FINAL YEAR PROJECT

TBB 3012

1st DRAFT DISSERATATION

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Year of Study	**: FINAL YEAR FINAL SEMESTER**
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ABSTRACT

This paper discusses the ideas and process of developing a mobile application – Bus Locator System (BLS). BLS is a mobile application that will be implemented to enhance one of the current public transportation systems – bus. The main objective is to provide the users the real-time information of the bus such as the current location of the bus so that they know exactly when the bus is arriving and from there, they can plan their trip efficiently. By promoting the public transport, traffic congestion and environment issues can be controlled or reduced, when there are lesser private vehicles on the road. The problem of current situation is that the current bus system is inefficient and inconvenience to the bus passengers as the current schedule stating arrival time of the bus is always inaccurate and the bus passengers have to spend their time to wait for the bus. Thus, BLS will be a stepping stone to improve the current system by providing a solution that allows the users to access to real-time information of the buses anywhere and anytime through their smartphone. This project will serve as an initiative to enhance the current system and at the same time, change the perception of public towards the old system and promote the importance of public transport. In terms of project development, a model known as rapid application development (RAD) will be applied and it will be explained later in one of the chapters. There will be 5 chapters in this paper: introduction, literature review, methodology, results and discussion, and finally ended with conclusion and recommendation of BLS.

CHAPTER 1 INTRODUCTION

1.1 Background of Study

Public transport is a mode of transportation service that is available to the general public (Wikipedia, 2013). It is a type of transportation that is shared among the citizens, without prior private arrangement. In another word, one will meet strangers when he/she is taking the public transport. Unlike the private transports like individual-owned car, taxi cab, etc. that carries limited amount of passengers, public transport often able to carry a large number of passengers. Usually, public transport is partially subsidized by the government of the country itself.

There are several mode of travel available in public transport: road vehicles such as bus, rail such as LRT and water such as boats and ferries. However, only the road vehicles public transport will be discussed and focused in this project work. In Malaysia, public transportation is not favored by the public as it is considered inconvenience and uncomfortable. Lots of place cannot be reached and it consumes a lot of time when one is taking public transport in Malaysia. Unlike in some countries like Singapore and Tokyo, their public transport is well designed and developed as the public can reach any destinations through the public transport. Besides, they have a strong law to abide to ensure the quality of the public transport. The author believes that it is important that a country promotes and enhances its public transportation to reduce the number of on-the-road vehicles, in turns coping with the traffic congestion issues.

Hereby, a mobile application namely Bus Locator System (BLS) will be introduced to help the bus passengers and indirectly, promoting the public transportation (bus). BLS would be an android-based mobile application that provides the real-time information of the bus. This means that the user will now able to access to real-time info of the bus, such as estimated arrival time, location of the bus, speed, etc. The author shall explain the details in this proposal.

1.2 Problem Statement

1.2.1 Problem Identification

According to the statistics given by JPJ Malaysia (2013), the number of registered cars is increasing dramatically since 2009. The trend shows that there is more and more people getting cars and this will lead to few concerns, where:

- "Is the current road capacity allows the number of on-the-road vehicles?"
- "Is there any public transportation system available to promote/improve current public transportation in order to reduce the number of private cars on the roads, to reduce the traffic problems?"

In fact, with the increment in the number of on-the-road vehicles, traffic congestion problem seems to becoming worse. In addition, most of the private vehicles on the road are not fully loaded with passengers; most of them are having only one or two passengers. In order to cope that, public transport should be improved and enhanced so that the public is willing to take the public transport. However, the current situation is that public does not favor the public transportation system in Malaysia since it is very inconvenience, not comfortable, etc.

Problem 1: For example, if the current bus passenger wants to go place "A" but have no idea which bus to take, he/she will then have to ask the people around that knows, and this is very troublesome. Imagine if someone shows you the wrong directions.

Problem 2: Besides, current bus system is not capable of providing the real time information of the bus. The bus passengers do not know where the bus is/at and when is it arriving, making the passengers to feel inconvenience and uncertain as they don't know if they will be on time to catch a bus. If they miss the bus, they will have to wait for another round, which in some of the cases, it takes long time. Even if it's the RapidKL, the information of next bus arrival will be placed at the bus stop, which means that the bus passengers will have to walk to the bus stop in order to know the arrival time. That's for the people that are catching a bus. For those who are already

sitting in the bus, they might wonder about their current location and the approximate time in reaching their destinations.

Problem 3: Lastly, it is the safety concern. Study shows that most of the bus drivers are speeding and this endanger the life of the passengers. Since it is related to the behavioral side, it is hard to control and to supervise the bus drivers to make sure they are driving within speed limit. Thus, an appropriate system should be implemented to tackle this problem.

1.2.2 Significant of the Project

Bus Locator System (BLS) is built to ease and provide convenience to the citizens that are going to use buses as their transportation tools. BLS is able to provide the users the real-time information of the buses such as the location, estimated arrival time, current speed of the bus, etc. This will allow the citizens or the users to be able to plan their trip well based on the information given. In a long run, this will promotes the public transportation of the particular country, and in turns reduce the number of on-the-road vehicles to reduce the traffic congestions.

1.3 Research Objectives

1.3.1 General Objective

The general objective of this project is to identify and provide a solution to allow the bus passengers to acquire the real time information of the buses to plan their travelling schedule efficiently. The aim is to finally develop an Android-based mobile application that serves the objectives.

1.3.2 Specific Objectives

The specific objectives to be achieved are:

- To provide the real-time information of the bus to the passenger so that the passenger can plan his/her trip efficiently. The real-time information include:
  - ✓ Current location of the bus

- ✓ Estimated arrival time (e.g. when bus will arrive bus stop/reaching destination)
- ✓ Speed limit warning

- To provide convenience for users in getting the real-time information through mobile application anytime and anywhere.
- To enhance safety of taking public transport by guiding/monitoring the behavior of the bus drivers to drive within the speed limit, as the users can actually report through the mobile application.
- To promote and improve the awareness of people in taking public transport to reduce problems such as traffic congestion, pollution level, etc.

1.4 Scope of Study

The scope of study is divided into 3 categories: the matter which author is looking into, target users who are going to be involved in the project and also the developing tools used to complete this project. All of these are summarized and displayed in the Figure 1.1 below.

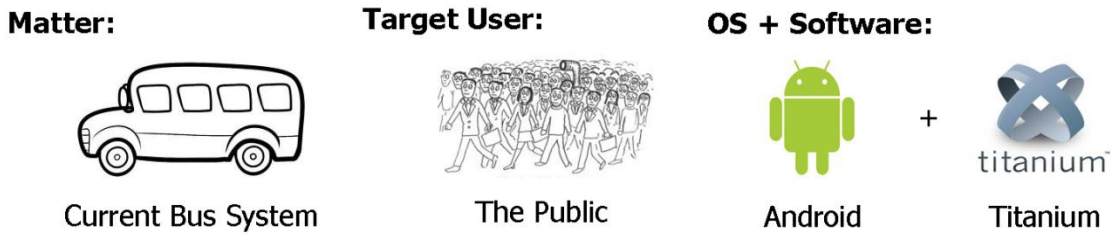

Figure 1.1 Scope of Study of BLS

This research is purposively focused on the current bus transportation system, which is to be implemented into the urban areas in Malaysia such as Selangor or Kuala Lumpur (KL). However, the system can still be tested or used in other places once all the necessary equipment and infrastructure are put in place. The main idea is to promote public transports and provide convenience to the public by developing a mobile

application that allows them to receive the real-time information of the buses so that they can plan their trip efficiently.

In terms of developing tools, Titanium Studio will be used as the platform to develop the prototype whereas Android will be the operating system for it. Due to time constraint, only one OS will be used to develop the prototype. The reason Android is chosen as the OS because of its vast amount of users in the market. According to the surveys by IDC, Android has a market share of 75% in first quarter of 2013. This means there are more Android users compared to other operating system such as IOS, Windows, BlackBerry, etc.

