Campus Shuttle Bus Application

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Abstract--- Transportation plays an important role in supporting the implementation of various activities including in universities. Nowadays, many of universities and colleges are also taking initiatives in building a sustainable transportation system by providing campus shuttle service for students. Maintaining a high standard of quality in service and performance are extremely importance to encourage student to make shuttle bus services as their preferred choice. Therefore, this study is aim to improve students' perceptions towards reliability and effectiveness of campus shuttle system.

Keywords--- Mobile Application, Shuttle Bus, Tracking System, Global Positioning System.

I. INTRODUCTION

Public transportation involves moving from one place to another with different types of transportation mode available to use, including buses, passenger trains and taxis [1]. Passengers rely on it for various purposes such as entertainment, education, social and business purposes [2].

Therefore, a good transportation system is important as it can bring efficiency in mobility of passengers, benefit the economy as well as the environment. Universities are also implementing strategies in building an efficient transportation system for students to improve the quality of life on campus in terms of commuting [3].

One of the main reasons for a transportation system is the growth of students, universities are experiencing, in which it cannot be overlooked [4]. As the number of students is increasing each year, the use of personal transportation increases, affecting on how students are commuting to and from campus creating various issues such as traffic congestions, parking shortages and increased of pollution [5].

Therefore, campus shuttle bus service is a solution for sustainable transportation on campus in the future as students are increasingly dependent on it as it eases mobility to and from campus, relatively cheaper than taking their own personal mode of transportation and enable them to conduct on educational activities [5].

Campus shuttle in universities has become a crucial facility for students as they provide transport for students across campus and accommodation. Universities and other institutions of higher education are embracing the concept of campus shuttle to reduce operational costs such as parking spaces, and students tend to use the service due to lower fares, easing traffic congestion and eases mobility [6]. Students are very dependent on public

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transportation, especially their campus shuttle bus services and this can be supported by a research conducted in the University of Cape Coast in 2014 where 67.3% of students use service every other day and 50.5% use the service due to lower transport fares [4].

A number of researches have been conducted to assessed students' satisfaction with campus shuttle in their respective universities which to determine the perceived quality level of campus shuttle [3]. However, despite bring a crucial facility and frequent usage of the service, results have shown that that the quality level of the campus bus service does not meet students' level of expectations. There are some problems that faced by students which include frustrated waiting time for the bus arrival, difficulty of accessing shuttle bus related information and unpleasant or unsupportive drivers. Hence, poor services will cause students to miss classes, attending late to class and discourage them from riding the shuttle buses.

The aim of the research is to enhance students' perceptions towards reliability and effectiveness of campus shuttle system. Additionally, to increase students' satisfaction by sustaining existing users and attracting new ones to utilize the service.

II. METHODS

2.1 Software Methodology

Scrum is an agile methodology processes which focuses on delivering high quality software which has a high business value and it focuses on strategy and a flexible product development where the team works towards a goal to achieve in the project [7]. Scrum will be used as the methodology for the project as development of system takes place during sprints and it goes through incremental changes as each set of features have been developed and as sprints are carried out during the development process of the application, amendments and enhancements can be made to the system with frequent testing to fix any bugs and errors, increasing the overall quality of the application.
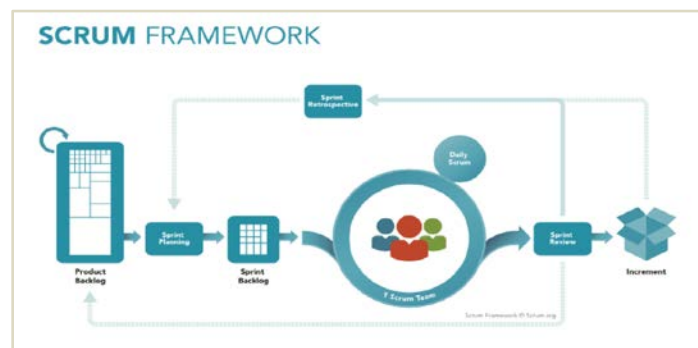

Figure 1: SCRUM Methodology [8]

Based on figure 1, Scrum process consists of 5 stages; developing product backlog, sprint planning, daily stand-up meeting, sprint review, sprint retrospective.

