CSIT321 - Final Year Project

Multi-factor transaction authorisation based on QR code

Project Requirement Documentation

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1. Introduction

This document serves as an overview of our project, containing a comprehensive description of the requirements for the project, including functional and non-functional requirements. The document is structured into several sections, including an overview of the project explaining the purpose and scope of the project, a detailed description of the project requirements, as well as the marketing research done for this project.

1.1. Purpose

The purpose of this project is to create a hotel booking platform which uses an authentication system that requires more than one authentication factor for successful authentication based on the QR codes that are being generated by us, the System Admin's. The authentication system will be executed between a QR code and a mobile application along with the QR code scanner to complete the transaction.

1.2. Scope

The scope of the project includes the overall description of the authentication system, as well as the integration of the system and the creation of a user-friendly interface. The project is subjected to strict security requirements and must meet the regulations set by the Personal Data Project Act (PDPA) and the Cybersecurity Act.

2.   Overview

This section of the document describes the project idea along with the project description and how our platform will work.

2.1.   Project Description

The team aims to create a platform that makes the process of booking a hotel room faster and more efficient along with a keyless check-in, check-out system. The customers using the platform will be entitled to promotions on their hotel bookings while the hotel operator who onboard our platform will be given access to the customer's personal details and preferences. Our platform will allow the hotel operator to understand their customers better while customers will be able to enjoy quality discounts unavailable to them outside the platform.

As our project is centred around the idea of QR Code, the team decided on the idea of providing convenience to hotel customers by replacing a room key with QR codes to unlock the room and check out of the hotel, along with providing customers with discounts for using our platform. Along with Multi-Factor Authentication such as the use of biometrics to secure the hotel customers information.

2.2.   How it works

The team plans to create a website and a mobile application. The website serves as a catalogue where customers can view all the available hotel rooms for rent. Once the customer finds a suitable room to book, the customer will be able to reserve a room and make their payment through the website itself.

A QR code will be pasted outside every room for scanning. After checking in to the hotel, the customer will be able to use the QR scanner on our mobile application to unlock the hotel room.After validating from the hotel side that the current customer is authorised to use the room at the appointed date and time, the room will be unlocked for the customer to use.

When the customer wants to check out of the room, there will be a main check-out QR code that is pasted at the hotel lobby for customers to check out of the hotel without having to go through the hassle of spending extra time and waiting in a queue at the hotel counter to check-out.