1.5 Relevancy of the Project

The relevancy of this project can be divided into two categories: relevancy of the project towards the society and relevancy of project towards the author/developer.

i. **Relevancy of project towards society**

Since the end product of this project is to develop a mobile app that assists the citizens in taking the public transport, it is definitely relevant to the public and will have an impact towards the society. User that uses this app is able to time their trip properly by referring to the real-time information provided. This will provide more convenient to the people and indirectly, promoting the public transport. Besides, this app will also help in maintaining the welfare of the society as it guides the behavior of the bus drivers so that they drive professionally as a driver; minimizing the number of accidents on the road due to the carelessness of the drivers.

ii. **Relevancy of project towards author/developer**

As the author carries out the research work, he is able to see the real world problem before proposing a solution. In this case, the author found out that the current public transportation system in the country is lacking behind and it is insufficient. Thus, author is given a chance to propose and build the solution to the problem by applying all the theoretical

knowledge learnt in class into the practical work. From there, the author can really learn, and at the same time, contribute to the society.

1.6 Feasibility of the Project within Scope & Time Frame

Since this is a mobile application development project and it is developed using the Rapid Application Development (RAD) model, the time taken to complete this project is short. Unlike other project which requires years to complete, this project, namely Bus Locator System (BLS) is estimated to be completed within 28 weeks, which is approximately 7 months. The progress of the work will be based on the Gantt chart and Milestone prepared in the later section, in order to make sure that the project is in line with the timeline. As for the scope of the project, it is only going to be focused on the three categories, as discussed in the earlier section. With the proper planning in accordance to the Gantt chart and Milestone, this project is feasible to be completed within the scope and time frame.

CHAPTER 2
REVIEW OF LITERATURE

2.1 Introduction

Literature review is one of the utmost important parts of the entire research work. It requires the critical analysis of the author after studying several pieces of work that have been done by other researchers. Meanwhile, it requires the author to relate and link the ideas of other researchers' work to his/her work.

In this chapter, the author will analyze numerous literatures related to the areas of research. Since the author's research work is regarding a mobile application for public transport, which is the bus. It will then begin with a discussion on comparing both public and private transportation system. Issues and future trend of the transportation system will be discussed in this section.

Next, discussion on the smartphone operating system is reviewed to identify the largest potential market when developing the mobile application to complete the entire research work.

At the end of the chapter, comparison between author's work – Bus Locator System (BLS) and relevant mobile applications will be reviewed and short summary will be presented. This is to show the significant of the research work.

2.2 Public Transport vs. Private Transport

With the tremendous increment in the number of on-the-road vehicles, traffic congestion issue has been raised. According to Sperling & Clausen (2002, cited in Mai Tuan Viet, 2012), traffic congestion that happened in developing countries is often due to these factors: high concentration population, lack of public transportation system, rapid increment in the number of private vehicles, etc. This shows that in the developing countries whereby there is high population, it is theoretically important to implement

and enhance the public transport system and if possible to reduce the number of private vehicles, so that the traffic congestion problem can be contained.

This is again supported by Dinna Dabbour and Khaled Tarabieh (2013), when they suggest that public transportation should be enhanced and at the same time, reducing the number of private vehicles in order to cope with the traffic congestion issue. One of the reasons to implement and enhance public transport such as busses is because buses often have higher road space per passenger, which means that a bus with full loaded-passenger will utilize the road better compared to average car which only loaded with approximately 1.5 passengers (C.H. Sharp, n.d.), and this situation will lead to traffic congestion.

Although public transport seems to be great to be implemented to cope traffic congestion, most of the people still prefer private transport. The reasons being advantages offered such as convenience, speed, comfort and individual freedoms (Anable, 2005; Hagman, 2003; Jensen, 1999, cited in Gabriela Beirao, 2007). However, if public transportation can offer the most of the advantages that private transport provides, people will switch their transportation method, since public transport is cheaper and more environmental friendly. In fact, in certain countries such as Singapore, although owning a car is expensive there, citizens there have no problems in traveling from one place to another as their public transport system is so advanced till that it enables the citizen to travel conveniently and comfortably even without driving their own cars (X. Yang, 2003).

In this research, the author will be developing a mobile application for bus, namely Bus Locator System (BLS). Thus, it's important to identify the importance of public transport and the future trend of it. As the increment of the private vehicles increases, it is important to important to implement or enhance the current transportation system in order make the people reduce the usage of private vehicles and in turns, cope with the issues such as traffic congestion, pollution level, etc.

2.3 Smartphone Operating System – Android vs. IOS vs. Other OS

Nowadays, 70% of enterprises are either looking to or actively venture into developing their own mobile application (Marci Weisler, 2013). Thus, it is important to mind the steps and avoid pitfalls in developing one. After all, an operating system is required to be chosen when developing a mobile application. There are a few mobile application OS in the market: Android, IOS, BlackBerry, Windows, Symbian, etc. It depends on which OS that the developer would like to develop the application. However, if the developer wants the application to reach to a bigger market, it will then have to choose an operating system that is widely used in the market (Aidan Hijleh, 2013).

According to Sasha Segan (2013), he states that Google's Android OS is available in all sizes and prices of the phones. One can have an android-based phone which is big or small, low-priced or high-end Android smartphone. On the other hand, Apple's IOS is built only for high-end Apple's product such as iPhone 4s, iPhone 5, iPad, etc., where these products might not be price at affordable level for some of the people. Besides, he also mentioned that the latest Android 4.2 'Jelly Bean' matches and beats the Apple's IOS in many ways, especially the customization. Thus, it shows that Google's Android might has a bigger market share compared to Apple's IOS. In fact, a study has been done by International Data Corporation (IDC) in analyzing the market share of smartphone operating system in 2013. As shown in the Figure 1 below, Android is the leading OS throughout the year 2012 and first quarter of 2013. This again prove that any mobile application that developed using android will have a higher chance to tap on bigger potential market, as there are more wider range of people that use Android OS.

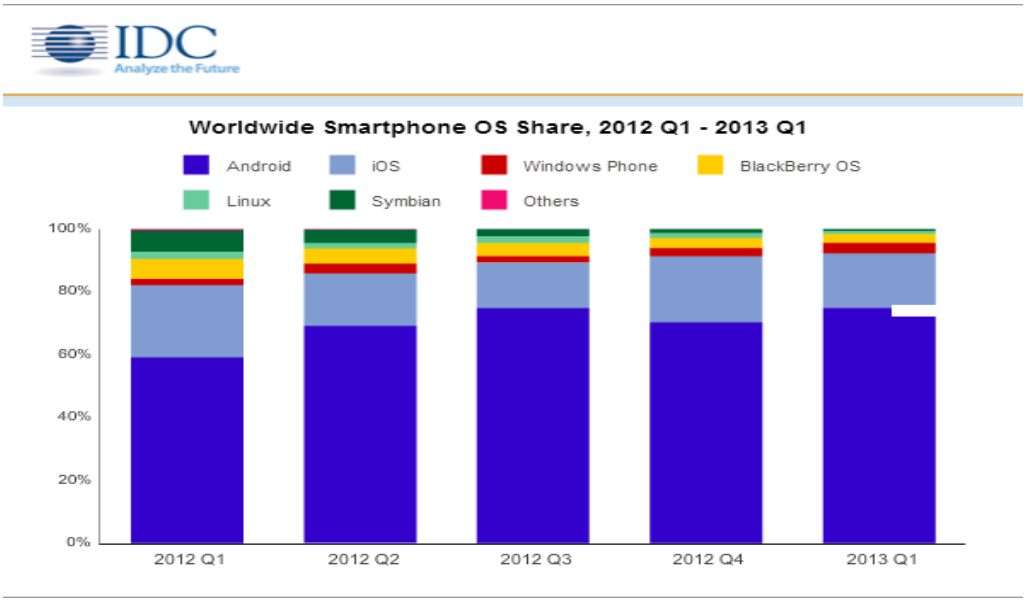

Figure 2.1 Smartphone Operating System Market Share

Source: *Retrieved 16 May 2013, from: http://www.idc.com/getdoc.jsp?containerId=prUS24108913*

2.4 Android-based Mobile Application - Bus Locator System (BLS) vs. "Competitors"

According to the research done through Internet, so far there are no exact mobile applications that serve the exact functions as BLS. However, there are few mobile applications that share some similarities with BLS, but these applications are only applicable in their respective country, which is located outside of Malaysia. One of them is "redBus.in". Alok Goel (2013) from Bangalore states that redBus.in is a mobile application that allows the users to book a bus online and allows them to see the location of the bus in real time. He also mentioned that such application provide ultimate convenience to the users as they are allowed to book their bus anywhere, anytime through the application. By checking through their smartphone, they are also able to see the real time location of the bus. However, redBus.in is only for long journey bus, not in the city areas.

