

Web Based Parking Reservation System

By
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CERTIFICATION OF APPROVAL

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Approved by,

(Dr. Yong Suet Peng)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
September 2012
CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the reference and acknowledgements, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.

(FLIRONNY GUNGAT)

ABSTRACT

Locating a single parking space in any metropolitan areas are becoming one of the major concerns of the society as more vehicles owned by citizens. This can be worse during the rush hours due to not knowing whether there are parking spaces available or not. Other than that, even if they there are a space available but it is not confirmed that they will get the respective space or slot. In Malaysia itself, the implementation of a smarter parking system are very low. Most or if not all of the parking area in shopping malls, airports, national parks and etc are managed manually which is quite ineffective [5]. Hence, this project aims to develop a Web Based Parking Reservation System which will aid in providing a smarter parking management [7] [8]. The system is updated in accordance to the current status of the parking areas which will then be displayed to the users or drivers. This is important to be done because, accuracy of information are one of the main things in this system. With this system, users will be able to know whether there are spaces available or not and if there are a space available for their vehicles, they can reserve the slot right away. Using this system as a means to manage parking areas will be more efficient, effective and beneficial for the drivers. This is because, they are able to reserve a space and go to the destination without wasting much time locating a single parking slot. In addition to this there is lesser fuel consumption by the drivers in terms of reduced fuel consumption and as a support to green technology to reduce air pollution.

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ABBREVIATIONS AND NOMENCLATURES

PHP	Hypertext- Preprocessor
SQL	Structured Query Language
MySQL	My Structured Query Language
RFID	Radio Frequency Identification Device
CPU	Central Processing Unit
PIC	Peripheral Interface Controller

CHAPTER 1: INTRODUCTION

1.1 Background of Study

Traffic jam is one of the closest problems that the society had in this era as more and more cars on the road. Proto Malaysia released a statistic that shows the total number of registered vehicles on Malaysian roads has passed 21.25 million units. In 2010, an increase of 11.74% over the 2009 figure of 19,016,782 units and this figure covers all types of vehicles including tractors, buses, and motorcycles [10]. Apart from this, fuel consumption also increases because the driver will spend quite and amount of their time to locate a single parking slot. Another concern is air pollution which is becoming worse since the first car created by men.

Other than that, study conducted show that people nowadays spend or waste between 3.5 to 14 minutes looking for a space each time they park [8]. Those wasted minutes might be very important for certain people such as, people that are rushing to catch their flight, people that are going for interviews and etc. Studies also showed that locating a single parking space in crowded metropolitan areas is one of the worst problems that the society had these days [9].

Hence, an approach to face the problems such as traffic congestion, air pollution and stressful situation faced by drivers is via development of a parking reservation system. The system must be easily accessible and able to provide users with correct and accurate information.

1.2 Problem Statement

Locating a single parking slot or lot might be one of the most frustrating problems that the societies are facing nowadays. There is many times where people go to the mall and spent more time locating a single parking slot than spending time on their exact purpose. In a worse scenario, the parking lot is full. Their time is wasted and their oil consumption increases. Besides that, they had contributed to some amount of hazardous chemicals to the air which cause air pollution.

1.3 Objectives

1. To provide a system where booking of a parking slot can be made
2. Prevent drivers from wasting too much time locating parking space
3. Reduce oil consumption and air pollution
4. Provide a more convenient life for the society

1.4 Scope of Study

The scope of study of this project is PHP and MySQL system which is used to develop the system along side XAMPP. The system is able to update the status of each parking slot in the system whenever changes occur. For example, once a booking or reservation is made on a single parking lot, the system must be able to update the information and display the correct information to the users of the system.

Other than that, studies on drivers such as people who always go to the national park, airports and special events such as those at the stadiums are one of the biggest concerns. For example, universities students itself always go to these specific events held at the stadiums where it is very crowded. Hence, with the feedback and information from this population a good parking reservation system will be able to be developed.

1.5 Significance of the Project

According to a report done by Professor Donald Soup of University of California, Los Angeles (UCLA), big numbers of traffic congestion is caused by people cruising for parking space [7]. In addition locating a single parking space is not easy especially in crowded places. National park for example, during school holidays and etc are the time where it is the hardest to locate parking space. Cars that are cruising around the parking area searching for parking spaces caused traffic jam which is unavoidable and one of the big problems that is faced by the society. Congested traffic causes other problems such as inefficient fuel consumption and air pollution [8].

Due to these problems, web based parking reservation system is significant to be implemented to reduce the problems faced by drivers. This is because by reserving a parking slot the drivers able to get rid of the uncertainty of having a parking space for their car or not when they arrived at the place. This contributes to less time wasted, less fuel consumption, and probability being stuck in the parking area can be avoided [8]. For the management of the place such as places like zoo, it will be easier for them to know whether there are parking spaces available for the visitor or not and from this, they can decide on letting more visitors in or not. Parking reservation system will be very useful for many drivers that seek to lessen and avoid these parking related problems.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter covers the literature review which is the analytical, critical and objective review of the materials. There are four literature reviews analyzed and reviewed on this project and each of them is explained further in part **2.2, 2.3, 2.4, 2.5 and 2.6**.

2.2 A Reservation Based Smart Parking System

This paper was written by Hongwei Wang from Computer Science and Engineering Department and Wenbo He from Electrical Engineering, University of Nebraska-Lincoln, NE, USA. This project is a study and development of a prototype on a Reservation Based Smart Parking System. The main concern of the project is the difficulties of the drivers when locating parking space. This project uses a parking areas installed with sensors, main or core system and interface between the drivers and the system.

Certain performance metrics also applied on this project to ensure that a more reliable result able to be attained. The first performance metric is walking distance which is the distance from the selected parking space to the destination. This is an important factor to consider because, it reflects the willingness of the drivers when selecting parking spaces [3]. Drivers commonly will pick the closest parking spaces to the destination. The second performance metric is traffic volume which defined as the number of vehicles. This metrics used to define the relationship between parking problems and traffic congestion. Other than that, the second metric is also used to analyze the amount of air pollution contributed during parking. The project also made studies on the existing parking management system such as blind search, Parking Information Sharing (PIS) and Buffered Parking Information Sharing (BPIS). The study done on these systems are purposely to compare which one is the most efficient and effective.

The system makes full use of the sensor system installed in the parking lot and this system has a full access to the internet to communicate with the management system which is the intermediaries between the users and the status of the parking lot. From any communication device that owned by users which have access to the internet, users can communicate with the management system and reserve the parking space from there. The simulation was done to test the effectiveness of the system by using the Los Angeles Downtown map and they choose the peak hours i:e 6-9 am and 5-8 pm. The result is taken and analyze.

The outcome of this project shows that, the driving distance of the users or drivers decreased with parking reservation system. This is because, the drivers was able to pre-book the parking space that they want and with this, able to choose the shortest distance of driving to the destination.

2.3 Evaluating Parking Reservation Policy in Urban Areas: An Environmental Perspective

This paper was written by Mei- Ting Sai form Business Administration Department of National Chung Hsing University, Taiwan and Chih Peng Chu from Business Administration and Logistics Management Department of National Dong Hwa University, Taiwan. This project is to study the effect of a parking reservation system to the amount of damaging pollutants released to the air.

A parking reservation system is developed to remove the uncertainty of searching for a parking space in busy urban areas [4]. This helps to reduce the distance travelled by the vehicles and at the same time reduce fuel combustion which helps to decrease the amount of damaging pollutants released [8]. Two parking facilities in Taipei, Taiwan were studied and data is gathered to aids in the project. The first parking facility is a small parking area with 130 spaces and the second facilities with 416 parking spaces. The type of pollution taken into consideration are NO, HC, CO and CO_2 . The average emission rate for each damaging emission were gathered and used later in the project

simulation. Other than this, the duration of drivers took cruising for empty spaces are also taken into consideration. This is because, logically the distance of driving that drivers took and cruising around the parking area affect the amount of damaging pollutants released. The result from the simulation was as expected where time taken for the drivers cruising for parking spaces greatly reduced after the implementation of parking reservation system. This is because, they were able to reserve a parking space beforehand and able to drive directly to the empty spaces reserved after that. This in turn, reduced the damaging emissions from cars that cruising to search for parking spaces.

This project concluded that, with parking reservation system we will be able to provide better convenience to the drivers and at the same time, able to reduce the affect of damaging pollutants that released by vehicles.

2.4 Smart Parking Reservation System Using Short Message Service (SMS)

This paper was written by Noor Hazrin Hany Mohamad Hanif and Mohd Hafiz Badiozaman from Electrical and Electronic Department and Hanita Daud from Fundamental and Applied Sciences Department, Universiti Teknologi PETRONAS. This project defines parking reservation system that uses short message service (SMS) as a means of communication.

The project aims to get rid of the unnecessary time wasted on locating a single parking space. This project makes full use of the short message service to communicate users i.e. the drivers and the system. There are two system involved in this project which are parking reservation system and access system. Parking reservation system is the system that will allows users to reserve or book a parking space [3]. Access system is the system that will control whether the drivers have the rights to enter the parking lot or not. This means that, the drivers reserved a parking space for their car and have the correct access code or password.

Under the parking reservation system, users of the system will have to know the exact command that they need to send through SMS. This message will be processed and interpreted by a wireless communication instrument called micro- RTU (Remote Terminal Unit). This same device will then send the details of the reservation made by users through SMS too. The micro- RTU is the one which allows communication between users and the CPU of the system. The CPU of the system is the one that interpret the availability of the parking spaces, determine whether the parking spaces can be reserved and etc. The micro-RTU will also carry out the sending of information to the drivers such as the parking space number, password and etc. Upon confirmation, the process of reservation is done and the drivers are now clear to go to the particular parking area.

At the entrance gate, the drivers need to deals with the access system to verify that they are eligible to enter the parking lot. Password that previously sent by micro- RTU will be used as the access code and once verified, they can straight away go to the respective parking space booked earlier. The system is fully automated with the implementation of Peripheral Interface Controller (PIC) and this allows the system to update the numbers of available parking space and controlling access to the parking area. The prototype developed under this project shows the capability of reserving parking space through short message service (SMS). Reserving parking space and controlling access to the parking area with the implementation of access code or password is also included in the prototype.

This project concluded that with a smarter parking management system, the hassle of locating an empty parking space can be eliminated. This project also agreed that parking reservation as an approach to a smart parking system able to provide better convenience. Other than that, the system is easily accessible which is by using SMS and the fact that most people own cell phone nowadays makes the system quite effective.

2.5 Smart Parking Using RFID Technology

This paper was written by Zeydin PALA and Nihat INAN from Yuzuncu Yil University, Van, Turkey. This paper is about parking system that implements Radio Frequency Identification technology.

This parking system uses RFID tag as a means to identify cars that enter and exit to and from the parking lot. With this technology, there will be shorter period for check- in and check- out from the parking lot [1]. This system also allows to get rid of person to carry out the task as gatekeeper. The main purpose of operators at the entrance and exit gate is usually to identify the car and open the gate and to receive payments. By using RFID, the system will identify the tag that is attached to the car and after the system successful identification of the car, the gate will open automatically. The car will be scanned by the RFID reader and a ticket will be issued to them via the terminal that is located at both entrance and exit of the parking lot.

The main advantage of this system is that they reduce the time taken for car parking mechanism by focusing on the entrance and exit. Whenever there are a lot of cars in the parking lot, the time taken to exit from the building or the parking lot takes quite a lot of time [1]. This is because, the traditional ways or the most practiced method at any parking lot is via using a human as the operator at the entrance and exit gate. The limitation of placing an operator at the entrance and exit gate is that human is slower compared to any computerized system. With the application of RFID technology in parking system, it will be more effective, faster execution and cost saving compared to salaried operators.

