

ONLINE CAR MECHANIC SHOP SYSTEM

BY

WONG SAI KIT

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)

JAN 2020

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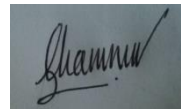
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ABSTRACT

Today, every family must have a car and will send their car for repair or regular service. However, one of the mechanic shops in Simpang Pulai, Perak, Malaysia named Pusat Servis Tayar Dan Kereta Maeng Wa still operate their business in a manual way. The shop only accepts walk-in customers, put service reminder sticker on the car windscreen to remind customers for next service due, and accept outdoor service requests by customers through phone calling. As a result, this has affected both car mechanic shop and customers. Firstly, walk-in customers may leave due to long waiting time and thus the shop lost its profits. Secondly, customer perform regular car service lately due to faded or dropped service reminder sticker and thus shop lost its profits again. Thirdly, customers need to wait longer time of the arrival of the shop for outdoor service due to the shop may not familiar of the location or the location stated by customers though phone calling is not clear. Therefore, this final year project aims to deliver an online system for the shop and its customers. Front-end mobile applications developed in Android platform and supported by back-end Amazon Web Service Elastic Compute Cloud (AWS EC2) server will be used by customers and the clerk of the shop. Ultimately, the main solutions provided by this system are service booking, service reminder, and car breakdown assistant.

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LIST OF ABBREVIATIONS

| | |
|-------------|------------------------------------|
| <i>AWS</i> | Amazon Web Service |
| <i>EC2</i> | Elastic Compute Cloud |
| <i>FYP</i> | Final Year Project |
| <i>HTTP</i> | Hypertext Transfer Protocol |
| <i>IDE</i> | Integrated Development Environment |
| <i>SDLC</i> | Software Development Life Cycle |
| <i>SMS</i> | Short Message Service |
| <i>UTAR</i> | Universiti Tunku Abdul Rahman |

1.1 Problem Statement

After taking an interview at Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulaui branch, several challenges facing by the shop have been identified.

First of all, there is a challenge of car outdoor service in terms of locating exact GPS coordinate of the car, hence help may not reach on time. The current way that their customers to request for car outdoor service is either call the shop using phone or ask for other to fetch them to the shop to bring a mechanic to the break-down location. However, this will introduce some inconveniences. Especially for merely phone calling, it may require the shop to spend more time and efforts to call back the customers again and again to confirm the correct car model, car plate number and broken-down location in case the shop cannot find the car and the customer.

Moreover, the shop is also currently facing the problem of some customers cannot wait for long queue. If long queue happened, some customers may choose not to wait their turn and leave the shop. Therefore, the shop is now losing this particular group of customers and also losing some potential profits from them at the same time.

Last but not least, the only way the shop is currently using to remind their customers for next service due is through using the marker pen to write out the next service date or mileage on the physical service reminder sticker and stick it on the car windscreen. However, this method is not reliable. Due to the car might be exposed to the sunlight for a long period and the windscreen will become extremely hot, words written on the sticker may faded or the sticker itself may not be able to stick on the windscreen anymore after some time and fall down to somewhere else. Customers may end up not sure when to perform the car service and may results in the service is performed after the stipulated date or mileage. This will not only cause some potential damage to the car, but also the shop may as well as losing some profits. Imagine that the customers service their car lately for two times, but actually they need to service their car for three times according to the stipulated next service date or mileage. In this case, the shop has earned one time lesser.

CHAPTER 1: INTRODUCTION

1.2 Background and Motivation

According to the Nielsen Global Survey of Automotive Demand in past few year of 2014, even though the car ownership in South-East Asia is quite low in which 47% of households in Philippine do not have a car and 46% of households in Indonesia do not have a car, but surprisingly Malaysia ranked as the third highest percentage i.e. 93% of car ownership in the world and 54% households having multiple car (The Start Online 2014). Recently for only the month of April in the year of 2019, car registrations in Malaysia already having an amount of 109012 (Trading Economics, n.d). Another record according to the Malaysian Vehicle Registration Data released by the Malaysia Automotive Association (MAA) showing that up to June 30, 2017, the total number of vehicles on the roads is 28,181,203 units which also near to 28.2 million units (paultan.org 2017). Below diagram showing details on how the figure actually to reach 28,181,203.

| State | Private Vehicles | | Public Service Vehicles (PSV) | Goods Vehicles | Others | Total |
|--------------------------|-------------------|-------------------|-------------------------------|------------------|----------------|-------------------|
| | Motorcycles | Cars | | | | |
| Perlis | 84,500 | 26,510 | 385 | 2,007 | 1,365 | 114,767 |
| Kedah | 954,751 | 341,197 | 7,273 | 40,710 | 20,104 | 1,364,035 |
| Penang | 1,408,528 | 1,130,601 | 9,586 | 80,254 | 26,710 | 2,655,679 |
| Perak | 1,359,771 | 772,591 | 9,534 | 75,638 | 42,708 | 2,260,242 |
| Selangor | 1,423,821 | 1,157,268 | 24,273 | 194,390 | 104,724 | 2,904,476 |
| Federal Territories | 1,863,260 | 3,987,468 | 78,752 | 268,340 | 122,509 | 6,320,329 |
| Negeri Sembilan | 557,482 | 343,007 | 4,635 | 50,160 | 7,845 | 963,129 |
| Melaka | 472,701 | 344,459 | 3,425 | 28,486 | 8,830 | 857,901 |
| Johor | 1,873,005 | 1,498,587 | 20,365 | 153,471 | 66,183 | 3,611,611 |
| Pahang | 600,470 | 392,200 | 4,310 | 45,640 | 14,663 | 1,057,283 |
| Terengganu | 393,228 | 211,124 | 2,159 | 22,172 | 6,015 | 634,698 |
| Kelantan | 549,363 | 309,663 | 3,928 | 29,689 | 7,264 | 899,907 |
| Sabah | 402,237 | 697,541 | 9,574 | 116,292 | 65,807 | 1,291,451 |
| Sarawak | 798,227 | 813,569 | 5,834 | 95,373 | 71,782 | 1,784,785 |
| Business Partner Portals | 191,698 | 1,263,012 | 1,002 | 3,122 | 2,076 | 1,460,910 |
| Total | 12,933,042 | 13,288,797 | 185,035 | 1,205,744 | 568,585 | 28,181,203 |

Figure 1.2.1: Amount of different type of vehicles in different states of Malaysia up to 30 June, 2017 (Source: <https://paultan.org/2017/10/03/vehicle-registrations-in-malaysia-hit-28-2-million-units/untitled-numbers/>)

From here we assume that almost every Malaysians are having a car nowadays. However, we must also know the fact of no matter how luxurious a car is, it is still like a human being, luxury or ordinary cars also will be broken anytime and requires to send to

CHAPTER 1: INTRODUCTION

“car hospital” which is the mechanic shop for repairing or regular maintenance. Owner can choose to send their car back to genuine service center or any other third-party car mechanic shops. However, for the case of third-party car mechanic shops in Malaysia, most of them are still operating their business in a traditional and manual way.

The first traditional and manual way is that the shop is running on first come first serve basis. We can only wait until the mechanics finish serving the customers come before us, then only the mechanics will come to serve us.

Next, after changing engine oil, or gear box oil, or performing tires services such as tires rotation, wheel balancing, and wheel alignment, the mechanics will manually write the next service due mileage on a sticker and stick it on the car windscreen to remind us to perform the particular service again when the mileage is reached.

The last part talking about how the normal mechanic shops handle the car outdoor services. We cannot predict the timing of our car that suddenly breakdown on the road due to maybe tire puncture or car cannot start. When this happened, we can search online for nearby car mechanic shops contact number and call them using our phone to come assist us. The other available option is to seek help from people around the area to fetch us to a mechanic shop and bring a mechanic from the shop to help us.

Above mentioning are so-called “outdated” practices of a local normal mechanic shop. However, some people still want to visit third-party mechanic shops may due to the following reasons or factors. According to the survey results in (Wahab, Ibrahim & Latif 2018), in the question “Reason of car users’ preference towards car maintenance”, 81.94% of respondents send their car to general workshop because of “Affordable costs”, 63.23% send their car to general workshop because of “Warranty ended/forfeited”, and 56.13% says that they will go general workshop because “Easy to discuss and get advisory services”. These perhaps are the advantages of a third-party mechanic shop to retain their customers.

| SERVICE CENTRE, N = 143 | | GENERAL W/SHOP & OTHERS, N = 155 | |
|-------------------------|--|--|--------|
| 86.71% | Maintain Warranty | Affordable costs | 81.94% |
| 81.12% | Assurance of quality & authenticity of replacement parts | Warranty ended/forfeited | 63.23% |
| 76.92% | Maintenance is recorded and easy to refer | Easy to discuss and get advisory services | 56.13% |
| 69.93% | Avoid scam/fraud | Highly skilled & knowledgeable workers | 30.97% |
| 57.34% | Cozy facilities and professional services | Assurance of quality & authenticity of replacement parts | 23.87% |
| 55.94% | Maintenance is given a warranty/additional warranty | Maintenance is recorded and easy to refer | 22.58% |
| 55.24% | Avoid additional/secondary damage | Cozy facilities and professional services | 18.71% |
| 53.15% | Free Service Benefits / Spend Vouchers | Maintenance is given a warranty/additional warranty | 18.06% |
| 48.95% | Highly skilled & knowledgeable workers | Avoid scam/fraud | 17.42% |
| 46.85% | Safe and eco-friendly maintenance | Safe and eco-friendly maintenance | 15.48% |
| 41.26% | Easy to discuss and get advisory services | Free Service Benefits / Spend Vouchers | 14.84% |
| 33.57% | Exclusive services / not offered elsewhere (courtesy car, door to door service, etc) | Avoid additional/secondary damage | 14.19% |
| 23.78% | Affordable costs | Exclusive services / not offered elsewhere (courtesy car, door to door service, etc) | 10.32% |

Figure 2: Reason of car users' preference towards car maintenance

Figure 1.2.2: Reasons of car users in choosing service center or general work shop

(Source: Wahab, Ibrahim & Latif 2018)

1.3 Objectives

1. To study the challenges facing by Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch.
2. To provide solution in terms of incorporation of GPS coordinate to locate precisely the customers of Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch that requesting for car outdoor services.
3. To provide solution in terms of service booking to help customers of Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch to lower down the rate of long waiting time.
4. To provide solution in terms of service reminder to notify customers of Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch to service their car before the mileage due.
5. To validate the prototype by deploying it in Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch.

1.4 Proposed Approach / Study



Figure 1.4.1: Proposed Approach

Figure 1.3.1 shows the architecture of the proposed approach in this project in which Android mobile application will be developed to be made use by the customers and clerk of the target mechanic shop and the back-end implementation is using AWS EC2 Instance cloud server. Customers and clerk will communicate with each other through the server to solve the challenges that are currently facing by them.

1.5 Highlight of What Have Been Achieved

A mobile application is completed with the functionalities of:

Seeking for Car Breakdown Assistant

Customers able to pin the location where their car is broken at and request for type of service they want. On the other side, admin able to view the pinned location and type of service requested by the customers. Lastly, admin able to perform an action by either accept or reject the request.

Booking for Service(s)

Customers able to book a particular timeslot for their car to be serviced. On the other side, admin able to check is there any booked service in a timeslot. If yes, priority will be given to the car to service first.

Reminder for Next Service(s)

After service is performed, admin able to enter the type of service performed and current mileage value of the car to the system. System is then able to calculate the next service mileage due based on the type of service entered by the admin. On the other side, customers able to view the added service history by the admin and the next service mileage due generated by the system. To make the service reminder possible, customer able to report the latest mileage value of their car to the system and system will notify the user on how many kilometers left for the customers to send their car back to the shop for a service.

1.6 Report Organization

This report consists of 6 chapters. In Chapter 1 Introduction, there have sub-chapters of problem statement, background and information, project objectives, proposed approach/study, highlight of what have been achieved, and report organization. In Chapter 2 Literature Review, there have sub chapters of 3 existing service reminder solutions, 4 researches about practices on capturing coordinates data, and data collection for this project. In Chapter 3 System Design, there have sub chapters of system block diagram, use case diagram, use case description, MySQL database entity relationship diagram, MySQL database data dictionary, and user interface design using Android Studio. In Chapter 4 System Implementation, there have sub-chapters of SDLC method adopted, implementation tools, screen captures of some configurations, and screen captures of the implemented Android mobile application. In Chapter 5 System Testing, there have sub-chapters of devices used to perform testing, and list of items which have been tested. In last chapter which is Chapter 6 Conclusion, it contains sub-chapters to summarize the project, list out any novelties, and make suggestion on possible future work to be done.

2.1 Literature Review on Existing Service Reminder Solutions

2.1.1 Solution 1 - Built-in Service Reminder Light (Motorist Assurance Program, 2019)

Today, some car manufacturers will equip their cars with a mileage or condition-based reminder system. It will keep track of the mileage driven since the last maintenance service was performed and signal the car owner with a reminder light when the next service is due and need to be performed. The possible weakness for this solution maybe is it may not available to some old model cars, so a more practical way for service reminder can be through SMS approach presented in the later part or an application-based service reminder.



Figure 2.1.1: Service Reminder Light

2.1.2 Solution 1 Real World Application - Honda Built-in Service Reminder System Codes (Honda Ireland, n.d.)

Recently new Honda models is all now having a built-in service reminder system to tell the owner when the service is due and show out a series of codes to indicate what type of service is needed. The service reminder spanner sensory signal will keep lighting for 30 days starting from the first day of the service is due.

CHAPTER 2: LITERATURE REVIEW

| Service Code | Operation |
|--------------|---|
| A | Replace Engine Oil and Filter |
| B | Annual Safety Inspection |
| 2 | Pollen Filter Replacement |
| 3 | Replace Manual Transmission Fluid Replace Automatic Transmission Fluid Replace CVT Transmission Fluid |
| 4 | Replace Petrol Fuel Filter Replace Diesel Fuel Filter Replace Spark Plugs |
| 5 | Replace Petrol Engine Coolant Replace Diesel Engine Coolant |
| 6 | Replace Rear Axle Fluid |
| 7 | Replace Brake Fluid |
| 8 | Replace Air Cleaner |
| 9 | Check Valve Clearance |

Figure 2.1.2: Honda Service Reminder Codes

2.1.3 Solution 2 - SMS Reminder System (Swift SMS Gateway, 2017)

Because of response rates are higher, automotive shops can also make use of SMS to keep their customers for coming back to perform routine car service maintenance. In this article, it reveals that SMS has an average open rate of 99 percent with a click-thru rate of 36% based on the statistic of marketing blog Business 2 Community.

2.2 Literature Review on Researches about Practices on Capturing Coordinates Data

2.2.1 Existing Project - GPS-based Location Tracking System via Android Device (Uddin, Islam & Nadim, 2013)

This project is mainly focusing on developing a system that able to let admin track for the user. Some works done by the project developer are shown as below.

CHAPTER 2: LITERATURE REVIEW

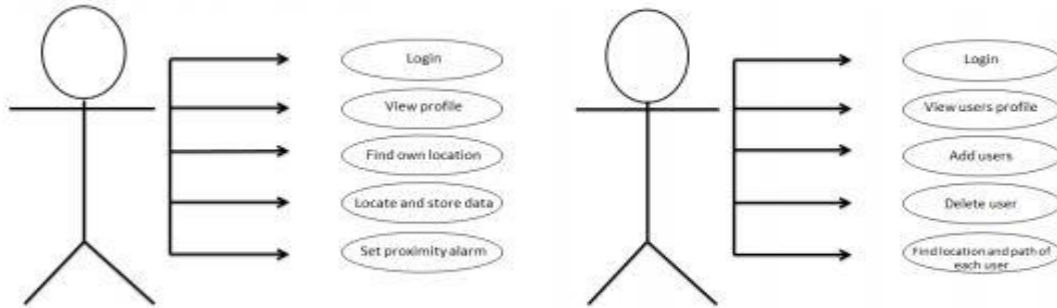


Figure 2.2.1: Existing Project Use Case Diagrams

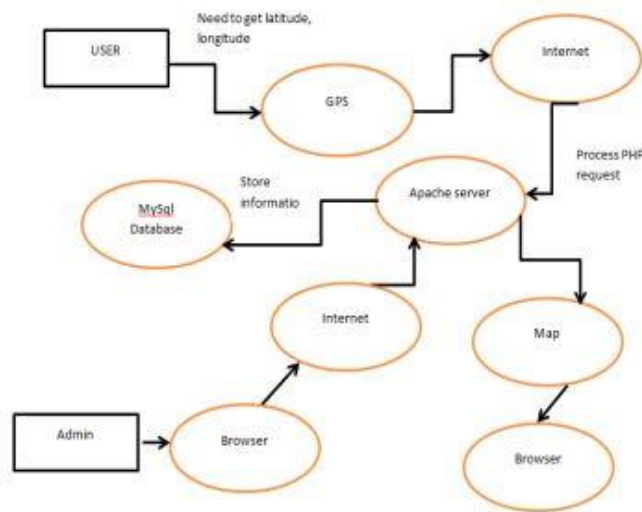


Figure 2.2.2: Existing Project Level 1 Data Flow Diagram



Figure 2.2.3: Existing Project Outcome

Showing above is from the admin view on user's location marker (left) and user's visited path (right).

2.2.2 GPS (Universal Service Administrative Co., n.d.)

Many mobile devices such as smartphones or tablet today are GPS-enabled. This is the most reliable methods to capture coordinates data because it produces the most accurate results with the least errors and ensure that the coordinates data which is the latitude/longitude data are gathered for the correct location. Additional jobs for data collection, verification, and/or clean-up also can be reduced. The requirements for this geolocation methods to work are telco service can reach the place or have enough telco signal and the mobile devices have internet connection.

2.2.3 Web-based Maps and Imagery (Universal Service Administrative Co., n.d.)

The second method to identify specific location and its corresponding latitude/longitude coordinates is through the desktop geolocation using secondary resources i.e. web-based maps and imagery. This is so-called manual or passive geolocation methods but it also can provide accurate results like what GPS does providing that the web-based maps and imagery are in good quality and also the location specified can be properly identified. The workflow is typically as follow:

1. Open the web-based map.
2. Navigate to the location that want to geolocate by either searching for an address or zooming the map.
3. Turn on the imagery.
4. Look for the specific location.
5. The latitude/longitude coordinates of the specific location are there.

This method relies highly on whether the map is updated or not, especially in some rural areas, it may not frequently update the new structures and results in an outdated map. Moreover, it sometimes is hard to identify specific buildings if there is tree cover the particular building in the map.

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2.2.4 Address Geocoding (Universal Service Administrative Co., n.d.)

This method uses an address geocoder program to convert user entered address information into latitude/longitude coordinates. The program will decipher the address and based on the underlying referenced data to produce matching latitude/longitude coordinates. Thus, it relies highly on the maintenance of the referenced data to be the most up to date one. The program also may not cover the addresses so deeply until rural areas, therefore results in the result is not reliable when you enter an address that is within a rural area. This means that if want to apply this geocoding method, large maintenance work is a must to ensure the accuracy!

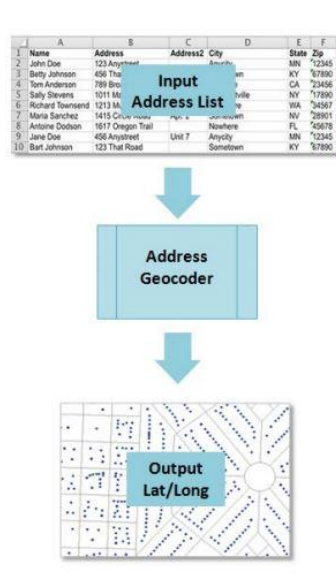


Figure 2.2.4: Address Geocoding

2.3 Data Collection

To gather user requirements for this project, interview approach is selected. On 8th August 2019 10AM, I have interviewed Madam Chu who is a clerk from Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai main branch. Showing below is the main points that I extracted from the interview session.

| Interview & Findings | | | |
|--|--|---|---|
| Interviewee | Question | Keywords of the answer | Findings |
| Madam Chu, clerk in Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch | “do you mind to briefly share with me the issues or challenges your company is facing because of still using traditional way in running the business?” | “we lost customers who cannot wait for their turn to let us service their car and leave our shop.” | The shop needs a system incorporating Service Timeslot Booking feature. |
| | | “we found that some customers come to change engine oil or gear box transmission oil after the mileage is due . Some of them complaint that it is because the reminder sticker on the windscreen drop to somewhere else or the words written on the sticker has faded and cannot be seen clearly, therefore they don’t know when need to change the particular lubricant oil.” | The shop needs a system incorporating Service Reminder feature. |
| | | “customers call from phone saying their car broken down at somewhere else but sometimes the location | The shop needs a system incorporating |

CHAPTER 2: LITERATURE REVIEW

| | | | |
|--|--|---|----------------------------------|
| | | mentioning by them is unclear or we may not familiar on that place . So, it requires us to keep on contact the customers to confirm their actual location which is very inconvenience for us and customers themselves.” | Outdoor Service Request feature. |
|--|--|---|----------------------------------|

Table 2.1: Interview & Findings

3.1 Requirements

Before stepping into System Design phase, functional requirements and non-functional requirements for this project are listed as follow:

Functional Requirements

1. Customers able to perform user authentication using registered email/password, Facebook, and Google Account.
2. Customers able to perform profile management.
3. Customers able to update latest car mileage.
4. Admin able to insert service record.
5. Customers able to book a service from service reminder listing or not from service reminder listing.
6. Customers able to request car breakdown assistant.

Non-functional Requirements

1. The application should be easy to learn, easy to remember, effective, pleasant, and error-free.
2. The SQL process should be accurate, and do not have any latency to avoid delaying from the front-end.

3.2 Block Diagram



Figure 3.2.1: System Block Diagram

Figure 3.2.1 shows the overall architecture of the system going to be implemented which consists of AWS EC2 server in between customers side and admin side mainly to support for functionalities of Request Outdoor Services, Make Service Booking, and Service Reminder.