The diagram below depicts the flow of how our platform works from customer and hotel operator.
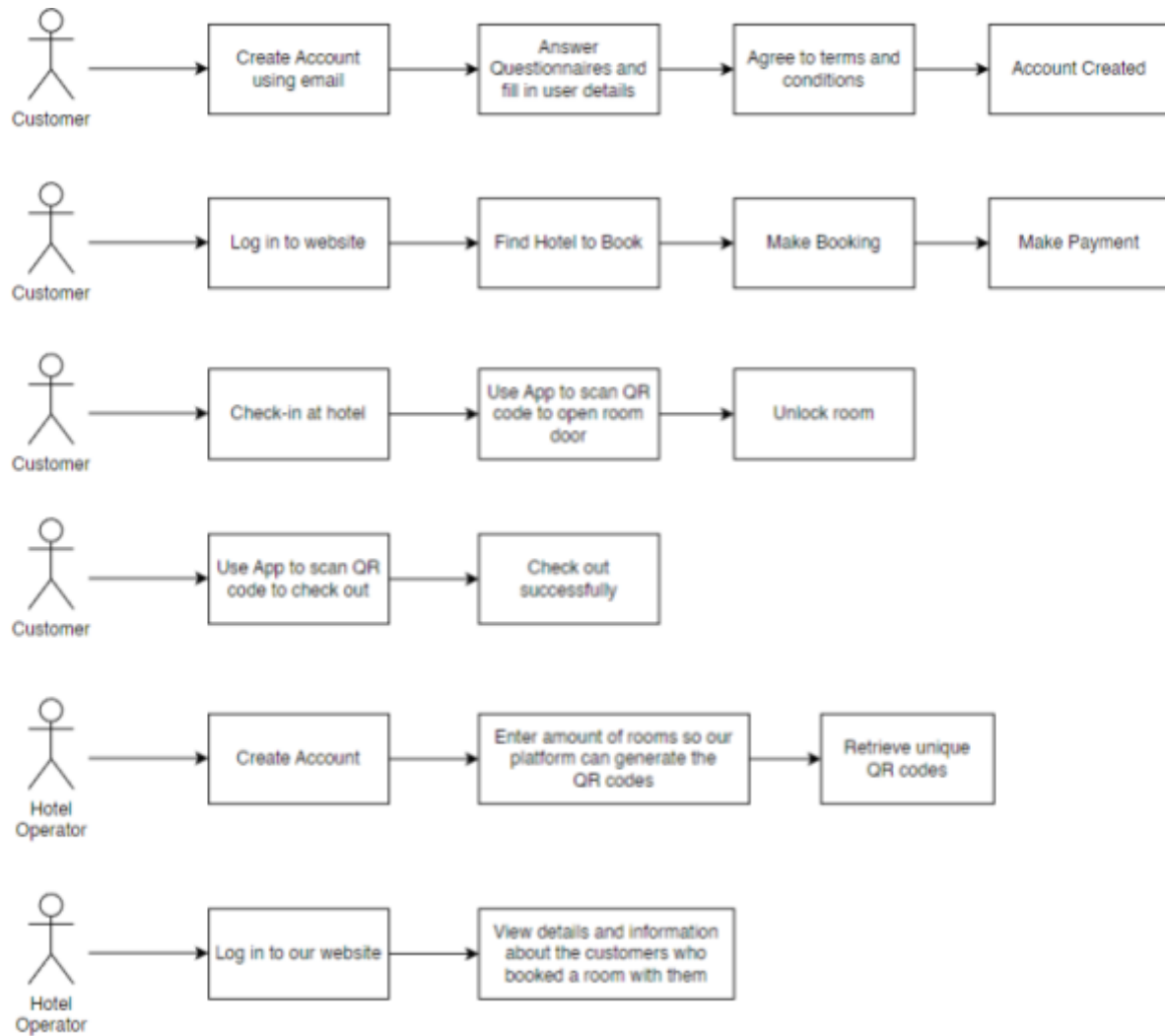

Figure 1: Simple diagram to show the process of our platform

3.   Functional Requirements

This section contains the functional requirement of our platform.

3.1.   Functional Requirement for Users

Customers will have to create a user account. Our platform - both mobile application and website will need the basic functions such as the login button, logout button and edit customer's details button. Other functions that our website requires is the view and search for hotel listings.

The main focus of our project is the usage of the QR Code. The QR code for each hotel room will be generated by our platform so that when the customer scans the QR code using the QR code reader from the mobile application, it will authenticate and authorise the customer.

Our mobile application will have the functionality of scanning the QR Code using the QR code scanner so the customer can scan the respective QR codes to unlock the hotel room door and check out of the hotel.

3.2.   Functional Requirement for Hotel Operators

Similarly, the hotel operators will have a hotel operator account assigned to them. Using this account, they will be able to view the bookings made by the customers, along with their personal information and their preferences.

The hotel operators will retrieve the QR codes from our platform based on the number of rooms the hotel has. The hotel operators have to put the QR codes outside of the hotel room doors.

3.3.   Functional Requirement for our platform

Our platform will need to generate QR codes for the hotel and the rooms along with a verification method to authenticate and authorise the hotel customer when they scan a QR code.

4.   User Stories

System Admin

1) As the System Admin, I want to be able to login so that I can manage the customers and the hotel chain client.
2) As the System Admin, I want to be able to logout so that I can exit the system.
3) As the System Admin, I want to be able to create a user account so that I can add a new user into the system.
4) As the System Admin, I want to be able to view all user accounts so that I can retrieve the user account details list.
5) As the System Admin, I want to be able to update user accounts so that I can edit the account information of a user.
6) As the System Admin, I want to be able to search for specific user accounts so that I can retrieve the user account.
7) As the System Admin, I want to be able to suspend a user account so that I can delete the user account.
8) As the System Admin, I want to be able to view user profiles so that I can retrieve the data based on the user profile.

