SEPTEMBER 29, 2023

REPORT 1

PARKEZ AUTOMATED PARKING GARAGE

TEAM 4

Report 1

CSCI 441 Software Engineering

Group # 4:

ParkEZ Automated Parking Garage

Project URL: https://fhsu-park-ez.vercel.app/

09/29/2023

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Contribution Breakdown

Task	Bylsma	Elgin	Mikaelian	Mongkhonvilay	Sarpong	Smith
Coversheet/Contribution Breakdown/Table of Contents						100%
Customer Problem Statement		100%				
Glossary of Terms	95%					5%
Functional Requirements				80%	20%	
Non-functional Requirements				100%		
User Interface Requirements			75%		20%	5%
Interface Design			20%	80%		
Functional Requirement Specification:						
Stakeholders/Actors and Goals			95%			5%
Use Cases			70%		30%	
Use Case Diagrams						100%
Traceability Matrix					100%	
Fully-Dressed Diagrams		100%				
User Interface Specification				95%		5%
Product Management					60%	40%
Summary of Changes						100%
Report Editing	10%	30%	10%	10%	20%	20%

Glossary of Terms

Cancellation: The act of a customer voiding their reservation to receive reimbursement (to be completed before half of the reservation time is passed).

Guaranteed Reservation: A monthly contract with the parking garage to reserve a parking space(s) for specified days and times.

No-Show: The act of a customer failing to check into the garage and filling their reservation (payment will still be collected for a no-show).

Overstay: The act of a customer failing to exit their reservation past their reservation's time ending (will receive an overstay charge).

Overstay Charge: A penalty fee added to the customer's bill for failing to exit their reservation before their reservation's time ends.

Park-Ez Customer: A user of the application who pays to reserve single use parking spots and fills said spot during the reservation time.

Registration: The sign-up process for the application to obtain the customer's name, billing address, phone/email, and license plate number.

Reservations: Single use parking spots that have been paid for and assigned to a user of the application.

Walk-in Customer: An individual who enters the garage without a reservation and is directed to the first floor of the garage.

Section 1: Customer Problem Statement

Parking Garages are a vital part of large cities, however ever since their creation there has been little done to improve the design of parking garages. Thus, we would like to request a system that would allow us to provide a better parking garage experience for our customers. Allowing them an innovative and stress-free way to use our parking garage.

Another of the largest issues we have noticed with how parking garages currently operate is how long it takes to enter, exist, and pay. Seeing as our new parking garage has an elevator to the upper floors, we would like to request some method of reducing the amount of time it takes to perform these tasks, for clarification we would like our customers to not have to worry about finding a parking spot or having to spend much time on the entering and exiting processes. Personal experience let us know that sometimes entering and exiting a parking garage can take upwards of twenty minutes, something we would like to avoid with the help of a new integrated system. Some basic ideas that we have thought up to help with that goal include a reservation system allowing the customer to book in advance. This would keep the amount of time customers would have to spend entering or exiting the garage down while also alleviating fears of not getting a parking spot. Our automated parking garage system would track how much time each vehicle stays parked in the garage and send automatic updates to the customer when their reserved time is approaching its end, as well as when the reservation time has expired. By reminding customers in this manner, it would

give them the opportunity to extend their reservation time through the ParkEZ site remotely before their reservation time expires. Making reservations through the ParkEZ website requires customers to pay beforehand, which in turn allows them to leave immediately without having to pay manually at a slow ticket booth and reduces overall parking garage congestion.

Another issue we have noticed is that many parking garages lack visibility and are not easily navigable. Many parking garage customers, as we can personally attest, spend quite some time driving around the parking garage looking for a parking spot, leading to congestion during high traffic hours. This congestion and lack of visibility might encourage frustrated parking garage customers to begin using a different parking garage. While we have a vehicle elevator to help alleviate part of the congestion issue, customers still do not know the layout or the happenings of the garage until they get into the garage. One idea we had would be to have a map of the parking garage on the website, while our parking garage has a rather simple layout, we would still like our customers to have the ability to see a map showing the location of the exit, and the locations of the various parking spaces. Similarly, we also think it would be nice if our customers had a way to get real-time knowledge of parking space availability and book specific parking spots. This would allow customers who are disabled, elderly, or have luggage to reserve parking spots closer to the elevators than if they were to just drive around looking for a parking spot. We know from experience that driving around a parking garage looking for a spot only to have to park far away from an elevator or stairs while having to carry luggage, having a disability or being elderly can cause unneeded stress for all involved parties.

While lightly touched upon in the previous paragraphs, our parking garage has several interesting features and pieces of technology that other parking garages do not possess. Our hope is that with the help of the new system in conjunction with the new technology we will be able to provide an unmatched parking garage experience for our customers. While we will not be going over the entire suite of new features we will go over some of the more important ones. The most obvious feature would be our vehicle elevator. Our hope is that with the vehicle elevator we will be able to limit the congestion that comes with finding a parking spot by having the floors be separate areas inaccessible without first going through the elevator. The second feature we have in our parking garage is license plate reading cameras, we have them set up throughout the garage. We would like the cameras in the vehicle elevator to automatically scan and register if the vehicle in question has a reservation, if they had a reservation the vehicle elevator would take the customer to the correct floor with no input needed, cutting down on user input time and the amount of time customers behind them in line might have to wait. Another feature in our Parking garage would be the console inside the vehicle elevator, the console is there in the event that a customer is driving a different vehicle than the one they have registered, or the camera does not read the license plate correctly. The user interface console in the vehicle elevator could also allow a registered individual to make a reservation immediately, if any spaces are available, in case they forgot to reserve a space online. This would take longer and possibly make lines longer, but we think this would be a great way to still offer our services to registered customers who perhaps forgot to reserve a parking spot. Tying in with previous technology, we have set up a camera at the exit ramps to read the license

plates of departing vehicles. The exit cameras, in conjunction with parking space sensors, would allow the automated system to know which vehicle has left, charge the owner's account accordingly and update the available parking space map. Each parking space will have an occupancy sensor that will toggle on when a vehicle is present and off when empty allowing the system to know whether a space is occupied.

We have briefly touched upon reservations in the previous paragraphs, and while we are not developers, we still have some ideas on how they might work. Reservations should be tied to a user account and be very easy for registered customers to make. They should request the amount of time the customer plans to have their vehicle parked along with the accompanying rate for that duration. If the customer goes over their planned time, they would be charged an overtime fee that would be calculated by their vehicle departure time, which the automated system will keep track of using the parking space sensors and exit camera license plate recognition system. If the customer leaves early the system can be configured to bill them for the full reserved time or discount their bill, and their parking spot will be entered back into the system to be used by another customer. Another reservation scenario our system could be made to deal with is when a customer arrives late or does not arrive within the reservation window. We know from experience that running late is something that can happen quite often. Thus, if a customer is running late the system can be made to hold a reserved parking space for a grace period of 30 minutes before adding their parking space back to the pool of available parking spaces. If the customer arrives after the 30-minute grace period or outside of the reserved time entirely they will simply be treated as a

registered customer who has not made a reservation and they will have the option to park on the first floor of the garage as a walk-in or reserve a spot on other floors from the garage user interface. Either case is dependent on whether there are spaces available.

All of us have spent time in a standard parking garage at some time or another. Whether it be from long entry and exit lines, overall parking garage congestion, difficulty of finding an available parking space, not finding one at all after spending valuable time searching or dealing with annoying payment booths, most of those parking garage experiences have not been positive ones. The aim of the ParkEZ automated parking garage system is to change every parking garage experience into a good one for both garage customers and garage owners. If customers are happy, they will come back and if parking space availability is maximized garage owners will be happy also.

Section 2: System Requirements

Enumerated Functional Requirements

REQ-X	Requirement Description	Priority
REQ-1	Real-time parking space availability.	High
REQ-2	Automated payment processing.	High
REQ-3	Automated entry and exit for vehicles	High
REQ-4	Ground floor display for vacancies	High
REQ-5	Reservation system with confirmation	High
REQ-6	Integration with security and surveillance.	Medium
REQ-7	User-friendly interface.	High
REQ-8	Reporting and analytics for administrators.	Medium
REQ-9	Elevator displays	Medium
REQ-10	The system-to be shall determine whether the customer has the necessary authorization to park at ParkEZ via license plate.	Medium
REQ-11	The system-to be shall display space occupied or available (including disability parking space, etc).	Low

REQ-X	Requirement Description	Priority
REQ-12	The system-to be shall guide the customer what area to park using map display functions.	High
REQ-13	The system-to be shall keep track of customer's time from entrance to exit, and lot number.	Medium
REQ-14	The system-to-be shall update changes of the parking space occupied or available to inform other users.	Low
REQ-15	The system-to be shall alert the user upon leaving, maxing out of time allotted, time remaining, and any additional payment	Medium
REQ-16	The system-to be shall allow the user to make the necessary changes on the system including updating parking information, payment, cancel parking, etc.	Medium

Enumerated Nonfunctional Requirements

1. **Performance**: The system must provide real-time updates with minimal latency (High).

2. **Reliability**: The system should have 99.9% uptime (High).