3.3 Use Case Diagram

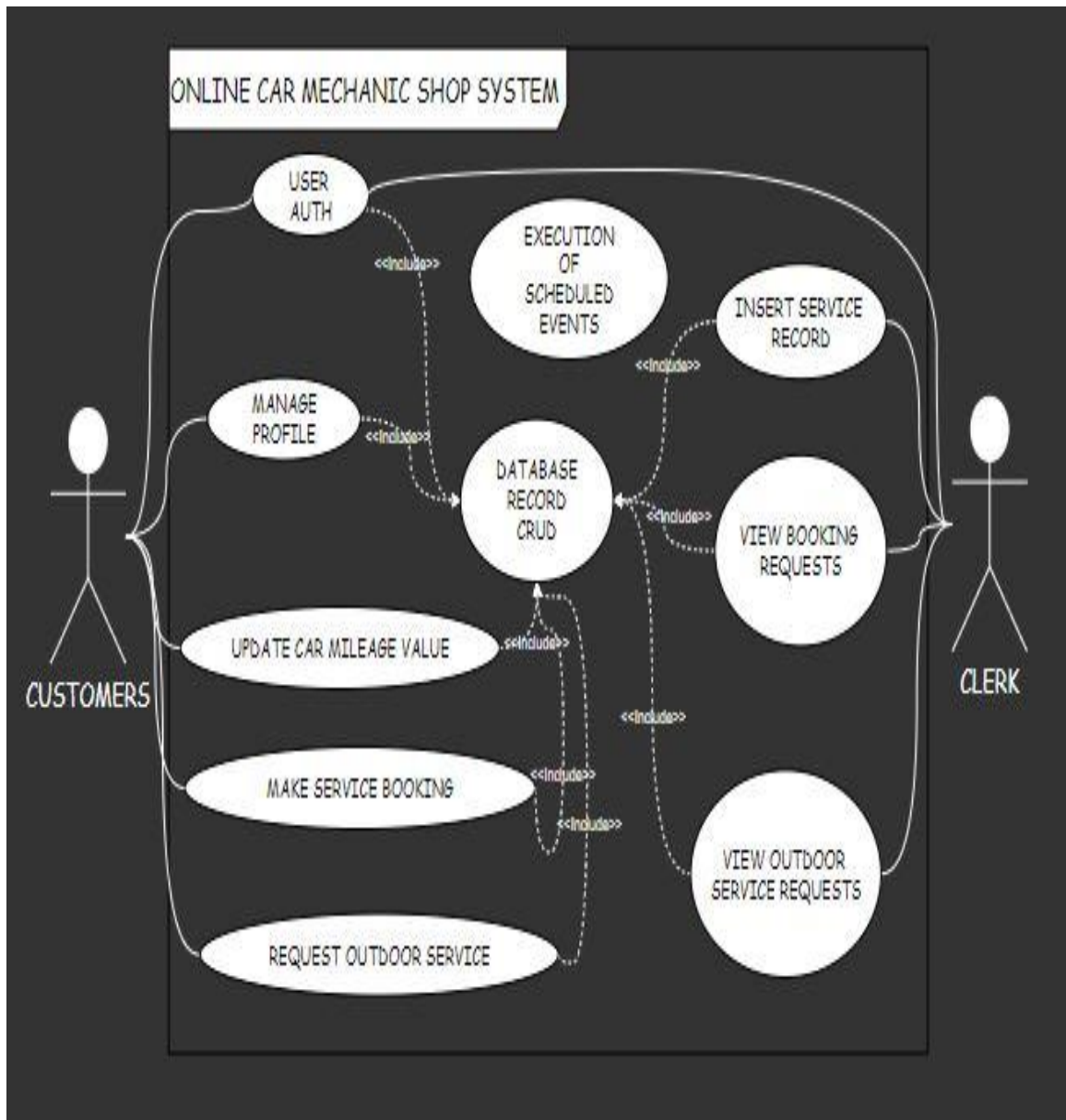


Figure 3.3.1: Use Case Diagram

3.4 Use Case Description**3.4.1 User Auth Use Case**

| | |
|------------------------------------|---|
| Use Case Name | USER AUTH |
| Actor | CUSTOMER, CLERK |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. User enter login credentials 2. System verify user 3. User login successfully 4. System update database |
| Alternate/Exceptional Flows | 1a1 Customer choose to login using Facebook account 1b1 Customer choose to login using Google account 1c1 Customer choose forget password and proceed to update new password 1d1 Customer choose to register new account 3a1 User login failure and display error message |

Table 3.1: Description for User Auth Use Case**3.4.2 Manage Profile Use Case**

| | |
|------------------------------------|--|
| Use Case Name | MANAGE PROFILE |
| Actor | CUSTOMER |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. Customer update profile picture 2. System verify the action 3. System update database |
| Alternate/Exceptional Flows | 1a1 Customer choose to update cover picture 1b1 Customer choose to update personal details 1c1 Customer choose to reset password 1d1 Customer choose to add car 2a1 System display error message |

Table 3.2: Description for Manage Profile Use Case

3.4.3 Update Car Mileage Value Use Case

| | |
|------------------------------------|---|
| Use Case Name | UPDATE CAR MILEAGE |
| Actor | CUSTOMER |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. Customer enter mileage 2. System verify the action 3. System update database 4. System alert user for overdue service |
| Alternate/Exceptional Flows | 2a1 System display error message 4a1 System do nothing |

Table 3.3: Description for Update Car Mileage Value Use Case**3.4.4 Make Service Booking Use Case**

| | |
|------------------------------------|--|
| Use Case Name | MAKE SERVICE BOOKING |
| Actor | CUSTOMER |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. Customer fill up service booking form 2. System verify the action 3. System update database 4. System forward request to clerk 5. System notify user to remember visit the shop at the booked date and time |
| Alternate/Exceptional Flows | 2a1 System display error message 5a1 System do nothing |

Table 3.4: Description for Make Service Booking Use Case**3.4.5 Request Outdoor Service Use Case**

| | |
|------------------------------------|--|
| Use Case Name | REQUEST OUTDOOR SERVICE |
| Actor | CUSTOMER |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. Customer fill up car breakdown assistant form 2. System verify the action 3. System update database 4. System forward request to clerk |
| Alternate/Exceptional Flows | 2a1 System display error message |

Table 3.5: Description for Request Outdoor Service Use Case

3.4.6 Insert Service Record Use Case

| | |
|------------------------------------|--|
| Use Case Name | INSERT SERVICE RECORD |
| Actor | CLERK |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. Clerk fill up the insert service record form 2. System verify the action 3. System update database 4. System forward service record has been updated message to customer |
| Alternate/Exceptional Flows | 2a1 System display error message |

Table 3.6: Description for Insert Service Record Use Case**3.4.7 View Booking Requests Use Case**

| | |
|------------------------------------|---|
| Use Case Name | VIEW BOOKING REQUESTS |
| Actor | CLERK |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. System list all service booking made by customer |
| Alternate/Exceptional Flows | - |

Table 3.7: Description for View Booking Requests Use Case**3.4.8 View Outdoor Service Requests Use Case**

| | |
|------------------------------------|---|
| Use Case Name | VIEW OUTDOOR SERVICE REQUESTS |
| Actor | CLERK |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. System list all outdoor service requests asked by customer 2. Admin responds on those requests 3. System forward the message to customer in which the content is the decision of admin towards their request |
| Alternate/Exceptional Flows | - |

Table 3.8: Description for View Outdoor Service Requests Use Case

3.4.9 Execution of Scheduled Event Use Case

| | |
|------------------------------------|---|
| Use Case Name | EXECUTION OF SCHEDULED EVENT |
| Actor | SYSTEM |
| Normal Flow of Events | <ol style="list-style-type: none"> 1. System execute event on the scheduled date and time 2. System message customer in the notification bar and in-app inbox |
| Alternate/Exceptional Flows | 2a1 System message customer in the in-app inbox because customer is not signed-in the application |

Table 3.9: Description for Execution of Scheduled Event Use Case

3.5 MySQL Entity Relationship Diagram

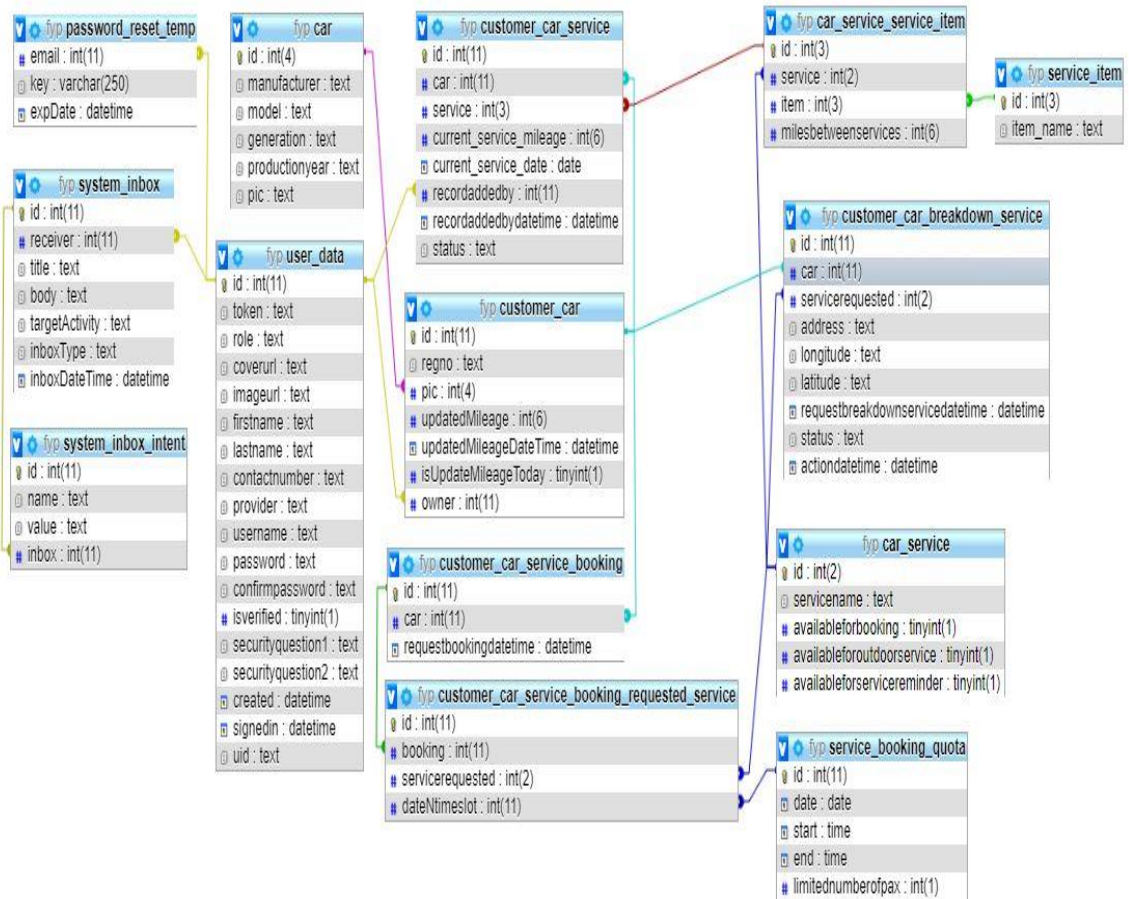


Figure 3.5.1: Entity Relationship Diagram

3.6 MySQL Data Dictionary**3.6.1 Table “car”**

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|----------------|--------|------------|------|---------|--------------------|----------|----------|------|
| id | int(4) | | No | | auto_incre ment | | | |
| manufacturer | text | | No | | | | | |
| model | text | | No | | | | | |
| generation | text | | No | | | | | |
| productionyear | text | | No | | | | | |
| pic | text | | No | | | | | |

Table 3.10: Data Dictionary for “car” Table**3.6.2 Table “car_service”**

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|---------------------------------|------------|------------|------|---------|--------------------|----------|----------|------|
| id | int(2) | | No | | auto_incre ment | | | |
| servicename | text | | No | | | | | |
| availablefor booking | tinyint(1) | | No | | | | | |
| availablefor outdoorservice | tinyint(1) | | No | | | | | |
| availablefor servicereminder | tinyint(1) | | No | | | | | |

Table 3.11: Data Dictionary for “car_service” Table

3.6.3 Table “car_service_service_item”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|--------------------------|--------|------------|------|---------|--------------------|---|----------|------|
| id | int(3) | | No | | auto_incre ment | | | |
| service | int(2) | | No | | | -> car_service.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| item | int(3) | | Yes | NULL | | -> service_item.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| milesbetwee nservices | int(6) | | No | | | | | |

Table 3.12: Data Dictionary for “car_service_service_item” Table

3.6.4 Table “customer_car”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|------------------------|------------|------------|------|---------|----------------|---|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| regno | text | | No | | | | | |
| pic | int(4) | | No | | | -> car.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| updatedMileage | int(6) | | Yes | NULL | | | | |
| updatedMileageDateTime | datetime | | Yes | NULL | | | | |
| isUpdateMileageToday | tinyint(1) | | No | | | | | |
| owner | int(11) | | No | | | -> user_data.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |

Table 3.13: Data Dictionary for “customer_car” Table

3.6.5 Table “customer_car_breakdown_service”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|---|----------|------------|------|---------|----------------|---|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| car | int(11) | | No | | | -> customer_car.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| servicerequ ested | int(2) | | No | | | -> car_service.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| address | text | | No | | | | | |
| longitude | text | | No | | | | | |
| latitude | text | | No | | | | | |
| requestbrea kdownservic edatetime | datetime | | No | | | | | |
| status | text | | No | | | | | |
| actiondateti me | datetime | | No | | | | | |

Table 3.14: Data Dictionary for “customer_car_breakdown_service” Table

3.6.6 Table “customer_car_service”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|-----------------------------|----------|------------|------|---------|--------------------|---|----------|------|
| id | int(11) | | No | | auto_incre ment | | | |
| car | int(11) | | No | | | -> customer_car.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| service | int(3) | | No | | | -> car_service_serv ice_item.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| current_serv ice_mileage | int(6) | | Yes | NULL | | | | |
| current_serv ice_date | date | | No | | | | | |
| recordadded by | int(11) | | No | | | -> user_data.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| recordadded bydatetime | datetime | | No | | | | | |
| status | text | | No | | | | | |

Table 3.15: Data Dictionary for “customer_car_service” Table

3.6.7 Table “customer_car_service_booking”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|------------------------|----------|------------|------|---------|----------------|---|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| car | int(11) | | No | | | -> customer_car.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| requestbookingdatetime | datetime | | No | | | | | |

Table 3.16: Data Dictionary for “customer_car_service_booking” Table

3.6.8 Table “customer_car_service_booking_requested_service”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|------------------|---------|------------|------|---------|----------------|---|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| booking | int(11) | | No | | | -> customer_car_service_booking.id ON UPDATE CASCADE ON DELETE CASCADE | | |
| servicerequested | int(2) | | No | | | -> car_service.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| dateNtimeslot | int(11) | | No | | | -> service_booking_quota.id ON UPDATE CASCADE ON DELETE CASCADE | | |

Table 3.17: Data Dictionary for “customer_car_service_booking_requested_service” Table

3.6.9 Table “password_reset_temp”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|---------|--------------|------------|------|---------|-------|---|----------|------|
| email | int(11) | | No | | | -> user_data.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| key | varchar(250) | | No | | | | | |
| expDate | datetime | | No | | | | | |

Table 3.18: Data Dictionary for “password_reset_temp” Table

3.6.10 Table “service_booking_quota”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|--------------------|---------|------------|------|---------|--------------------|----------|----------|------|
| id | int(11) | | No | | auto_incre ment | | | |
| date | date | | No | | | | | |
| start | time | | No | | | | | |
| end | time | | No | | | | | |
| limitednumberofpax | int(1) | | No | | | | | |

Table 3.19: Data Dictionary for “service_booking_quota” Table

3.6.11 Table “service_item”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|-----------|--------|------------|------|---------|----------------|----------|----------|------|
| id | int(3) | | No | | auto_increment | | | |
| item_name | Text | | No | | | | | |

Table 3.20: Data Dictionary for “service_item” Table

3.6.12 Table “system_inbox”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|----------------|----------|------------|------|---------|----------------|---|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| receiver | int(11) | | No | | | -> user_data.id ON UPDATE RESTRICT ON DELETE RESTRICT | | |
| title | text | | No | | | | | |
| body | text | | No | | | | | |
| targetActivity | text | | No | | | | | |
| inboxType | text | | No | | | | | |
| inboxDateTime | datetime | | No | | | | | |

Table 3.21: Data Dictionary for “system_inbox” Table

3.6.13 Table “system_inbox_intent”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|--------|---------|------------|------|---------|----------------|---|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| name | text | | No | | | | | |
| value | text | | No | | | | | |
| inbox | int(11) | | No | | | -> system_inbox.id ON UPDATE CASCADE ON DELETE CASCADE | | |

Table 3.22: Data Dictionary for “system_inbox_intent” Table

3.6.14 Table “user_data”

| Column | Type | Attributes | Null | Default | Extra | Links to | Comments | MIME |
|-------------------|------------|------------|------|---------|----------------|----------|----------|------|
| id | int(11) | | No | | auto_increment | | | |
| token | text | | Yes | NULL | | | | |
| role | text | | No | | | | | |
| coverurl | text | | Yes | NULL | | | | |
| imageurl | text | | Yes | NULL | | | | |
| firstname | text | | Yes | NULL | | | | |
| lastname | text | | Yes | NULL | | | | |
| contactnumber | text | | Yes | NULL | | | | |
| provider | text | | No | | | | | |
| username | text | | No | | | | | |
| password | text | | Yes | NULL | | | | |
| confirmpassword | text | | Yes | NULL | | | | |
| isverified | tinyint(1) | | Yes | NULL | | | | |
| securityquestion1 | text | | Yes | NULL | | | | |
| securityquestion2 | text | | Yes | NULL | | | | |
| created | datetime | | No | | | | | |
| signedin | datetime | | Yes | NULL | | | | |
| uid | text | | Yes | NULL | | | | |

Table 3.23: Data Dictionary for “user_data” Table

3.7 User Interface Design in Android Studio

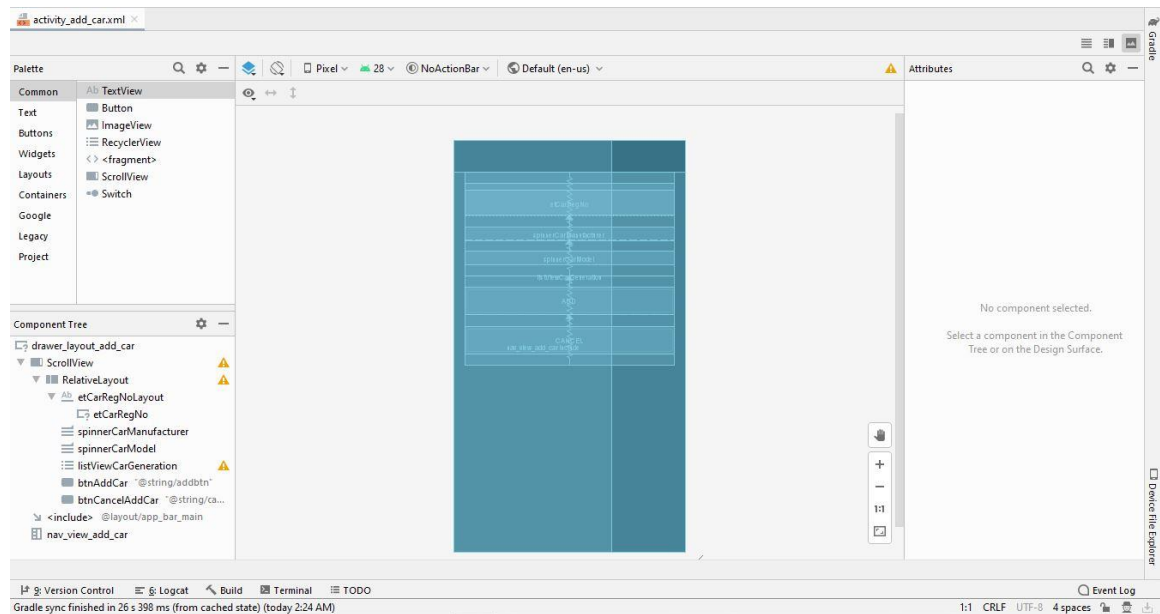


Figure 3.7.1: Sample of User Interface Design in Android Studio

Figure 3.7.1 shows the one of the sample screen (Customer Add Car) is designed conveniently using the drag-and-drop feature provided by Android Studio.

4.1 SDLC Method Adopted

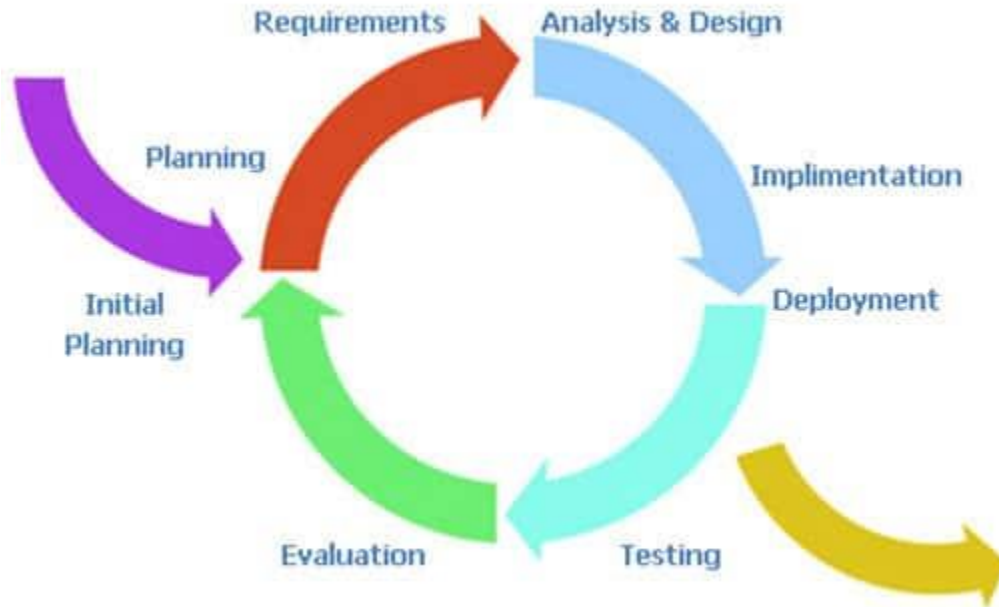


Figure 4.1: SDLC Adopted

The adopted software development life cycle is the incremental model. It consists of several phases, such as Initial Planning, Planning, Requirements, Analysis & Design, Implementation, Testing, Evaluation, and Deployment. The overall concept is like this: We first plan the project, second gather user requirements, third analyze those gathered requirements to come out some system functionalities, fourth design the system based on functionalities that must be included, fifth implement the functionalities to the system based on the design, sixth test the implemented functionalities, then deploy the version of the system to the user. User will then test and evaluate the system. If developer or user think that the system needs to add on anything, the process will be run again from planning, requirements, analysis, design, implementation, alpha testing, deployment, beta testing, and evaluation.

4.2 Implementation Tools

Cloud Computing Software

1. Amazon Web Services (**AWS**) EC2 Instance for web service.
2. Web-based **phpMyAdmin** database management tool reside in the instance to manage the cloud database.
3. **Cloud MySQL database** reside in the instance to store mobile application data.
4. **Apache HTTP server** reside in the instance to handling HTTP request from the mobile application

Software

1. **Android Studio** act as the IDE to develop the mobile applications and test run the mobile applications in the Android emulator.
2. **WinSCP** to view and edit the php programs store in the AWS EC2 instance (remote computer) from our computer (local).
3. **Web Browser** to connect phpMyAdmin and to view uploaded images in the instance.
4. **Postman** for testing PHP scripts.

Hardware

Android smartphone / Android Studio Emulator to run the mobile applications

CHAPTER 4: SYSTEM IMPLEMENTATION

APIs

1. **Facebook Login API** for Facebook User Authentication
2. **Google Login API** for Google User Authentication
3. **Google Map API** for locating the customers with car breakdown assistant need
4. **Firestore Cloud Messaging API** for handling notification from device to device

Library

PHPMailer to send emails safely and easily via PHP code from a web server for user account verification and forgot password usage.

4.3 AWS EC2 Instance Configuration

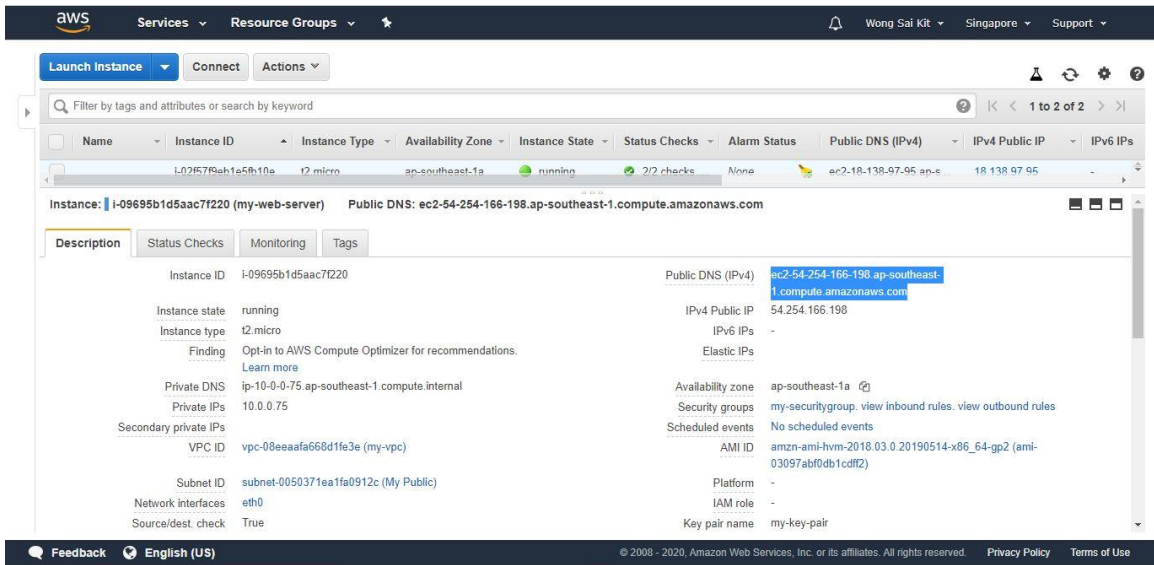


Figure 4.3.1: AWS EC2 Instance Details

Figure 4.3.1 shows the public DNS and other details of the configured Amazon Linux server.

