

# A STUDY ON CAR PARKING RESERVATION SYSTEM USING ANDROID APPLICATION

<sup>1</sup>Kate Lam Woon Yee \*, <sup>2</sup>Dr. Leelavathi Rajamanickam,

<sup>1</sup>School of Information Technology, SEGi University

<sup>2</sup>School of Information Technology, SEGi University

\* [katelam@segi.edu.my](mailto:katelam@segi.edu.my)

---

**Abstract:** Nowadays with the increase in vehicle production and world population, more and more spaces and facilities are required. The problem arises from not knowing where the empty space is; even if it is known, many vehicles may pursue very limited parking spaces which will cause serious traffic congestion. Because of that, we purpose a system that will help car users to find a parking space in most metropolitan areas even during the rush hours, by computerizing the parking space reservation using an application on Android smartphone. The proposed smart parking policy has the potential to solve the problems of parking systems, as well as reduce traffic congestion caused by parking searching thus making the system two-way efficient, that is, cost wise and time wise.

**Keywords:** Android, parking, reservation, smart

---

## 1. Introduction

Nowadays, with the increasing of world population and cars production, most of the people around the world have the difficulty of finding a free car parking slot to park their cars, car park inside a building is become popular in public places like shopping malls, hotels and multiplex cinema halls, “because it is user friendly and can prevent car from exposing to the sunlight” [8]. Every day, hundreds of cars enter the car parking. Therefore, it is difficult to find out an empty parking slot, “car drivers still need to find out empty parking slot for themselves and there is always competition for the parking space” [10]. The problem has reached the limit of impossibility especially in rush hours of the day. This problem had produced variety of issues like air pollution, congestion, traffic, street blocking, and wasting of time and fuel. As per recent survey “more than 30% of traffic congestion in big towns, drivers who are looking for vacant parking space come at the top of the parking factor [9]”. researchers have found that “for one year, car cruising for parking created the equivalent of 38 times trips around the world, burning 177914.8 liters of fuel and producing 730 tons of CO<sub>2</sub>” [1]. All of these issues are happened because of searching for a proper slot to park the car in. This problem calls for the need for an automated parking system that not only regulates parking in given area but also reduce the human intervention by making a fully automated system to solve finding a free parking slot problem with the help of nowadays technologies to reserve the required parking slot earlier.

Our project introduces an Android application which help the users to reserve a parking slot at any time in the provided parks using our fully automated system. The user will have to register the required details for the first time only, which are name, ID number, phone number, the user’s credit or debit card information, plus vehicle’s details. But to use this system, additional hardware needs to be installed inside the parking, which are a camera on the parking entrance to capture and recognize the car plate, the camera is connected with Radio-frequency identification (RFID) to analyze the vehicle details and check it with the help of the server, it also used for debit the amount for parking charges through the RFID tag [2], a server to update the parking slots availability and to manage the system’ database, IR sensor on each parking slot to detect the availability of the slot [5], a gate security lock provided in the entrance to open the gate using one-time-password (OTP) by key it in using smart keypad. After the user submit his details, he/she can proceed to the parking reservation, the user will enter the date and time to reserve the required slot, the application will display a structure of the parking slots, the available slots will be in green color and the reserved slots will be in red color, the user can select the proper slot then proceed to payment confirmation, after the payment is confirmed, the user will receive specific

and unique OTP on the application's notification. When the user goes to the parking, the camera will detect the car plate to open the gate, and if any issues in detecting the plate, the user can use the provided keypad to enter the received OTP to open the gate and park the car in the reserved slot. If the user stayed longer in the reserved slot, then he/she must pay the outstanding, then another camera and gate security lock will be installed in the parking exit will work as the entrance gate.

The main idea behind the proposed solution is to provide an efficient method to reduce the problem occurred when the car drivers are searching for a free slot, the solution will help to reduce these issues by reducing the wastage of time and fuel by reserve a slot earlier using the android application.