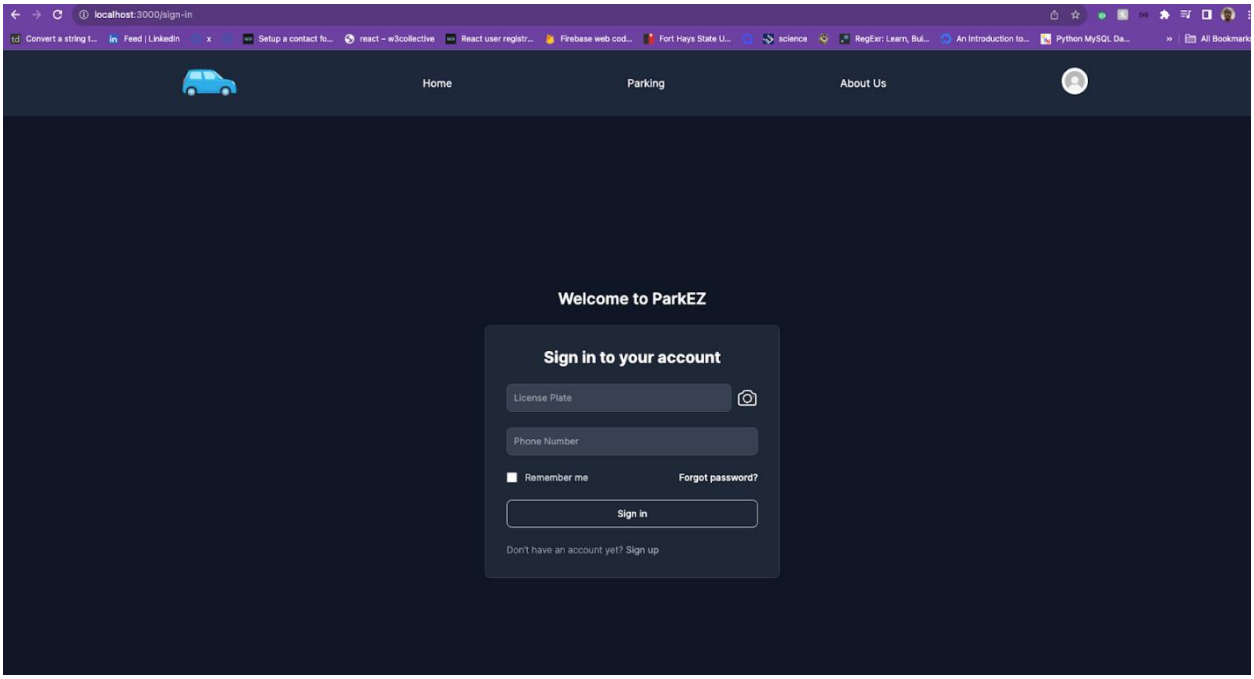
3. **Security**: Data encryption and secure user authentication (High).

4. **Scalability**: The system must handle increased demand during peak hours (Medium).

5. **Usability**: The user interface should be intuitive and accessible (High).

UI-X	Description	Status
UI-1	Parking Space Locator/Map	High
UI-2	Payment Interface	High
UI-3	Registration/Login	High
UI-4	Store User Data for analytics	High
UI-5	Notifications	Medium

Login: /sign-in



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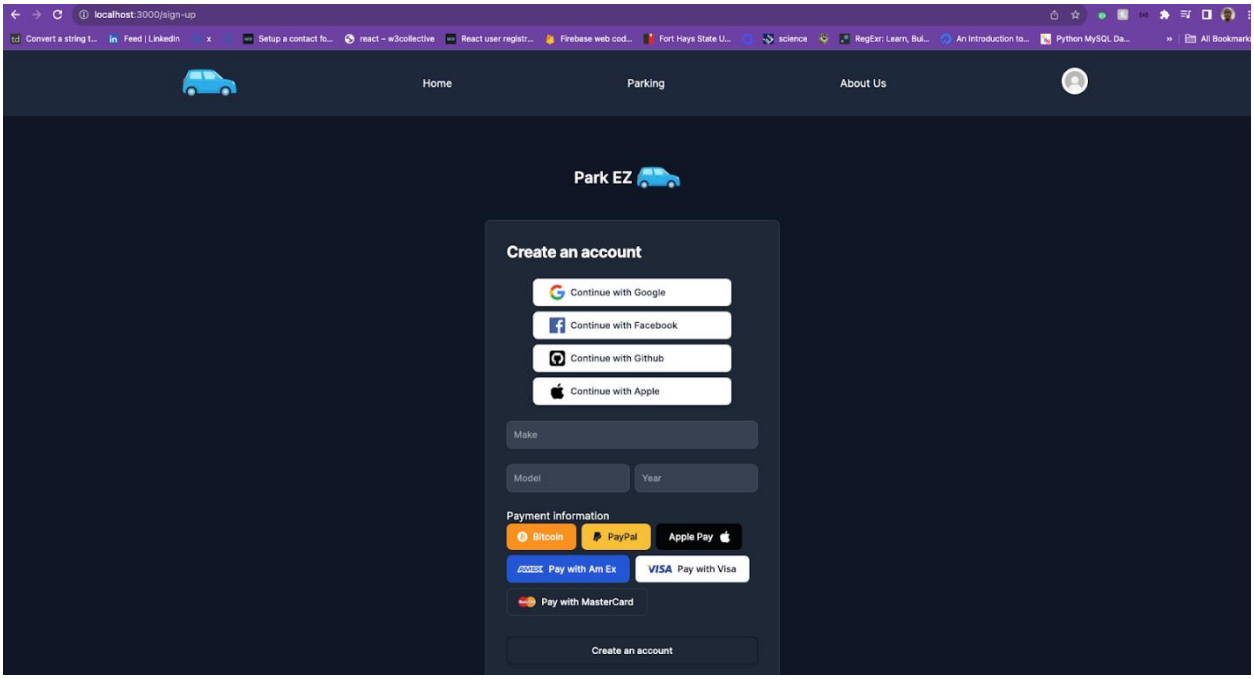

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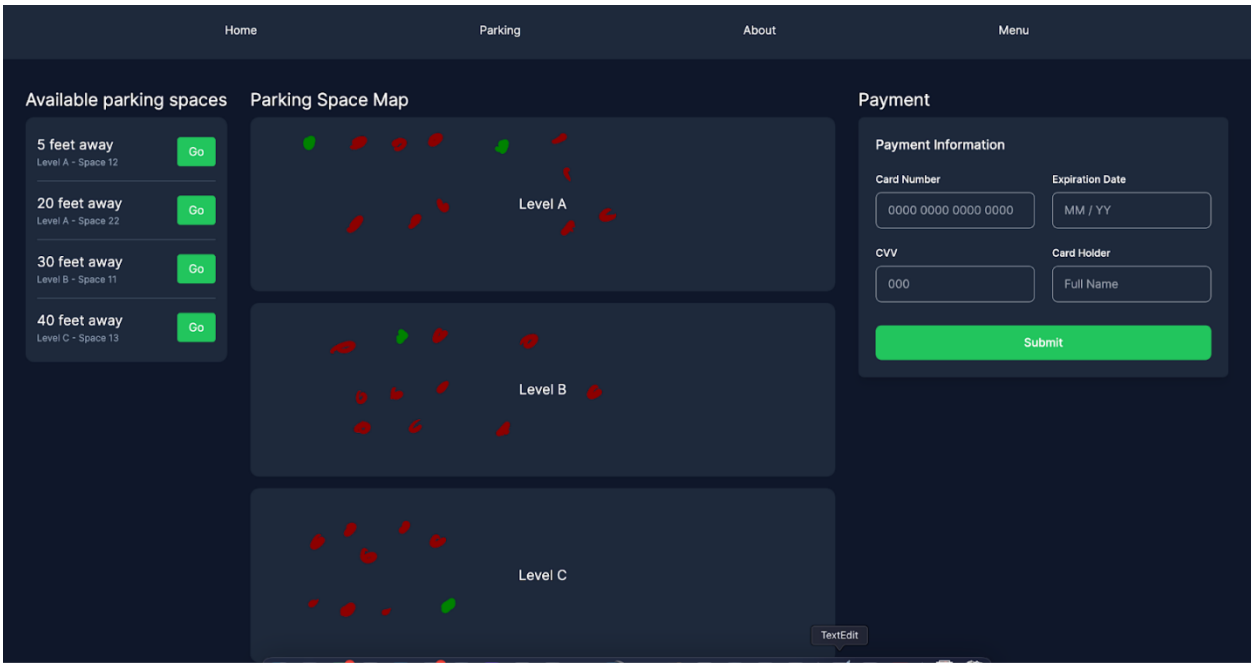

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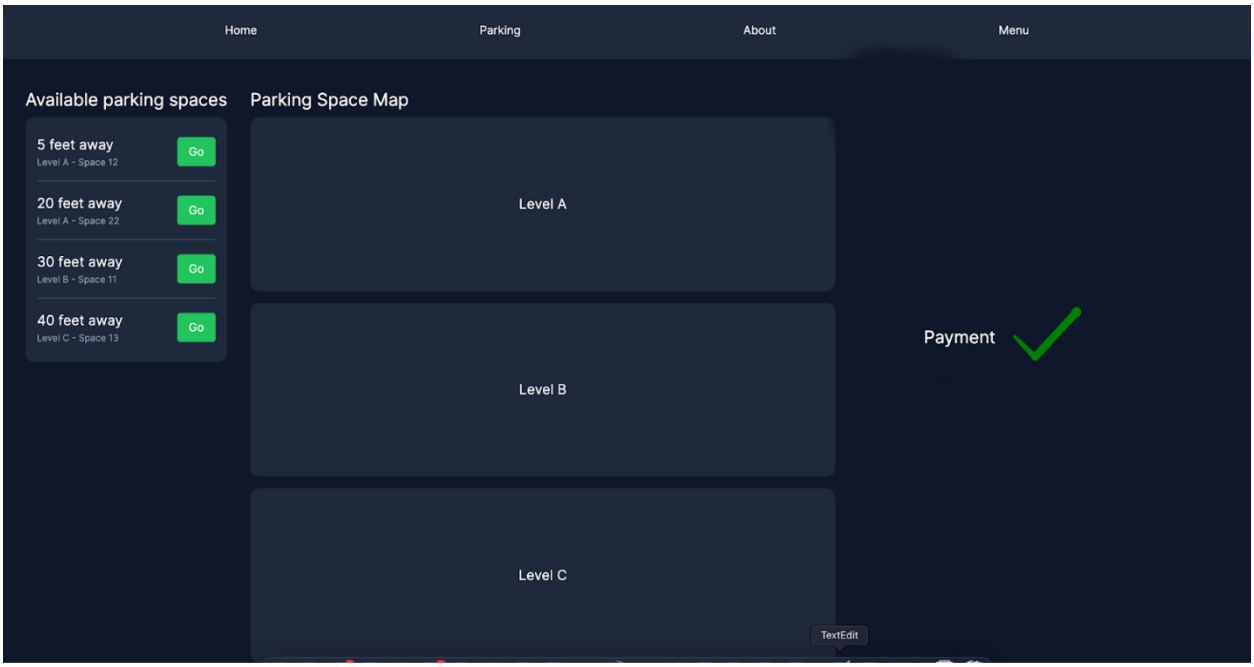