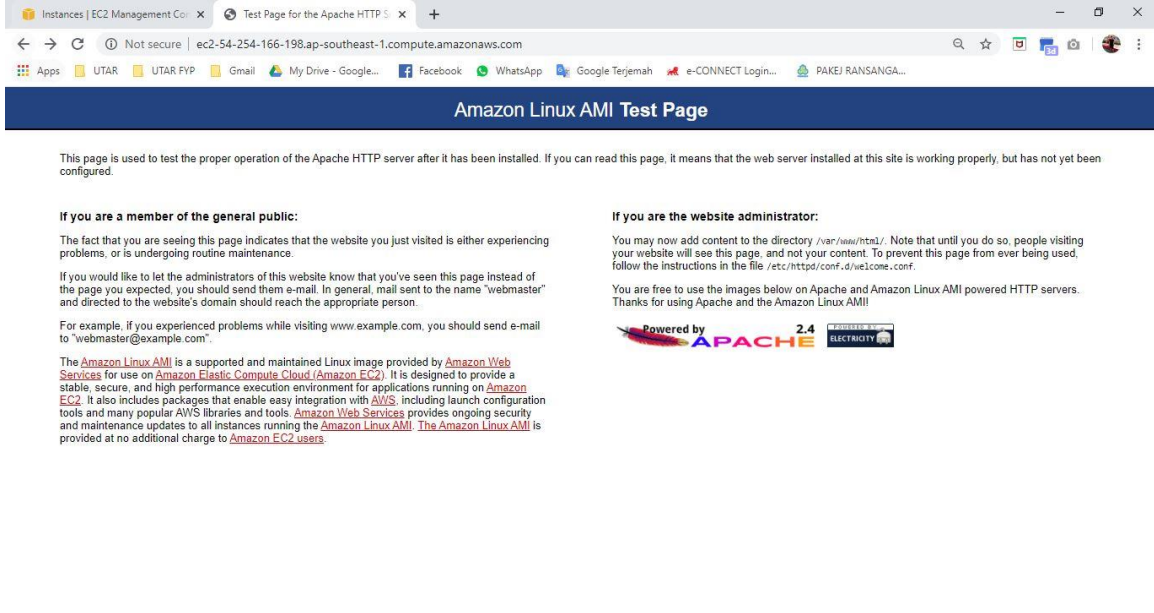


Figure 4.3.2: AWS EC2 Instance Is Running Prove

Figure 4.3.2 shows the server page is loaded successfully in the browser using the public DNS which proved that the server is in running state

4.4 Linux Crontab Command in AWS EC2 Instance

```

ec2-user@ip-10-0-0-75:~
Using username "ec2-user".
Authenticating with public key "imported-openssh-key"
Last login: Thu Apr 23 00:17:25 2020 from 118.101.79.24

    _   _          _
   /_   _/        /
  /_   _/        /
 /_   _/        /
/_   _/        /

Amazon Linux AMI

https://aws.amazon.com/amazon-linux-ami/2018.03-release-notes/
22 package(s) needed for security, out of 28 available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-10-0-0-75 ~]$ crontab -l
0 9 * * 1-5 /usr/bin/php /var/www/html/fyp/scheduleSendMultiplePush.php
0 4 * * * /usr/bin/php /var/www/html/fyp/scheduleSendMultiplePushForServiceReminder.php
* * * * * /usr/bin/php /var/www/html/fyp/scheduleSendMultiplePushForServiceBookingReminder.php
[ec2-user@ip-10-0-0-75 ~]$

```

Figure 4.4.1: AWS EC2 Instance Scheduled Tasks Using Crontab

*9 * * 1-5 /usr/bin/php /var/www/html/fyp/scheduleSendMultiplePush.php*

Above Linux command means scheduleSendMultiplePush php script will be executed on 9pm every Monday to Friday. The script is to ask customers to update latest mileage value of their car.

*0 4 * * * /usr/bin/php*

/var/www/html/fyp/scheduleSendMultiplePushForServiceReminder.php

Above Linux command means scheduleSendMultiplePushForServiceReminder php script will be executed on 12pm every day. The script is to remind customers of the remaining kilometers to go for the next service.

** * * * * /usr/bin/php*

/var/www/html/fyp/scheduleSendMultiplePushForServiceBookingReminder.php

Above Linux command means scheduleSendMultiplePushForServiceBookingReminder php script will be executed on every single minute. The script is to remind customers one day and one hour before the date time they choose to send their car for some service(s).

4.5 MySQL Table Creation

4.5.1 Table “car”

```
Your SQL query has been executed successfully.

show create table car

+ Options
Table Create Table
CREATE TABLE `car` (
  `id` int(4) NOT NULL AUTO_INCREMENT,
  `manufacturer` text NOT NULL,
  `model` text NOT NULL,
  `generation` text NOT NULL,
  `productionyear` text NOT NULL,
  `pic` text NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=17 DEFAULT CHARSET=latin1
```

Figure 4.5.1: MySQL Create Table “car”

Figure 4.5.1 shows the created “car” table in MySQL database using the table structure designed during system design phase.

4.5.2 Table “car_service”

```
Your SQL query has been executed successfully.

show create table car_service

+ Options
Table Create Table
CREATE TABLE `car_service` (
  `id` int(2) NOT NULL AUTO_INCREMENT,
  `servicename` text NOT NULL,
  `availableforbooking` tinyint(1) NOT NULL,
  `availableforoutdoorservice` tinyint(1) NOT NULL,
  `availableforservicereminder` tinyint(1) NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=10 DEFAULT CHARSET=latin1
```

Figure 4.5.2: MySQL Create Table “car_service”

Figure 4.5.2 shows the created “car_service” table in MySQL database using the table structure designed during system design phase.

4.5.3 Table “car_service_service_item”

```
Your SQL query has been executed successfully.

show create table car_service_service_item

+ Options
Table      Create Table
-----
car_service_service_item
CREATE TABLE `car_service_service_item` (
  `id` int(3) NOT NULL AUTO_INCREMENT,
  `service` int(2) NOT NULL,
  `item` int(3) DEFAULT NULL,
  `milesbetweenservices` int(6) NOT NULL,
  PRIMARY KEY (`id`),
  KEY `service_idx` (`service`),
  KEY `item_idx` (`item`),
  CONSTRAINT `car_service_service_item.itemFKservice_item.id` FOREIGN KEY (`item`) REFERENCES `service_item` (`id`),
  CONSTRAINT `car_service_service_item.serviceFKcar_service.id` FOREIGN KEY (`service`) REFERENCES `car_service` (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=28 DEFAULT CHARSET=latin1
```

Figure 4.5.3: MySQL Create Table “car_service_service_item”

Figure 4.5.3 shows the created “car_service_service_item” table in MySQL database using the table structure designed during system design phase.

4.5.4 Table “customer_car”

```
Your SQL query has been executed successfully.


show create table customer_car

+ Options
Table      Create Table
-----
customer_car
CREATE TABLE `customer_car` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `regno` text NOT NULL,
  `pic` int(4) NOT NULL,
  `updatedMileage` int(6) DEFAULT NULL,
  `updatedMileageDateTime` datetime DEFAULT NULL,
  `isUpdateMileageToday` tinyint(1) NOT NULL,
  `owner` int(11) NOT NULL,
  PRIMARY KEY (`id`),
  KEY `owner_idx` (`owner`),
  KEY `pic_idx` (`pic`),
  CONSTRAINT `customer_car.ownerFKuser_data.id` FOREIGN KEY (`owner`) REFERENCES `user_data` (`id`),
  CONSTRAINT `customer_car.picFKcar.id` FOREIGN KEY (`pic`) REFERENCES `car` (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=20 DEFAULT CHARSET=latin1
```

Figure 4.5.4: MySQL Create Table “customer_car”

Figure 4.5.4 shows the created “customer_car” table in MySQL database using the table structure designed during system design phase.

4.5.5 Table “customer_car_breakdown_service”



Your SQL query has been executed successfully.

```
show create table customer_car_breakdown_service
```

+ Options Profiling

| Table | Create Table |
|--------------------------------|---|
| customer_car_breakdown_service | <pre>CREATE TABLE `customer_car_breakdown_service` (`id` int(11) NOT NULL AUTO_INCREMENT, `car` int(11) NOT NULL, `servicerequested` int(2) NOT NULL, `address` text NOT NULL, `longitude` text NOT NULL, `latitude` text NOT NULL, `requestbreakdownservicedatetime` datetime NOT NULL, `status` text NOT NULL, `actiondatetime` datetime NOT NULL, PRIMARY KEY (`id`), KEY `customer_car_breakdown_service.car_idx` (`car`), KEY `customer_car_breakdown_service.servicerequested_idx` (`servicerequested`), CONSTRAINT `carFKcustomer_car.id` FOREIGN KEY (`car`) REFERENCES `customer_car` (`id`), CONSTRAINT `servicerequestedFKcar_service.id` FOREIGN KEY (`servicerequested`) REFERENCES `car_service` (`id`)) ENGINE=InnoDB AUTO_INCREMENT=30 DEFAULT CHARSET=latin1</pre> |

Figure 4.5.5: MySQL Create Table “customer_car_breakdown_service”

Figure 4.5.5 shows the created “customer_car_breakdown_service” table in MySQL database using the table structure designed during system design phase.

4.5.6 Table “customer_car_service”



Your SQL query has been executed successfully.

```
show create table customer_car_service
```

+ Options Profiling [Edit inline]

| Table | Create Table |
|----------------------|---|
| customer_car_service | <pre>CREATE TABLE `customer_car_service` (`id` int(11) NOT NULL AUTO_INCREMENT, `car` int(11) NOT NULL, `service` int(3) NOT NULL, `current_service_mileage` int(6) DEFAULT NULL, `current_service_date` date NOT NULL, `recordaddedby` int(11) NOT NULL, `recordaddedbydatetime` datetime NOT NULL, `status` text NOT NULL, PRIMARY KEY (`id`), KEY `cust_car_index` (`car`), KEY `record_added_by_index` (`recordaddedby`), KEY `customer_car_service.service_idx` (`service`), CONSTRAINT `customer_car_service.carFKcustomer_car.id` FOREIGN KEY (`car`) REFERENCES `customer_car` (`id`), CONSTRAINT `customer_car_service.recordaddedbyFKuser_data.id` FOREIGN KEY (`recordaddedby`) REFERENCES `user_data` (`id`), CONSTRAINT `customer_car_service.serviceFKcar_service_service_item.id` FOREIGN KEY (`service`) REFERENCES `car_service_service_item` (`id`)) ENGINE=InnoDB AUTO_INCREMENT=22 DEFAULT CHARSET=latin1</pre> |

Figure 4.5.6: MySQL Create Table “customer_car_service”

Figure 4.5.6 shows the created “customer_car_service” table in MySQL database using the table structure designed during system design phase.

4.5.7 Table “customer_car_service_booking”

```

Your SQL query has been executed successfully.

show create table customer_car_service_booking

+ Options
Table      Create Table
customer_car_service_booking CREATE TABLE `customer_car_service_booking` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `car` int(11) NOT NULL,
  `requestbookingdatetime` datetime NOT NULL,
  PRIMARY KEY (`id`),
  KEY `customer_car_service_booking.cust_car_idx` (`car`),
  CONSTRAINT `customer_car_service_booking.carFKcustomer_car.id` FOREIGN KEY (`car`) REFERENCES `customer_car` (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=96 DEFAULT CHARSET=latin1
    
```

Figure 4.5.7: MySQL Create Table “customer_car_service_booking”

Figure 4.5.7 shows the created “customer_car_service_booking” table in MySQL database using the table structure designed during system design phase.

4.5.8 Table “customer_car_service_booking_requested_service”

```

Your SQL query has been executed successfully.

show create table customer_car_service_booking_requested_service

+ Options
Table      Create Table
customer_car_service_booking_requested_service CREATE TABLE `customer_car_service_booking_requested_service` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `booking` int(11) NOT NULL,
  `servicerequested` int(2) NOT NULL,
  `dateNtimeslot` int(11) NOT NULL,
  PRIMARY KEY (`id`),
  KEY `customer_car_service_booking_service_requested_booking_idx` (`booking`),
  KEY `customer_car_service_booking_service_requested_sr_idx` (`servicerequested`),
  KEY `dateNtimeslot_idx` (`dateNtimeslot`),
  CONSTRAINT `bookingFKcustomer_car_service_booking.id` FOREIGN KEY (`booking`) REFERENCES `customer_car_service_booking` (`id`) ON DELETE CASCADE ON UPDATE CASCADE,
  CONSTRAINT `dateNtimeslotFKservice_booking_quota.id` FOREIGN KEY (`dateNtimeslot`) REFERENCES `service_booking_quota` (`id`) ON DELETE CASCADE ON UPDATE CASCADE,
  CONSTRAINT `this_servicerequestedFKcar_service.id` FOREIGN KEY (`servicerequested`) REFERENCES `car_service` (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=90 DEFAULT CHARSET=latin1
    
```

Figure 4.5.8: MySQL Create Table “customer_car_service_booking_requested_service”

Figure 4.5.8 shows the created “customer_car_service_booking_requested_service” table in MySQL database using the table structure designed during system design phase.

4.5.9 Table “password_reset_temp”

```
Your SQL query has been executed successfully.

show create table password_reset_temp
```

| Table | Create Table |
|---------------------|--|
| password_reset_temp | <pre>CREATE TABLE `password_reset_temp` (`email` int(11) NOT NULL, `key` varchar(250) NOT NULL, `expDate` datetime NOT NULL, KEY `password_reset_email_idx` (`email`), CONSTRAINT `password_reset_tmp_emailFKuser_data.id` FOREIGN KEY (`email`) REFERENCES `user_data` (`id`)) ENGINE=InnoDB DEFAULT CHARSET=latin1</pre> |

Figure 4.5.9: MySQL Create Table “password_reset_temp”

Figure 4.5.9 shows the created “password_reset_temp” table in MySQL database using the table structure designed during system design phase.

4.5.10 Table “service_booking_quota”

```
Your SQL query has been executed successfully.

show create table service_booking_quota
```

| Table | Create Table |
|-----------------------|--|
| service_booking_quota | <pre>CREATE TABLE `service_booking_quota` (`id` int(11) NOT NULL AUTO_INCREMENT, `date` date NOT NULL, `start` time NOT NULL, `end` time NOT NULL, `limitednumberofpax` int(1) NOT NULL, PRIMARY KEY (`id`)) ENGINE=InnoDB AUTO_INCREMENT=330 DEFAULT CHARSET=latin1</pre> |

Figure 4.5.10: MySQL Create Table “service_booking_quota”

Figure 4.5.10 shows the created “service_booking_quota” table in MySQL database using the table structure designed during system design phase.

4.5.11 Table “service_item”

```
Your SQL query has been executed successfully.
show create table service_item

+ Options
Table      Create Table
service_item CREATE TABLE `service_item` (
            `id` int(3) NOT NULL AUTO_INCREMENT,
            `item_name` text NOT NULL,
            PRIMARY KEY (`id`)
            ) ENGINE=InnoDB AUTO_INCREMENT=27 DEFAULT CHARSET=latin1
```

Figure 4.5.11: MySQL Create Table “service_item”

Figure 4.5.11 shows the created “service_item” table in MySQL database using the table structure designed during system design phase.

4.5.12 Table “system_inbox”

```
Your SQL query has been executed successfully.
show create table system_inbox

- Options
Table      Create Table
system_inbox CREATE TABLE `system_inbox` (
            `id` int(11) NOT NULL AUTO_INCREMENT,
            `receiver` int(11) NOT NULL,
            `title` text NOT NULL,
            `body` text NOT NULL,
            `targetActivity` text NOT NULL,
            `inboxType` text NOT NULL,
            `inboxDateTime` datetime NOT NULL,
            PRIMARY KEY (`id`),
            KEY `system_inbox_receiver_idx` (`receiver`),
            CONSTRAINT `system_inbox_receiverFKuser_data.id` FOREIGN KEY (`receiver`) REFERENCES `user_data` (`id`)
            ) ENGINE=InnoDB AUTO_INCREMENT=282 DEFAULT CHARSET=latin1
```

Figure 4.5.12: MySQL Create Table “system_inbox”

Figure 4.5.12 shows the created “system_inbox” table in MySQL database using the table structure designed during system design phase.

4.5.13 Table “system_inbox_intent”



Your SQL query has been executed successfully.

```
show create table system_inbox_intent
```

Profiling [Edit inline] [Edit] [Create PHP]

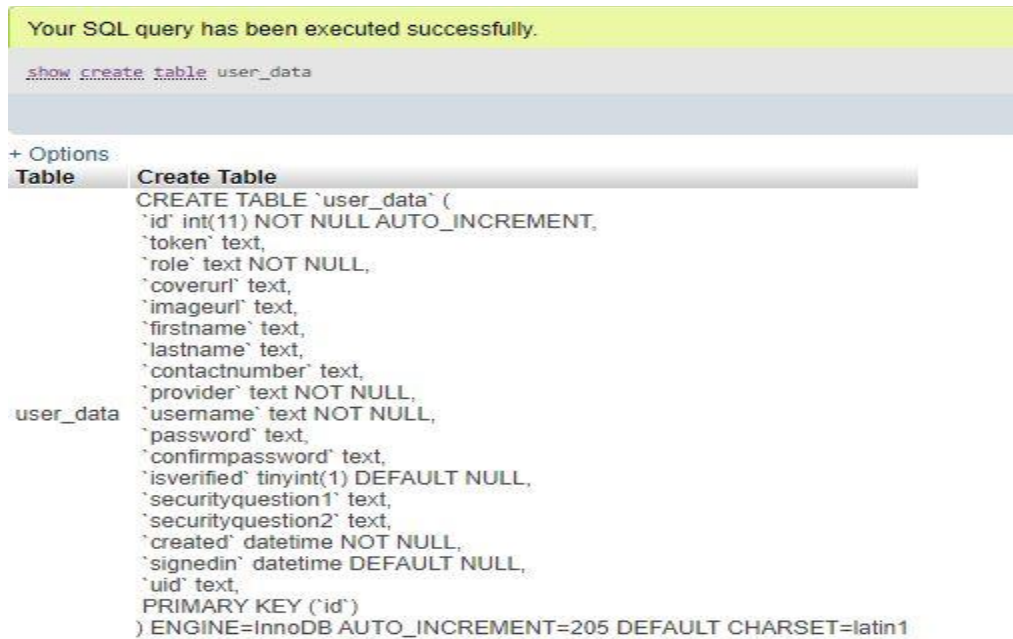
+ Options

| Table | Create Table |
|---------------------|--|
| system_inbox_intent | <pre>CREATE TABLE `system_inbox_intent` (`id` int(11) NOT NULL AUTO_INCREMENT, `name` text NOT NULL, `value` text NOT NULL, `inbox` int(11) NOT NULL, PRIMARY KEY (`id`), KEY `system_inbox_intent_inbox_idx` (`inbox`), CONSTRAINT `system_inbox_intent_inboxFKsystem_inbox.id` FOREIGN KEY (`inbox`) REFERENCES `system_inbox` (`id`) ON DELETE CASCADE ON UPDATE CASCADE) ENGINE=InnoDB AUTO_INCREMENT=451 DEFAULT CHARSET=latin1</pre> |

Figure 4.5.13: MySQL Create Table “system_inbox_intent”

Figure 4.5.13 shows the created “system_inbox_intent” table in MySQL database using the table structure designed during system design phase.

4.5.14 Table “user_data”



Your SQL query has been executed successfully.

```
show create table user_data
```

+ Options

| Table | Create Table |
|-----------|---|
| user_data | <pre>CREATE TABLE `user_data` (`id` int(11) NOT NULL AUTO_INCREMENT, `token` text, `role` text NOT NULL, `coverurl` text, `imageurl` text, `firstname` text, `lastname` text, `contactnumber` text, `provider` text NOT NULL, `username` text NOT NULL, `password` text, `confirmpassword` text, `isverified` tinyint(1) DEFAULT NULL, `securityquestion1` text, `securityquestion2` text, `created` datetime NOT NULL, `signedin` datetime DEFAULT NULL, `uid` text, PRIMARY KEY (`id`)) ENGINE=InnoDB AUTO_INCREMENT=205 DEFAULT CHARSET=latin1</pre> |

Figure 4.5.14: MySQL Create Table “user_data”

Figure 4.5.14 shows the created “user_data” table in MySQL database using the table structure designed during system design phase.

4.6 MySQL Event Creation

4.6.1 Scheduled Event to Remove Inbox Message

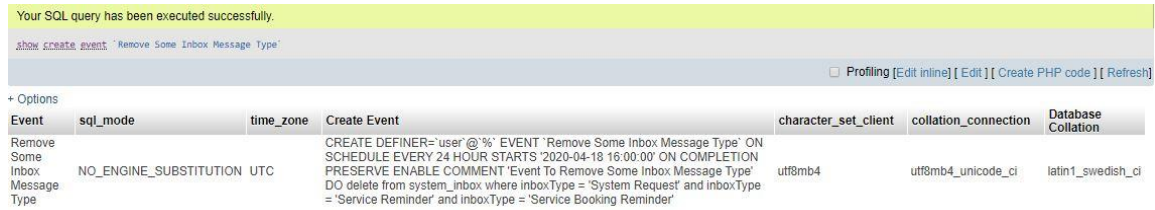


Figure 4.6.1: MySQL Create Event “Remove Some Inbox Message Type”

Figure 4.6.1 shows the created “Remove Some Inbox Message Type” event in MySQL database with the purpose of removing all the “Request Update Latest Car Mileage”, “Service Reminder”, and “Service Booking Reminder” message from the inbox on 12am every day.

4.6.2 Scheduled Event to Reset “isUpdateMileageToday” Flag



Figure 4.6.2: MySQL Create Event “Reset Customers Update Their Car Mileage Daily”

Figure 4.6.2 shows the created “Reset Customers Update Their Car Mileage Daily” event in MySQL database with the purpose of setting the status of all the customer car to “car mileage is not yet updated today” on 12am every day.

4.6.3 Scheduled Event to Remove Customer Service Booking

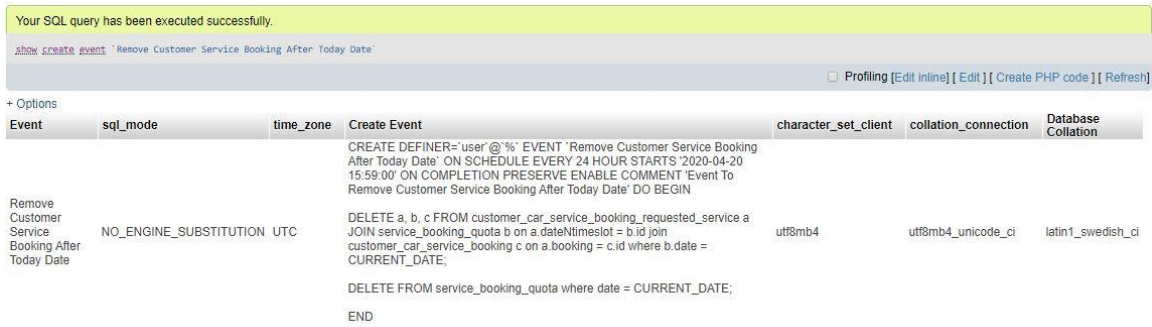


Figure 4.6.3: MySQL Create Event “Remove Customer Service Booking After Today Date”

Figure 4.6.3 shows the created “Remove Customer Service Booking After Today Date” event in MySQL database with the purpose of removing all that day’s customer service booking requests on 11.59pm every day.