This project concluded that by reducing the time taken of checking- in and checking- out from the parking lot, it will be able to reduce traffic congestion and at the same time, able to reduce fuel consumption. Hence, a good parking system plays a big role in providing a better life to the society.

2.6 How Smarter Parking Technology Will Reduce Traffic Congestion

This article is written by Sarah Kessler who is a writer for *mashable.com*, a website which publishes educational articles on various fields of studies such as technology, engineering and etc. This article is about how smarter parking technology will help to reduce traffic congestion. Between 8% and 74% of traffic congestion in a major city is caused by driver who is cruising for parking [7]. It is also stated that the time taken or the time spent on searching for a single parking space is between 3.5 up to 14 minutes [8]. This statistic or information is taken from a report by UCLA professor Donald Shoup who synthesized studies on how smarter parking will improve the traffics.

City like Los Angeles had applied some technology as a means to provide the society with smarter parking management system. A low powered sensor is installed at the parking lot and connected to the system. The system will be able to determine whether the specific parking lot is already taken or not by the information send by the sensor. This sensor is able to sense whether there is a car on that specific parking lot or not. Other than that, driver is also able to access the database of the system to see which parking lot is available to them by using Smartphone.

Relating this article on the parking system that the city of Los Angeles applies, there is some useful information that can be applied on this project. The system that they used which is by using sensor is a real time system and can provide more precise information to the drivers. Other than that, the system is also accessible via internet and this provides a greater convenience to the drivers. The concept of how the system works is also simple and effective which is, sensor get the information about the specific parking lot, pass the information to the system and the system will then pass the information to the driver. The concept of this system will be useful in the pursuing of completion of the project and at the same time strive to solve the problems that many drivers had experienced.

2.7 Parking Reservation System and Related Methods

This paper was written by John Blake Slemmer, Norcross GA, US and Neil Fredrick Rivenburgh, Lawrenceville GA, US. This paper documented about how a parking reservation system should be and other related system that can be applied.

This paper explains how a parking reservation system can be very useful for specific events such as events at the stadiums, airports and etc. Most of the parking lots that we have today are managed manually where workers i.e. persons will check whether there are still parking lot available or not. This is not effective where even if there are still parking spaces available, sometimes the workers will flag the parking lot as full. The drivers will need to drive around the parking area to locate a single parking space for them which are troublesome. Under this project, a parking reservation system must be able to locate an available space or parking lot, communicate the information across the system and display the information to the users or the drivers.

Following this method, the parking reservation system must be able to identify availability of the parking spaces. After identifying the availability of the parking lot, information must be sent to the Central Processing Unit (CPU) of the whole system. This processor will then process the information and display it to the drivers. Drivers will pick which parking space that they want to reserve based on the information displayed. Choices of the drivers will be sent to the CPU and it will process the request. The system will generate receipt and confirmation on the reserved parking space. After this, the database of the system must be updated on which parking slot is available and which one is not to prevent overlapping request on reservation.

Related methods that are explained in this paper are about other methods to scan or identify the availability of the parking areas or lot. There are varied methods or ways of identifying parking spaces availability that can be implemented together with the parking reservation system that under this project. Sensors play vital roles in identifying and locating the available parking space. These sensors are located on the parking areas and communicate with the CPU of the system. For example image processing technology, infrared technology and etc.

This paper concluded that reserving a parking space in the parking lot compromises of detecting whether the parking space is vacant or occupied, determining whether the parking space is reserved but unoccupied, displaying only the available parking space to drivers, processing reservation request and confirmation on the reserved parking space. Smart parking management system should be able to carry out these processes in order to be effective system.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The research methodology of this project covers the studies on the current parking reservation and management system. Research work also done on identifying the advantages and disadvantages of the current system. This chapter covers on the research methodology, tools required, key milestone or key project activities and the Gantt chart of the project.

3.2 Research Methodology

3.2.1 1st Stage: Project Planning

This is the stage of the project where problems are identified and the significance of the study is identified. At this stage, the objective and scope of studies of the project is also identified. Feasibility becomes one of the concerns where the system must be completed on allocated time. The main activities in completing this project are indentified and a Gantt chart throughout the completion is created. This will be the guiding tools in order to develop and complete the project on time. Problems statement are analyzed and deep study are made to find the possible solution to the problems. Literature review are done to get more knowledge about this project, comparing with the other existing system and to be able to understand more on the scope of the project.

3.2.2 2nd Stage: Data Gathering and Analysis

Data gathering and analysis is the stage where all the data that is required to study more on parking management system is collected. This includes the methods available to be used and implemented on the project such as the

architecture and etc. Other than that, knowledge about technologies that can be implemented on this project is also gathered. The problems faced by drivers with the common method of parking management system is also gathered and analyzed. Studying the problems in depth can provide a better understanding and at the same time, solutions to the problems can be crafted better. These data will be used at the later stage of the project completion.

3.2.3 3rd Stage: Research on Existing System

Research on existing system is done to know how the previous systems cope with the problems that the drivers faced. This is also to understand the approaches of the existing system such as in terms of technologies used, methods, architecture and etc. The knowledge that gathered from the existing system can be used to develop a better system that can cope with the current lifestyle or trends of the society. A higher percentage of success can be achieved by knowing what the existing system able to provide and what the existing system are lacking.

3.2.4 4th Stage: Drafting the Main Components of the System

The next stage of the research methodology will be the drafting of the main components of the system that this project aims to develop. The purpose of this project is to provide a parking management system that will be able to solve to problems that is experience by drivers. To accomplish the purpose of this project, the system must be able to:

- Calculate the number of taken and available parking lot
- Pass the information to the drivers

3.2.5 5th Stage: Developing System Architecture

The next phase of the research methodology is the development of the system architecture. This is to define and get a clearer picture of how the system will work and interact with users of the system. This include what information need to be gathered by the system, who need to know the information, at which stage of the system the information will be processed and etc. **Figure 1** below shows how the system will work.

Below is the system architecture and the main thing that the system should know is the parking space availability and this is the information that will be communicated to the users. From this information, users or the drivers will pick which parking areas that they want and do the reservation. The system will process the confirmation of the reservation on the respective parking space and database of the system will then be updated according to the changes that previously occurred.

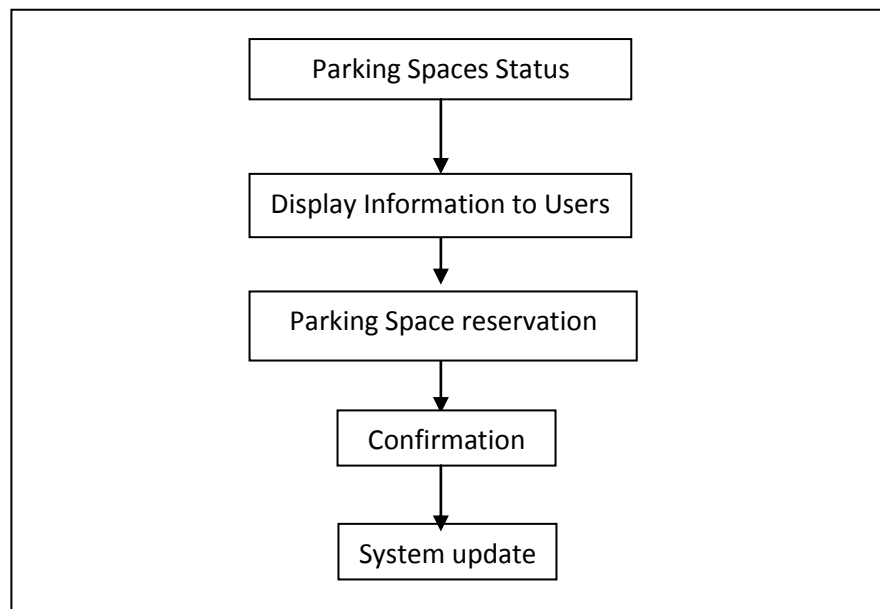


Figure 1: System Architecture

3.2.6 6th Stage: Sketching the Interface of the System

The next phase of the methodology is drafting and sketching the interface of the system. This is done after the identification and definition of the system architecture. The interface must be easy to understand, easy to use and in accordance to the standard interface that most users are familiar with. Sketching of the interface is done to be used as guidance on developing the system interface during the actual system development. The sketches are also to get a clear vision on how the system should interact with users.

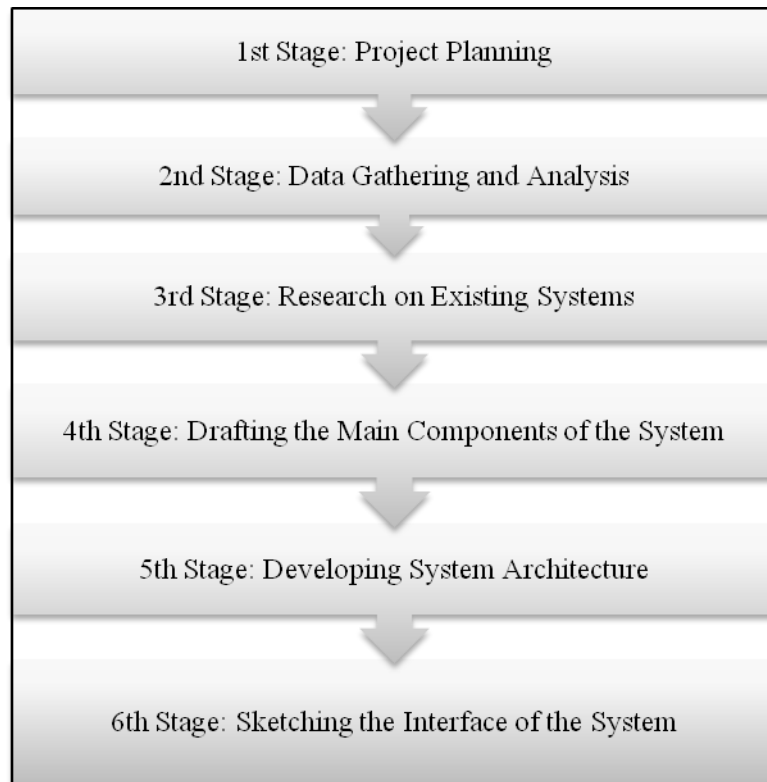


Figure 2: Research Methodology Workflow

3.3 Project Development Methodology

The methodology used on the development of the system is Rapid Application Development (RAD) method. This methodology is chosen because of the time constraint of this project, which in total is less than 10 months. This allocated time is quite short considering all the other stages of the project such as planning, analyzing and etc. In order to complete the project within the specified period, this methodology is the most suitable method to be used.

