellites that orbiting the Earth to pinpoint the location through a process called trilateration. The trilateration is a process that the intersection points is obtained from three or above of the radius coverage of satellites. AGPS works the same with GPS do but AGPS gets the location information with the aid of network resources.

AGPS has done the improvement on GPS which reduces the response delay. AGPS stores the information about the location of satellite with the assist of mobile network. This makes AGPS track the location in a quick way as it does not need to download the information via satellite (Zahradnik 2014).

| | A-GPS | GPS |
|---|---|---|
| **Stands for** | Assisted Global Positioning System | Global Positioning System |
| **Source of triangulation information** | Radio signals from satellites and assistance servers e.g. mobile network cell sites | Radio signals from GPS satellites |
| **Speed** | A-GPS devices determine location coordinates faster because they have better connectivity with cell sites than directly with satellites. | GPS devices may take several minutes to determine their location because it takes longer to establish connectivity with 4 satellites. |
| **Reliability** | Location determined via A-GPS are slightly less accurate than GPS | GPS devices can determine location coordinates to within 1 meter accuracy |
| **Cost** | It costs money to use A-GPS devices on an ongoing basis because they use mobile network resources. | GPS devices communicate directly with satellites for free. There is no cost of operation once the device is paid for. |
| **Usage** | Mobile phones | Cars, planes, ships/boats |

Figure 2-1-F1 Comparison between AGPS and GPS (A-GPS vs GPS 2012)

The GPS satellites orbiting the Earth send the location information to the Earth through radio waves continuously (A-GPS vs GPS 2012). Then the distance of a particular location is calculate based on how long it took for the message to reach. There are at least three satellites are needed to be above of a GPS receiver in order to track the exact location. The location is determined through a process called trilateration which is a process that the intersection point between overlapping satellites is taken. This computing needs to takes some time for a GPS device to track the location. Some environmental factors such as blockages of some buildings or the weather could affect the response time.

The cell sites tower or an AGPS server continuously updates their location information by sending and receiving the message to the GPS satellites. The orbital information is downloaded from satellites and stored in the server database. The time performance for tracking locations is greatly improve for an AGPS device because the information only needs to be downloaded from AGPS server instead of the satellites.

### 2-1-3 Wi-Fi Positioning System

The Wi-Fi positioning system (WPS) uses the intensity of signal strengths of wireless access points or modems to localize a person. The main objective of introducing WPS to this world is to solve the unavailable using of GPS at indoor. The indoor positioning using WPS took the advantage of the 21$^{st}$ century rapid growth of wireless access point and modem in urban area. The poor performances of GPS in indoor building and the popularity of using Wi-Fi had encouraged companies to design the Wi-Fi based indoor positioning.

The location of Wi-Fi hotspot is tracked by the SSID and the MAC address of the particular device. When a mobile devices starts the WPS service, the RSSI which is the signal strength of Wi-Fi hotspots is determined. The estimated location of the mobile device is then calculated using multilateration technique.

Fingerprinting method is now a popular technique of WPS. This method is also RSSI-based but the RSSI information is store as a ‘fingerprint’ in the wireless access points. During the learning phase, the known position of a mobile device is categorised

by the RSSI from different Wi-Fi hotspot and stored into the database. For the positioning phase, the position is compared to the fingerprint information to find the closest match and an estimated position is computed (Navaro, Peuker & Quan n.d.).

The WPS did a good performance in indoor but the main drawback of using Wi-Fi positioning is the accuracy of tracked position is relatively low when compared to GPS.

### 2-1-4 Cell ID

Cell ID is a unique number used to identify a cell tower which a mobile device is connected to. The cell ID is used to detect the location from the closest tower. By knowing the location of the tower, an estimated position of a mobile device can be manipulated.

The time taken for localizing a mobile device using cell id is the least compared to AGPS and Wi-Fi because the location information is stored previously in the cell tower. However, the accuracy is very low due to the large coverage of a cell tower. As a result, the difference between the actual position and the estimated position can be up to 1 or 2 kilometers. The accuracy can be improved by increasing the number of cell tower in an area.

### 2-1-5 Google location detection technique

Google uses a hybrid way to track the mobile devices including using GPS and Cell ID. The new feature in Google Map called My Location can pinpoint the location of the phone even the phone has no GPS service (Ji & Jain 2008).

A mobile phone connects to a cell tower to make a call and use the internet. If a phone has GPS service, it sends the Cell ID of cell tower with the GPS location to the Google server even when the phone does not request GPS service. Many of this kind of data is collected and formed a huge database of location information by clustering algorithm. Then when a mobile phone users want to track the location of themselves, the

application on phone request from the Google server with Cell ID to map into an exact location (Ji & Jain 2008).

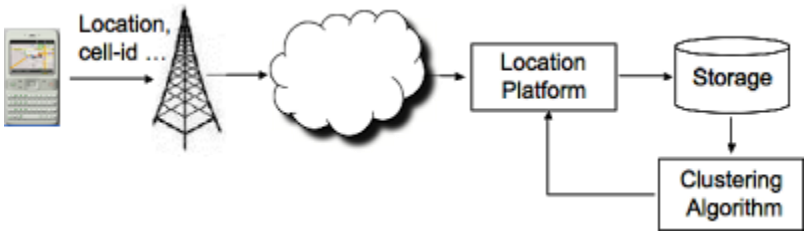



Figure 2-1-F2 Process of location detection of Google (Ji & Jain 2008).

### 2-1-6 Summary

In a conclusion, AGPS has the most accurate result in tracking a location but the GPS signal is weak in indoor. The Cell ID has a relatively low cost and less response time when compared to AGPS. The location detection technique using Wi-Fi has a good performance in indoor but still less accurate than AGPS.

| **Features \ Techniques** | **AGPS** | **WPS** | **Cell ID** |
|---|---|---|---|
| **Accuracy** | High | Moderate | Low |
| **Response time** | Slow | Moderate | Fast |
| **Availability in indoor** | No | Yes | Yes |
| **Power consumption** | High | Moderate | Low |
| **Cost** | Moderate | Low | Low |

Table 2-1-T1 Comparison of AGPS, WPS and Cell ID

## 2-2 Technique to Obtain Social Information from Individual Mobile Devices

### 2-2-1 Introduction

Mobile advertising have been highly effective throughout the past few years, however recently its effectiveness have been decreasing. But most of the time mobile advertising might potentially irritate or offend people. So, advertisers should focus on providing mobile device user relevant advertisement which they are interested on and also be respectful to the user at the same time (How do I Make n.d.).

In this project, the mobile application should provide a suitable advertisement to users by obtaining their information firstly. In this case, Google Advertisement has done a good example to provide a suitable advertisement to Google users. How can Google do this? The studies below will explain the way of Google gain social information from the users' devices in order to choose a suitable advertisement for users.

Before studying the Google's way of advertisement, let's see where mobile advertisements appear.

*Browsers of smartphones or tablets*

The first one is text ads, followed by image ads, the third is application promotion ads and lastly is HTML 5 ads which is built with Google Web Designer (About Mobile Ads n.d.).

*Application of smartphones or tablets*

Same as the advertisement which appears on browsers of smartphones or tablets but minus the HTML 5 ads which is built with Google Web Designer, it includes some extra types of advertisement which is image app promotion ads, video app promotion ads and lastly which is TrueView for app promotion ads (About Mobile Ads n.d.).

*Devices which can only make calls*

This only have one type of advertisement which is call-only ads (About Mobile Ads n.d.).

### 2-2-2 Google's information-gathering channels

Google's mission is stated that "to organize the world's information and make it universally accessible and useful". However, Google may have gathered even more information than we thought (How Google Collects data 2010).

The first channel would be searches which includes web, images, news, and blogs. With a market share of 70%, Google keeps track of all searches, with the personalization of searching on Google, this kind of information is going to grow detailed and user specific (How Google Collects data 2010). The next channel is clicks on search results, which means Google also keeps an eye on what search result we click on. Up next is web crawling which is done by Googlebot (Google's web crawler) it helps to index web pages.

Other than those mentioned above, Google's Website analytics which is named Google Analytics supports a lots of advanced features while it remains free, that's why it is the most popular website analytics. Moreover, ad serving also plays a big role for Google's information mining and their financial success right now. It tells Google which advertisement people are clicking on and which key terms are the advertisers bidding on.

Next, Gmail which is considered as one of the three email giants others are Hotmail from Microsoft and Yahoo. All email contents are examined and analyzed. At a security point of view, Google's email, Web security and archiving service (Postini), receive many data about spam, malware and email security movement from all Gmail users. Moreover, Google has made a deal with social media giants which is Twitter, to have the privilege of direct access to all tweets. Examples such as docs, spreadsheets and calendar, which all of them are Google's office suite is also a great place for information mining for Google.

Google Finance provides not only finance data, it also collects what user search for and use on Google Finance. Google's video site, YouTube, which is also known as the world's largest video sharing and streaming platform, also provides Google of user's viewing habits. To help perfect their natural language analysis and translation, Google uses Google Translate. Up next, a not so popular Google service (Google books) may help Google to figure out what user are reading. RSS feeds that user subscribe to and

which blog post does user reads? Google collect those information with Google reader. Feedburner is a service Google provides to allow blogs to publicize their RSS feeds, and Google will track all the Feedburner Link. Google's location services include Google Maps and Google Earth are also collecting information about which parts of the world are user interested in (How Google Collects data 2010).

## 2-3 Type of Multimedia That Are Suitable for Mobile Sharing

In this modern era of smartphones, videos sharing have been everywhere, no matter it is a short-clip from YouTube or a sample of work to your boss or producer.

In a recent Pyramid research, and it is inform by that report that mobile video usage is predicted to rise at annual compound growth rate of 28% through the next 5 years. People nowadays are watching TV programs, news, videos from a video sharing sites on their smartphone anywhere and at any time as everyone nowadays carry smart phones everywhere.

In order to develop mobile application of this project, suitable types of multimedia for mobile sharing is a necessary to be studied and reviewed.

### 2-3-1 Video Formats Compression Methods

The first compression method for video is the primary video format for mobile video which is 3GPP (3rd Generation Partnership Project). All cell phones will save videos in this kind of format. But it is often assign separately from other MPEG-4 formats, although in reality 3GPP is a variation of MPEG-4.

Motion Picture Experts Group which is also known as MPEG-4. It is separated into parts for example, part 2 comprises of Windows Media Video (.wmv), DivX, Xvid, 3ivx QuickTime 6 and Nero Digital. Whereas part 10 includes H.264 or AVC standard and also QuickTime 7. MPEG-4 video is playable in all mobile video devices.

Next, there is an enhanced version of Flash which is meant for mobile devices. Flash Lite is used by most video sharing sites, and H.264 standard and FLV is both supported by it.

Main benefit of 3GPP format is that its size is small. This is advantageous for users that often save and watch videos on their mobile devices. Uploading and downloading a video in this format only take seconds to minutes (depends on sizes of the

file) so it is suitable for sharing. The down side of this format is that it is highly compressed so that the quality and resolution might be degraded from the original file or when compared to other format (Apowersoft 2015).

The first benefits of Flash Lite is its browser penetration, as most user's computer have Flash player installed than other video format. Next is its consistency and compatibility, Flash files works the same on all platforms, and for consistency you can rest assure that after you've implemented a Flash video, the video will perform the same way for all users. Lastly is its advanced features, Flash provides unique features when it comes to interactive content even QuickTime fell behind in this comparison. However, disadvantages do exist in this format, is that this format is less matured for example, Flash video have undergoes 2 major changes throughout version 5 and 8 (The Pros and Cons n.d.).

In conclusion, all of the file format compression methods above are suitable for video sharing between mobile devices. It depends on what the user will use it for.

### 2-3-2 Types of Video Formats

Firstly, there is a .mp4 file format. Video sharing giants such as YouTube and Vimeo prefer it as it is good in quality and small in size. But there's one disadvantage that Windows devices cannot play this kind of file format without codecs like VLC Media Player.

.wmv file format is used to stream and download contents through the World Wide Web. It is small in size but not so good in quality. Same as to the .mp4 file format, .wmv is not playable on Windows machine without any codecs.

The next one is .mov file format. Apple Quick Time Movie uses this file format. It is great in quality but large in size and it does not play without a codecs on Windows devices also.

Flash video format is the most common video sharing format out there, almost everyone have Adobe Flash player installed on their computer. Even social media giants such as YouTube, Yahoo and MySpace are using this file format. It is relatively small in size but needs some aids to increase its quality. Also, codecs is needed on a Windows devices.

Last but not least, .avi file have a good quality and its size varies from small to large. But downside is it is not playable on Mac without a codecs, it is playable for Windows since they developed this file format. It is slowly replacing .mp4 file format as it compresses videos more effectively (Downs 2012).

### 2-3-4 Best Image Format for Sharing

JPEG format image has a minimal of 24 bits of memory delegated to each pixel which can integrate 16.8 million colours. However, the quality of the image is worsen each time it is transferred as the file is compressed by selectively discarding its data. It is mainly used for the photographs. JPEG is good for images which needed to be small in sizes but it performs poor on logos.

The next image format is GIF, which is also known as Graphics Interchange Format. It is one of the file formats used to display indexed-colour graphics and images in HTML documents on the web. It only displays a total of 256 colours. GIF is beneficial for animated image, clip art and flat graphics. It is good when only minimal colour is needed. Logos with only blocks of color is beneficial from this format.

In addition, there is another image format which is PNG file format which stands for Portable Network Graphics. It includes a full range of colour depths, support for sophisticated image transparency, better interlacing and automatic corrections for display monitor gamma. PNG images can also hold a short text description of the image's content. It is lossless and it retains the colour and quality. It is beneficial for logos and line art and when transparency is a factor. However, there are some compatibility issues on this format which is this format is not supported in all platforms.

To decide which file format is the best, first we need to determine which format is more appropriate for our main purpose. If we are sharing an animation, GIF is the format to go with, if we want to share a photograph which can retain detail and colour, we should use a JPEG. Last but not least if we're sharing a picture of a logo we should use PNG file format.

## 2-4 Google Maps APIs

### 2-4-1 Introduction

Google Maps is originally designed for desktop used. This is a web mapping service developed by Google. There are two views in Google Maps which are normal 2D map view and earth view captured by the satellites. Some features such as imagery, 3D street view and route suggested for walking, cycling, driving and public transportation are also offered in the service.

Google introduced a mobile application for Google Maps in 2005 (Gilliam 2016). This brought the convenience for the users of mobile devices that they can track their location using Google Maps and also get a route to a destination from Google Maps application on mobile devices.

Google Maps API had been launched in the same year Google introduced the mobile application of Google Maps. Google Maps API allows developers to plugin Google Maps into their websites (Gilliam 2016). Developers can customize maps and information on maps using Google Maps API.

In this project, the mobile application will be using Google Map API to perform many features such as track the public transportation in real-time and plan a route for the users.

### 2-4-2 Google Maps Android API

Google Maps Android API is an API that allows android developers to use the google maps service in their application on an android platform. The developers can integrate the Google Maps in their android application and customize it. The functions in Google Maps Android API included adding a marker on the map, moving the map to a particular location, getting the user location and drawing polylines on the maps.

### 2-4-3 Google Maps Direction API

Google Maps Android API is a service that calculates directions between locations using an HTTP request. With the Google Maps Android API, the developers can:

i) Search the directions from one place to another with various modes of transports including driving, cycling, walking or transit.
ii) Return multi-parts directions using a series of waypoints.
iii) Specify origins, destination and waypoints as text strings or as latitude/longitude coordinates or as place IDs.

The developers are able to compute the direction data within google map using this API. (Developer's Guide, 2016).

### 2-4-4 Term of Service for API

Google Maps API is free of charge and accessible for commercial use provided that the application developed using this service is not charge for access and is accessible for public. However, Google reverses the right to set the transaction limits and usage policies and publish the advertisements in the future.

## 2-5 Similar Mobile Applications

In this review, several mobile applications are studied and compared to find their strength and weakness.

### 2-5-1 Uber

Uber is a mobile application with a concept that anyone can be a 'taxi driver'. This application is not only available in the cities in Malaysia but also 400 and more cities in the world. A user can register to be a driver with some details such as city preferred to drive in, information of vehicle used and some personal details. The identity of the particular driver is verified before approving the driver's profile to protect the safety of Uber users.

When a user wants to travel to somewhere, he (or she) can choose his destination and pickup location with account logged in. The price and estimated time for driver to reach his location are then displayed to the user. The real-time locations of drivers are broadcasted to every user. Besides, when the user confirms the booking, the details of driver will also be shown to the user. A user can choose to pay by credit card or cash. This application also saves the histories of trips for the users.

This is an application that benefits everyone since passengers could pay less for transportation fees and driver could earn money.