4.6.4 Scheduled Event to Auto Reject Breakdown Assistant Request (Sunday)

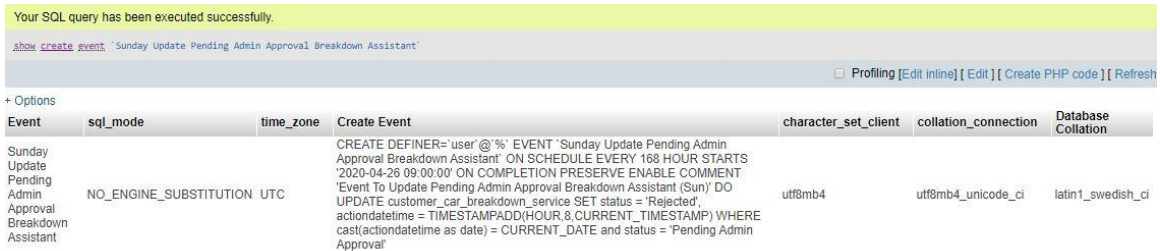


Figure 4.6.4: MySQL Create Event “Sunday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.4 shows the created “Sunday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 5pm at Sunday (Shop closing time).

4.6.5 Scheduled Event to Auto Reject Breakdown Assistant Request (Monday)

Your SQL query has been executed successfully.

[show create event](#) `Monday Update Pending Admin Approval Breakdown Assistant`

Profiling [\[Edit inline\]](#) [\[Edit\]](#) [\[Create PHP code\]](#) [\[Refresh\]](#)

+ Options

| Event | sql_mode | time_zone | Create Event | character_set_client | collation_connection | Database Collation |
|--|------------------------|-----------|---|----------------------|----------------------|--------------------|
| Monday Update Pending Admin Approval Breakdown Assistant | NO_ENGINE_SUBSTITUTION | UTC | CREATE DEFINER='user'@'%' EVENT `Monday Update Pending Admin Approval Breakdown Assistant` ON SCHEDULE EVERY 168 HOUR STARTS '2020-04-27 11:00:00' ON COMPLETION PRESERVE ENABLE COMMENT 'Event To Update Pending Admin Approval Breakdown Assistant (Mon)' DO UPDATE customer_car_breakdown_service SET status = 'Rejected', actiondatetime = TIMESTAMPADD(HOUR,8,CURRENT_TIMESTAMP) WHERE cast(actiondatetime as date) = CURRENT_DATE and status = 'Pending Admin Approval' | utf8mb4 | utf8mb4_unicode_ci | latin1_swedish_ci |

Figure 4.6.5: MySQL Create Event “Monday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.5 shows the created “Monday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 7pm at Monday (Shop closing time).

4.6.6 Scheduled Event to Auto Reject Breakdown Assistant Request (Tuesday)

Your SQL query has been executed successfully.

[show create event](#) `Tuesday Update Pending Admin Approval Breakdown Assistant`

Profiling [\[Edit inline\]](#) [\[Edit\]](#) [\[Create PHP code\]](#) [\[Refresh\]](#)

+ Options

| Event | sql_mode | time_zone | Create Event | character_set_client | collation_connection | Database Collation |
|---|------------------------|-----------|--|----------------------|----------------------|--------------------|
| Tuesday Update Pending Admin Approval Breakdown Assistant | NO_ENGINE_SUBSTITUTION | UTC | CREATE DEFINER='user'@'%' EVENT `Tuesday Update Pending Admin Approval Breakdown Assistant` ON SCHEDULE EVERY 168 HOUR STARTS '2020-04-21 11:00:00' ON COMPLETION PRESERVE ENABLE COMMENT 'Event To Update Pending Admin Approval Breakdown Assistant (Tue)' DO UPDATE customer_car_breakdown_service SET status = 'Rejected', actiondatetime = TIMESTAMPADD(HOUR,8,CURRENT_TIMESTAMP) WHERE cast(actiondatetime as date) = CURRENT_DATE and status = 'Pending Admin Approval' | utf8mb4 | utf8mb4_unicode_ci | latin1_swedish_ci |

Figure 4.6.6: MySQL Create Event “Tuesday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.6 shows the created “Tuesday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 7pm at Tuesday (Shop closing time).

4.6.7 Scheduled Event to Auto Reject Breakdown Assistant Request (Wednesday)

Your SQL query has been executed successfully.

[show create event](#) `Wednesday Update Pending Admin Approval Breakdown Assistant`

Profiling [\[Edit inline\]](#) [\[Edit\]](#) [\[Create PHP code\]](#) [\[Refresh\]](#)

+ Options

| Event | sql_mode | time_zone | Create Event | character_set_client | collation_connection | Database Collation |
|---|------------------------|-----------|--|----------------------|----------------------|--------------------|
| Wednesday Update Pending Admin Approval Breakdown Assistant | NO_ENGINE_SUBSTITUTION | UTC | CREATE DEFINER='user'@'%' EVENT `Wednesday Update Pending Admin Approval Breakdown Assistant` ON SCHEDULE EVERY 168 HOUR STARTS '2020-04-22 11:00:00' ON COMPLETION PRESERVE ENABLE COMMENT 'Event To Update Pending Admin Approval Breakdown Assistant (Wed)' DO UPDATE customer_car_breakdown_service SET status = 'Rejected', actiondatetime = TIMESTAMPADD(HOUR,8,CURRENT_TIMESTAMP) WHERE cast(actiondatetime as date) = CURRENT_DATE and status = 'Pending Admin Approval' | utf8mb4 | utf8mb4_unicode_ci | latin1_swedish_ci |

Figure 4.6.7: MySQL Create Event “Wednesday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.7 shows the created “Wednesday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 7pm at Wednesday (Shop closing time).

4.6.8 Scheduled Event to Auto Reject Breakdown Assistant Request (Thursday)

Your SQL query has been executed successfully.

[show create event](#) `Thursday Update Pending Admin Approval Breakdown Assistant`

Profiling [\[Edit inline\]](#) [\[Edit\]](#) [\[Create PHP code\]](#) [\[Refresh\]](#)

+ Options

| Event | sql_mode | time_zone | Create Event | character_set_client | collation_connection | Database Collation |
|--|------------------------|-----------|---|----------------------|----------------------|--------------------|
| Thursday Update Pending Admin Approval Breakdown Assistant | NO_ENGINE_SUBSTITUTION | UTC | CREATE DEFINER='user'@'%' EVENT `Thursday Update Pending Admin Approval Breakdown Assistant` ON SCHEDULE EVERY 168 HOUR STARTS '2020-04-23 11:00:00' ON COMPLETION PRESERVE ENABLE COMMENT 'Event To Update Pending Admin Approval Breakdown Assistant (Thu)' DO UPDATE customer_car_breakdown_service SET status = 'Rejected', actiondatetime = TIMESTAMPADD(HOUR,8,CURRENT_TIMESTAMP) WHERE cast(actiondatetime as date) = CURRENT_DATE and status = 'Pending Admin Approval' | utf8mb4 | utf8mb4_unicode_ci | latin1_swedish_ci |

Figure 4.6.8: MySQL Create Event “Thursday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.8 shows the created “Thursday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 7pm at Thursday (Shop closing time).

4.6.9 Scheduled Event to Auto Reject Breakdown Assistant Request (Friday)



Figure 4.6.9: MySQL Create Event “Friday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.9 shows the created “Friday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 7pm at Friday (Shop closing time).

4.6.10 Scheduled Event to Auto Reject Breakdown Assistant Request (Saturday)



Figure 4.6.10: MySQL Create Event “Saturday Update Pending Admin Approval Breakdown Assistant”

Figure 4.6.10 shows the created “Saturday Update Pending Admin Approval Breakdown Assistant” event in MySQL database with the purpose of auto reject all the customer car breakdown assistant requests which are still in pending admin approval state on 7pm at Saturday (Shop closing time).

4.7 “Facebook For Developer” Configuration for User Authentication Using Facebook Account

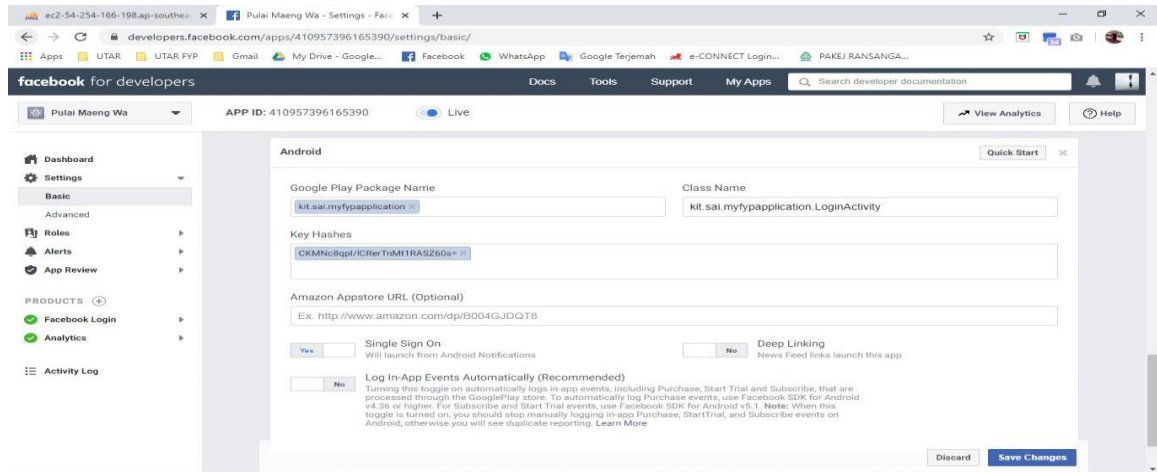


Figure 4.7.1: Facebook for Developer User Authentication Configuration

Figure 4.7.1 shows the configuration at Facebook for Developer to make the Android mobile application able to authenticate customers with their Facebook account.

4.8 Google APIs Configuration for User Authentication Using Google Account

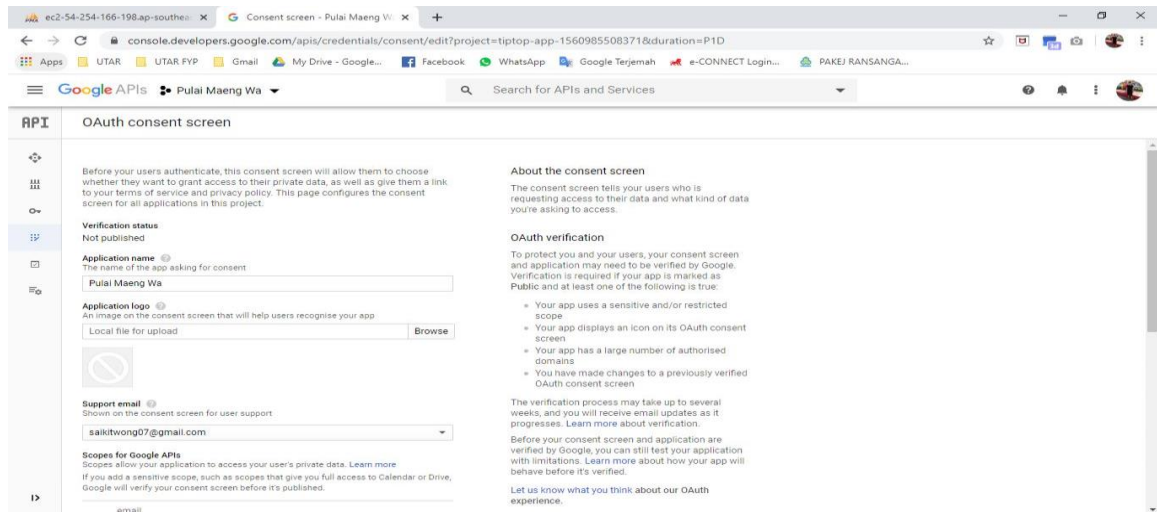


Figure 4.8.1: Google APIs User Authentication Configuration

Figure 4.8.1 shows the configuration at Google APIs to make the Android mobile application able to authenticate customers with their Google account.

4.9 Firebase Configuration for Publishing Notification Using Firebase Cloud Messaging

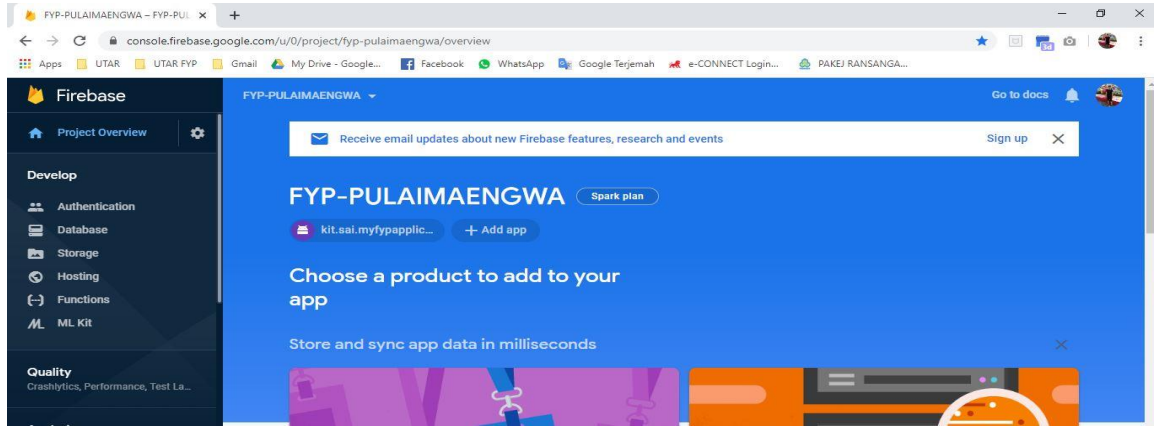


Figure 4.9.1: Firebase Configuration

Figure 4.9.1 shows the configuration at Firebase to make use of the Firebase Cloud Messaging feature so that any notification of the Android mobile application able to send from single device to single device, and system to multiple devices.

4.10 Google APIs Maps SDK for Android Configuration

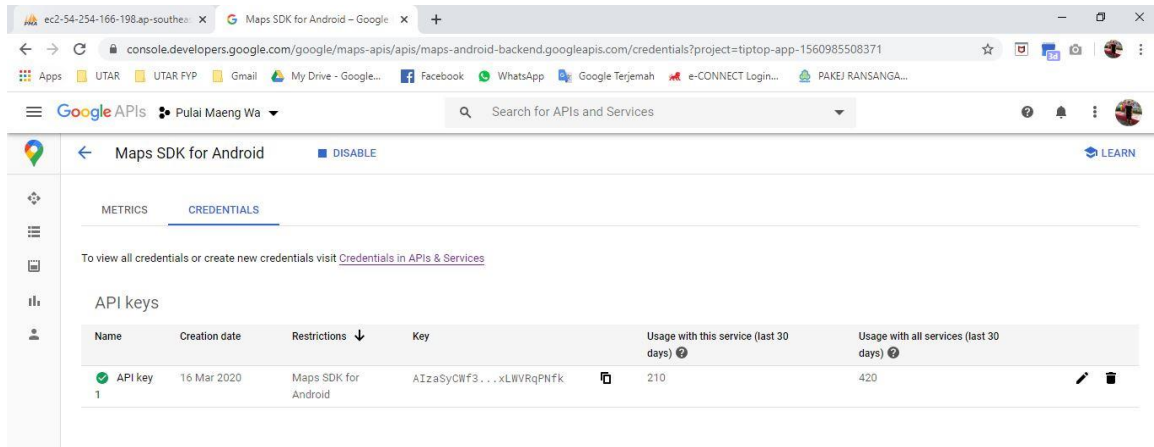


Figure 4.10.1: Google APIs Maps SDK for Android Configuration

Figure 4.10.1 shows the configuration at Google APIs to make use of the Maps SDK for Android so that the Android mobile application able to locate the customers at their current coordinate.

4.11 Android Application Development

4.11.1 Splash Screen

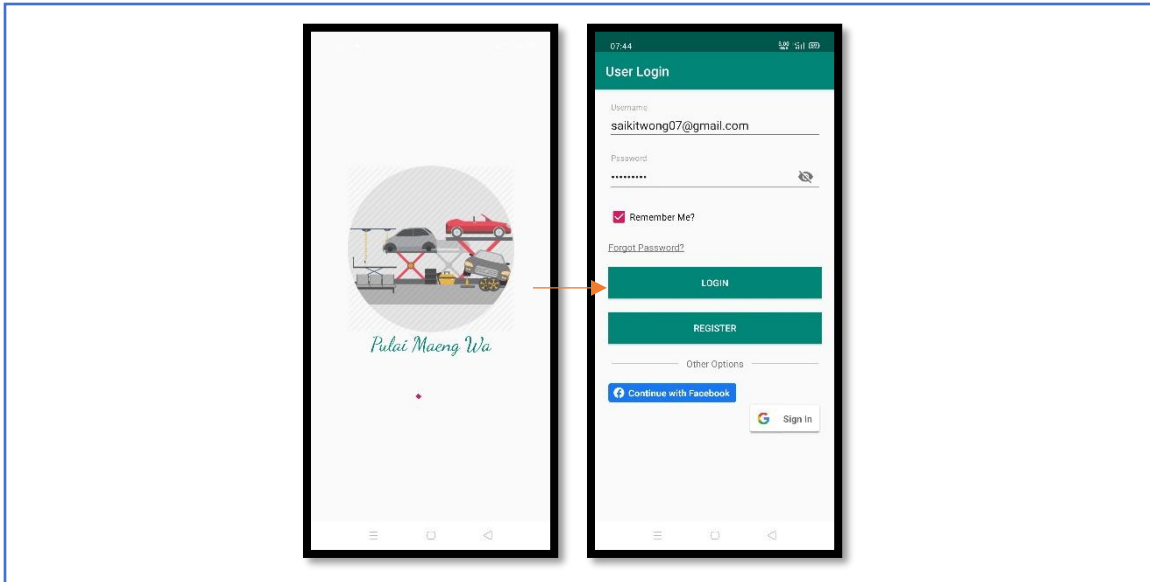


Figure 4.11.1: Splash Screen

Figure 4.11.1 shows the completely implemented splash screen and User Login screen.

4.11.2 User Authentication Using Email/Password

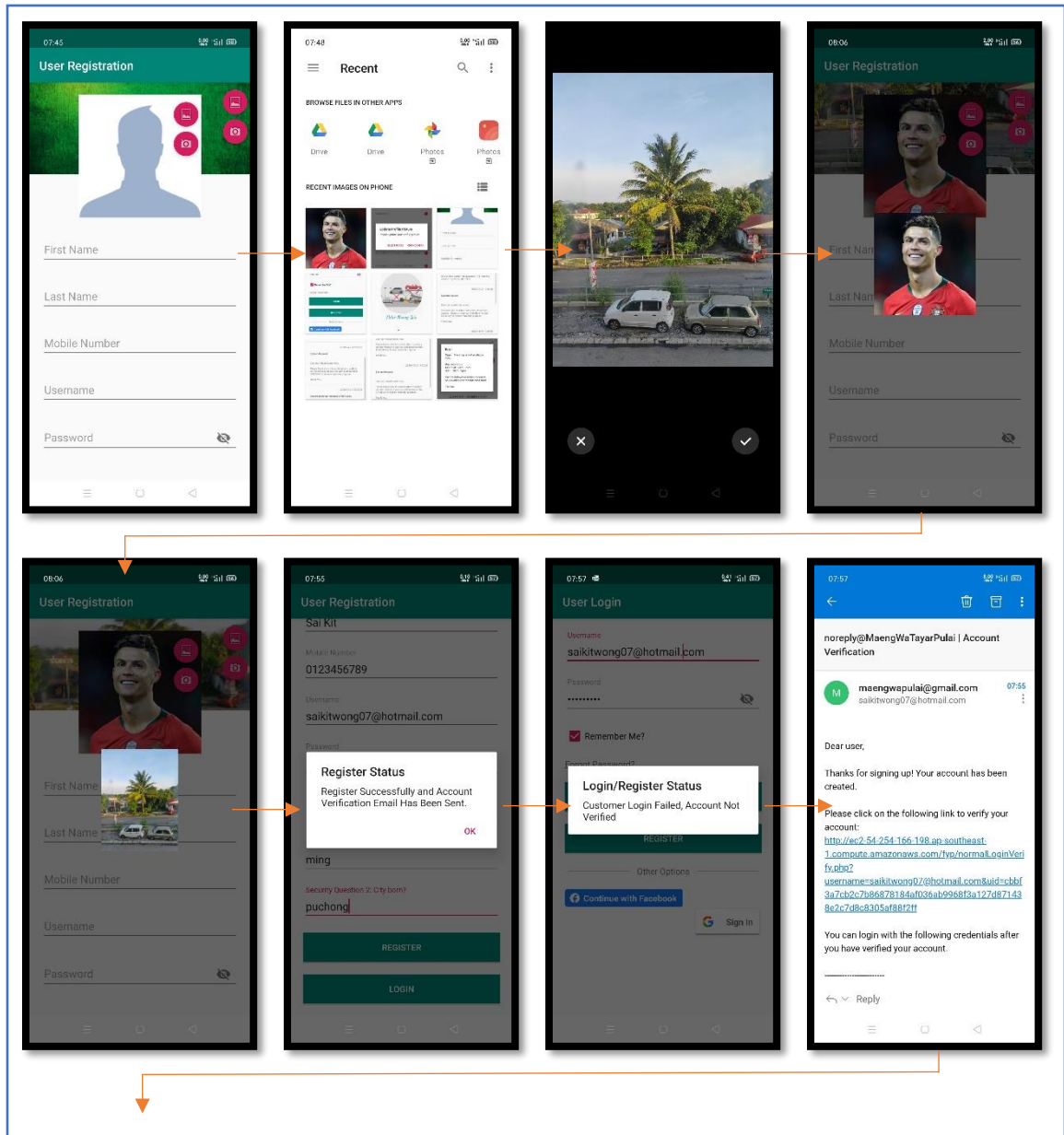


Figure 4.11.2: User Authentication Using Email/Password (1)

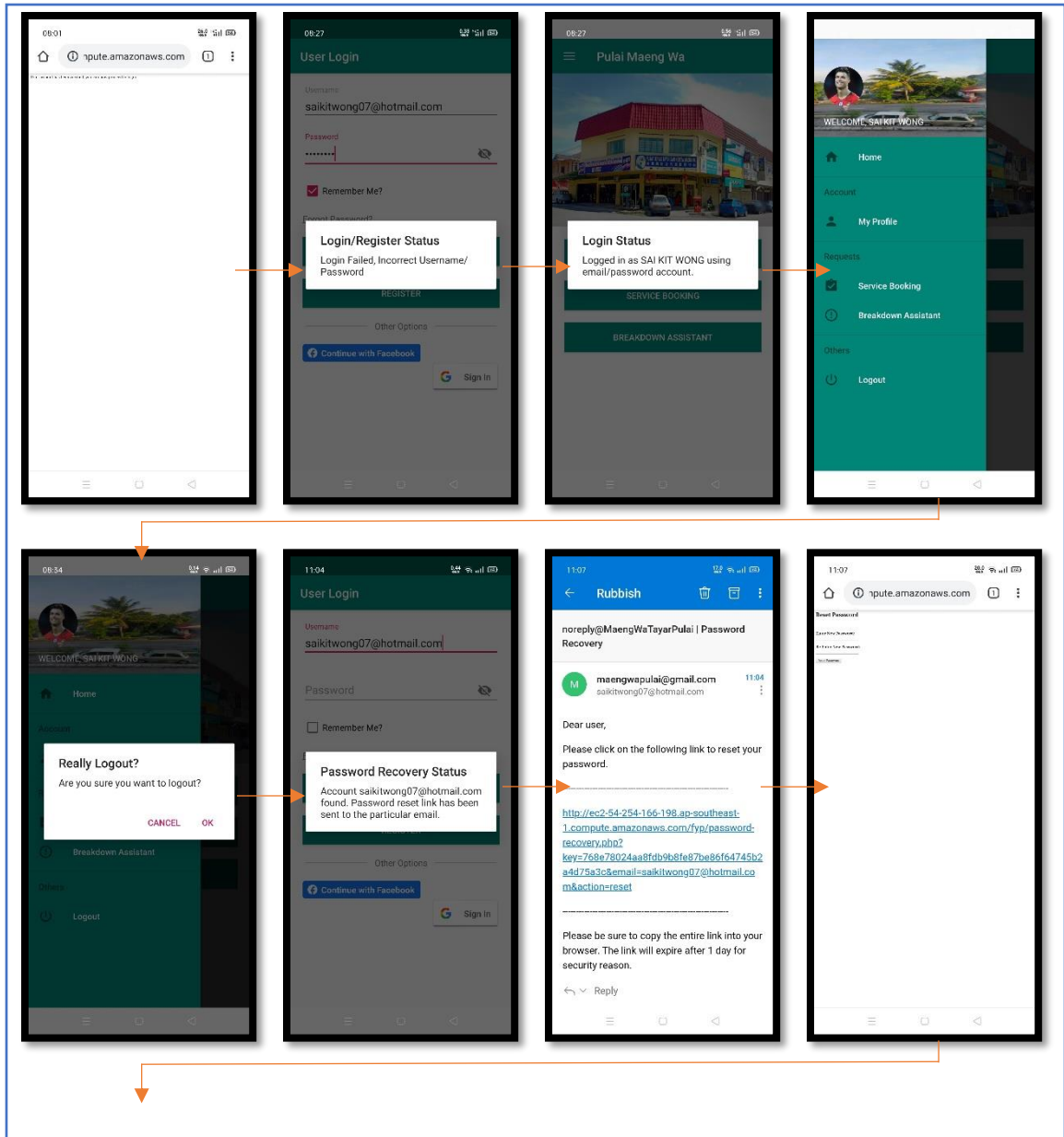


Figure 4.11.3: User Authentication Using Email/Password (2)

