King Abdulaziz University

DEPARTMENT OF COMPUTER SCIENCE

Faculty of Computing and Information Technology

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Group 7		
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Phase1: Project Description

1.1. Introduction

Having a car is a necessity in Saudi Arabia. Using natural gas cars are harmful to the environment. So, by using cars that are eco-friendly, we can improve the state of our climate gradually. Electric cars station is one of the best solutions to move towards the cleaner world.

The Main idea of our application is to facilitate finding the nearest electric car stations and provide services that the eco-friendly cars need. Smart All-in-one **Charged Up** application that will help to improve the user experience by controlling the dashboard, manage charging sessions, payment history, find nearby stations by using advanced Google maps, availability, and applicable discount.

Using electric car stations in an effective manner makes a big difference in our life. By promoting electric cars, People may switch to it. In one hand, it makes electric car holders satisfied. on the other hand, it reduces the global warming.

1.2. Problem Description

The main problem is the difficulty to find an electric charging station in Saudi Arabia. Also, the services which facilitate the process of electric charging are not available, which makes people use the gas cars instead of electric cars.

1.3. Project Objectives

- Facilitate locating electric charging stations by providing their site on an electronic map
- Facilitate controlling the charging process
- Promote clean energy by supporting stations that uses Solar power

Goals and Scope

1.4. Project Goals

- To increase the number of people using electronic cars.
- To decrease the reliance on gas.
- To create an environment friendly station that relays on solar energy

1.5. Scope and Sources of Domain Analysis Information

The source of domain analysis are the sustainable energy research, electric stations and electric car owners. As a result, we can collect their needs, by researching about solar energy charging stations.

In the past, the least amount of time needed to fully charge a car was 8 hours, but with the latest technology. The minimum time needed to fully charge electric cars is 20 minutes. Potentially, In the future these 20 minutes could be reduced even more.

Unfortunately, as of now there are no stations for electric cars here in Saudi Arabia, but there are plans to start building some in Riyadh city and hopefully in all the country soon. For now, the people who own electric cars can benefit from home charging station. Which is basically a small portable box that can be plugged to the electricity and connected to the local network in order to maintain it through an application.

1.6. System's Stakeholders

The stakeholders of our system are people who have electric cars and the owners of electric charging stations

1.7. Scope of the system

The application will provide various functions for eco-friendly cars. It will provide the user with the locations of the stations nearby and let them book a parking spot to let their car charge. It also comes with perks if the user uses the app regularly. This section will cover the features that the app can and can’t do.

1.7.1. This System Included

- Choosing how much to charge and show the state of battery.
- Notify the user of the charging completion.
- Notify the user of the remaining time left for charging.
- Provide locations of the stations nearby.
- Point system; the user benefits from using the app regularly.
- Membership offers.
- Provide pre-booking service for VIP cardholders.

1.7.2. This System Excluded

- Does not provide gas cars with any benefits.
- Does not provide in-app communication center.
- Does not support multiple languages except English and Arabic.

Phase2: Business Requirements Specifications

2.2. Requirements

2.1.1. Functional Requirement

- R1. The system shall allow users to use the app.
- R2. The system shall allow the users to sign up.
- R3. The system shall allow users to enter car info.
- R4. The system shall ask the user to sign in.
- R5. The system shall allow the user to view their dashboard record.
- R6. The system shall allow the VIP users to make a pre-booking for charging.
- R6.1. The system shall allow the user to cancel their reservation.
- R7. The system shall allow the user to track the remaining duration of the charging.
- R8. The system shall allow the user to get a notification when the charging is complete.
- R9. The system shall allow the user to track and navigate to the nearest charging station by using advanced Google maps.
- R10. The system shall display to the user multiple payment methods, and they can choose the best option for them.
- R11. The system shall allow users to sign out.
- R12. The user can change the theme and the colors of the interface.
- R13. The user's account shall be synced between all their devices.
- R14. The system shall allow the user to subscribe to family plan
- R15. The system shall provide tracking history of the user’s charging sessions.

2.1.2. Non-Functional Requirement

- R1. The system shall be available 24/7.
- R2. The system shall support two languages Arabic and English.
- R3. The system's interface shall be simple/clear and easy to learn.
- R4. The system shall be implemented on both portable and non-portable devices.

2.2. Techniques for Gathering Data

The result of survey we conducted suggested that around 61.8% of respondents would switch to electric cars due to the increasing prices of the gases. Also, the survey shows that 64.7% are planning to buy an electric car. 94.1% of the respondents think that an application made for assessing charging processes for electric cars would be helpful.

The next question shows that 76.5% of the respondents would prefer credit card as their payment method. 79.4% of the respondents think that having a VIP membership subscription is a good idea.

We used surveys as a way of gathering the opinion of the potential users, the results are in Appendix A.

2.3. Use Case Descriptions

2.3.1. Use case 1

Name:	**Sign Up**
Actor:	User
Pre-condition:	- The user must have a valid phone number.
Description:	The user creates a new account
Basic flow of events:	1- The system asks the user to enter their name phone number. 2- They user enters their name and phone number. 3- The system asks the user to enter general information about their car. Such as:(The car model – car name …etc.). 4- The user enters general information about their car. 5- The system asks the user to enter in a password. 6- The user enters in a password. 7- The user press Sign up. 8- The system will display the user's home page.
Extension:	Error message: The verification code that was sent to your phone number is incorrect.
Post-condition:	The system displays the user's home page.
Special requirement:	The actor needs to be connected to the Internet and has the application.

2.3.2. Use case 2

Name:	**Subscribing to a VIP service**
Actor:	User
Pre-condition:	The user has a valid account and is logged in the app.
Description:	Subscribers can access extra services.
Basic flow of events:	1- The user goes to the main menu. 2- The user selects “VIP membership” option. 3- The system displays the advantages of subscribing.

	4- The system displays different duration options (a month, a year, etc.) for the subscription. 5- The user chooses one of the options. 6- The system displays the payment page. 7- The user chooses the payment method. 8- The user presses ok button. 9- The system displays that the use is upgraded to a VIP member.
Extension:	1- Error massage: The Verification Code is Incorrect. The app will show a message to the user that the verification code is incorrect. 2- Error message: Insufficient Credit The app will show a message that payment did not get processed.
Post-condition:	The user is upgraded to a VIP member.
Special requirement:	The actor needs to be connected to the Internet and has the application.