## **2. Literature Review**

The aim of the proposed solution is to solve the problems that occurred while searching for free parking slot. There are some solutions form other authors to solve the problem using an app to reserve the free slots earlier or to detect the free parking slots, but these solutions have limitations or require human intervention. The first proposed solution is [7] "Android based Smart Parking System", this system can be implemented in two ways, which are to guide drivers in congested areas to the nearest parking facility with empty parking slots. The latter guidance system addresses that the driver need information about the position and the number of the parking slots that are available within a parking structure. The user must register in the application before he can proceed to selecting the requested slot and reserve it early by making payment of the parking fees through "google thus". This method has some limitations which are the application doesn't show a structure of the free slots to make it easy for the user to select a free spot, it just shows the closest slot which is nearby from the selected location, plus it is requiring another app to proceed the reservation which is "google thus" to make the payment.

A. The second solution is [6] "Car Parking System an Android Approach" The project prototype can act as way-finder to guide car driver inside the car park to parking slot available inside car park and guides car driver to go there. It uses the infrared sensor to detect the availability of each parking slot at a level of car park, sending signal to microcontroller to display total of available parking slot on displays. At the same time, an arrow also used to show the location of the available parking slots. The availability of the slots is obtained from the sensors that count the number of cars entering and exiting or by comparing the tickets issued at machines. This solution doesn't allow the user to reserve the free slot, it just shows the directions of the

free slot and requires a guard to open the parking gate and to receive the parking fees. Another proposed solution is [3] “Smart Parking System Based on Embedded System and Sensor Network” The system works on real time parking information based on which it makes reservation and on spot resource allocation of parking spaces for drivers. The system works on IR led Sensors. IR led keeps transmitting infrared rays up to some range when some object is detected in the infrared range the IR waves hits the object and comes back at some angle the photo diode next to IR led detects that infrared rays reflected from the object. Thus, the object or the car standing in front of the IR sensors gets detected, providing us the status or availability of a particular parking space, Reservation of the slots can be made using multiplatform tools such as Android application and iOS application by using QR technology. This method is using QR technology to get in the parking, so the user will have to scan the QR code to open the gate which might be slower than using a camera that detect the car plate to open the gate, plus this method is requiring too many hardware devices.

B. Another proposed method is [4] “Intelligent Parking System Using Android Application”, this system is an Android Application which mainly consists of three modules. The user can choose a parking space that is nearest to his destination after getting login to the application. After the user books a particular slot the administrator updates the status of that respective parking slot to “RESERVED”. If the user doesn’t arrive to the parking slot within 20 minutes from the time of booking his booking will be cancelled and the status is updated to “EMPTY”. This solution requires human intervention to open the gate, plus managing the parking availability is not automated, it done by the administrator manually.

## **2.1 Aims And Objectives**

Utilization of cars has expanded in today’s world. The accessible parking slots are not used appropriately, so, this project aims to develop a car park reservation system to address and tackle the above daily problems, it will be focusing on how reservation could be done, and how drivers' parking experience could be improved for the above situation through using software system with latest technology. These are the results of using the proposed application:

- Finding a car parking slot will be much easier.
- Users can get to learn about parking areas for particular locations.
- Reduce the wastage of time.
- Reduce the wastage of fuel.
- Prevent road blocking.

- Reduce Traffic congestion.
- Avoids air pollution & global warming.Reduces the driver stress and improves parking management.
- It doesn't need much of human efforts for managing the parking spaces.

## 2.2 SCOPE

This project will be developing a car park reservation system which will be running on Android smartphones. The scope of this project is defined as follow:

- Investigate the value and the benefits of developing a system for assisting drivers' parking needs.
- Study the feasibility and different options to enhance the drivers' experience and efficiency of parking.
- explore geometry application development and location-based service.
- Study the application development process on smart phone and using latest technologies and various software development techniques.
- Design and develop prototype system which includes a backend system and a mobile client running on smart phone.
- Evaluate and review the strengths and weaknesses of the project outcome, seek and identify for further improvements..