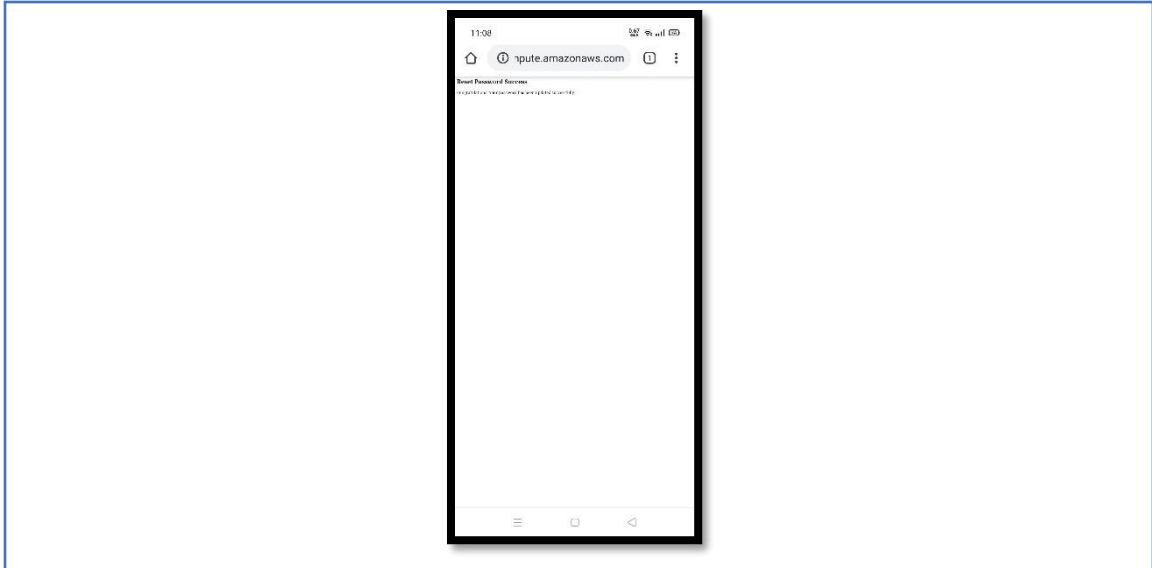


Figure 4.11.4: User Authentication Using Email/Password (3)

Figure 4.11.2 to Figure 4.11.4 shows the flow of completely implemented User Authentication Using Email/Password function which covers Registration, New User Account Verification, Login, Logout, and Password Recovery features.

4.11.3 User Authentication Using Facebook & Google Account

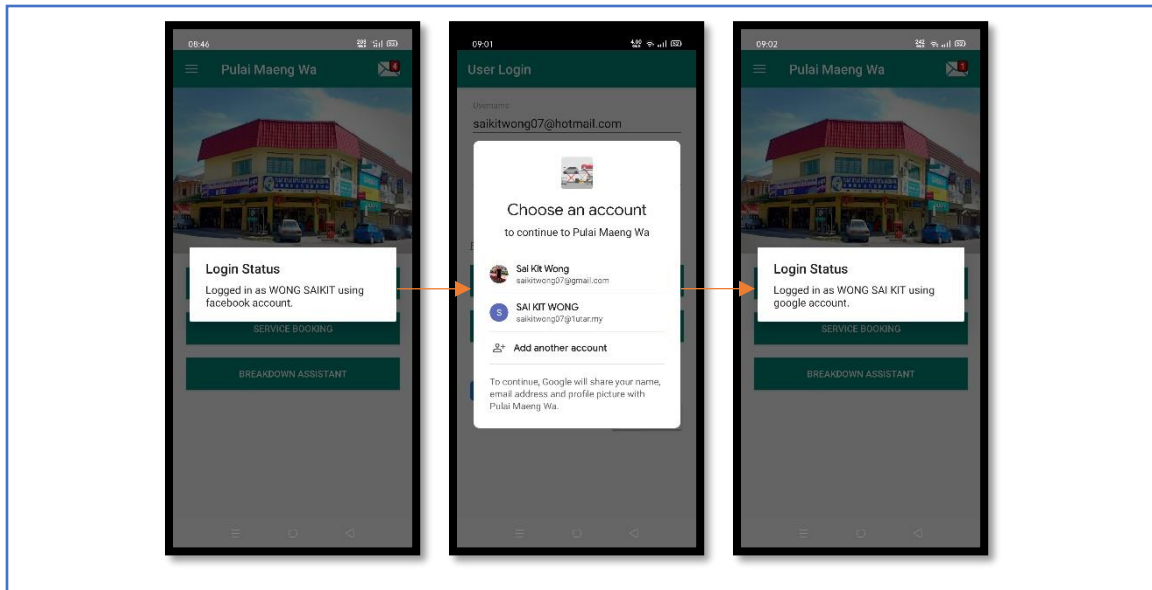


Figure 4.11.5: User Authentication Using Facebook & Google Account

Figure 4.11.5 shows the flow of completely implemented User Authentication Using Facebook & Google Account function.

4.11.4 Customer Profile Management

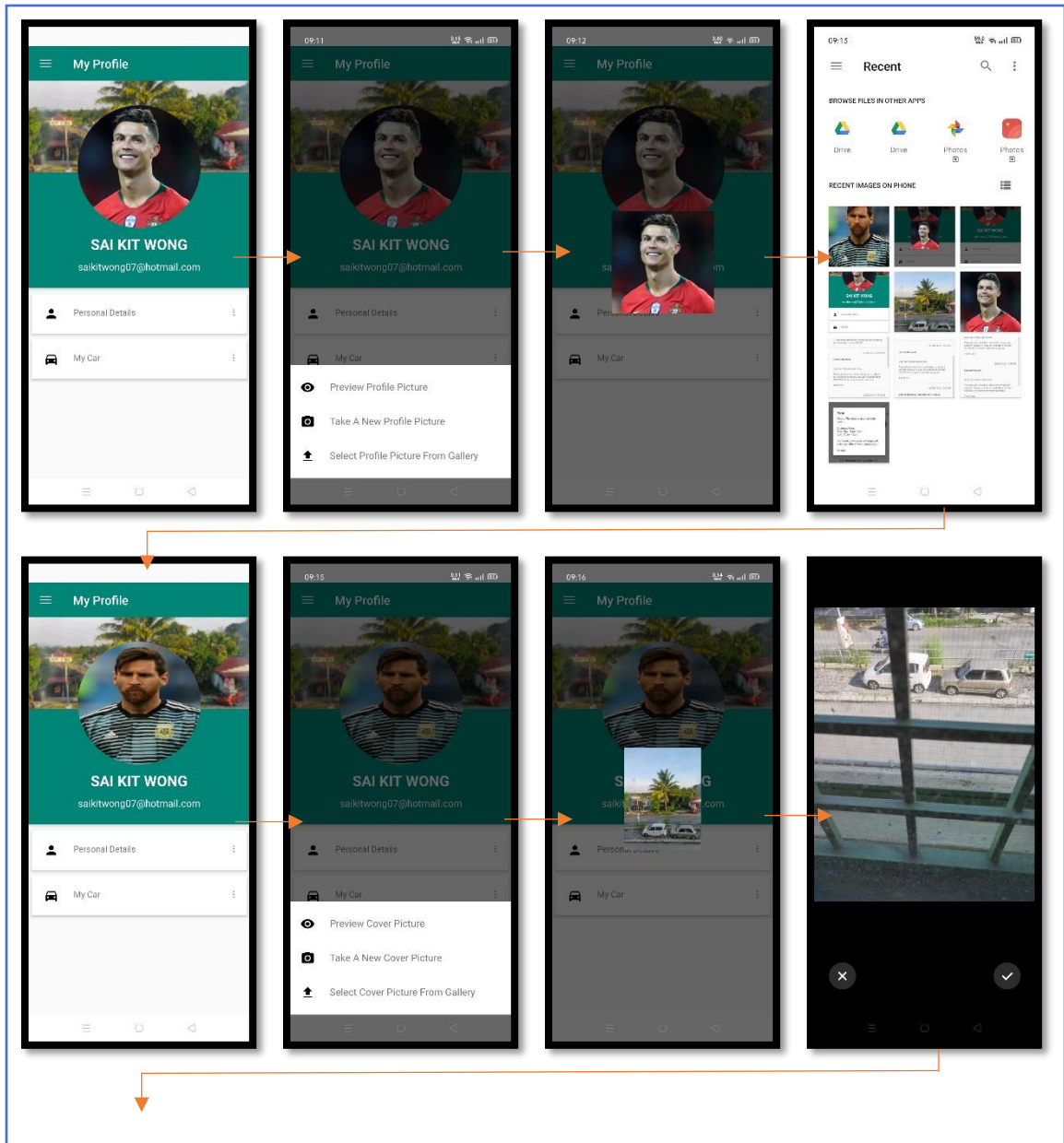


Figure 4.11.6: Customer Profile Management (1)

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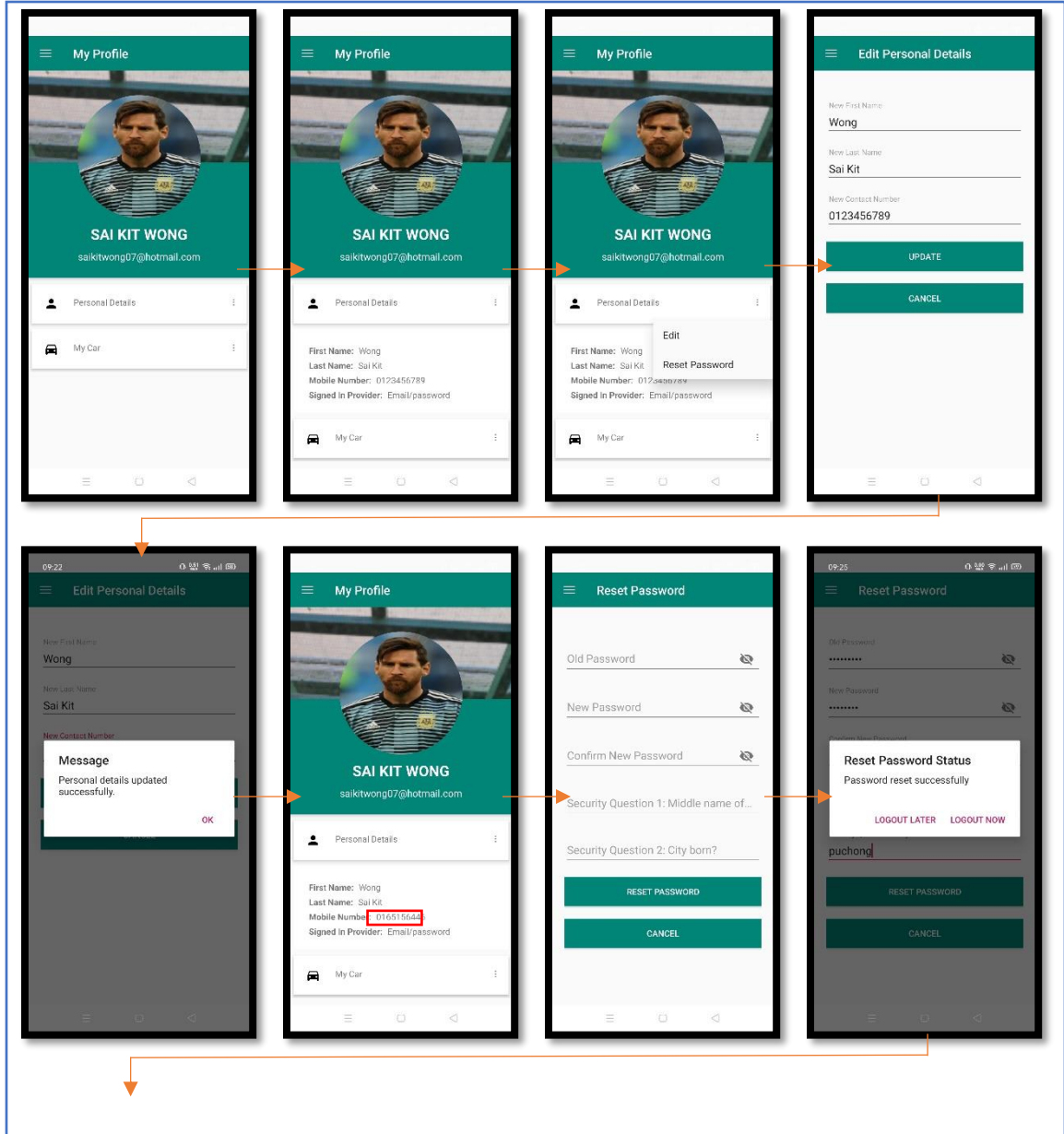


Figure 4.11.7: Customer Profile Management (2)

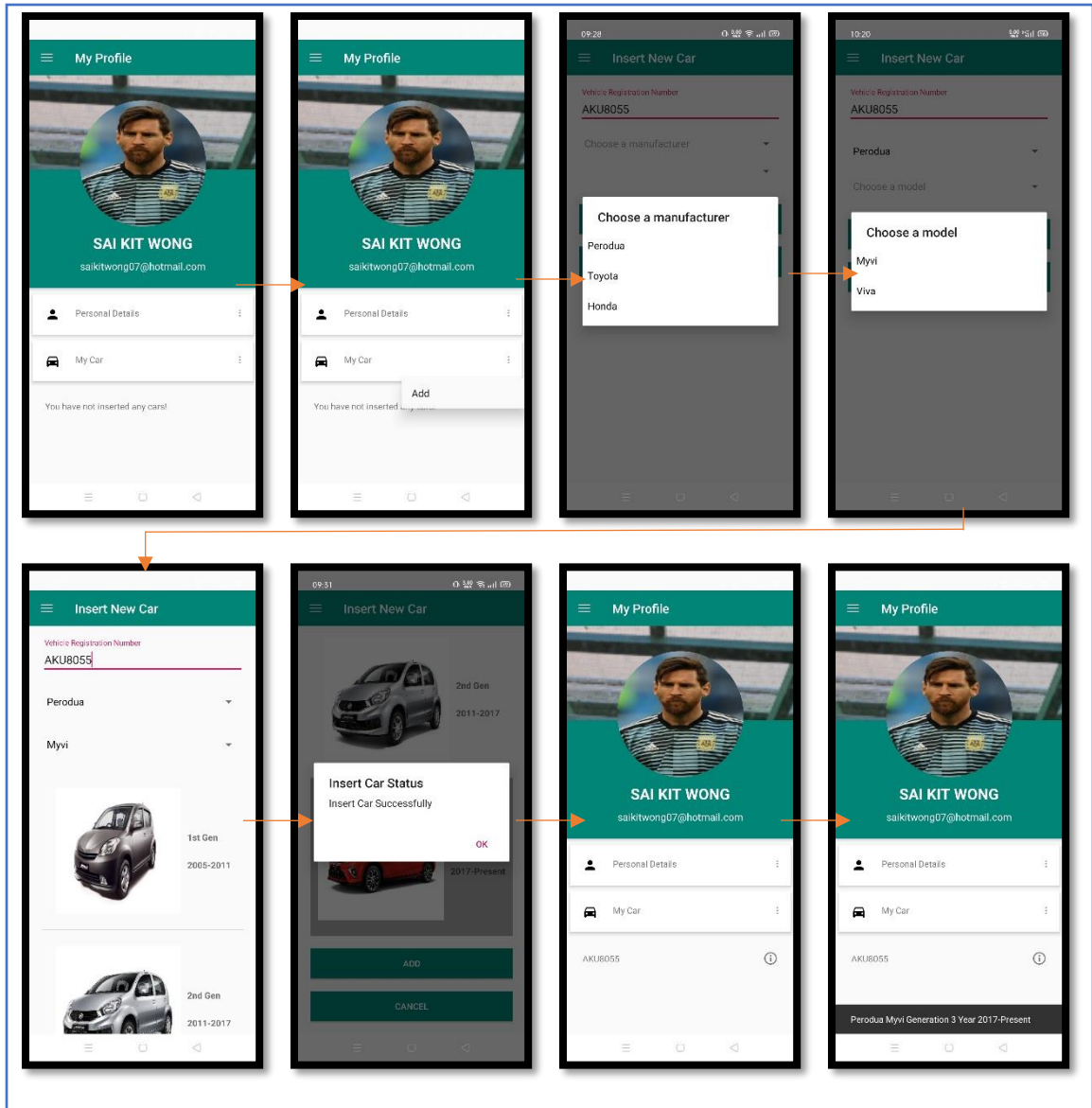


Figure 4.11.8: Customer Profile Management (3)

Figure 4.11.6 to Figure 4.11.8 shows the flow of completely implemented Customer Profile Management function which covers Change Picture, Update Personal Details, Reset Password, and Add Car features.

4.11.5 Customer Profile Management Special Case for Facebook or Google Authenticated Users

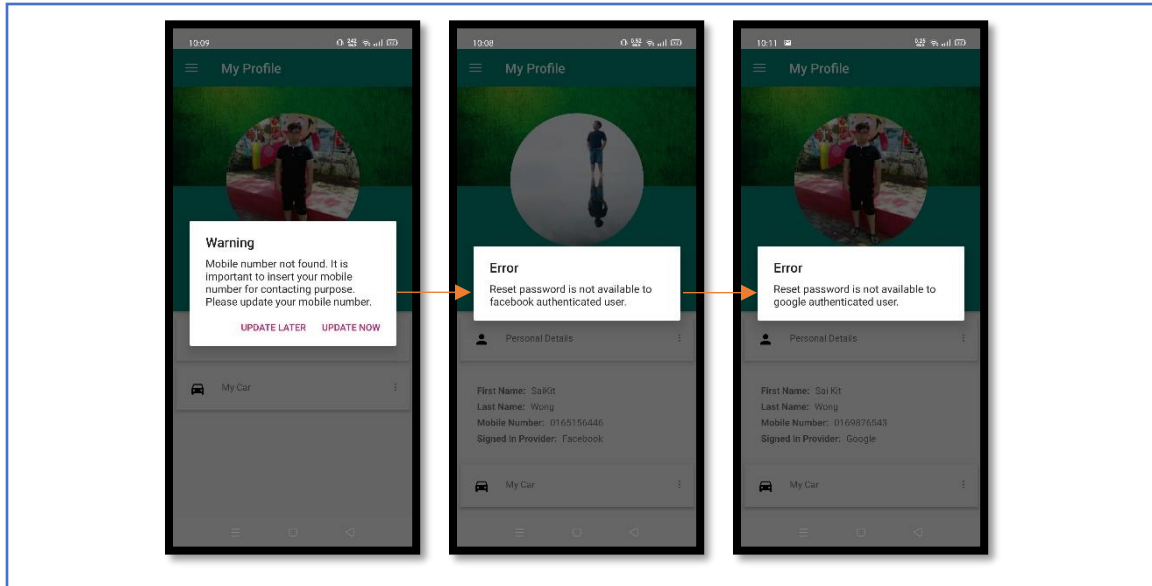


Figure 4.11.9: Customer Profile Management Special Case

Figure 4.11.9 shows 2 special cases of the implemented Customer Profile Management function for customers signed in using Facebook or Google Account in which the customer will be alerted to update his phone number and the customer cannot make use of reset password feature.

4.11.6 Customer Update Latest Car Mileage

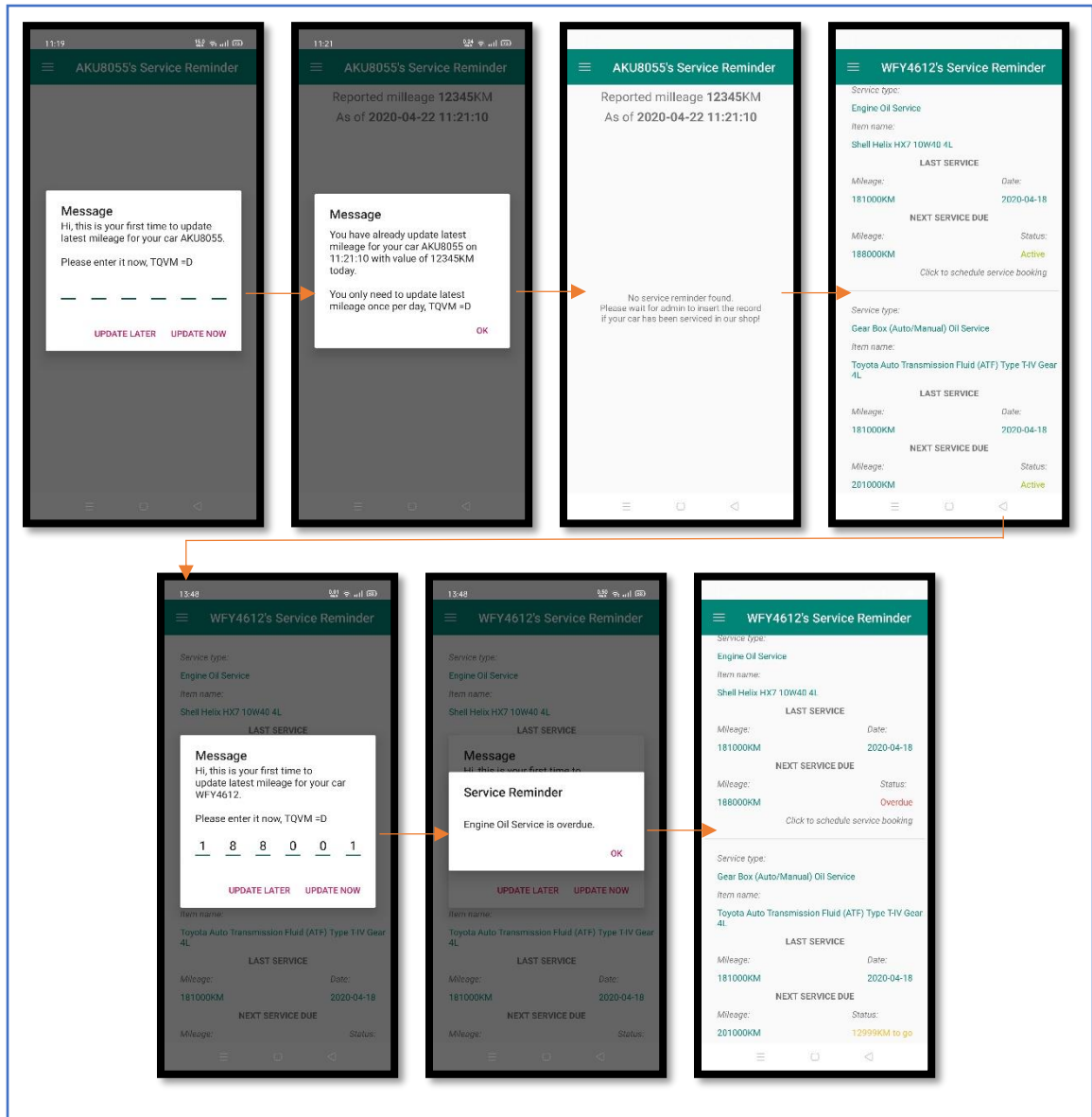


Figure 4.11.10: Customer Update Latest Car Mileage

Figure 4.11.10 shows the flow of completely implemented Customer Update Latest Car Mileage function which covers System to Request Customer to Update Latest Car Mileage on 5pm every day, and Customer to Update Car Mileage features.

