

## UTHM Shuttle Bus Application

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**Abstract:** In the rise of information technology, manual routine, system, and activity has turned out to be useless and a waste of time. In Malaysia, the manual system is still working as daily activity where system can replace it. The lack of knowledge and learning was the main factor of the manual system exist and not being replace. The key point of proposing this idea is to build a mobile application for UTHM shuttle bus booking system. Its goal is to convert the manual routine of shuttle bus booking into a computerized system to ease the routine proses. The proposed system will serve as a communication platform between drivers and students. The system will allow user to book a shuttle bus to ride and pick a drop-off destination beforehand. The system will also allow the bus driver to see the list of bus stops they need to pick and drop user. The rides information will be record for internal usage. k.

**Keywords:** Shuttle Bus, Real-Time Location, Bus Booking, Bus Stop, Gps, Geolocation, Firebsase, Android Studio

### 1. Introduction

Transportation services are highly in demand nowadays. People used it daily as their means of transportation to work, classes, and meetings. Public transport was one of the transportations services that are greatly used these days. However, it is hard to know the availability and movement of these services [1]. There are computer system and application that can help in detect vehicle movement, provide a booking system for a ride and a medium of communication between the services and its provider [2]. Grab Car application by Grab Holdings is one of the most used mobile transportation services nowadays. Its ability to order a ride from user mobile application and choose the nearest driver have made it popular among transportations services consumers [3].

Despite the trending of using mobile application for meant of ordering a ride, there are still a manual system uses for ordering a ride which is by waiting at the roadside and waving at the vehicles to stop them. The case studied proposed is the transportation service provide by University Tun Hussein Onn Malaysia (UTHM) for the uses of its student. Student Housing and Transportation Centre, Universiti Tun Hussein Onn Malaysia has provided a transportation service for its student uses to move around campus and residential college. The services have provided number of busses that designated for different routes. Each route has several bus stops designated for them. For example, buses designated for campus route does not go stop at Bestari residential college while buses for Bestari residential college does not stop at Perwira residential college.

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To track the bus movement and provide it student for tracking the bus location, UTHM has collaborate with KATSANA organization and provide UTHM Public Shuttle Tracking known as UTHM-KATSANA. This application provide student with a real time location and movement of the buses. They also provide student with bus schedule for each route which will posted at each residential. To ride the bus, firs the student need to check the bus schedules for its availability. Next, they open UTHM-KATSANA to check the bus location. Lastly, students to the designated bus stop and wait for the buses there. They will be stop-ping the bus by waving their hand to the bus and press the bell to stop the bus at their destination. This application provides movement tracking for the bus and record of bus movement along the routes. For internal audit, the record of busses passes each stop have been record which they used time taken for bus to reach from one stop to others as a record that the bus has stop at the bus stops [4]. If the time taken for the bus to reach between to stops is short, the database will take them as missing the stops. However, if the database has recorded that the bus has move along the routes but misses one bus stop in between, the management will take that as the driver has stop at the missed bus stops.

The problem based on this case study is that there are no computerized shuttle bus system or application that can provide drivers early information of which bus stop they need to take and drop student. Drivers only know which stop to take students only by reaching each bus stops. This situation prevents them from planning a safety ride by suddenly stopping at bus stops in order to pick or drop students Be-sides, student also unavailable to notify drivers their wish to ride the bus at certain stop beforehand [5]. Their only way to alert the drivers is by reaching to the bus stop and wait there. Because there are different routes designated for different busses, student need to wave their hand to the bus they want to ride to alert the driver to stop there. They will miss the bus if they are just standing there without stop the bus. Lastly, there are no method or way to record all the rides history. The UTHM-KATSANA website will only provide the movement of the bus but will not record the ride. In any cases of complaint of unavailability or missing service of one bus can only be check through satellite record of bus movement around the campus and the CCTV camera operate at UTHM main gate.

To overcome the rise issues stated above, a mobile application which is UTHM shuttle bus application is proposed through this paper. This mobile application will be operate using Android system and will contribute in:

1. To design a booking system between busses and students through UTHM shuttle bus application. All ride and drop information to bus stops will be through this application.
2. To develop a system that provide and share real-time information of available busses, location of busses and students to its users for them to plan their ride.
3. To test the system is able to book and record rides between drivers and students. for the. Records can be used for internal audit and further improvement and improvement of the system.