One of the benefits of applying this methodology is that if there are any changes need to be made during the development it can be implemented without actually affecting the whole system. The prototype is also keep evolving from time to time to comply with the changes that required to be done on the system. Applying this method means that, there are flexibility on the project development such as mentioned previously that changes can be implemented in between the development stages. The steps are:

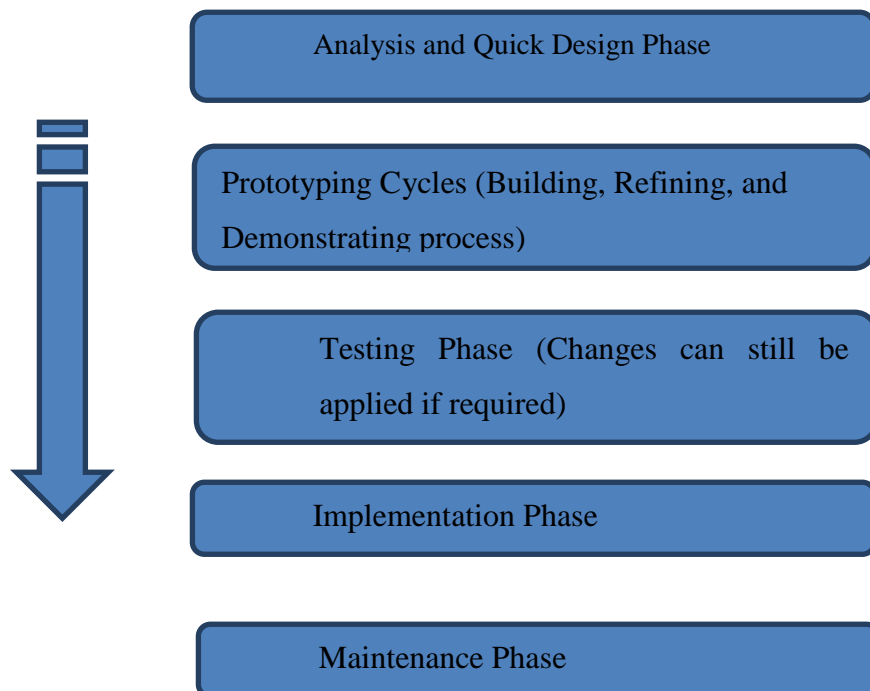


Figure 3: Project Development Phase

3.4 Tools Required for System Development

3.4.1 Hardware

1. PC/ Laptop

3.4.2 Software

1. Php MySQL
2. Xampp
3. Compiler (Notepad++)

3.5 Key Milestone

Key Milestones for this project is shown in **Table 1** below.

Week	FYP1 Activities	Date
1	Title Selection	-
2-14	Regular Meeting with Supervisor	-
2	FYP Briefing	30 th May, Wed
3	Proposal Submission to Research Cluster	8 th June, Fri
5	FYP1 Lecture “Data Collection Methods, Sampling, Data Analysis”	20 th June, Wed
6	Submission of Extended Proposal to Supervisor	27 th June, Wed
6	FYP1 Lecture “Report Writing”	27 th June, Wed
8	FYP1 Lecture “e-Resources”	11 th July, Wed
10	Viva: Proposal Defense and Progress Evaluation	25 th July, Wed
12	Submission of Interim Report	7 th August, Tue

3.6 Gantt Chart for FYP1

Table 2 Gantt Chart for FYP1

No.	Detail/Week	1	2	3	4	5	6	7		8	9	10	11	12	
1	Selection of project topic	■	■						Mid-semester Break						
2	Literature review				■	■	■	■			■	■			
3	Research, Defining Problem Statement, Data Gathering and Analysis				■	■	■	■							
4	Submission of Extended Proposal						■								
5	FYP1 Lectures					■	■				■				
6	Proposal Defence												■		
9	Submission of Interim Report														■

3.6 Gantt Chart for FYP 2

Table 3 Gantt chart for FYP 2

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Implementation & Development	■	■	■	■	■	■	■	■	■	■				
2	System Testing					■	■	■	■	■	■				
3	Submission of Progress Report				■										
4	Pre-EDX								■						
5	Dissertation											■			
6	Viva: Oral Presentation												■		
7	Final Dissertation														■

CHAPTER 4

RESULT AND DISCUSSION

4.1 RESULT AND DISCUSSION

The developed prototype for Web- Based Parking Reservation System performs well and able to execute all the main function. There are five sections on this chapter which are information fetching and displaying process (a), reservation and confirmation process (b), reviewing and cancellation of reservation (c), system administrator (d) and limitation of the system (e). Each section will be explained further and in more details.

4.2 INFORMATION FETCHING AND DISPLAYING

The Web- Based Parking Reservation system must be able to identify the current state of the system to be able to transfer accurate information to the users. Identification of the current system's state is important to know which slots are taken and which slots are available for reservation. The first thing that the system does to identify the current state of the system is accessing the database for information fetching.

4.2.1 Information Fetching

The design of the database plays a vital role in making sure that updating the system can be done properly. In the prototype, there are seven tables in the database. For each day, there are allocated time slots ranging from 9am to 5pm which indicate that the parking slots only available from 9am to 5pm. Each time slots has their own status which is "Taken" and "Available". This is the data that the system will fetch to identify whether the particular parking slot is available at that particular time or not. Figure below shows the design of the database used in the prototype.

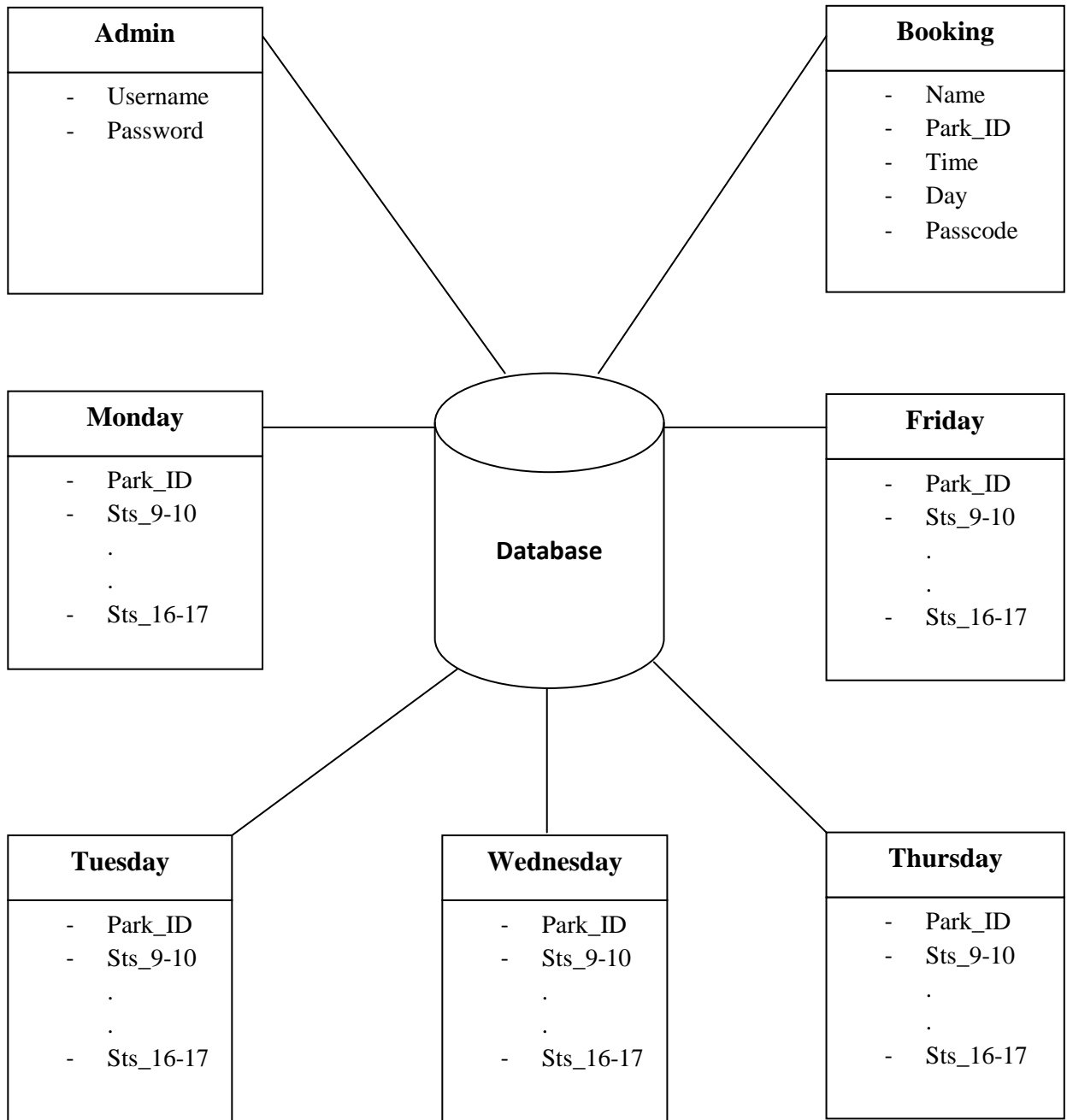


Figure 4: Database Model

The system will query for which parking slots is taken and which parking slots are available according to the day and time that users enter into the system. Information in the database are fetched and filtered by MySQL command from the tables in the database. Figures below shows the interface to prompt users of their chosen day and time slots.



Figure 5: Prompting Day of Reservation

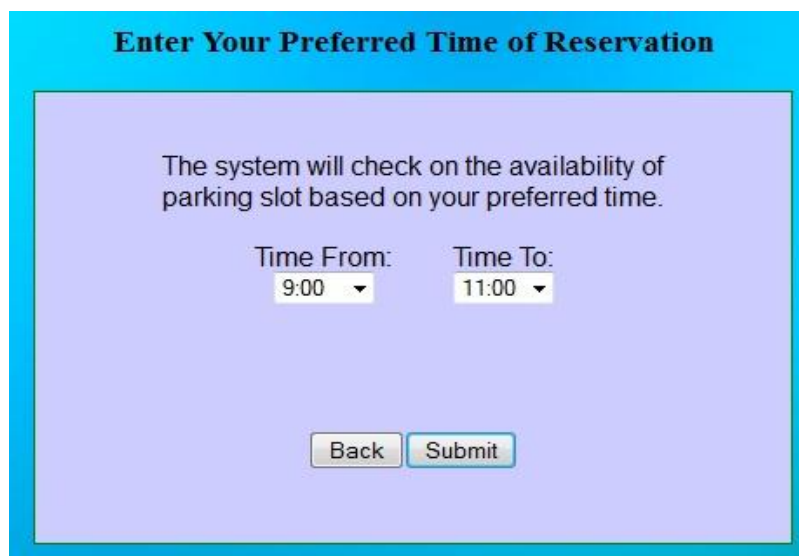


Figure 6: Prompting Time Slots of Reservation

4.2.2 Information Displaying

Once the required data are fetched from the database, it will be then displayed on the web browsers where the system runs. It will be displayed in accordance to the particular parking area's layout. The purpose of this is to make it easier for the users or the drivers to locate the parking slot that they reserved earlier when they arrive at the parking area. However, parking ID is still included to make it even easier for the users and drivers to locate their reserved parking slot. In the prototype, taken slots are displayed as a red car and vacant spaces are displayed as green box. There are only 20 parking slots used in the prototype and these parking slots were mapped into a big box as to simulate the real parking areas. Figure below shows steps involved in fetching data from the database and displaying the information to the users through the web-based parking reservation system. The next figure is the screenshot on how the information on the availability of the parking slots are displayed.