2.3.3. Use case 3

Name:	**Pre-booking charging session**
Actor:	User
Pre-condition:	- The user must have an active account. - The user is a VIP member.
Description:	The user checks for an available station and books a place to charge their car.
Basic flow of events:	1- The user goes to the booking section. 2- The user navigate map. 3- The system displays the stations and their availability in the map. 4- The user chooses an available station. 5- The system displays the station's available plots and times. 6- The user chooses an available plot and time. 7- The user presses ok button

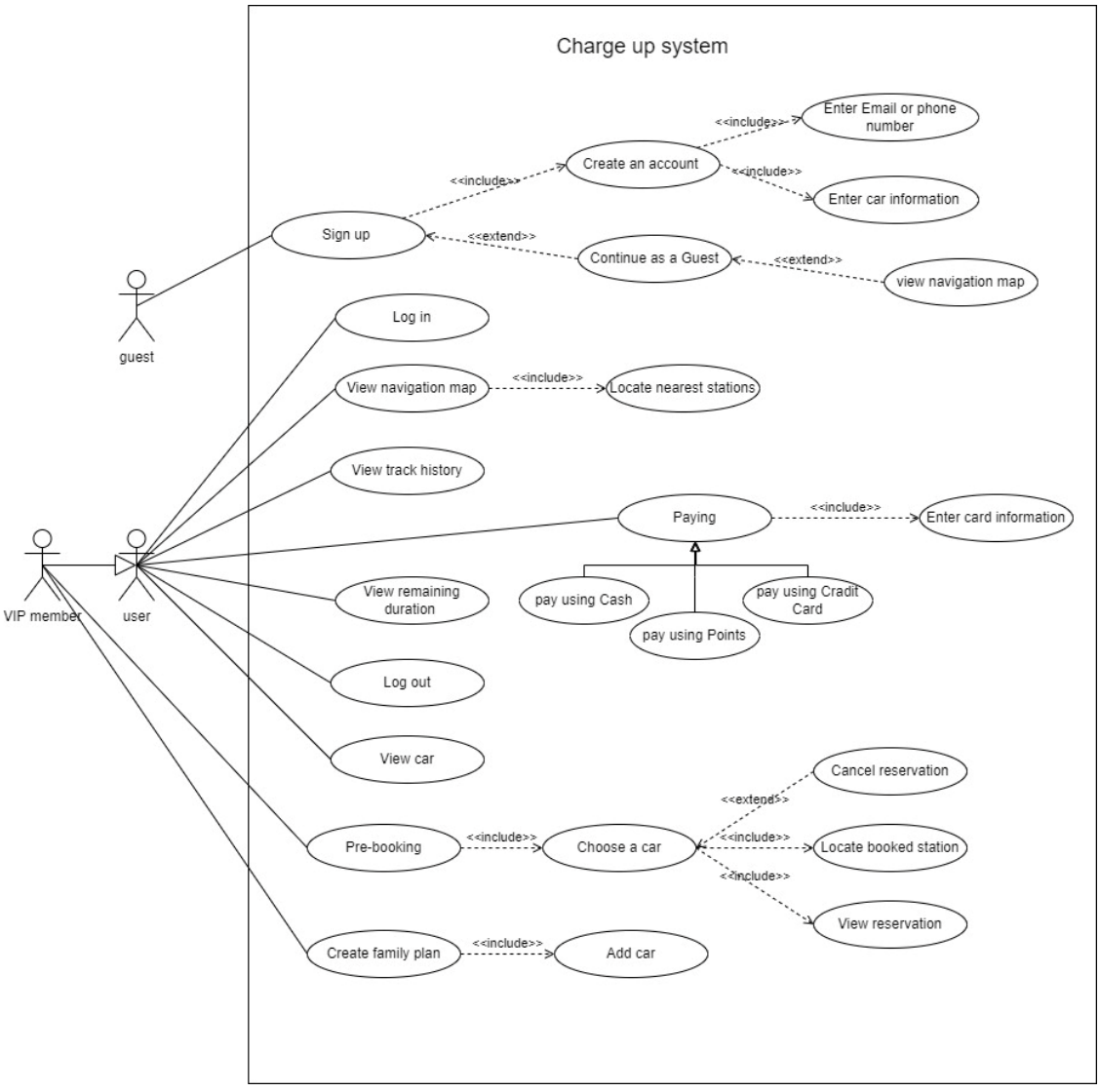
	8- The system displays the payment page. 9- The user chooses a payment method. 10- The user presses ok button. 11- The system displays confirmation message.
Extension:	1- Error message: booking failed The system shows a message if the user was trying to reserve in already taken space or time. 2- Error message: Insufficient balance An error message will show when trying to use a card with insufficient balance.
Post-condition:	- The system shows a confirmation message. - Remind the user 3 hours before their reservation time.
Special requirement:	The actor needs to be connected to the Internet and has the application.

2.3.4. Use case 4

Name:	**Charging car at station, Make payment**
Actor:	User
Pre-condition:	- The user must have an active account. - There must be an available plot for charging.
Description:	The user can navigate through the map and choose the nearest station.
Basic flow of events:	1- The user will select the charging amount. 2- The system will display various information: (distance, duration, cost. etc). 3- The user presses ok button. 4- The system displays payment page. 5- The user chooses a payment method. 6- The user presses ok button. 7- Th system displays confirmation message of the payment. 8- The system displays the time remaining for completing charging in the home page. 9- The system sends a notification when the charging is complete.

Extension:	- The system shows a message if the user didn't finish payment process. - The system shows a message if the user exceeded the time for the charging.
Post-condition:	- The system notifies the user after the charging ends. - The system will add the record in the history.
Special requirement:	The actor needs to be connected to the Internet and has the application.