4.11.7 Admin Insert Service Record

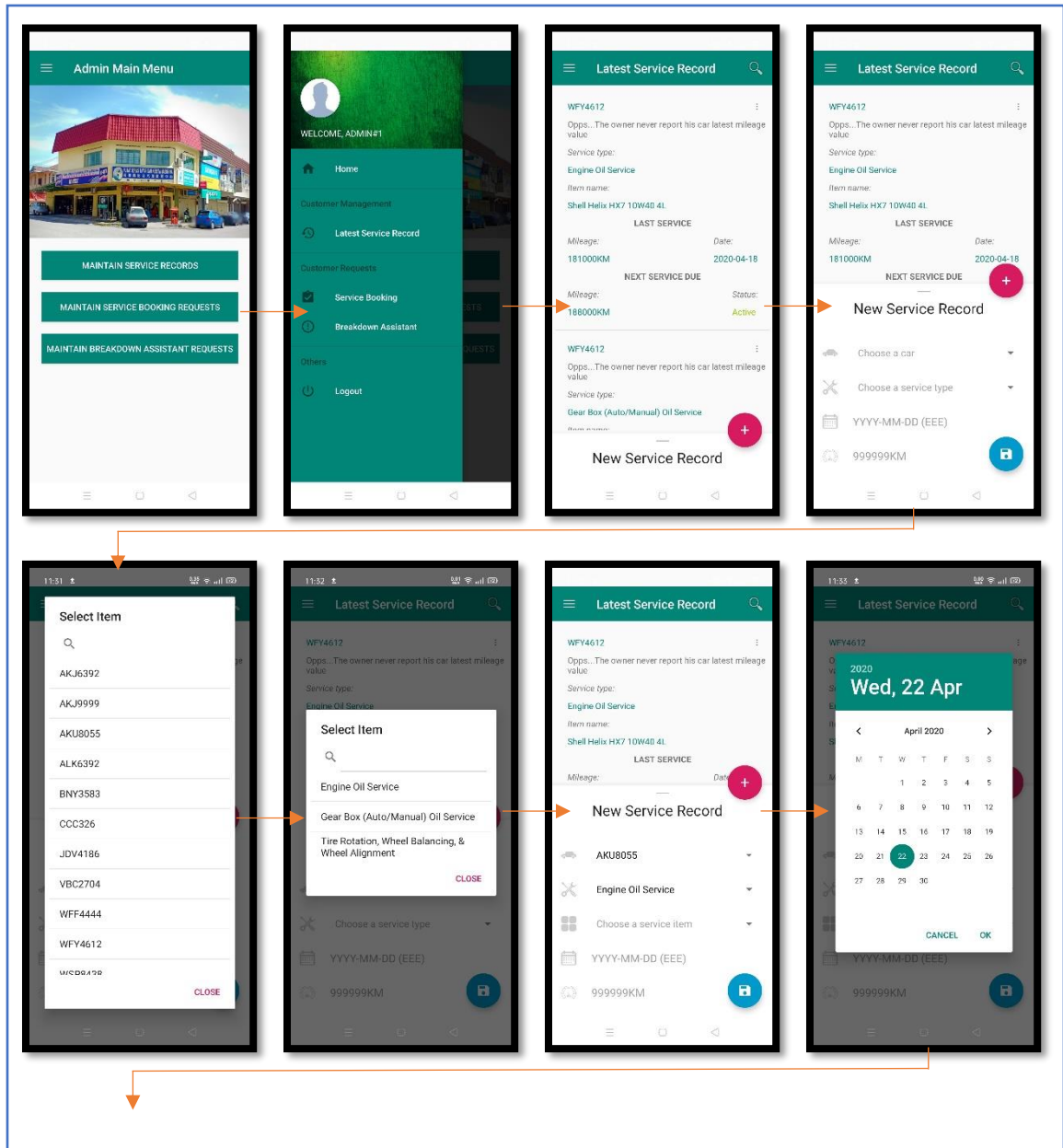


Figure 4.11.11: Admin Insert Service Record (1)

CHAPTER 4: SYSTEM IMPLEMENTATION

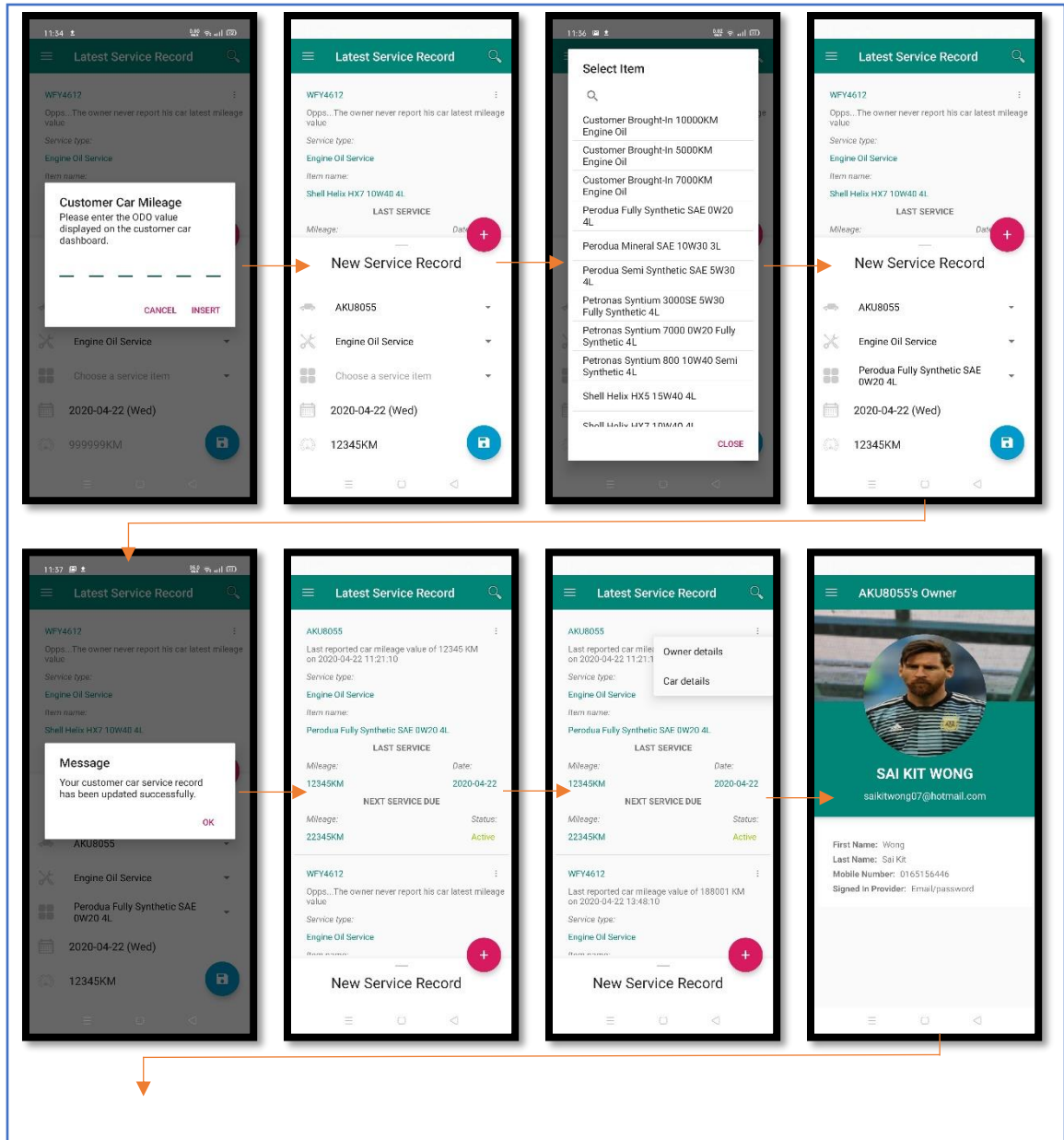


Figure 4.11.12: Admin Insert Service Record (2)

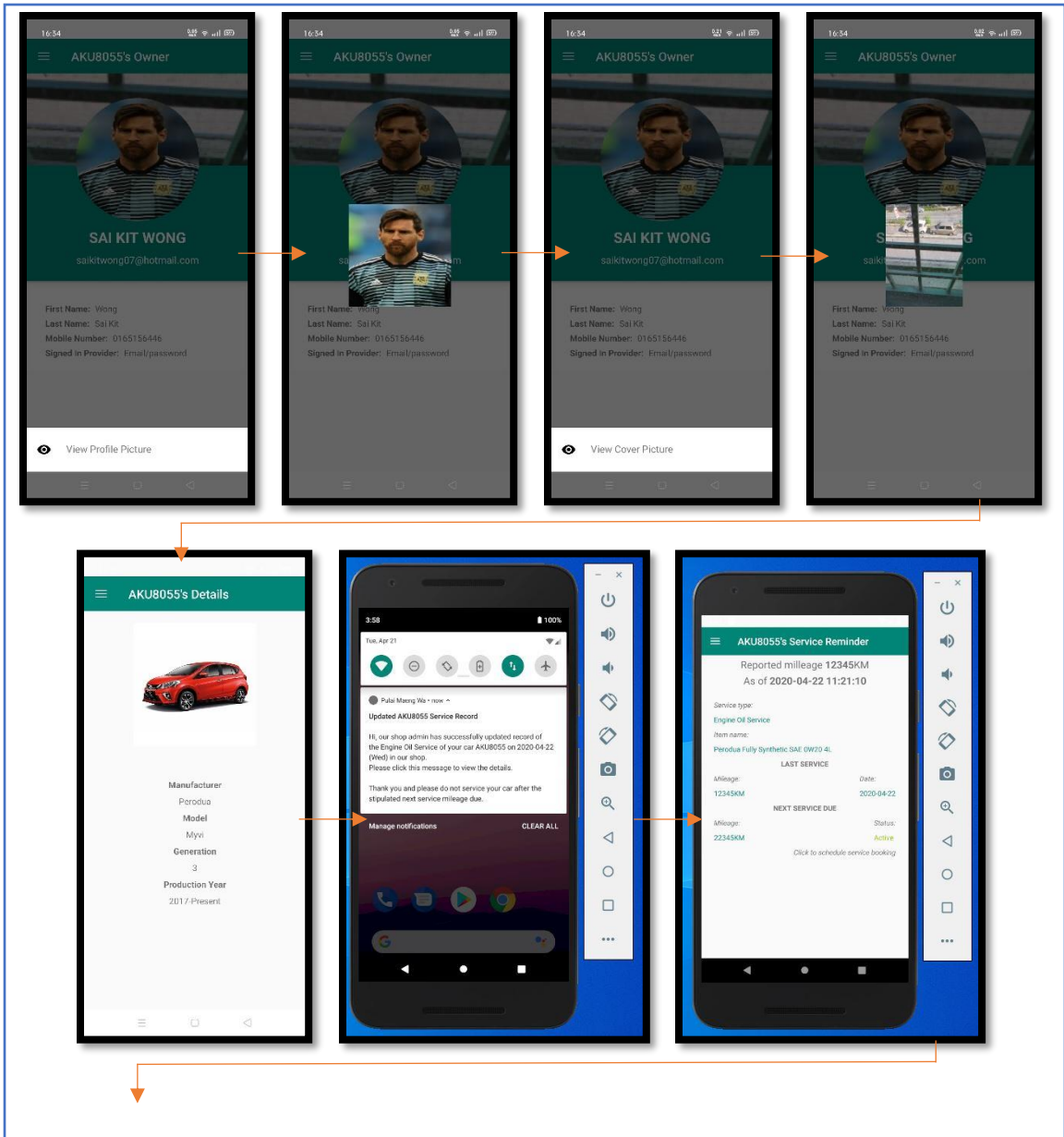


Figure 4.11.13: Admin Insert Service Record (3)

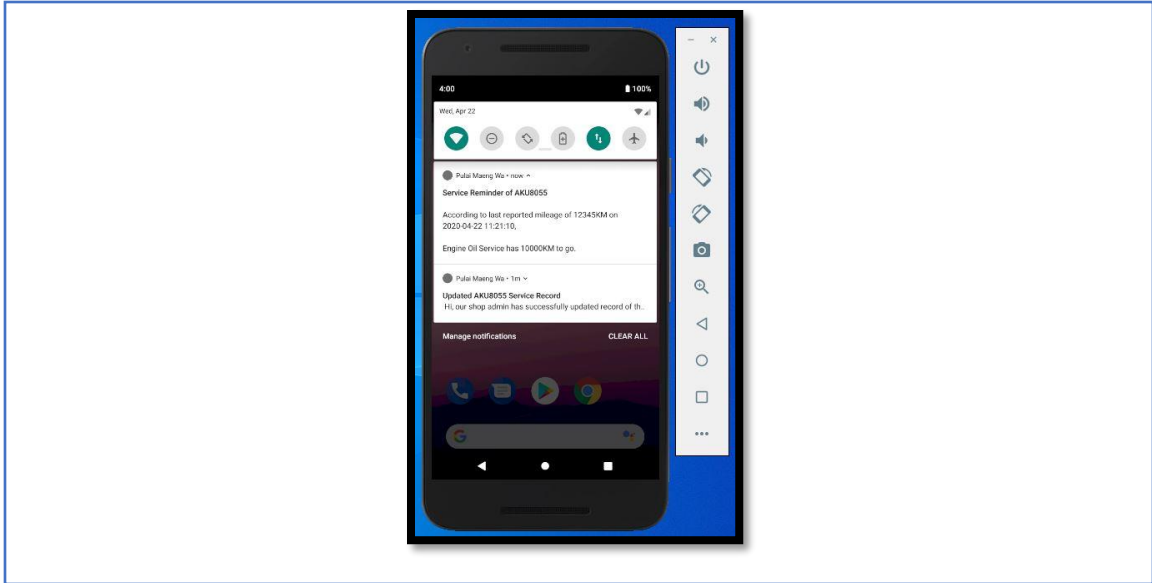


Figure 4.11.14: Admin Insert Service Record (4)

Figure 4.11.11 to Figure 4.11.14 shows the flow of completely implemented Admin Insert Service Record function which covers Admin to Insert Service Record, Admin to View Owner Details and Car Details of the Added Service Record, Customer to View the Added/Updated Service Record, and Service Reminder features.

4.11.8 Book a Service from Service Reminder Listing

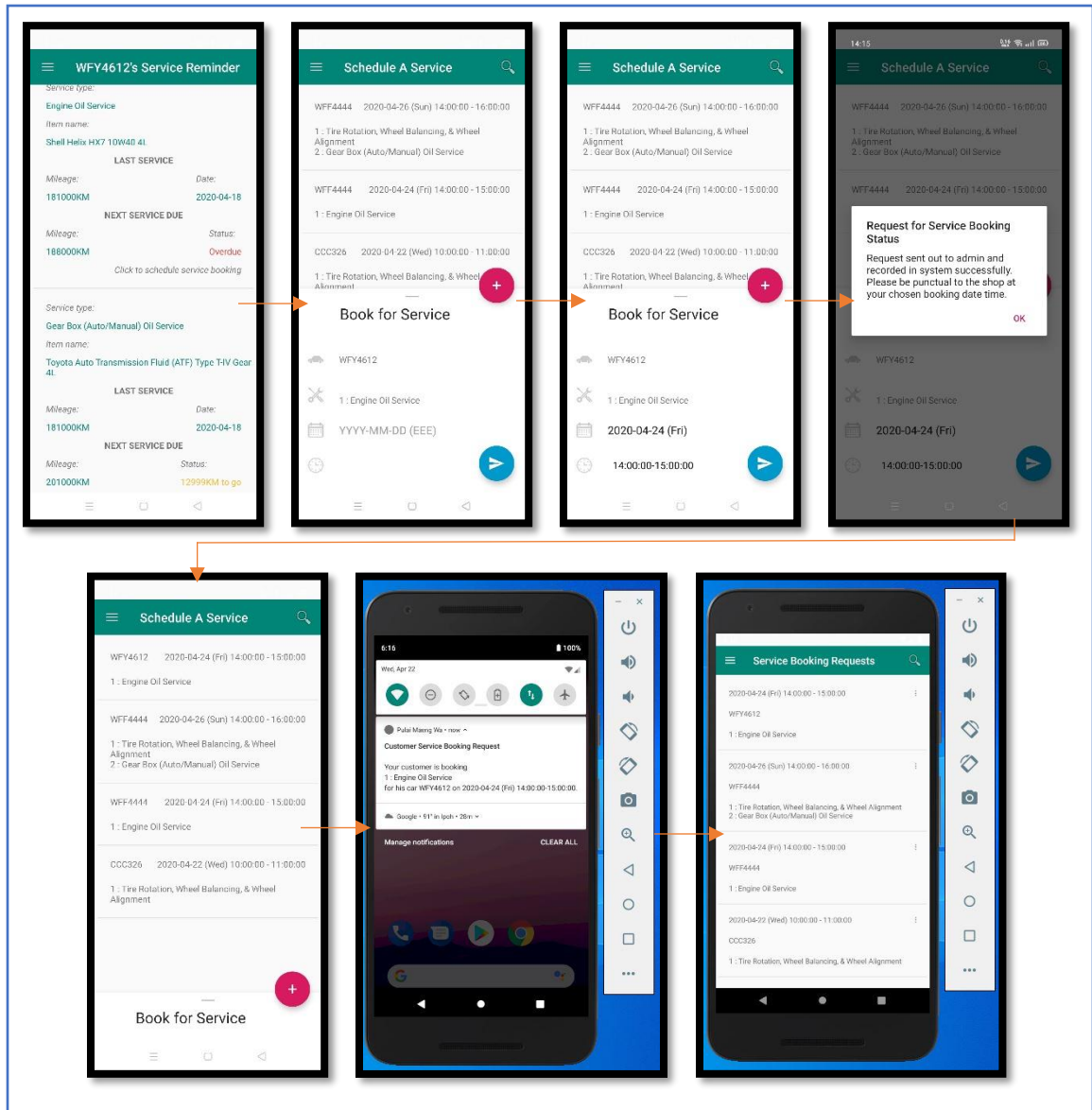


Figure 4.11.15: Book a Service from Service Reminder Listing

Figure 4.11.15 shows the flow of completely implemented Book a Service from Service Reminder Listing function which covers Customer to Make Service Booking with auto-filled Car Registration Number and Service, and Admin to View the Details of Service Booking Made by Customer features.

4.11.9 Service Booking

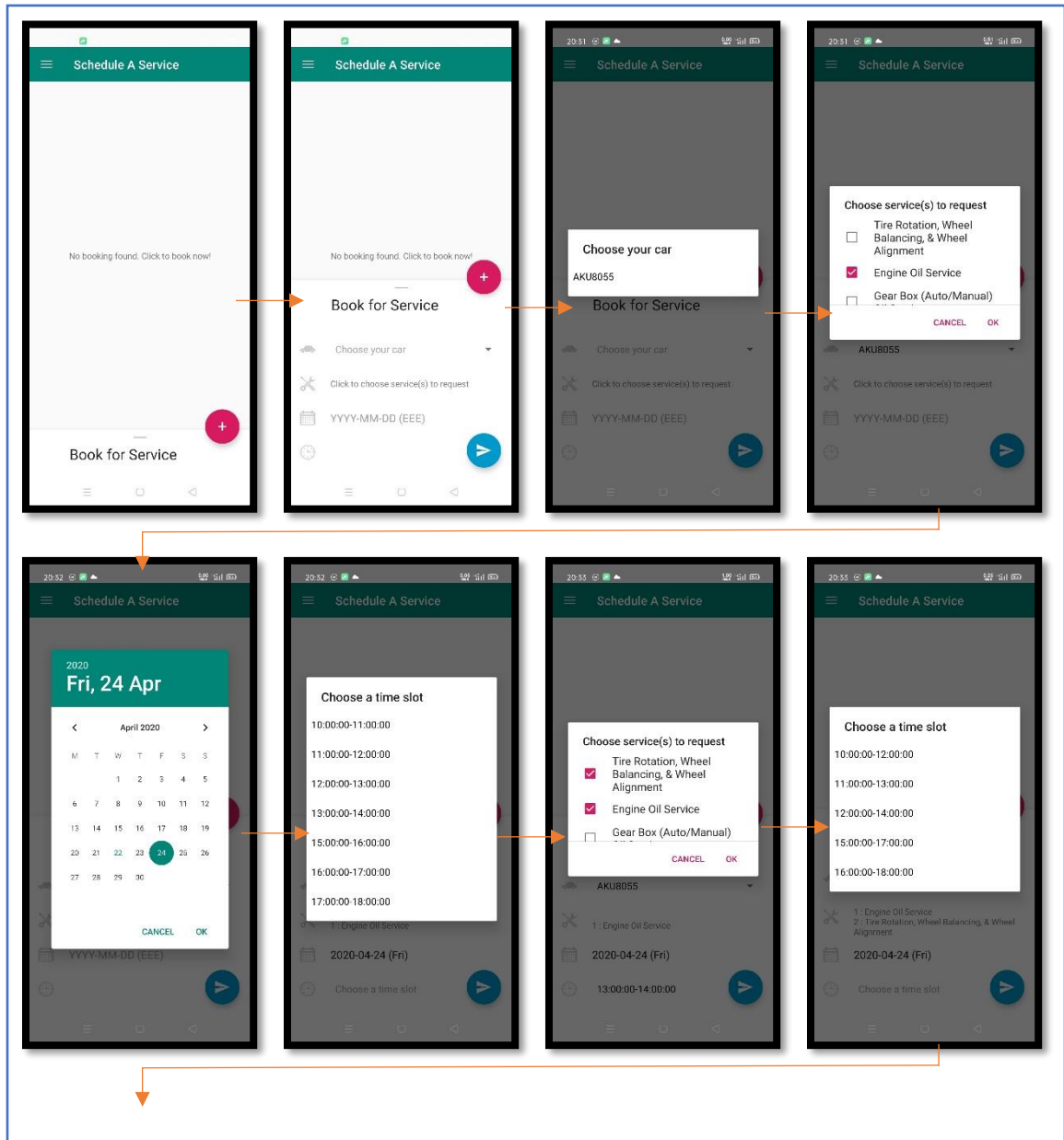


Figure 4.11.16: Service Booking (1)