Hotel Operator

9) As the Hotel Operator, I want to be able to login into the Website so that I can access the system.
10) As the Hotel Operator, I want to be able to logout from the Website so that I can exit the system.
11) As the Hotel Operator, I want to be able to view Customer's details from the Website so I know who my customers are.
12) As the Hotel Operator, I want to be able to view Customer's transactions from the Website so that I know my customer's preferences.
13) As the Hotel Operator, I want to be able to retrieve the generated QR codes from the Website so that the customer can scan the QR code to enter the hotel room
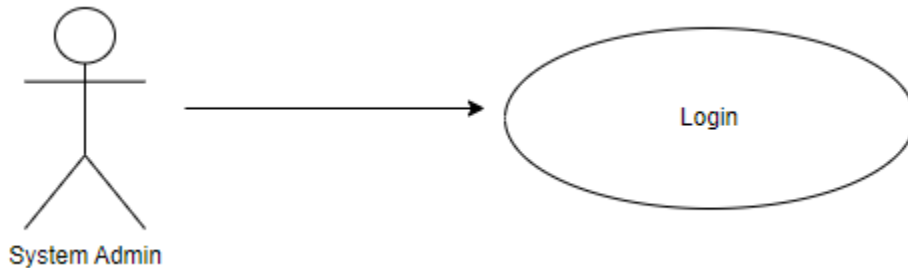
Customer

14) As the Customer, I want to be able to login into the Website so that I can access the system.
15) As the Customer, I want to be able to logout from the Website so that I can exit the system.
16) As the Customer, I want to be able to update the password in the Website so that I can edit the password.
17) As the Customer, I want to be able to create a hotel booking from the Website so that I can book a room to stay in.
18) As the Customer, I want to be able to view my hotel booking(s) from the Website so that I can retrieve the hotel booking details.
19) As the Customer, I want to be able to update my hotel booking from the Website so that I can edit the hotel booking details.
20) As the Customer, I want to be able to create payment for hotel booking on the Website so that I can make payment for booking.
21) As the Customer, I want to be able to search for rooms from the Website so that I can retrieve the hotel details to book.
22) As the Customer, I want to be able to login into the Mobile App so that I can access the system.
23) As the Customer, I want to be able to logout from the Mobile App so that I can exit the system.
24) As the Customer, I want to be able to use the QR code scanner from the Mobile App so I can scan the QR code to access the hotel room that I have booked / check-out (sub flow).

5. Use Case Diagrams and Descriptions

Use Case # 1
As the System Admin,
I want to be able to login so that I can manage the customers and the hotel chain client.

System Admin

Name: Login	ID: 1
Stakeholders and goals: System Admin - want to login to the system	
Description: The System Admin wants to login to the system to manage customers and hotel operators.	
Actors: System Admin	
Trigger: The System Admin enters the website	

Normal flow:
  1. System will display a login page.
  2. System Admin will enter the username and password.
  3. System Admin clicks on the "Login" button.
  4. System will validate the username and password combination.
  5. System will navigate to the homepage.
  6. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 2

As the System Admin,
I want to be able to logout so that I can exit the System.
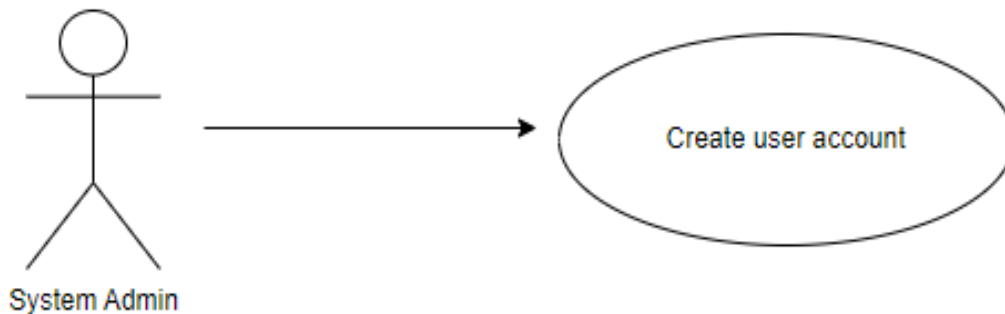