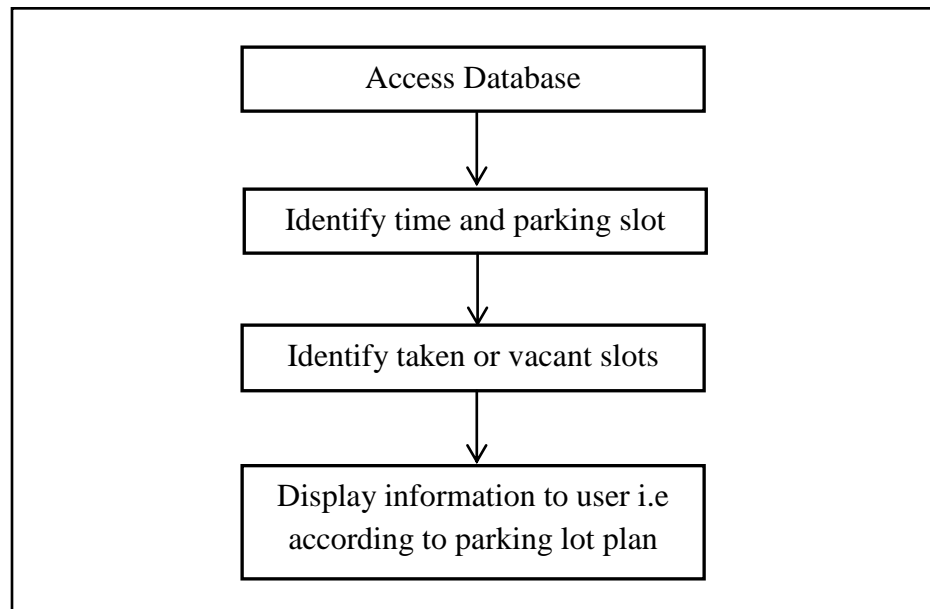


Figure 7: Process Flow for Information Fetching and Displaying

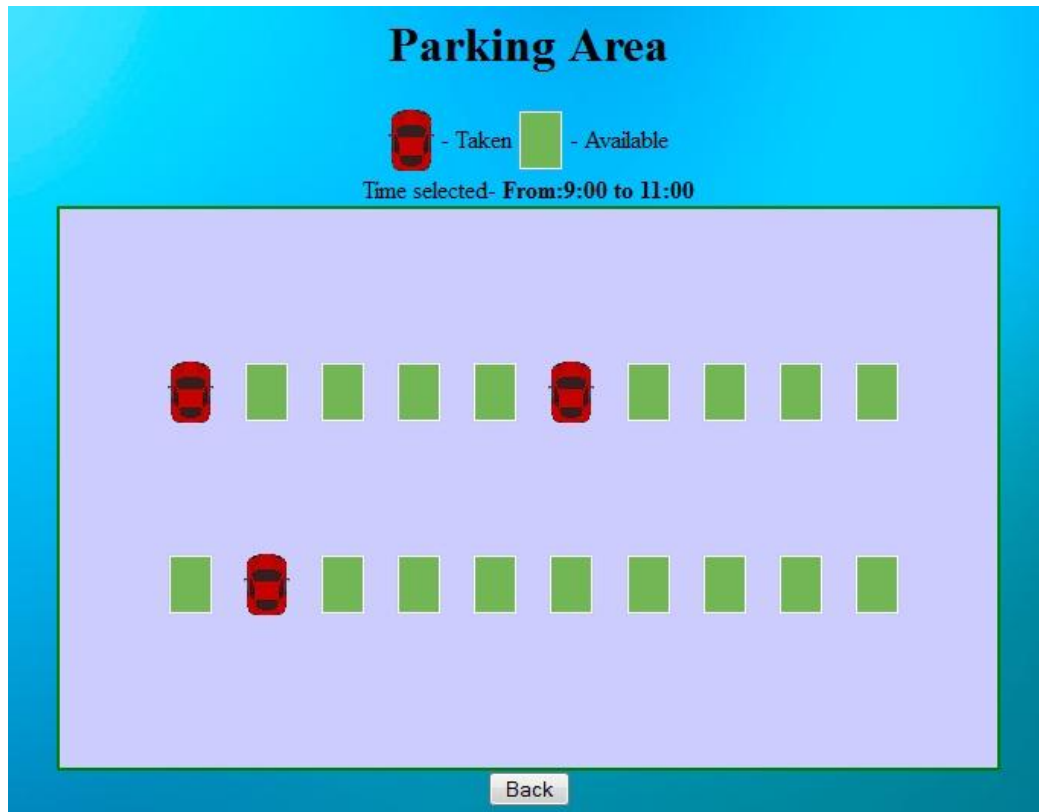


Figure 8: Taken and Vacant Spaces Displaying

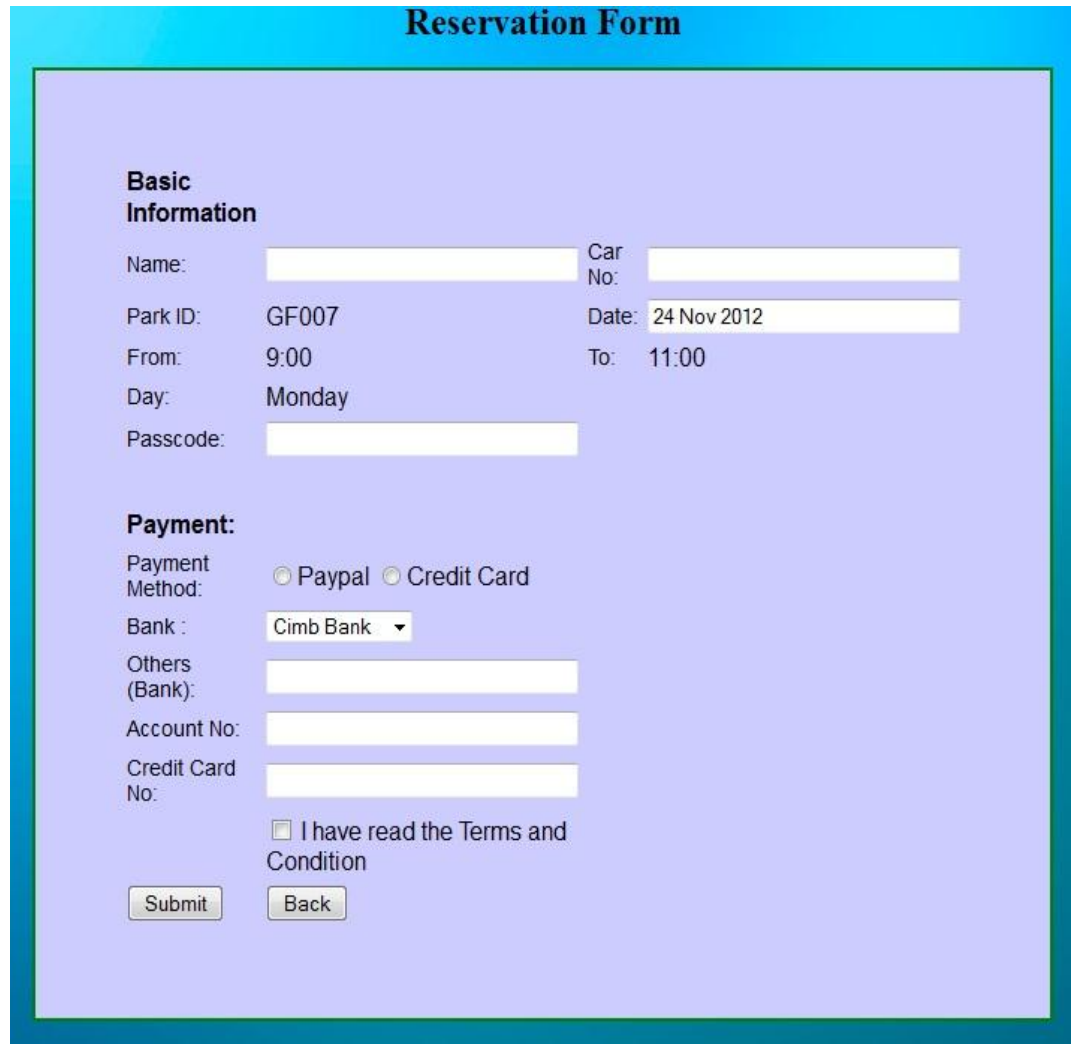
4.3 RESERVATION AND CONFIRMATION PROCESS

Reservation and confirmation of reservation is another main function of the system. This is the core function of the system and it is also included and fully implemented in the prototype.

4.3.1 Reservation Process

Under this function, users will choose any slots that are available displayed in the system. After choosing the vacant space, the system will then prompt users to input data into the reservation form. This information is important as this will be used to identify who reserved the particular space. There are few details or information that users will need to fill in the reservation form. The details are compulsory to fill so that errors can be avoided or if not, can be reduced. Input from users such as day, time slots chosen, parking no and passcode are among the data that must be entered by the users to the system. This is because these inputs are important for the system to operate. For example, without the entry of which day and time slots the user wish to reserve, the system will not be able to identify when the parking slots are vacant or not available for reservation.

To prevent this, in the prototype the system will prevent the data from being submitted into the database if there are any empty fields on the reservation form. There are two section in the reservation form which is basic personal details and payment section. Basic personal details require users to enter basic information to identify themselves and for the system to identify who made the reservation. On the other hand, payment section is useful later in the execution of payment process. If there are any important details missing, the system will redirect the users to the reservation form so that the users are able to reenter valid data and fill all the required info.



The image shows a web form titled "Reservation Form" with a blue header. The form is divided into two main sections: "Basic Information" and "Payment".

Basic Information:

- Name: [text input]
- Car No: [text input]
- Park ID: GF007
- Date: 24 Nov 2012
- From: 9:00
- To: 11:00
- Day: Monday
- Passcode: [text input]

Payment:

- Payment Method: Paypal Credit Card
- Bank: Cimb Bank (dropdown menu)
- Others (Bank): [text input]
- Account No: [text input]
- Credit Card No: [text input]
- I have read the Terms and Condition

At the bottom, there are two buttons: "Submit" and "Back".

Figure 9: Reservation Form

Figure above shows the reservation form taken from the prototype of the Web-Based Parking Reservation System. In the form, parking ID, time slots, and day are auto-generated. This is done by taking the values of day and time slots that users entered earlier in the system. Users are unable to change this value and the purpose of preventing users from changing this is to maintain consistency and avoid errors.

4.3.2 Confirmation Process

Confirmation process is executed after the users successfully enter all the necessary and important details into the system. This is mainly to let the users know that their reservation is confirmed and successful. In the developed prototype, users will only be able to reach the confirmation page if they manage to provide the system with all the necessary details. Another important thing is the users must agree to the Terms and Conditions of the system assuming that there are some terms and conditions that need to be fulfilled. For example, the payment will increase if they do not check out from the parking slots or areas on time and etc. On the prototype, once the required inputs are given on the payment details, it is considered that they have filled all details, paid the required amount of fees and agreed to the Term and Condition. If any of the fields on the payment details are empty, the system will notify users that payment is not done and also notify users that reservation is unsuccessful.

On the confirmation page, the system will display again the reservation details to the users. The system will display the user's day and time of reservation together with the parking slots chosen and their passcode. On this page, there are buttons labeled "Confirm Reservation" which indicate that the users confirmed and successfully made their reservation. This button will redirect users to the main page of the system. The instructions on what the users will need to do once they arrive at the parking areas or the parking lot is also displayed to the users on this page. There will be a specific instruction on what information they will need to give to the parking attendants and etc. The whole system status and the database will then be updated on which parking slots are taken and available. Below shows the steps involved in reservation and confirmation process.

