Personalized Car Parking System

By

Chai Chin Yee

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

In partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONS) INFORMATION SYSTEMS
ENGINEERING

Faculty of Information and Communication Technology

(Kampar Campus)

MAY 2020

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 Date: ____9/9/2020_____   **Date**: ____9/9/2020

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DECLARATION OF ORIGINALITY

I declare that this report entitled "**Personalized Car Parking System**" is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

Signature : _____

Name : _____CHAI CHIN YEE_____

Date : _____ 9/9/2020_____

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ACKNOWLEDGEMENTS

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Finally, I must say thanks to my parents and my family for their love, support and continuous encouragement throughout the course.

ABSTRACT

As the number of vehicles start to outnumber parking space in major city and limitation of existing smart parking system, drivers with special need getting more difficult to find car parking space based on their requirements. This project is a mobile application for showing location of car parking space in parking facility. It will provide user location of parking space, information of parking facility and current availability of parking as well. User able to filter and view different types of parking spaces such as parking for disabled and ladies' parking space. Since some feature of existing smart parking technology is well suited for this project, it is therefore implemented in the project. From the design point of view, user interface are designed to have simple, clean structure and easy to learn instruction to guide user. This project will minimize user interaction to application as the target user are driver who unable to perform interaction activity by maximize automation of functionality. The filter car parking focus on matching the requirement entered by user and display filtered parking space to them. Since internet connection in closed parking facility are usually low, offline database are implemented in this application.

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LIST OF ABBREVIATIONS

PGIS   Parking Guidance and Information System

GPS   Global Positioning System

RFID   Radio Frequency Identification

WAP   Wireless Application Protocol

PDA   Personal Digital Assistants

CCTV   Closed-circuit television

COINS   Car Park Occupancy Information System

AI   Artificial Intelligence

HOG   Histogram of Oriented Gradients

CNN   Convolutional Neural Network

R-CNN   Regional-Based Convolutional Neural Network

YOLO   You Only Look Once

ID   Identification

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1.1 Problem Statement and Motivation

As the evolution of technology and economy being pushed rapidly from the past decade until now and increase of population around the world, there are new IT product or innovation introduced in every few minutes. Every machine that have the potential to improve its functionality and usability commonly using the solution by combining machine technology and information technology together in order to explore larger range of product functionality and overcome current limitation. However, the quantity of product and the space to accommodate the product did not developed equally. This led to innovation to face problem cause by the situation stated above.

Total number of 28,181,203 units of vehicles; 13,288,797 cars and 12,933,042 motorcycles registered recorded on road in Malaysia on June 30, 2017 (Lee 2017). Furthermore, according to trend of Malaysian purchase ability, the using vehicles is projected to increase 1.4 times to 31 million by 2030 (Aris 2018). Based on number of vehicles recorded currently and its increasing trend, the current public and private car park facilities become insufficient to sustain number of vehicles on road.

Numbers of problem caused by large number of vehicles on road including traffic jam, accident and difficult to find parking space.

Finding parking space is always pain in the neck to driver especially in major city and in closed space parking such as parking space in shopping mall because of excessive number of vehicles compared to number of parking space. Driver may take around an hour to find a parking space during peak hour. Besides, this bring more challenge to those who have special needs such as disabled to find parking space for disabled.

Various solution have been attempt to face problems rise by excessive number of vehicles such as smart parking system and empty parking navigation system. Technology of object detection and video image processing algorithm (Bong et al. 2008) commonly used to detect empty parking space for user. However, there is no existing system or application have feature to take care of users with special requirements and only few similar mobile applications introduced in Malaysia. Finding a normal parking space may

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difficult but finding a parking space with special requirement will be much more challenging to drivers.

Besides existing parking indicator system mostly depends on internet connection. Those system will unable to function when entered closed parking space such as parking lot in shopping mall which there is very poor in internet connection.

Based on the problems of drivers having hard time finding parking space and limitation of existing system, an innovation to tackle its weakness is introduce in this project. In this project a mobile application will be developed that provide location of car parking space that matches the requirement stated by user. User will be able to change their requirements and preferences based on their needs. Rather than only showing all car parking space, this project will focus on give convenient to drivers who have their own preference on parking space.

1.2 Background and motivation

The supporting technology to guide driver to desired parking space are smart parking technology. Smart parking technology are invented decades ago to help drivers to find or guide them to an available parking space and keeps on evolving until now. Currently there are two major categories of smart parking system, one is mechanical way and another is programmable way. Mechanical way mostly can be called as automated parking as users hand over their vehicles to the machine and it will handle the rest of process including parking to empty space and return vehicle.

Figure 1.1

While programmable way having larger area of variety from website, computer software, AI to mobile application. Although smart parking technology can have many different of forms, the ultimate goals of smart parking system are still providing convenience to driver. Based on previous invention, this project is decided to develop in programmable way to match current well-developed smart phone era.

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1.3 Project Objective

The primary objective of this project is to improve existing smart parking system by develop a mobile application that provides location of parking space in parking facilities based in the requirements of user. The application will able to match criteria of user and provide accurate result such as user enter Ladies' parking space, the system will identify the existence of particular parking in that closed parking facility and provide result as location of parking space.

Sub-objective such as application will able to provide result mixed criteria provided. For example, user enter Ladies' parking space and close to elevator the application will match and provide parking space which meet both criteria. Besides, this application will able to perform its main functionality without internet connection.

Other sub-objective will be this mobile application is provide flexibility to parking space owner to change the parking space details and manage user behavior without totally depending from developer.

1.4 Approach achieved

Functional mobile application can act as potable platform to connect all other functionality of this project since smart phone is common and easy to carry for user who is in the vehicles. Simple user interface to enable user to access functionality of this mobile application while the interface-user interaction is minimized to reduce the procedure to return result to user. The parking facility structure are obtained from parking facility floor plan, the types of parking space and location are recorded stored in different array form for easy management.

Database that connect to application will be configured to stored necessary data such as user information, parking space data, and parking space condition data. The data can be preloaded before user go offline and still able to view and update the parking space condition during offline, the application will update the database once user back to online.

An algorithm are developed to match parking space filter criteria to parking space condition stored database to provide result by highlight location in 2D floor plan picture. Besides another algorithm will be developed to match mixed criteria user entered. For example, ladies parking and close to parking space entrance. The 2D parking space floor plan will keep update the condition of parking space between occupied and empty once any user update the parking space condition. User can report other user who did not follow the parking rules such as check in at wrong sparking space and irresponsible parking behavior.

Users in this program are separated into two roles, drivers and parking facility owner. Drivers are given functionalities state above while parking facility owner are authorized with more functionalities such as update parking space information for example, change Disabled parking space to ladies parking space. Other than that, parking facility owner also provided function to view reports and option to ban user to continue using the application after receiving excessive report.

Last and not least, the user interface have login function to let user create account to save their information and data for easy access and convenient data transfer as user changing device. Besides login function enable program to separate user roles into driver and parking space owner. These functionality are connected together through application user interface.

1.5 Impact, Significance and Contribution

With this mobile application, driver no longer need to wander around in parking lot searching for desired parking space. In terms of environment friendly, air pollution can be greatly reduced as vehicle emission in the air is decreased. User can save their time as they will only need to open application in the smart phone and see the location of parking space with just few seconds. Besides cost of vehicle fuel can be reduced as redundant travel distance no longer existed. The traffic caused by drivers drive slowly to search available car park will also be eliminated because they already know where the available car park are.

Moreover, this application can be a much less costly method compared to existing system using many hardware such as monitor and digital signboard. This application can easy to reach as most of the people now have smartphone in order to use this mobile application.

2.1 Existing Similar Systems

"Smart parking system used around the world can be categorize into five major categories which are namely, PGIS, transit based information system, smart payment system, E-parking and automated parking."(Idris et al. 2009). Knowledge and method used in these system helps in understanding the ways to solve difficulty in finding parking space.

PGIS are used by many developed country such as China. It provides information which assist driver decision making process in order to reach their destination location and navigate them to location of unoccupied parking space. PGIS is used and covered in major cities stated provide convenient in helping drivers shorten their travel time and distance to unoccupied parking space by provide information of current parking space condition through electronic facility such as digital board. Besides digital board display arrows as a brief direction guidance to drivers. By utilizing GPS for vehicle detection, mobile phone can be used as navigation guidance. GPS will first detect current location of driver then a parking layout that contain parking space condition are send to driver.

Figure 2.1 PGIS Implementation

Transit based information system, TBIS also used by many development country such as Germany and France which is similar to PGIS that provide information aids driver's decision making and direction guidance (Shaheen et al. 2005). The different between TBIS and PGIS is TBIS provide updated information of condition of each supported facility and public transportation such as traffic condition. User can plan in advance before getting involved in heavy traffic. This smart parking system successfully increase public transport revenue as it recommend user to use public transport when heavy traffic occur.

Smart Payment System implemented in countries such as Finland, Italy, London, United States and Malaysia. This system overcome problems of drivers when they need to pay for parking fee, they have to find the payment kiosk in order to do payment. User can do payment through associated mobile application by deducting the credit of user account. RFID technology also included in this system to make payment more convenient, user's credit will be deducted automatically when vehicles pass by the RFID scanner (Shim et al. 2006) (Rieback et al. 2006).

Figure 2.2 Sunway Smart Parking System with Smart Payment

E-parking system introduce parking reservation feature to user by SMS, WAP and PDAs to make parking reservation request. However, the reservation made can be accepted or rejected by the provider.

Automated parking is a combination of machine technology and information technology which is computer controlled mechanism allow user drive their vehicles into the machine bay and the machine will lock and place vehicle to allocated space automatically (Li et al. 2017). This system eliminates the times and effort of driver to search available parking space and fully utilize of space.