2.2 Implementation of Scrum in Project

The Scrum concept will be implemented throughout the project where the iterative cycle or sprints will take place:

The development of the application will follow the scrum process by prioritizing features that will be developed first and reorganizing features into sets that will be incorporated in sprints.

After organizing them into sprints, the development of the application will start following the tasks that have been determined for the sprints based on the user requirements that will be gathered from primary data collection through questionnaire.

During the running of sprints, testing will be conducted continuously after each feature has been developed and after each sprint is completed, testing will be conducted again to inspect all the features assigned to the particular sprint, identify the bugs and make necessary fixes to it. Once amendments have been made, the set of features will be adopted, and the next sprint will be carried out until development is complete. Below are the features and sprints to be completed (high-level):

Table 1: Implementation of Scrum in Project

Sprints	Features	
Sprint 1	User interface such as homepage and log-in page	Log-in function (all users)
Sprint 2	Bus schedule function (student)	Real-time tracking function (student)
Sprint 3	GPS location function (driver)	Departure and arrival information (driver)
Sprint 4	Edit function (admin)	Create and view report function (admin)

2.3. Software and Tools

Java

Java will be the programming language chosen to develop the proposed mobile application, because the language is widely known and most devices nowadays support Java language and it will be easier for the application to be targeted to many people, such as Android apps which uses Java language, and apps written with the language can be targeted to many types of devices which uses Android operating system.

Android Studio

Android Studio is the integrated development environment chosen to develop the proposed mobile application. By downloading Android Studio, it also provides developers the Android SDK (Software Development Kit) tools and its Android libraries, which allows the developer to create a high-quality mobile application.

Google Maps APIs

Google Maps APIs will be the external libraries imported to the IDE to develop the required features of the proposed application; tracking buses location, route finding and arrival notification.

Firebase

Firebase is a mobile platform owned by Google that helps developers create high quality apps and they support applications for web, iOS and Android [9]. Firebase will be chosen as the database storage for the proposed application as it is suitable to host a simple application and it would be much easier to integrate it to the IDE as Android Studio has a Firebase assistant that can guide developers to integrate the application with the Firebase and can choose to add other services to meet their needs such as analytics, authentication and notification with step-by-step guide, increasing the learn ability for the developer.

Android (Operating System)

The operating system in which the proposed application will run on is Android as an android application will be developed. Android is an operating system and a middleware and applications that runs on the Linux-based platform which uses Java language codes as the programming language to develop its application [10].By making it an open development platform, developers can also take full advantage of the device such as the GPS location, access device camera and contacts [10].

2.3.1 System Architecture

The proposed mobile application for APU's shuttle bus service focuses mainly on the tracking of the shuttle buses that are assigned to different locations to allow students who are residing in different accommodations to track their respective shuttle buses. However, there are other features that the application offers to users such as submit feedback, view bus schedules and report creation. The mobile application currently targets 3 main users; student, driver and admin.