Another example would be the "LehighULive". It is a mobile application that developed by LeHigh University that provides all the current information of the campus, including the real time information of the shuttle bus. Mark Ironside (2013) as the executive director of the university's Business Services states that LehighULive has been a great mobile application in helping their university communities, especially the students as they are able to plan their schedule with the real time info of the bus. However, this application is only workable in the campus areas.

Lastly, it is the "Moovit". Ryan Kim (2012) reported that Moovit is a mobile application that looks like "Waze", but serving at the public transportation sectors, which includes bus, trains, etc. He continues that Moovit provides the real time information of the public transportation like the redBus.in and LehighULive and this info makes Moovit extremely valuable (CEO Nir Eriz, n.d., cited in Ryan Kim, 2012). However, Moovit is operated slightly different, which it takes the feedback from the users and update the system accordingly. According to Ryan Kim (2012), users can give feedbacks such as traffic on the road, traffic/saturation in the public transport, satisfaction towards the drivers, etc. Then, the info will be updated and other users can view the status to select their desired route/public transport.

However, there is one concern that should be raised when discussing about public transportation, which is the safety (S. Kulanthayan et al., 2012). A research has been done in year 2007 to study the factors which lead to speeding among the bus drivers. According to S. Kulanthayan et al. (2012), more than half (54.2%) of the bus observed are speeding. This shows that passengers can be endangered due to the acting of the bus drivers and this problem should be tackled in order to provide a safe journey for the passengers. However, none of the related mobile application has this feature yet, except for BLS.

2.5 Chapter Conclusion

The literature reviewed in this chapter is divided into 3 sections: Public Transport vs. Private Transport, Smartphone Operating System – Android vs. IOS vs. Other OS and Android-based Mobile Application - Bus Locator System (BLS) vs. "Competitors". Each of these sections shows and relates the current issues to the significant of the author's research work. The ideas that have been discussed and highlighted will be used in the later part of the research.

CHAPTER 3 METHODOLOGY

3.1 Research Methodology

A model known as rapid application development (RAD) is used to develop Bus Locator System (BLS). According to Wikipedia (2013), Rapid Application Development (RAD) is one of the software development methodologies that require minimal planning in developing rapid prototyping. RAD requires the developer to constantly test the system throughout the completion of the entire system. There are several reasons why RAD is being employed:

- **Short developing period** – Since it is only approximately 28 weeks to complete the research and the prototype, it is best to use RAD as it speeds up the process by constantly testing the prototype until the complete system is being developed.
- **Constant maintenance** – RAD is a method that requires the developer to constantly test the system. Once the system has detected any errors, the developer can fix the error bit by bit, rather than fixing all the errors in the ending, which is the testing phase.
- **Encourage user feedback** – RAD enables the developer to constantly update the system, as such, it allows making changes after users give their feedbacks.

Under RAD, there are **four** main phases:

- Requirement Planning phase
- User Design phase
- Construction phase
- Cutover phase

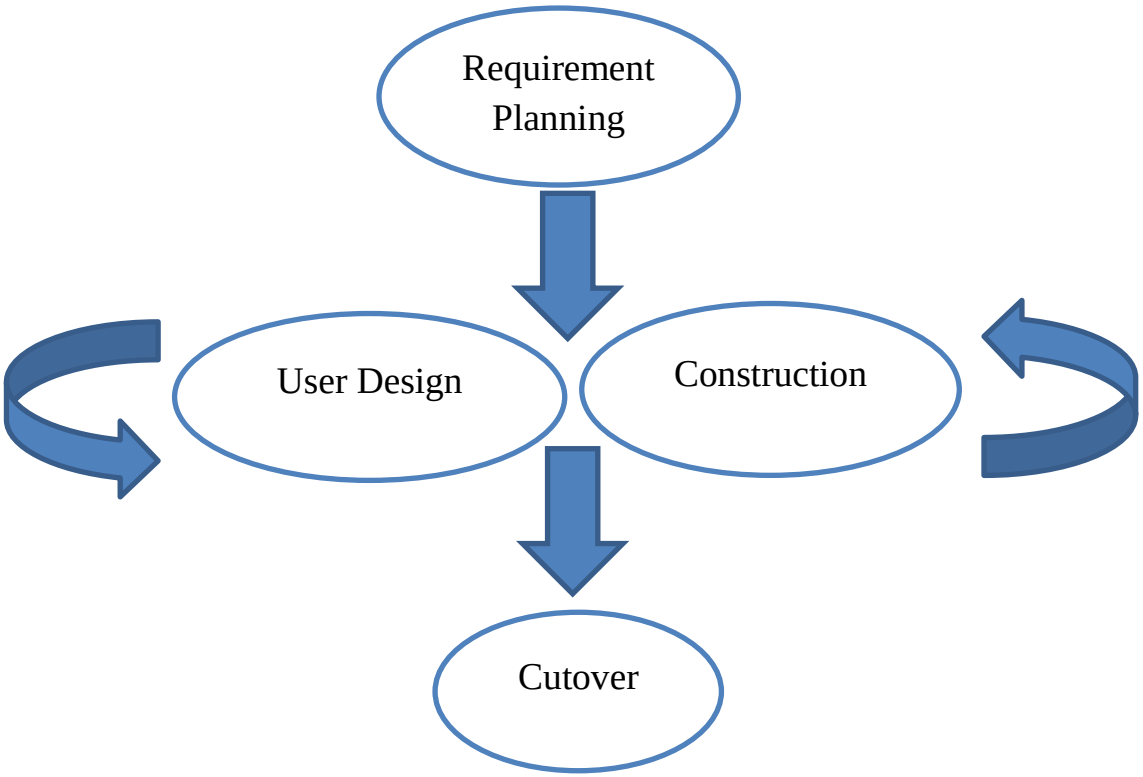

Figure 3.1 above shows the 4 main phases of RAD Model

Phase I: Requirement planning phase

Both system planning and system analysis will be carried out in this phase. In the beginning of this phase, preliminary research work will be carried out. Information such as what kind of sources and the whereabouts of sources would be identified. For this project, a mixture of primary and secondary sources will be used. An example of primary source is the research study on the current bus system; an example of secondary source is the commentary and the analysis part of the competitors' mobile apps. Both of these sources can be retrieved from the internet. After getting the information, analysis study will be taken place to identify the project needs, project scope, problems statement and system requirement, which all these have been discussed in the earlier sections.

Phase II: User Design phase

In this phase, the draft idea of the whole system will be identified. System architecture and several important things such as the initial interface, functionalities, etc. will be drafted out. Throughout this phase, the author will have to design the whole system before proceeding into the next phase to construct the prototype.

Phase III: Construction phase

This is a phase whereby a prototype will be developed. After the developer has drafted out the whole system, which include the initial interface, functionalities, etc., a prototype will be built based on those information. However, the prototype is not finalized yet. During this phase, the developer will also acts as the user to try out the prototype in order to make sure that the prototype is working perfectly and also ensure that it is user-friendly. Whenever there's a problem occurs, the developer will then move back to phase II to redesign and continue to reconstruct the new prototype in phase III until all the requirements are satisfied (as shown in Figure 3.1 above).

Phase IV: Cutover Phase

This phase is also known as the implementation phase. In this phase, all the changes made to the prototype are finalized and the prototype now is ready to deploy as the system. A final testing will be carried out in this phase to ensure that the prototype is truly ready to be used.

For this project, it consists of two parts: FYP I and FYP II. Phase I and II are carried out throughout the FYP I to come out with the paperwork and the general idea of the whole system. In FYP II, the prototype will be developed, whereby it will then involve the phase II, III and IV.