Figure 2.3 Automated parking

Video image processing is the technology to analyze every frame captured by cameras then differentiate whether the parking space are occupied by comparing subsequent video frames. For example, video image processor recognize empty parking space as background a car are then parked into that particular parking space, video image processor detect the change from original background and identify that particular parking space are occupied. In detecting vehicle condition, CCTV cameras in closed parking facilities are used to capture video image which is cost-effective as video image come from existing CCTV cameras (Hampapur et al. 2005). The functionality of video image processing decrease the work of management Advantage of video image processing are

availability of hardware as most of the closed parking facilities surveillance systems have CCTV camera. The figure below show COINS using video processing to detect available parking spaces (Bong et al. 2008).
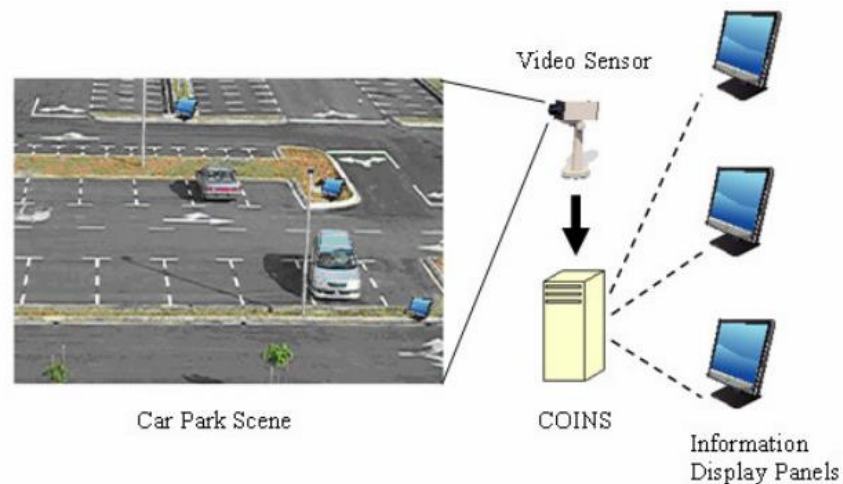

Figure 2.4 COINS

Object detection technology are also used to detect available parking space using with Mask R-CNN and Python. Object detection also using video captured from cameras to tell the parking space availability (Hampapur et al. 2005). The difference between video image processing and object detection are program in object detection designed to first identify parking space in an image, then the program to recognize vehicles by different approach used in AI such as HOG, CNN (Polprasert et al. 2019), Mask R-CNN, Faster R-CNN, OpenCV (Crisostomo et al. 2019) and YOLO. Finally, the program filter out parking space containing vehicles.
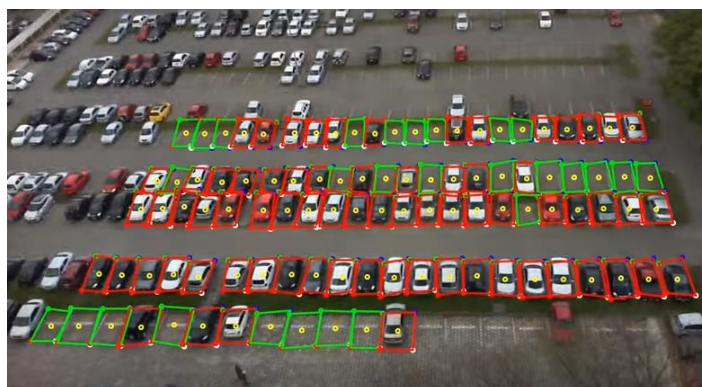
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Figure 2.5 Object Detection

2.2 Existing Mobile Applications at Google Play

Application Name	Penang Smart Parking	Smart Parking	ParkEasy
Reviews from Google Play Store	2.2/5	1.2/5	4.3/5
Region	Pulau Penang, Malaysia	Most of the city around the world	IOI City Mall - VIP, associated Tesco and GSC in Malaysia
Functions and Features	1. Buy monthly pass to replace parking coupon, eliminates the physical parking coupons. 2. Search and show empty parking space. 3. Pay summon for vehicle. 4. Detect user current parking zone. 5. Extend parking duration. 6. Show number of available parking space in that particular parking lot.	1. Live information of parking space condition. 2. Find car parking based on user current location or address search. 3. Turn by turn directions to user selected parking. 4. Filter parking options by type (On-street or Off-street). 5. Show other transport alternatives to destination.	1. Show number of available parking space in particular floor in closed parking facilities. 2. Enable user to reserve parking space in advance. 3. Show location of served parking space. 4. Payment made through online.
Strength	1. Eliminates	1. Real-time updates	1. Availability of

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	physical parking coupons, environment friendly. 2. Pay summon through online, save user time to go government department to pay summon. 3. User able to view and choose alternative parking option, high flexibility of application. 4. Decreased vehicle air emission, environment friendly.	for parking space availability, notify user parking become occupied before user reach location. 2. User able to configure search result by filter feature. 3. Navigation to selected parking location, assist user and avoid user to travel extra distance. 4. Auto-search for available parking space near user current location, user not required to search manually every time. 5. Show alternative available parking space to user, high flexibility of application to match user need.	parking space is guaranteed as user can reserve parking space in advance. 2. Show location of parking space to user and user only need to follow directory given in closed parking facility, travel distance and time saved. 3. User time saved as parking payment is made online; user no longer require go to payment kiosk before leaving. 4. Simple interface and instruction. 5. Less travel means less air pollution, environment friendly.
Weakness	1. Limited region of coverage. Low usability and flexibility. 2. Does not show exact location of available parking space.	1. Even with real-time updates, the accuracy of updates are very low in feedbacks of many users. 2. Navigation feature may unavailable for	1. Only available in few closed parking facilities. Low flexibility and usability. 2. No directed navigation feature to guide, user have to

	3. Parking space not updated in real-time, parking space may become unavailable become user reach. 4. Poor user interface and functionality, rely on Google maps.	unexplained reason. 3. Location search are not accurate for most of the time. 4. Most of the functions and features are unusable, main reason of low review.	depend on themselves to follow directory in parking lot.

Table 2.1

2.3 Inspiration from Existing Application and System

After attempt the applications that have been selected from Google Play Store and reviewing the existing system, here are some inspirations that can get from them in order to be add on and improve in the application development later on.

Current existing application and system reviewed only focus on provide normal parking space to normal driver but there are different types of drivers and parking spaces such as disabled parking for disabled drivers, women's parking space implemented in Germany, China, South Korea and Indonesia which is established in more visible spots to reduce the chance of sexual attacks, entrance parking space for truck to load and unload cargo and other criteria such as parking near elevator, entrance or payment kiosk. This application will implement algorithm to process to provide result matching user requirement and this feature is the main focus throughout whole project.

Moreover, based on user review on mobile application, a clean, simple and easy to learn user interface are more preferred to most of the users rather than complex user interface with many functionality. The application should mainly focus on its primary function which is process and show useful information to user such as number of available parking spaces, location of available parking space, direction to parking space. Other than specification or filter and necessary information entered by user, the remaining functionality of application should be designed working automatically without user involvement to save user time.

Other than user interface, another important factors should give more attention will be the accuracy and update rates of information. The usability and functionality of applications are greatly depending in these factor. The information provided by application such as available parking space will become meaningless if it is not accurate, suitable method to detect empty parking spaces that provide both most accurate result and economic should be selected. The update rates of information are also important as user depend on information provided by this application and parking space become unavailable before user reach is the most undesired situation happen to user.

2.4 Comparison of Existing Application and Proposed Application

Name	Penang Smart Parking	Smart Parking	ParkEasy	Fukurou
Region	Open	Open	Closed	Both
Live Information	No	Yes	Yes	Yes
Show Parking Space Condition	No	Yes	Yes	Yes
Navigation	No	Yes	Yes	No
Parking Space Type Filter	No	No	No	Yes
E-Payment	Yes	No	Yes	No
Parking Location	No	Yes	Yes	Yes
Offline Information	No	No	No	Yes

Table 2.2

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Table 2.2 show proposed application (Fukurou) will focus on overcome function limitation of existing application after review and compare functionality and user feedbacks.

Chapter 3: System Design

This section explains the detailed design of the proposed system and algorithm in order to achieve the project objectives. In this project, application are planned to implement more on closed parking facilities.

3.1 Database Design

Necessary information of parking space in parking facilities such as parking space location, parking space type and parking space condition for example parking space near to entrance can be obtained from facility's floor plan. These necessary information are stored in database system for application process later on. Different types of database system are used to handle different types of data to be process.

Firebase database is used to stored user account information and their criteria of parking space search. Authentication feature in firebase provides user login through e-mail and Facebook. Firebase also provides storage facility. It can store and retrieve content like images, videos and audio directly from client SDK in this case user information and usage are recorded to update the data in database as well as retrieve and show to user. Uploading and downloading process is done in the background. Data stores are safe and the only authorized user can access it.

To have higher updates rates of parking space information, database in firebase is a cloud-based database and does not need SQL-based queries to store and fetch data. Database is highly reliable thus even if connection is lost, data is maintained. With cloud-based database, the application can provide real-time information to user.
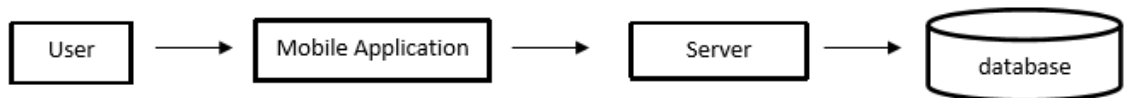

Figure 3.1 Cloud-based Block Diagram

Due to weak signal in closed parking facilities, user cannot obtain real-time parking information all the time. As firebase support offline operation. Firebase enable user to preload data before offline, user still able to perform parking space details view

and update parking space and submit report as well. Synchronization will be done once user go online and database will be updated as well. Specific parking space condition information such as disabled and women's parking. The parking space condition data such as available and unavailable parking are data before user goes offline.