Figure 2 to 5 shows samples of the design of the proposed application in the form of use-case, activity, class diagram and database design.
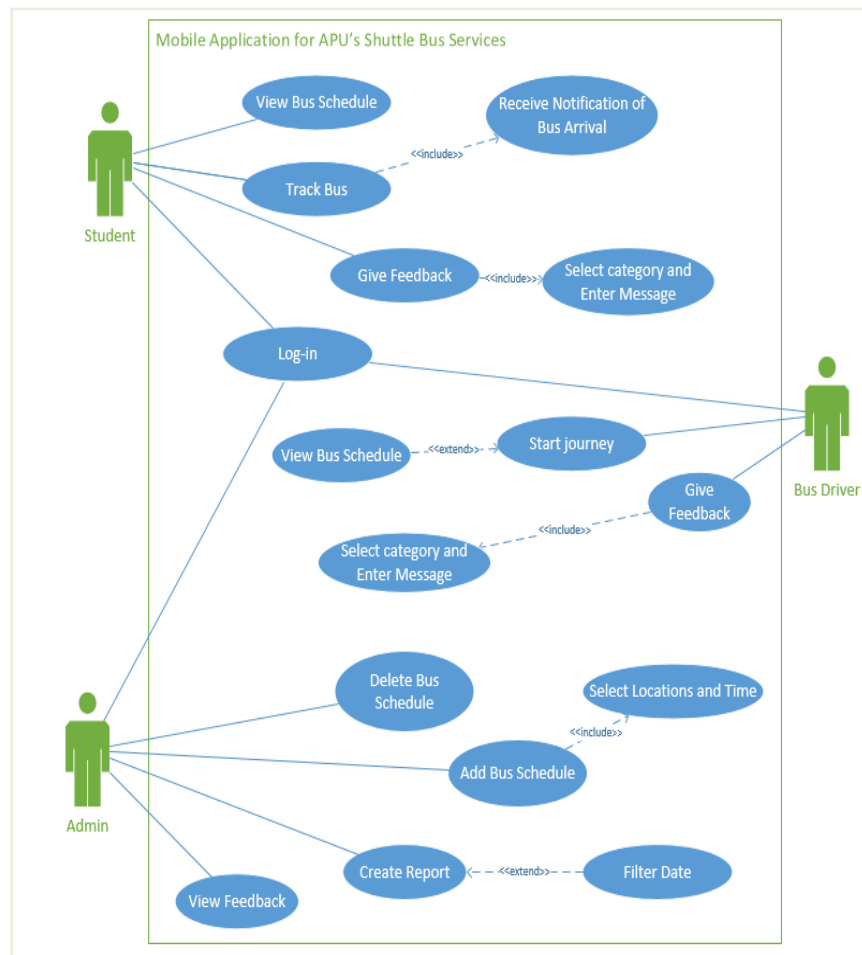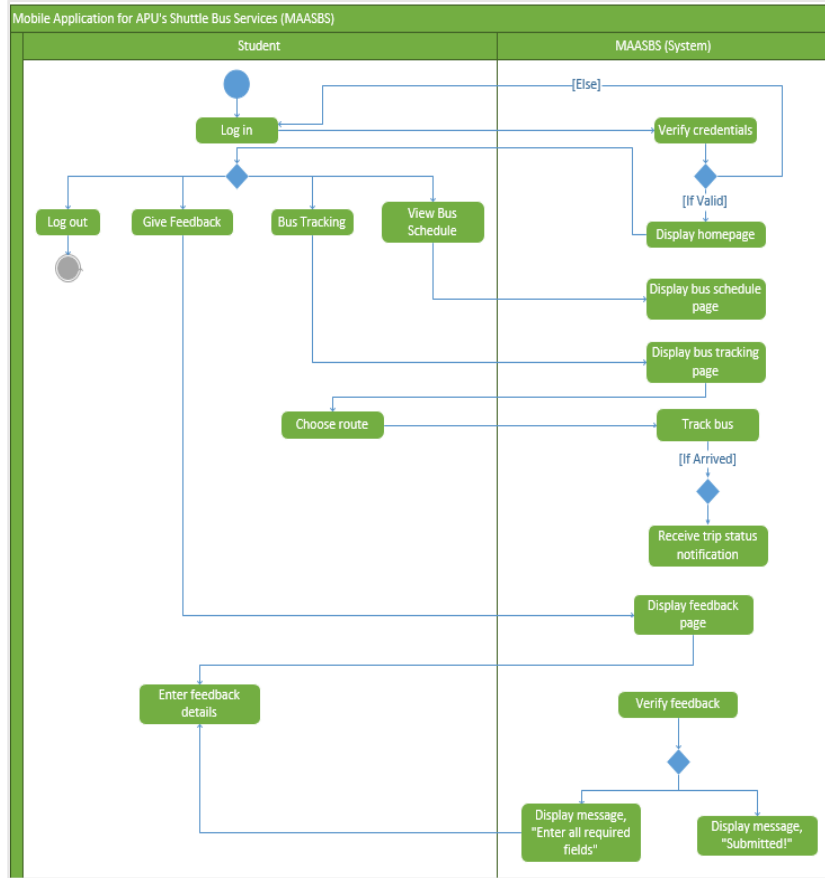