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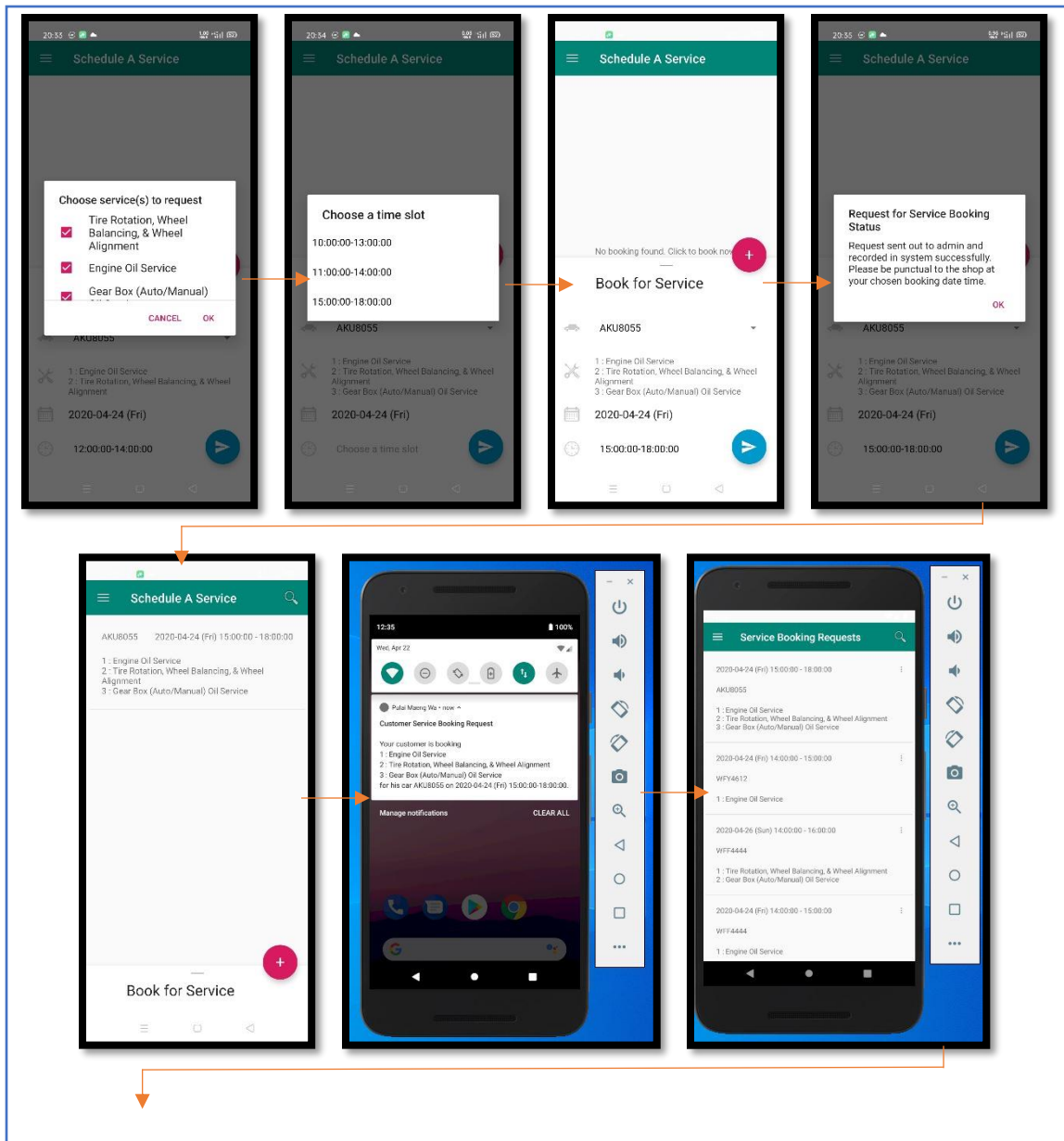


Figure 4.11.17: Service Booking (2)

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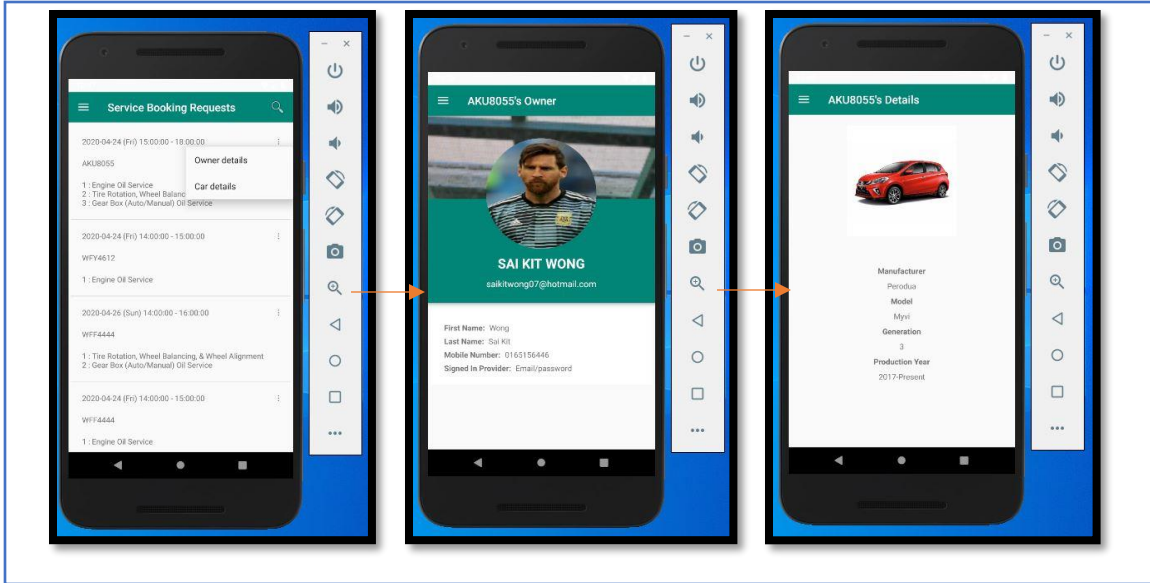


Figure 4.11.18: Service Booking (3)

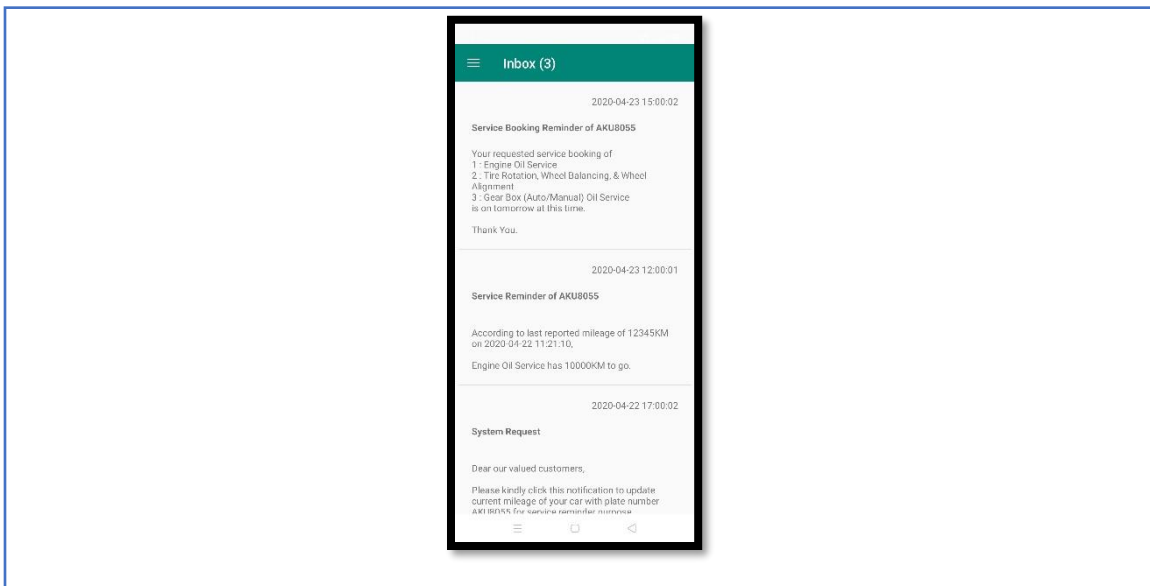


Figure 4.11.19: Service Booking Reminder One Day Before the Booking Date and Time

Figure 4.11.16 to Figure 4.11.18 shows the flow of implemented Service Booking function which is not initiated from the Service Reminder Listing and thus the Car Registration Number and Service are not auto-filled. Figure 4.11.19 shows the features of System to Remind Customer to Present in the Booked Date and Time.

4.11.10 Car Breakdown Assistant

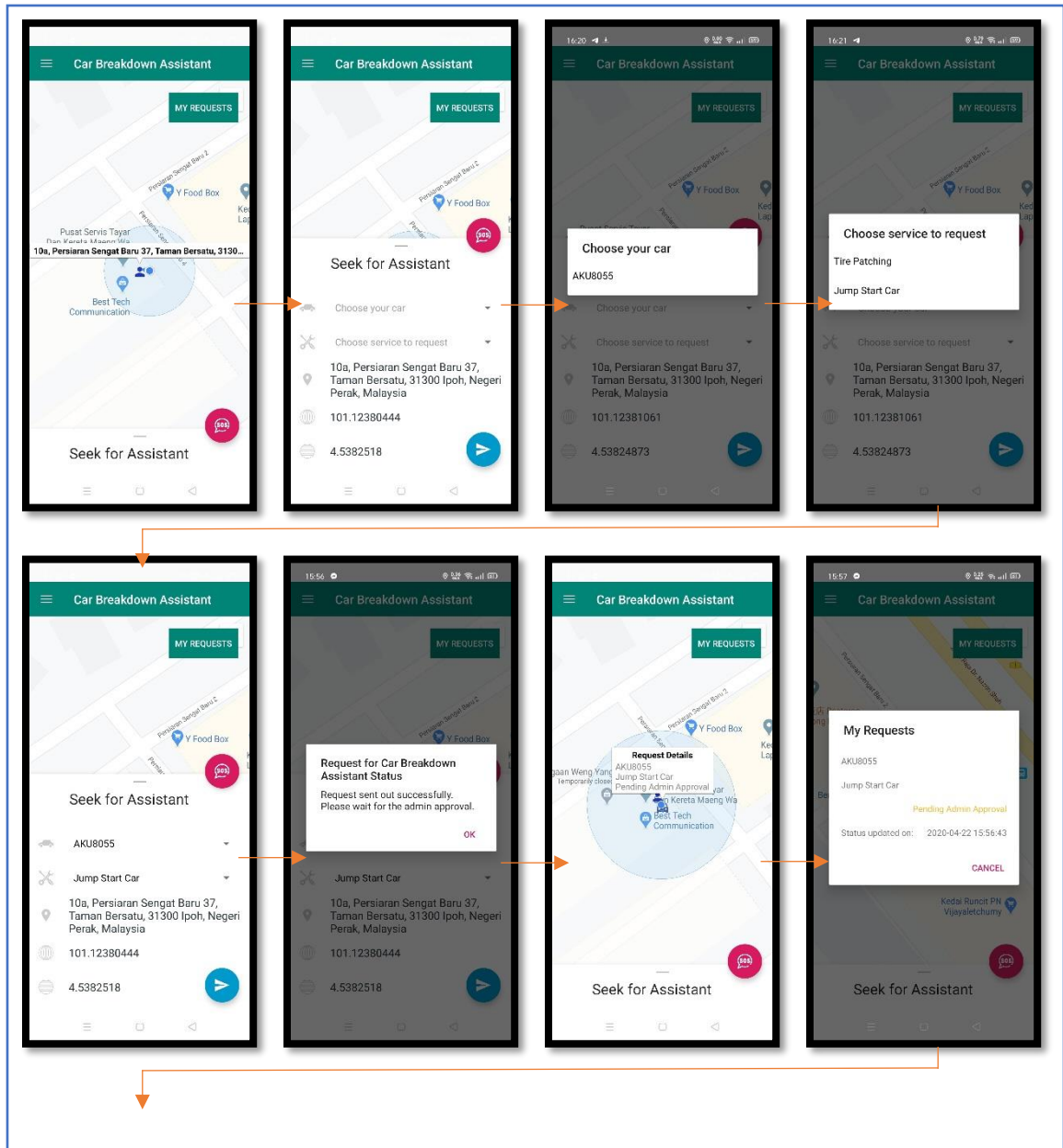


Figure 4.11.20: Car Breakdown Assistant (1)

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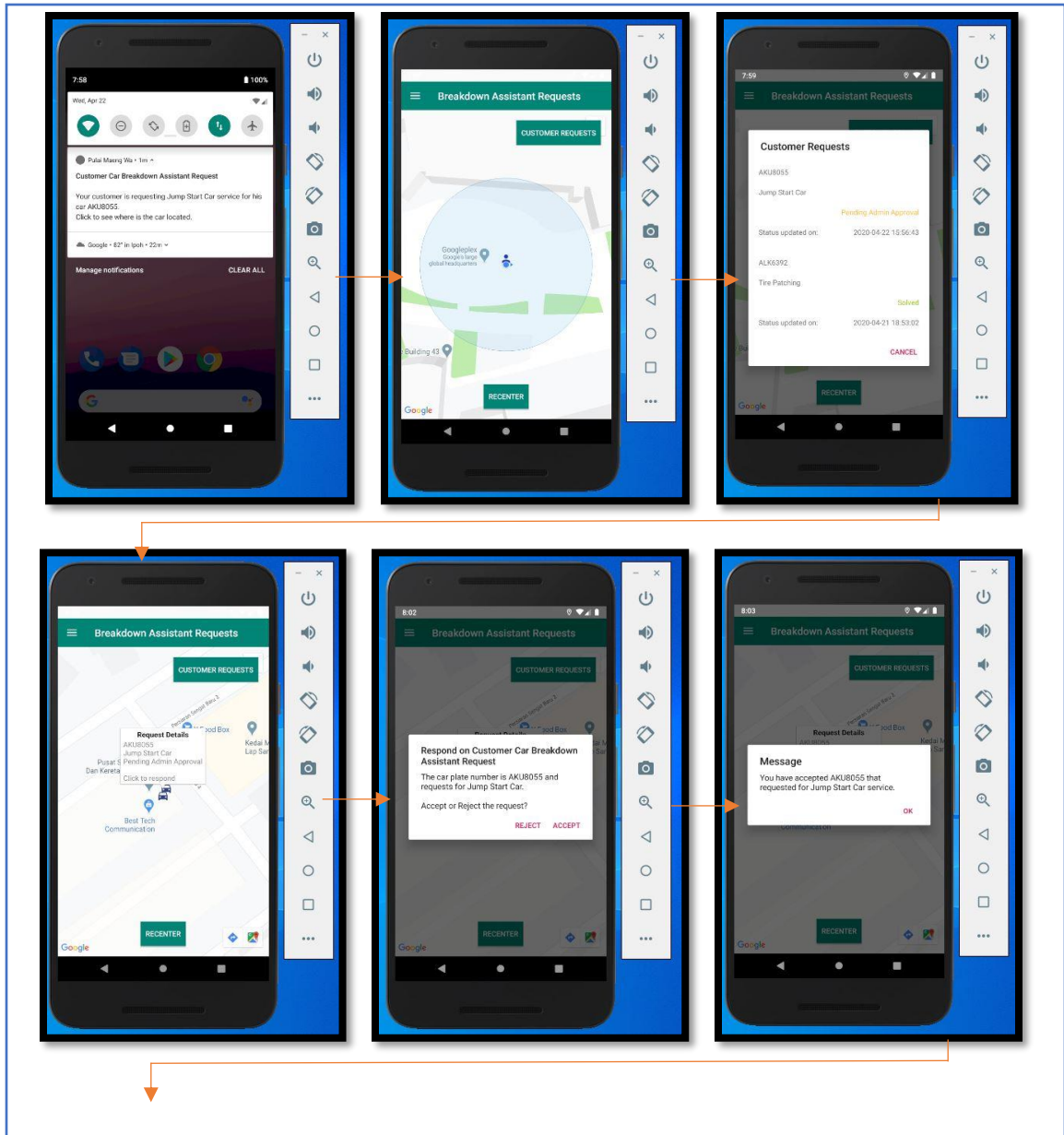


Figure 4.11.21: Car Breakdown Assistant (2)

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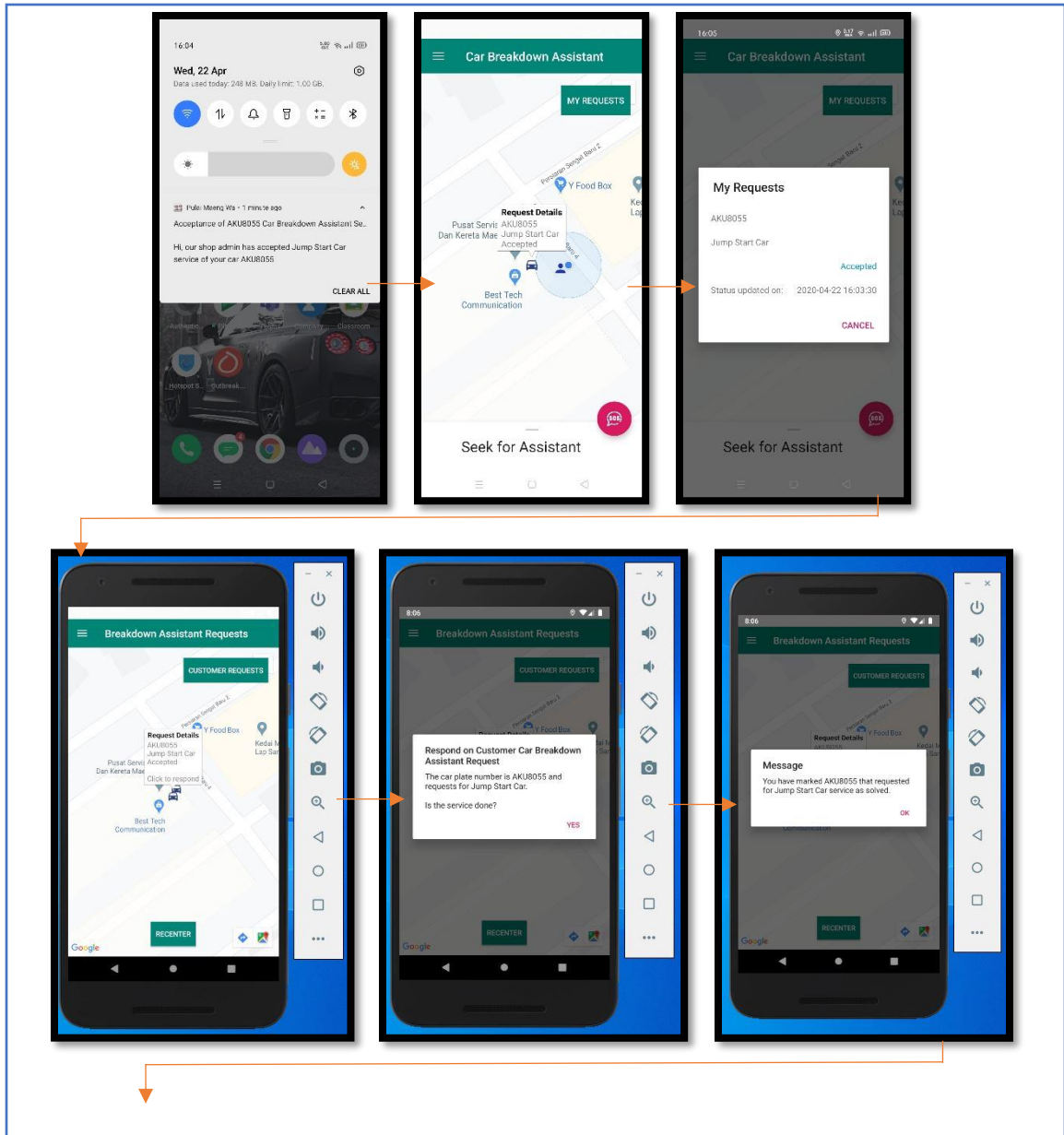


Figure 4.11.22: Car Breakdown Assistant (3)

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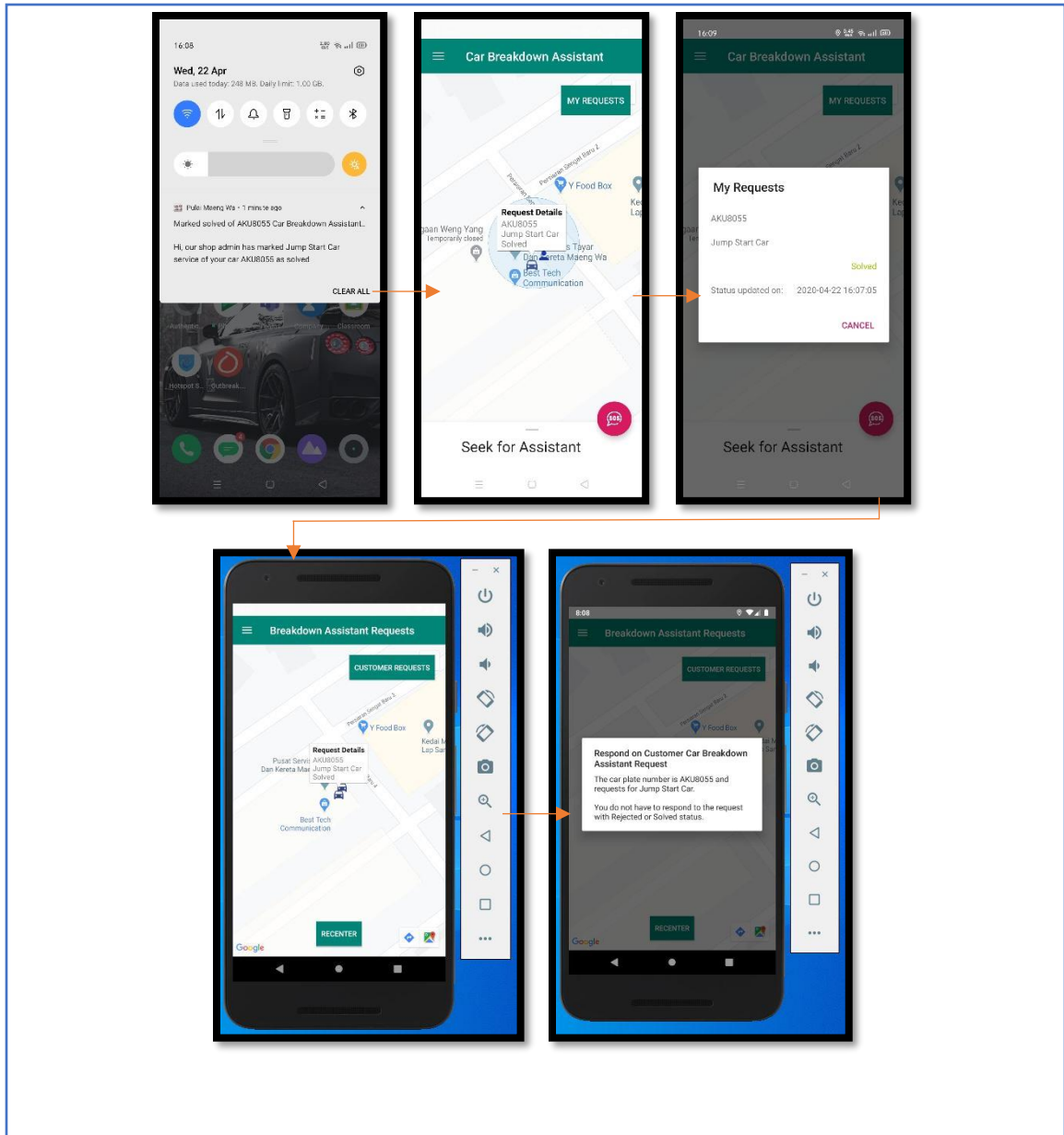


Figure 4.11.23: Car Breakdown Assistant (4)

Figure 4.11.20 to Figure 4.11.23 shows the flow of completely implemented Car Breakdown Assistant function which covers Customer to Request Assistant, and Admin to Perform Action on Customer Request features.