System Admin — Logout
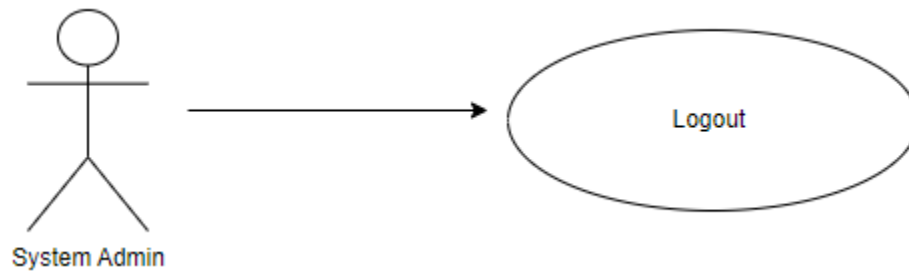
Name: Logout	ID: 2
Stakeholders and goals: System Admin - wants to log out from the system.	
Description: The System Admin wants to log out from the system to stop managing customers and hotel operators.	
Actors: System Admin	
Pre-condition: The system admin must already login into the system	
Trigger: The System Admin clicks on "Log Out" button	

Normal flow:
    1. System Admin clicks on the "Log Out" button.
    2. System will direct them to the Login page.
    3. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 3

As the System Admin,

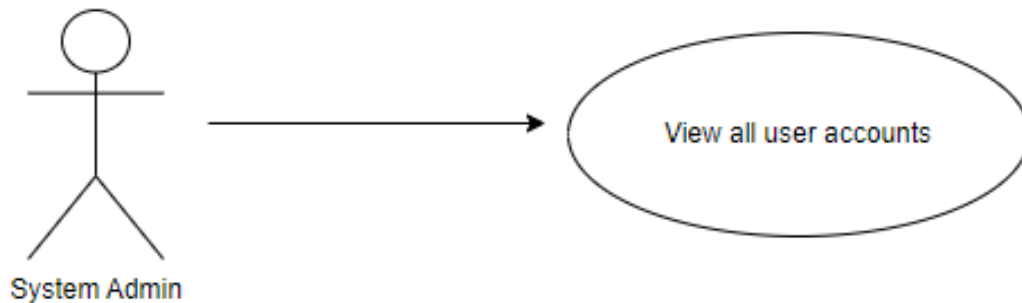I want to be able to create a user account so that I can add a new user into the System.

System Admin

Name: Create a user account	ID: 3
Stakeholders and goals: System Admin – wants to add a new user into the system	
Description: The System Administrator wants to create a user account to add a new user into the system.	
Actors: System Admin	
Trigger: The system administrator clicks on the "Create account" button.	
Normal flow: 1. System admin logs into the System. 2. System will display the homepage that shows the "Create account" button. 3. System admin clicks on the "Create account" button. 4. System directs the user to another page for the user to fill up the details. 5. System admin can enter the name, email, contact and select the account type (hotel operator, customer, system admin) in the drop down button. 6. System admin clicks on the "create" button. 7. System display "confirm" button. 8. System admin clicks on the "confirm" button. 9. System creates the account and returns to the homepage. 10. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 4

As the System Admin,

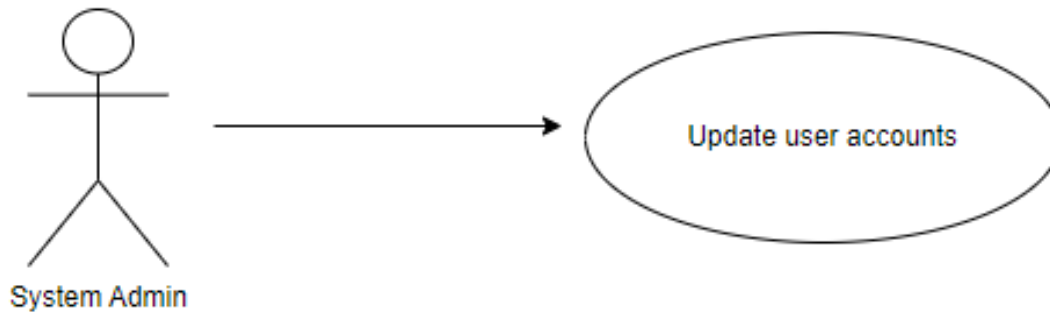I want to be able to view all user accounts so that I can retrieve the user account details list from the System.

System Admin

Name: View all user accounts	ID: 4
Stakeholders and goals: System Admin - wants to retrieve the user account details list	
Description: The System Administrator wants to view all user accounts to retrieve the user account details list in the system.	
Actors: System Admin	
Trigger: The system administrator clicks on the "User Accounts" button.	