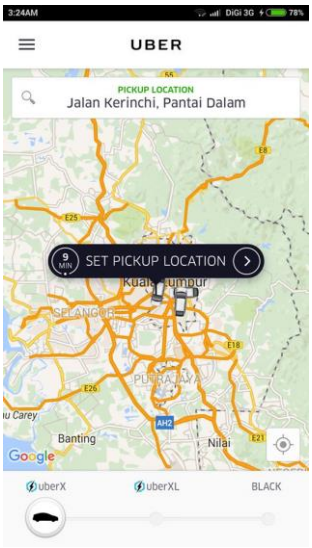



Figure 2-5-F1 GUI of Uber

### 2-5-2 Grab (My Taxi)

Grab is a mobile application for user to book a taxi which the original name of the application is called My Taxi. This application is available in the South-East Asian countries such as Singapore, Malaysia, Philippines, Indonesia, Thailand and Vietnam. Similar to Uber, Grab users can choose their origin location and destination, the estimated time and price will be provided.

In addition, Grab users can choose their preferred type of taxi based on the price and comfortability. The extra feature that Grab has is users can make pre-bookings on a selected date and they can check their schedule of bookings. The main difference between these two mobile applications is Grab's driver is a real taxi with license. Users might feel more secure to take on a taxi compared to a stranger.

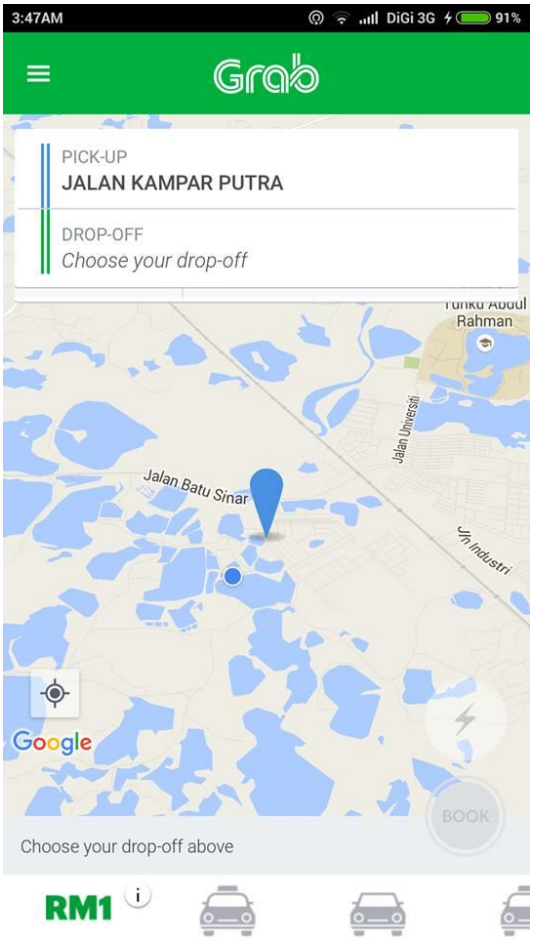



Figure 2-5-F2 GUI of Grab

### 2-5-3 Transit MY

Transit MY provides the map of the rail network in Kuala Lumpur formed by KTM Komuter, KLIA Ekspress, KLIA Transit, LRT and Monorail system. Users choose the origin rail station, destination station and the time they wish to travel. The system will choose the earliest train from time input. Then the arrival time, travelling time and the time to reach destination are computed. The user's history of trip can also be viewed. Transit MY also allows users to check the nearest station based on the users' current location.

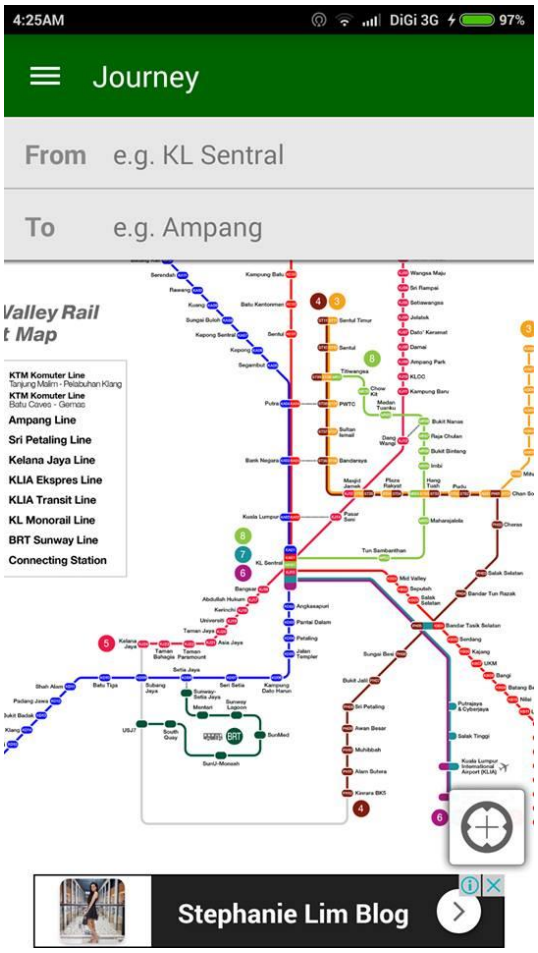



Figure 2-5-F3 GUI of Transit MY

### 2-5-4 mySPAD

mySPAD is developed by Malaysia's government to provide the information about the public transport in Malaysia such as taxi, school bus, city bus, LRT and monorail in KL.

This mobile application just provides the basic route of buses but not the route planning for buses. For the taxi information, users are allowed to enter the taxi registration number to check the identity of the particular taxi driver. The phone numbers of taxi companies in Malaysia are also provided. Users can check the fares of travelling on rails in KL including KLIA Ekspress, KLIA Transit, LRT and monorail by entering the origin and destination station.


Figure 2-5-F4 GUI of mySPAD

### 2-5-5 Citymapper

Citymapper basically does route planning in cities for users. Similar to Google Maps, users select their starting point and ending point, Citymapper plan a route for them based on the transportation they selected such as walking, cycling, train, bus or uber. Users can check the nearest station for public transportation such as bus, LRT, MRT or ferry.

Users can check the information of the whole public transportation network in a particular city including the map, the stations' names and the status of the station. Moreover, users can save their home, working and some frequently-visit locations for the higher efficiency of accessing those locations. By taking the advantage of high popularity of social networks today, this mobile application allows users to share their location via Facebook or Twitter.

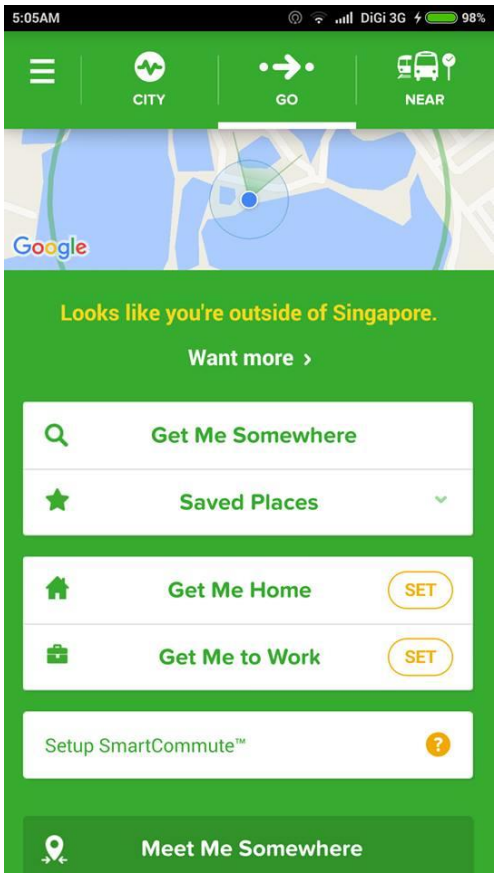



Figure 2-5-F5 GUI of Citymapper

### 2-5-6 Comparisons in the mobile applications

| | **Uber** | **Grab** | **Transit KL** | **mySPAD** | **Citymapper** |
|---|---|---|---|---|---|
| **Types of public transportation** | Uber | Taxi | Rails in KL | Taxi, school bus, city bus, rails in KL | Bus, Uber, MRT, LRT, Ferry |
| **Fares** | Cheap | Cheap | Normal | Normal | Normal |
| **Shown of fares** | Yes | Yes | No | Yes | No |
| **Display schedules** | No | Yes | No | Yes | Yes |
| **Estimate time for arrival, travelling and time to reach** | Yes | Yes | Yes | No | Yes |
| **Track the location of public transport in real-time** | Yes | No | No | No | No |
| **Route planning** | No | No | No | No | Yes |
| **Display the map of rail-based network** | - | - | Yes | Yes | Yes |
| **Display of history** | - | - | Yes | No | No |
| **Check the nearest station for public transportation** | - | - | Yes | No | Yes |
| **Social sharing** | No | No | No | No | Yes |

| | | | | | |
|---|---|---|---|---|---|
| **Strength** | - New concept that everyone could be a driver and earn money<br><br>- Normally lower fares than taxi<br><br>- The location of driver is tracked in real-time | - More secure for passenger<br><br>- Pre-bookings are allowed<br><br>- There are always promotions | - Display the actual rail-based network map<br><br>- Provide estimated time<br><br>- Display nearest rail station | Sufficient information about public transportation in Malaysia | Many features are included such as social sharing |
| **Weakness** | Less credibility of the driver | - Still more cost than Uber<br><br>- Less driver | No route planning and check of fares | No useful features such as route planning and estimate time | Not available in Malaysia |

Table 2-5-T1 Comparisons in the mobile applications

## 3-1 Methodology

The methodology used in this project is throwaway prototyping. This methodology emphases on the creation of prototypes. Prototype is an incomplete version of the programs for users to try out and evaluate. The user then gives feedback and the prototype is thrown away. This methodology is a rapid development.

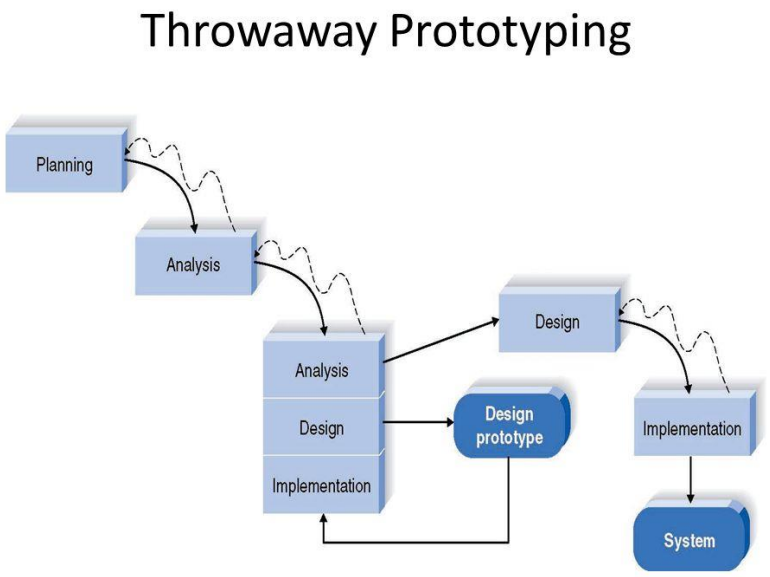



Figure 3-1-F1 Throwaway Prototyping (Bimo, G n.d.)

In the planning phase, the problems and issues occur in the society today are evaluated. Then the problem statements are determined and the ultimate goal is set. Some documents and a proposal are prepared.

In the analysis phase, information is gathered and ideas are developed for the system concepts. Then the analysis and design phases are performed concurrently to produce a design prototype. The design prototype will be implemented. After getting the user's feedback, the prototype is then discarded and is thrown away. These phases are repeated in a cycle until the issues are resolved.

Next, the project moves to the next phase which is design phase. The final requirements are determined. The solutions on the problems with some techniques used is designed. The design model is implemented and coded during implementation phase.

Finally, the system is set up in a real environment.

There are various pros and cons for this methodology:

*The Advantages of Throwaway Prototyping*

- Quickly provide a system to user
- Increase the user involvement in the project
- Quickly refine real requirement

*The Disadvantages of Throwaway Prototyping*

- Fast-paced system releases challenge attempts to conduct careful, methodical analysis
- User may confuse of prototypes and real system.

However, the advantages still overweigh the disadvantages.

## 3-2 Project Timeline

*FYP 1*

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Review Preliminary Report | 30/5/2016 | 30/5/2016 | 1d |
| 2 | **Chapter 1: Introduction** | **31/5/2016** | **14/6/2016** | **2w 1d** |
| 3 | Problem Statement | 31/5/2016 | 1/6/2016 | 2d |
| 4 | Motivation | 2/6/2016 | 2/6/2016 | 1d |
| 5 | Project Scopes | 3/6/2016 | 4/6/2016 | 2d |
| 6 | Project Objectives | 7/6/2016 | 8/6/2016 | 2d |
| 7 | Impact, Significances and Contribution | 9/6/2016 | 10/6/2016 | 2d |
| 8 | Project Background | 13/6/2016 | 14/6/2016 | 2d |
| 9 | **Chapter 2 Literature Review** | **15/6/2016** | **19/6/2016** | **5d** |
| 10 | **Chapter 3 Proposed Method/Approach** | **20/6/2016** | **4/7/2016** | **2w 1d** |
| 11 | Methodology | 20/6/2016 | 20/6/2016 | 1d |
| 12 | Tools used | 21/6/2016 | 21/6/2016 | 1d |
| 13 | User requirements | 22/6/2016 | 22/6/2016 | 1d |
| 14 | System overview | 23/6/2016 | 24/6/2016 | 2d |
| 15 | Use case diagram | 25/6/2016 | 27/6/2016 | 3d |
| 16 | Activity diagram | 28/6/2016 | 2/7/2016 | 5d |
| 17 | Implementation Issues and Challenges | 3/7/2016 | 4/7/2016 | 2d |
| 18 | **Chapter 4 Summary** | **13/7/2016** | **14/7/2016** | **2d** |
| 19 | Develop the prototype | 15/7/2016 | 28/7/2016 | 2w |
| 20 | Testing and debugging the prototype | 29/7/2016 | 11/8/2016 | 2w |
| 21 | Finalize the report | 12/8/2016 | 18/8/2016 | 1w |
| 22 | Finalize the prototype | 19/8/2016 | 25/8/2016 | 1w |
| 23 | FYP report 1 submission | 26/8/2016 | 26/8/2016 | 1d |
| 24 | Design Poster | 26/8/2016 | 27/8/2016 | 2d |
| 25 | Preparation for presentation | 28/8/2016 | 28/8/2016 | 1d |
| 26 | Oral presentation and poster submission | 29/8/2016 | 29/8/2016 | 1d |

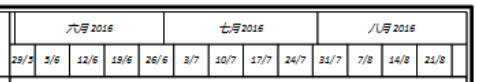



Figure 3-2-F1 FYP 1 Gantt chart

*FYP 2*

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Review FYP Report 1 | 16/1/2017 | 16/1/2017 | 1d |
| 2 | Make a final report draft | 17/1/2017 | 18/1/2017 | 2d |
| 3 | Design second prototype | 18/1/2017 | 19/1/2017 | 2d |
| 4 | Develop the prototype | 20/1/2017 | 26/1/2017 | 1w |
| 5 | Testing and debugging the prototype | 27/1/2017 | 2/2/2017 | 1w |
| 6 | Complete system development | 3/2/2017 | 23/2/2017 | 3w |
| 7 | Testing and debugging the complete system | 24/2/2017 | 9/3/2017 | 2w |
| 8 | Evaluate the system performance | 10/3/2017 | 16/3/2017 | 1w |
| 9 | Finalize the full report | 17/3/2017 | 26/3/2017 | 1w 3d |
| 10 | Full report submission | 27/3/2017 | 27/3/2017 | 1d |
| 11 | Edit or design poster | 28/3/2017 | 29/3/2017 | 2d |
| 12 | Preparation for presentation | 30/3/2017 | 2/4/2017 | 4d |
| 13 | Oral presentation and poster submission | 3/4/2017 | 3/4/2017 | 1d |

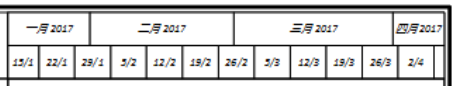



Figure 3-2-F2 FYP 2 Gantt chart

## 3-3 Tools used

*Platform*

- **Android**

  The mobile application is developed based on the android platform. Android is chosen because this platform is most famous and can be fit in most of the smartphone nowadays. The application is developed with a minimum SDK of API level 19 which is Android 4.4 (KitKat). By targeting API 19 and later, the application will run on approximately 73.9% of the devices that are active on the Google Play Store.

*Language*

- **Java**

  Java is an object-oriented programming language. This mobile application is developed using Java language. Java is used because most mobile applications are developed using Java language.

- **XML**

  XML is a markup language that is used to design the layout and interface of mobile application.

*Database*

- **MySQL**

  MySQL is the most popular open source relational SQL database management system. MySQL is used in this project due to its high performance.

- **PHP**

  PHP is a server-side scripting language. PHP is used in this project to access, retrieve and update the data in the database of the server.

*Web Hosting*

- **Hostinger**

  Hostinger is a website that provides free service of hosting a web with the support of PHP and MySQL. This website is used in this project to host the database in the internet.

*Software*

- **Android Studio**

  Android Studio is an IDE for android application development.

- **Google Maps Android API**

  Google Maps Android API is used in order to add a google map to the mobile application. The API also provides other map functions.

- **Google Maps Direction API**

  Google Maps Direction API is used to get direction data of given origin and destination.