5.1 Devices Used for System Testing

Device 1 (Real Android Smartphone):



Figure 5.1.1: System Testing Device 1

Device 2 (Android Emulator):

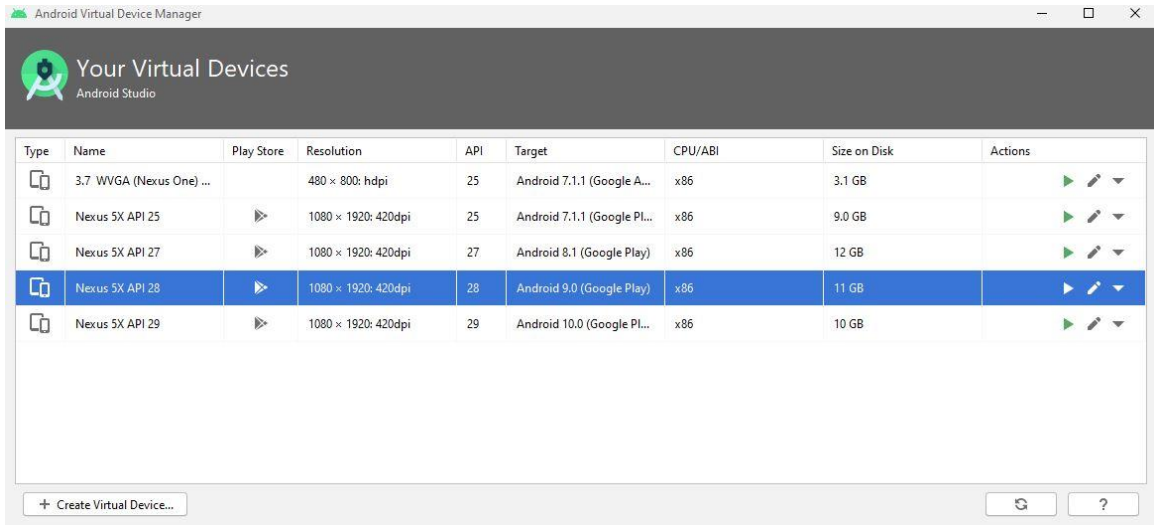


Figure 5.1.2: System Testing Device 2

5.2 Tested Items

| Category | Items | Results | | Verified by |
|---|--|-------------|-------------|--------------|
| | | Device 1 | Device 2 | |
| 1. Splash Screen | Animated splash screen is functioned. | √ | √ | Wong Sai Kit |
| | If no user logged in, User Login screen is launched after animated splash screen. | √ | √ | Wong Sai Kit |
| | If there is user logged in, Main Menu screen is launched after splash screen. | √ | √ | Wong Sai Kit |
| | Username and password are auto filled up if previously “Remember me?” is ticked. | √ | √ | Wong Sai Kit |
| | Username and password fields are empty if previously “Remember me?” is unticked. | √ | √ | Wong Sai Kit |
| 2. User Authentication Using Email/Password | User Registration screen able to reach if user clicked on “Register” button at User Login screen. | √ | √ | Wong Sai Kit |
| | Camera able to launch when user choose to take a picture to upload his profile picture or cover picture. | √ | √ | Wong Sai Kit |
| | Image gallery able to launch when user choose to select existing picture from image | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | gallery to upload his profile picture or cover picture. | | | |
| | Picture able to attach in profile picture or cover picture section after selecting an image from device image gallery. | √ | √ | Wong Sai Kit |
| | Picture able to attach in profile picture or cover picture section after capturing image using device camera. | √ | √ | Wong Sai Kit |
| | If profile picture or cover picture is made by capturing using device camera, the system able to keep a copy of the captured image in the device gallery. | √ | √ | Wong Sai Kit |
| | User able to view attached profile picture and cover picture in a pop-up window after clicking it. | √ | √ | Wong Sai Kit |
| | System able to alert user with corresponding error message when profile picture is empty, cover picture is empty, field validation rule is violated, or the username (Email address) is existing in database. | √ | √ | Wong Sai Kit |
| | User registration is success when all the necessarily information is provided in correct format. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|--|---|---|--------------|
| | System able to store the user information provided into the database. | √ | √ | Wong Sai Kit |
| | System able to mark all newly registered users as account not yet verified status. | √ | √ | Wong Sai Kit |
| | System able to send an account verification email to the username (Email address) provided by the user. | √ | √ | Wong Sai Kit |
| | System able to mark users as account verified when the account verification link in the email is clicked. | √ | √ | Wong Sai Kit |
| | The account verification link is one-time usage only and so subsequent time of clicking it will display invalid link message. | √ | √ | Wong Sai Kit |
| | System do not allow for account not verified user from signing in the application by alerting the user with an error message. | √ | √ | Wong Sai Kit |
| | If account is verified, system will make sure the login credential entered is matched with the database, else error message will be alerted. | √ | √ | Wong Sai Kit |
| | If sign in success, system able to alert user with his display name | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|--|---|---|--------------|
| | and provider used for signing in the application. | | | |
| | System able to generate a Firebase token to successfully signed in user for receiving notification purpose. | √ | √ | Wong Sai Kit |
| | System able to display profile picture, cover picture, and display name section in the side drawer with the profile picture, cover picture, and display name of the successfully signed in user. | √ | √ | Wong Sai Kit |
| | System able to sign out the user and clear off the Firebase token granted. | √ | √ | Wong Sai Kit |
| | System able to prompt user an error message if the user clicked on “Forget password?” but the username field is empty. | √ | √ | Wong Sai Kit |
| | System able to send a password recovery email to the username (Email address) entered by the user providing that the username is found in the database, else error message will be alerted. | √ | √ | Wong Sai Kit |
| | User able to reach password recovery page in the browser when clicked on the link in the password recovery email. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | System able to update the password of the user in database to new password entered by the user in the password recovery page providing that all the field validation rules are passed, else error message will be prompted. | √ | √ | Wong Sai Kit |
| | The password recovery link will be deactivated once the password is updated successfully, else will be expired after 24 hours. | √ | √ | Wong Sai Kit |
| 3. User Authentication Using Facebook & Google Account | System able to sign in those users who using Facebook account to authenticate themselves. | √ | √ | Wong Sai Kit |
| | System able to sign in those users who using Google account to authenticate themselves. | √ | √ | Wong Sai Kit |
| | If sign in successfully, system able to alert user with his display name and provider used for signing in the application. | √ | √ | Wong Sai Kit |
| 4. Customer Profile Management | My Profile screen able to reach if user clicked on “My Profile” button at Main Menu screen or side drawer. | √ | √ | Wong Sai Kit |
| | System able to display profile picture, cover picture, display name, and username section | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
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| | with the profile picture, cover picture, display name, and username (Email address) of the signed in user. | | | |
| | List of actions such as to view picture in a pop-up window, update picture by taking picture using device camera, and update picture by selecting picture from device image gallery will appear at the bottom when user clicked on profile picture or cover picture. | √ | √ | Wong Sai Kit |
| | Profile picture or cover picture will display in a pop-up window when preview picture selection is chosen. | √ | √ | Wong Sai Kit |
| | Camera able to launch when take picture from camera is chosen. | √ | √ | Wong Sai Kit |
| | Image gallery able to launch when select image from gallery is chosen. | √ | √ | Wong Sai Kit |
| | User able to update his profile picture or cover picture to a new one after capturing an image using camera. | √ | √ | Wong Sai Kit |
| | User able to update his profile picture and cover picture to a | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|--|---|---|--------------|
| | new one after selecting an image from image gallery. | | | |
| | If new profile picture or cover picture is captured using device camera, the system able to keep a copy of the captured image in the device gallery. | √ | √ | Wong Sai Kit |
| | Personal details and my cars section are collapsed at first the screen is loaded. | √ | √ | Wong Sai Kit |
| | By clicking the tab of the collapsed section respectively, the particular section will expand. | √ | √ | Wong Sai Kit |
| | By clicking the tab of the expanded section respectively, the particular section will collapse. | √ | √ | Wong Sai Kit |
| | System able to display all the information in the personal details section matched to the signed in user correctly. | √ | √ | Wong Sai Kit |
| | “Edit” and “Reset Password” menu will be prompted when the vertical ellipsis in the right most of the “Personal Details” bar is clicked. | √ | √ | Wong Sai Kit |
| | Edit Personal Details screen able to reach if user clicked on the “Edit” menu item. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|--|---|---|--------------|
| | All fields in Edit Personal Details screen is auto filled up with old values. | √ | √ | Wong Sai Kit |
| | Error message will be alerted if user submit the edit personal details form without making any changes or violating field validation rules. | √ | √ | Wong Sai Kit |
| | User will be redirect back to My Profile screen and able the see the changes of their personal details under personal details section if the edit personal details form is submitted successfully. | √ | √ | Wong Sai Kit |
| | Reset Password screen able to reach if user clicked on the “Reset Password” menu item. | √ | √ | Wong Sai Kit |
| | Error message will be alerted if user submit the reset password form by violating field validation rules, providing wrong old password, wrong security question 1, or wrong security question 2. | √ | √ | Wong Sai Kit |
| | System able to update that particular user’s information in the database with the new password entered and prompt to ask user whether to sign out if | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
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| | the reset password form is submitted successfully. | | | |
| | User unable to sign in the application with old password after reset password successfully. | √ | √ | Wong Sai Kit |
| | System able to display list of cars in the expanded my car section if the user has added any car to the system or else display no car is added message. | √ | √ | Wong Sai Kit |
| | “Add” menu will be prompted when the vertical ellipsis in the right most of the “My Car” bar is clicked. | √ | √ | Wong Sai Kit |
| | Insert New Car screen able to reach if user clicked on the “Add” menu item or no car is added message. | √ | √ | Wong Sai Kit |
| | List of car manufacturer will pop up for user to select if manufacturer dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | Car model will be dynamically listed out according to the selected car manufacturer. | √ | √ | Wong Sai Kit |
| | Car sample picture will be dynamically listed out according to the selected car model. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|---|---|---|---|--------------|
| | Error message will be alerted if car registration number is existing in the database, car registration number field is empty, car manufacturer is not selected, car model is not selected, or car sample picture is not selected. | √ | √ | Wong Sai Kit |
| | User will be redirect back to My Profile screen and able the see the car registration number of the newly added car under my car section if the insert new car form is submitted successfully. | √ | √ | Wong Sai Kit |
| | Car information will be prompted at the bottom if user click on the info button at the right most of the listed car registration number under my car section. | √ | √ | Wong Sai Kit |
| 5. Customer Profile Management Special Case for Facebook or Google Authenticated Users | System able to change the displayed username (Email address) to display “Facebook/Google authenticated” since email address of Facebook or Google authenticated user is not available in the system. | √ | √ | Wong Sai Kit |
| | System able to alert user to update his phone number since | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|---------------------------------------|--|---|---|--------------|
| | phone number of the user is not taken and saved to the database for users who signed in to the application using Facebook or Google account for the first time. | | | |
| | System able to update database with the phone number entered by user providing that the phone number is not empty and in correct format, else error message will be prompted. | √ | √ | Wong Sai Kit |
| | System will not alert message to request for phone number anymore if the phone number is successfully updated in the database. | √ | √ | Wong Sai Kit |
| | System able to lock the password reset feature for users who signed in to the application using Facebook or Google account. | √ | √ | Wong Sai Kit |
| 6. Customer Update Latest Car Mileage | System able to send the message to users requesting them to update the latest mileage value of all their added car through notification bar (user is signed in) and in-app inbox (user is not signed in) on 5pm every day. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|--|---|---|--------------|
| | System able to reset all the customer car to the status of not yet update latest car mileage value on 12am every day. | √ | √ | Wong Sai Kit |
| | System able to launch Service Reminder screen of a car once user clicked on the request for updating car mileage message in the notification bar or in-app inbox. | √ | √ | Wong Sai Kit |
| | System able to determine whether the user has updated the car mileage on that day (if yes, alert message saying no need to update car mileage for that day; if no, ask for entering current mileage value of that car). If it is not the first time to update the latest car mileage value, system will able to display last updated car mileage value and date time the user performed that update. | √ | √ | Wong Sai Kit |
| | Error message will be alerted if the entered latest car mileage value is empty, contains leading zero, smaller than last reported mileage value (if not the first time of updating mileage value of that car). Or else the value will be successfully updated. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--------------------------------|--|---|---|--------------|
| | User will see the changes of the reported mileage value and date time made the report once the latest mileage value is successfully updated. | √ | √ | Wong Sai Kit |
| | For all the listed service reminder, once update latest car mileage value request is accepted successfully, system able to calculate and display the remaining kilometers to go for next service. If found the reported mileage is exceed the next service due, system able to alert user and change the status of that service reminder to “Overdue”. | √ | √ | Wong Sai Kit |
| | System able to send the message to users on 12pm every day reminding them the remaining kilometers to go for next service or service that already overdue (if any) providing that the user has updated the latest mileage of his car. | √ | √ | Wong Sai Kit |
| 7. Admin Insert Service Record | Admin able to navigate to Latest Service Record screen with customer service record listing and collapsed New Service Record section. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|--|---|---|--------------|
| | New Service Record section able to expand to reveal the insert new customer service record form when the “+” button is clicked. | √ | √ | Wong Sai Kit |
| | System able to display the filterable customer car registration number listing when the car dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | System able to display the filterable service type (mainly for service reminder) listing when the service type dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | System able to reveal the service item dropdown list if the selected service type does have list of items to select. | √ | √ | Wong Sai Kit |
| | System able to display the filterable service item listing when the service item dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | System able to display the calendar when date is clicked. | √ | √ | Wong Sai Kit |
| | System able to ask for entering mileage value of that car during that service when mileage is clicked. | √ | √ | Wong Sai Kit |
| | System able to verify the mileage value is not empty, do | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | not contains leading zero, or greater than the last reported mileage value by the owner (if there is last reported mileage value). Or else error message will be prompted and disallow the insertion of invalid car mileage value. | | | |
| | Providing that not exiting the Latest Service Record screen, application able to load back the cached selected date and successfully inserted car mileage value. | √ | √ | Wong Sai Kit |
| | When click to submit insert new customer service request, system able to alert admin if car is not selected, service type is not selected, service item (if any) is not selected, date is not selected, or mileage value is not entered. Else the request can be proceeded. | √ | √ | Wong Sai Kit |
| | If the request is allowed to proceed, system able to check first whether the combination of the car and the service type is found in the database. If found, just update the item and mileage | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | column of that row, or else insert a new row. | | | |
| | System able to display the most recent updated / inserted customer service record at the first row of customer service record listing. | √ | √ | Wong Sai Kit |
| | Admin able to filter the displayed customer service record listing by using car registration number. | √ | √ | Wong Sai Kit |
| | Admin able to navigate to Owner Details screen and Car Details screen by selecting the showing “Owner details” or “Car details” menu item respectively when clicked the listed customer service record. | √ | √ | Wong Sai Kit |
| | Admin able to view the owner personal details in Owner Details screen. | √ | √ | Wong Sai Kit |
| | Admin able to view the picture in a pop-up window when clicked on the picture in Owner Details screen. | √ | √ | Wong Sai Kit |
| | Admin able to view car information in Car Details screen. | √ | √ | Wong Sai Kit |
| | System able to send message to the car owner through | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|---|--|---|---|--------------|
| | notification bar or in-app inbox saying that admin has recently updated his car service record. | | | |
| | At customer side, system able to launch Service Reminder screen of that car once he clicked the car service record updated message in the notification bar or in-app inbox and that particular service record will appear in the service reminder listing. | √ | √ | Wong Sai Kit |
| 8. Book a Service from Service Reminder Listing | System able to launch Schedule a Service screen with expanded Book for Service section contains auto-filled car registration number and service to be booked when user click on any service reminder in the Service Reminder screen. | √ | √ | Wong Sai Kit |
| | System able to display the calendar when date is clicked. | √ | √ | Wong Sai Kit |
| | System able to alert user if the selected date is not after today date. | √ | √ | Wong Sai Kit |
| | Providing that not exiting the Schedule a Service screen, application able to load back the cached selected date. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | System able to display the only timeslots which are occupied by 0 or 1 car on the selected date when timeslot dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | When click to submit service booking, system able to alert user if date is not selected, timeslot is not selected, or the combination of the car and service is found in the database. Else the details of the booking will be saved. | √ | √ | Wong Sai Kit |
| | System able to display the most recent service booking at the first row of service booking listing. | √ | √ | Wong Sai Kit |
| | User able to filter the displayed service booking listing by using car registration number. | √ | √ | Wong Sai Kit |
| | System able to send message to the user through notification bar or in-app inbox one day before and one hour before the booked date time to remind the user for the service booking he made. | √ | √ | Wong Sai Kit |
| | System able to send message to the admin through notification bar or in-app inbox informing that the customer has booked the | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--------------------|---|---|---|--------------|
| | time from xx to xx at xx date for his xx car to be having xx service. | | | |
| | At admin side, system able to launch Service Booking Requests screen once he clicked the customer service booking message in the notification bar or in-app inbox and that particular customer service booking will appear in the customer service booking listing. | √ | √ | Wong Sai Kit |
| | System able to remove all the service booking record after that booking date at 11:59pm every day. | √ | √ | Wong Sai Kit |
| 9. Service Booking | System able to launch Schedule a Service screen with collapsed Book for Service section when user clicked on “Service Booking” button at Main Menu screen or side drawer. | √ | √ | Wong Sai Kit |
| | Book for Service able to expand once the “+” button is clicked. | √ | √ | Wong Sai Kit |
| | System able to list car registration number of all the cars added by the user when car dropdown list is clicked. | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|-----------------------------|--|---|---|--------------|
| | System able to list all services available for booking when service dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | System able to alert user if user do not select any service from the service listing. | √ | √ | Wong Sai Kit |
| | User able to select more than one service for service booking. | √ | √ | Wong Sai Kit |
| | Providing that not exiting the Schedule a Service screen, application able to load back the cached selected date and selected service(s). | √ | √ | Wong Sai Kit |
| | System able to change the listing timeslot duration dynamically based on number of services selected and make sure not include those timeslots that contains hour that occupied by 2 cars. | √ | √ | Wong Sai Kit |
| 10. Car Breakdown Assistant | System able to launch Car Breakdown Assistant screen with Google Map displayed, a person icon on the map representing the current coordinate of the user, and a collapsed Seek for Assistant section when user clicked on “Breakdown Assistant” button | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | at Main Menu screen or side drawer. | | | |
| | System able to display address of the coordinate on top of the person icon if user clicked on the person icon. | √ | √ | Wong Sai Kit |
| | System able to expand the Seek for Assistant section with auto-filled address, longitude, and latitude information and the map will be re-centered if user clicked on the SOS button. | √ | √ | Wong Sai Kit |
| | System able to list car registration number of all the cars added by the user when car dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | System able to list all services available for breakdown assistant when service dropdown list is clicked. | √ | √ | Wong Sai Kit |
| | When click to submit car breakdown assistant request, system able to alert user if car is not selected, service is not selected, there is other cars owned by the user is/are in pending admin approval status, or the time is not within business hour of that day. Else the car | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | breakdown assistant request will be proceeded. | | | |
| | System able to add a car icon to the coordinate where the user requested breakdown assistant for his car. | √ | √ | Wong Sai Kit |
| | User able to trace back his car breakdown assistant request once “My Requests” button is clicked. | √ | √ | Wong Sai Kit |
| | System able to move the view to focus on the pinned location of the broken-down car corresponding to the clicked request in “My Requests”. | √ | √ | Wong Sai Kit |
| | System able to send message to admin through notification bar or in-app inbox saying that customer has recently requested for an assistant for his broken-down car. | √ | √ | Wong Sai Kit |
| | At admin side, system able to launch Breakdown Assistant Requests screen once he clicked the customer car breakdown assistant request message in the notification bar or in-app inbox and that particular request will appear in the alert once | √ | √ | Wong Sai Kit |

CHAPTER 5: SYSTEM TESTING

| | | | | |
|--|---|---|---|--------------|
| | “Customer Requests” button is clicked. | | | |
| | Admin able to perform action on the car breakdown assistant requested by users in accepting the request, rejecting the request, or marking the request as solved. | √ | √ | Wong Sai Kit |
| | System able to send message to users through notification bar or in-app inbox for whatever action by the admin towards the car breakdown assistant requested by them. | √ | √ | Wong Sai Kit |

Table 5.1: System Testing

6.1 Project Review, Discussions and Conclusions

| | Project Outcomes | Objectives | Is Objective Achieved? |
|---|--|---|------------------------|
| 1 | Challenges facing by the target user able to identified through interview. | To study the challenges facing by Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch. | Yes |
| 2 | Customers able to pin the location where their car is broken at and request for type of service they want. On the other side, admin able to view the pinned location and type of service requested by the customers. Lastly, admin able to perform an action by either accept or reject the request. | To provide solution in terms of incorporation of GPS coordinate to locate precisely the customers of Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch that requesting for car outdoor services. | Yes |
| 3 | Customers able to book a particular timeslot for their car to be serviced. On the other side, admin able to check is there any booked service in a timeslot. If yes, priority will be given to the car to service first. | To provide solution in terms of service booking to help customers of Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch to lower down the rate of long waiting time. | Yes |
| 4 | After service is performed, admin able to enter the type of service performed and current mileage value of the car to the system. System is then able to calculate the next service | To provide solution in terms of service reminder to notify customers of Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main | Yes |

CHAPTER 6: CONCLUSION

| | | | |
|---|--|--|--------------------|
| | mileage due based on the type of service entered by the admin. On the other side, customers able to view the added service history by the admin and the next service mileage due generated by the system. To make the service reminder possible, customer able to report the latest mileage value of their car to the system and system will notify the user on how many kilometers left for the customers to send their car back to the shop for a service. | Branch to service their car before the mileage due. | |
| 5 | Because of 2020 Malaysia movement control order, user testing is not available but system testing made by developer is available. | To validate the prototype by deploying it in Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai Main Branch. | Partially Achieved |

Table 6.1: Project Review

6.2 Highlight any novelties and contributions the project has achieved

First of all, the shop no need to rely on phone calling from those customers who asking for breakdown assistant because customer can now use the application to pin the location of their broken-down car. Secondly, the shop no need to worry on losing customers who leave due to long waiting since the customers can now use the application to check on what date and what time the shop is available for service booking and appoint to it, then priority will be given to that customer. Last but not least, the shop no need to make us of physical service reminder sticker to remind customers for next service due because customer can now use the application to check for their “digital service reminder”.

6.3 Future Work

More advanced car breakdown assistant function might need in which the customer able to know where is the current location of the mechanic that the admin sent out to assist him time to time like what Grab Car is implemented. For service reminder, it can be more advanced also by installing a hardware in the customer car that will update its mileage value time to time to the server, so that customers no need to update it manually through the mobile application.

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APPENDIX A

POSTER



FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

FINAL YEAR PROJECT 2 - JAN 2020

ONLINE CAR MECHANIC SHOP SYSTEM

Specially Designing and Developing for Pusat Servis Tayar Dan Kereta Maeng Wa Simpang Pulai, Ipoh, Perak, Malaysia



INTRODUCTION

People are unavoidable to send their cars to official service centers or independent repair shops for regular service maintenance or repairing. However, most of the independent repair shops in Malaysia still using traditional way to operate their business which have therefore causing some issues to the shop itself and also their customers.

OBJECTIVES

- To study challenges facing by the shop.
- To provide solution in terms of solving the challenges.
- To validate the solution.

INCREMENTAL DEVELOPMENT

REQUIREMENTS GATHERING

Interviewee:
Madam Chu Ming Thye (Clerk)
Pusat Servis Tayar Dan Kereta Maeng Wa
Simpang Pulai Main Branch

CHALLENGES FACING

- Difficult to locate customers request for outdoor services.
- Lack of service booking.
- Unreliable physical service reminder sticker using.

PROPOSED SOLUTION

Main Functionalities:
Request Outdoor Services
Make Service Booking
Service Reminder

SYSTEM DESIGN (USE CASE DIAGRAM)

DATABASE DESIGN (ERD)

METHOD (BACK-END IMPLEMENTATION)

- Configure cloud-based virtual machine (AWS EC2 Instance)
- Configure cloud database (MySQL)
- Configure web-based database management tool (PhpMyAdmin)
- Configure SFTP and FTP client virtual machine file management tool (WinSCP)

METHOD (FRONT-END IMPLEMENTATION)

- Develop Android mobile application for clerk and customers (Android Studio)

APPLICATION SNAPSHOTS

| | BREAKDOWN ASSISTANT | SERVICE BOOKING | SERVICE REMINDER |
|------------------|---------------------|-----------------|------------------|
| CUSTOMER SIDE | | | |
| CLERK/ADMIN SIDE | | | |

CONCLUSION

With this system implemented in the shop, it believes that

- The shop able to accurately know the exact location of customers requesting for car outdoor services.
- Customers no need to wait for long queue.
- Customers come to service their cars on time.
- The shop gain more profits from customers.

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SUPERVISOR: DR. MANORANJITHAM A/P MUNIANDY
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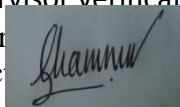
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