2.4. Use Case Diagram



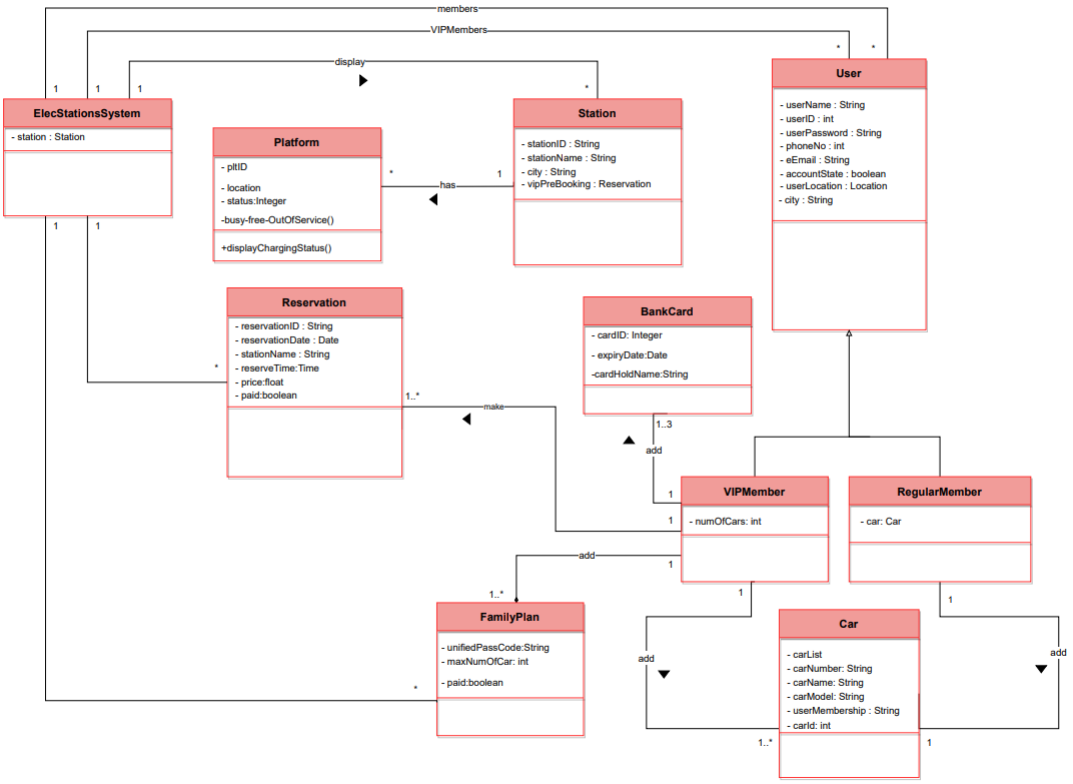
2.5. Difficulties & Risk Analysis in the Domain

1- The requirements may change if seen better throughout the process.

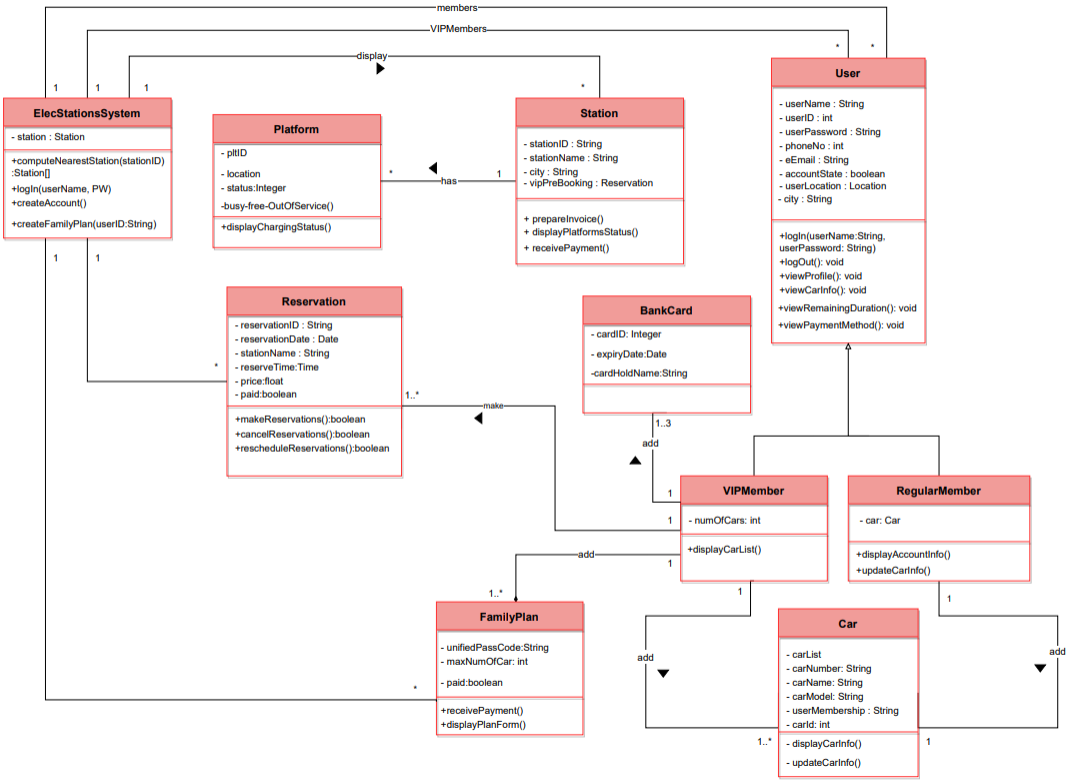
2- The non-functional requirements require testing with a wide range of users to insure accessibility.

Phase 03: Designing and structuring

3.1. UML class diagram that represents the domain model



3.2. UML class diagram



3.2.1. Association Relationships and Their Multiplicity

1. Between Guest class and Station class.

- A Guest can navigate one or more Station.
- A Station can be navigated by one or more Guest.

2. Between User class and Station class.

- A User can choose the nearest Station.
- A Station can be chosen by one or more User.

3. Between Car class and Regular User class.

- One car can be added by a Regular User.
- A Regular User can add only one car.

4. Between Car class and VIP member class.

- A VIP member can add one or more car.
- A car can be added by one VIP member.

5. Between Reservation class and Station class.

- A Reservation is displayed by one Station.
- A Station can display one or more reservation.

6. Between Reservation and VIP member class.

- A Reservation can be made by one VIP member.
- A VIP member can make one or more reservation.