*Hardware*

- **Smartphone with Android OS**

  This device is used for installation and testing of the mobile application.

| | |
|---|---|
| **Operating System** | Android 6.0.1 (Marshmallow) |
| **CPU** | 4x ARM Cortex-A15, 1x ARM Cortex-A9, 1800MHz, Cores: 5 |
| **GPU** | GeForce, 672 MHz, Cores: 72 |
| **RAM** | 2GB, 933MHz |
| **Storage** | 16GB, 64GB |
| **Display** | 5in, IPS, 1080 x 1920 pixels, 24 bit |
| **Wi-Fi** | a, b, g, n, Wi-Fi Hotspot, Wi-Fi Direct |
| **Positioning** | GPS, A-GPS, GLONASS |

Table 3-3-T1 Smartphone Hardware Specification

- **Personal computer**

  This device is used to develop the mobile application.

| | |
|---|---|
| **Operating System** | Windows 10 64-bit |
| **CPU** | Intel® Core™ i5-3210M CPU @ 2.50GHz 2.50GHz |
| **GPU** | NVIDIA GeForce GT 635M |
| **RAM** | 4.00 GB |

Table 3-3-T2 Computer Hardware Specification

## 3-4 Requirements

### 3-4-1 Functional Requirements

Sign up and Sign in

- The system shall allow user to sign up a new account of passenger role.
- The system shall allow user to sign up a new account of driver role.
- The system shall authenticate the login of the user.

For passenger user

- The system shall allow user to login as passenger.
- The system shall display the map.
- The system shall detect the current location of the user.
- The system shall animate the camera based on the user location.
- The system shall display the markers of stations on the map.
- The system shall display the location of public transports on the map.
- The system shall allow user to set the origin and destination points.
- The system shall allow user to log out.

- The system shall allow user to use the route planning feature.
    - The system shall provide a route planning for the user given origin and destination points.
    - The system shall display instruction of each step of the planned route.
    - The system shall compute the estimated travelling time and distance for each step.
    - The system shall display the departure and arrival points, time for arrival and departure and transit line of the public transport for each step of route which using public transports.
    - The system shall compute the total estimated travelling time and total distance for the whole route.
    - The system shall display a polyline indicating the route planned on the map.

- The system shall allow user to use the public transport tracking feature.
    - The system shall display the current location of the public transports on the map.
    - The system shall allow user to check on the details of the public transports including driver's username, transport registration number and type of transports.

- The system shall allow user to send request for transports when the user is nearby a station.
    - The system shall display the station name when the user is nearby a station.
    - The system shall allow user to cancel the request sent.
    - The system shall cancel the request sent automatically when the user leave the station.

- The system shall display a location-based advertisement when the user is nearby the base location of the advertisement.
    - The system shall allow user to close the advertisement.

For driver user

- The system shall allow user to login as driver.
- The system shall display the map.
- The system shall detect the current location of the user.
- The system shall animate the camera based on the user location.
- The system shall display the speed of the driver.
- The system shall display the markers of stations on the map.
- The system shall allow user to log out.
- The system shall allow user to share the current user location.
    - The system shall display message indicating the sharing is started.
    - The system shall update database based on the current user location.
    - The system shall allow user to stop sharing the current user location.
    - The system shall display message indicating the sharing is stopped.
- The system shall allow user to view the number of requests at a bus station.
    - The system shall display the details of station name and number of requests at the station when the user is nearby a station.
    - The system shall display a message indicating the number of requests when the user is nearby a station.

Admin Management System

- The system shall allow user to login as admin.
- The system shall authenticate the login of the user.
- The system shall allow user to perform driver management.
    - The system shall allow user to view driver records.
    - The system shall allow user to add a driver record.
    - The system shall allow user to edit a driver record.
    - The system shall allow user to remove a driver record.

- The system shall allow user to perform passenger management.
  - The system shall allow user to view passenger records.
  - The system shall allow user to add a passenger record.
  - The system shall allow user to edit a passenger record.
  - The system shall allow user to remove a passenger record.
- The system shall allow user to perform advertisement management.
  - The system shall allow user to view advertisement records.
  - The system shall allow user to add an advertisement record.
  - The system shall allow user to edit an advertisement record.
  - The system shall allow user to remove an advertisement record.
- The system shall allow user to perform fare management.
  - The system shall allow user to view fare records.
  - The system shall allow user to add a fare record.
  - The system shall allow user to edit a fare record.
  - The system shall allow user to remove a fare record.
- The system shall allow user to logout.

### 3-4-2 Non-Functional Requirements

Environmental requirements

- The system shall be able to work on an android platform.
- The system shall be able to work when there is internet connection for the device.
- The system shall be able to work when GPS permission is allowed.

Performance requirements

- The system shall be able to response in less than 10 seconds.
- The system shall be able to display error message for invalid user input.
- The system shall be able to display error message when there is internet problem or problem of server.

## 4-1 System Overview

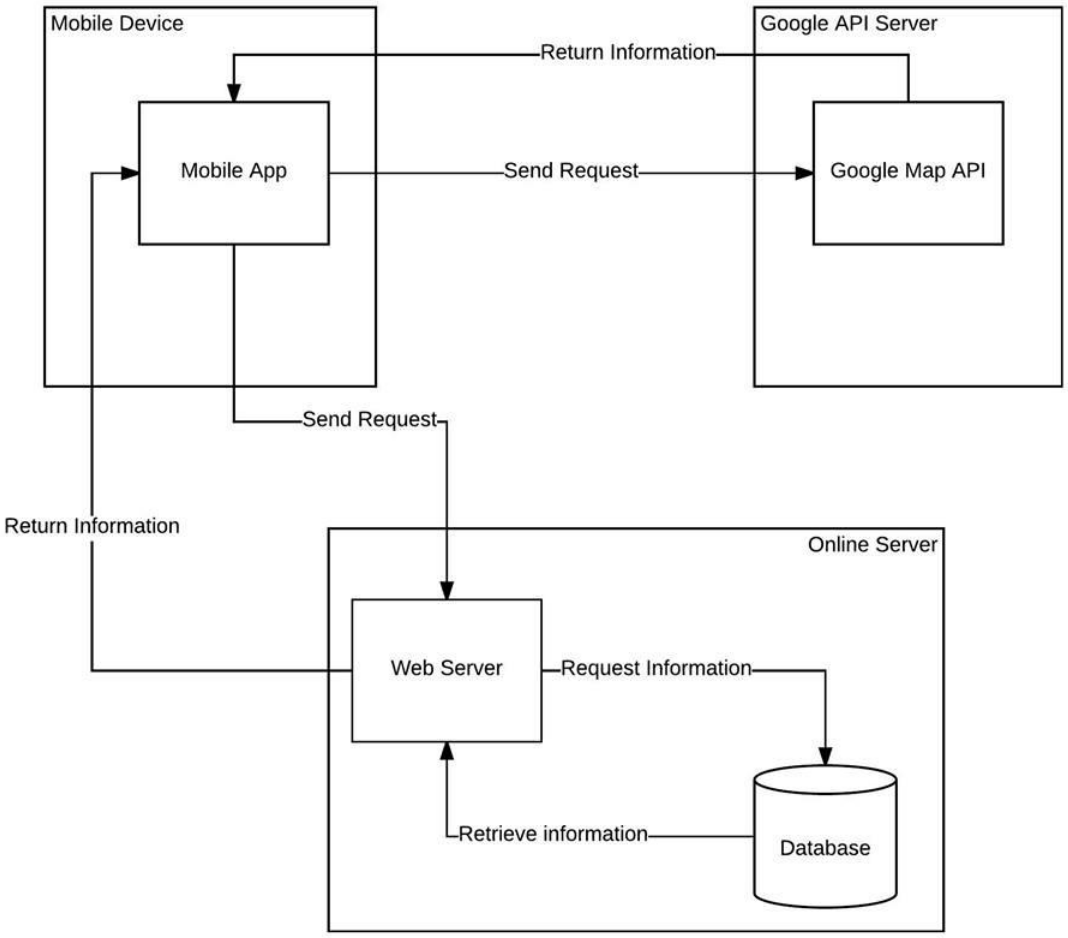



Figure 4-1-F1 System Architecture

This mobile application for public transportation requires a server to store the database. In order to use this application, user needs to approve the permission of the application to access the user location and the internet. The application will get the user location using GPS. For a driver, the location is stored and updated to the database periodically. The system will then retrieve the driver's location and provide the location to the passenger in order for them to track the location of public transport. For a passenger, when the user location is nearby a bus station, the user is allowed to send a request of transport at the particular bus station. The request is then updated to the database. The number of requests

of each bus station would be retrieved from the database and be shown to the drivers. Some functions such as route planning are done by using the Google Maps API. The application will send the request to the Google API server by providing some information such as user location and destination location. The Google API server will then return the information such as steps of route planned, estimated time and distance. Therefore, the information can be provided to the user.

## 4-2 Use case diagram

### 4-2-1 Use case diagram for user

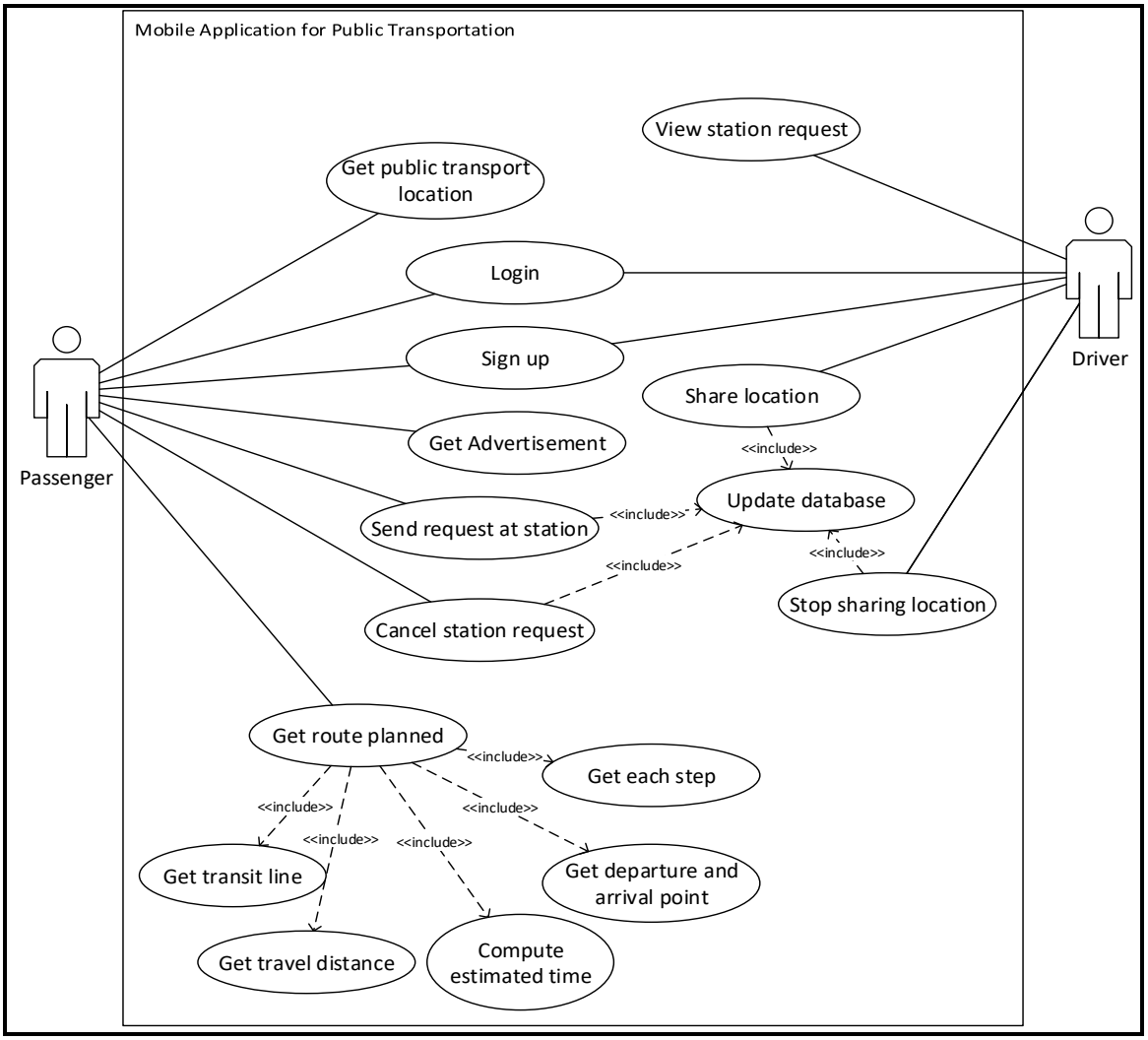



Figure 4-2-1-F1 Use case diagram for user

The use case diagram above (Figure 4-2-1-F1) shows the use cases for users in this project. There are mainly two users in this system who are driver and passenger. Both driver and passenger are allowed to sign up and login to this application. Drivers can start and stop sharing their location and view the request at different bus stations. Passengers can send and cancel requests for bus when they are nearby a bus station. Passengers can check the current location of the public transports and get a route planning by input the origin and destination. Passengers are also able to get location-based advertisements triggered by the current user location.

### 4-2-2 Use case diagram for admin

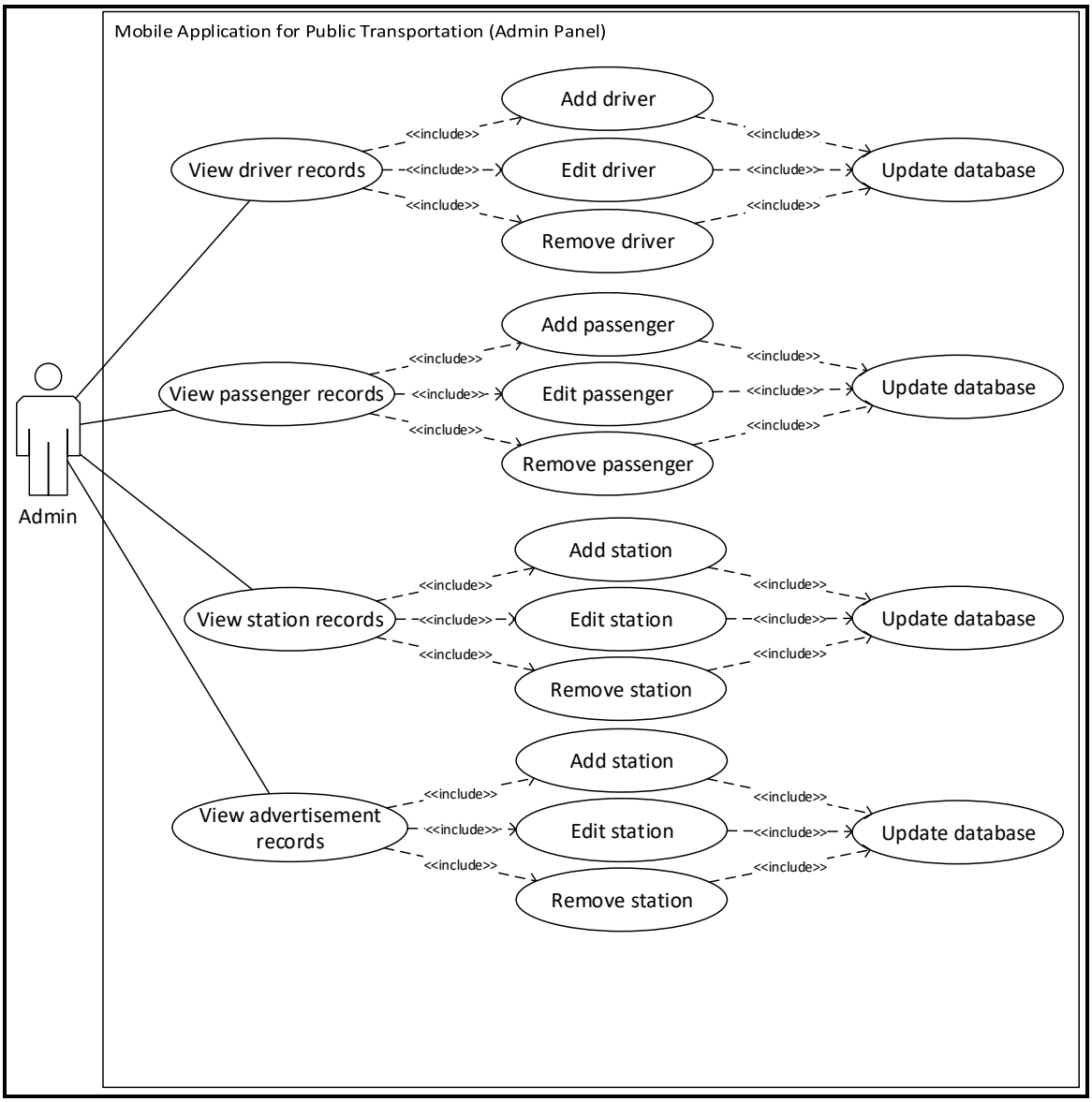



Figure 4-2-2-F1 Use case diagram for admin

The use case diagram above (Figure 4-2-2-F1) shows the use cases for admin in this system. Admin is able to view the records for drivers, passengers, stations and advertisements. Admin can add, edit and remove the records. The system will then update the database after adding, editing or remove any record.