Figure 2: Use Case Diagram
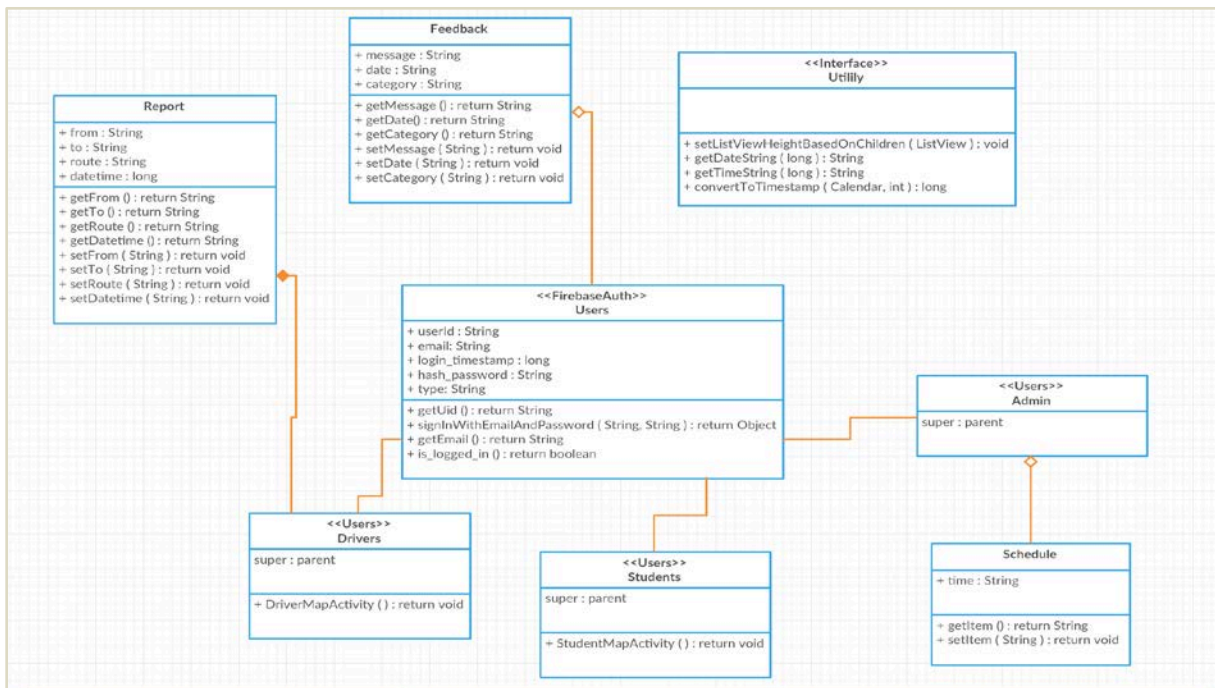
Figure 3: Activity Diagram for Student Module
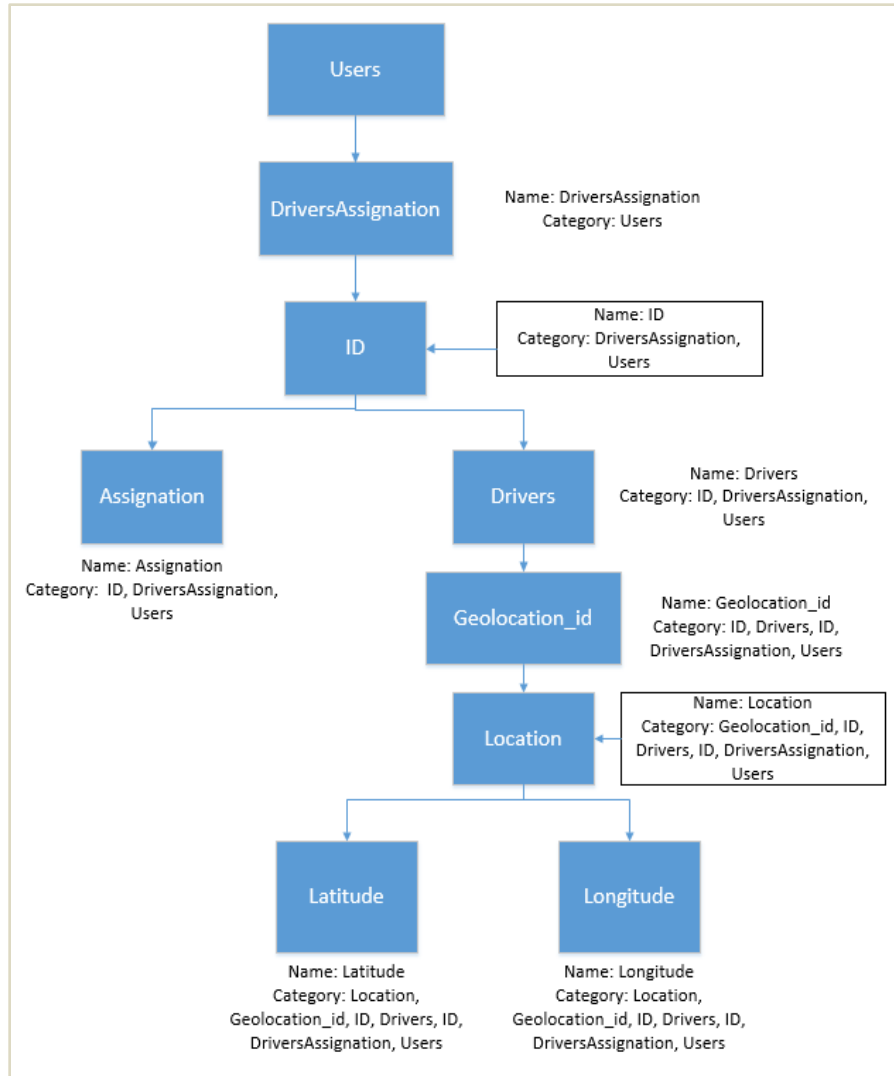