Normal flow:
  1. System admin logs into the System.
  2. System will display the homepage that shows 2 buttons: "User Accounts" and "User Profiles".
  3. System admin clicks on the "User Accounts" button.
  4. System directs the user to another page where all the users are displayed in rows.
  5. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 5

As the System Admin,

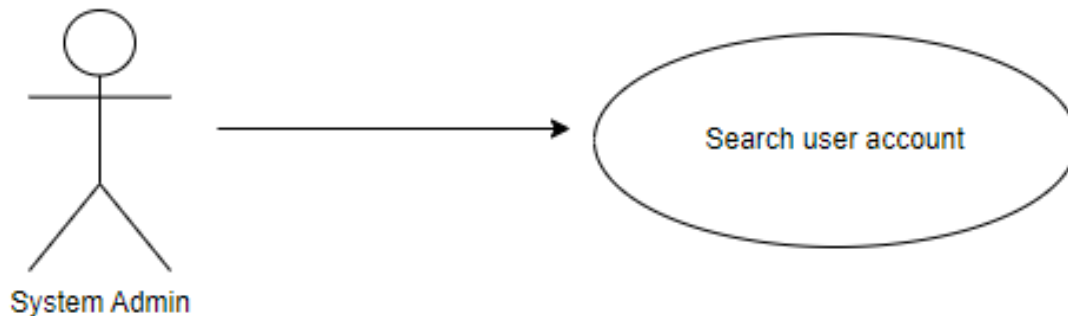I want to be able to update user accounts so that I can edit the account information of a user in the System.

System Admin   Update user accounts

Name: Update user accounts	ID: 5
Stakeholders and goals: System Admin - wants to update user accounts in the system	
Description: The System Administrator wants to update user accounts to edit the account information of a user in the system.	
Actors: System Admin	
Pre-Condition: User account must be created	
Trigger: The system administrator clicks on the "Edit Account" button.	
Normal flow: 1. System admin logs into the System. 2. System displays the homepage that shows 2 buttons: "User Accounts" and "User Profiles". 3. System admin clicks on the "User Accounts" button. 4. System directs the user to another page where all the users are displayed in rows. 5. System admin needs to select the user from the list. 6. System will display the details of the selected user. 7. System admin clicks on the "Edit Account" button and changes the necessary details. 8. System admin clicks on the "Save" button. 9. System will save the updated account details. 10. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 6
As the System Admin,
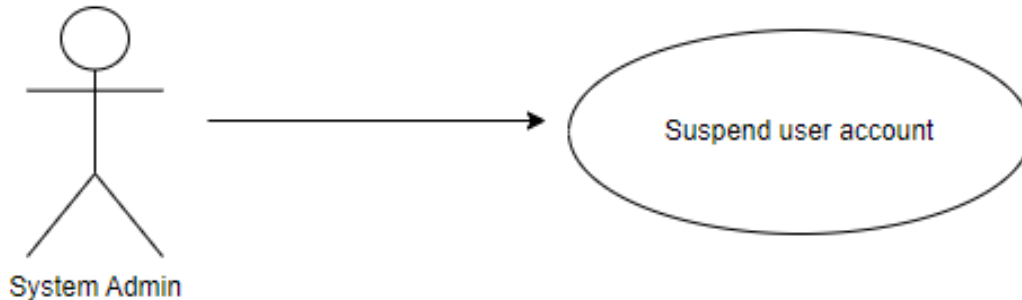I want to be able to search for specific user accounts so that I can retrieve the user account in the System.

System Admin

Name: Search for specific user accounts	ID: 6
Stakeholders and goals: System Admin - wants to search for specific user accounts.	
Description: The System Administrator wants to search for specific user accounts to retrieve the user account in the system.	
Actors: System Admin	
Trigger: The system administrator clicks on the "search bar"	
Normal flow: 1. System admin logs into the System. 2. System display homepage that shows 2 buttons: "User Accounts" and "User Profiles". 3. System admin clicks on the "User accounts" button. 4. System directs the user to another page where all the users are displayed in rows and a search bar. 5. System admin clicks on the search bar and enters the user account that they wish to search for and click the search button. 6. System search for the user account and displays the user accounts that match the searched name. 7. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 7