## 4-3 Use Case Description

| **Use Case ID** | UC001 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Sign Up | | |
| **Purpose** | To allow user to sign up an account. | | |
| **Actor** | Passenger, Driver | | |
| **Trigger** | User clicks sign up button in the home page or login page. | | |
| **Precondition** | The application is at home page or login page and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User clicks sign up button from home page or login page. | |
| | 2 | User chooses the role (passenger or driver). | |
| | 3 | User enters basic information. | |
| | 4 | User clicks “Register” button. | |
| | 5 | Systems validates the user input. | |
| | 6 | If user enters valid input, system check the existences of user from database. | |
| | 7 | If user not exists, database is updated. | |
| | 8 | System displays sign up successful message. | |
| | 9 | User logged in as new user account created. | |
| **Alternate Flow – Back to Home** | 2.1 | User clicks “Back to Home” button. | |
| | 2.2 | System back to home page. | |
| **Alternate Flow – Log In** | 4.1.1 | User clicks “Login” button. | |
| | 4.1.2 | System directs user to login page. | |
| **Alternate Flow – Cancel** | 4.2.1 | User clicks “Back” button | |
| | 4.2.2 | System back to home page. | |
| **Alternate Flow - Invalid Input** | 6.1 | If user enters invalid input, system displays error message. | |
| | 6.2 | Back to Main Flow Step 3. | |

| | | |
|---|---|---|
| **Alternate Flow – User Exists** | 7.1 | If user exists, system displays error message. |
| | 7.2 | Back to Main Flow Step 3. |
| **Author** | Chan Man Ling | |

Table 4-3-T1 Sign up use case description

| | | | |
|---|---|---|---|
| **Use Case ID** | UC002 | **Version** | 1.0 |
| **Use Case** | Login | | |
| **Purpose** | To allow user to login to the application | | |
| **Actor** | Passenger, Driver | | |
| **Trigger** | User clicks login button in the home page or sign up page. | | |
| **Precondition** | The application is at home page or sign up page and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User clicks login button in the home page or sign up page. | |
| | 2 | User enters details. | |
| | 3 | User clicks “Sign in” button. | |
| | 4 | Systems verifies the user identity. | |
| | 5 | If user enters valid username and correct password, system display login successful message. | |
| | 6 | User logged in to the main page. | |
| **Alternate Flow – Sign up** | 3.1 | User clicks “Sign up” button. | |
| | 3.2 | System directs user to sign up page. | |
| **Alternate Flow – User not Exists** | 5.1.1 | If user not exists, system displays error message. | |
| | 5.1.2 | Back to Main Flow Step 2. | |
| **Alternate Flow – Password incorrect** | 5.2.1 | If password is incorrect, system display error message. | |
| | 5.2.2 | Back to Main Flow Step 2. | |
| **Author** | Chan Man Ling | | |

Table 4-3-T2 Login use case description

| **Use Case ID** | UC003 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Share Location | | |
| **Purpose** | To allow driver to share location of public transport. | | |
| **Actor** | Driver | | |
| **Trigger** | User clicks share location button in the main page. | | |
| **Precondition** | User logged in as driver, the application is at main page, the location is not yet shared and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User logged in as driver. | |
| | 2 | User clicks share location button. | |
| | 3 | System changes the button icon into stop sharing icon. | |
| | 4 | System gets current user location. | |
| | 5 | System updates database. | |
| | 6 | Systems displays “Start location sharing” message. | |
| **Author** | Chan Man Ling | | |

Table 4-3-T3 Share location use case description

| **Use Case ID** | UC004 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Stop Sharing Location | | |
| **Purpose** | To allow driver to stop sharing of the location. | | |
| **Actor** | Driver | | |
| **Trigger** | User clicks stop sharing location button in the main page. | | |
| **Precondition** | User logged in as driver, the application is at main page, the location has being shared and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User logged in as driver. | |
| | 2 | User clicks stop sharing location button. | |
| | 3 | System changes the button icon into share location icon. | |

| | | |
|---|---|---|
| | 4 | System updates database. |
| | 5 | Systems displays “Stop sharing location” message. |
| **Author** | Chan Man Ling | |

Table 4-3-T4 Stop sharing location use case description

| **Use Case ID** | UC005 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Get Public Transport Location | | |
| **Purpose** | To allow passenger to view the current location of public transports | | |
| **Actor** | Passenger | | |
| **Trigger** | User logged in as passenger. | | |
| **Precondition** | The application is at main page and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User logged in as passenger. | |
| | 2 | System retrieve public transports’ locations from database. | |
| | 3 | System displays the locations of public transports on map. | |
| **Author** | Chan Man Ling | | |

Table 4-3-T5 Get public transport location use case description

| **Use Case ID** | UC006 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Send Station Request | | |
| **Purpose** | To allow passenger to send request for bus at a bus station. | | |
| **Actor** | Passenger | | |
| **Trigger** | User clicks check-in button at a bus station. | | |
| **Precondition** | User logged in as passenger, the application is at main page, user is nearby the bus station, the request is not yet sent and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |

| | | |
|---|---|---|
| **Main Flow** | 1 | User logged in as passenger. |
| | 2 | System retrieve locations of stations from database. |
| | 3 | System gets the current user location. |
| | 4 | System checks the distance between the user location and the station locations. |
| | 5 | User is near to a bus station. |
| | 6 | A check-in button pops up. |
| | 7 | User clicks on the check-in button. |
| | 8 | System changes the button icon into check-out icon. |
| | 9 | System updates database. |
| | 10 | System displays "Station request sent" message. |
| **Author** | Chan Man Ling | |

Table 4-3-T6 Send station request use case description

| **Use Case ID** | UC007 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Cancel Station Request | | |
| **Purpose** | To allow passenger to cancel the station request sent. | | |
| **Actor** | Passenger | | |
| **Trigger** | User clicks check-out button at a bus station. / User leaves the particular bus station | | |
| **Precondition** | User logged in as passenger, the application is at main page, the station request has been sent and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User sends station request at a bus station. | |
| | 2 | System gets the current user location. | |
| | 3 | System checks the distance between the user location and the bus station. | |
| | 4 | User is near to the bus station. | |
| | 5 | User clicks on the check-out button. | |

| | | |
|---|---|---|
| | 6 | System changes the button icon into check-in icon. |
| | 7 | System updates database. |
| | 8 | System displays “Station request cancelled” message. |
| **Alternate Flow – Leave Station** | 4.1 | User leaves the bus station. |
| | 4.2 | Back to Main Flow Step 7. |
| **Author** | Chan Man Ling | |

Table 4-3-T7 Cancel station request use case description

| **Use Case ID** | UC008 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | View Station Request | | |
| **Purpose** | To allow driver to view the number of requests for bus of each station. | | |
| **Actor** | Driver | | |
| **Trigger** | User logged in as driver, user is nearby the bus station | | |
| **Precondition** | User logged in as driver, the application is at main page, user is nearby the bus station and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User logged in as driver. | |
| | 2 | System retrieve locations of stations from database. | |
| | 3 | System displays the status of each station on the map. | |
| | 4 | System gets the current user location. | |
| | 5 | System checks the distance between the user location and the station locations. | |
| | 6 | User is near to a bus station. | |
| | 7 | System retrieves the station information from database. | |
| | 8 | System displays the number of requests at the particular bus station. | |
| **Author** | Chan Man Ling | | |

Table 4-3-T8 View station request use case description

| **Use Case ID** | UC009 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Get Advertisement | | |
| **Purpose** | To publish location-based advertisement to the user. | | |
| **Actor** | Passenger | | |
| **Trigger** | User is nearby the advertisement base location. | | |
| **Precondition** | User logged in as passenger and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User logged in as passenger. | |
| | 2 | System retrieve base locations of advertisements from database. | |
| | 3 | System gets the current user location. | |
| | 4 | System checks the distance between the user location and the advertisements location. | |
| | 5 | User is near to an advertisement base location. | |
| | 6 | System displays the particular advertisement. | |
| **Author** | Chan Man Ling | | |

Table 4-3-T9 Get advertisement use case description

| **Use Case ID** | UC010 | **Version** | 1.0 |
|---|---|---|---|
| **Use Case** | Get Route Planned | | |
| **Purpose** | To plan a route for the user with the origin and destination provided. | | |
| **Actor** | Passenger | | |
| **Trigger** | User clicks on the route button. | | |
| **Precondition** | User logged in as passenger, the application is at main page and there is internet connection. | | |
| **Scenario Name** | **Step** | **Action** | |
| **Main Flow** | 1 | User logged in as passenger. | |
| | 2 | System gets the current user location. | |
| | 3 | User set the origin and destination. | |

| | | |
|---|---|---|
| | 4 | User clicks on the route button. |
| | 5 | System retrieves route information with the origin and destination set from Google Maps API. |
| | 6 | System displays route planned with details of each step shown including departure and arrival stop point (if any), departure and arrival time (if any), transit line (if any), distance and travelling time. |
| **Author** | Chan Man Ling | |