3.2.2. Aggregation Relationship

Between VIP member and Family plan

- A VIP member can add one or more car to the Family plan.
- A car in Family plan can be added by one VIP member.

3.2.3. Generalization Relationship

1. User class is inherited by Regular member class and VIP member class

2. User class is inherited by the Guest class when creating an account.

3.2.4. Composition Relationships and Their Multiplicity

Between Reservation class and Payment class

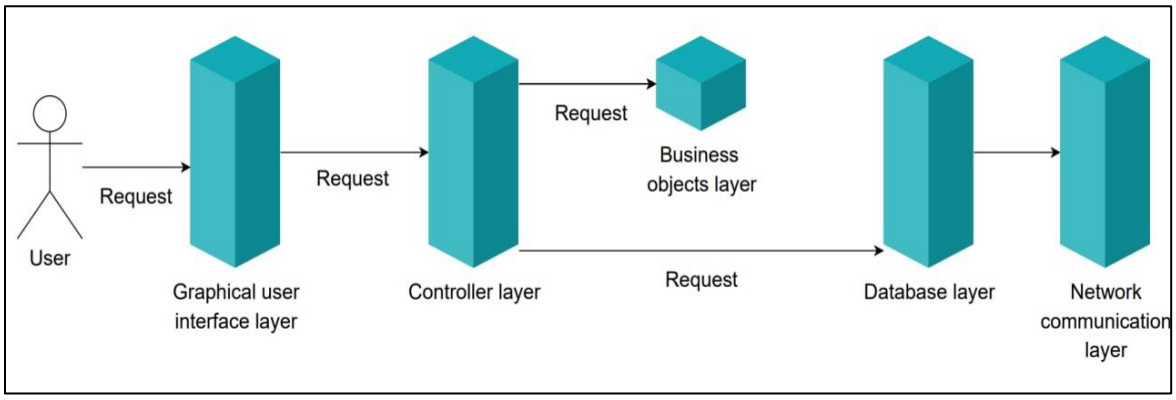
- If there is no payment, there is no reservation.
- A reservation can use one payment method.
- A payment method can be used for one or more reservation.

3.3. System Architecture

3.3.1. Type of the system

We chose N-tier architecture because our system involves user interaction from the beginning until finishing the processes. For instance, the user can ask to view the data of the car, the system will handle the user's instruction and will display these data