As the application separate user into driver and parking facility owner role, login function are implemented to give identity to each user. User can create and login using the application while parking facility owner accounts are created by developer to authorize for high level functions. User can edit their information anytime in the application.

The parking space information are received from Firebase and load it into arrays of object class called Parking Description containing function needed such as get, set and constructor. These array are stored in application, so when user goes offline the application still able to view the parking space information. Every time user update parking space information for example, user check in to a parking space or user submit report to the database during offline, the application will hold the command and execute it once application gain internet access.

The 2D parking space layout picture are connected to real time database, so the application will constantly update the 2D layout picture every time there is a data change in connected database. The parking space condition, type or filter is show in different colour in the 2D parking space layout picture to provide clear and simple view to user.
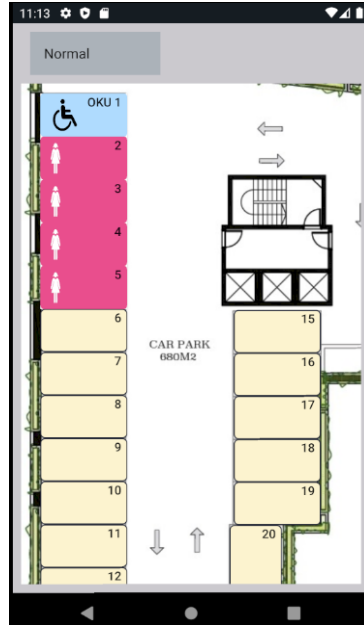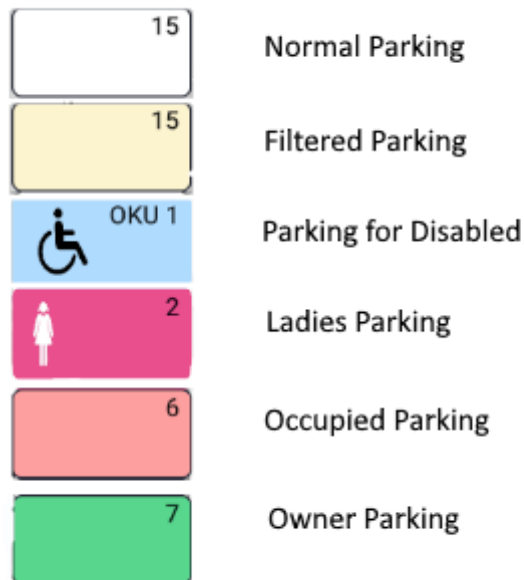
Figure 3.2 Show Parking Condition

Figure 3.3 Different type of layout view

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3.2 Parking Database and Information Management

All parking space information retrieved from parking facilities are stored in the form of arrays for user view and filter algorithm later on. Information of parking space such as location and condition are stored in corresponding arrays as well. Array method provides easy management and configuration of data, as system can easily allocate specific parking space array to updates parking space condition and display function will have to allocate specific parking space array as well to retrieve data in order to show graphical view to user.

3.3 Application Function Development

Filter function are given to user in the form of options such as Ladies, Disabled and Normal parking space type or user can choose to mix filter like Disabled and close to Elevator. So user can use this function by just few clicking in application rather than typing for filter. The application will retrieve user input and match the requirement in the database then show to user in the 2D parking space layout picture as highlighted with light yellow colour.

View parking description function is trigger when user click on specific parking space. Information of parking space are show to user in application by popup dialog. The information are get from array containing data retrieved from firebase. The application will check if the parking space is empty then prompt user to check in, if user is the one check in at that parking space then prompt user to check out or the parking space is occupied by other user then give user option to report if applicable. After user check in a parking space then application will prompt user to do check in verification by enter the parking space as confirmation to avoid user check in at wrong parking space.

More functionalities are included in parking facility owner account. Once user login, the application will identify the user role. Design layout function allow parking space owner to modify the parking space layout using mobile application interface. View report function are also included in parking facility owner account, user can view report

submitted and have the option to ban the reported user. The banned user can no longer able to login to the application.

3.4 Incremental Development

The prototype of application will be tested by target user, feedback of user after attempts to use this application are reviewed. System and design improvement will be implemented based on user feedback. Versions of prototype will be developed, review and improve before actual launch of application.

3.5 User Interface

User interface will develop using Android Studio which is an official Integrated Development Environment, IDE for Android application development.

Compared to Eclipse which also computer software to develop Android application, Android Studio have much more updated and user-friendly feature as it is open source for everyone to use. Android Studio updated frequently to become better and add more feature with user feedback around the world this is the reason why Eclipse seems more outdated, have less feature and hardly keep up with the needs of developers now. Android Studio have its community for developers to discuss and import sample code giving developers more resource for their programs. Besides Android Studio use Gradle Integration build system which support multi-language development and many performance optimizations while Eclipse using Apache which is a very robust build system (Rajput, 2015). Due to high amount of RAM space and CPU speed are required for emulation, failed to meet the requirement may cause crash and program not responding, Android Studio also provides higher system stability because it have many bugs fixed and performance optimization compared to Eclipse. Although both Android Studio and Eclipse provides Drag and Drop feature in user interface design, Android Studio gives more design options and smoother control over the panel.

After reviewing both Android application development program, Android Studio are more outstanding in overall aspect compared to Eclipse. Android Studio are chosen for this project. All coding to connect all functionalities and database are coded in Android Studio mostly in Java language. User can access to functionalities provided through user interface.

3.6 User Requirement

User requirement are collected from feedbacks and comments from existing system and application, both positive and negative feedbacks and comments are analyzed and interpret into final user requirement.

Interface	- Simple and Clean
	- Better color contrast between background and content
	- Big Parking Space Layout
Functionality	- Minimal interaction between user and application
	- Easy to use / Simple

Table 3.1

3.7 Implementation Issues and Challenges

The accuracy of the application are concerned. The data and information will update continuously when user have their mobile phone connected internet but once user goes offline because of poor signal in closed parking space, the data and information shown are last captured before they go offline. The data will be synchronize and update the database once they go online again. So if a user stay offline too long the data may be not accurate. Besides parking condition such as empty or occupied are depend on user updated as system work like hotel, user park their car into the parking space and update the information in application then the system will only able to retrieve information and update the database.

Designing and assigning parking space information may be time consuming as different parking space layout are different. Object detection program can be used to detect parking space in the layout for easier information management.

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3.8 System Design

Login Function flow chart

Figure 3.4

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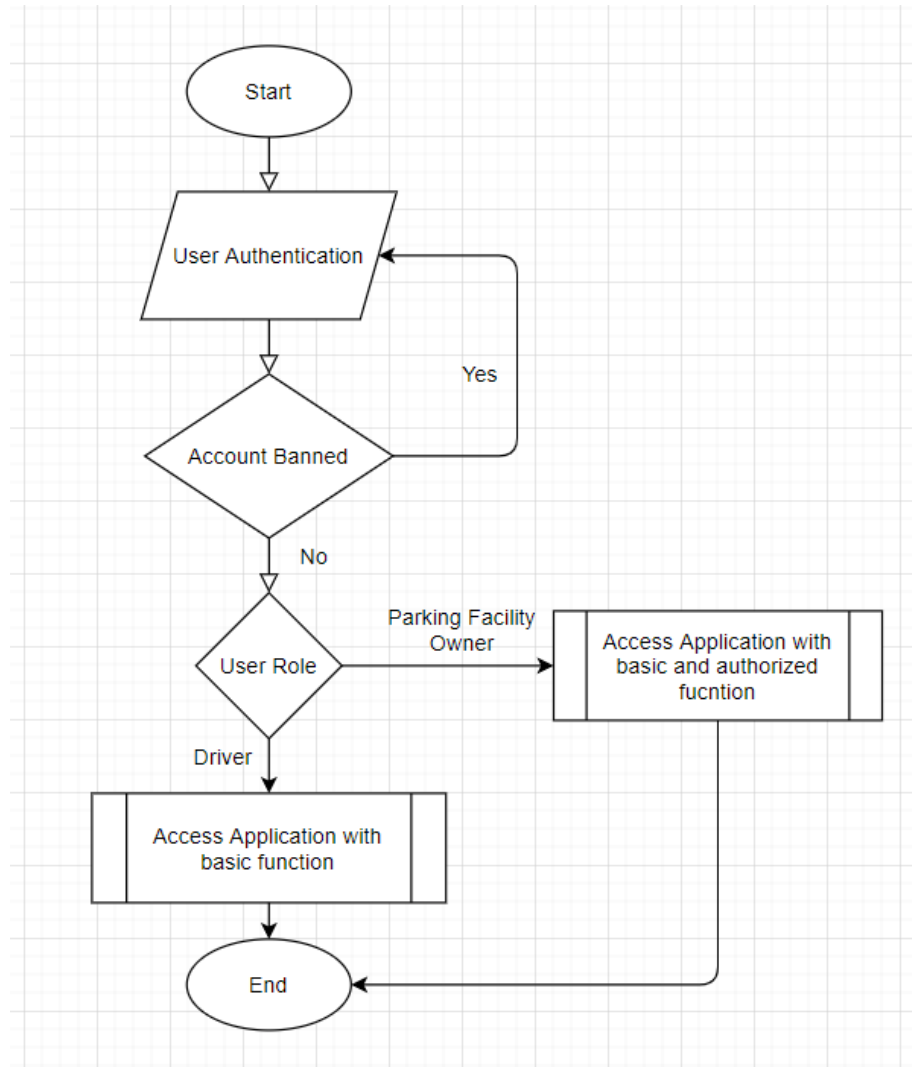
Filter Function Flow Chart
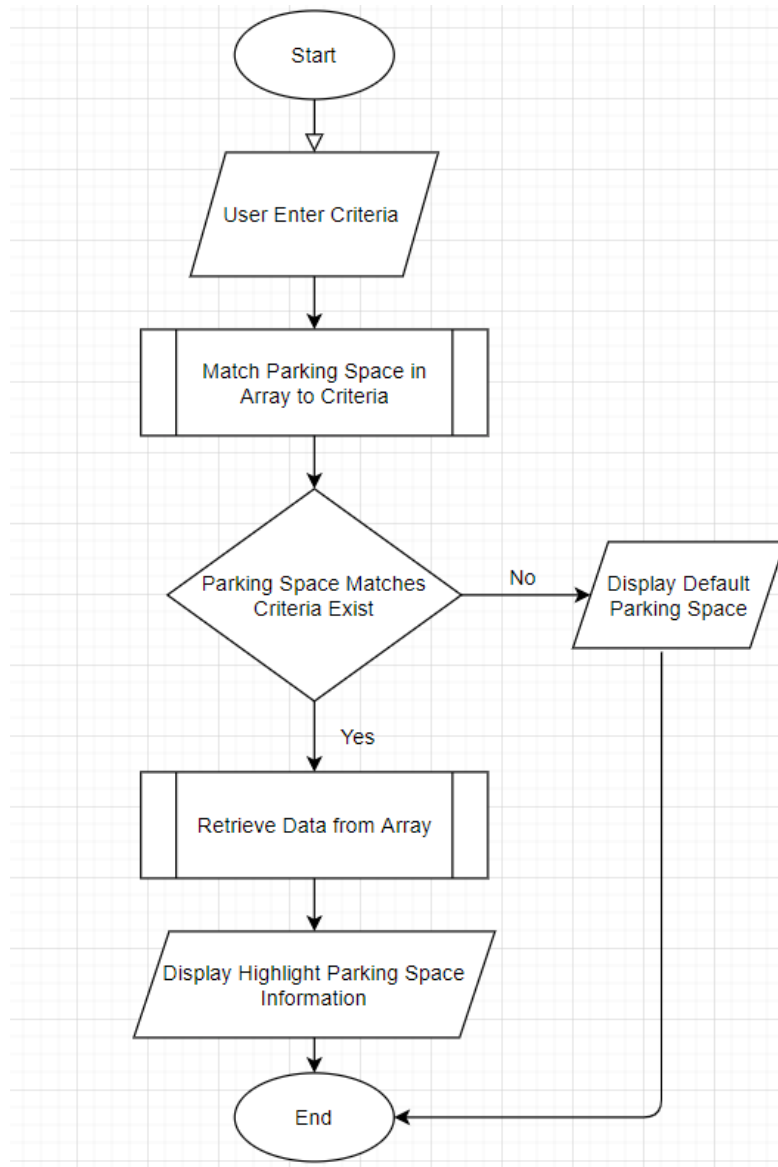
Figure 3.5