## 3. Materials And Methodology

Usefulness of car parking system is our prime objective to solve searching for free car parking slot, which lead to many problems and frustrations for car drivers, So, the process of developing and implementing car parking reservation system requires hardware and software requirements:

### 3.1 Hardware Requirements:

#### A) CCTV Camera

2MP 20X industrial Explosion proof &anti-corrosion infrared IP network PTZ integration CCTV security camera.

Specification:

- The highest explosion -proof level certification, used of many high-risk and worse place.

- 2million pixels 1/2.8 CMOS sensor, the maximum resolution is 1920x1080, clear, delicate images.
- 20times optical variable times, the focal length is 4.7-94mm, accurate fast focus. Adopt high efficiency infrared lamp, long service life, low heating, low consumption, irradiation distance is up to 100meters.
- Support the lowest illumination, 0.05 Lux/F1.6color, 0.01Lux/F1.6black and white.
- Support 3d digital noise reduction, support numbers wide dynamic, strong light inhibition and so on.
- Support H.265 high efficiency compression arithmetic, tremendously lower code rate.
- Complete functions: heartbeat, PTZ control, alarm system, audio, user management.
- It can be used both day and night, low light will open infrared lighting automatically, even though the light is very bad, it can still get high quality images.
- Precision motor driver, sensitive reaction, run stably, little accuracy error, no shaking at any speed.
- Rotation angle horizontal:360°, vertical :180°
- Support power off memory, support 255 presetting bits.
- Four pieces of automatic cruise, every piece can set 16preset bits, time interval can be set.
- Turbine worm drive structure setting design, precision stepper motor driver, sensitive reaction, run stably.
- Modularization electric design, support baud rate and controlling agreement automatic identification, support soft address setting.
- The newest design idea, PTZ decoder, infrared /white-light sources, HD network camera are all-in-one design.
- View-finder use unique explosion-proof glass, high light transmittance, completely eliminate infrared light halo.
- View-finder surface by nanotechnology, non-stick water, non-stick oil, excluding dust.
- Low power consumption, internal body use flowing cooling design.
- 304 stainless steel materials, suitable for strong highly corrosive environment.

## **B) RFID based**

Essentially, these systems use Radio-frequency identification (RFID) technologies to detect the parking spaces available in the area. This is accomplished by saving information about the id for the vehicle on a microchip with an antenna. RFID tag, as these are commonly known as help identify the entering or leaving vehicles. And this feature connected to the CCTV Camera.

## **C) Gate Security lock**

Security Smart Keypad Digital Electronic Drawer Lock.

Specification:

- Input password, don't need card or key.
- Have two versions: Master code version or Jump code version.
- Two Classes management- Master code, and User code.
- Emergency open: When battery power off and can't open lock, at this time can use an external power supply to insert into a socket of lock to supply power to open lock.
- 1-10 numbers, you can set password as you want.
- Easy installation and operation, very easy to use.

## **D) IR sensor**

LANBAP m12 Metal cylindrical photoelectric sensor electronic IR sensor switch PR12-TM5DPC.

Definition: (An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion)

Specification:

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo ohms.
- Variable resistors.
- LED (Light Emitting Diode).

## **E) Slot Allocation Algorithm**

Slot Allocation Algorithm The slot allocation method follows a sequence as discussed above. It has the Parking Area Control Unit and the Smart Parking Area Control Unit (SPAC).

## **F) Server**

PIC 16FXX Micro-Controller PIC (Peripheral Interface Controller) is an 8-bit Micro-controller used in this system and it is the heart of the overall system. PIC16F877A series controller used here seems to be efficient and cost effective for this parking management system. The proposed design uses PIC micro- controller. It is a low power controller that provides support for high speed communications, with the ability to be programmed using different commands. When the vehicle passes the IR sensors, the sensor will detect that vehicle and give the information to the database system. The database notes the vehicle information, simultaneously the micro-controller searching for the vacant slots in the car parking area. The server will be connected the database to manage the information.