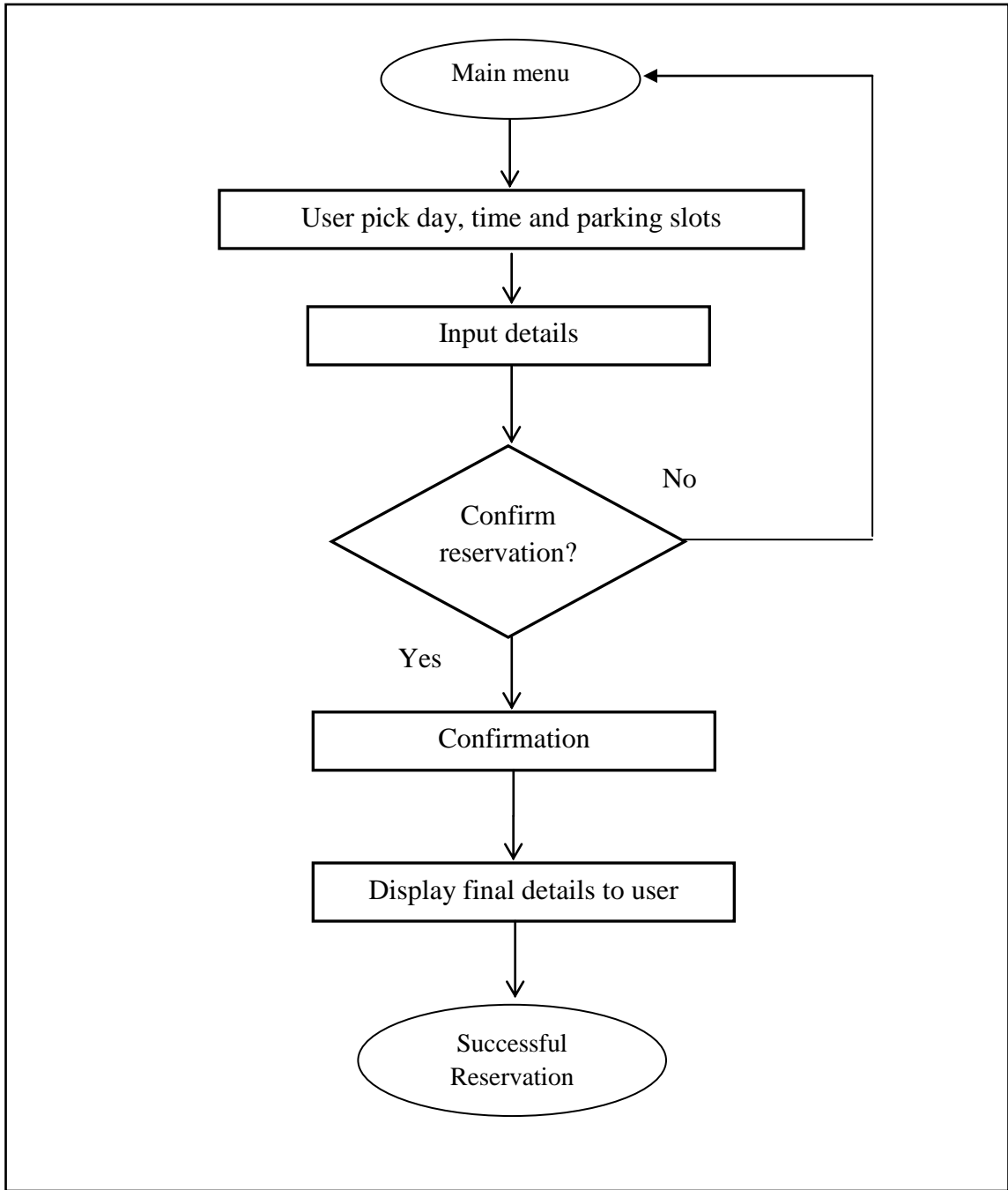


Figure 10: Process Flow for Reservation and Confirmation of Parking Space

The next figure shows the notification that users will receive after they successfully provide all required details in the reservation form and submit their reservation details to the system.

4.3.3 Payment Process

Under the confirmation section, there is a payment method which allows users or the drivers to pay the fees for their reservation through the system. In the prototype that was developed, the payment process included is only the entry of payments details such as account number, bank type and payment method. Payment process is simulated with prompting payment details from users and once all the details is given, it indicate that payment process is done. On the other hand, if any of the payment details is missing it is considered as payment is not done. Figure below shows the screenshot for notification on payment in the prototype.

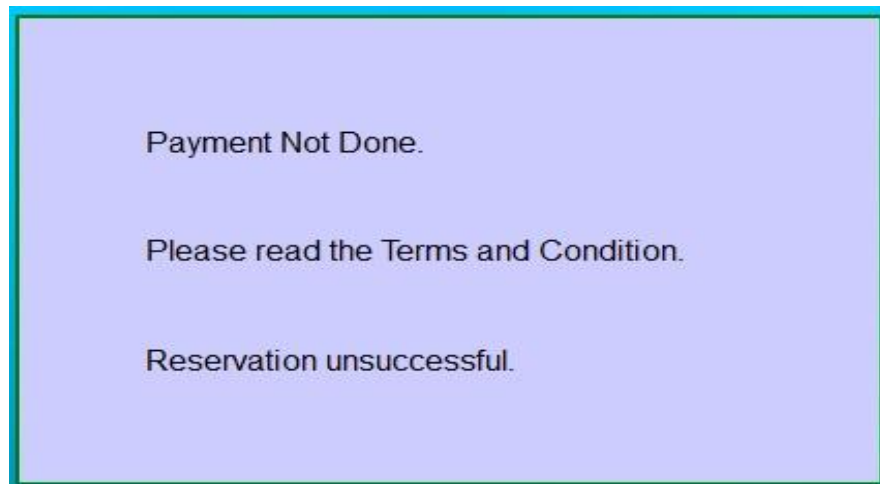


Figure 11: Notification On Payment

In the reservation details, there is option to pay via online banking service and this meets one of the objectives of the system which is to give more convenience to the users or the drivers. This is because once they submit the reservation, at the same time the payment will be paid through the system. In the prototype, the parameter used to simulate payment of the fees is the entry of the payment details from the users. If any of the fields under the payment section is empty, it indicates

that the payment had not been made. The formula to calculate the total payment is which is not fully implemented in the developed prototype is:

Let:

Total Payment = A, Parking Zone = B, Duration = C,

Entry Fees= D

$$A = B + C + D$$

Figure 12: Formulas for Computing Total Payment

4.4 REVIEWING AND CANCELLATION OF RESERVATION

As planned earlier, the system must be able to allow users to review their reservation and also to cancel their reservation in case they do not want to. This function is included in the developed prototype and was fully implemented. The users are able to review and cancel their reservation on the system. The implementation of this function is important to shows the usability of the system.

4.4.1 Reviewing Reservation

On the reviewing part, the users will input their reservation details which are their name, car number, day or date of reservation and their passcode. All of this input is necessary because if there are any empty fields, the system will not be able to fetch the user's reservation details. Other than that, it is important to avoid unauthorized person from viewing others reservation details. This is achieved by prompting passcode from the users and as a compulsory detail that users need to fill in the form. Passcode is only known by the person who made the reservation and hence it is included in the form to ensure that the user's details cannot be viewed by any other users. From this input, the system will query the database and fetch the user's reservation details. Figure below shows the steps involved under this function.

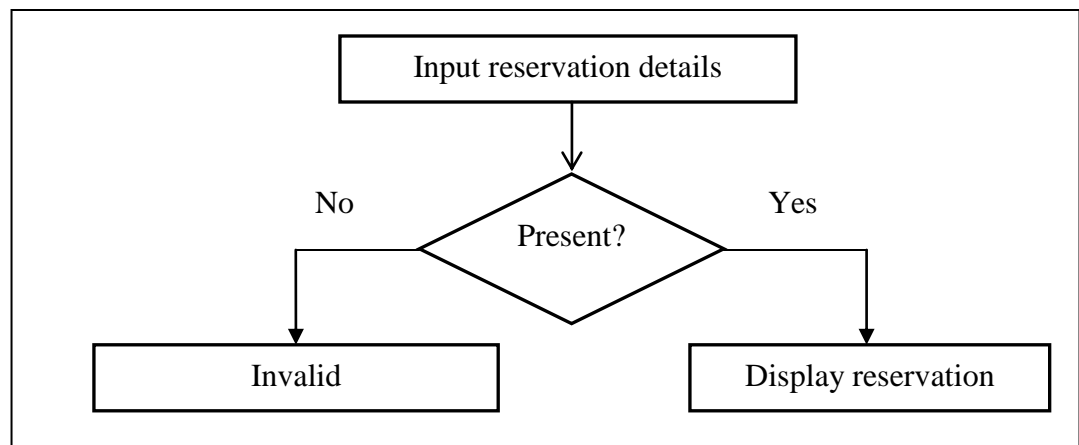


Figure 13: Flowchart for Reviewing Reservation Details

4.4.2 Cancelling Reservation

On the other hand, the cancellation parts are almost the same with the reviewing process. Users need to input some necessary and secure data into the form such as their name, car number and passcode. Once all the details are submitted, the system displays the details and there is a “Cancel Reservation” button which will redirects users to the cancellation page. Once pressed, the cancellation will be performed and redirects users to the main page of the system. The system will check all the status of the parking slots and the respective time slots. The parking slots reserved before by the users will be updated to “Available” and available to be reserved for other users. Figure below shows the flowchart of cancelling reservation.

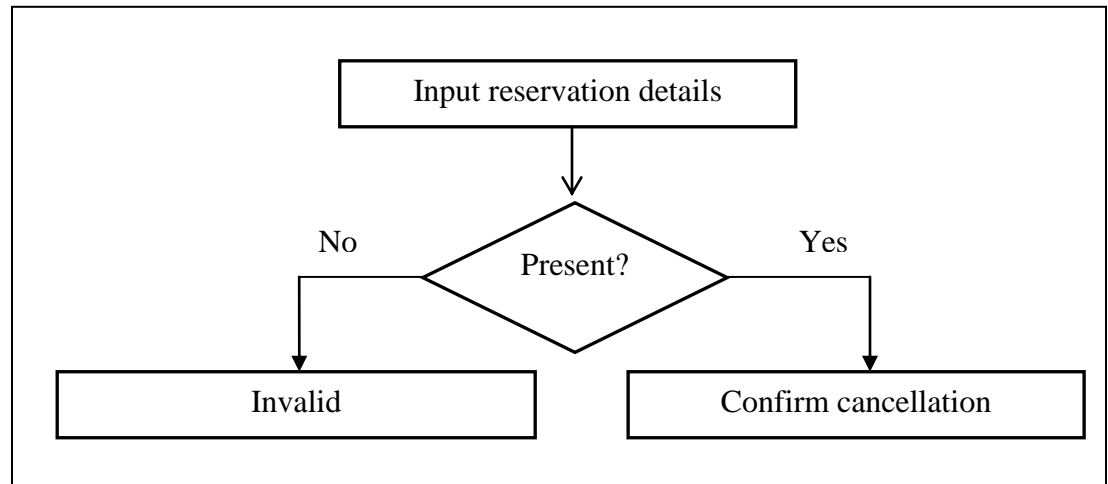


Figure 14: Flowchart for Cancellation of Reservation

4.5 SYSTEM ADMINISTRATOR

The feature for system administrator is also one of the key components in this system. The system administrator's features are implemented as the one who controls the whole system. In the prototype, the main features included are the function to simulate on opening the gate i.e. checking in and going out from the parking lot or checking out from the parking area.

4.5.1 Checking In and Checking Out

On checking in, the users will provide their passcode to the parking attendants and the parking attendants or the system admin will then enter the given passcode. Once entered, if there are reservation done earlier and the passcode is correct the system will display notification that the gate is open. This simulate that the entrance gate is open after correct passcode is entered into the system. On the other hand, when users or drivers are checking out from the parking lot, they will once again provide the passcode and it will then be entered into the system. Once entered, the parking slot's status that they reserved earlier will be changed to "Available" to allow others to make reservation. The system will notify the system administrator that the previously reserved slots are now available.

This function is performed by matching the entered passcode and the passcode that was stored in the system. The system will do query on the database and uses passcode as the parameter. To achieve this, the field passcode in the database must be unique and different from the other passcode. The passcode must be different from each reservation even if the person making the reservation is the same. This is to prevent errors on the system and at the same time, this increases security on the system. This is because the passcode used for each person or the drivers will not be the same for every reservation.



Figure 15: Checking In and Checking Out

4.5.2 Security and Access Level

To ensure security of the system, secure login is implemented in the system. In the prototype, the system will prompt system administrator for their username and password. If the entered detail is valid, the system will redirect the users to the system administrator's page and if not, the system will notify the users that their input is invalid. This feature is implemented and included in the system to prevent unauthorized users to login as system administrator and access data in the system. This is because some of the data that stored in the system might be private and confidential for certain people.

To increase the security, md5 encryption function implemented in the system. This is an encryption algorithm that helps to prevent SQL injection in case any unauthorized personnel try to access the database. By doing this, the access level of the system administrator and users can be differentiated where system administrator can view all the details of the reservation made in the system where the other users will only able to view their own reservation details. At the same

time, the user's information that is stored in the system is secure and safe from unauthorized access. Security on the system is one of the important factors in making sure that the system is safe and usable.