3.9 Project Timeline

Figure 3.6

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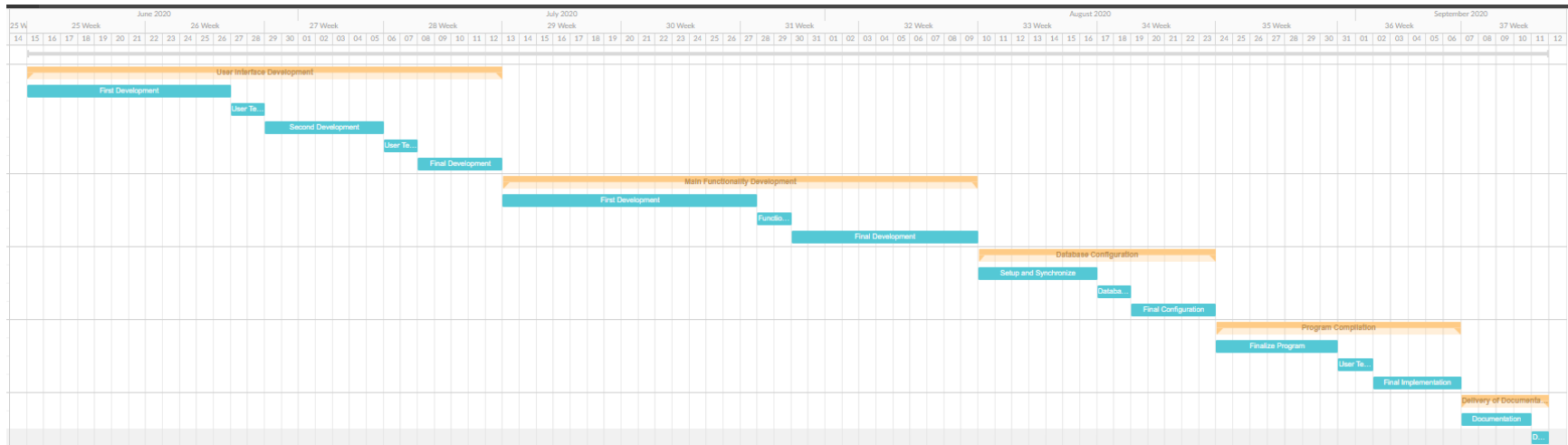
Name	Start Date	Due Date
User Interface Development	15/6/2020	12/7/2020
i. First Development	15/6/2020	26/6/2020
ii. User Testing and feedback	27/6/2020	28/6/2020
iii. Second Development	29/6/2020	5/7/2020
iv. User Testing and feedback	6/7/2020	7/7/2020
v. Final Development	8/7/2020	12/7/2020
Main Functionality Development	13/7/2020	9/8/2020
i. First Development	13/7/2020	27/7/2020
ii. Functionality Testing	28/7/2020	29/7/2020
iii. Final Development	30/7/2020	9/8/2020
Database Configuration	10/8/2020	23/8/2020
i. Setup and Synchronize	10/8/2020	16/8/2020
ii. Database testing	17/8/2020	18/8/2020
iii. Final Configuration	19/8/2020	23/8/2020
Program Compilation	24/8/2020	6/9/2020
i. Finalize Program	24/8/2020	30/8/2020
ii. User Testing and Feedback	31/8/2020	1/9/2020
iii. Final Implementation	2/9/2020	6/9/2020
Delivery of Documentation and Program	7/9/2020	11/9/2020
i. Documentation	7/9/2020	10/9/2020
ii. Delivery of Documentation and Program	11/9/2020	11/9/2020

Table 3.3

Prototype Progress (Fukurou)

Figure 4.1

The functionalities of current application development are completed. The modules are tested in different scenario and documented in this chapter.
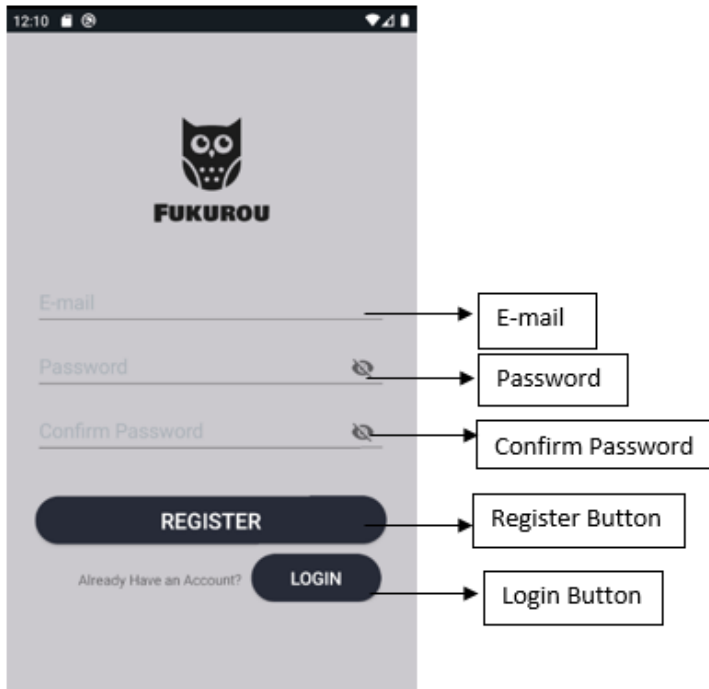
4.1 Splash Screen
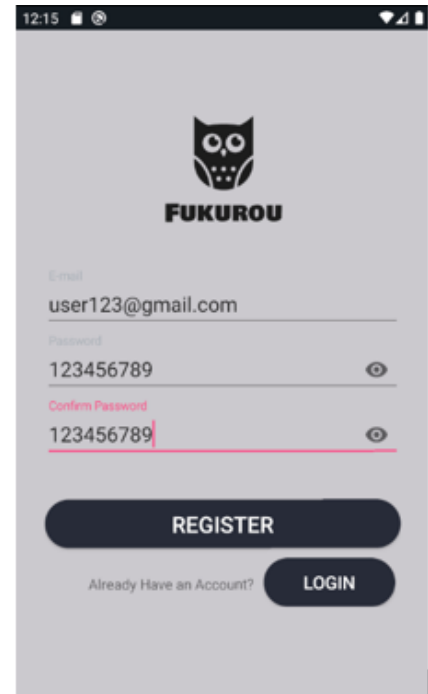