3.2 System Architecture

Figure 3.0 below shows the system architecture of this project.

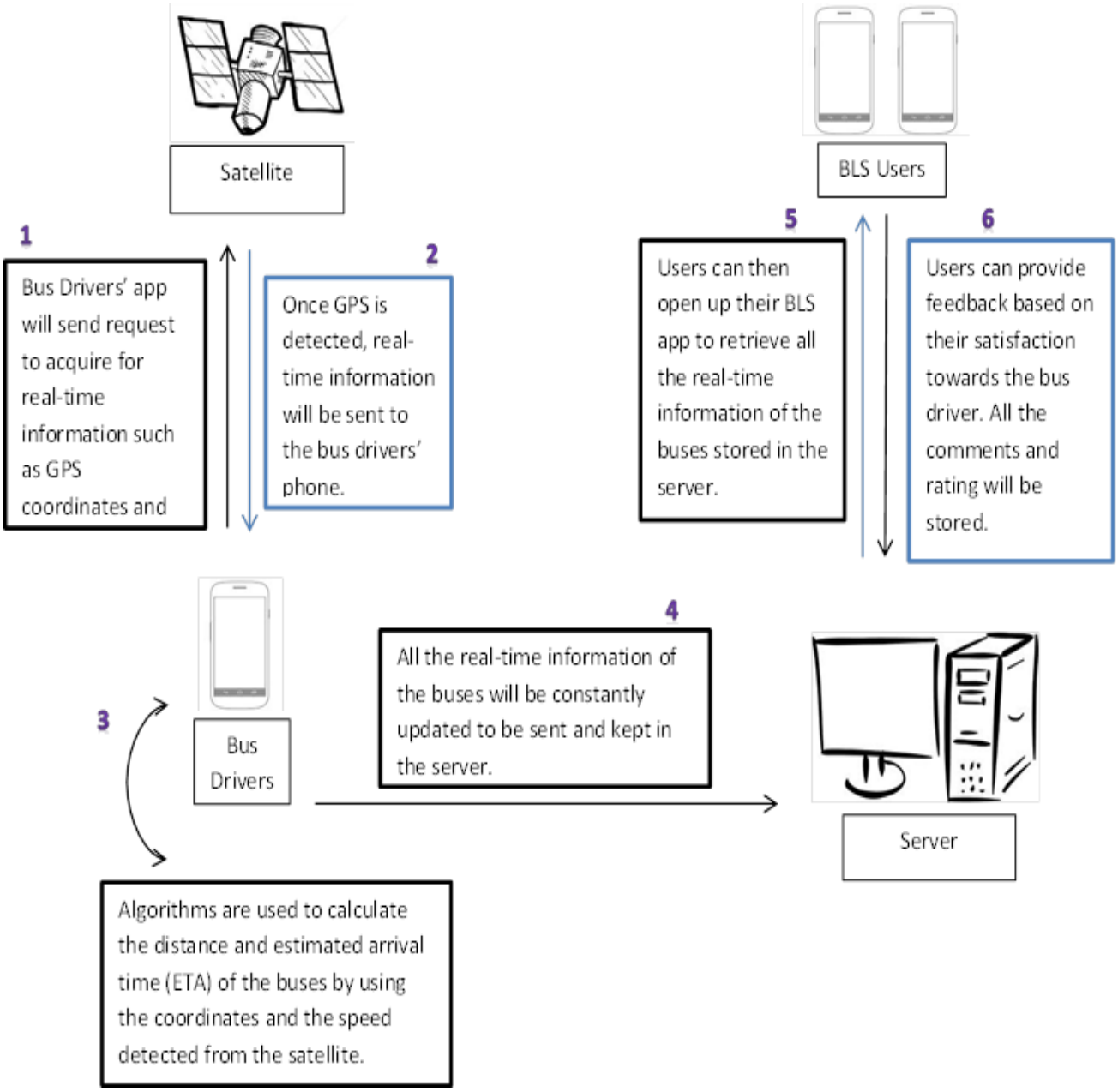

Figure 3.2 System Architecture of BLS

Below is the full explanation for the system architecture of BLS. Further elaboration on the screenshots and functionalities of the application will be discussed in "Chapter 4 – Results and Discussion".

- Each bus driver will have a company mobile phone with BLS installed in it. When the app is launched, the driver will have to login into the system and press the "Start" button to retrieve the real-time information of the bus (e.g. current coordinates, speed, etc.)
- When the bus drivers' phone successfully retrieve coordinates and the speed, distance and estimated arrival time (ETA) will then be calculated through the algorithms built within the application.
- All the real-time information of the buses will then be constantly updated within a specific time interval and sent to the server to be stored.
- From there, users can retrieve and view the real-time information of the buses. Besides, they are also able to provide their feedbacks on the bus drivers and those comments/ratings will be stored in the server for the host company to review.

3.3 Requirement Analysis

3.3.1 System Requirements

Both hardware and software will be required in this project. They are categorized into 3 groups: hardware/software requirements for the developing process, hardware/software requirements for the server sides and hardware/software requirements for the client/end user side

Hardware/Software requirements for developing process:

- ✓ Desktop/Laptop with Internet Connection
- ✓ Android Smartphone
- ✓ Titanium Studio
- ✓ App Inventor

Hardware/Software requirements for server sides:

- ✓ Desktop/Laptop with Internet Connection
- ✓ Local Database – XAMP: phpMyAdmin

Hardware/Software requirements for client/end user side:

- ✓ Android Smartphone
- ✓ Mobile App – Bus Drivers' app (BLS)
- ✓ Mobile App – Users' app (BLS)

3.3.2 User Requirements

By referring to Figure 3.2, there are two types of end users: company's bus drivers and the public who uses BLS. For the bus driver with the company phone, he/she has to launch the application and press the "Start" button on the app to constantly retrieve the coordinates and speed when he/she is on the duty. All the required information will then be retrieved or calculated and stored in the server. For the public that uses BLS, they only have to launch the app and follow the instructions given in order to get the real-time information of the buses.

3.3.3 Functional Requirement

Since Bus Locator System (BLS) serves two types of end users, it has two different applications: **Bus Drivers' BLS** and **Users' BLS**. Both of these applications have different functionalities.

For **Bus Drivers' BLS**, the functionalities are as listed below:

1. **Login/Register**

   Each of the bus drivers will have their own account, allowing the bus company to keep track on the records of each driver. If he/she doesn't have an account, he/she can register through the application.

2. **"Start Transmitting" Button**

   Once bus driver logged in to the system, he/she has to press the "Start transmitting" button, to allow the application to retrieve the real-time information such as current coordinates, speed, etc. All the real-time information will be displayed on the screen and it will be updated every specific time interval (e.g. 20 seconds).

3. **"Stop" Button**

   "Stop" Button is used to stop retrieving the real-time information.

For the **Users' BLS**, the functionalities are as listed below:

1. **Select the route**

   Once the user launched the application, he/she will be prompted a list of main routes of all the buses. He/she will then have to choose which route he/she wants to take in order to reach the destination.

2. **Map Display**

   Once the user selects a route, that particular route will be zoomed and displayed in the Google Map with all the markers placed in the map (e.g. current location icon, bus icon, bus station icons, etc.). With that, the user will be able to see his/her current location, location of the bus and available bus stations along on the route.

3. **Real-time information retrieval**

   By clicking on the "Bus Icon" displayed on the map, the list of information (e.g. bus no. plate, driver's name, speed, estimated arrival time, etc.) will be displayed on the bottom of the screen.

4. **Notifications**

   Upon the arrival of the bus or when the bus is reaching the next bus station, a notification will be prompted, alerting the users with the alert message so that users are aware of the current situation.

5. **"Report Driver" Button**

   The users are allowed to report the drivers directly through the apps if they find that the drivers are misbehave (e.g. speeding, keep switching lane, playing phone, etc.). At the same time, they can also rate the driver if the driver is good.

3.4 Key Milestones

Several key milestones have been highlighted to ensure that the project can be delivered on time.