### **3.2 Software Requirements:**

#### **Android OS**

An android application is created using Android studio. The android applications are developed using the JAVA code. Using the JAVA compiler, the source files are converted to JAVA class files. The Android SDK contains a tool, which converts JAVA class files into a. Dex (Dalvik Executable) file. The. Dex file and the resources of an android application are packed into an. Apk (Android Package) file. The resulting. Apk file contains all data to run the Android application and can be deployed to an Android device using adb tool. The Android system is more secured. The Android system installs each and every Android application with the unique user and group ID. Android contains a permission system, declares required permission in the AndroidManifest.xml configuration file. Using the slot allocation method, the Android application is developed for the Smart parking. Slot reservation can be done using the slot allocation method. The request is updated in the server and forwards it to parking area.

#### **Database:**

The system has real-time communication between the mobile app and the server, using SQL. All the information will be loading and stored.

#### **Application Algorithm**

The algorithm to use the proposed application stated as the steps below:



### **Step 1: Installing the application**

The user must download and install the apk first on his android device.

### **Step 2: Registration**

In order to use the mobile application, the user need to be a member of our car park reservation system prototype. If the user wasn't a member, he/she must register by clicking on the Register button at the entry screen and provide his/her required information, which are name, phone number, ID number and the credit/debit card information. The information will be sent to the server for processing and stored in the database, and the registration result will be returned to the mobile client.

### **Step 3: Profile and vehicle management**

Once the user registers successfully to system, they can see the entry screen starting from the options available from the bottom, user can manage their profile as well as their vehicle defiles, the user must provide the car details which are car plate number and the car color. the profile management has a similar UI as the registration screen, in which user can manage and update their personal details, however, membership is a read-only property and are not available for user to change. Upon submitting the data to the server, the server will determine validate the user input, if there is no error, the member profile will be updated immediately in both application server and mobile client. Similar to profile management, user is able to view their vehicle listing in our current system. User can also create new vehicle which will be available for making new reservation. Upon submitting the request to the server, it will be further processed, the application server and the mobile client will then be updated immediately in a similar manner. However, as vehicle consists of limit number of info, editing of vehicle is disabled to avoid data inconsistency in the reservation log, server log and other statistic functions.

### **Step 4: Car park searching**

To make a reservation, the first step which a user will do is search for a car park. We provide two searching mode — text based and structure view. Both of them accept keyword and area search which will issue request to our application server to perform string wildcard matching against car park name, address and company name, which is within the selected area. Once the server returns the matching results, the mobile client will display a list of car park including their available parking spaces and current hourly charges. We assume most user will make use of the map view instead of the text-based mode, however, we reserve this basic searching method which

enable car park searching for low end devices and for the situation where geo location information is not accessible.

### **Step 5: Reservation**

In our prototype system, we have modeled the entire reservation process into computerized system. We study and tried different approach such as advance reservation and expanding car park spaces from monthly user, we eventually come up with and suggesting the use of integrating membership system, overbooking with instance reservation which is more realistic and practical. In this section, we will cover most of the major system flow involved in the reservation process. Then the application will Transfers request for parking slot. The user has to provide the time and the date for the slot he/she wants to reserve. The application will display the parking structure, each park has its own unique number, the free slots will be shown in green color and the reserved slots will be in red color. The user will click on the slot he/she wants to reserve to proceed to the next step.

### **Step 6: Fees calculation**

The system will automatically calculate the total cost incurred for parking based on the time that the user has asked for booking.

### **Step 7: payment process**

The payment will be processed on the app by checking after selecting a slot and provide the time and date to reserve that slot, the server will calculate the required fees for the slot and ask the user to confirm the payment and reservation. After the payment is confirmed the user will receive OTP on the application notification.

### **Step 8: Check-in**

After reserving a particular slot by the user then the status of that respective slot will be marked as RED=RESERVED and the remaining will be GREEN=EMPTY, the user will arrive the car park, they can check in to the car parking after the CCTV capture and analyze the car plate or by entering the OTP. As soon as the vehicle gets entered the parking slot, the timer gets ON and measures the total time. Also, depending on the car park operation. In a worst case, if one of the cars stayed longer, that user have to pay the fees for the addition time. The system will send a message to next user to notify him/her that the reservation has been changed to select a new slot instead of the slot he/she reserved.