Table 4-3-T10 Get route planned use case description

## 4-4 Activity diagram

*Sign up Activity*

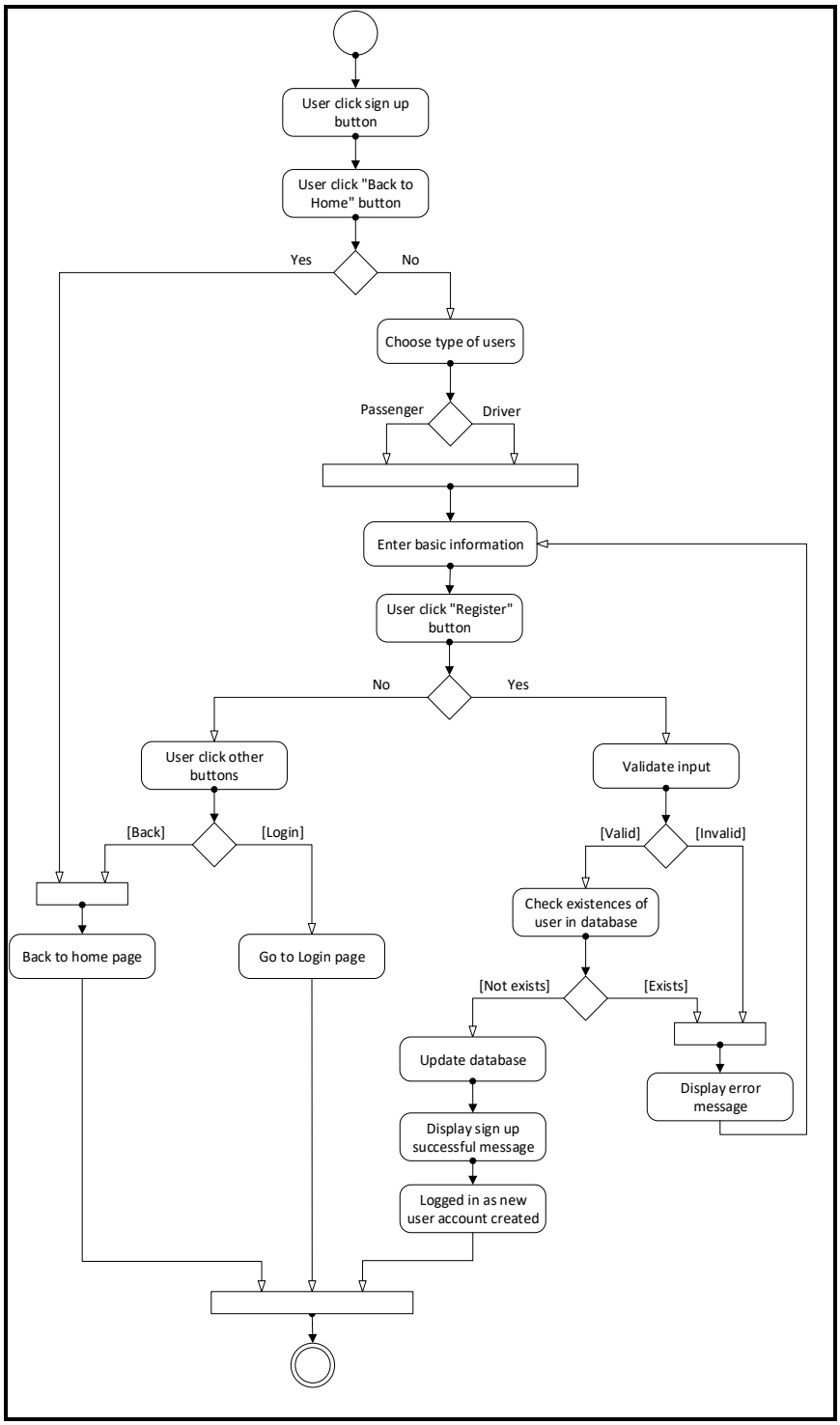



Figure 4-4-F1 Sign up activity diagram

*Login Activity*

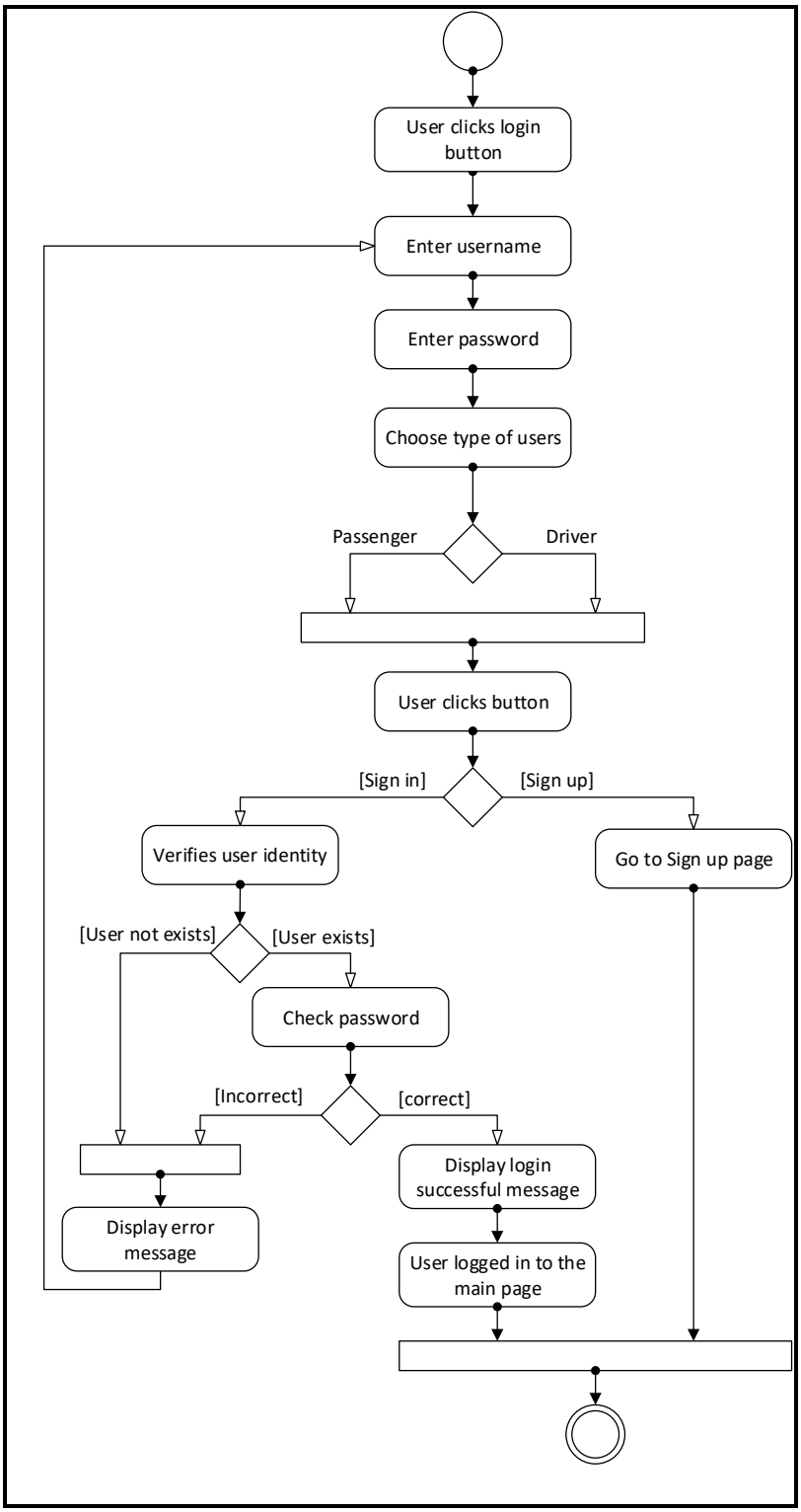



Figure 4-4-F2 Login activity diagram

*Share location activity*

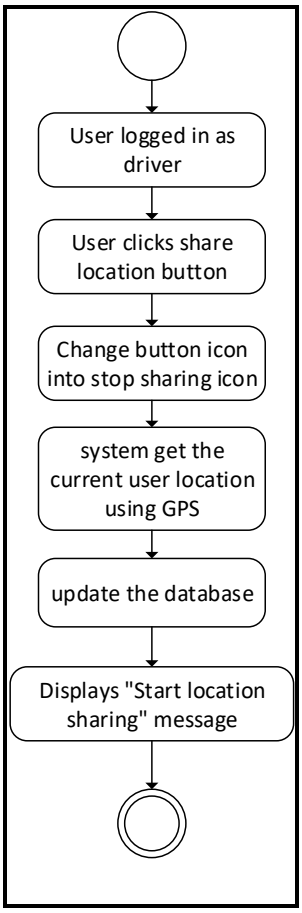



Figure 4-4-F3 Share location activity diagram

*Stop sharing location activity*

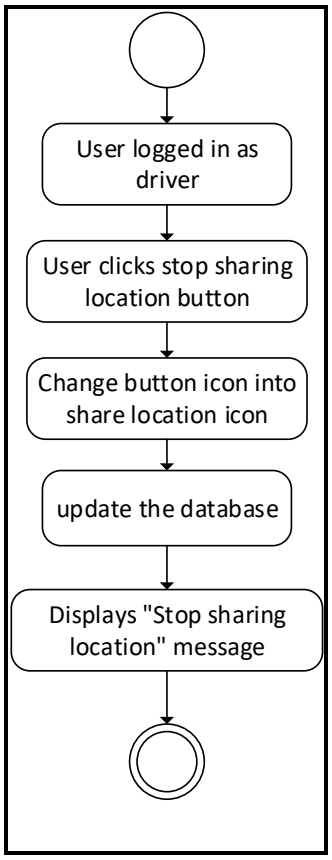



Figure 4-4-F4 Stop sharing location activity diagram

*Get public transport location activity*

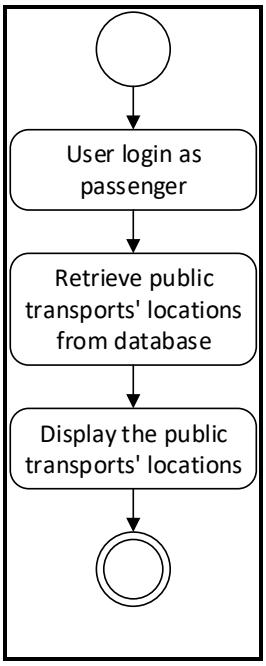



Figure 4-4-F5 Get public transport location activity diagram

*Send station request activity*

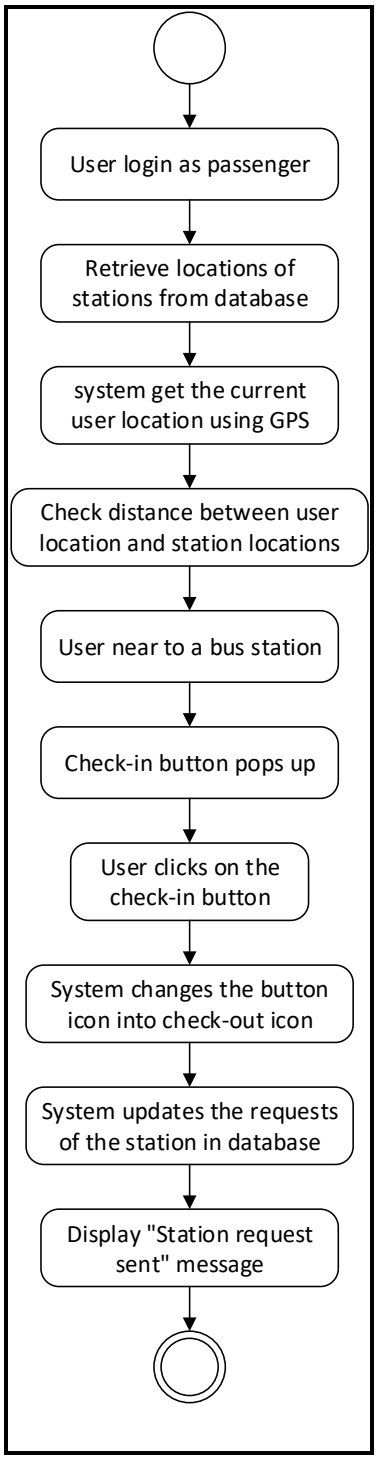



Figure 4-4-F6 Send station request activity diagram

*Cancel station request activity*

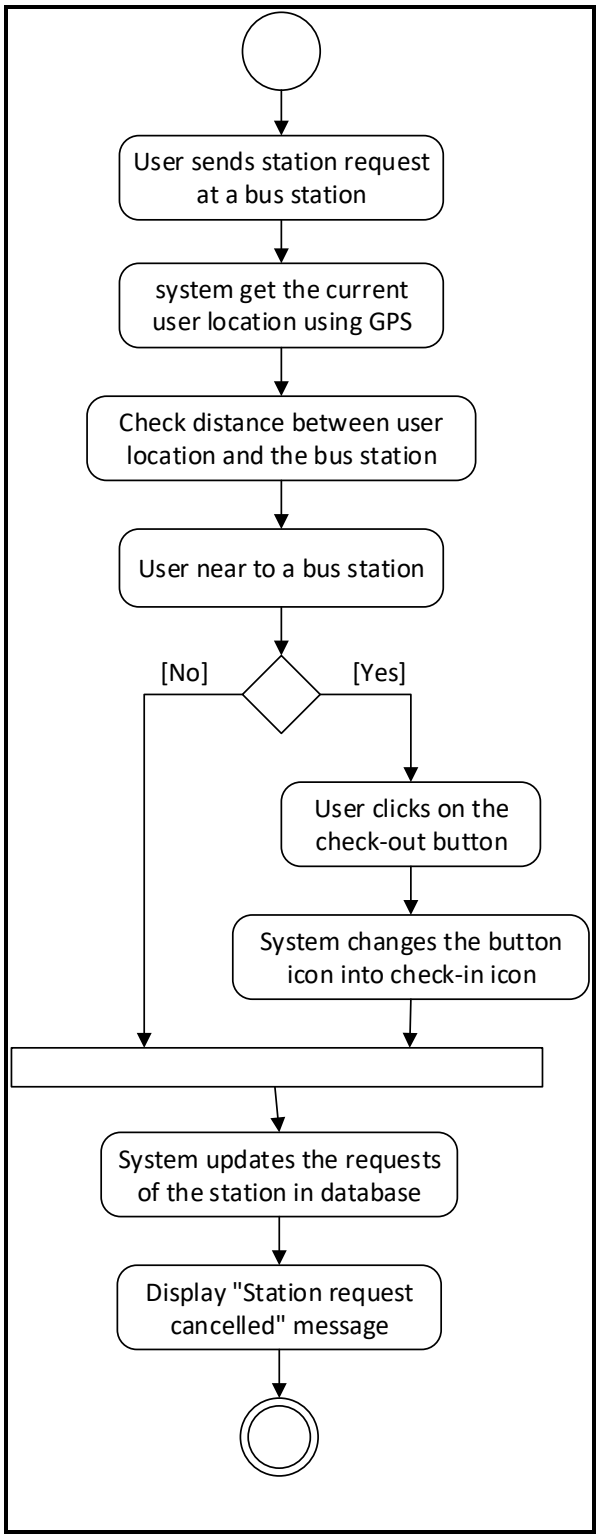



Figure 4-4-F7 Cancel station request activity diagram

*View station request activity*

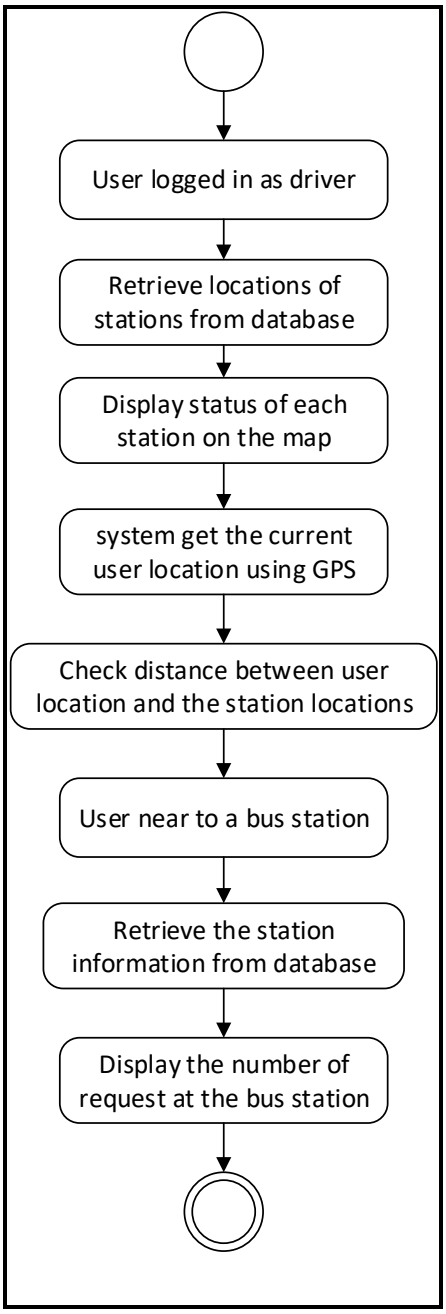



Figure 4-4-F8 View station request activity diagram

*Get Advertisement activity*

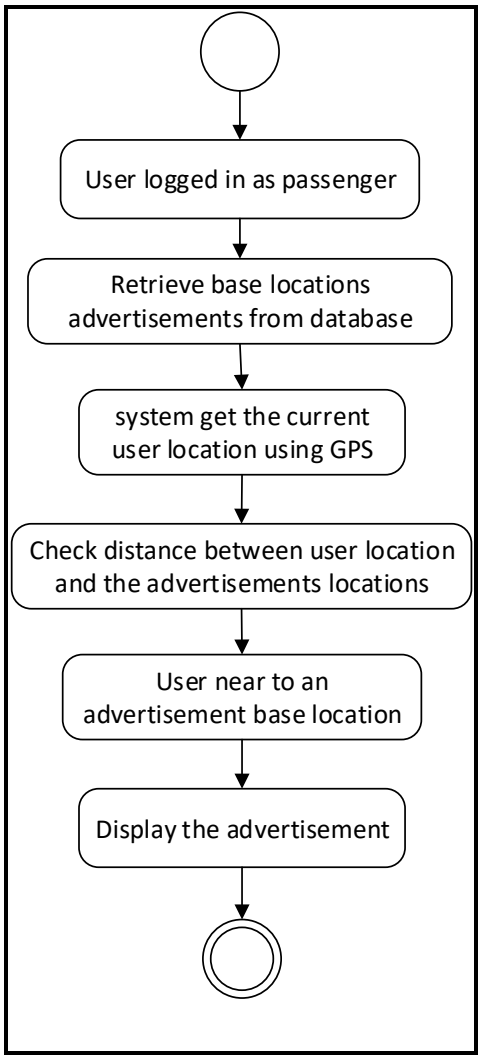



Figure 4-4-F9 Get advertisement activity diagram

*Get route planned activity*

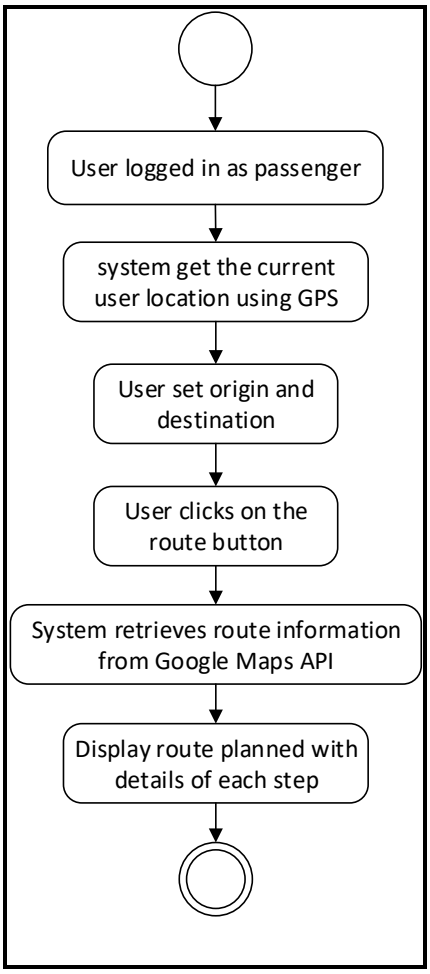



Figure 4-4-F10 Get route planned activity diagram

## 4-5 Entity Relationship Diagram (ERD)

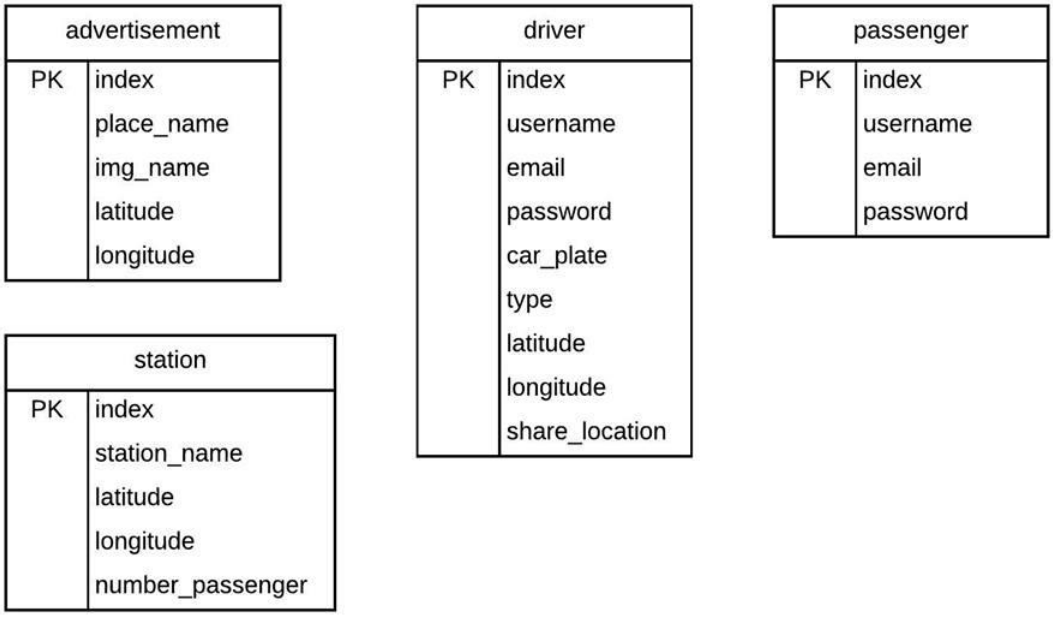



Figure 4-5-F1 Entity Relationship Diagram (ERD)

The entity relationship diagram (ERD) above shows the database model of this system. There are four tables in this database model which are advertisement, station, driver and passenger. Driver and passenger tables store the basic user information where driver table store extra information such as transport registration number, type of transports, location of the transports and whether the driver allows the location sharing of the transport. Advertisement table stores the base location of the particular advertisement, the name of the store/place and the image name of the advert for image loading purpose. On the other hand, the table of station includes the attributes of the station name, the station location and the number of transport request at the station.

## 4-6 Data Dictionary

The data dictionary below describes the data objects in this project.