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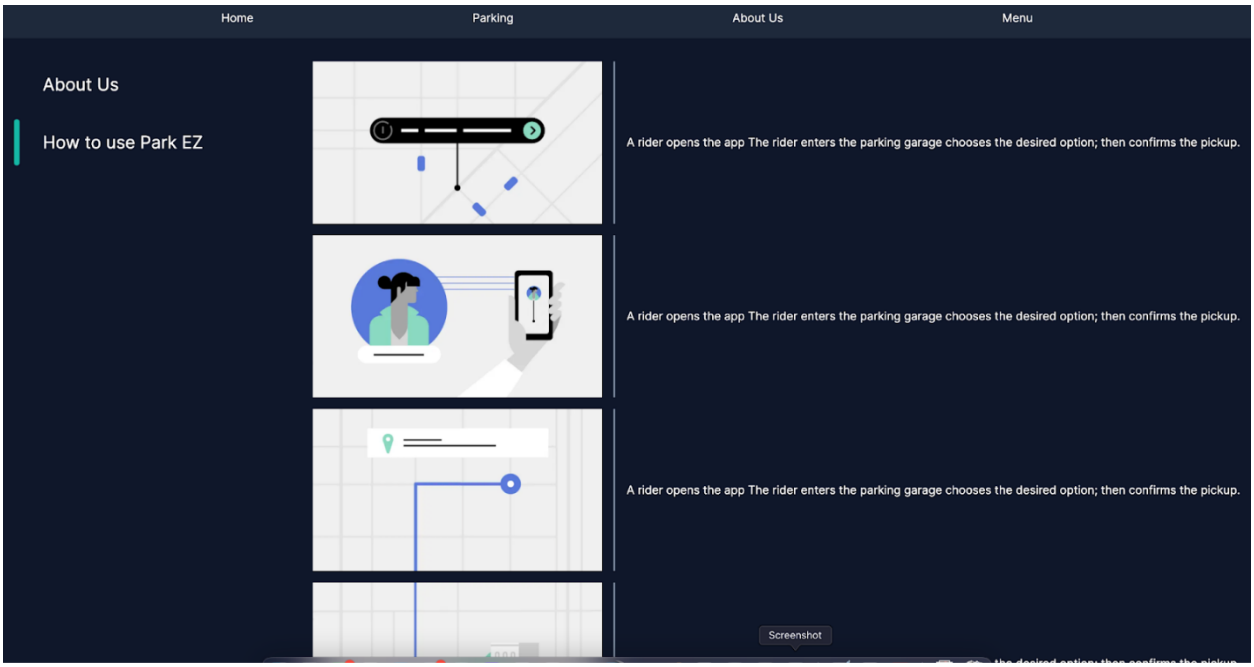

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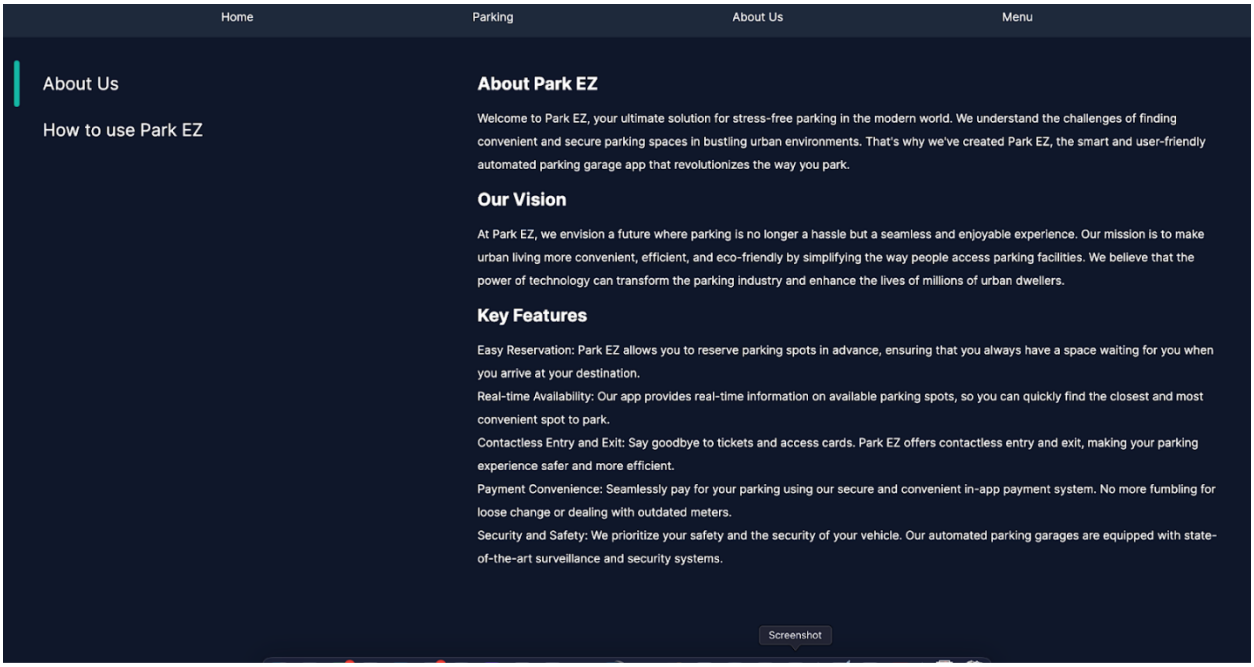

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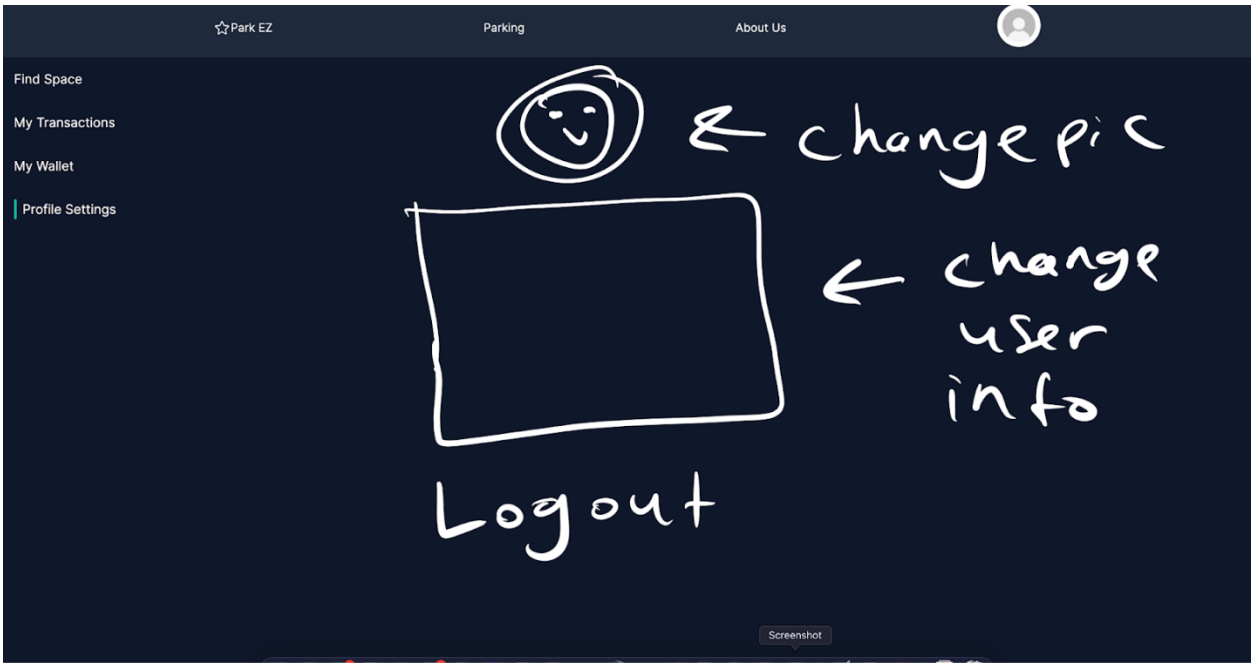
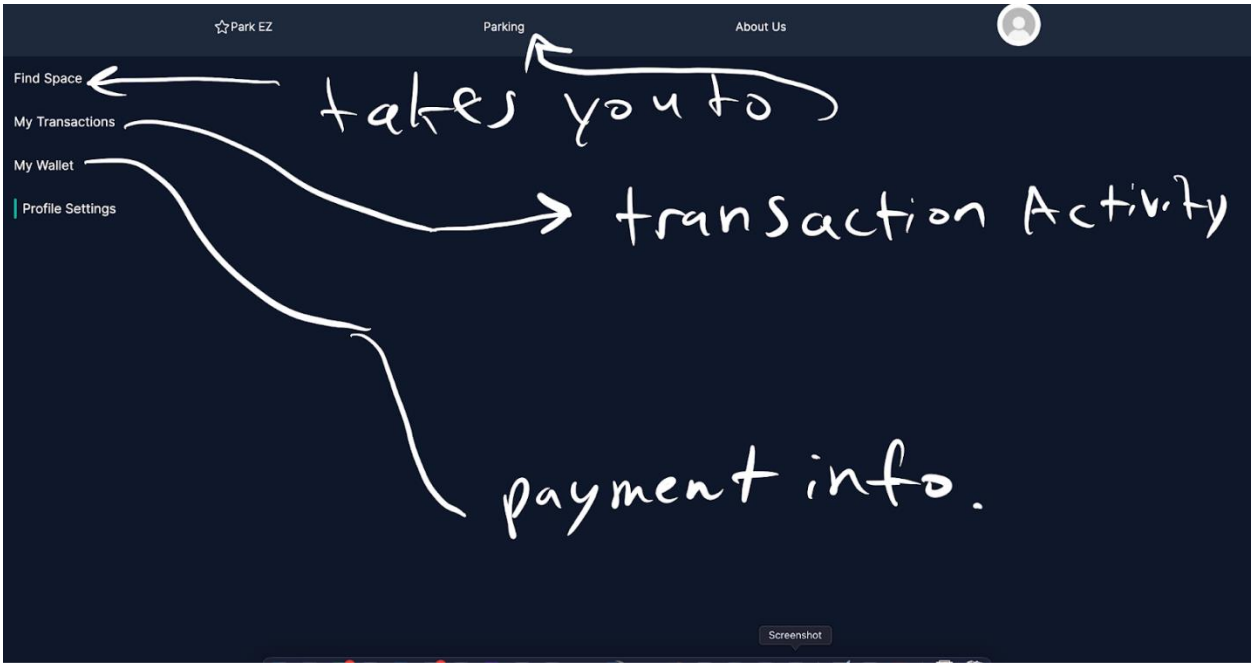