4.5.2 Other Features

On the developed prototype, some basic features of system administrator are also included. They will be able to view all the bookings made on the system and used this function as record keeping. This will be very useful in case some of the users forget their details and etc. The search function is also included in the prototype. This is mainly to make it easier for the system administrator to find any specific details on the database. This is done by making search or query on the database according to name. The system administrator will key in some names and the system will search through the database and fetch the matching data.

Another function that is implemented on the system administrator feature is ability to reset all the "Taken" spaces or slots to "Available". This need to be implemented as to increase the usability of the system in case there is a need to reset the whole system. Other than that, in the prototype the system administrator is also able to set all the parking slots to "Taken". Apart from this, in the prototype the system administrator also able to add new system administrator and this is quite crucial in most of the systems that exist nowadays. This is because, depending on only one system administrator proves to be inefficient and ineffective practices.

4.6 LIMITATION OF THE SYSTEM

As most of the other system, there are some limitations that the web- based parking reservation system posses. One of the limitations of the system is that it is not real- time. This means that there will be some delays on the system. For example, since the drivers need to check- out at the exit gate and not at the particular parking slots there are some delays. To solve this, there are some methods that the management can use to reduce the delay. For example, they can implement some policies where drivers must check out earlier. In case the driver want to extend their reservation, they must let the management know earlier. This is to avoid other drivers encountering problems whenever things happen such as late checking out and etc.

Another limitation on the system is that, there might be parking areas that is quite hard to map on the system. For example, the arrangement of the parking lot might not always be in line. This might cause the system unable to provide users with an accurate layout of the parking areas or the parking lot. Other than that, drivers took another driver's reserved slot is another limitation of this system. This is because to be able to achieve efficiency in this system the drivers must really follow some rules or policy to avoid other problems from arising. Another possible solution to this problem is implementation of identification device on each parking space to determine whether the driver is authorized to park their car at the specific parking slot or not. This might be implemented in the future.

This limitation might cause some problems on the parking management but it can be solved or if not reduced by implementing some policies and clearly communicating the policies to the users or the drivers. Even though there are limitations on this system, it is still able to fulfill the main objective of the project which is to reduce time wasted on locating parking slots, inefficient fuel usage and reducing pollutions. Another important aspect is that the system able to provide more convenience to the society.

4.7 CHALLENGES IN DEVELOPMENT PHASE

On the development phase, there are few challenges that were faced in order to come up with a working prototype of the Web- Based Parking Reservation System. The first one is designing system architecture. The challenge on this is that, it is not clear whether the system architecture is doable or not. Other than that, the architecture must be able to fulfill the overall objectives of the project. This is why understanding every process in the system is very important. This is another challenge in the system prototype development where every details in each of the process is taken into consideration whether it can be implemented or not and if it can be implemented, it must be cleared how it will be done.

Another challenge on the prototype development is translating the design of the system architecture to a usable system. The main problem at this stage is the limitations on the knowledge, skills and experience on system development. To overcome this, further studies on the scope of the project which is PHP and MySQL system development is done. Other than that, the system architecture and the process flows in the system were reanalyzed so that it can be translated into a usable system.

Debugging phase of the system development also gave some challenges on the development stage. This is because, some part of the system is quite complex especially those functions that deals with the database. Apart from that, knowing exactly what causes the errors is another challenge because of lacking in knowledge and expertise on the language used which is PHP. However, these challenges were overcame and system prototype was able to be developed.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATION

As a conclusion, the web- based parking reservation system able to provide solution to the problems of wasted time locating parking slots, inefficiency of fuel usage, reducing air pollutions and gives better convenience to the society. Most of the parking areas that exist currently are managed manually by people as a worker and it are not effective. A web- based parking reservation system will help them to identify whether there are parking space available or not. In addition it is easily accessible by users as long as there are internet connections. This project will be a great help for people that live in a crowded metropolitan city where majority of the population owns a car and always rushing to go to places. Other than that, this system will also be a good thing for people who are time conscious and always plan ahead before going out to any places. There are many studies done on parking management and some are still in progress to provide the society with a better convenience. From this, we can conclude that parking do give problems to the societies. Other than that, academician sees this as an opportunity to solve and reduce other related problems. As a conclusion, parking reservation system able to provide the societies with a better convenience and at the same time helps to solve and reduce other problems such as air pollution and etc.

As a recommendation for future work, there are some things that can be done to provide the society with a better parking reservation system. Implementation of real- time web based parking reservation system will be able to perfect the parking reservation system. This is because with a real- time system the system will be more accurate but at the same time the cost will increase. Other than that, implementation of identification device will helps to get rid of drivers taking another driver's parking slot. Identification technology such as RFID tag will helps a lot in eliminating the problems where drivers simply park their car at any empty space which already reserved for other drivers. In addition, studies on the current practices of parking management system must also be done to understand more and get to know more about parking and related problems.

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APPENDICES

Web Based Parking Reservation System

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ABSTRACT

Locating a single parking space in any metropolitan areas are becoming one of the major concerns of the society as more vehicles owned by citizens. This can be worse during the rush hours due to not knowing whether there are parking spaces available or not. Other than that, even if they there are spaces available it is not confirmed that they will get the respective space or slot. In Malaysia itself, the implementation of a smarter parking system are very low. Most or if not all of the parking area in shopping malls, airports, national parks and etc are managed manually which is quite ineffective [5]. Hence, this project aims to develop a Web Based Parking Reservation System which will aid in providing a smarter parking management [7] [8]. The system is updated to the current status of the parking areas which will then be displayed to the users or drivers. This is important to be done because, accuracy of information are one of the main things in this system. With this system, users will be able to know whether there are spaces available or not and if there are a space available for their vehicles, they can reserve the slot right away. Using this system as a means to manage parking areas will be more efficient, effective and beneficial for the drivers. This is because, they are able to reserve a space and go to the destination without wasting much time locating a single parking slot. In addition, lesser fuel consumption by the drivers and as a support to green technology, this system can contribute in terms of reducing the fuel consumption during parking.

Keywords: *Oil Consumption, Society, Air Pollution, Reservation.*

I. INTRODUCTION

Traffic jam is one of the closest problems that the society had in this era as more and more cars on the road. Proto Malaysia released a statistic that shows the total number of registered vehicles on Malaysian roads has passed 21.25 million units. In 2010, an increase of 11.74% over the 2009 figure of 19,016,782 units and this figure covers all types of vehicles including tractors, buses, and motorcycles [10]. Apart from this, fuel consumption also increases because the driver will spend quite and amount of their time to locate a single parking slot. Another concern is air pollution which is

becoming worse since the first car created by men. Other than that, study conducted show that people nowadays spend or waste between 3.5 to 14 minutes looking for a space each time they park [8]. Those wasted minutes might be very important for certain people such as, people that are rushing to catch their flight, people that are going for interviews and etc. Studies also showed that locating a single parking space in crowded metropolitan areas is one of the worst problems that the society had these days [9]. Hence, an approach to face the problems such as traffic congestion, air pollution and stressful situation faced by drivers is via development of a parking reservation system. The system must be easily accessible and able to provide users with correct and accurate information.

A. Problem Statement

Locating a single parking slot or lot might be one of the most frustrating problems that the societies are facing nowadays. There is many times where people go to the mall and spent more time locating a single parking slot than spending time on their exact purpose. In a worse scenario, the parking lot is full. Their time is wasted and their oil consumption increases. Besides that, they had contributed to some amount of hazardous chemicals to the air which cause air pollution.

B. Objective

The objectives of this project are as outlined below.

5. To provide a system where booking of a parking slot can be made
6. Prevent drivers from wasting too much time locating parking space
7. Reduce oil consumption and air pollution
8. Provide a more convenient life for the society

C. Scope of Study

The scope of study of this project is development of PHP and MySQL system which is used to develop the system along side XAMPP to simulate client and server interaction. The system must able to update the information in the system whenever changes occur. For example, once a booking or reservation is made on a single parking lot, the system must be able to update the information and display the correct information to the users of the system.

Other than that, studies on drivers such as people who always go to the shopping mall, airports and any other places where locating parking slots is one of the biggest concern. For example, universities students itself always go to the shopping mall during weekend which is the time where the shopping malls are greatly crowded. Hence, with the feedback and information from this population a good parking reservation system will be able to be developed.

II. LITERATURE REVIEW

A. *A Reservation Based Smart Parking System*

This paper was written by Hongwei Wang from Computer Science and Engineering Department and Wenbo He from Electrical Engineering, University of Nebraska- Lincoln, NE, USA. This project is a study and development of a prototype on a Reservation Based Smart Parking System. The main concern of the project is the difficulties of the drivers when locating parking space. This project uses a parking area installed with sensors, a core system and interface between the drivers and the system. Certain performance metrics applied on this project to ensure that a more reliable result able to be attained. The first performance metric is walking distance which is the distance from the selected parking space to the destination. This is an important factor to consider because, it reflects the willingness of the drivers when selecting parking spaces [3]. The second performance metric is traffic volume which defined as the number of vehicles. This metrics used to define the relationship between parking problems and traffic congestion. The system makes full use of the sensor system installed in the parking lot and this system has a full access to the internet to communicate with the management system which is the intermediaries between the users and the status of the parking lot. From any communication device that owned by users which have access to the internet, users can communicate with the management system and reserve the parking space from there. The simulation was done to test the effectiveness of the system by using the Los Angeles Downtown map and they choose the peak hours i:e 6-9 am and 5-8 pm. The result is taken and analyze. The outcome of this project shows that, the driving distance of the users or drivers decreased with parking reservation system. This is because, the drivers was able to pre- book the parking space that they want and with this, able to choose the shortest distance of driving to the destination.

B. *Evaluating Parking Reservation Policy in Urban Areas: An Environmental Perspective*

This paper was written by Mei- Ting Sai from Business Administration Department of National Chung Hsing University, Taiwan and Chih Peng Chu from Business Administration and Logistics Management Department of National Dong Hwa University, Taiwan. This project is a study on the effect of a parking reservation system to the amount of damaging pollutants released to the air. A parking reservation system is developed to remove the uncertainty of searching for a parking space in busy urban areas [4]. This helps to reduce the distance travelled by the vehicles and at the same time reduce fuel combustion which helps to

decrease the amount of damaging pollutants released [8]. Two parking facilities in Taipei, Taiwan were studied and data is gathered to aids in the project. The first parking facility is a small parking area with 130 spaces and the second facilities with 416 parking spaces. The type of pollution taken into consideration are NO, HC, CO and CO_2 .

Other than this, the duration drivers took cruising for empty spaces are also taken into consideration. This is because, logically the distance of driving that drivers took and cruising around the parking area affect the amount of damaging pollutants released. The result from the simulation was as expected where time taken for the drivers cruising for parking spaces greatly reduced after the implementation of parking reservation system. This is because, they were able to reserve a parking space beforehand and able to drive directly to the empty spaces reserved after that. This in turn, reduced the damaging emissions from cars that cruising to search for parking spaces. This project concluded that, with parking reservation system we will be able to provide better convenience to the drivers and at the same time, able to reduce the affect of damaging pollutants that released by vehicles.