As the System Admin,

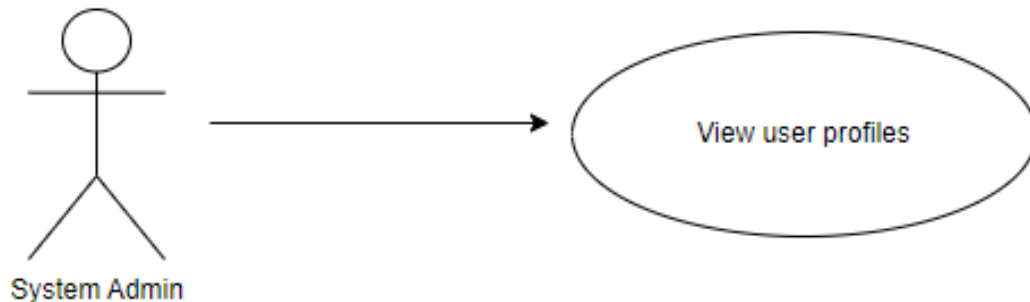I want to be able to suspend a user account so that I can delete the user account in the System.

System Admin

Name: Suspend a user account	ID: 7
Stakeholders and goals: System Admin - wants to suspend a user account.	
Description: The System Administrator wants to suspend a user account to delete the user account in the system.	
Actors: System Admin	
Trigger: The system administrator clicks on the "Delete" button	
Normal flow: 1. System admin logs into the System. 2. System display homepage that shows 2 buttons: "User Accounts" and "User Profiles". 3. System admin clicks on the "User Accounts" button. 4. System directs the user to another page where all the users are displayed in rows. 5. System admin clicks on the "Delete" button. 6. System confirms the account deletion with the system admin. 1. System admin clicks on the "Confirm" button. 2. System deletes the account. 3. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 8

As the System Admin,

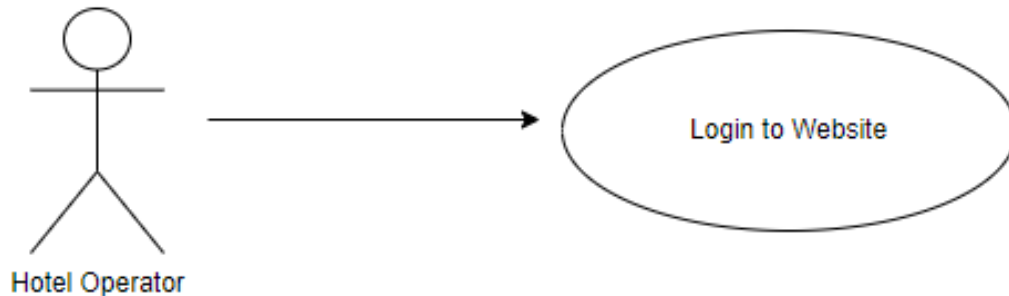I want to be able to view user profiles so that I can retrieve the data based on the user profile in the System.

System Admin

Name: View user profiles	ID: 8
Stakeholders and goals: System Admin - wants to view user profiles	
Description: The System Administrator wants to view user profiles to retrieve the data based on the user profile in the system.	
Actors: System Admin	
Trigger: The system administrator clicks on "User Profiles" button	
Normal flow: 　1.　System admin logs into the System. 　2.　System display homepage that shows 2 buttons: "User Accounts" and "User Profiles" 　3.　System admin clicks on the "User Profiles" button. 　4.　System directs the user to another page where all the users' profiles are displayed in rows. 　5.　End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 9

As the Hotel Operator,

I want to be able to login into the Website so that I can access the system.

Hotel Operator

Name: Login	ID: 9
Stakeholders and goals: Hotel Operator - wants to login to the website.	
Description: The Hotel Operator wants to log in to the website to access the system.	
Actors: Hotel Operator	
Trigger: The hotel operator enters the website URL.	
Normal flow: 1. Hotel Operator will enter the website URL. 2. System will display a login page. 3. Hotel Operator will enter the username and password on the website. 4. Hotel Operator clicks on the "Login" button. 5. System will validate the username and password combination. 6. System will navigate to the homepage. 7. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