Park EZ
Parking
About Us
Find Space
My Transactions
My Wallet
Profile Settings
change pic
change user info
Logout
Screenshot


Park EZ
Parking
About Us
Find Space
My Transactions
My Wallet
Profile Settings
takes you to
transaction Activity
payment info.
Screenshot

User Interface Requirements

REQ-X	Requirement Description	Priority
REQ-17	To create an account, customers require a mobile device with internet access. During registration, they must provide their name, email, mobile number, date of birth, and license plate number.	High
REQ-18	To log in to the customer's account, the customer needs to input their email or phone number and password.	High
REQ-19	The reset password feature needs to be available in the login case in case the customers forget the password	High
REQ-20	The sign-up button is shown in the login page for unregistered customers	High
REQ-21	The update and edit customer's info should be available after the customer logs in.	High
REQ-22	To top up the balance customers need to choose a preferred method on top-up account balance and make the payment.	High
REQ-23	To make an online reservation, customers need to log in to their account, choose the hours and slot to reserve and make a submission. The payment is done through account balance or directly through the credit card.	High
REQ-24	To edit or cancel the reservation, the customer needs to log in into their account, choose reservation and update or cancel it.	High
REQ-25	The system-to-be will allow users to click a button to see a map display of the garage location and features.	Medium
REQ-26	The system-to-be will allow users to click a button to access parking status (including available spots, and occupied spots).	Low
REQ–27	The system-to-be will display parking lot number, time remaining, additional fees on screen.	Medium
REQ-28	The system-to-be will display an edit button for the user to make changes to parking, payment, and other personal information.	Medium

REQ-X	Requirement Description	Priority
REQ-29	The system-to-be will display a click button to allow users to continue, cancel or end parking.	High
REQ-30	The system-to-be will display an alert notification when the customer enters or exits the parking garage via license plate readings.	High
REQ-31	The system-to-be will display parking history and fees.	Low
REQ-32	To enroll in a monthly guaranteed reservation online, customers need to log into their account, select the guaranteed reservation option, select the days of the week, select time slots, and select the reserve button to make a submission. The payment is done through account balance or directly through the credit card.	Medium

Section 3: Functional Requirement Specification

a. Stakeholders

1. Customers: Primary users of the automated garage parking system, focused on quick parking, efficient entry/exit, and stress-free experience.
2. Garage Owners: Interested in maximizing parking space utilization, streamline garage operation for higher profitability.
3. System Administrators: Responsible for managing and maintaining the automated garage system.

b. Actors and Goals

Actors	Goals	Use Cases
Parking UI	Display available slots, enable online payment, reserve slots upon payment, and allow cancellations within a set time.	UC1, UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9, UC10, UC16, UC17, UC18
Parking Interface	Show open slots for walk-in customers and permit them to park upon entering the garage.	UC3, UC4, UC5, UC7, UC17
System	Update customer's information	UC18
System	Update parking information	UC8, UC9, UC10
Security System	Protect customer's info	UC13
Camera	Scan car plates	UC15
Customer	Register and log in on the website	UC1, UC2
Customer	Modify info or payment method	UC17, UC18
Customer	Check the available slots and reserve on website	UC3, UC4, UC6, UC7, UC17
Customer	Check the available slots and reserve for walk-in	UC3, UC4, UC5, UC7
Customer	Arrive at the garage	UC11, UC15
Customer	Exit and pay	UC12, UC15, UC7

Customer	Receive confirmation code / reservation details on email	UC8, UC9, UC14
Customer	Cancel/Edit the reservation on the website	UC6, UC10
System	Confirm customer on the garage elevator has a reservation, the license plate number is in the database and the customer is transported to the correct deck	UC3, UC4, UC5, UC15

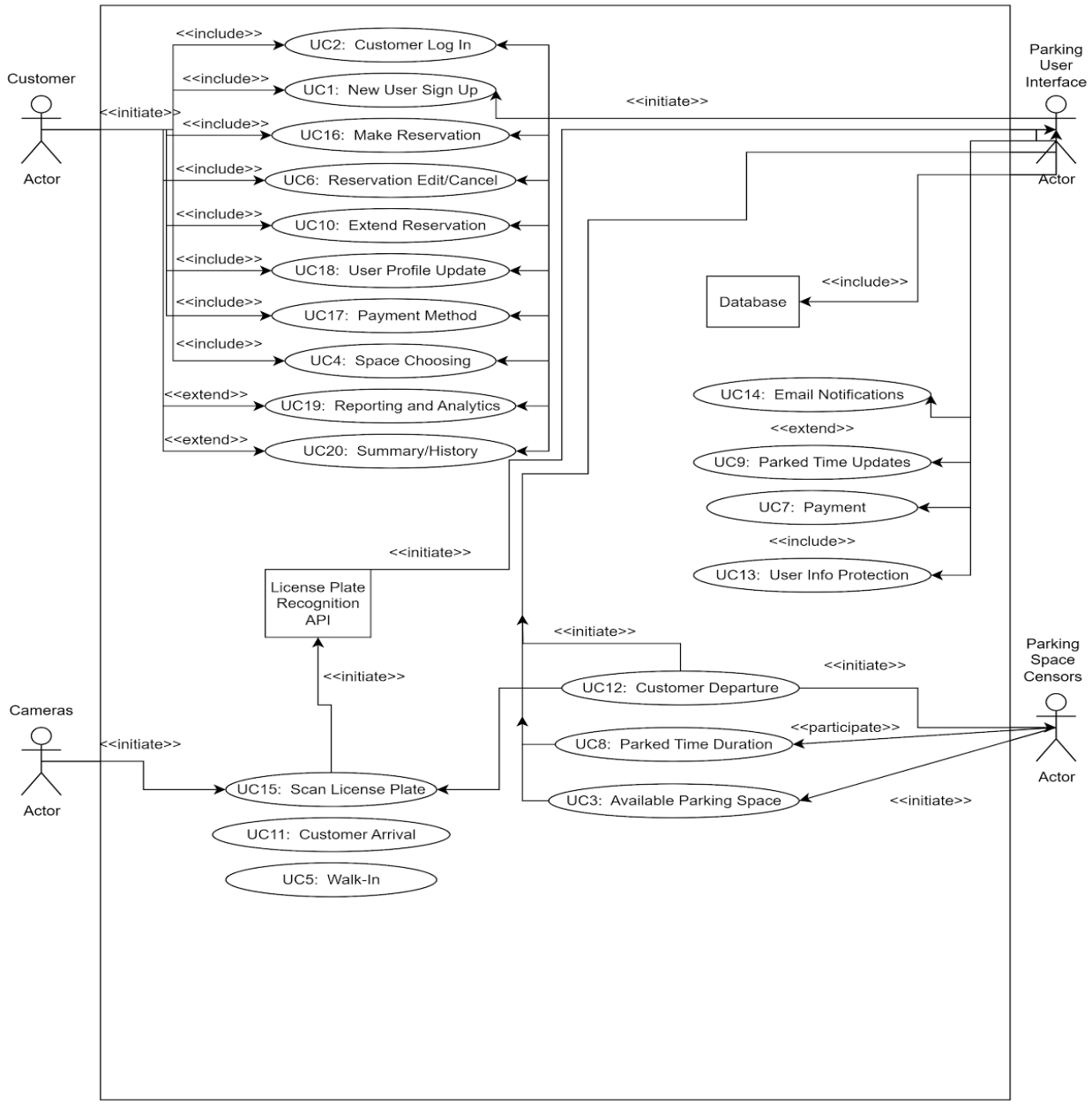
i. Casual Description

UC1	Sign Up - Customer create an account on the website
UC2	Log In - Customer use their phone number/email and password/one time code to access the website
UC3	Available Parking Space- Customer checks if free slots are available
UC4	Slot Choosing - Customer select desired slot from available ones
UC5	Walk-in - Customer with no advanced reservation
UC6	Reservation Editing/Cancelation: Customer edits or cancels reservation
UC7	Payment - Charging of the customers at the end of parking
UC8	Time duration - Keeping an account of time lasted since parking started
UC9	Time update - Keep customer updated about the time left before reservation expiry
UC10	Reservation Extension - Extend current reservation time
UC11	Arrival - customer enters the garage
UC12	Departure - customer exits the garage
UC13	Information Privacy - Encrypt customer information for security
UC14	Email/SMS Notifications - Send checks, security codes, reservation details
UC15	Scan plate - scan vehicle registration plate
UC16	Reservation - customer reserves a slot for selected time.
UC17	Payment method - Customer chooses payment method