Figure 4.2

4.2 Register New Account
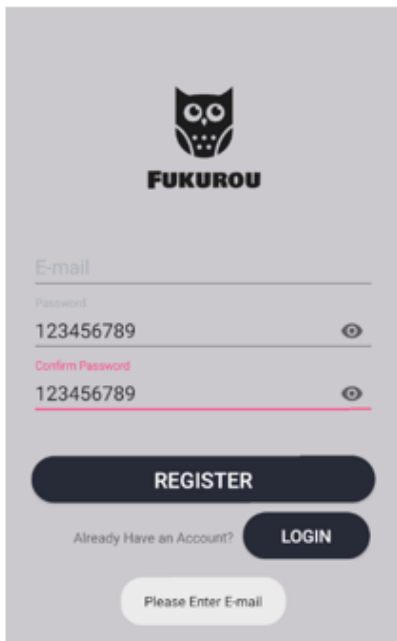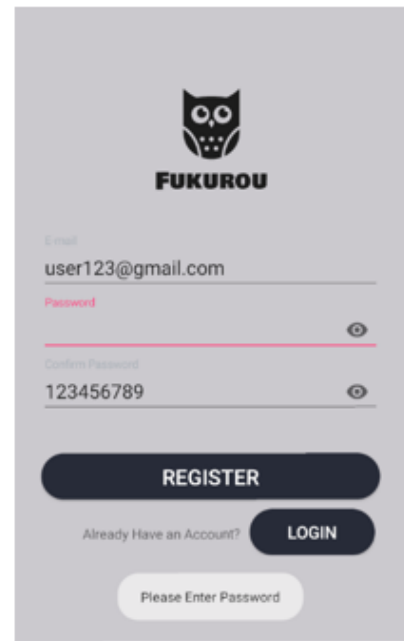

Figure 4.3

Figure 4.4

Figure 4.5

Figure 4.6

BIS (HONS) Information Systems Engineering
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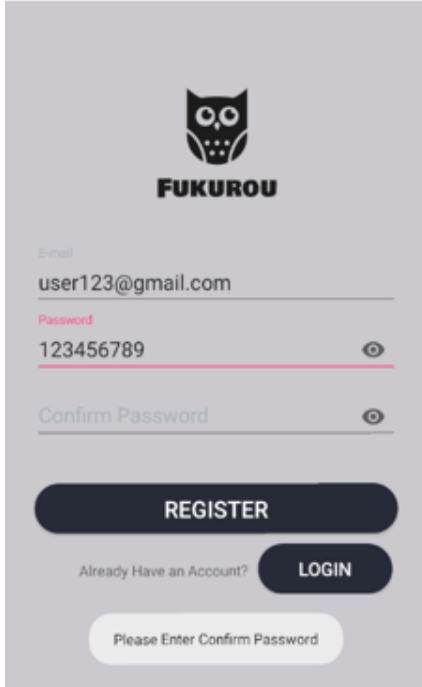
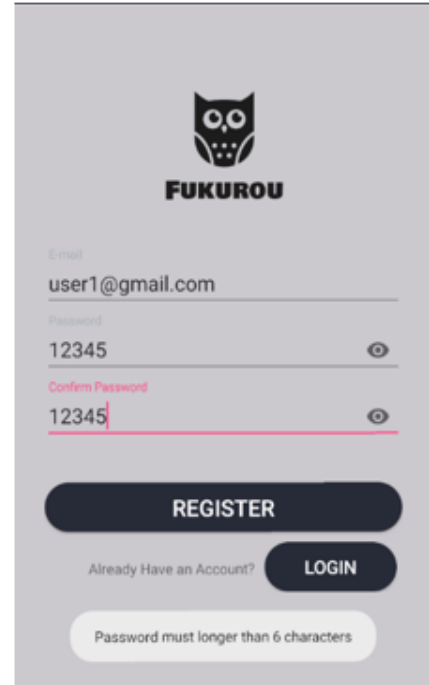Figure 4.7   Figure 4.8

After the splash screen, user are require to create an account if they don't have one. By enter e-mail address and password then click Register Button (Figure 4.4), the application will check the existing account for entered e-mail address if the e-mail address is not an existing account then application will create a new database and assign new unique ID for this account for identification in future. Input validation are included to ensure correct input from user, a popup message (Figure 4.5, 4.6, 4.7, 4.8) will show to user for each incorrect input format are submitted by user. Login Button redirect user to login function interface.

Scenario	Respond
Empty e-mail - Figure 4.5	"Please Enter E-mail"
Empty password - Figure 4.6	"Please Enter Password"
Empty password confirmation - Figure 4.7	"Please Enter Confirm Password"
Password less than 6 characters - Figure 4.8	"Password must longer than 6 characters"

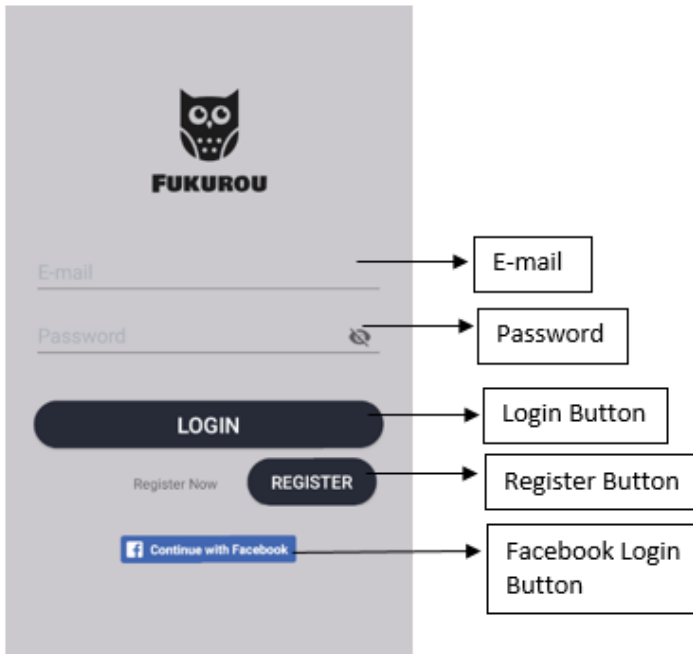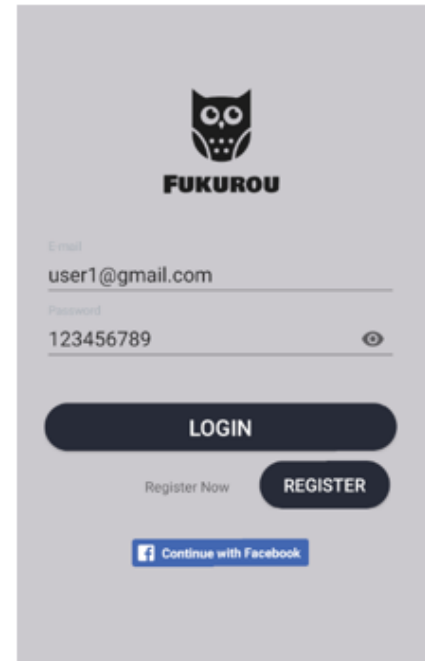Table 4.1

4.3 Login to Existing Account

Figure 4.9

Figure 4.10

Figure 4.11

Figure 4.12

BIS (HONS) Information Systems Engineering
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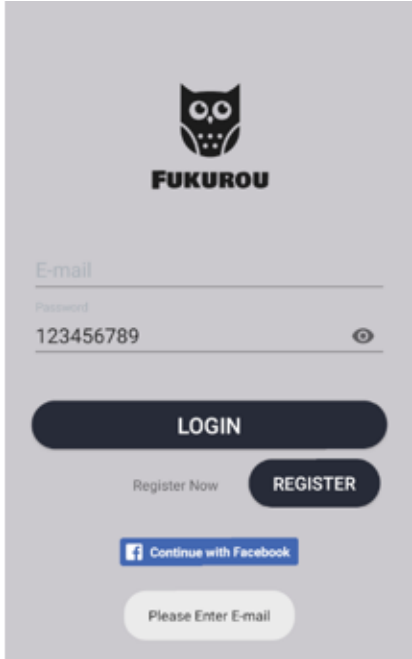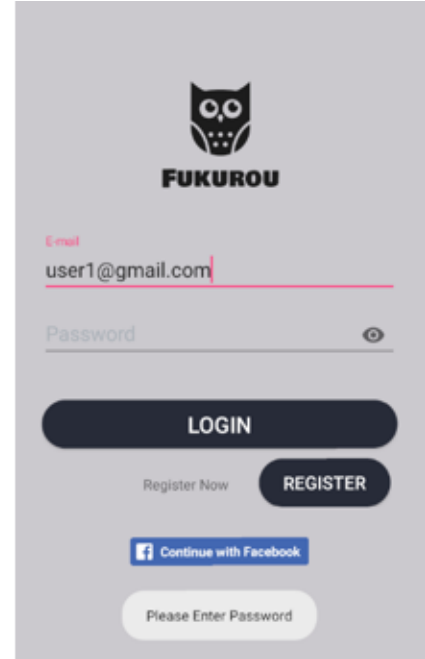
| Figure 4.13 | Figure 4.14 |

User can login to existing account in login interface. After user enter e-mail address and password then click Register Button (Figure 4.10), the application will check the existing account for entered e-mail address if there is matched account then redirect user to profile interface. User are provided login option with Facebook account, if the account is not create before then application will create a new database otherwise redirect user to profile interface. Validation are included to ensure correct user input format (Figure 4.13, Figure 4.14).