C. *Smart Parking Reservation System Using Short Message Service (SMS)*

This paper was written by Noor Hazrin Hany Mohamad Hanif and Mohd Hafiz Badiozaman from Electrical and Electronic Department and Hanita Daud from Fundamental and Applied Sciences Department, Universiti Teknologi PETRONAS. This project applies parking reservation system that uses short message service (SMS) as a means of communication. There are two system used in this project which are parking reservation system and access system. Parking reservation system is the system that allows users to reserve or book a parking space [3]. Access system is the system that control whether the drivers have the rights to enter the parking lot or not. Under the parking reservation system, users of the system will have to know the exact command that they need to send through SMS. This message will be processed and interpreted by a wireless communication instrument called micro- RTU (Remote Terminal Unit). This same device will then send the details of the reservation made by users through SMS too. The micro-RTU is the one which allows communication between users and the CPU of the system. The CPU of the system is the one that interpret the availability of the parking spaces, determine whether the parking spaces can be reserved and etc. The micro-RTU will also carry out the sending of information to the drivers such as the parking space number, password and etc. Upon confirmation, the process of reservation is done and the drivers are now clear to go to the particular parking area. Password that previously sent by micro- RTU will be used as the access code and once verified, they can straight away go to the respective parking space booked earlier. The system is fully automated with the implementation of Peripheral Interface Controller (PIC) and this allows the system to update the numbers of available parking space and controlling access to the parking area. The prototype developed under this project shows the capability of reserving parking space through short message service

(SMS). This project concluded that with a smarter parking management system, the hassle of locating an empty parking space can be eliminated. This project also agreed that parking reservation as an approach to a smart parking system able to provide better convenience and the fact that most people own cell phone nowadays makes the system quite effective.

D. Smart Parking Using RFID Technology

This paper was written by Zeydin PALA and Nihat INAN from Yuzuncu Yil University, Van, Turkey. This paper is a study about parking system that implements Radio Frequency Identification (RFID) technology. This parking system uses RFID tag as a means to identify cars that enter and exit to and from the parking lot. With this technology, there will be shorter period for check- in and check- out from the parking lot [1]. By using RFID, the system will identify the tag that is attached to the car and after the system's successful identification of the car, the gate will open automatically and a ticket will be issued to them via the terminal that is located at both entrance and exit of the parking lot. The main advantage of this system is that they reduce the time taken for car parking mechanism by focusing on the entrance and exit. Whenever there are a lot of cars in the parking lot, the time taken to exit from the building or the parking lot takes quite a lot of time [1]. The limitation of placing an operator at the entrance and exit gate is that human is slower compared to any computerized system. With the application of RFID technology in parking system, it will be more effective, faster execution and cost saving compared to salaried operators. This project concluded that by reducing the time taken of checking- in and checking- out from the parking lot, it will be able to reduce traffic congestion and at the same time, able to reduce fuel consumption. Hence, a good parking system plays a big role in providing a better life to the society.

E. How Smarter Parking Technology Will Reduce Traffic Congestion

This article is written by Sarah Kessler who is a writer for *mashable.com*, a website which publishes educational articles on various fields of studies such as technology, engineering and etc. This article is about how smarter parking technology will help to reduce traffic congestion. Traffic congestion in a major city can be caused by driver who is cruising for parking [7]. It is also stated that the time taken or the time spent on searching for a single parking space is between 3.5 up to 14 minutes [8]. This statistic or information is taken from a report by UCLA professor Donald Shoup who synthesized studies on how smarter parking will improve the traffics. One implementation of smart parking in Los Angeles is a low powered sensor is installed at the parking lot and connected to the main system. The system will be able to determine whether the specific parking lot is already taken or not by the information from the sensor. Relating this article on the parking system that the city of Los Angeles applies, there is some useful information that can be applied on this project. The system that they used which is by using sensor is a real time system and can provide more precise information to the drivers. Other than that, the system is also accessible via internet and this provides a greater convenience to the drivers. The concept of how the system works is also simple

and effective. The concept of this system will be useful in the completion of the project and at the same time provide solution to problems that many drivers experienced.

F. Parking Reservation System and Related Methods

This paper was written by John Blake Slemmer, Norcross GA, US and Neil Fredrick Rivenburgh, Lawrenceville GA, US. This paper documented about how a parking reservation system should be and other related system that can be applied. This paper explains how a parking reservation system can be very useful for specific events such as events at the stadiums, airports and etc. Under this project, a parking reservation system must be able to locate an available space, communicate the information across the system and display the information to the users or the drivers. Following this method, the parking reservation system must be able to identify availability of the parking spaces. After identifying the availability of the parking lot, information must be sent to the Central Processing Unit (CPU) of the whole system. This processor will then process the information and display it to the drivers. Drivers will pick which parking space that they want to reserve based on the information displayed. Choices of the drivers will be sent to the CPU and it will process the request. The system will generate receipt and confirmation on the reserved parking space. After this, the database of the system must be updated on which parking slot is available and which one is not to prevent overlapping request on reservation. There are varied methods or ways of identifying parking spaces availability that can be implemented together with the parking reservation system that under this project. For example image processing technology, infrared technology and etc. This paper concluded that reserving a parking space in the parking lot compromises of detecting whether the parking space is vacant or occupied, determining whether the parking space is reserved but unoccupied, displaying only the available parking space to drivers, processing reservation request and confirmation on the reserved parking space. Smart parking management system should be able to carry out these processes in order to be effective system.

III. METHODOLOGY

A. Software Process Model

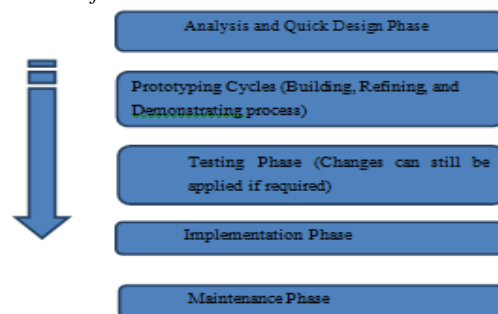


Figure 1: Rapid Application Design (RAD) Model

Software development process model that used is Rapid Application Development (RAD) method as shown in **Figure**

1 [10]. This methodology is chosen due to the time constrain of this project which in total is 9 months. This is also to make sure that changes can be implemented throughout the project completion.

B. System Architecture

Figure 2 shows the complete system architecture of the project. The system will fetch information on the parking slots and it will display to the users which slots are taken and which are vacant. Drivers will choose their desired slot and the next stage is confirming their reservation. The last stage is system update where the system will update the system on changes in the system.

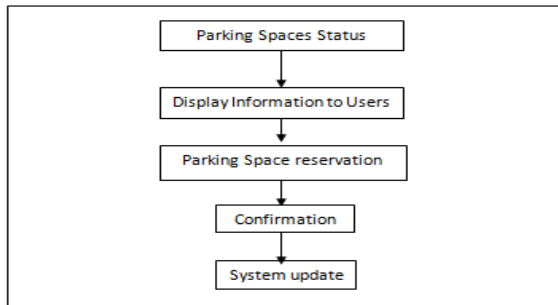


Figure 2: System Architecture

C. Development Tools Required

- Platform Windows 7 Ultimate 32Bit
- Php MySQL
- Compiler
- XAMPP

IV. RESULTS AND DISCUSSION

The developed prototype for Web- Based Parking Reservation System performs well and able to execute all the main function. There are five sections on this chapter which are information fetching and displaying process (a), reservation and confirmation process (b), reviewing and cancellation of reservation (c), system administrator (d) and limitation of the system (e). Each section will be explained further and in more details.

A. Information Fetching and Displaying Process

Information Fetching

The design of the database plays a vital role in making sure that updating the system can be done properly. In the prototype, there are seven tables in the database. For each day, there are time slots ranging from 9am to 5pm which indicate that the parking slots only available from 9am to 5pm. Each time slots has their own status which is “Taken” and “Available”. This is the data that the system will fetch to identify whether the particular parking slot is available at that particular time or not. The system will query for which parking slots is taken and which parking slots are available

according to the day and time slots that users entered into the system. Information in the database are fetched and filtered by MySQL command from the tables in the database. Figures below shows the interface to prompt users of their chosen day and time slots.

Information Displaying

Once the required data are fetched from the database, it will be then displayed on the web browsers where the system runs. It will be displayed in accordance to the parking area’s layout. This is done to make it easier for the users or the drivers to locate the parking slot that they reserved earlier when they arrive at the parking area. However, parking ID is still included to make it even easier for the users and drivers to locate their reserved parking slot. In the prototype, taken slots are displayed as a red car and vacant spaces are displayed as green box. There are only 20 parking slots used in the prototype and these parking slots were mapped into a big box as to simulate the real parking areas. Figure below shows steps involved in fetching data from the database and displaying the information to the users through the web-based parking reservation system. The next figure is the screenshot on how the information on the availability of the parking slots are displayed.

B. Reservation and Confirmation Process

Reservation Process

Users will choose any one from the available slots that are displayed in the system. After choosing the vacant space, the system will then prompt users to input data into the reservation form. Input from users such as day, time slots chosen, parking no and passcode are among the data that must be entered by the users to the system. This is because these inputs are important for the system to operate. For example, without the entry of which day and time slots the user wish to reserve, the system will not be able to identify when the parking slots are vacant or not available for reservation. To prevent this, in the prototype the system will prevent the data from being submitted into the database if there are any empty fields on the reservation form. There are two section in the reservation form which is basic personal details and payment section. Basic personal details require users to enter basic information to identify themselves and for the system to identify who made the reservation. On the other hand, payment section is useful later in the execution of payment process. If there are any important details missing, the system will redirect the users to the reservation form so that the users are able to reenter valid data and fill all the required info.

Confirmation Process

Confirmation process is executed after the users successfully enter all the necessary and important details into the system. This is mainly to let the users know that their reservation is confirmed and successful. On this page, there are buttons labeled “Confirm Reservation” which indicate that the users confirmed and successfully made their reservation. This button will redirects users to the main page of the system.

The instructions on what the users will need to do once they arrive at the parking areas or the parking lot is also displayed to the users on this page. The whole system status and the database will then be updated on which parking slots are taken and available.

C. Reviewing and Cancellation of Reservation

Reviewing Reservation

On the reviewing part, the users will input their reservation details which are their name, car number, day or date of reservation and their passcode. All of this input is necessary because if there are any empty fields, the system will not be able to fetch the user's reservation details. Other than that, it is important to avoid unauthorized person from viewing others reservation details. This is achieved by prompting passcode from the users and as a compulsory detail that users need to fill in the form. Passcode is only known by the person who made the reservation and hence it is included in the form to ensure that the user's details cannot be viewed by any other users. From this input, the system will query the database and fetch the user's reservation details. Figure below shows the steps involved under this function.

Cancelling Reservation

On the other hand, the cancellation parts are almost the same with the reviewing process. Users need to input some necessary and secure data into the form such as their name, car number and passcode. Once all the details are submitted, the system displays the details and there is a "Cancel Reservation" button which will redirects users to the cancellation page. The parking slots reserved before by the users will be updated to "Available" and available to be reserved for other users.

D. System Administrator

Checking In and Checking Out

On checking in, the users will provide their passcode to the parking attendants and the parking attendants or the system admin will then enter the given passcode. Once entered, if there are reservation done earlier and the passcode is correct the system will display notification that the gate is open. This simulate that the entrance gate is open after correct passcode is entered into the system. On the other hand, when users or drivers are checking out from the parking lot, they will once again provide the passcode and it will then be entered into the system. Once entered, the parking slot's status that they reserved earlier will be changed to "Available" to allow others to make reservation. The system will notify the system administrator that the previously reserved slots are now available.

Security and Access Level

To ensure security of the system, secure login is implemented in the system. This feature is implemented and included in the system to prevent unauthorized users to login as system administrator and access data in the system. Md5 encryption is implemented in the system. This is an encryption algorithm

that helps to prevent SQL injection in case any unauthorized personnel try to access the database. Security on the system is one of the important factors in making sure that the system is safe and usable.

Other Features

On the developed prototype, some basic features of system administrator are also included. They will be able to view all the bookings made on the system and used this function as record keeping. This will be very useful in case some of the users forget their details and etc. The search function is also included in the prototype. This is mainly to make it easier for the system administrator to find any specific details on the database. This is done by making search or query on the database according to name. Another function that is implemented on the system administrator feature is ability to reset all the "Taken" spaces or slots to "Available". This need to be implemented as to increase the usability of the system in case there is a need to reset the whole system.