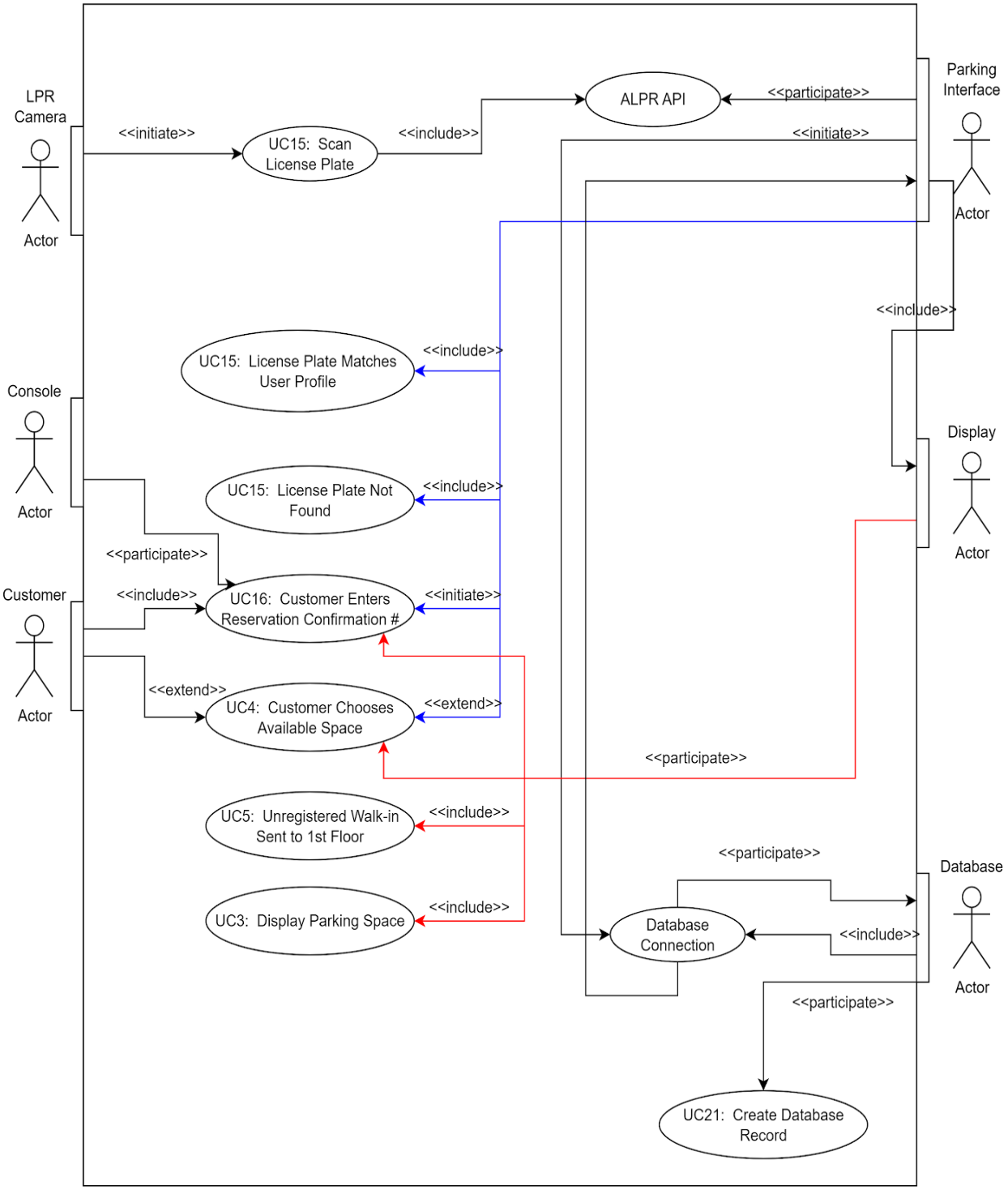
UC18	Info update - Customer updates their account information
UC19	Reporting and Analytics - Customer sends any issues and agree or disagree to administrator gathering and analyzing the customer usage
UC20	Summary/History- Customer sees their parking history and payments
UC21	Database Record Creation - User profile and parking activity saved as database records

ii. Use Cases

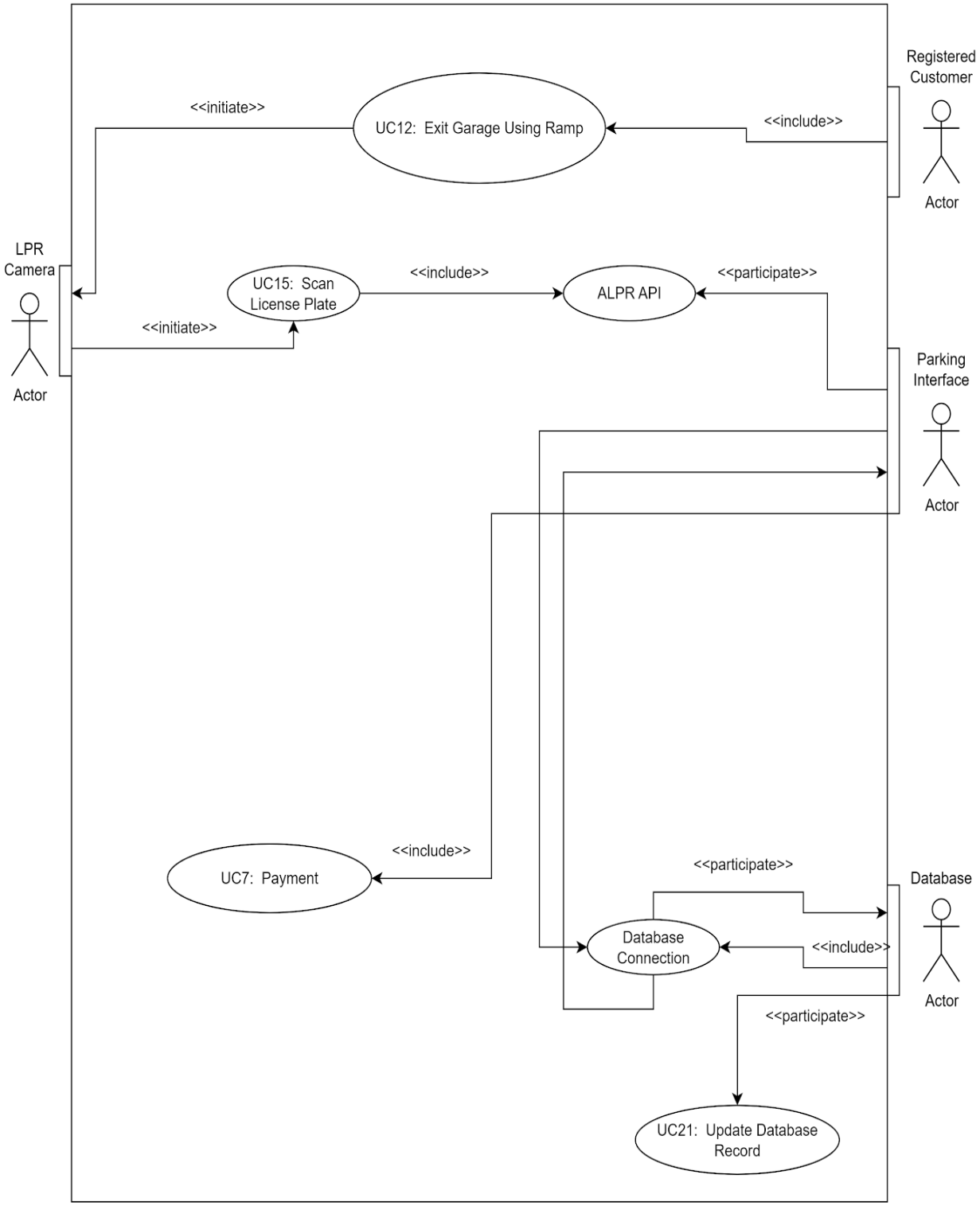
ParkEZ Use Case Diagram



Garage Elevator Use Case Diagram



Registered Customer Exits Garage
Use Case Diagram



Iii. Traceability Matrix

Requirements	Priority Weights	UC1	UC2	UC3	UC4	UC5	UC6	UC7	UC8	UC9	UC10	UC11	UC12	UC13	UC14	UC15	UC16	UC17	UC18	UC19	UC20	UC21
REQ1	10			✓		✓																✓
REQ2	10							✓										✓				✓
REQ3	8											✓	✓									
REQ4	8			✓		✓																
REQ5	9																✓					
REQ6	7													✓	✓							
REQ7	8																					✓
REQ8	6																			✓		
REQ9	5			✓	✓	✓																
REQ10	6					✓										✓	✓					
REQ11	3				✓																	
REQ12	10			✓		✓																
REQ13	5								✓			✓	✓									
REQ14	2			✓		✓									✓							
REQ15	7									✓			✓									
REQ16	7						✓				✓		✓					✓	✓			
REQ17	8	✓																				
REQ18	8		✓																			
REQ19	8		✓																			

REQ20	8	✓	✓																				
REQ21	8		✓																	✓			
REQ22	9							✓										✓	✓				
REQ23	9		✓	✓	✓	✓		✓										✓					
REQ24	8		✓				✓						✓										
REQ25	5			✓		✓																	
REQ26	2			✓		✓									✓								
REQ27	6								✓	✓	✓											✓	
REQ28	7				✓		✓						✓					✓	✓				
REQ29	8						✓				✓		✓										
REQ30	8											✓	✓		✓	✓							
REQ31	4																					✓	✓
REQ32	7		✓	✓	✓	✓		✓								✓							
Max Priority Weight		8	9	10	9	10	8	10	6	7	8	8	8	7	8	8	9	10	9	6	8	10	
Total Priority Weight		16	49	51	31	64	31	35	11	13	21	21	58	7	19	21	15	42	31	6	14	32	

iv. Fully-Dressed Diagrams

Use Case (5): (Walk-in)
Related Requirements: REQ-1, REQ-4, REQ-7, REQ-8, REQ-14
Initiating Actor: Customer
Actor's Goal: To use parking garage
Participating Actors: System (database)
Preconditions: The customer arrives without a reservation.
Success End Condition(s): Customer successfully uses the parking garage.
Failed End Condition(s): The Customer does not use the parking garage.