## **Step 9: Check-out**

When the user finish using the parking service, the user has to pay any addition fees if he/she stayed longer, then he/she will be able to leave the car parking and check out at the gate. The process is similar to the check in process, the car can be recognized by CCTV or by OTP to check out.

## **4. Evaluation**

In particular, smart parking solutions for cars parking necessarily and primarily need to involve all the stakeholders in an early phase of the solution development. The majority of participant stakeholders were impressed by the prototype and believed that the system would be useful, at least to alleviate the issue of finding parking spaces. They believed that even if the system is able to tell the users that there are no vacant spaces available, which would be useful information instead of the driver wasting time and fuel searching for a space when none is available. However, they had a variety of ideas regarding how to improve the prototype. We took this into consideration above as a general prospective for our Android based smart parking reservation system prototype.

## **5. Limitation**

The Android based smart parking reservation system is proposed to solve finding free parking slots issues, we studied the solution and testing it, and we find out that there is some limitation that could be improved in the future, which are:

- The solution required too many hardware devices, so implementing the proposed method might be expensive.
- The IR sensor need to clean regularly.
- If the user stayed in the slot longer, and that slot was reserved at that time, the other user who reserved it will have to select another slot.

## **6. Conclusion**

Since the number of cars is increasing at a fast rate comparing to car parking, there is need of such a system and solution to solve that problem, since it leads to many issues such as traffic congestion, road blocking, waste of time and fuel. This project was developed to help car drivers to find free parking slots faster and easier by reserving the slot earlier through the proposed Android based smart parking reservation system, the application is developed to be user friendly

and easy to use. The proposed system reduces the driver's effort and time. Also, the payment transaction is handled through the application which makes the system less human dependent with the help of the installed hardware devices such as security gate lock, camera and RFID in the parking entrance and exit. This system will also provide IR sensor to detect slot availability status and a server to manage the system which is connected to the provided database. This solution aims to reduce the occurred issues and to manage the cars parking easily with an automated solution without human intervention.

### References

- [1] Ajay Thakur, P. N. S. R. P. P. J., March 2017. Intelligent Android based Online Parking System. *International Journal of Advanced Research in Computer and Communication Engineering ISO 3297:2007 Certified Vol. 6, Issue 3.*
- [2] Dhanalakshmi, R. R. a. S., APRIL 2015. ANDROID BASED SMART PARKING SYSTEM USING SLOT ALLOCATION & RESERVATIONS. *ARPJ Journal of Engineering and Applied Sciences, VOL. 10, NO. 7.*
- [3] Faiz Ibrahim Shaikh, P. N. J. S. P. O. P. K. N. B. S., April 2016. Smart Parking System Based on Embedded System and Sensor Network. *International Journal of Computer Applications (0975 – 8887) Volume 140 – No.12.*
- [4] J. Anitha, Y. T. A. R. V. S. P. K., 2017. Intelligent Parking System Using Android Application. *International Journal of Pure and Applied Mathematics Volume 114 No. 7.*
- [5] Jones, W. D., December 2006. Parking 2.0 meters go high tech. *IEEE Spectrum.*
- [6] Nikhil Palde, C. N. S. K., March 2016. Car Parking System an Android Approach. *International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 3.*
- [7] Pallavi Mane, R. D. S. N. S. M. S. S., May 2015. Android based Smart Parking System. *International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 5.*
- [8] Reve, S. C. S. V., July 2012. Management of car parking system using wireless sensor network. *International Journal of Emerging Technology and Advanced Engineering.*

[9] Rosario Salpietro, L. B. M. D. L. B., 2015. Park Here! A Smart Parking System based on Smartphones' Embedded Sensors and Short-Range Communication Technologies. *Department of Engineering and Computer Science, University of Bologna* , 978-1-5090-0366.

[10] Shinde Smita N., S. K. V. N. R. D. ., T. A. S. P. A. M. S., March 2015. A Android Application for Parking Management and Dissemination System. *International journal of advanced research in computer engineering & technology (IJARCET) Volume 4 issue 3*.