This application will be designed to be develop for UTHM transportation service only. This application will help to contribute to the objective stated and handle the issue from the existing system. The application will allow students to order a ride from the application and choose the closest driver match the routes he/her taken. Drivers will be able to view the ride orders from the students. The application will also record all the rides happened and allow students and drivers to view this history.

## **2. Materials and Methods**

The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to obtain the results of the study.

## 2.1 Materials

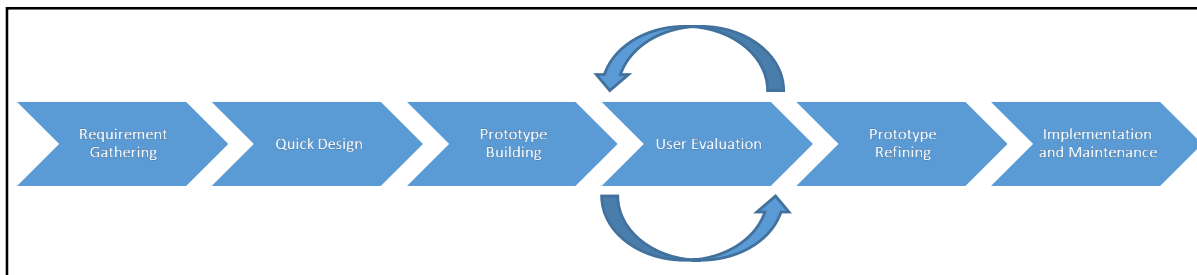
In order of developing this application, three existing systems and mobile application has been analyzed and studied to learn its features and the benefits of it. Those applications are UTHM Public Shuttle Tracking by Katsana, Sunway Shuttle Bus Tracker and Selangor Intelligent Transit System (SITS). Besides, ideas, technologies and preventive measures also can be collected from these studies. Comparison of applications' features and benefits with the proposed application was shown in Table 1.

**Table 1: Comparison of Existing Application**

Features	UTHM Shuttle Bus Tracking by Katsana - UTHM Katsana	Sunway Shuttle Bus Tracker	Selangor Intelligent Transit System-SITS	Proposed Application – UTHM Shuttle Bus Application
Bus Real-Time Location and Movement	This system does provide this feature. However, it does not differentiate bus that are active and not active. Busses location are shown depending on the route user choose.	This system does provide this feature.	This system does provide this feature. Bus that are active are label with green while non-active bus is label with red.	This system does provide this feature. Active busses will be shown on map while non-active busses will not be shown.
Bus Stop Location	Bus stop locations are shown on the map. The locations of the bus stops are shown depending on the route user choose.	Bus stop locations are shown on the map. The application also provided the direction of bus through each stop.	Bus stop locations are provided on the map. The locations of bus stop will be shown based on which routes user choose.	Bus stop locations are provided on the map. The bus stops shown are depend on user routes choose.
Login and User Personalization	-	-	The application provided the login page.	The application provides login page for its user.
Time Estimation	-	-	Time estimation are provided in this application. It estimated the first closest bus to arrived at one bus stop. Then, it estimated the next closest bus after the first one.	Time estimation are provided in this application. Bus tha have been assigned to user will be calculate its estimated time to arrive at user location.

## 2.2 Methods

In developing this system, software model development that have been implement in prototyping model. In prototyping model, prototype of the application is being built, tested, and reworked [6]. These processes are being done repeatedly until the out-put is acceptable by the client. Phases that are included in this model is requirement gathering, quick designing, built prototype, prototype testing or user evaluation, prototype refining, and implementation and maintenance [7]. All the project planning and requirements and specification are gathered in requirement gathering phase. Based on the requirement gathered, a quick design of the application is being done in quick design phase. Then, a prototype was built from the design created. The prototype then was being tested and evaluated by user before going to prototype refining phase. The evaluation and prototype refining phase are being repeat until the prototype have reached the best outcome that is acceptable by user. The final changes of the prototype then the being implemented and maintain in implementation and maintenance phase.



**Figure 1: Prototype Methodology Diagram**

There are four type of prototype software model development that is rapid throwaway prototype, evolutionary prototype, incremental prototype, and extreme prototype. Type of prototype model used in developing this application is evolutionary prototype. In evolutionary prototyping model, it is the most time and effort saving rather than the other three. It is gradually built based on user feedback on each version of prototype. After developing one prototype, user feedbacks are collected, and a new version of prototype are being built from the previous version [8]. The cycles are repeated until the prototype fully acceptable by user. This type of prototype model is helpful if the requirements are not fully understood in the initial stage of developing. Besides, it is the most beneficial model to use if each functionality of a complex project is needed to be checked.