Extension Points:

Flow of Events for Main Success Scenario:
include::*login* UC-2
include::*Available Parking Space* UC-3
include::*Choose parking spot* UC-4
include::*Arrival* UC-11

1. **Customer** pulls up to the Parking garage without reservation.
2. **System** (a) recognizes that the Customer has no reservation, (b) checks to see if the customer is a registered user, (c) if the customer is not a registered user the system checks if there are any open parking spaces, (d) if there are parking spaces allow the customer to make a reservation (send to UC-16 step 1) on the ground floor.
3. **Customer** (a) makes a reservation, (b) enters the garage.

Flow Events for Extensions:

2b. The customer arrives without a reservation but is a registered user.
1. **Customer** pulls up to the parking garage without a reservation.
2. **System** (a) recognizes that the customer has no reservation, (b) checks to see if the customer is a registered user, (c) if the customer is a registered user the system checks if there are any available parking spaces, (d) if there are parking spaces allow the customer to make a reservation on any floor (send to UC-16 step 1).
3. **Customer** (a) makes a reservation, (b) enters the garage, (c) if parking above the ground floor the customer enters the garage elevator.
4. **System** (a) the elevator displays the customers parking space, (b) the elevator arrives at the desired floor.
5. **Customer** (a) exits the elevator and drives to the reserved parking space.

Use Case (6):	Reservation Editing/Cancelation
Related Requirements:	REQ-1, REQ-5, REQ-7, REQ-11, REQ-16
Initiating Actor:	Customer
Actor's Goal:	To edit or cancel an existing reservation.
Participating Actors:	System (database)
Preconditions:	The customer has a reservation
Success End Condition(s):	The reservation is successfully modified or deleted
Failed End Condition(s):	The reservation is not successfully modified.

Extension Points: UC10 reservation extension

Flow of Events for Main Success Scenario:

include::*login* UC-2
include::*Reservation Extension* UC10

1. **Customer** requests to modify an existing reservation.
2. **System** (a) checks if **Customer** has an existing reservation, and whether the reservation is currently in progress, (b) **System** displays reservation information for **Customer** to modify.
3. **Customer** modifies or deletes reservation.
4. **System** (a) updates database, (b) shows **Customer** modified reservation or deleted reservation.
5. **Customer** confirms new information or exits the window.

Flow Events for Extensions:

Any Step: Customer leaves window or loses connection.
1. **System** deletes all imputed data and changes nothing.

2a. System does not find reservations.
1. **System** (a) informs the **Customer** that they do not have a reservation, (b) **System** sends **Customer** to create a reservation page.

3. Customer attempts to delete an ongoing reservation.
1. **System** (a) refuses to delete an ongoing reservation, (b) **System** informs **Customer** that they cannot delete an ongoing reservation, (c) **System** sends **Customer** to reservation page.

3. Customer requests to extend reservation.
1. **System** (a) sends Customer to step 1 of UC-10, (b) afterwards sends customer to step 4.

Use Case (7):	Payment
Related Requirements:	REQ-5, REQ-7, REQ-13, REQ-11, REQ-13, REQ-15
Initiating Actor:	System
Actor's Goal:	To receive payment from customer.
Participating Actors:	Customer, database
Preconditions:	The customer has completed their stay in the Parking garage.
Success End Condition(s):	System receives Customer payment.
Failed End Condition(s):	System does not receive Customer payment.

Extension Points:

Flow of Events for Main Success Scenario:
include::*login* UC-2
include::*payment -method* UC-17
include::*Departure* UC-12

1. **Customer** leaves the parking garage.
2. **System** (a) notices **Customer** leaving Garage, (b) **System** calculates how much the **Customer** owes, (c) **System** sends invoice to **Customer**.
3. **Customer** (a) receives the invoice, (b) pays.
4. **System** (a) updates database to mark invoice as paid, (b) **System** sends receipt to **Customer**.

Flow Events for Extensions:

Any Step: Customer leaves reservation window or loses connection.

1. **System** (a) deletes all input data and returns to the last completed step, if needed resending information.

3b.

1. **System** If the **Customer** (a) does not pay in time, (b) **System** resends invoice, (c) repeat x number of times.

2. **System** if the **Customer** (a) still does not pay in time, (b) alert **Garage Administrators**.

3. **Garage Administrators** will either send information to a collection agency or file a lawsuit against the **Customer**.

Use Case (16):	Reservation
Related Requirements:	REQ-1, REQ-5, REQ-7, REQ,11
Initiating Actor:	Customer
Actor's Goal:	To book a reservation at the parking garage
Participating Actors:	System (database)
Preconditions:	Customer has an account, Customer has set up Payment options.
Success End Condition(s):	Customer successfully set up a reservation.
Failed End Condition(s):	Customer does not successfully set up a reservation.
Extension Points:	UC-6

Flow of Events for Main Success Scenario:

include::*login* UC-2
include::*Available Parking Space* UC-3
include::*Chose parking spot* UC-4

1. **System** (a) displays parking space availability data by floor, (b) **System** also displays the option of having a guaranteed parking spot.
2. **Customer** choses a parking space, and the amount of time the Customer wants to reserve the parking space for.

3. **System** (a) accepts the reservation, (b) **System** makes changes to the database, (c) **System** receives notice that the reservation was made successfully, (d) **System** shows Customer reservation success and reservation information.
4. **Customer** confirms that reservation is correct or exits system prompt.

Flow Events for Extensions:

Any Step: **Customer** leaves reservation window or loses connection.

1. **System** deletes all input data and confirms nothing.

1b. Customer chooses the guaranteed reservation option.

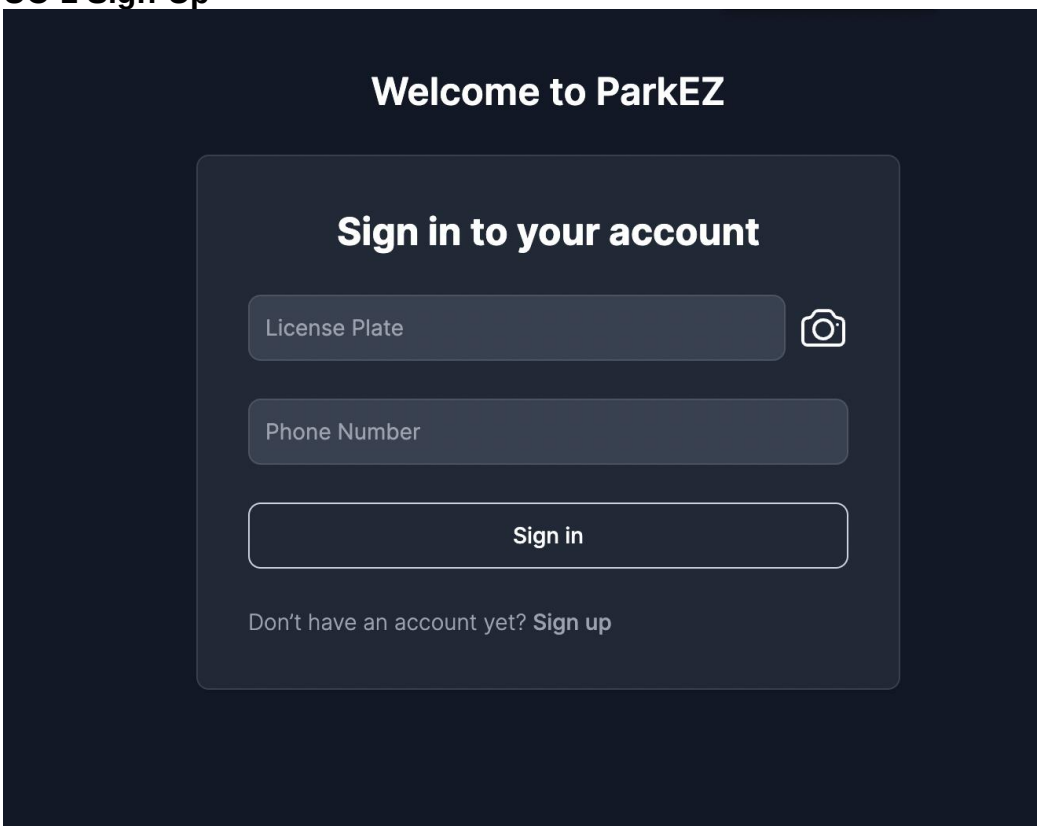
1. **System** asks **Customer** which parking space they would like to reserve, and how long they would like to reserve it for (minimum of one month).
2. **Customer** chooses a parking space and a duration.
3. **System** sends **Customer** to UC-16 step 3.

2. Customer attempts to pick an already selected parking place.

1. **System** (a) informs the **Customer** that that parking place is already reserved. (b) sends the **Customer** to step 2 (repeat if needed).

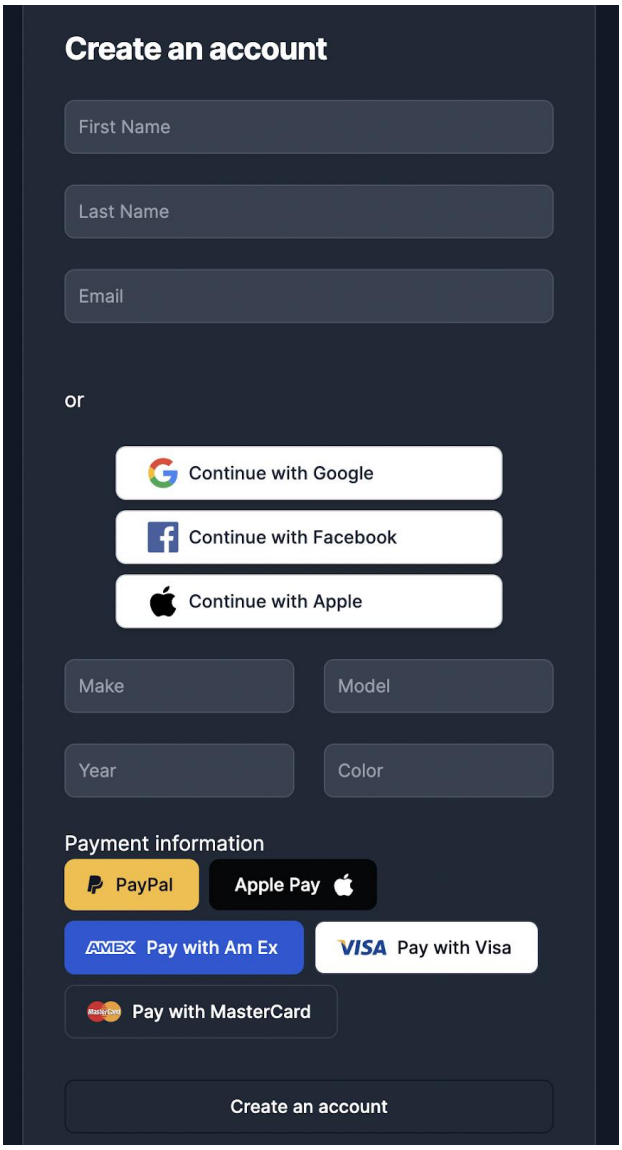
Section 4: User Interface Specification

UC-1 Sign-Up



The user can log in with License plate and phone number, if there is no phone number connected with that license plate, the page will be redirected to /sign-up route.