E. Limitation of the System

As most of the other system, there are some limitations that the Web- Based Parking Reservation System posses. One of the limitations of the system is that it is not real- time. This means that there will be some delays on the system. For example, since the drivers need to check- out at the exit gate and not at the particular parking slots there are some delays. In case the drivers want to extend their reservation, they must let the management know earlier. Another limitation on the system is that, there might be parking areas that is quite hard to map on the system. For example, the arrangement of the parking lot might not always be in line. This might cause the system unable to provide users with an accurate layout of the parking areas or the parking lot. However, this is sometime depends on the skills and ability of the system developer. This limitation might cause some problems on the parking management but it can be solved or if not reduced by implementing some policies and clearly communicating the policies to the users or the drivers. Even though there are limitations on this system, it is still able to fulfill the main objective of the project which is to reduce time wasted on locating parking slots, inefficient fuel usage and reducing pollutions.

Overall System Flow

With the implementation of all these function in the develop prototype, the system able to perform as expected and also able to meet the objectives of the project. Reservation of parking slot can be done through the developed prototype. Figure on the next page below shows the complete workflow of the prototype.

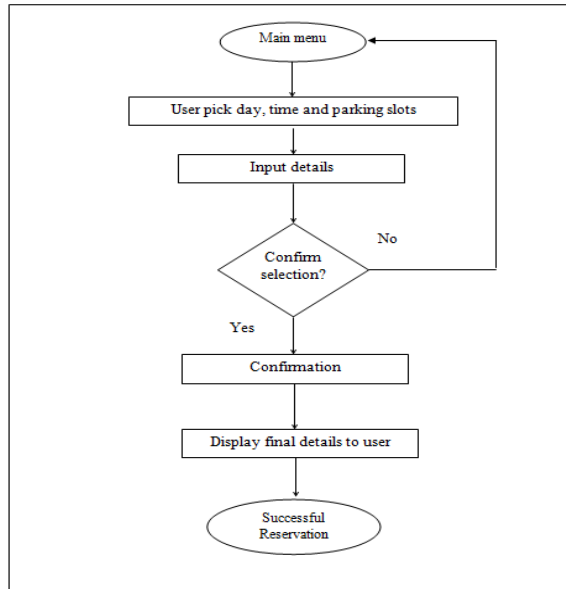


Figure 3: Overall System Flow

V. CONCLUSION

As a conclusion, Web- Based Parking Reservation System able to provide solution to the problems of wasting too much time locating parking slots, inefficiency of fuel usage, reducing air pollutions and gives better convenience to the society. Most of the parking areas that exist currently are managed manually by people as a worker and it are not effective. A web- based parking reservation system will help them to get rid of the uncertainty of getting parking slot. This project will be a great help for people that live in a crowded metropolitan city where majority of the population owns a car and always rushing to go to places. Other than that, this system will also be a good thing for people who are time conscious and always plan ahead before going out to any places. There are many studies done on parking management and some are still in progress to provide the society with a better convenience. From this, we can say that parking do give problems to the societies. Other than that, academician sees this as an opportunity to solve and reduce other related problems. As a conclusion, parking reservation system is able to provide the societies with a better convenience.

VI. ACKNOWLEDGEMENT

First and foremost, the writer would like to take this opportunity to express his greatest gratitude and appreciation to project supervisor, Dr. Yong Suet Peng, who had continuously monitored his progress throughout the duration of the project. Her constructive comments, advices, and suggestions have guided the project towards its successful final outcome. This gratitude also dedicated towards Universiti Teknologi PETRONAS (UTP) especially the committee of Final Year Project of Computer Information Sciences (CIS) department for excellent organization and management of this course. Last but not least; the writer

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USER INTERFACE



Figure 16: System Homepage

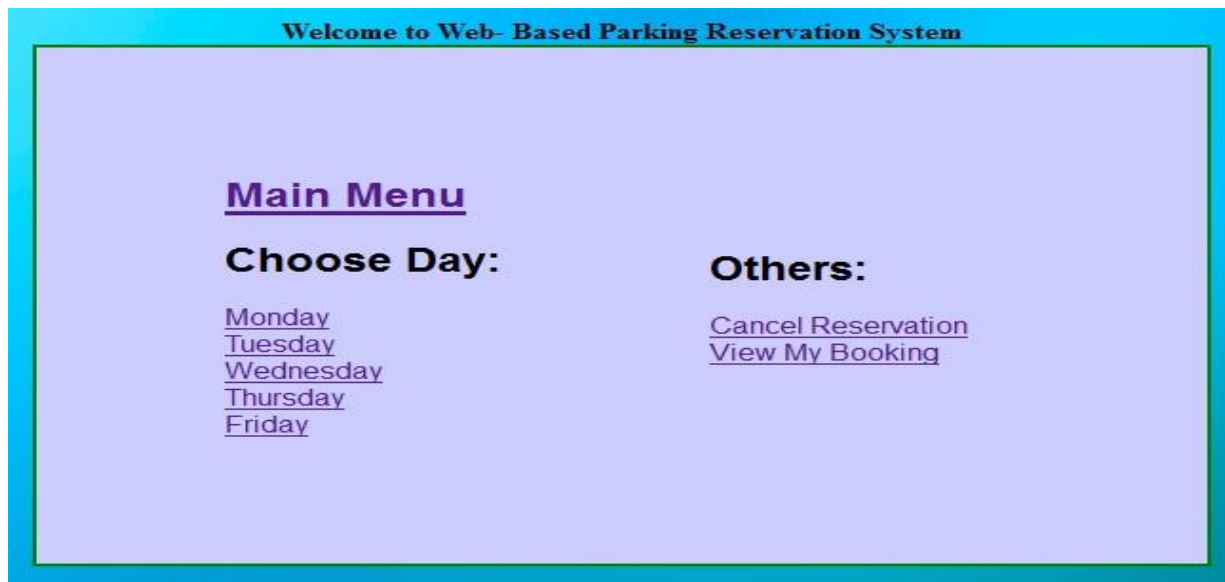


Figure 17: User's Main Menu



The image shows a login page titled "System Admin" with a blue header. Below the header is a light purple box containing the login form. The form has two input fields: "Username" with the text "Flironny" and "Password" with six dots. A "Login" button is located below the password field.

Figure 18: System Administration Login Page



The image shows a dialog box titled "System Admin" with a dark blue header. The dialog box has a white background and contains the text "Invalid username or password!". An "OK" button is located at the bottom right of the dialog box.

Figure 19: Invalid System Administrator Login



The image shows a menu page titled "System Administrator Menu" with a blue header. The page has a light purple background. At the top, there are two links: "[View Single Booking](#)" and "[View All Booking](#)". Below these links, there are two sections for entering passcodes. The first section is labeled "Enter passcode to open the gate:" and has a "Passcode:" label, a text input field, and an "Enter" button. The second section is labeled "Enter passcode to open the gate (Checking Out):" and has a "Passcode:" label, a text input field, and an "Enter" button. At the bottom of the page, there is a "[Logout](#)" link.

Figure 20: System Administrator's Homepage

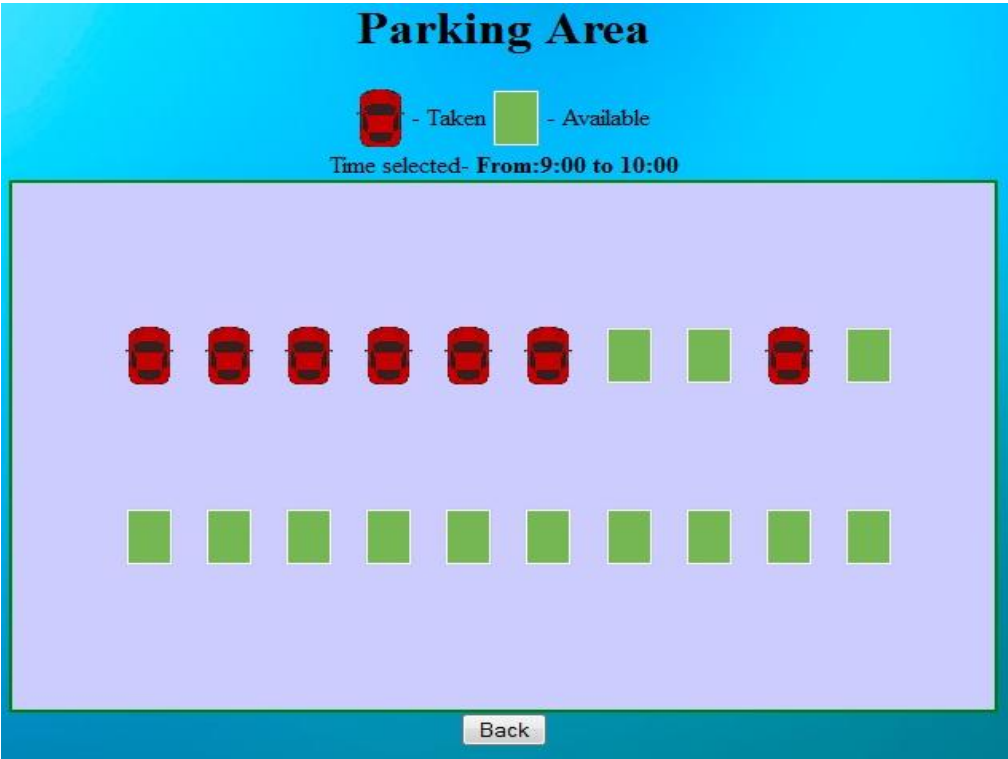


Figure 21: Taken and Vacant Spaces Displaying

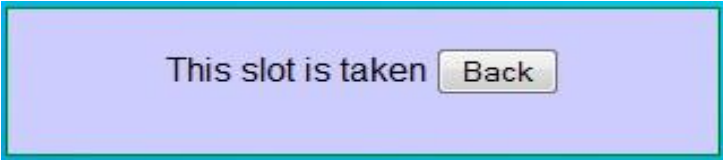


Figure 22: Notification On Taken Slot

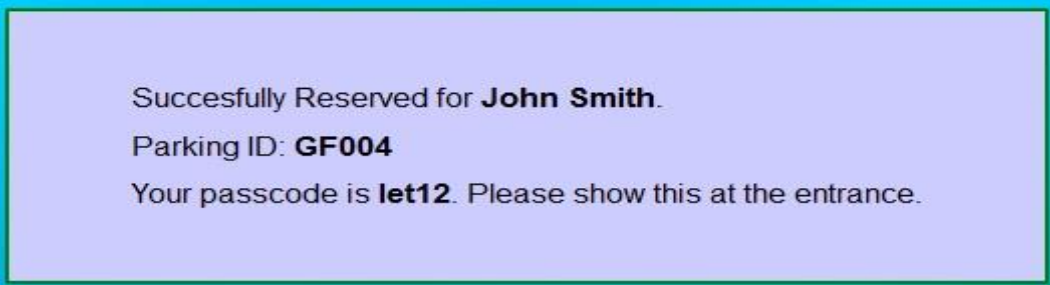


Figure 23: Reservation Slot Confirmation

Reservation Form

Basic Information

Name: Car No:

Park ID: GF007 Date:

Time (From): Time (To):

Passcode:

Payment:

Payment Method: Paypal Credit Card

Bank :

Others (Bank):

Account No:

Credit Card No:

I have read the Terms and Condition

Figure 24: Reservation Form

Payment Not Done.

Please read the Terms and Condition.

Reservation unsuccessful.

Figure 25: Invalid User's Input



Figure 26: Notification on Gate Open for Checking In



Figure 27: Notification for Checking Out