Deliverables\Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Title Selection/Proposal	X													
Submit proposal to research cluster			X											
Problem Identification						X								
Extended Proposal						X								
Initial Interface											X			
Viva: Proposal Defense and Progress Evaluation												X		
Final Interface														X
Interim Report														X

= **General Key Milestone for the FYP I**

= **Specific Key Milestone for FYP I (Bus Locator System)**

Figure 3.3 Key Milestone of Final Year Project I

Deliverables\Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Users' BLS Function I: Select the route				X										
Progress Report				X										
Users' BLS Function II: Map Display					X									
Users' BLS Function III: Information Retrieval							X							
Users' BLS Function IV: Notifications								X						
Users' BLS Function V: "Report Driver" Button								X						
Bus Drivers' BLS Function I: "Login/Register"									X					
Bus Drivers' BLS Function II: "Start/Stop Display"									X					
Pre-SEDEX										X				
Dissertation (1st Draft)											X			
SEDEX												X		
Online Submission of Technical report and Dissertation												X		
VIVA													X	

= **General Key Milestone for the FYP II**

= **Specific Key Milestone for FYP II (Bus Locator System)**

Figure 3.4 Key Milestone Final Year Project II

3.5 Gantt Chart

Basically, it is divided into two periods: FYP I and FYP II, whereby the planning and analysis part that require paperwork will be done in FYP I, including some of the interface of the Bus Locator System (BLS); prototyping, testing and implementation phase will then be completed in FYP II.

Deliverables\Week	Final Year Project 1														Final Year Project 2												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PROJECT: Bus Locator System (BLS)																												
Requirements Planning Phase																												
Preliminary Research Work																												
Problem Identification																												
Literature Review and research on the subject matter																												
User Design Phase																												
Design proposed System architecture																												
Initial User Interface (Draft)																												
Refined User Interface																												
Develop report																												
Design "Select the route" function																												
Design "Map Display" function																												
Design "Real-time info Retrieval" function																												
Design "Notifications" function																												
Design "Report Driver" function																												
Design "Login/Register" function																												
Design "Start/Stop Display" function																												
Construction Phase																												
Code and test "Select the route" function																												
Code and test"Map Display" function																												
Code and test "Real-time info Retrieval" function																												
Code and test "Notifications" function																												
Code and test "Report Driver" function																												
Code and test "Login/Register" function																												
Code and test "Start/Stop Display" function																												
Test run apps																												

Figure 3.5 Gantt chart of Final Year Project I & II

CHAPTER 4
RESULTS AND DISCUSSION

4.0 Introduction

In this chapter, the discussions are done based on the results of literature survey and the prototype of this project – Bus Locator System (BLS). The purpose is to show the significance of this project and to enhance the understanding of readers towards the concept behind it. As mentioned, there are two main sections in this chapter: discussion on results of literature review and discussion on BLS. In the first section, the author provides the insight on the impact of public transportation sector towards society and the study on the mobile operating system that will be used for BLS. In the second section, the author discusses the interfaces for the prototype of BLS.

4.1 Discussion on Results of Literature Survey

4.1.1 Public Transportation Sectors

Based on the research, the ultimate objective of this project is to promote the public transportation sector so that more and more people will be taking public transport instead of private vehicle. The reason is to prevent the traffic from worsening, which caused by the overloaded on-the-road vehicles.

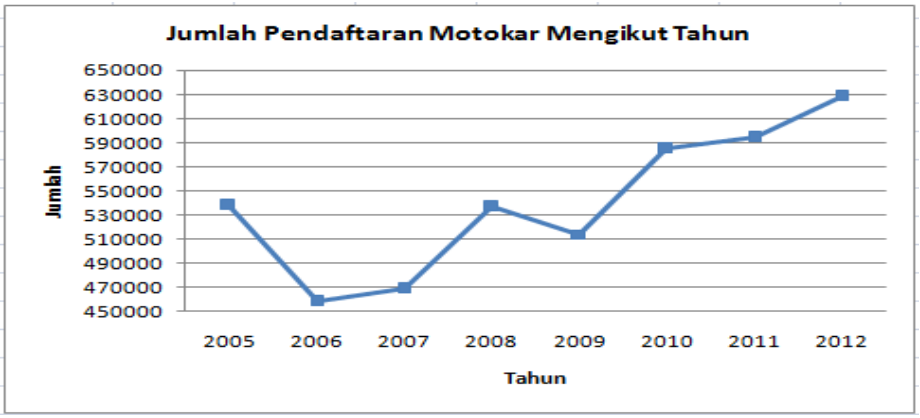

Figure 4.1 Number of Registered Motorcar 2005-2012

Figure 4.2 Cumulative Number of Driver 2005-2012

Sources: Retrieved from http://www.jpj.gov.my/

Looking at the statistics provided by JPJ Malaysia (2013) as shown in the Figure 6.0 above, we see that the number of vehicles is increasing year after year since 2009, after the financial crisis happened in 2008. Also, looking at Figure 7.0 above, the number of driver is increasing every year. This says that there will be more and more vehicles on-the-road if public transport is not promoted to the public. Assuming that the road capacity is around the same after years, the increment in the number of vehicles is associated with the worsening of traffic congestion problem. Thus, promoting the public transportation sector is important to hedge against this risk.

However, most of the Malaysian citizens are taking on their privates vehicles. According to Federation of Malaysian Consumer Association (FOMCA) Chief Executive Officer Datuk Paul Selva Raj, he says that most Kuala Lumpur residents were hesitant about taking public transportation mainly because of the poor service. He continues to say, as quoted below:

- "The current bus system is not integrated and efficient enough to accommodate the passengers."

- "That's why FOMCA believes that the government should focus more on improving the public bus system, so that it will help bring more people to light rail transit stations and other destinations."
- "That's why we are hoping the government will give serious attention to improving the bus service."

Source: Retrieved 21 March 2013, from http://www.nst.com.my/nation/general/crying-need-for-better-public-transport-1.238882

Based on the quotes above, Bus Location System (BLS) is able to integrate and improve the efficiency of the current system, by providing the real-time information of the bus to the public. Besides, BLS can also help in controlling and managing the bus drivers' driving behavior. A study has been conducted by TheMalaysianInsider.com to study the causes/factors of bus accident.

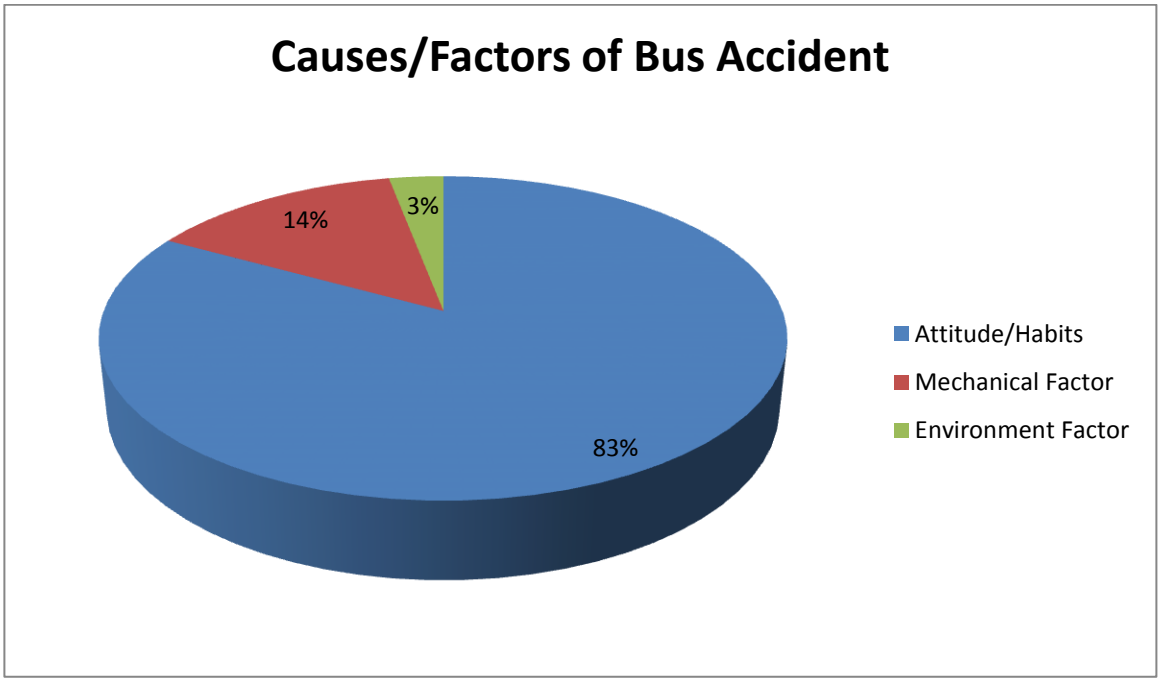

Figure 4.3 Causes/Factors of Bus Accident

Source: Derived from http://www.themalaysianinsider.com/malaysia/article/deadly-drivers-the-main-cause-of-bus-and-lorry-crashes-says-plus/