Estimation: 1 text input + 2 clicks.



Sign up route will be passed the parameters from /sign-in which are **license plate** and **phone number**.

Additional information needed from the end-user for registering in the /sign-up route will be **first name**, **last name**, **email**.

Alternatively, they can use O-Auth sign with providers such as **google**, **Facebook** or **apple**, where first name, last name, email, and profile image will be attached to the form data of the /sign-up route.

Next, the end-user will enter in vehicle **make**, **model**, **year**, and **color**. Finally, a **payment option** to keep on file, that includes credit card number and billing address, will be filled out by the user.

After completing these inputs, the user will be allowed to click the Create an Account button, which redirects them to the /sign-in route.

Estimation: 7 text inputs and 2 clicks or 3 text inputs + 3 clicks.

UC-2 Sign-In
If there exists a user with matching credentials of license plate and phone number, there will be a one- time code sent via SMS, where standard messaging rates will apply.

After authentication is granted, a link will be sent to the user that redirects them to the /parking-space route.

Estimation: 1 click if license plate is registered into system.

UC-3 Available Parking Space

In the /parking-space route there will be a map of available and occupied parking spaces

Estimation: 1 click to find parking space.

UC-4 Slot Choosing

In the /parking-space route there will be a display of available slots, a parking space map, and a date and time picker.

A time stamp for a parking space will start once the status sensor for a parking space changes from available to occupied.

Estimation: 1 click to find parking space.

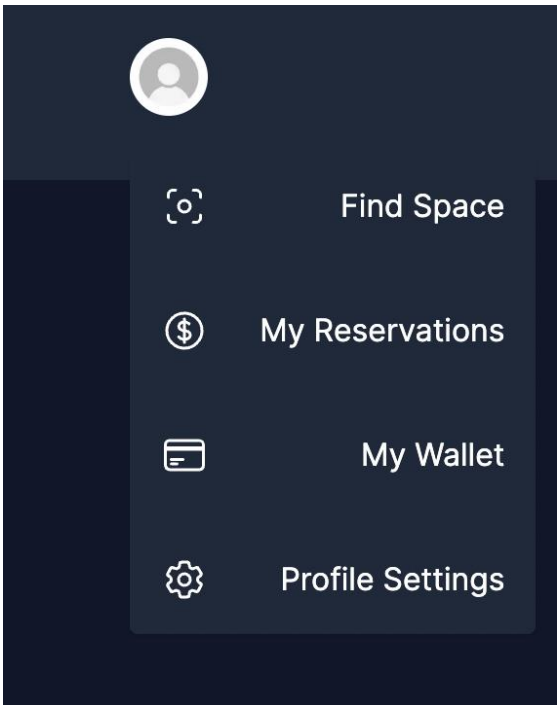
UC-5 Walk-in

Customers with no advanced reservation will stop at the user interface at the garage entrance. The user interface will ask for a registered user ID or reservation number. If a valid ID or reservation number is provided the user will be allowed to enter and be directed to the garage elevator. If no valid ID or reservation number is provided the display will show any available parking spaces or show no occupancies available if the ground floor is full. If parking spaces are available, the user will be prompted for name and payment/billing information. The license plate camera takes a picture of the customer's license plate and displays the license plate number on the screen. Once payment/billing information has been entered the user interface display will show the customer the selected parking space and they will be allowed to enter.

UC-6 Reservation Editing/Cancellations

After choosing a spot, the user can edit user parking space slot data, including time, date, parking space and be able to delete/cancel the reservation in the My Reservations, menu option.

Estimation: 2 clicks to get to reservations.



UC-7 Payments

Once a user leaves the parking space and the status for the sensor changes from occupied to available, payment is initiated from the user payment method upon leaving.

Estimation: 0 clicks for payment, just a confirmation message?

UC-8 Time Duration

Parking space time duration will depend on parking space status sensors.

Estimation: 0 clicks

UC-9 Time Update

Time updates will be sent through SMS updates.

Estimation: 0 clicks

UC-10 Reservation Extension

A link will be sent to the user for quick time extension capabilities.
Estimation: 1 click

UC-11 Arrival

When a user enters the garage, a camera will take a picture of the license plate and if the user is registered an SMS will be sent to the user for phone authentication and link to access Park EZ web app with user credentials.

Estimation: 1 click, one time code input, and another click.

UC-12 Departure

When a customer exits the garage, a picture will be taken of the license plate and vehicle and a thank you message will be sent?

UC-13 Information Privacy

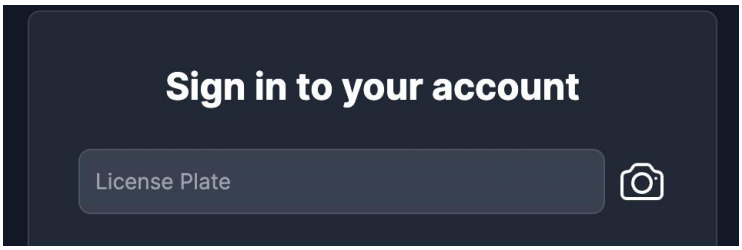
A passwordless, phone authenticated sign in will ensure all users are authorized and data will be better secured. Transactions will be encrypted and secured using Stripe API.

UC-14 Email/Phone Notifications

Send notifications by phone or email, which includes purchase and reservation confirmations, security codes, and reservation details.

UC-15 Scan Plate

Cameras will scan plate numbers and automatically display them in UI, or the user can upload a picture of the license plate, implemented through License Plate Scanner API.



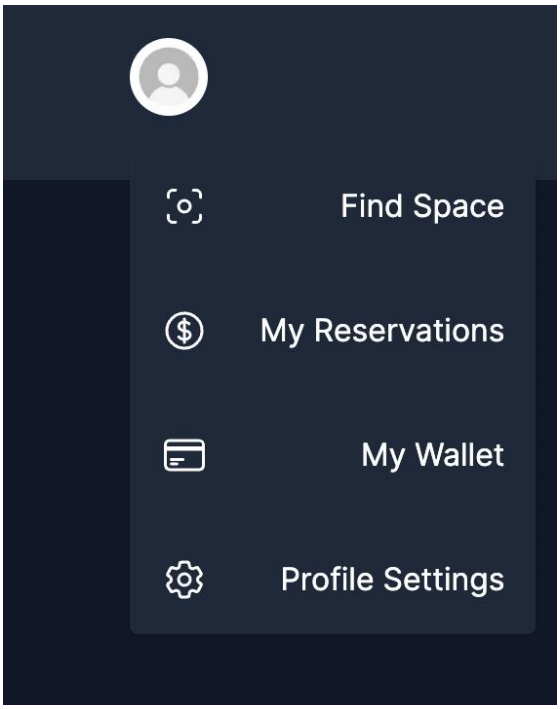
UC-16 Reservation

Customers can reserve a “one time” parking space or a monthly guaranteed reservation through /parking-space route.

Estimation: To reserve takes 3 clicks and 2 inputs for date and time.

UC-17 Payment Method

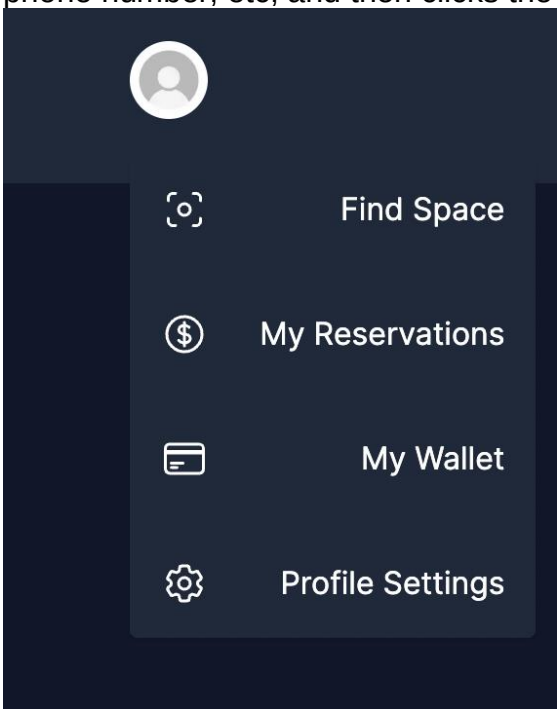
User payment method should be saved in the My Wallet section of user profile for faster transaction implementation.



Estimation: To update payment method takes 2 clicks and text inputs.

UC-18 Info Update

The user can update user details by clicking the profile picture icon, then clicking Profile Settings. The user changes whichever field needs to be updated, such as address, phone number, etc, and then clicks the Save Profile button.