*Admin table*

| Entity Name | Attribute | Data Type | Field Size | Default Value | Constraint | Description |
|---|---|---|---|---|---|---|
| admin | index | integer | 11 | None | Primary Key, Auto increment | Admin's unique id number |
| | username | varchar | 255 | None | Not null | Admin's username |
| | password | varchar | 255 | None | Not null | Admin's password |

Table 4-6-T1 Data dictionary for admin table

*Driver table*

| Entity Name | Attribute | Data Type | Field Size | Default Value | Constraint | Description |
|---|---|---|---|---|---|---|
| driver | index | integer | 11 | None | Primary Key, Auto increment | Driver's unique id number |
| | username | varchar | 255 | None | Not null | Driver's username |
| | email | varchar | 30 | None | Not null | Driver's email address |
| | password | varchar | 255 | None | Not null | Driver's password |
| | car_plate | varchar | 10 | None | Not null | Driver's transport registration number |
| | type | varchar | 15 | None | Not null | Type of driver's transport |
| | latitude | float | - | None | Not null | Latitude of the driver's location |
| | longitude | float | - | None | Not null | Longitude of the driver's location |
| | share_location | boolean | 1 | None | Not null | Whether the driver allows current location sharing |

Table 4-6-T2 Data dictionary for driver table

*Passenger table*

| Entity Name | Attribute | Data Type | Field Size | Default Value | Constraint | Description |
|---|---|---|---|---|---|---|
| passenger | index | integer | 11 | None | Primary Key, Auto increment | Passenger's unique id number |
| | username | varchar | 255 | None | Not null | Passenger's username |
| | email | varchar | 30 | None | Not null | Passenger's email address |
| | password | varchar | 255 | None | Not null | Passenger's password |

Table 4-6-T3 Data dictionary for passenger table

*Advertisement table*

| Entity Name | Attribute | Data Type | Field Size | Default Value | Constraint | Description |
|---|---|---|---|---|---|---|
| advertisement | index | integer | 11 | None | Primary Key, Auto increment | Advertisement's unique id number |
| | place_name | varchar | 255 | None | Not null | The name of the store/place of the advertisement |
| | img_name | varchar | 255 | None | Not null | Advertisement's image name |
| | latitude | float | - | None | Not null | Latitude of the advertisement's base location |
| | longitude | float | - | None | Not null | Longitude of the advertisement's base location |

Table 4-6-T4 Data dictionary for advertisement table

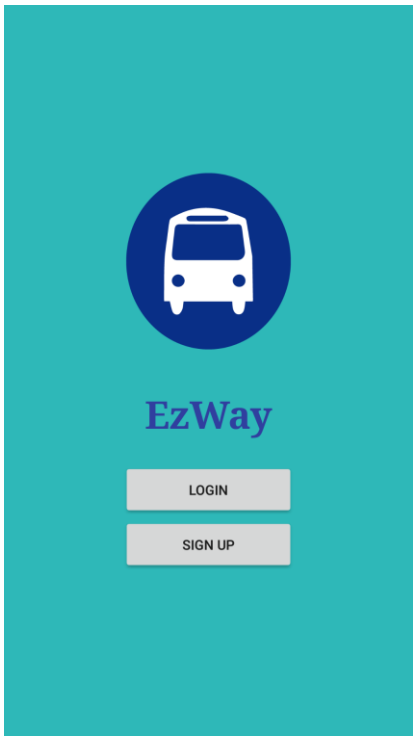
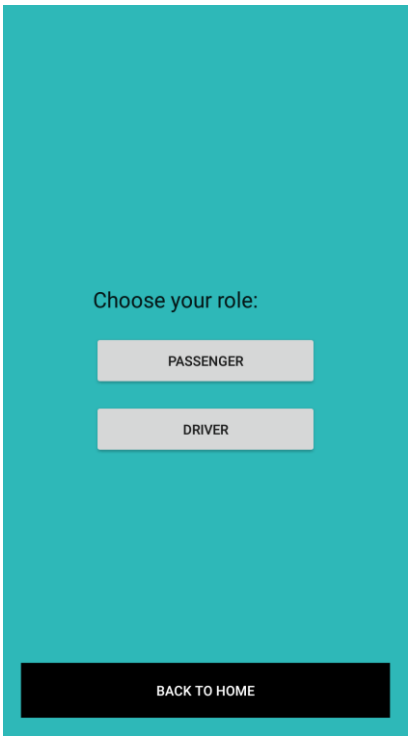
*Station table*

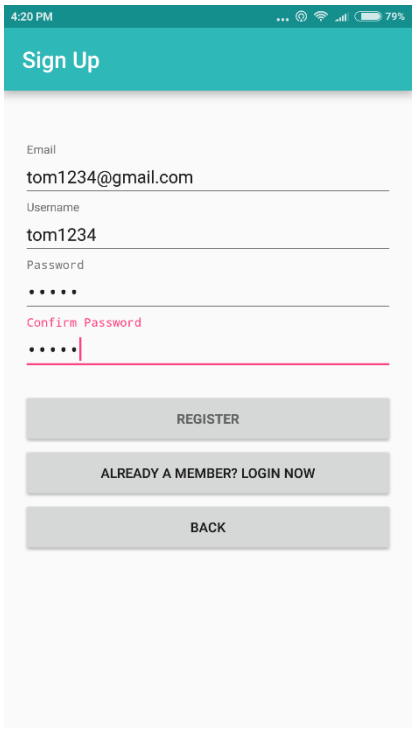
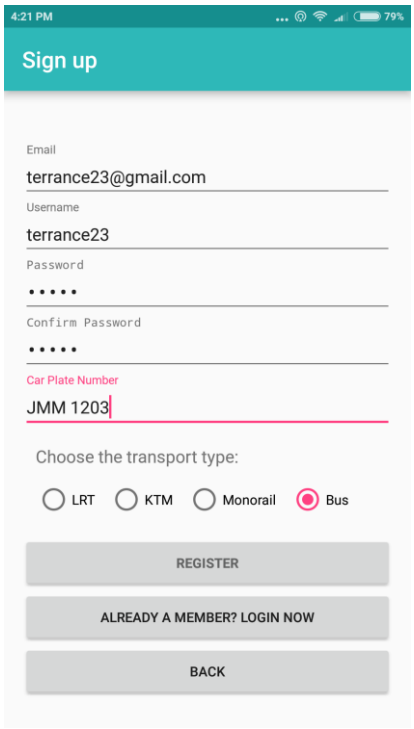
| Entity Name | Attribute | Data Type | Field Size | Default Value | Constraint | Description |
|---|---|---|---|---|---|---|
| station | index | integer | 11 | None | Primary Key, Auto increment | Station's unique id number |
| | station_name | varchar | 255 | None | Not null | Station's name |
| | latitude | float | - | None | Not null | Latitude of the station's location |
| | longitude | float | - | None | Not null | Longitude of the station's location |
| | number_passenger | integer | 11 | 0 | Not null | Number of requests for transports at the station |

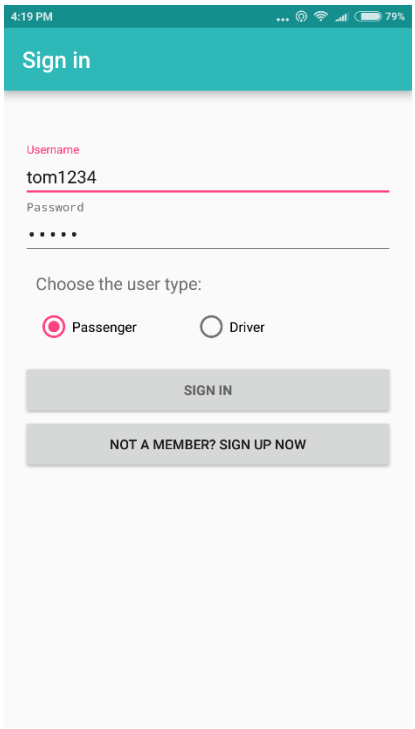
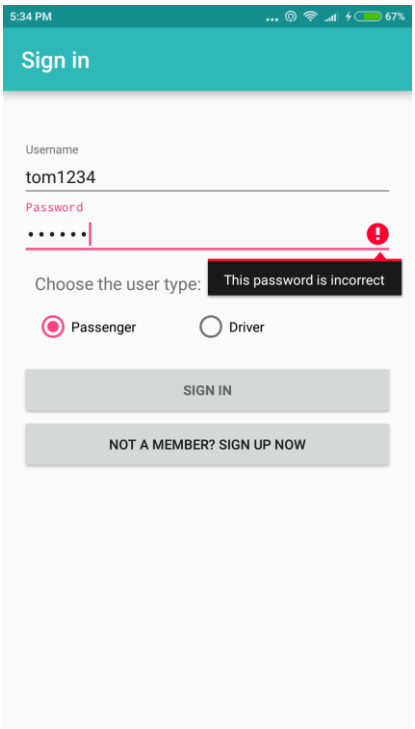
Table 4-6-T5 Data dictionary for station table

## 4-7 User Interface Design

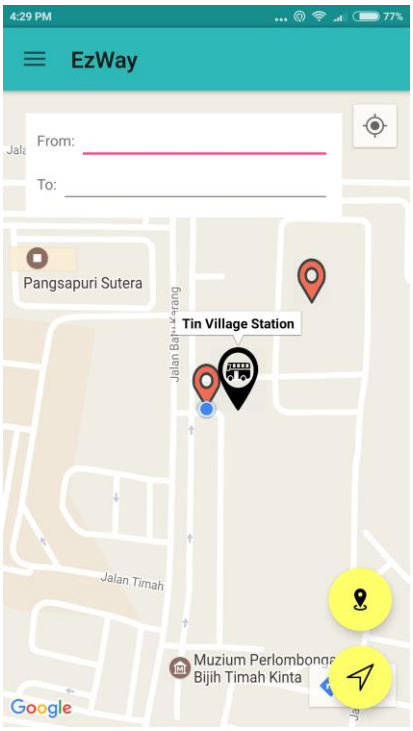
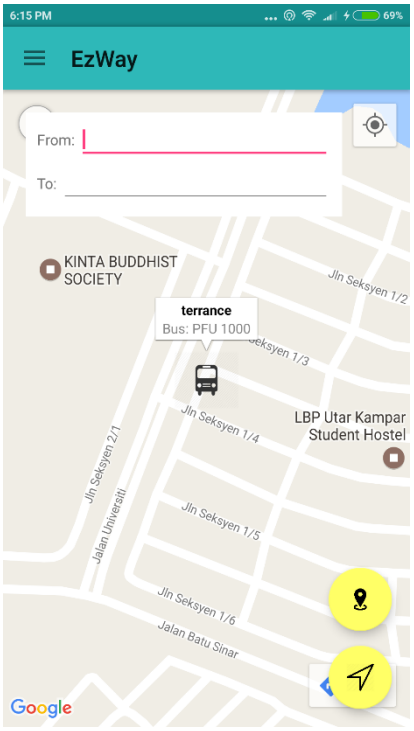
### 4-7-1 Sign up and Log in Interface

| *Home Page* | *Sign up Page – Choose role* |
|---|---|
|  |  |
| Figure 4-7-1-F1 EzWay home page | Figure 4-7-1-F2 EzWay sign up page (choose role) |
| This is the Home Page of EzWay mobile application. User needs to login or sign up before proceeding to use this application. | After user clicks on the sign up button, he/she needs to choose a role from driver and passenger. As this application provides different features to the different roles of users, users need to choose their role before signing up a new account. The "Back to Home" button directs user back to the Home Page. |

| *Sign up Page – Passenger role* | *Sign up Page – Driver role* |
|---|---|
|  |  |
| Figure 4-7-1-F3 EzWay sign up page (passenger) | Figure 4-7-1-F4 EzWay sign up page (driver) |
| This is the Sign up interface for passenger role. User as a passenger role needs to enter basic information including email, username and password to create a new passenger account. The below "Login Now" and "Back" buttons direct users to sign in page and home page respectively. | This is the Sign up interface for driver role. A driver user needs to provide basic information as passenger user and also information of the transport such as registration number and type of transport. |

| *Sign in Page* | *Sign in Page* |
|---|---|
|  |  |
| Figure 4-7-1-F5 EzWay sign in page | Figure 4-7-1-F6 EzWay sign in page (password incorrect) |
| This is the sign in page for EzWay mobile application. User needs to enter correct username and password and chooses the role between passenger and driver in order to signing in to the system. An error message would be shown when user enters incorrect password. | |

### 4-7-2 Passenger User Interface

| *Main Page (Passenger)* | *Main Page (Passenger)* |
|---|---|
|  |  |
| Figure 4-7-2-F1 EzWay main page for passenger | Figure 4-7-2-F2 EzWay main page for passenger |

This is the page shown when user signs in as a passenger. The application will show the current user location and bus stations on the map. The text boxes above allow user enters the origin and destination addresses in order to do the route planning. There are also origin and destination markers on the map that allow users to drag on and set the origin and destination location. Besides, there are markers shown on the maps indicates the location of the particular public transport. The details such as the driver's username, registration number of the transport and the type of transport will be displayed.

*Main Page (Passenger)*

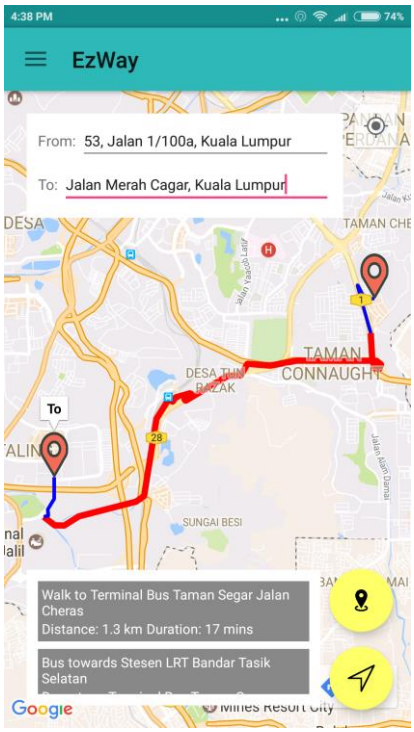



Figure 4-7-2-F3 EzWay main page for passenger (route planning feature)

*Main Page (Passenger)*

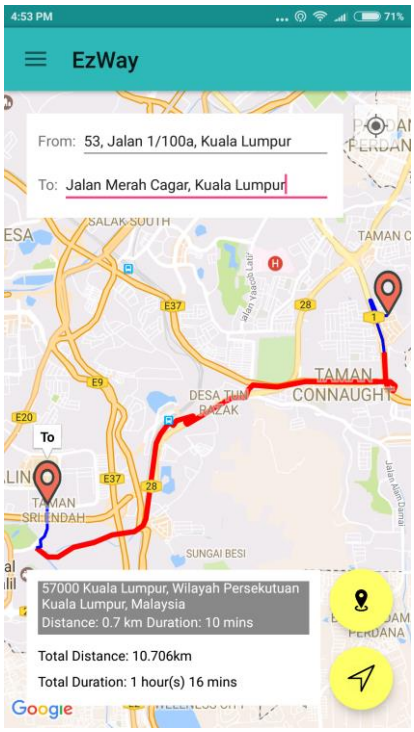



Figure 4-7-2-F4 EzWay main page for passenger (route planning feature)

After user enters the addresses of origin and destination or just simply drags on the origin and destination markers, user may click on the “route” button on the bottom right of screen to get a planned route. A scroll view would be shown on the bottom of screen to display the steps of route. There are the details of estimated distance and estimated travelling time for each step. Besides, if it is a step needs to use a public transport, there are extra information such as transit line, departure and arrival stop points and estimated time for departure and arrival for the particular public transport. A summary of total distance and total duration of travelling for the whole route to be complete is shown below. A line is drawn on the map for the route planned where blue line represents a walking route and red line represents a transit route.

*Main Page (Passenger)*

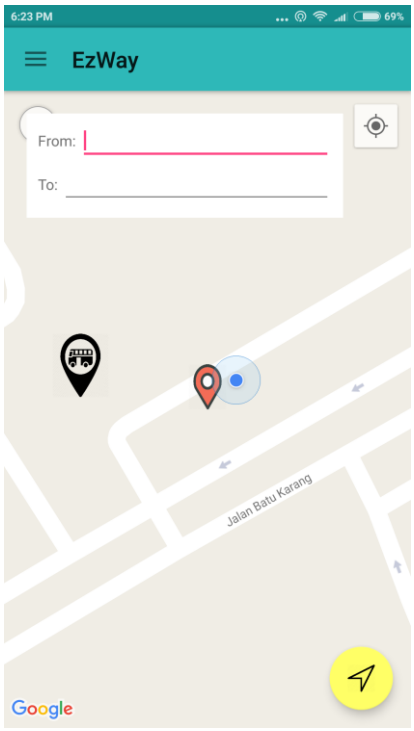



Figure 4-7-2-F5 EzWay main page for passenger (station request feature)

*Main Page (Passenger)*

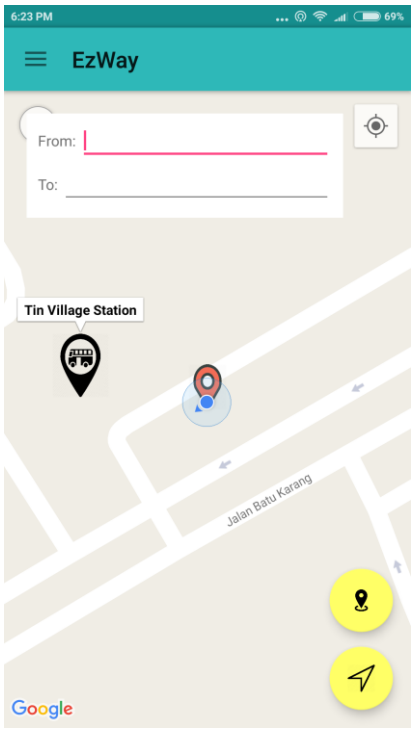



Figure 4-7-2-F6 EzWay main page for passenger (station request feature)

The screenshots above show the feature of station request for passenger user. In Figure 4-7-1-F9, the distance between user location and the "Tin Village Station" is more than 50 meters. When user moves nearer to the station, literally the distance between user and the station is less than 50 meters, a pop-up window is displayed above the station marker to show the station name (as shown in Figure 4-7-1-F10). Apart from that, a check-in button is available on the bottom right of the screen to allow user to send request for transports at the particular station.