Scenario	Respond
Empty e-mail - Figure 4.13	"Please Enter E-mail"
Empty password - Figure 4.14	"Please Enter Password"

Table 4.2

4.4 Profile Management
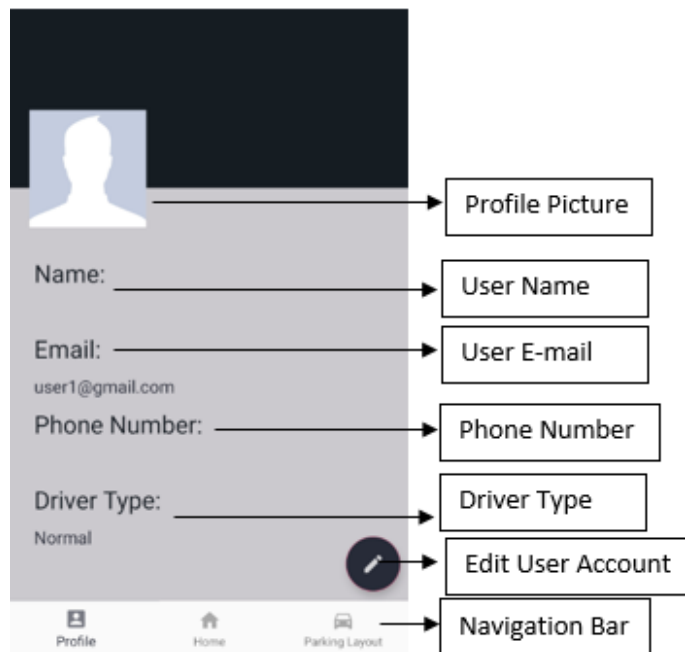
Figure 4.15
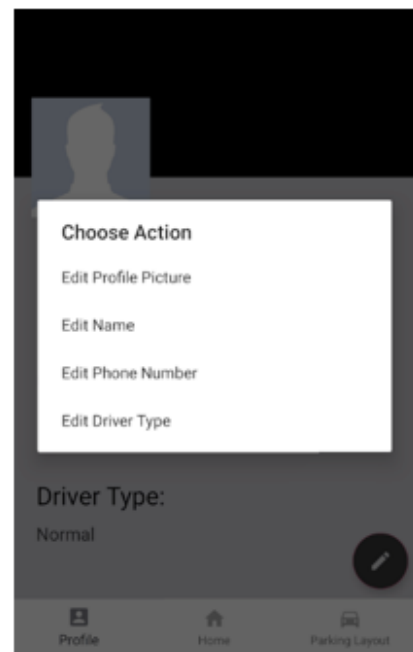
Figure 4.16

After login, user is redirect to profile interface to edit user information. User can toggle between profile, home, and parking layout interface. User name and phone number are optional while driver type is set to normal by default. The driver type will affect the graphical result of parking layout, the application will show filtered parking space to user depends on the driver type set by user.

4.5 Parking Layout
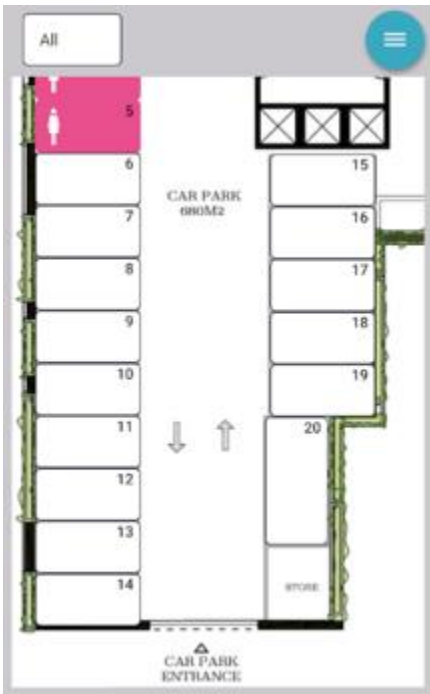
Figure 4.17
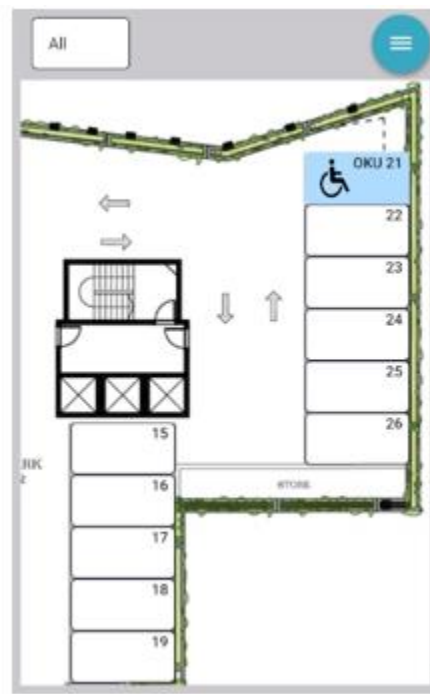
Figure 4.18
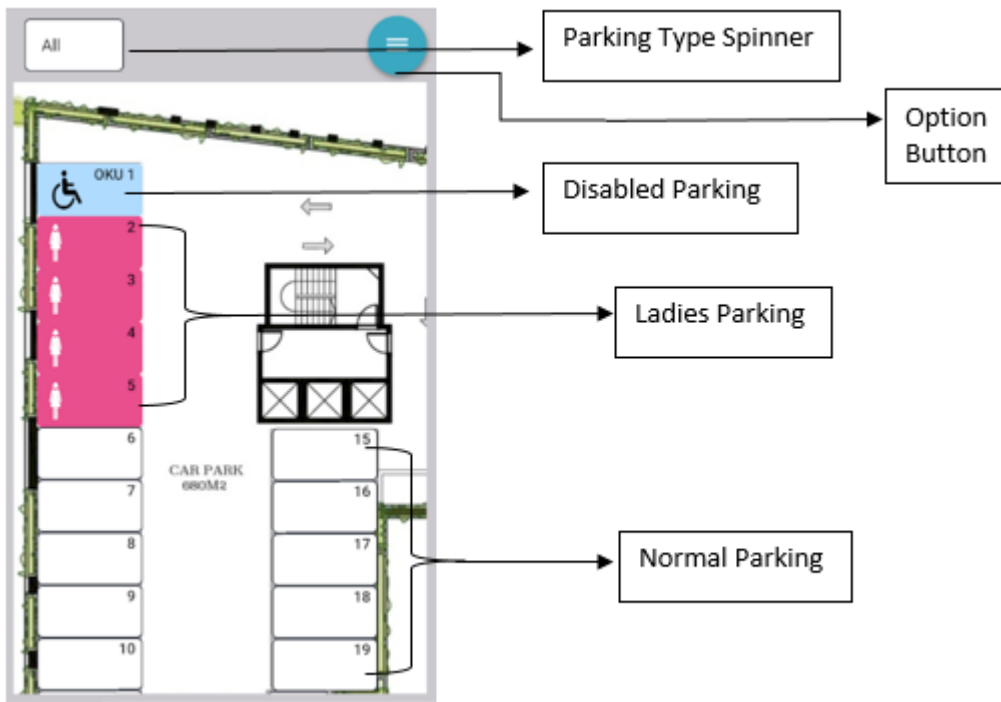
Figure 4.19

A basement parking layout of a parking facility is used to test the functionality. Different types of parking space in this parking layout are replaced with custom label and color to fit user requirement. A spinner that enable user to filter different types of parking space are designed on top of the interface. An option button are created to let user to view layout design information and exit function.

4.6 Filer Function

Figure 4.20

Figure 4.21
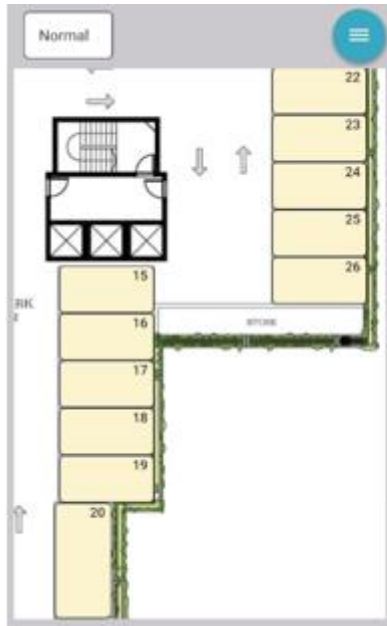
Figure 4.22

Figure 4.23

Figure 4.24

Figure 4.25

BIS (HONS) Information Systems Engineering
Faculty of Information and Communication Technology (Kampar Campus), UTAR
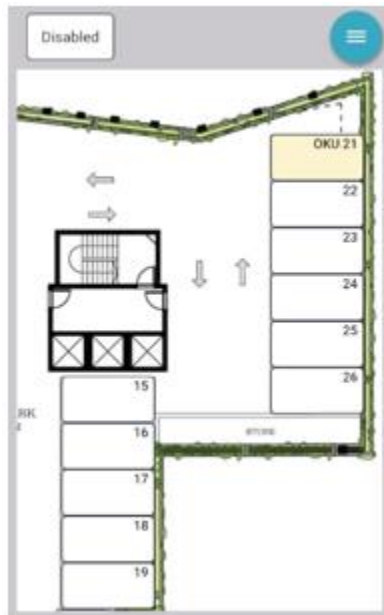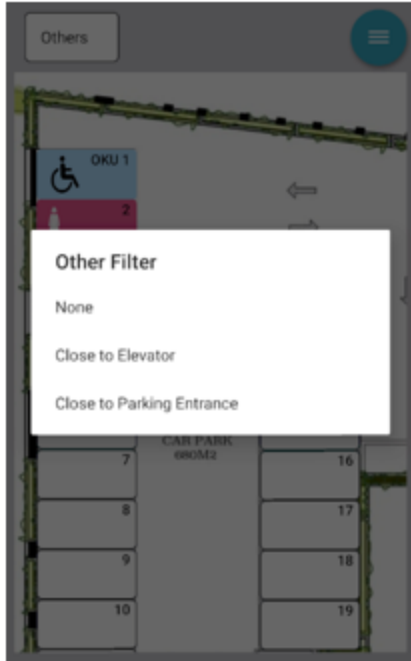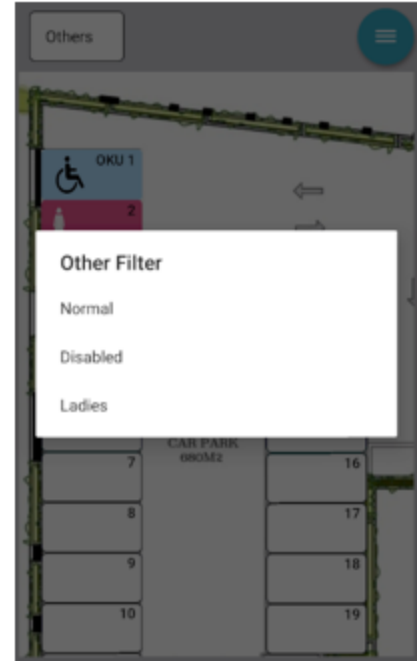
Figure 4.26

Figure 4.27

Figure 4.28

Figure 4.29

In the Parking Type Spinner contains "All", "Normal", "Disabled", "Ladies" and "Other" filter. Each filter are selected to test the filter functionality. "Other" function contains mix filter function for further filter parking space. Filtered parking space is highlighted with yellow color.

