

## Smart Parking System Based on Cloud Computing

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**Abstract:** Parking is an act of leaving a vehicle in a particular place for a period while parking system is the set of connected things or devices that can operate together in the systematic way. The problem that usually faces by Malaysia's local authority council is a significant problem regarding the parking system. As we know the parking lot is important either in urban areas or in rural areas. This study aims to design and develop an application for a smartphone that would help the user and parking management to navigate the parking lot and to evaluate the functionality and the performance of the system and the application. At the end of the project, the user and the parking provider will have connected each other by an application for a better parking system solution. This project application can improve the effectiveness of the parking system. The application will help users to navigate, park and pay. The parking capacity, parking rate and parking time that was set up by the parking provider and stored in the firebase database of the application before being published to Playstore.

**Keywords:** Smart Parking System, Cloud Computing, Firebase Database

### 1. Introduction

Parking can be defined as an act of stopping and disengaging a vehicle for a short time and leaving it unoccupied for a certain time. Parking the vehicle may on the side of the road could be permitted or not depending to that country or the local government rules. The local government are the body that responsible on designing the space or the facility for the user to park the car in order to avoid any problem that may cause by the parking.

In fact, the shortage of parking spaces to cover that amount of vehicle would cause several problems such as reduce the productivity, waste of time whereas they need to come out early, the safety of the vehicle when they need to park in the dangerous places and many more [1]. Parking system that was existing in Malaysia are essentially required the drivers to seeks for an empty parking spot space in the car park without providing the information of the direction to the available parking space.

Consequently, while they turn around in the car park without direction, drivers can waste a lot of time and unnecessary energy and can cause car traffic congestion in the parking space. The conventional parking system also required user to pay their parking ticket at parking booth which may encourage more transaction by cash that may increase the possibility of not have changes. Parking fee payment can be a time-consuming activity for people. At the other hand, the new coronavirus (COVID-19) can be prevented from spreading by reducing the banknote consumption transferring from hand to hand. Researchers at CSIRO, Australia's national science agency, have found that the virus responsible for Covid-19, can survive for up to 28 days on common surfaces including banknotes [2]. The emerging industrial 4.0 and the development of IoT are a very suitable solution to build a better smart parking system [3]-[4].

In this project research proposes a smart parking system using cloud database and to develop the monitor real time information about all types of parking zones such as open space parking zones that usually conducted by local city council.

## **2. Materials and Methods**

The materials and methods section, often known as methodology, covers all the information needed to achieve the study's results

### **2.1 Software**

This project application was built by using Android Studio, All the information stored in Firebase Database and the location area detached using Google API

### **2.2 Methods**

The application was built using Android Studio and the data stored in Firebase Database that was provided by Google. The application also used Google API for maps navigation for the user to navigate them to the parking area that was setup by the parking provider. The application was design using JAVA language as it was the language that was familiar to the author. The interface uses as simple design to help user experience in an easier as possible.

Figure 1 shows the flowchart for the whole process. First, the user needs to login into the application before searching the available parking to provide data of their vehicle and their payment method into the system. If the user does not have an id account, they were required to create an account first before being able to login to the Smart Parking System Mobile Application by register at the registering section. The data that was provided will be stored in the cloud database. The database will collect, compute, and store the information and the evaluation process of parking system. The user can search the nearest parking area and the application will navigate the user to the parking area. The application also provides the feature to navigate to the exact parking lot. If the parking slot that was shown on the application as available but unavailable, the user can file a report to the parking provider and the parking provider will send new parking slot to the user as if still have empty space. Once the user park the car, the application will start computing the rates of the parking based on the rates that was set up by admin (parking provider).