Referring to the Figure 8.0 above, there are 3 main factors that caused a bus accident. They are the attitudes/habits of the bus driver, mechanical factor and environment factor. The driving attitude/habits are including speeding, constantly switching lane, driving in the wrong lane, playing phone when driving, etc. Mechanical factors include condition of the bus such as brake defect, tyre defect, engine breakdown, etc. Environment factor include the condition of the road or weather such as wet road, pit holes, etc.

Looking at the statistic, it shows that 83% of the bus accidents are caused by the driving attitude/habits of the bus drivers. The other factors are mechanical factor and environment factor, at 14% and 3% respectively. This shows that measurement should be taken to supervise the bus drivers, or the life of passengers will be jeopardized. BLS is able to tackle this as it has a function to allow the users report the bus driver (will be discussed later in the prototype, Section 1.4.3) when they are not behaving.

4.1.2 Smartphone Operating System

Since this is a mobile application development project, it is required to choose a mobile operating system when developing the apps. Due to the time constraint, this mobile app will only be developed in one operating system. A study has been conducted International Data Corporation (2013) to see which smartphone operating system is the best to use in terms of reliability and crowd number.

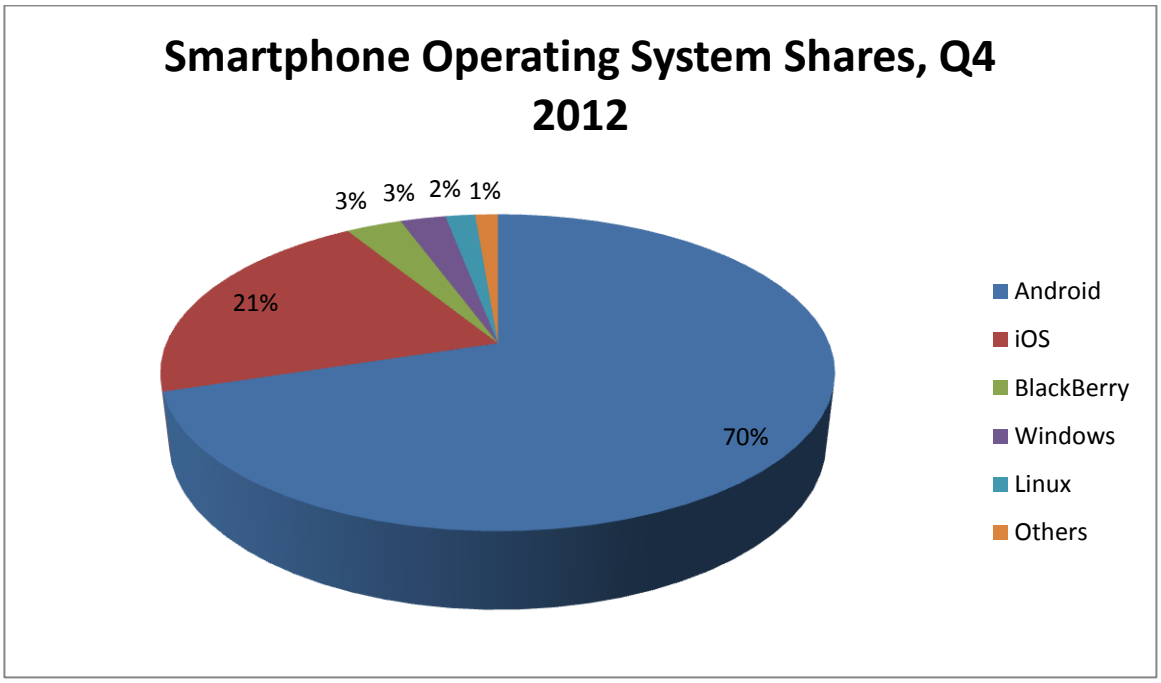

Figure 4.4 Smartphone Operating System Share, Q4 2012

Source: Retrieved from http://www.idc.com/getdoc.jsp?containerId=prUS23946013

According to the Figure 9.0 above, there are 5 most common smartphone operating systems available in the market. This includes the Android, iOS, BlackBerry, Windows and Linux. Google's Android has the biggest market shares of 70%. It is then followed by the Apple's iOS, BlackBerry, Windows and Linux, at 21%, 3%, 3% and 2% respectively. This shows that Google's Android is the most reliable and majority of the people is using it now. Thus, Google' Android will be chosen as the operating system in developing the prototype.

4.1.3 Prototype

As for the prototype of this project, two BLS applications are built for two different types of end users: Bus Drivers' BLS and the Users' BLS, as mentioned in the previous chapter and a local database are involved in keeping all the information. As a result, both of the interfaces of these applications and the database will be discussed in this section.

For Bus Drivers' BLS:

Three main interfaces have been designed and built. Each of these interfaces is displaying/showing one of its functionalities. Below are the screenshots for the three main interfaces for Bus Drivers' BLS:

1.

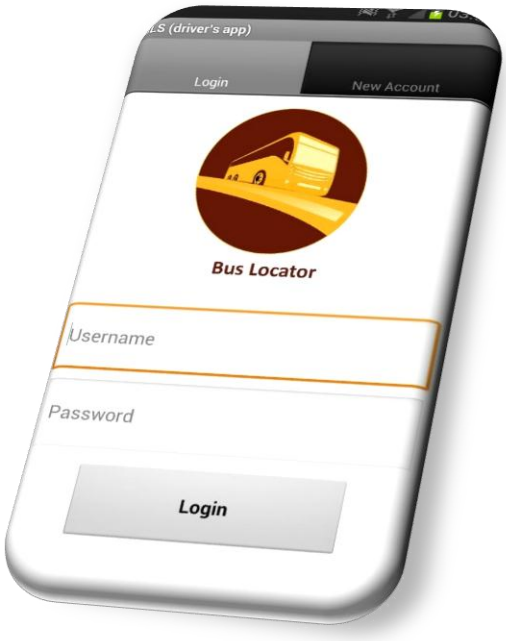

Figure 4.5 "Login" Interface

Every bus driver will have his/her own account when using Bus Drivers' BLS. This is to identify the details of the drivers and at the same time, enable the company to track down the records of these drivers easily. An error message will be prompted if the username/password is invalid. If they do not have an account, they can register through the "New Account" tab on the top right corner of the interface as shown in Figure 4.5 above.

2.