Senario	Result
All	No parking space is hightlighted (Figure 4.20)
Normal	All normal parking space is hightlighted (Figure 4.21 & 4.22)
Disabled	All disabled parking space is hightlighted (Figure 4.23 & 4.24)
Ladies	All ladies parking space is hightlighted (Figure 4.25)
Other	Close to elevator and normal parking space (Figure 4.28) Close to parking entrance and normal parking space (Figure 4.29)

Table 4.3

4.7 Parking Space Description

Figure 4.30

When click or touch the car parking space, a parking space description will pop out and show the information about that particular parking space as shown in Figure 4.30.

4.8 Check in Parking Space and verification
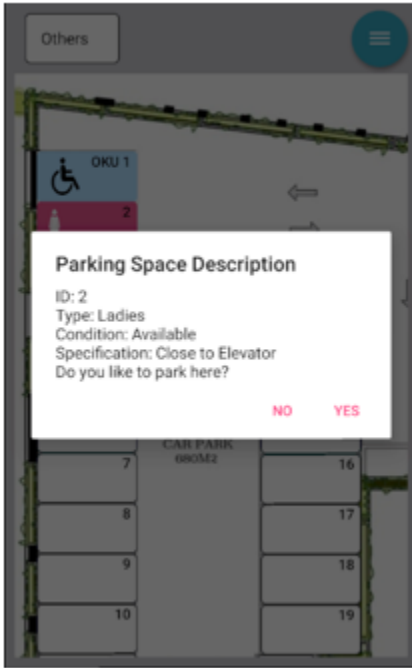
Figure 4.31
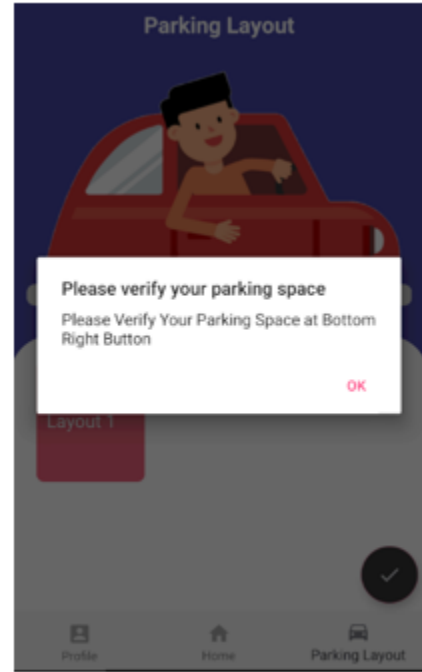
Figure 4.32

Figure 4.33

Figure 4.34

BIS (HONS) Information Systems Engineering
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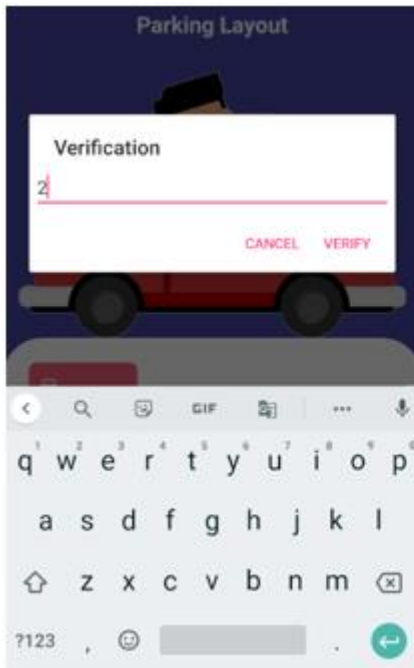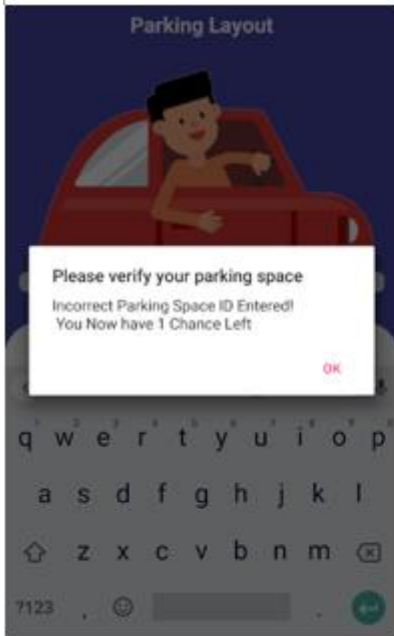
Figure 3.35

Figure 3.36

When "Yes" is selected in parking space description (Figure 4.31), the application will lead user to perform verification to ensure user check in at correct parking space (Figure 4.32 & 4.33). If user enter correct parking space ID then the particular parking space will be labelled with green color (Figure 4.34) indicating is it parked and no longer selectable while user enter incorrect input twice then application will check out user from parking space that check in early.

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4.9 Report and Ban User Function
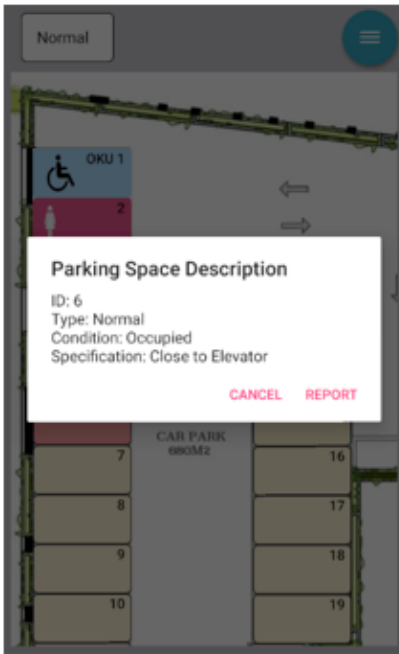
Figure 4.37

Figure 4.38

Figure 4.39

Figure 4.40

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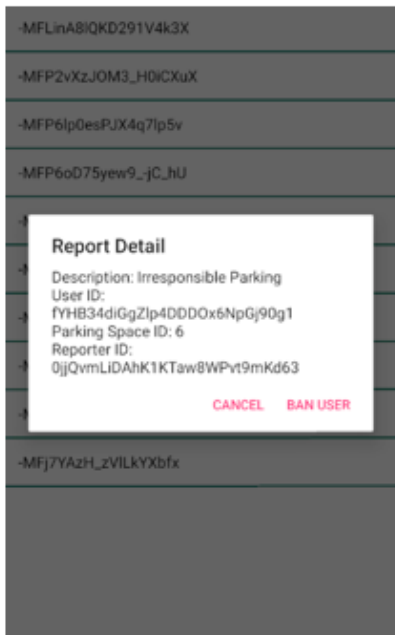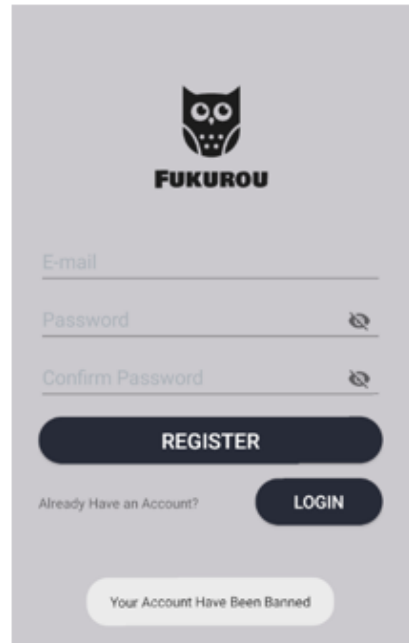
Figure	Description
4.37	User issue report
4.38	Parking Facility Owner view reports made by users
4.39	Parking Facility Owner view details and ban reported user
4.40	Banned user no longer able to login their account

Table 4.4

4.10 Design Layout Function
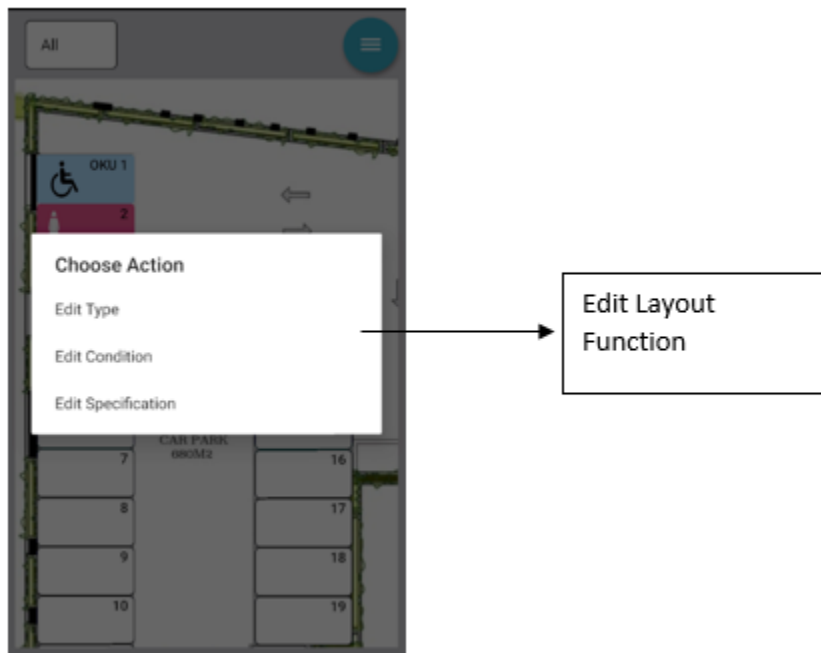
Figure 4.41

Parking facility owner account are provided a similar layout for them to update parking space design. The change done by parking facility owner will update the parking space design at driver side as well. Design layout function will have filter function as well to stimulate driver usage scenario.