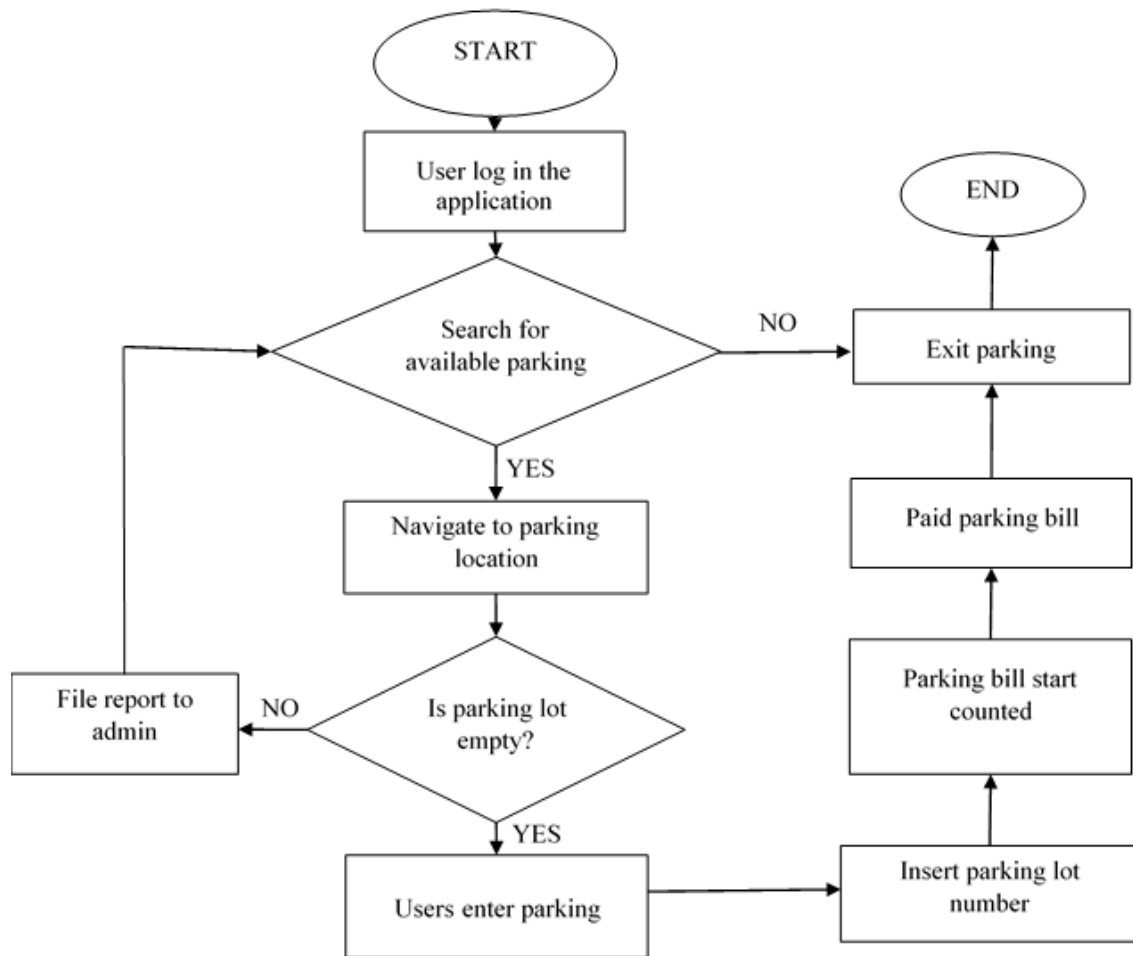


Figure 1: Flowchart for the whole process

### 3. Results and Discussion

The data and analysis from a prototype test are presented in the findings and discussion section. This section can be organized based on the stated objectives, the chronological timeline, different case groupings, different experimental configurations, or any logical order as deemed appropriate.

#### 3.1 Results

The result of this project was as shown as in Figure 2, Figure 3, Figure 4. Figure 2 shows the main layout/page of the application once the application was launched. As the first step to use the application the user needs to register a new account. Once the user was successfully login, the app will direct the user to another main as in Figure 3 where all the features was embedded. Figure 4 shows the layout of parking location where the user can choose the parking area on the maps that was offered by parking provider. The layout can also navigate the user to parking area that they select on the maps. Figure 5 shows the data that was stored in the Firebase database. The data that was stored including the details of the parking and also the data of the user’s authentication which is user email id and password.



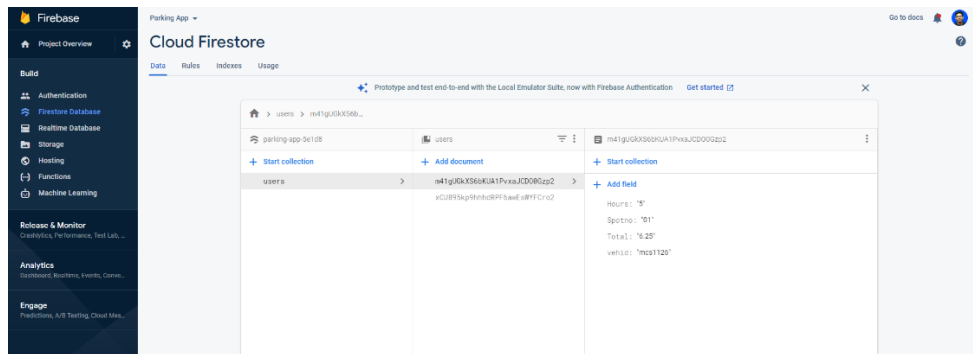
Figure 2: Main Layout of the application



Figure 3: The main activity of the application



Figure 4: User's map navigation



**Figure 5: Cloud Firestore**

### 3.2 Discussions

The application has been published and tested on the Android smartphone. The application operates on the basis of its general workflow. An individual test conducted on each layout by going through all the codes in the software.

### 4. Conclusion

The design of the Smart Parking System android application using cloud computing has been achieved. The application has been built with the use of Android Studio software and the result obtained through the Android Emulator that was generated from the software. Besides, the codes for each layout works as it is was structured where all the codes on each layout could be install and run on the smartphone without any issues.

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