*Main Page (Passenger)*

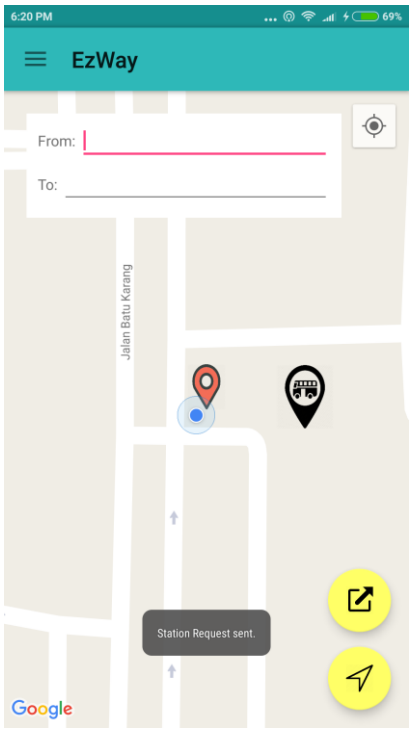



Figure 4-7-2-F7 EzWay main page for passenger (station request feature)

*Main Page (Passenger)*

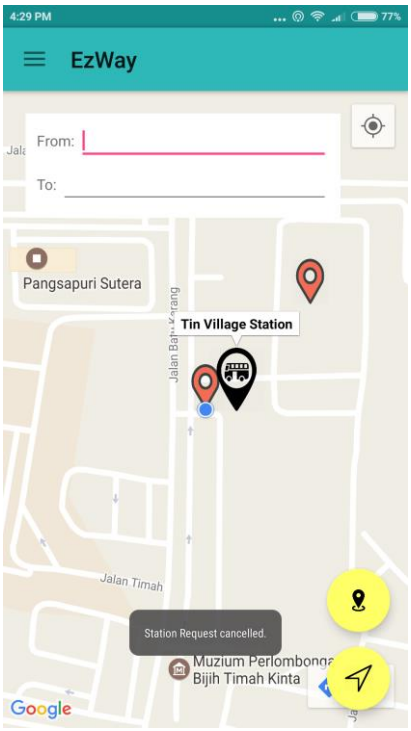



Figure 4-7-2-F8 EzWay main page for passenger (station request feature)

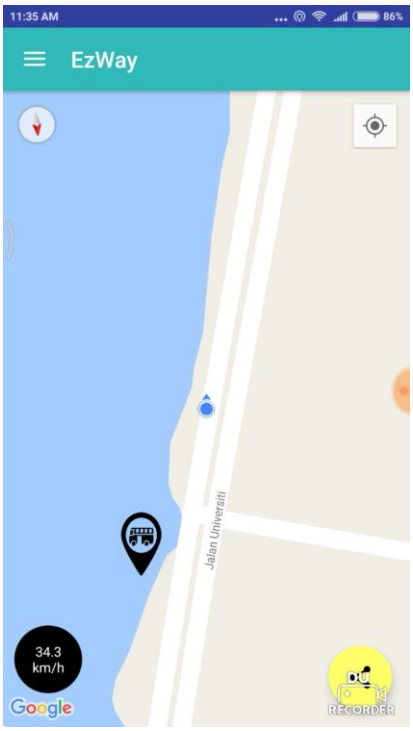
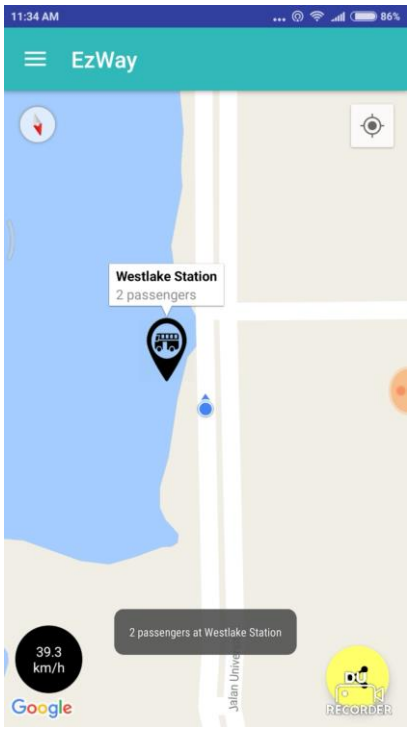
When a passenger user is near to a station, he/she is allowed to send a station request by clicking on the "check-in" button. After user clicks on the button, the icon of the button would change to "check-out" and a "Station Request sent" message would be shown to indicate the station request of the user is sent successfully. User can click on the "check-out" button or when he/she leaves the particular station, the station request sent before would be automatically cancelled. A "Station Request cancelled" message would be shown to indicate the station request sent is cancelled.

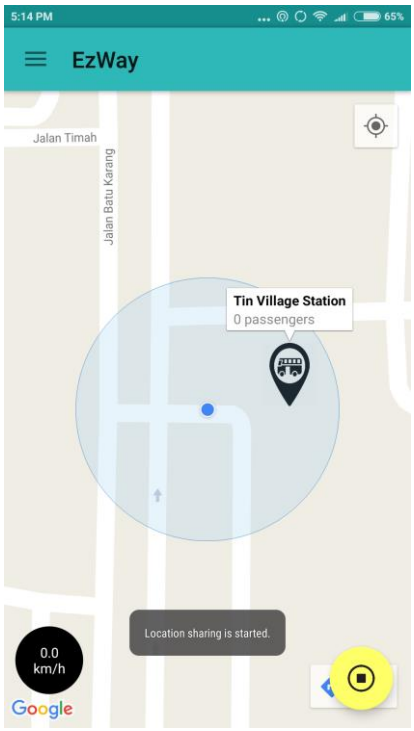
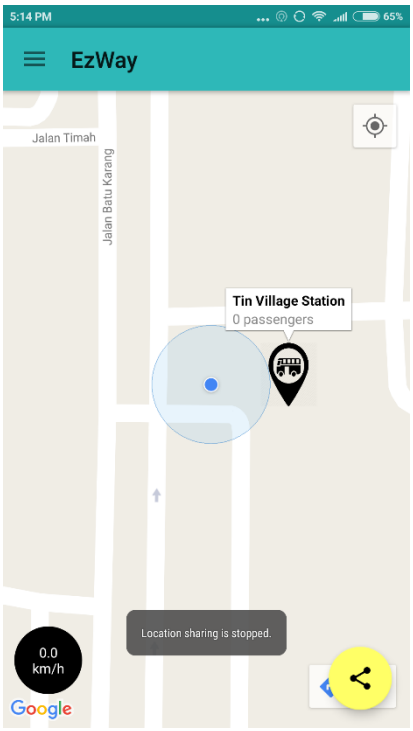
*Main Page (Passenger)*


Figure 4-7-2-F9 EzWay main page for passenger (location-based advertisement feature)

When a passenger user is near to a base location of advertisements, a pop-up advertisement will be displayed on the screen.

### 4-7-3 Driver User Interface

| *Main Page (Driver)* | *Main Page (Driver)* |
|---|---|
|  |  |
| Figure 4-7-3-F1 EzWay main page for driver | Figure 4-7-3-F2 EzWay main page for driver (station request feature) |
| This is the main page shown when user signs in as a driver. The location of stations are shown on the map with markers. The speed of the driver is shown on the bottom left of the screen. There is a "share location" button on the bottom right of the screen to allow driver to share his/her location. | When a driver is nearby a station, a pop-up window is shown on the station marker describing the station name and the number of passenger request on the particular station. A pop-up message about the number of requests at the nearby station is displayed. |

| *Main Page (Passenger)* | *Main Page (Passenger)* |
|---|---|
|  |  |
| Figure 4-7-3-F3 EzWay main page for driver (location sharing feature) | Figure 4-7-3-F4 EzWay main page for driver (location sharing feature) |

The figures above show the location sharing feature for the driver users. A driver can share his/her location by clicking on the “share” button on the bottom right of screen. A “Location sharing is started” message is displayed when user starts to share his/her location. The button change to a “stop sharing” icon. When user clicks on the stop button once again, the sharing is stopped and a “Location sharing is stopped” message is displayed.

### 4-7-4 Web-based Management System Interface

In this project, a management system is built on the web to ease the admin's job of managing the database of the EzWay system.

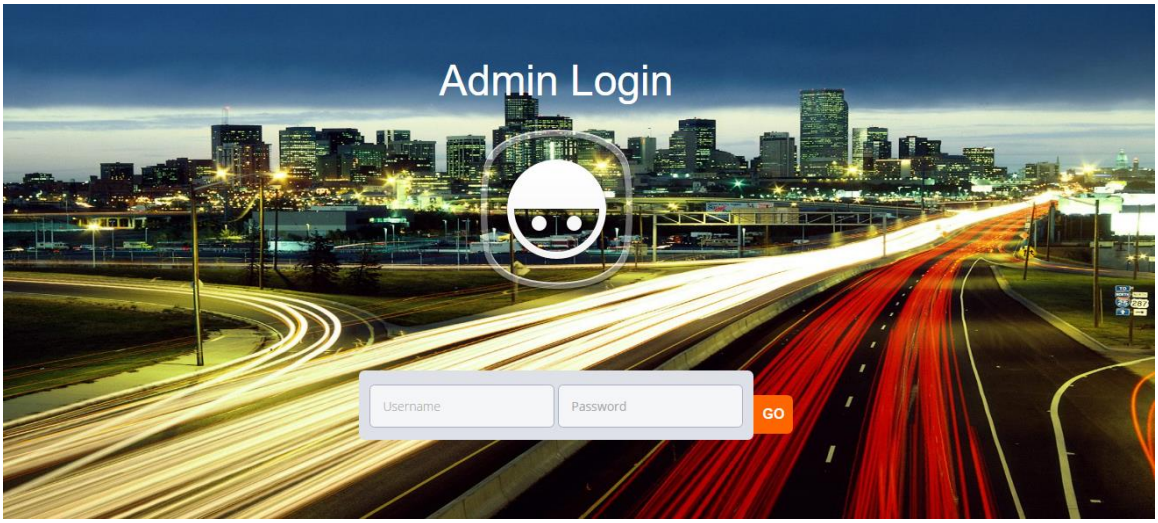



Figure 4-7-4-F1 Web-based management system log in page

The figure above shows the log in page of the web-based management system. An admin needs to log in using the correct username and password before proceeding to manage the EzWay system.


Figure 4-7-4-F2 Web-based management system main page

The Figure 4-7-4-F2 shows the main page of the management system after admin logging in. There are four types of managements that an admin can perform on which are driver management, passenger management, advertisement management and station management.

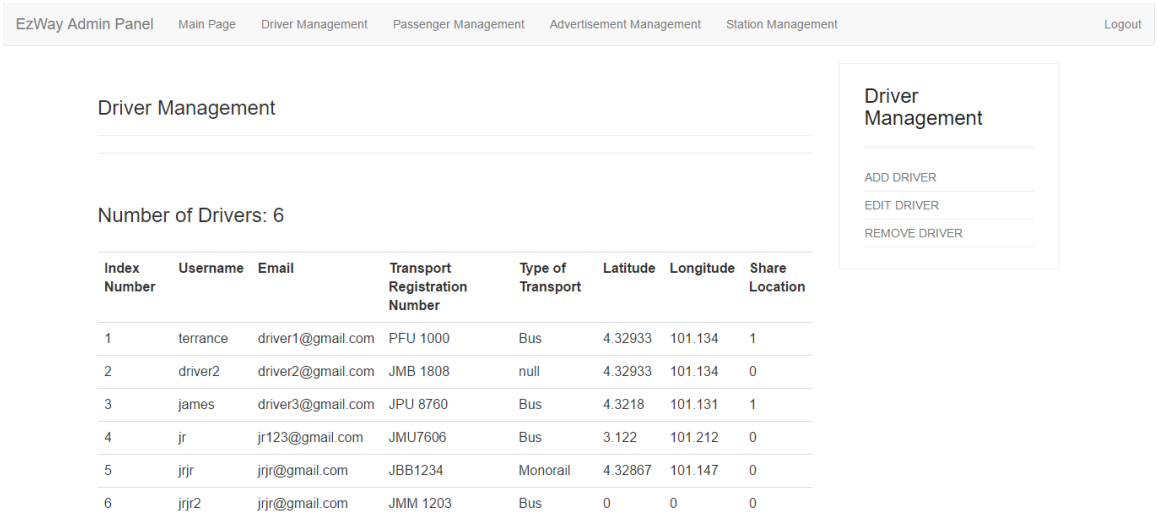



Figure 4-7-4-F3 Web-based management system – driver management

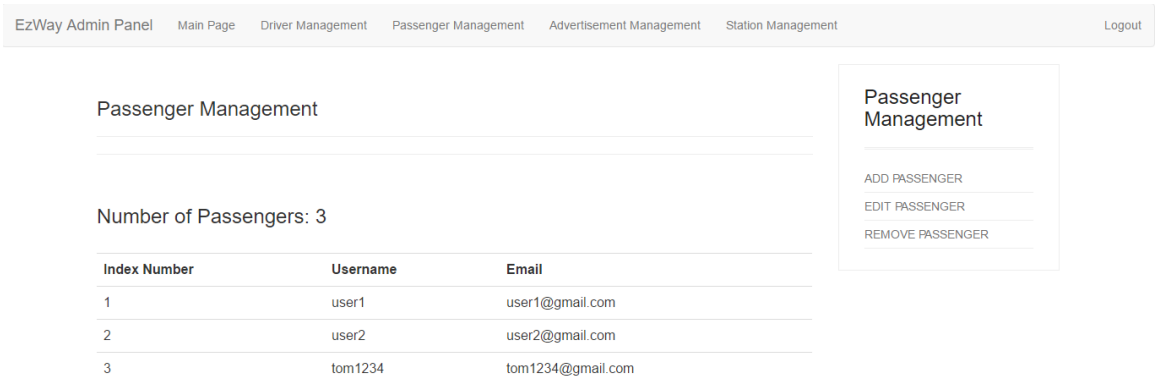



Figure 4-7-4-F4 Web-based management system – passenger management

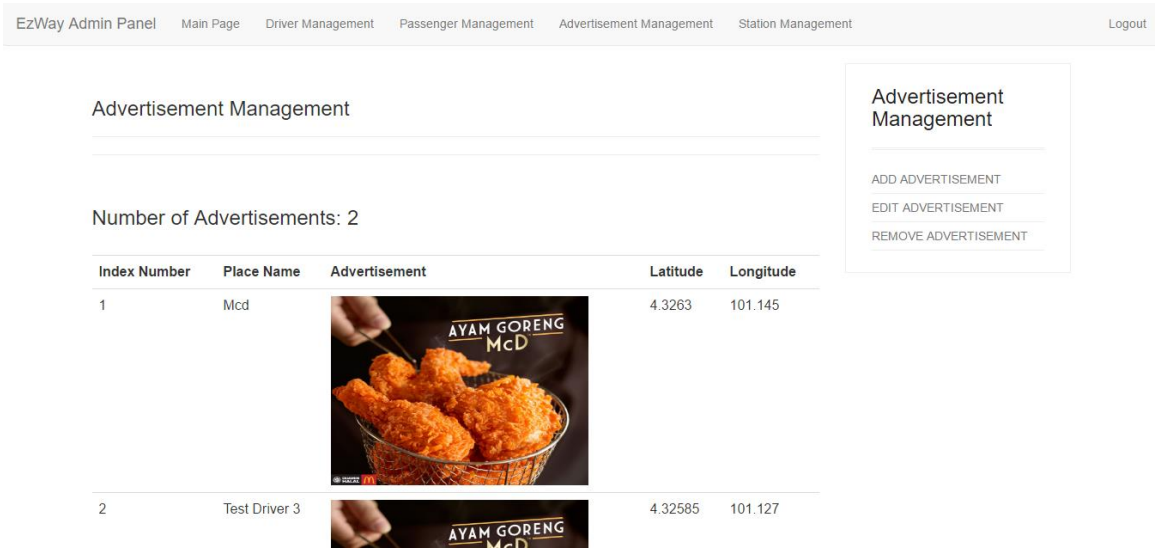



Figure 4-7-4-F5 Web-based management system – advertisement management

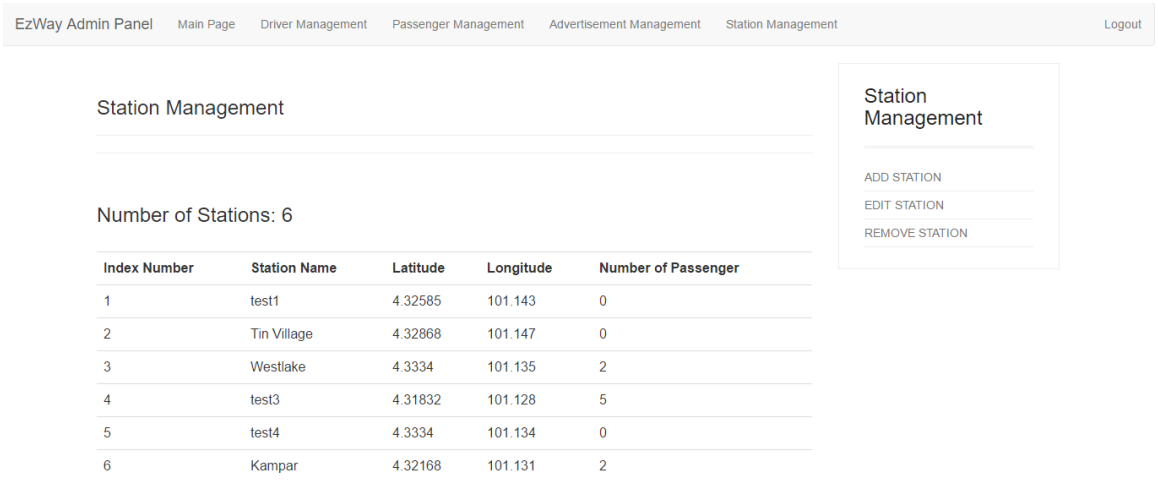



Figure 4-7-4-F6 Web-based management system – station management

Figure 4-7-4-F3, Figure 4-7-4-F4, Figure 4-7-4-F5 and Figure 4-7-4-F6 show the interfaces of driver management, passenger management, advertisement management and station management. In each management interface, number of records would be shown and each record is displayed in the table. Admin can choose to add, edit or remove the records where the changes would be updated to the database server.