<u>Use Case # 10</u>

As the Hotel Operator,

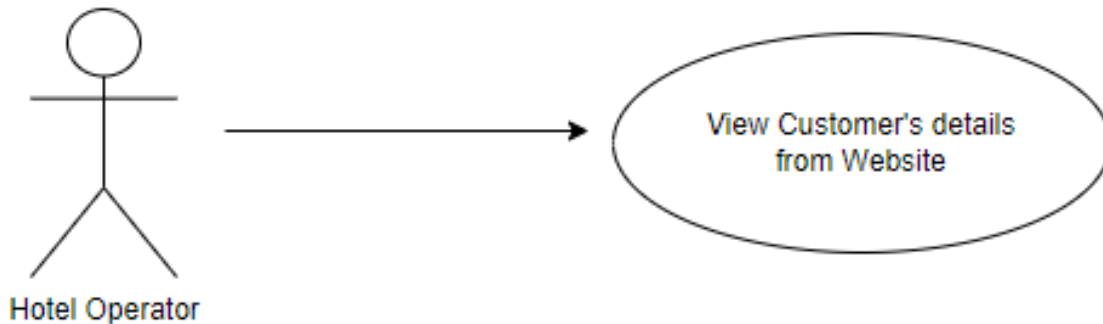I want to be able to logout from the Website so that I can exit the system.
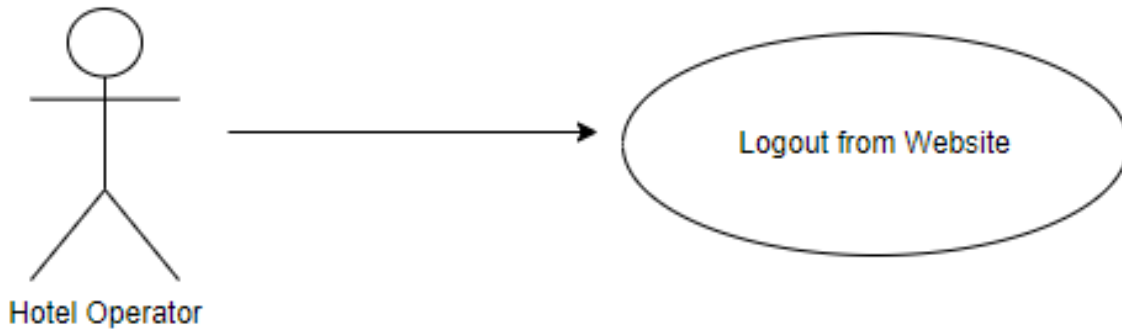
Hotel Operator

Name: Logout	ID: 10
Stakeholders and goals: Hotel Operator - logout from the website	
Description: The Hotel Operator wants to logout from the website to exit the system.	
Actors: Hotel Operator	
Trigger: The hotel operator clicks on "Log Out" button	

Normal flow:
    1. Hotel Operator clicks on the "Log Out" button
    2. System will direct them to the Login page
    3. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 11

As the Hotel Operator,

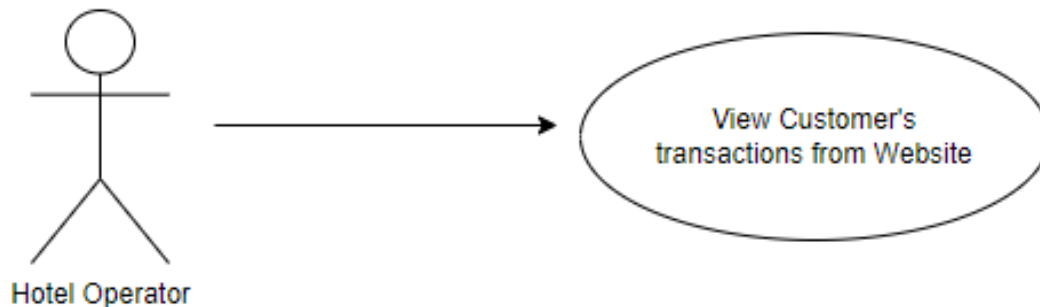I want to be able to view Customer's details from the Website so I know who my customers are.

Hotel Operator

Name: View Customer's Details	ID: 11
Stakeholders and goals: Hotel Operator - view customer's details from the website	
Description: The Hotel Operator wants to view customer's details from the website to know who their customers are.	
Actors: Hotel Operator	
Trigger: The hotel operator clicks on "Customer Accounts" button	

Normal flow:
  1. Hotel Operator logs into the System.
  2. System will display the homepage that shows the "Customer Accounts" button.
  3. Hotel Operator clicks on the "Customer Accounts" button.
  4. System directs the user to another page where all the customers are displayed in rows.
  5. Hotel Operator needs to select the customer's name from the list.
  6. System will display the details of the selected customer.
  7. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 12

As the Hotel Operator,

I want to be able to view Customer's transactions from the Website so that I know my customer's preferences.