**Table 2: Software Development Activity**

Phase	Task	Output
Requirement Gathering	<ul style="list-style-type: none"> <li>• Planning requirement gathering technique</li> <li>• Conduct an interview session with stakeholder               <ul style="list-style-type: none"> <li>- Prepare and submit referral letter requesting for interview</li> <li>- Prepare interview question</li> <li>- Held an interview with stakeholder</li> </ul> </li> <li>• Research and study existing system               <ul style="list-style-type: none"> <li>- UTHM Katsana</li> <li>- Sunway Shuttle Bus Tracker</li> <li>- SITS</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Requirements technique choose:               <ul style="list-style-type: none"> <li>- Interview</li> <li>- Research existing system</li> <li>- User observation</li> </ul> </li> <li>• System requirements are gathered.</li> <li>• Understand system flow.</li> <li>• Knowledge about technology used in the application.</li> <li>• Learn technology and technique encouraged for the proposed system and avoid</li> </ul>

**Table 2: (cont)**

Phase	Task	Output
Quick Design	<ul style="list-style-type: none"> <li>User observation               <ul style="list-style-type: none"> <li>Observing user activity and action on the existing system</li> </ul> </li> <li>Sorting and determine user requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Learn user behavior towards the existing system</li> <li>List of specification and requirements for the application</li> </ul>
	<ul style="list-style-type: none"> <li>Design UML diagrams for system</li> <li>Designing database system</li> <li>Determine data, attributes, and key fields for database</li> <li>Perform data normalization</li> <li>Design system's database</li> <li>Design a conceptual model and ERD</li> <li>Designing User Interface</li> </ul>	<ul style="list-style-type: none"> <li>Use case diagram</li> <li>Sequence diagram</li> <li>Activity diagram</li> <li>Completed database system design, tables and attributes.</li> <li>ERD diagram visualizing database and its entities relationship.</li> <li>User interface design for students</li> <li>User interface design for drivers</li> </ul>
Prototype Built	<ul style="list-style-type: none"> <li>Develop application prototype based on system design.</li> </ul>	<ul style="list-style-type: none"> <li>First version of prototype</li> </ul>
User Evaluation	<ul style="list-style-type: none"> <li>Testing the user interface.</li> <li>Testing the application functionality.</li> </ul>	<ul style="list-style-type: none"> <li>User evaluation and feedback on the application interface and its functionality.</li> <li>Receive feedback on functions, design, and interface to be improve.</li> </ul>
Prototype Refining	<ul style="list-style-type: none"> <li>Repair and refining the existing prototype.</li> </ul>	<ul style="list-style-type: none"> <li>New and refined version of prototype.</li> </ul>
Implementation and Maintenance	<ul style="list-style-type: none"> <li>Implement the accepted prototype to a final product.</li> <li>Maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>Final product released.</li> </ul>

### 3. Results and Discussion

The final product is being develop by using Android Studio using Java language. The database that are being used is a Firebase Real-Time Database. It is a cloud hosting database. It used NoSQL query to query the data and saved the data in string in JSON format. The product then being test by using functional testing method.

#### 3.1 Functional Testing

Functional testing module are used to test all the module functionality in the application. There are six test plan that have been conduct according to the modules in the application which is login module test plan, registration module test plan, student map module test plan, driver map module test plan, user profile module test plan and ride history module test plan.

#### 4. Conclusion

In conclusion, UTHM Shuttle Bus application is built to ease the booking and ride between busses and students through booking system provide by this application. besides, this application also helps in providing and sharing real-time information of available busses, location of busses and students to its user. In addition, each ride is being recorded to be shown in history of drivers and students for the meant of internal audit and further improvement. Records can be used for further improvement of the system. to a computerized the manual shuttle bus system and make it easier for its user to access all data related to this system [9].

Aside from that, this application can help in diminish unsafety way of stopping bus at bus stop by booking a ride from this application. This also help in arranging student movement in riding the bus in a mannerly way without pushing and forcing into the bus. It is because for each student ride request, busses will be assigned to them. However, there are a lot of improvement can be done in future. One of the suggested improvements is adding the notification module. This module will help to notify student upon bus arrival. Besides, it is also recommended to include a Full button for driver to indicate that the bus is full and cannot received any student re-quest. Finally, development of this application is hoped to cater the problem stated before and will be beneficial for its user.

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