Figure 4: Class Diagram

Figure 5: Database Design for 'Location' Key

III. RESULTS AND DISCUSSION

3.1 System Implementation

Figure 6-10 shows screenshots of the proposed mobile application which consists of view bus schedules, route picking, bus tracking, submit feedback and report creation.

The overall flow of the application would start with the student viewing the bus schedule of respective accommodation/location (figure 6). The student would start tracking the location of the bus for the respective accommodation. The student must pick a route to track (figure 7) and will be redirected to the map (figure 8). which shows the bus's assigned to the route that the student picked. If the student is not satisfied with the service, a feedback can be submitted (figure 9). Similarly, a bus driver can submit a feedback if there needs to be further improvement to the service. Once a trip is completed, the trip status will be recorded, and it will be shown in the report creation page of the admin where report can be categorized to view weekly completed trips (figure 10).
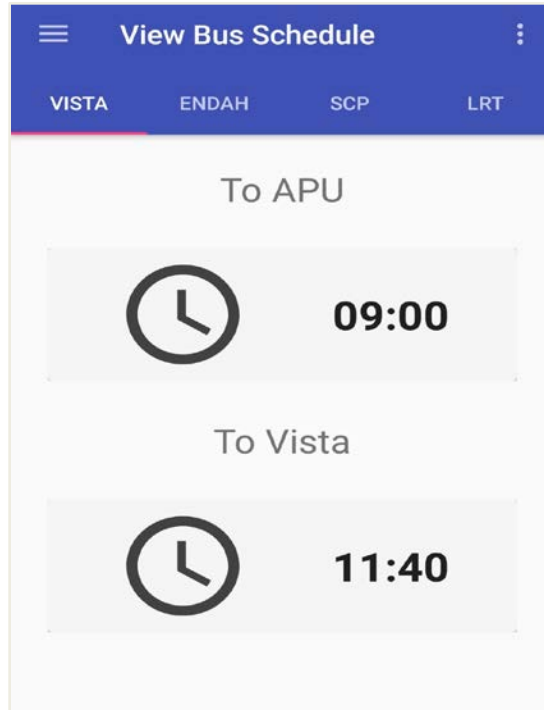
Figure 6: View Bus Schedule Page in Student