## 5-1 Implementation Issues and Challenges

During the project development, several challenges occur as following:

- **Different screen size of various mobile device**

  As we know, mobile devices nowadays come in all sort of sizes. This may increase the difficulty of designing the interface for the different screen size of mobile devices. The interface designed may not be consistent for all the screen sizes.

- **Performance of server**

  In a real situation, there may be many users that using the mobile application at the same time. This may lead to server down because of the large amount of access to the server at the same time. Therefore, the system performance will be affected also.

## 5-2 Testing

In this project, some testing are conducted to ensure all the requirements are met without any anomalies or bugs. The techniques of use case testing and black-box testing is used to test on the features in the mobile application.

### 5-2-1 Use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Sign up use case | Main Flow | **Choose:** Passenger<br>**Email:** tom1234@gmail.com<br>**Username:** tom1234<br>**Password:** admin | Go to main page with user logged in | Go to main page with user logged in | Pass |
| | Alternate Flow – Back to Home | Click on “Back to Home” button | Go to home page | Go to home page | Pass |

| | | | | | |
|---|---|---|---|---|---|
| | Alternate Flow – Log In | Click on “Log In” button | Go to log in page | Go to log in page | Pass |
| | Alternate Flow – Cancel | Click on “Cancel” button | Go to home page | Go to home page | Pass |
| | Alternate Flow - Invalid Input | **Email:** tom1234 **Username:** tom1234 **Password:** admin | Display error message | Display error message | Pass |
| | Alternate Flow – User Exists | **Email:** jr@gmail.com **Username:** jr **Password:** admin | Display error message | Display error message | Pass |

Table 5-2-1-T1 Sign up use case test

| **Test Item** | **Test Condition** | **Test Data** | **Expected Outcome** | **Actual Outcome** | **Result (Pass/Fail)** |
|---|---|---|---|---|---|
| Login use case | Main Flow | **Email:** tom1234@gmail.com **Username:** tom1234 **Password:** admin **Choose:** Passenger | Go to main page with user logged in | Go to main page with user logged in | Pass |
| | Alternate Flow – Sign up | Click on “Sign up” button | Go to sign up page | Go to sign up page | Pass |
| | Alternate Flow – User not Exists | **Email:** testing@gmail.com **Username:** testing **Password:** admin **Choose:** Passenger | Display error message | Display error message | Pass |
| | Alternate Flow – Password incorrect | **Email:** tom1234@gmail.com **Username:** tom1234 **Password:** admmi **Choose:** Passenger | Display error message | Display error message | Pass |

Table 5-2-1-T2 Login use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Share location use case | Main Flow | Log in as driver.<br><br>Click on share location button | Display "Start location sharing" message | Display "Start location sharing" message | Pass |

Table 5-2-1-T3 Share location use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Stop sharing location use case | Main Flow | Log in as driver<br>.<br>Click on share location button.<br><br>Click on stop sharing location button. | Display "Stop sharing location" message | Display "Stop sharing location" message | Pass |

Table 5-2-1-T4 Stop sharing location use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Get public transport location use case | Main Flow | Log in as passenger | Display locations of public transports on map | Display locations of public transports on map | Pass |

Table 5-2-1-T5 Get public transport location use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Send station request use case | Main Flow | Log in as passenger.<br><br>Move to a bus station.<br><br>Click on the pop-up check-in button | Display "Station request sent" message. | Display "Station request sent" message. | Pass |

Table 5-2-1-T6 Send station request use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Cancel station request use case | Main Flow | Log in as passenger.<br><br>Move to a bus station.<br><br>Click on the pop-up check-in button<br><br>Click on the check-out button | Display "Station request cancelled" message. | Display "Station request cancelled" message. | Pass |
| | Alternate Flow – Leave Station | Leave the bus station | Display "Station request cancelled" message. | Display "Station request cancelled" message. | Pass |

Table 5-2-1-T7 Cancel station request use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| View station request use case | Main Flow | Log in as driver.<br><br>Move to a bus station. | Display pop-up window about the station name and number of request on the station marker.<br><br>Display message about the number of request at nearby station. | Display pop-up window about the station name and number of request on the station marker.<br><br>Display message about the number of request at nearby station. | Pass |

Table 5-2-1-T8 View station request use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Get advertisement use case | Main Flow | Log in as passenger.<br><br>Approach a base location of advertisements. | Display the advertisements. | Display the advertisements. | Pass |

Table 5-2-1-T9 Get advertisement use case test

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Get route planned use case | Main Flow | Log in as passenger.<br><br>**Origin:** 53, Jalan 1/100a, Kuala Lumpur<br>**Destination:** Jalan Merah Cagar, Kuala Lumpur | Display the correct route information. | Display the correct route information. | Pass |

Table 5-2-1-T10 Get route planned use case test

### 5-2-2 Black-box testing

In this project, only several features with high risk are tested using black-box testing.

| Feature ID | Feature | Risk Level |
|---|---|---|
| F001 | Route planning | High |
| F002 | Location-based advertisement | High |
| F003 | Station Request | High |

Table 5-2-2-T1 Features to be tested

F001 Route planning

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Checking internet connection | With internet connection | **Origin:** 53, Jalan 1/100a, Kuala Lumpur **Destination:** Jalan Merah Cagar, Kuala Lumpur | Display proper route information. | Display proper route information. | Pass |
| | Without internet connection | **Origin:** 53, Jalan 1/100a, Kuala Lumpur **Destination:** Jalan Merah Cagar, Kuala Lumpur | Display "Internet connection problem" message. | Display "Internet connection problem" message. | Pass |
| No route information found | Valid origin and destination for route | **Origin:** 53, Jalan 1/100a, Kuala Lumpur **Destination:** Jalan Merah Cagar, Kuala Lumpur | Display proper route information. | Display proper route information. | Pass |
| | Invalid origin and destination for route | **Origin:** Cheras, Kuala Lumpur **Destination:** A Famosa | Display "No route could be found" message. | Display "No route could be found" message. | Pass |

Table 5-2-2-T2 Route planning black-box test

F002 Location-based advertisement

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Location based advertisement pop-up | Distance <= 300 meters | Keep the distance with the base location of advertisement below 300 meters. | Pop-up the location-based advertisement | Pop-up the location-based advertisement | Pass |
| | Distance > 300 meters | Keep the distance with the base location of advertisement more than 300 meters. | Continue on main page | Continue on main page | Pass |
| Close pop-up after leaving the base location of advertisement | Distance <= 300 meters | Keep the distance with the base location of advertisement below 300 meters. | Continue the pop-up of advertisement | Continue the pop-up of advertisement | Pass |
| | Distance > 300 meters | Keep the distance with the base location of advertisement more than 300 meters. | Close the pop-up advertisement | Close the pop-up advertisement | Pass |

Table 5-2-2-T3 Location-based advertisement black-box test

F003 Station request

| Test Item | Test Condition | Test Data | Expected Outcome | Actual Outcome | Result (Pass/Fail) |
|---|---|---|---|---|---|
| Allow station request when reaching a station | Distance <= 50 meters | Keep the distance with the station below 50 meters. | Pop-up the check-in button | Pop-up the check-in button | Pass |
| | Distance > 50 meters | Keep the distance with the station more than 50 meters. | Continue on main page | Continue on main page | Pass |
| Automatically cancel request when leaving a station | Distance <= 50 meters | Keep the distance with the station below 50 meters. | Continue station request | Continue station request | Pass |
| | Distance > 50 meters | Keep the distance with the station more than 50 meters. | Display "Station request cancelled" message | Display "Station request cancelled" message | Pass |

Table 5-2-2-T4 Station request black-box test

## 6-1 Project Review, Discussions and Conclusions

Mobile social networking allows individuals to share interests, opinions or information among the network using mobile devices such as mobile phones or tablets. As technology advances, the users of mobile devices increase sharply in the past few years. As a result, demand of mobile social networking grows over years. This project is a mobile application project to develop a mobile application for public transportation.

The biggest problem of public transports nowadays is the public transport always arrives late. Commuters cannot tell the actual arrival time of the public transport. This may waste a lot of time. Although there exits some mobile application for public transportation in Malaysia, no one includes the features of tracking the location of public transports. This feature is important for solving the problem stated above.

The objectives of this project is to track the location of public transports, at the same time estimate the travelling time and time for departure and arrival of public transports. On the other hand, this mobile application is able to do the route planning for the users based on the origin and destination provided. Location-based advertisement will also be included in the application. The user of this mobile application could request for public transports at a station when he/she is nearby the station.

In a nutshell, the main focus of this project is to develop a mobile application of public transportation that could improve the user experience of public transports and enhance the current system. This proposed project is believed to be a great benefit of the society.

## 6-2 Strengths, Weakness and Future Work

EzWay is a mobile application that provides several useful features such as public transport tracking, route planning, request for public transports at a station and provide location-based advertisement. The strength of this application is the combination of these features into one application that brings convenience to the KL citizens for using public transports in KL.

Users can now track the bus before going out from their house which could save a lot of time for waiting the bus to arrive the bus station. The route planning feature can guide users especially tourists in KL to use the public transports in order to reach the destination in a more convenient way. Location-based advertisement feature provides suitable and relevant ads to the users which may benefit both the users and the advertisers. The station request feature is the uniqueness of EzWay mobile application to allow the commuters to use the public transport with a better user experience. This feature solves the crowded condition of using public transports during peak hours. While waiting a bus at a bus station, user may send a request for bus. By knowing the demand of public transports users at a bus station, the bus operators may plan more proper routes for the buses or sending more buses to the bus station which has a higher demand.

However, there are still some weakness in this mobile application. The system takes a longer time to response to the database due to the server problem. This may result in the application would delay a few seconds to response to the users. Besides, the user interface is not designed properly. The route information displayed to the users is hard to be read and the learnability is low.

For the future enhancement, Google Firebase would be used for hosting and storing database. Google Firebase provides a real-time database which can store and sync app data in real-time. It delivers the web content faster and ease the backend coding which may improve the performance of this mobile application. Other than that, the user interface should be designed as more user-friendly where tab layout should be used for displaying the route information. Lastly, this application should include a tutorial for the first-time users to guide them on the functions in this application.

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Faculty of Information and Communication Technology (Perak Campus), UTAR.

# EzWay

Mobile Application for Public Transportation

By **Chan Man Ling**

Bachelor of Computer Science (Hons)
Universiti Tunku Abdul Rahman (UTAR - FICT)

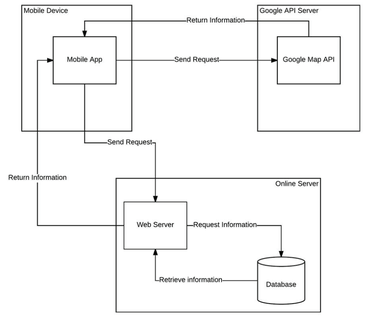
## INTRODUCTION

This project is a mobile application for public transportation developed based on android platform. The main problem of the public transport in Malaysia is the public transports always arrive late and the route information for public transport is not provided appropriately. Besides, the demand is often greater than the availability of public transports in peak hours. EzWay mobile application is expected to provide some features such as tracking the public transports, route planning, requests of transportation at a station and providing location-based advertisement.

## OBJECTIVES

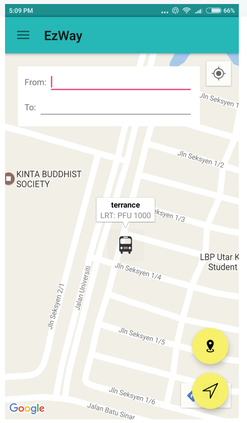
- To track the location of public transport
- Estimate travelling time and time for arrival and departure of public transports
- Plan a route for a given origin and destination
- Provide location-based advertisements
- Allow sending and viewing of requests for public transport at a station

## SYSTEM OVERVIEW



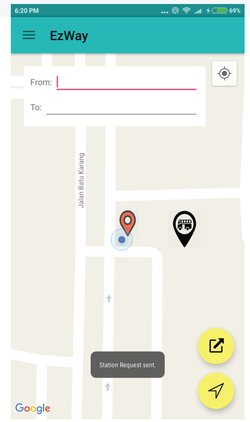

This mobile application for public transportation requires a server to store the database. The application will get the user location using GPS. For a driver, the location is stored and updated to the database periodically. The system will then retrieve the driver's location and provide the location to the passenger in order for them to track the location of public transport. The number of requests at a station will also be updated to the database when user sends a request from the application. The requests are then retrieved from the database and provided to the drivers. Some functions such as route planning are done by using the Google Maps API. The application will send the request to the Google API server by providing some information such as user location and destination location. The Google API server will then return the information and the information is provided to the user.

## RESULTS



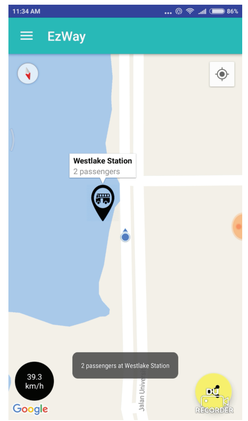

Public transport tracking


Route planning

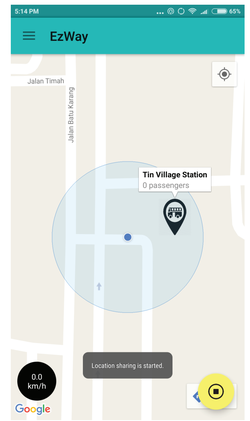



Request for transports at a station


Location-based advertisement




View of requests at a nearby station




Location sharing of public transports

## CONCLUSIONS

This mobile application guides the users to use the public transports in KL in a more convenient way with some features like tracking the public transports, route planning, time estimation and request for public transport at a station. This proposed project is believed to improve the user experience of public transports and enhance the current system.

# EzWay

Mobile Application for Public Transportation

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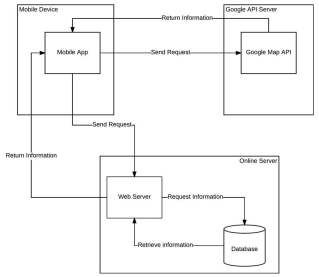
## INTRODUCTION

This project is a mobile application for public transportation developed based on android platform. The main problem of the public transport in Malaysia is the public transports always arrive late and the route information for public transport is not provided appropriately. Besides, the demand is often greater than the availability of public transports in peak hours. EzWay mobile application is expected to provide some features such as tracking the public transports, route planning, requests of transportation at a station and providing location-based advertisement.

## OBJECTIVES

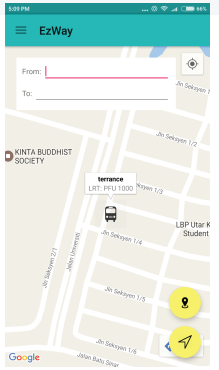
- To track the location of public transport
- Estimate travelling time and time for arrival and departure of public transports
- Plan a route for a given origin and destination
- Provide location-based advertisements
- Allow sending and viewing of requests for public transport at a station

## SYSTEM OVERVIEW

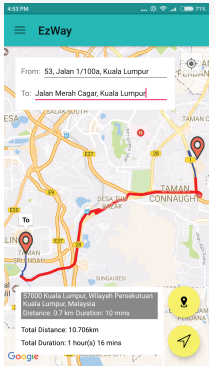



This mobile application for public transportation requires a server to store the database. The application will get the user location using GPS. For a driver, the location is stored and updated to the database periodically. The system will then retrieve the driver's location and provide the location to the passenger in order for them to track the location of public transport. The number of requests at a station will also be updated to the database when user sends a request from the application. The requests are then retrieved from the database and provided to the drivers. Some functions such as route planning are done by using the Google Maps API. The application will send the request to the Google API server by providing some information such as user location and destination location. The Google API server will then return the information and the information is provided to the user.

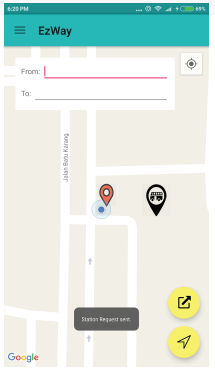
## RESULTS




Public transport tracking

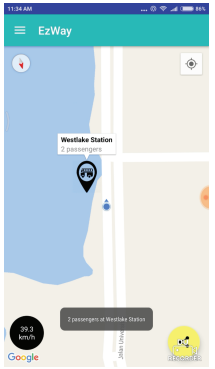



Route planning

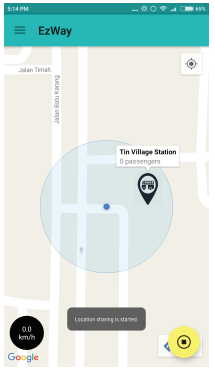



Request for transports at a station


Location-based advertisement




View of requests at a nearby station

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