4.11 User Role Identification
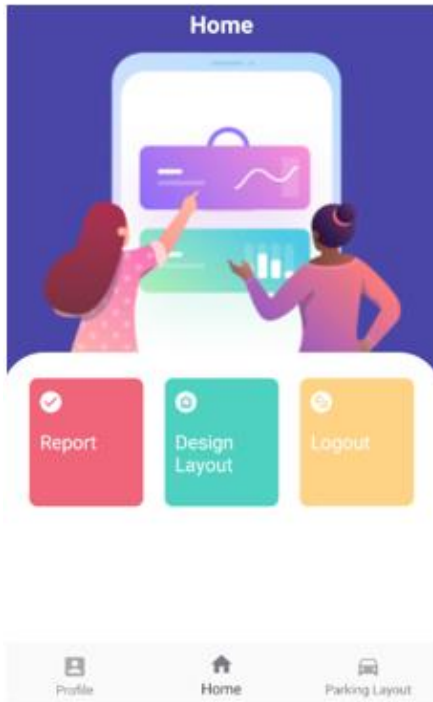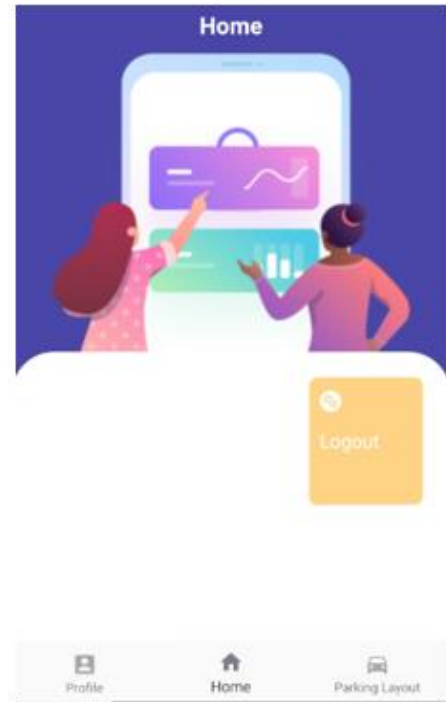
<table>
<tr><td align="center">Figure 4.42</td><td align="center">Figure 4.43</td></tr>
</table>

User role are assigned by developer. When user login, application will check user role. Figure 4.42 show Parking Facility Owner account with report and design layout function. Figure 4.43 show driver account with only logout function.

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5.1 Conclusion

This project are focused on giving convenience to drivers with special requirements and also overcome existing system limitations and weakness. Functionality such as Parking space information, support both online and offline usage, parking space type filter can help drivers to find their desired parking space based on their requirements and preferences can be done in this project.

The problem of drivers with special requirements can be solved by Parking Space Filter functionality, the filtered result will display to user with just one touch. Besides, existing limitations and weakness of existing systems such as parking space location, parking space condition and parking space type can be overcome by Parking Space Description in this project, providing drivers useful and necessary information. Other than that, low availability of existing systems are also a problematic to drivers because it is not available or not functioning when drivers need it. This problem can be solve by supporting both online and offline data information to the application as some parking facilities closed, result in weak internet connection.

The functionality of this project can shorten the travel distance of driver as well as saving drivers time, lower traffic, less vehicle emission and giving driver a better driving experience; improving people's life quality.

5.2 Future Work

To improve Fukurou to be better in every aspect to assist driver in their daily life, future work can be implemented to Fukurou.

5.2.1 Navigation Function

Enable user to select parking space and application will provide direction from user current location to selected parking space. This function can assist user by act as a guidance, leading user to selected parking space without wasting time on extra travel distance.

5.2.2 Electronic Payment Function

Considering some parking space maybe need make payment in order to check in. E-payment such as Touch N Go can be included to perform transaction. Payment information data associate to E-payment service. When user paid parking fees, status will update to database as well. This function provide convenience to driver as they no longer need to switch between applications or make physical payment at payment kiosk.

5.2.3 Object Detection

Object detection can be included in Fukurou to differentiate empty or occupied parking space. The data will update database automatically and driver no longer need to check in as it update by object detection system.

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Appendix A

Poster

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Biweekly Reports

FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	Study week no.: 2
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

 Developed user interface

2. WORK TO BE DONE

Develop user profile management function and user data configuration

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3. PROBLEMS ENCOUNTERED

No problem encountered

4. SELF EVALUATION OF THE PROGRESS

User interface should be more attractive to user.

_____   _____

Supervisor's signature   Student's signature

Appendix A

FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	Study week no.: 4
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

 Developed user profile management function and user data configuration

2. WORK TO BE DONE

Create database for parking layout and link data to mobile application

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3. PROBLEMS ENCOUNTERED

No problem encountered

4. SELF EVALUATION OF THE PROGRESS

Ensure necessary data are provided by user

_____   _____

Supervisor's signature   Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	Study week no.: 6
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

Created database for parking layout and link data to mobile application

2. WORK TO BE DONE

Develop verification function after user check in a parking space

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Faculty of Information and Communication Technology (Kampar Campus), UTAR

3. PROBLEMS ENCOUNTERED No problem encountered
4. SELF EVALUATION OF THE PROGRESS   Parking layout database should be monitored to prevent any data inconsistent

_____   _____

Supervisor's signature   Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	**Study week no.: 8**
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

Developed verification function after user check in a parking space

2. WORK TO BE DONE

Develop mix filter function in parking layout

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<div style="border:1px solid black; padding:10px;">

3. PROBLEMS ENCOUNTERED

No problem encountered

</div>

<div style="border:1px solid black; padding:10px;">

4. SELF EVALUATION OF THE PROGRESS

Alternative way of verification function can be developed for user to choose

</div>

_____   _____

Supervisor's signature   Student's signature

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Appendix A

FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	Study week no.: 10
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

Develop of mix filter function in parking layout is completed

2. WORK TO BE DONE

Develop report function and authorized account functionality

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3. PROBLEMS ENCOUNTERED   No problem encountered
4. SELF EVALUATION OF THE PROGRESS   Testing of program in different scenario need to be done for any bug and correctness of result

_____   _____

Supervisor's signature   Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	**Study week no.: 12**
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

Developed report function and authorized account functionality

2. WORK TO BE DONE

Complete report and documentation (Poster and Turnitin)

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Faculty of Information and Communication Technology (Kampar Campus), UTAR

<table>
<tr><td></td></tr>
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3. PROBLEMS ENCOUNTERED

No problem encountered

4. SELF EVALUATION OF THE PROGRESS

The usability of authorized account functionality need to collect from parking facility owner for future improvement

_____   _____

Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT
(Project I / Project II)

Trimester, Year: MAY 2020	Study week no.: 14
Student Name & ID: CHAI CHIN YEE 15ACB04171	
Supervisor: Dr Mobashar Rehman	
Project Title: PERSONALIZED CAR PARKING SYSTEM	

1. WORK DONE
[Please write the details of the work done in the last fortnight.]

Completed report (Poster and Turnitin)

Discussed oral presentation schedule.

2. WORK TO BE DONE

Prepare for oral presentation and PowerPoint slide.

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3. PROBLEMS ENCOUNTERED   No problem encountered
4. SELF EVALUATION OF THE PROGRESS Contain of report need to be checked carefully.

_____   _____

Supervisor's signature   Student's signature

Turnitin Result

FYP2

5%	4%	2%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	orca.cf.ac.uk Internet Source	1%
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FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Chai Chin Yee
ID Number(s)	15ACB04171
Programme / Course	Bachelor of Information Systems (HONS) Information Systems Engineering
Title of Final Year Project	Personalized Car Parking Systems

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
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Number of individual sources listed of more than 3% similarity: _____0_____	

Parameters of originality required and limits approved by UTAR are as Follows:
  (i)   **Overall similarity index is 20% and below, and**
  (ii) **Matching of individual sources listed must be less than 3% each, and**
  (iii) **Matching texts in continuous block must not exceed 8 words**
Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

_____   _____
Signature of Supervisor   Signature of Co-Supervisor

Name: _Mobashar Rehman_____   Name: _____

Date: 09/09/2020_____   Date: _____

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UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

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Student Id	15ACB04171
Student Name	Chai Chin Yee
Supervisor Name	Dr Mobashar Rehman

TICK (√)	DOCUMENT ITEMS Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
√	Front Cover
√	Signed Report Status Declaration Form
√	Title Page
√	Signed form of the Declaration of Originality
√	Acknowledgement
√	Abstract
√	Table of Contents
√	List of Figures (if applicable)
√	List of Tables (if applicable)
N/A	List of Symbols (if applicable)
√	List of Abbreviations (if applicable)
√	Chapters / Content
√	Bibliography (or References)
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