3.3.2. Architectural design

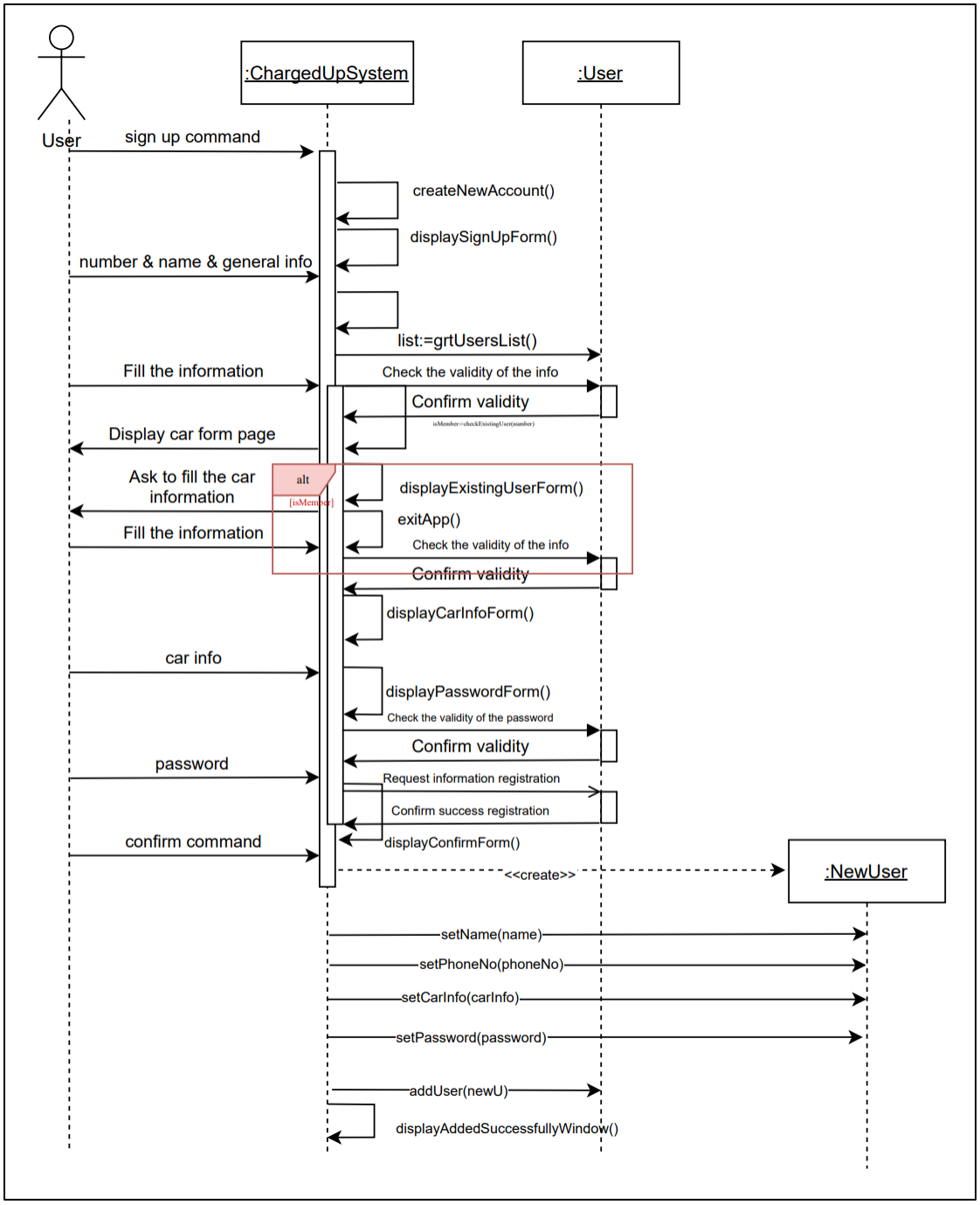


Phase 4: Modelling, Interaction & Behavior

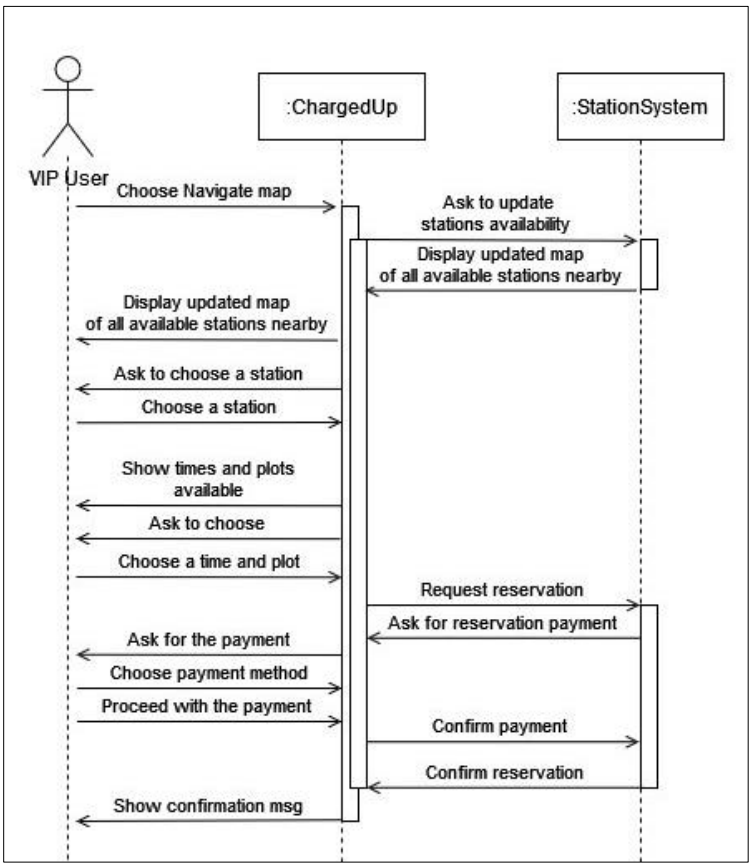
4.1 Interaction diagram

4.1.1. Sequence diagram

4.1.1.1. Create account

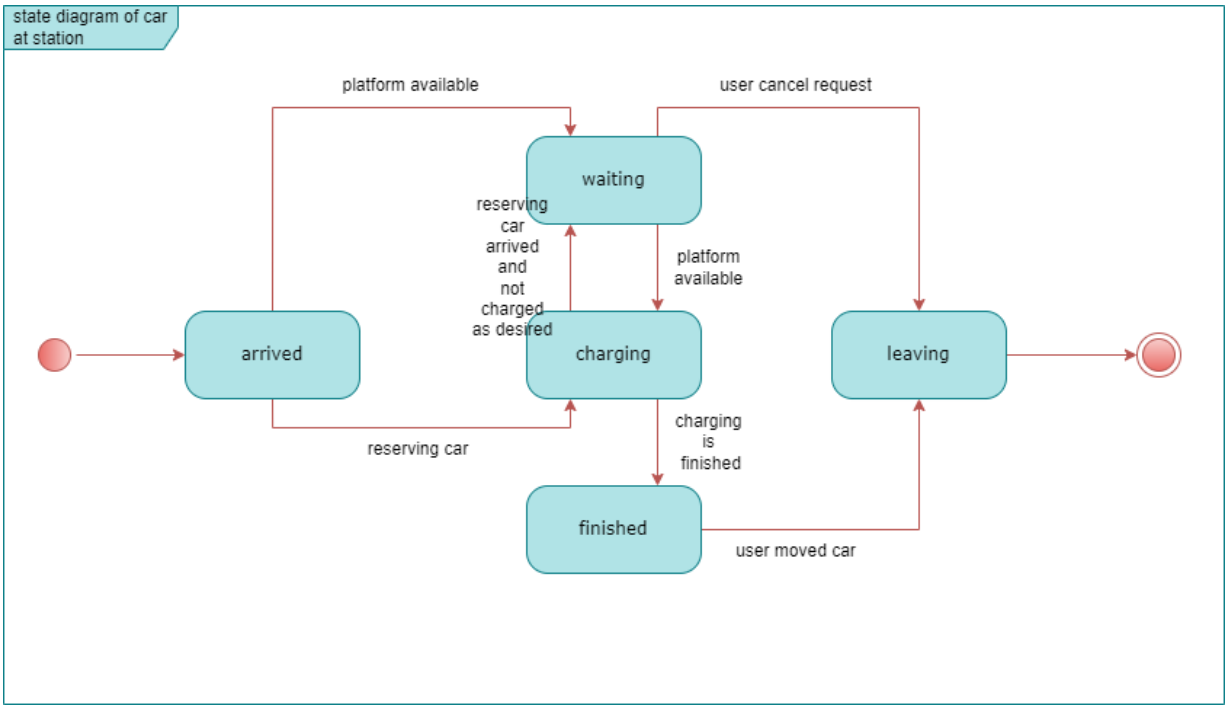


4.1.1.2. Pre-booking

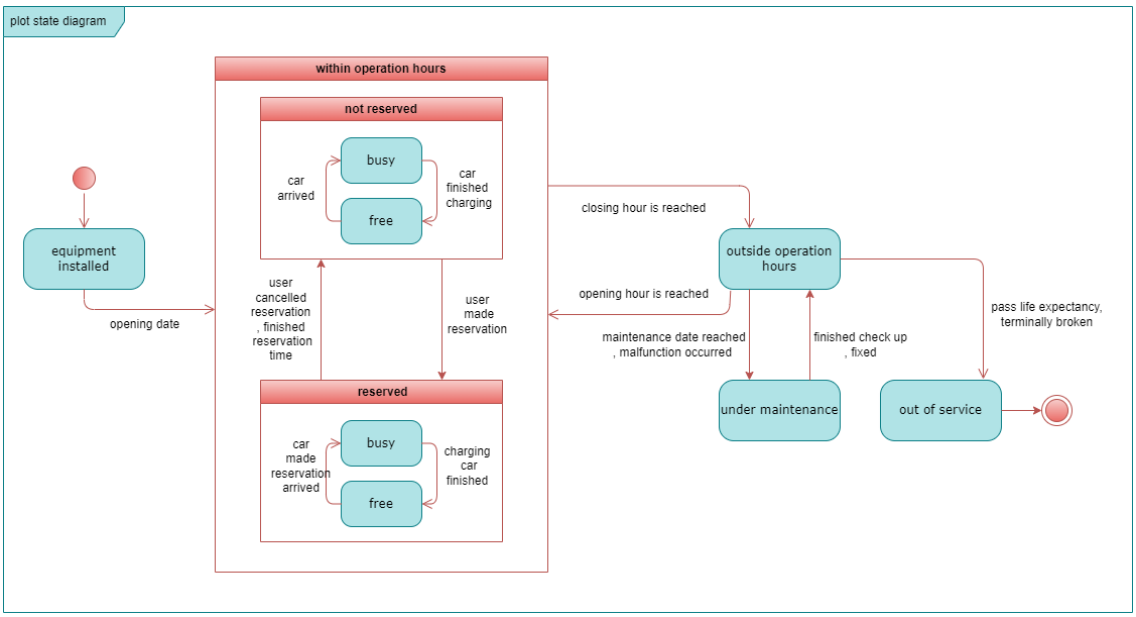


4.1.2. State diagram

4.1.2.1. ~~Create account~~ Car at station

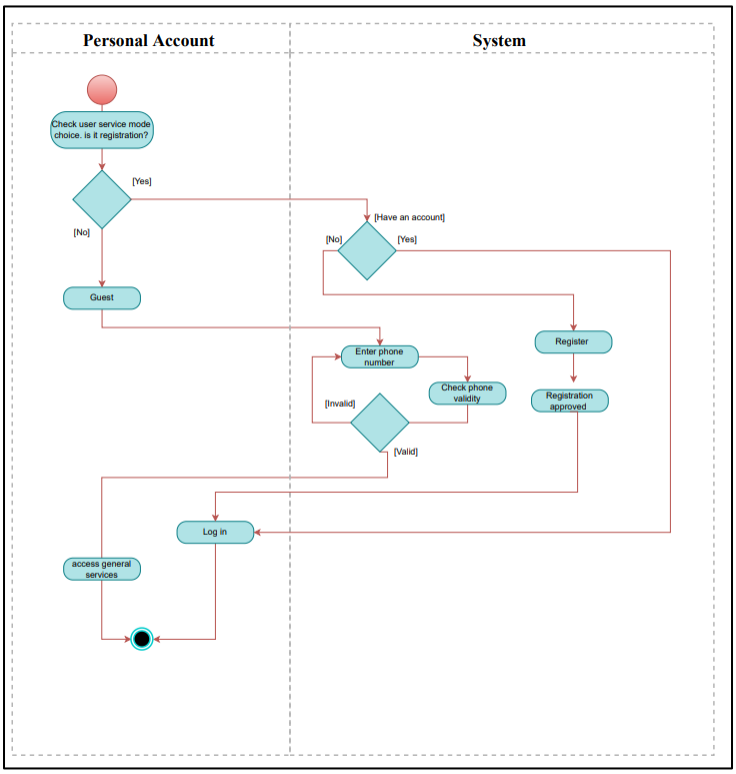


4.1.2.2. Pre booking plot diagram state

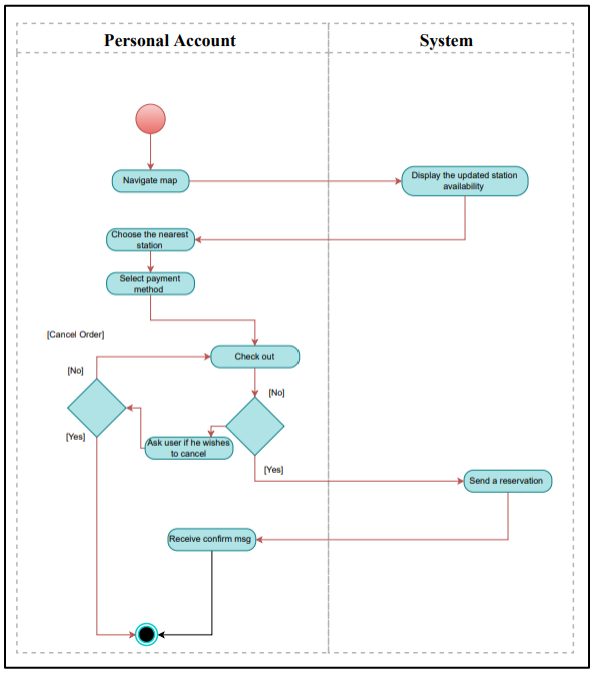


4.1.3. Activity diagram

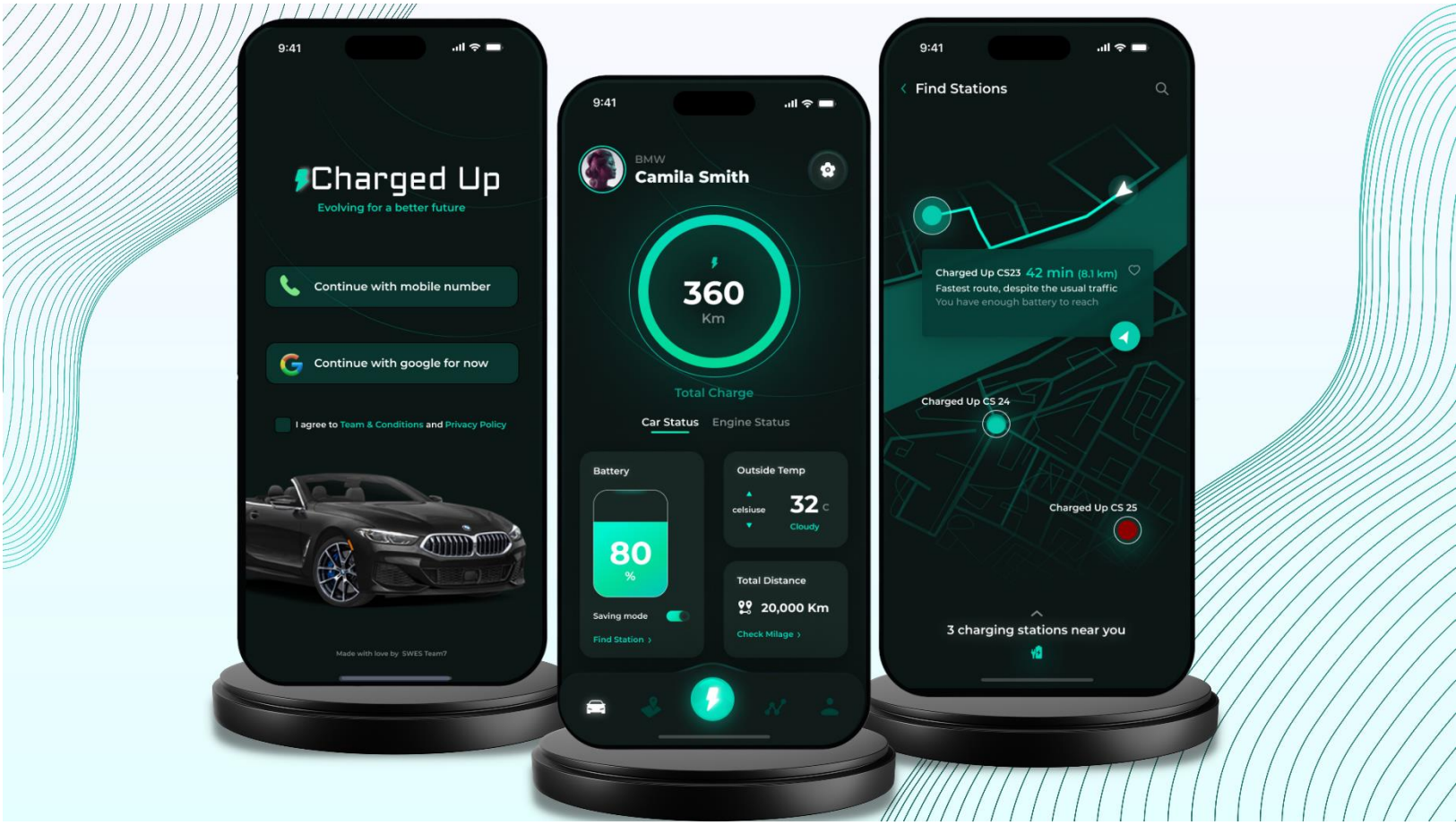
4.1.3.1. Create account



4.1.3.2. Pre-booking



Prototype Of Our App



4.2. Testing

4.2.1. Objectives

Testing the system to make sure it follows the requirements, and detect any possible gaps, errors or missing requirements that may affect the functionality of the system. Also, by testing the interface to evaluate the user experience. Moreover, delivers results that ensure correct interactions and user-friendly design.

4.2.2. Testing strategy

In order to test the functional requirements, we decided to use black-box testing based on our system. The three features we are going to test are:

- Sign up
- Pre-booking
- Charging process

Features that will not be tested are the rest of the functionalities. For the testing phase, the system must produce the expected response, otherwise the test fails.

4.2.3. Approach

The testing approach used for this system is the black box testing approach. It is preferable to use this method because with it the tester interacts with the system's interface, providing inputs and examining outputs without knowing where and how inputs are transformed.

4.2.4. Test Sign up

- Click on Charged Up App to open.
- Click on sign up button
- Store users' information in Charged Up database
- Sign in the users who are already registered in the database

Username (6 to 10):

Invalid Partition - Valid Partition Lower Boundary		Invalid Partition - Valid Partition Upper Boundary	
BV Below The Boundary	BV Above The Boundary	BV Below The Boundary	BV above The Boundary
5 Character	6 Character	10 Character	11 Character

Phone Number (10):

Invalid Partition - Valid Partition Lower Boundary		Invalid Partition - Valid Partition Upper Boundary	
BV Below The Boundary	BV Above The Boundary	BV Below The Boundary	BV above The Boundary
9	10		11

User ID (10):

Invalid Partition - Valid Partition Lower Boundary		Invalid Partition - Valid Partition Upper Boundary	
BV Below The Boundary	BV Above The Boundary	BV Below The Boundary	BV above The Boundary
9	10		11

Password (5 to 10):

Invalid	Valid	Invalid
0 (Character & Numbers & Symbols) … 4 (Character & Numbers & Symbols)	5 (Character & Numbers & Symbols) … 10 (Character & Numbers & Symbols)	11 (Character & Numbers & Symbols) …

4.2.5. Test Pre-booking

- The user must have an active account
- The user is subscribed to a VIP membership

Conditions	Time availability	F	F	T	T
	Plot availability	F	T	F	T
Actions	Expected results	Error message: booking failed	Error message: booking failed	Error message: booking failed	Reservation has been made successfully

4.2.6. Test Charging process

- The user must have an active account.
- There must be an available plot for charging.
- The user proceeds to pay

Conditions	Balance sufficiency	F	F	T	T
	Security code	F	T	F	T
Actions	Expected results	Error message: payment failed	Error message: Insufficient balance	Error message: payment failed	Payment has been accepted

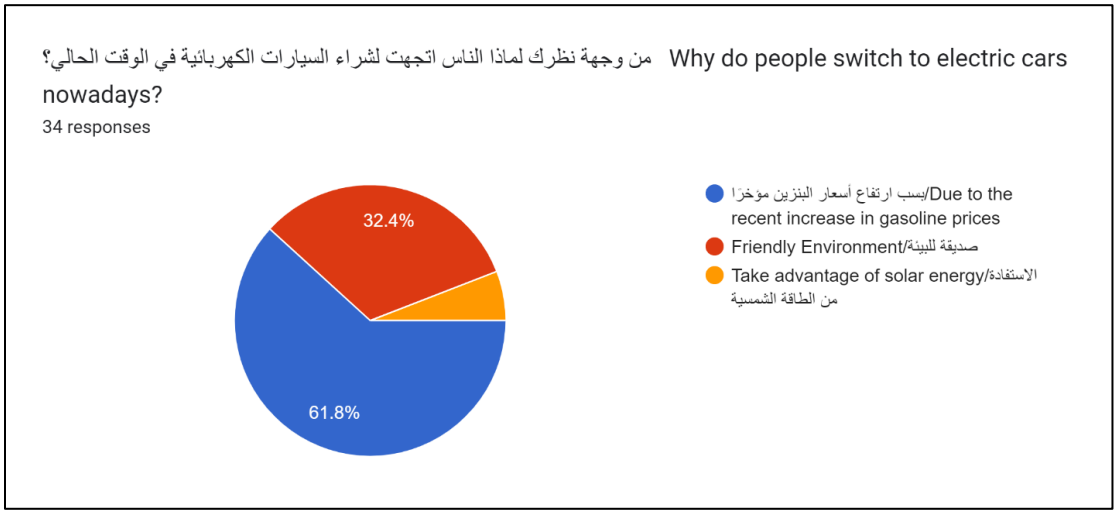
4.2.7. Testing Non-functional Requirements