The bus schedule page shown above is a feature offered to students where it will allow them to view the bus schedules for different location; Vista, Endah, LRT and South city. In each location tab, there are 2 main card views for the bus schedule; the schedule to and from the location. The card views are scrollable, and the user will be able to see the list of bus timings when they scroll down in the card view.
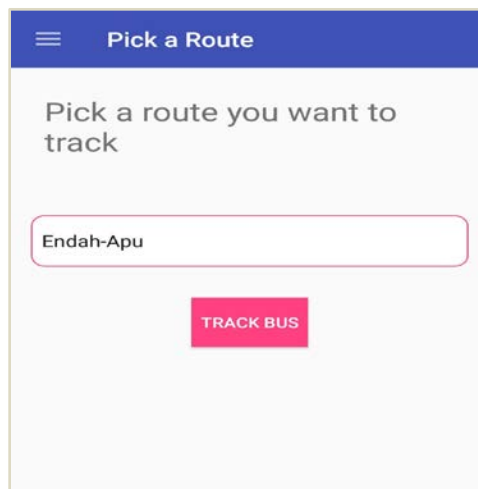

Figure 7: Route Picker Page in Student Module

The route picker page will be displayed before allowing the user to track the bus because they would have to pick a route first because based on the route they choose, it will display the driver that is assigned to that route. In the route picker, user would have to pick the route from the dropdown which a list of routes will appear when they click the dropdown. Once selected, user can then track the bus by clicking the 'Track Bus' button.
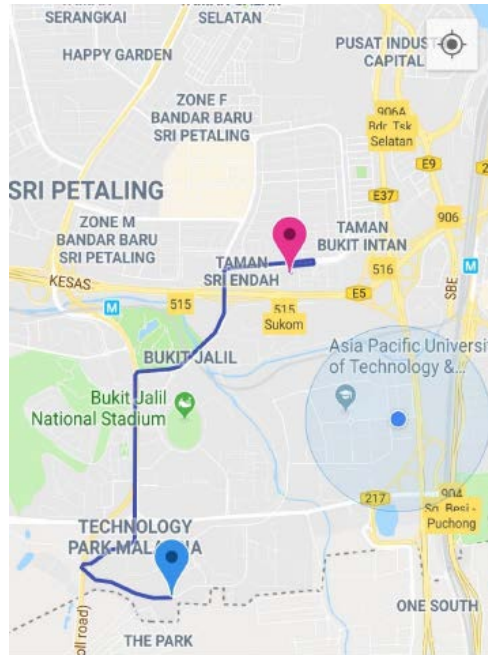
Figure 8: Bus Tracking Page

The screenshot above shows the map activity for student where it will allow the user to track the real-time location of the bus based on the route they chose.

On the map, they will be able to see the driver's location, their own location, the location markers and the routing between the two location points. Above is an example of the map displaying the route of Endah and APU.