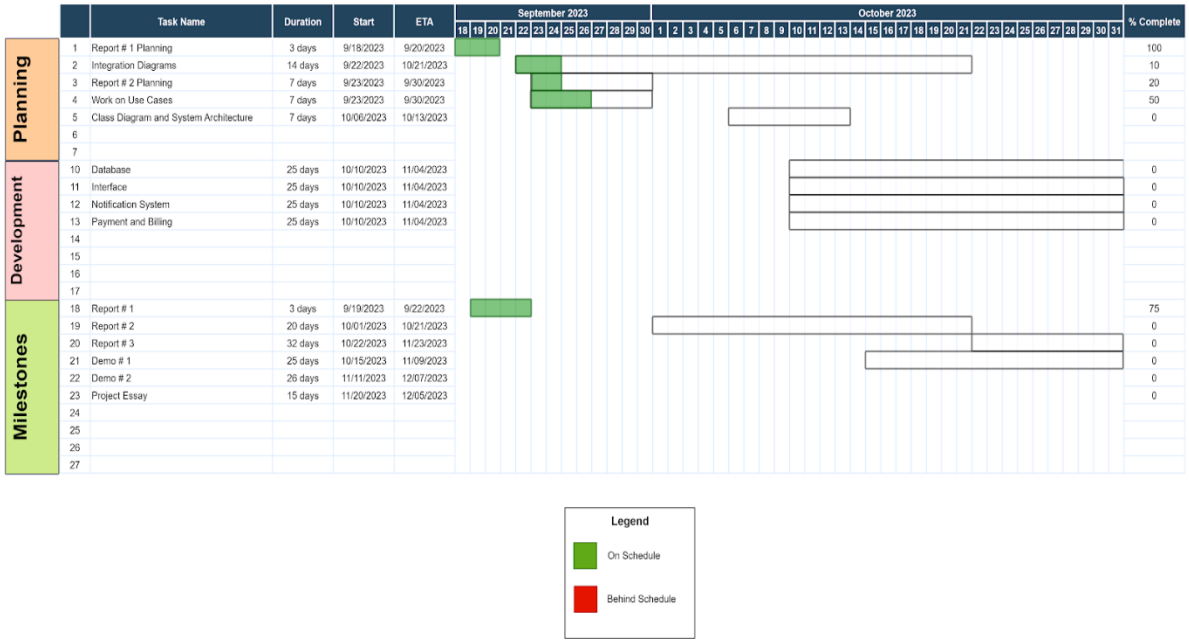


Estimation: 2 clicks to get to the Profile Settings section, however many input fields that need updating and 1 click to save changes.

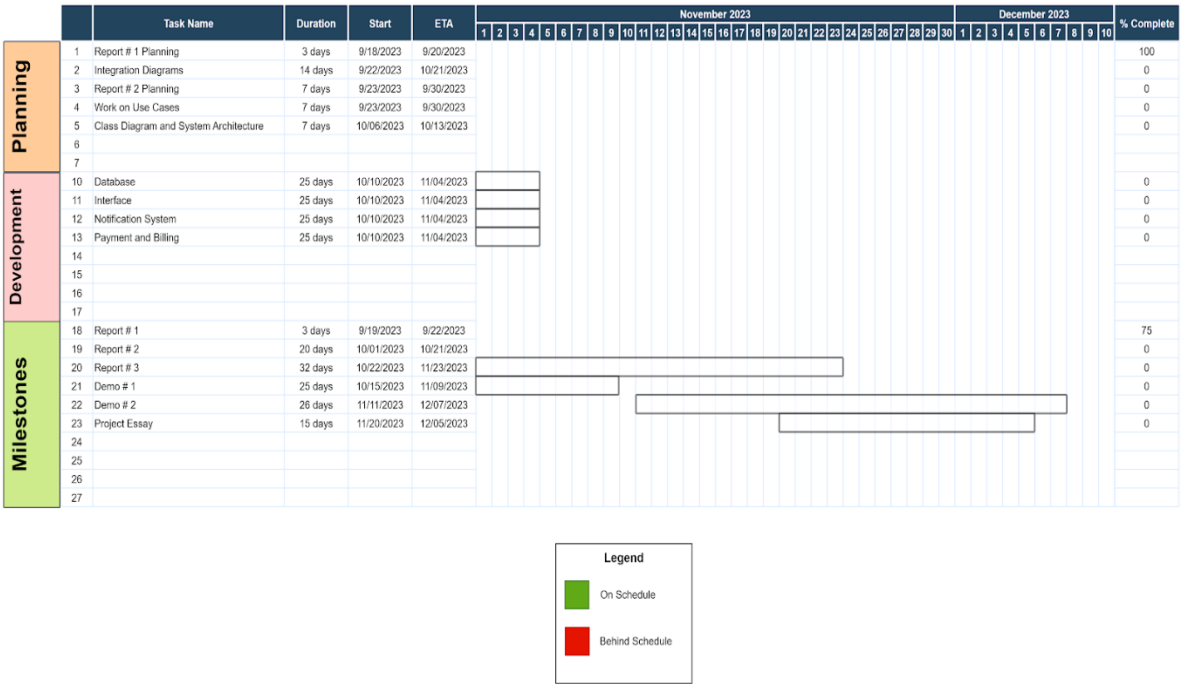
Project Management

Plan to Work: This project is in the planning phase and all of the foundation laid so far has been a team effort. Our group discussions have been conducted on a Discord text server that was created for the purpose of this project. We have also attended a weekly Discord voice chat for project discussion, planning and design. The Report was created on Google Docs and was shared with the entire group so that each member could contribute in real time to the content of the document and participate in the editing process. We will continue to use Discord for meetings and Google Docs for future reports.

ParkEZ Gantt Chart



ParkEZ Gantt Chart



		Task Name	Duration	Start	ETA	% Complete
Planning	1	Report # 1 Planning	3 days	9/18/2023	9/20/2023	100
	2	Integration Diagrams	14 days	9/22/2023	10/21/2023	0
	3	Report # 2 Planning	7 days	9/23/2023	9/30/2023	0
	4	Work on Use Cases	7 days	9/23/2023	9/30/2023	0
	5	Class Diagram and System Architecture	7 days	10/06/2023	10/13/2023	0
	6					
	7					
Development	10	Database	25 days	10/10/2023	11/04/2023	0
	11	Interface	25 days	10/10/2023	11/04/2023	0
	12	Notification System	25 days	10/10/2023	11/04/2023	0
	13	Payment and Billing	25 days	10/10/2023	11/04/2023	0
	14					
	15					
	16					
	17					
Milestones	18	Report # 1	3 days	9/19/2023	9/22/2023	75
	19	Report # 2	20 days	10/01/2023	10/21/2023	0
	20	Report # 3	32 days	10/22/2023	11/23/2023	0
	21	Demo # 1	25 days	10/15/2023	11/09/2023	0
	22	Demo # 2	26 days	11/11/2023	12/07/2023	0
	23	Project Essay	15 days	11/20/2023	12/05/2023	0
	24					
	25					
	26					
	27					

Product Ownership

Breakdown of Teams	Team Member Assignment	Coordination Activities
Team Pair #1: Benjamin Bylsma Mikael Mikaelian	Benjamin Bylsma • Customer registration and profile management. Mikael Mikaelian • Payment processing and billing.	Functionalities: Customer registration and profile management Qualitative Property: Develop an intuitive and user-friendly online registration process. that securely stores customer data and reservation data in a database. Treatment: Address the problem of user registration complexity and ensure a seamless onboarding experience.

Team Pair # 2: Christopher Smith Adrian Elgin	Christopher Smith • Real-time parking space availability updates. Adrian Elgin • Reservation system with confirmation.	Functionalities: Real-time parking space availability updates by integrating parking. space sensors, license plate cameras and customer check-in software. Qualitative Property: Ensure system performance to display availability within Seconds. Treatment: Alleviate the problem of customer frustration due to inefficient parking space searches.
Team Pair # 3: Phongsavanh Mongkhonvilay Geoffrey Sarpong	Phongsavanh Mongkhonvilay • Integration with security and surveillance. Geoffrey Sarpong • Automated entry and exit for vehicles.	Functionalities: Automated entry and exit for vehicles using license plate recognition camera system. Qualitative Property: Develop and evaluate a user-friendly interface for the entry and exit process. Treatment: Resolve the issue of congestion and delays at entry and exit points. Additionally, we will collectively work on payment processing, billing, and the reservation system to enhance overall system efficiency.

Summary of Changes

Some changes were made to Report one after Parts 1 and 2 were merged to form one document. The Glossary of terms, User Interface Requirements, User Interface Specification, and the UC-16 full dress diagram was updated to include the option of enrolling in a monthly Guaranteed Reservation. This gives customers the opportunity to have one or more parking spaces reserved on a regular basis for the month on certain days and time blocks. Guaranteed Reservations also help to maximize parking space occupancy and ensure profits for parking garage owners. In addition to the Guaranteed Reservation option, we also added some detail and clarification as to the role the garage elevator plays in the ParkEZ system. Originally, we had one of the LPR cameras at the garage entrance on the ground floor, but that was not how the parking garage project scenario specified it. In the scenario there are two cameras, one at the elevator lift entrance and one at the ramp exit. We adjusted our report and specification documents and diagrams to reflect the project scenario. Use case diagrams were added for the garage elevator and for the exit of registered customers by way of the ramp. Included in the use case diagrams were the behaviors of the LPR camera, Display and Parking Interface in the vehicle elevator. We needed to specify that when a registered customer with an unrecognized license plate or a walk-in customer entered the elevator, they would be prompted by the display to enter a reservation confirmation number on the console. If the reservation confirmation number could not be supplied, then the display would prompt the customer to exit the elevator and obtain a parking space on the ground floor as a walk-in customer. The system function of "confirmation of reservation in the garage elevator" was added in the Actors and Goals section. We also added UC21: Database Record Creation in the Casual Use Case section to highlight the fact that when a customer arrives in the elevator and their license plate does not match what is listed on the reservation, but they can produce the reservation confirmation number a record of the license plate is added to the database.

References

Marsic, I. (2009). *Software Engineering*. Ivan Marsic. https://www.ece.rutgers.edu/~marsic/books/SE/book-SE_marsic.pdf.

Gantt Chart and Use Case Diagram Design: https://app.diagrams.net/