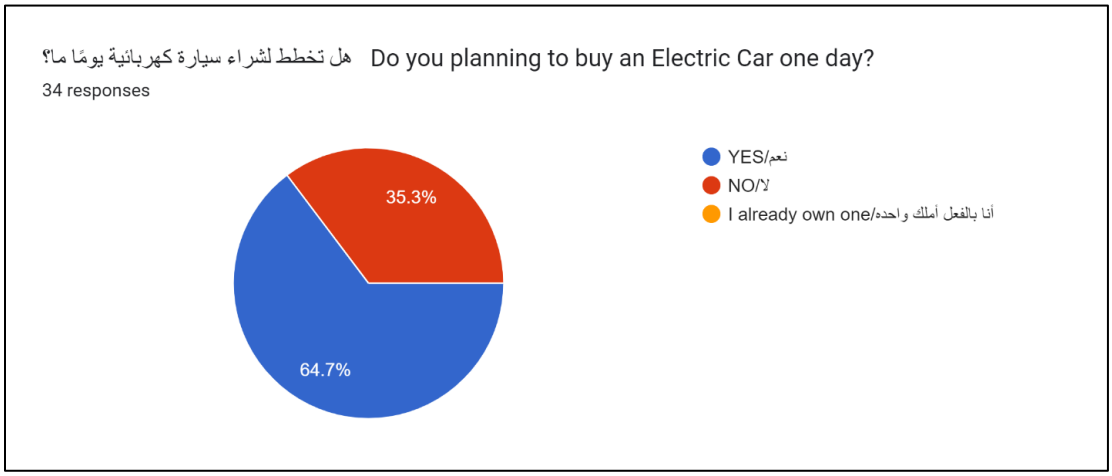
- Performance testing: the testing process includes making sure that the users' accounts are synchronized between devices, the system support English and Arabic languages, and the theme and colors of the system can be changed to be suitable to the user's taste.

References

- Kung, D. C. (2014). Object-Oriented Software Engineering: An Agile Unified Methodology. US: McGraw-Hill.

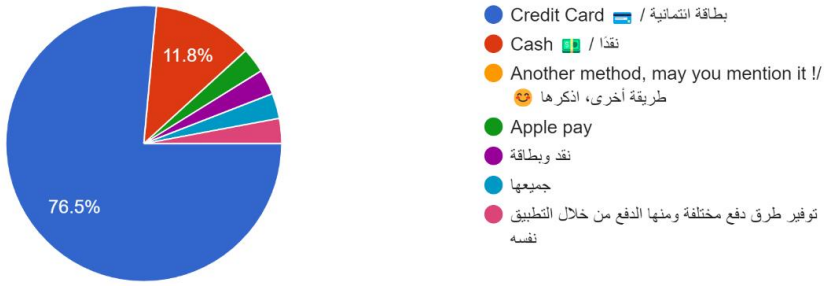
Appendix A





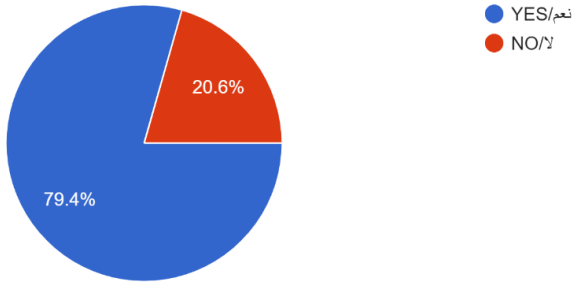
ما هي أفضل طريقة دفع تفضلها لشحن سيارتك؟ What is your preferred paying method to charging your car?

34 responses



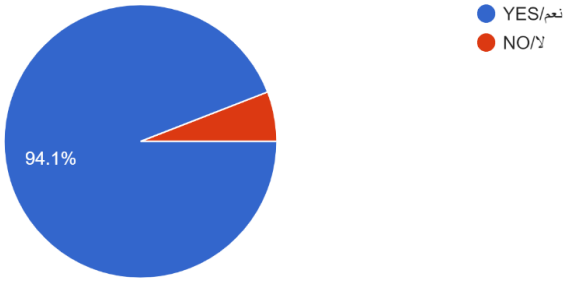
هل تعتقد توفر خدمة اشتراك كبار الشخصيات فكرة جيدة للشحن؟(مثال: خدمة الحجز المسبق لشحن سيارتك الكهربائية .. إلخ Do you think that having a VIP membership subscription is ...booking service to charge your electric car.. etc)

34 responses



اذا ملكت سيارة كهربائية يومًا ما، هل تعتقد وجود أبليكيشن يوفر (شحن السيارات الكهربائية/ إيجاد أقرب محطة شحن) سوف يكون مفيد؟ If you had an electric car one day, do you think that a...s / finding the nearest stations) would be helpful?

34 responses



اذا كانت إجابتك بـ لا أذكر السبب

If your answer was no, mention the reason

4 responses

نعم

ليس لدي خبرة كافية للاجابة

افضل بدون حجز بس تكثر اماكن الشحن اهم شي بدون مبالغه فى الاسعار

i mean i understand that its a good idea but still if its a VIP membership that means it cost alot and i don't like i bought the car so i can save more money not to waste more i mean that from my perspective other people with alot of money or don't like to wait would like it after all everyone in this world have an own opinion