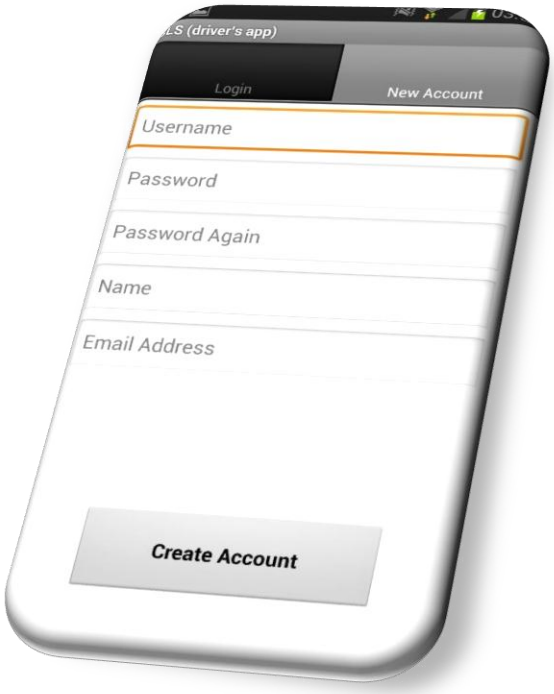

Figure 4.6 "Register" Interface

If the driver presses the "New Account" tab, it will lead to an interface as shown in the Figure 4.6 above. The driver has to fill in all the details such as username, password, name and email address before pressing the "Create Account" button. Error checking is mandatory in this phase. If there is duplicating/existing username or email address or if the email address is in invalid format, an error message will be displayed and the driver has to re-input the data. Besides, the passwords that are entered have to be consistent in both fields in order to proceed in creating an account. Failure to do so will result in another error message, which requires the user to enter the passwords again. Once all the data is properly/error-free entered, the driver can then proceed with creating account by pressing the "Create Account" at the bottom of the screen.

3.

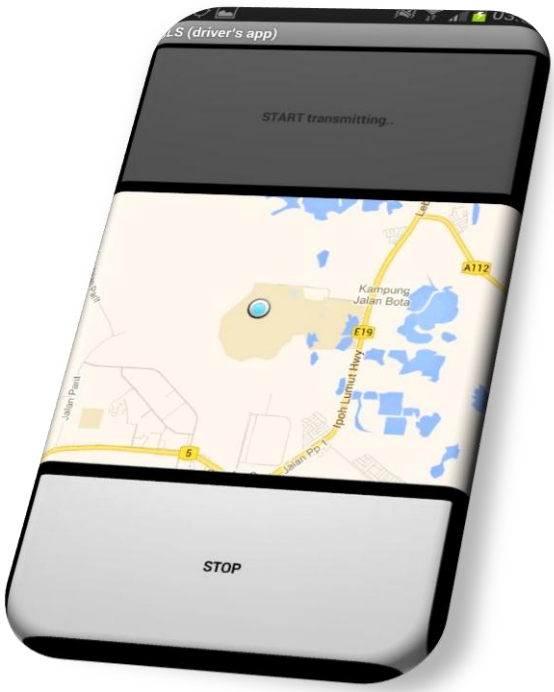

Figure 4.7 "Start/Stop Display" Interface

Once the bus driver has successfully logged in, it will lead to an interface as shown in the Figure 4.7 above. There are two buttons in this interface: "Start transmitting" and "Stop" buttons. Bus driver will have to press the "Start transmitting" button when he/she is on duty and "Stop" button when he/she stops duty. By pressing "Start transmitting" button, current location and the speed of the device will be detected and it will be constantly updated within a specific time interval (e.g. 20 seconds). By knowing the coordinates of both current location and destination, distance and estimated arrival time (ETA) can be calculated. In order to calculate the distance, the law of Haversine is applied. Once distance is calculated, estimated arrival time (ETA) can be identified by multiplying the current speed to the left over distance. Harvesine formula is as below:

$$d = 2r \arcsin\left(\sqrt{\sin 2\left(\frac{\emptyset_1 - \emptyset_2}{2}\right) + \cos(\emptyset_1)\cos(\emptyset_2)\sin 2\left(\frac{\alpha_2 - \alpha_1}{2}\right)}\right)$$

Where d = distance between two point

r = radius of the sphere

$\emptyset_1, \emptyset_2$ = latitude of point 1 & latitude of point 2

α_1, α_2 = longitude of point 1 & longitude of point 2

For the Users' BLS:

There are only two main interfaces designed and built for the Users' BLS: "Select Route" and "Map Display" interface. However, there are quite a number of functions built within these two interfaces (e.g. notifications, real-time info display panel, report driver function, etc.). Thus, all the explanation for screenshots will be provided as shown in the figures below:

1.

Figure 4.8 "Select Route" Interface

Figure 4.8 above is the first interface that users will see once he/she launches the application. At here, a list of main routes of the buses will be displayed. The user will then have to select which route he/she wants. Note that the routes displayed will be the main routes. This means that the user will only have to select the route favor to his/her direction and he/she can drop by at any of the bus stations located along the route.

2.

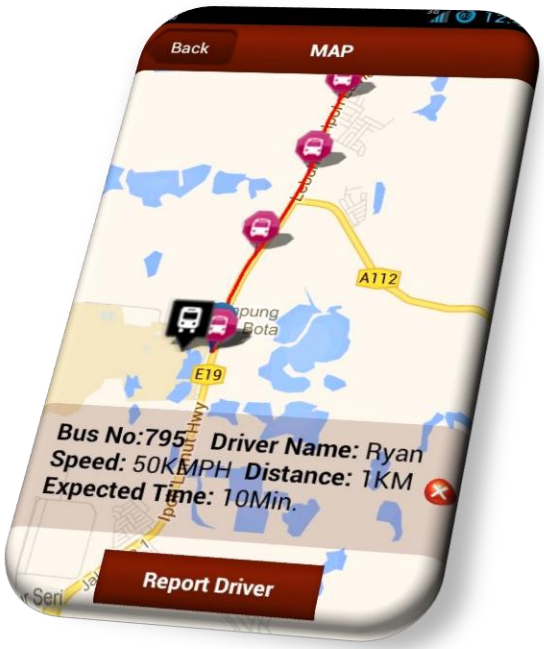

Figure 4.9 "Map Display with Details" Interface

Once the user selects a route, a map will zoomed and displayed as shown in Figure 4.9 above. Here, the user is able to see all markers/icons on the map. If the user would like to know the details of the bus, he/she can press the bus icon on the map. All the related information will be displayed according as shown in Figure 4.9 above. For further information regarding the markers/icons, refer to the Table 4.1 below:

Icons	Meaning
	Current location of the user
	Current location of the bus
	Bus Stations

Table 4.1 Map Markers

3.

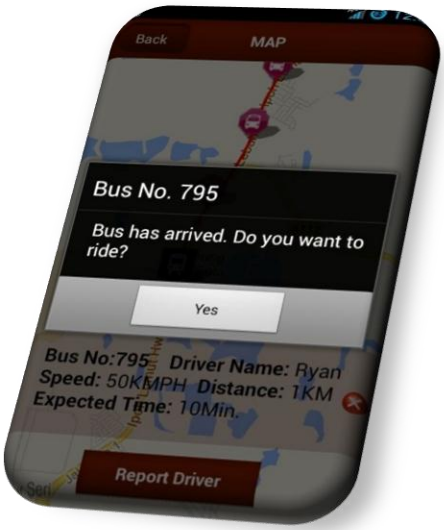

Figure 4.10 "Bus Arrival Message" Interface

The application is programmed in such a way that if the bus is approaching to the bus stop where the user is located nearby , a notification box will be prompted out as shown in the Figure 4.10 above, asking if the user wants to ride the bus. If the user agrees to ride on the bus, the color of the bus icon will turns from black to blue as shown in Figure 4.11 below, indicating the user is onboard.

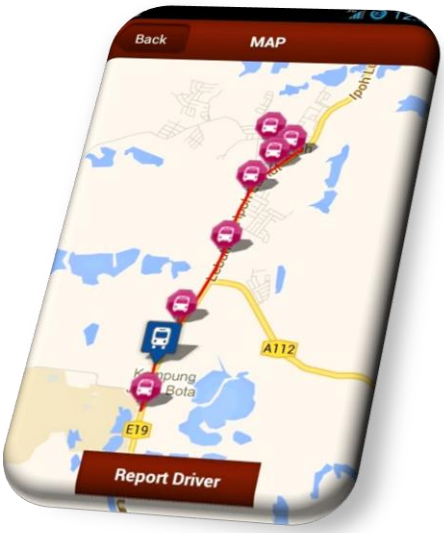

Figure 4.11 "User Onboard" Interface

4.