Figure 9: Feedback Page

This is the feedback page for student which will allow them to submit a feedback through the application if they face any issues regarding the service. To submit a feedback, the user would have to select a category of the message to provide a guide for the user, so they can know what kind of issues they can discuss and if any of the categories provided could be relevant to the issue they are facing. After selecting the category, they must discuss the issue further in the message box and once done filling in the required fields, they can click the submit button.
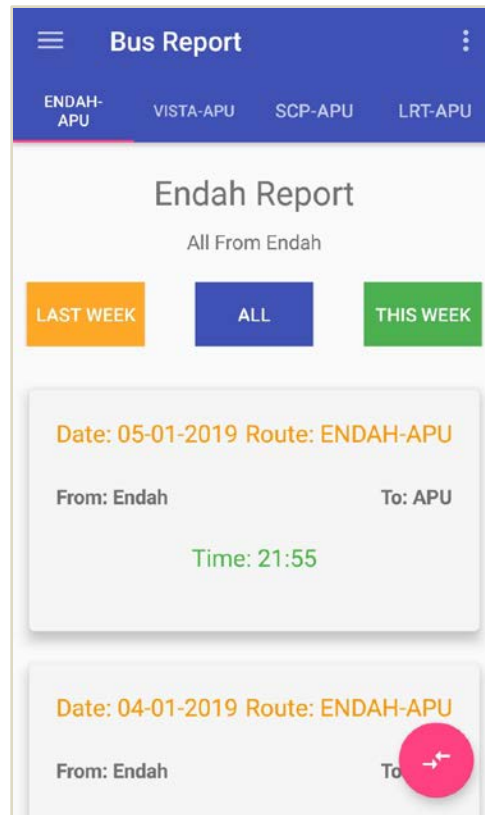
Figure 10: Report Creation for Admin Module

The bus report page basically shows bus trips record for each route and basically it is showing it in different tabs so it will be easier for the user to view and categories the record. Each card view represents the bus trip record where it displays the date of the trip, route name, to and from location and the arrival time. If the user clicks 'LAST WEEK', it will show last week's record and if the user selects this week, vice versa. If user clicks 'ALL', it will show the entire record including this week and last week. The switch action button below is also a type of filter button where if the user clicks on it, it will switch record of trips all from Endah to the trips of all to Endah, making it easier to categorize.

3.2 Future Enhancement

The following can be added as future enhancement:

- Integrate independent device onto GPS system to overcome dependency on manually turning on GPS location on device.
- A feature to allow admin to categorize report not only weekly but also monthly for data analysis purposes.

- A download feature for report creation

- A feature which displays estimated time taken feature on map for students

- A feature which allows categorization in view feedback page for admin for data analysis purposes

IV. CONCLUSION

Overall, the implementation of campus shuttle services provided for students transport expenses and the need to drive and put effort to search for a parking, thus resolving issues such as traffic congestion in the university. As stated, majority of students tend to rely on this service due to the positive impact it has to students' travel practice. However, there is still room for improvements in the service because even though students are satisfied or dissatisfied with the service due to several factors which can affect their perception, the score of perceived quality of the service does not meet the expected quality score even though the value is positive and above average, for majority of the research conducted in different universities. Therefore, it is important to not overlook these issues to encourage students to continue utilizing the service for the benefit of the university and students.

The emerging of new technologies has changed the way public transportation operates and this can be one of the solutions to tackle the current issues students are facing with the shuttle services with apps like Grab and Moovit, in whichsimilar concepts can be implemented in the solution for greater information accuracy, which can increase level of students' satisfactions towards the service. Furthermore, the similar systems which were compared previously has greatly impact the service positively in a way, students do not need to self-predict on the buses' arrival timing and avoid unnecessary waiting for unavailable or cancelled trips. However, each system/application has their own unique features to increase the effectiveness of the service, while at the same time, they have their own drawbacks. Based on these, there will be considerations on whether unique features of the systems discussed, such as notifying users through SMS regarding bus arrivals and announcement of delays, could be implemented in the proposed system as additional features.

V. ACKNOWLEDGMENTS

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