Bus Tracking App for Universities Transportation

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Abstract: Shuttle buses have become an important means of transportation for students especially for those who rely on it to go to class. However, students often face difficulty knowing the current location of the bus and its estimated arrival time. Some of them are even unaware of the bus schedule provided by higher management. Consequently, they have to wait too long for their respective buses to arrive. Hence, for the convenience of those who want to plan their journey with shuttle buses, two applications are proposed. One application will track the location of the bus and the other application will be used by the students. Both proposed applications will be used along with an Android phone since it is mostly used by students.

The main objectives of developing this application are to inform users regarding the current bus location and estimated arrival time. This application also provides users real-time forum so they can start conversations with others with the same application. Besides, the driver's profile is also included for the user's future reference.

Keywords: Mobile application, Tracking System

1. Introduction

The mobile phone has become an essential usage among university students in sharing information and learning [1]. Many universities have started to develop mobile apps to give sufficient information and guidance to their students while they are at the university to elevate information sharing and smoothen academic activities. Among the mobile app that would be useful for students is a bus tracking system. Most students within the university campus will use a shuttle bus to commute from their hostel to their faculties. However, most of the time, students are faced with difficulty because they do not know the current location of the bus as well as the estimated arrival time. The objective of this paper is to present a mobile application developed for a bus tracking system within a university environment.

2. Literature Review

A tracking system is an observation of one or more people or objects that are moving with some duration of time. Once, a study showed that the use of Short Message Service (SMS)[2], could be one way of having a cost-effective tracking system. An SMS (Short Message Service) can be used to notify users of the bus location that could diminish the high incurred cost of buying a tracker. However, this is still costly for the users as it will incur cost for the SMS charges. Now, there is another alternative to notify users that is by using smartphones to access the location of the bus.

Shruti Kotadia, Ankita Mane and Jignasha Dalal developed a tracking system that is called the BMTC bus tracking system, uses a real-time bus tracker by using smartphones [3]. The tracking system will compute the distance travelled and time taken and electronic display boards will announce the arrival and departure timing at the bus stops. The tracking application will provide the real-time location of the bus without requiring an SMS to be sent. The main idea of this application is to display the routes and bus arrival time to the users in real time. All possible stops between the exact location and destination of the users and the map for the area specified will be provided. The goal is to mitigate the problems and overcome the drawbacks of the past systems by notifying users in a short period.

Hence, the objective of this paper is to proposed the design of a bus tracking system for university buses in order to get accurate timing and updated information on the bus schedules. The reason for choosing Android as a platform is due to the high number of Android users. Afterall, using a smartphone as a tracker would be cheaper as most students nowadays are using smartphones as smartphones are now become a necessity rather than luxury.
3. Methodology

The methodology used in developing the app is by following the incremental software process model [4]. The system is divided into parts and each part is tested to the users. Based on the user's feedback, the system and the requirements are updated. The system development goes in a cycle until it reaches a point of acceptance based on the objectives and expectations from the users, in which the aim is to create a successful product. With this methodology, every function in the application is built and tested individually by the user and once all the functions are complete, they will be combined as one system, if not every function will be rebuilt and tested again. Later, the system is tested once again by the users to get the final product.

The incremental model focuses on updating and adding features based on the users' feedback. This gives a more flexible method because it allows changes based on the needs that could not be identified at the early of the system development. Thus, improvements are allowed by using this model.

A qualitative approach was employed for eliciting the requirements of the app design and functionality. The requirements were built with the knowledge or understanding of what was needed for the system. A semi-structured interview was used for data gathering among the students and also bus drivers. After the requirements were done, it went through a designing and specification process. Data gathered from the interview were transcribed, analyzed and presented in a use case diagram.

4. Results

In developing this application, the Android Studio and Firebase real-time database are used. The Android Studio is where applications are developed while the Firebase real-time database is used to store and retrieve data as it provides real-time database. In this proposed application, the location of the bus needs to be updated every three seconds by the tracking device and the change of its location will be stored inside the database. The location will be reflected by the marker on the map assisted by Google Maps API and Google Maps Geocoding API are also used in developing the system.

Google Maps API is used to show the map inside the application as well as to get the current user location. It is also used to get the current bus location in the form of coordinates. At the same time, Google Maps Geocoding API is used by applying reverse geocoding to get the physical address of the bus location by sending request URLs of its respective latitude and longitude. Furthermore, this application is developed for the Android platform as most of the students are using Android smartphones. Google Map Direction API is also applied in this application in which it is used to get the estimated arrival time of the bus. In addition, Photoshop is also used for editing the user interfaces. Picture 1 shows the use case diagram for developing this bus tracking app. The use case shows the main features or functions of this app.

![Use case diagram for bus tracking app](image-url)
Table 1 below shows the main features and capabilities of the bus tracking app being developed together with the system interface.

**Table 1. Main features of the bus tracking app and system interface**

<table>
<thead>
<tr>
<th>System Interface</th>
<th>Main features</th>
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<tbody>
<tr>
<td>1.</td>
<td>Inform users regarding current bus location and the estimated arrival time.</td>
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<tr>
<td>2.</td>
<td>Provide real-time forum so that users can have conversations with others with the same application</td>
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<tr>
<td>3.</td>
<td>Provide driver’s profile for future reference</td>
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The students need to install the application on their smartphones and the GPS will be able to detect his or her location. From there, the application will do the rest. The students just need to click on the bus marker to get the
estimation arrival time of the bus. Besides that, the real-time forum can help students that have lost or left their belongings on the bus. These two features are the main features of the application that will attract the students to use it.

5. Conclusion

Nowadays, the use of a smartphone is not a new phenomenon among university students. Students spend a lot of time on their mobile phones either for pleasure or learning purposes. Information sharing and communication have become vital through the use of mobile phones. Thus, the development of this bus tracking app will ease the student’s everyday life and also ease their academic activities. This application is meant to give benefits to the student in terms of providing real-time location of the bus and the estimated arrival time.

6. Acknowledgement

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