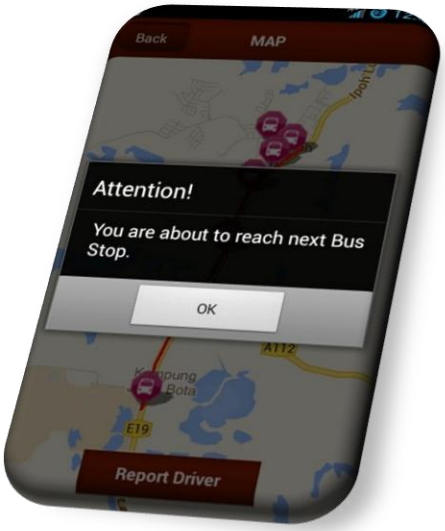

Figure 4.12 "Alert Reaching Next Bus Stop" Interface

A notification function is programmed into the application to notify the user every time the bus is approaching next bus stop. This will allow the user to aware on his/her current location and reduces the chances of missing the bus stop.

5.

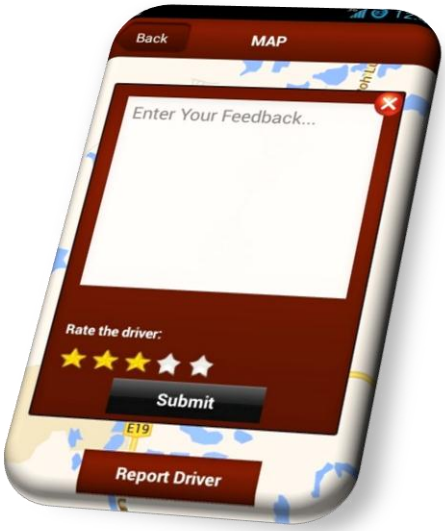

Figure 4.13 "Report Driver" Interface

Lastly, the user is encouraged to provide the feedback on the driver. He/she can rate or write down the comments on the bus driver by pressing the "Report

Driver" button as shown in the Figure 4.13 above. All of the comments and ratings will be kept in the database for the host company to review. From there, if the driver is excellent or misbehaving (e.g. speeding, switching lane too often, occupying the right lane, etc.), the user can write it down and left it to the company to decide on the rewards or punishments to be made to the drivers.

For the local database (phpMyadmin):

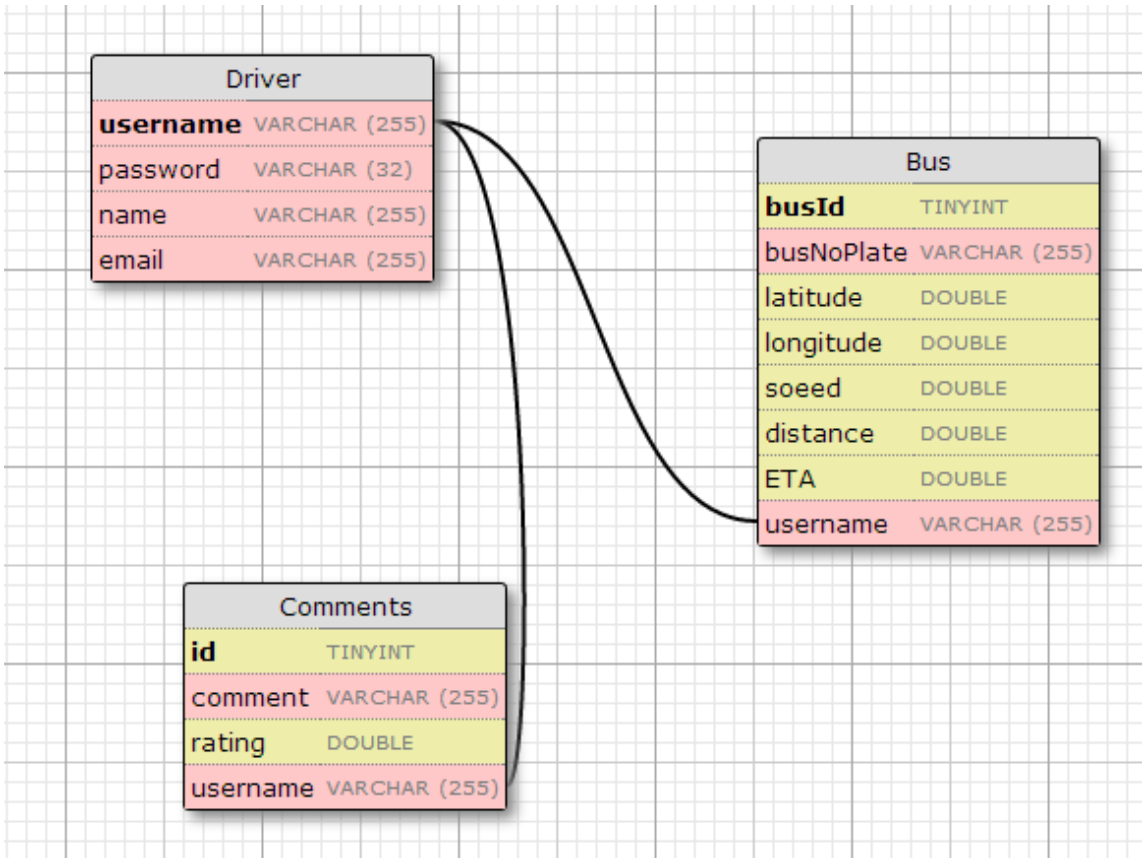

Figure 4.14 Database Structure

There are 3 tables in the database: driver, bus and comments. In driver table, personal details of the drivers will be stored and username will be the primary key. From there, the username will be the foreign keys in both bus and comments table. It is used to link bus and comments tables where bus table consists of all the details of the bus and comments table consists of all the feedback on the drivers from the BLS users.

CHAPTER 5
CONCLUSION & RECOMMENDATIONS

5.0 Introduction

This is the final chapter of this study whereby the conclusion of overall outcomes would be thoroughly explained. First and foremost, a general conclusion on the major findings in this study will be provided. Then, the relevancy of the project to the objectives will be highlighted in the following section. Finally, some possible areas for future studies or literature expansion as well as recommendations for the project would be discussed.

5.1 Conclusion of Findings

In a nutshell, the current bus system is not integrated and inefficient enough to convenience the citizens. That's the main reason public transportation is not favored by the public. As a stepping stone towards a better developed country, the public transportation issues should be addressed properly. The current system should be improvised by making the citizens easier when taking bus. Relevant information such as location of time and estimated arrival time should be provided to the citizens in order to them to plan their trip well without spending time to wait for a bus, which is very time consuming. Besides, the safety of the bus passengers should also be well taken care of by monitoring the driving attitude/habits of the bus drivers. By promoting public transportation, we are able to participate in establishing a greener environment. Also, this will allow us to control the number of traffic on the road before the congestion issue becoming worse.

5.1 Relevancy to the Objectives

The author believes that the project – Bus Locator System (BLS) has fulfilled the SMART criteria, as explained below:

- **S** stands for **Specific** – This project has a very specific set of objectives which to be completed upon the completion of the project.
- **M** stands for **Measurement** – Project achievement is measured by the number of objectives achieved upon the completion of the prototype.
- **A** stands for **Achievable** – Developing Bus Locator System (BLS) is not an impossible job and it can actually be done through proper planning and hard work.
- **R** stands for **Realistic** – Developing Bus Locator System (BLS) is a realistic idea in improving the efficiency and effectiveness of the current bus system.
- **T** stands for **Timely –** 28 weeks are given to complete this project to develop a complete prototype.

5.2 Suggested Future Works for Continuation

Due to time constraint, the author is only able to complete the main functions of the system. There are still some additional functions that can be added to improve the current system. For example, function such as online payment can be implemented whereby the users are able to pay the bus fees online in a lump sum if he/she is a frequent user. As such, it brings convenience to the citizens when they travel in public transport as they can now travel anywhere, even they are with their smartphones only.

Besides, inter-city buses can be included in the system. The current proposed system is only targeting the buses within the city. However, the system can be designed in a wider scope as it includes the function to provide all the real-time information of all the inter-city buses when they are moving across the states.

Lastly, this system can be developed into other smartphone Operating System so that all of the citizens, regardless of what smartphone they are using, they are able to enjoy the benefits of this application.

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