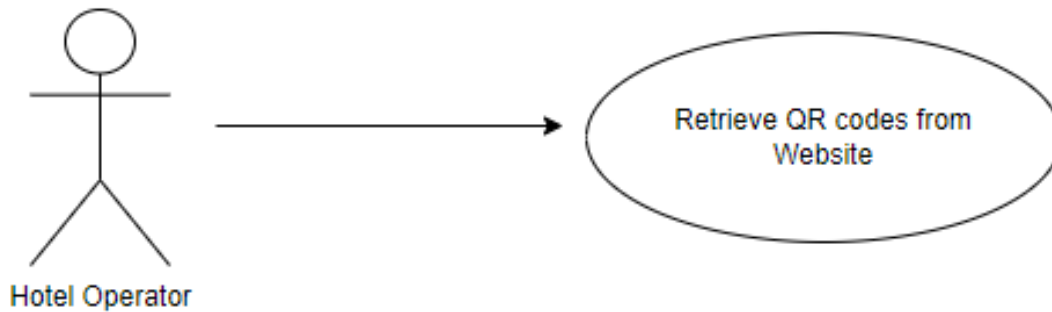Hotel Operator

Name: View Customer's transactions	ID: 12
Stakeholders and goals: Hotel Operator - view customer's transactions from the Website	
Description: The Hotel Operator wants to view Customer's transactions from the Website to know the customer's preferences.	
Actors: Hotel Operator	
Trigger: The hotel operator clicks on "Customer Accounts" button	
Normal flow: 1. Hotel Operator logs into the System. 2. System will display the homepage that shows the "Customer Accounts" button. 3. Hotel Operator clicks on the "Customer Accounts" button. 4. System directs the user to another page where all the customers are displayed in rows. 5. Hotel Operator needs to select the customer's name from the list. 6. System displays customer's detailed information and hotel transactions. 7. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 13

As the Hotel Operator,

I want to be able to retrieve the generated QR codes from the Website so that the customer can scan the QR code to enter the hotel room.

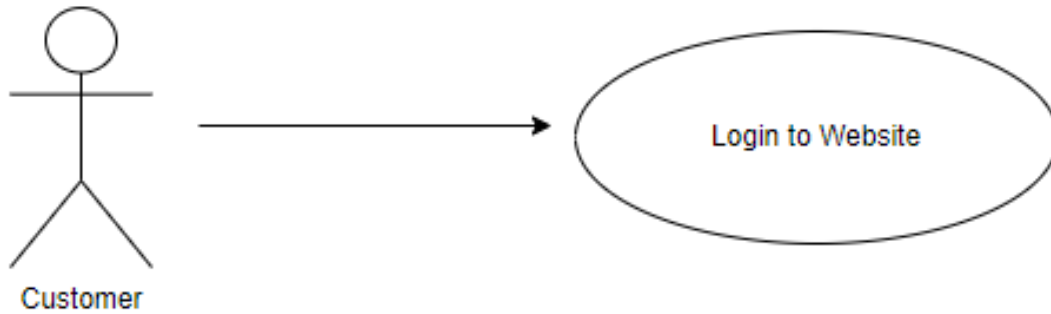Hotel Operator

Name: Retrieve generated QR codes	ID: 13
Stakeholders and goals: Hotel Operator - retrieve the generated QR codes.	
Description: The Hotel Operator wants to retrieve the generated QR codes from the website for the customer to scan the QR code and enter the hotel room.	
Actors: Hotel Operator	
Trigger: The hotel operator clicks on "QR Codes" button	
Normal flow: 1. Hotel Operator logs into the website. 2. System will display the homepage that shows the "QR Codes" button. 3. Hotel Operator clicks on the "QR Codes" button. 4. System directs the user to another page where the hotel room number QR Codes are listed. 5. Hotel Operator retrieves the generated QR codes for the rooms. 6. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 14

As the Customer,

I want to be able to login into the Website so that I can access the system.

Customer

Login to Website

Name: Login	ID: 14
Stakeholders and goals: Customer - wants to login to the website.	
Description: The Customer wants to log into the website to access the system.	
Actors: Customer	
Trigger: The Customer enters the website URL.	
Normal flow: 　1.　Customer will enter the website URL. 　2.　System will display a login page. 　3.　Customer will enter the username and password. 　4.　Customer clicks on the "Login" button. 　5.　System will validate the username and password combination. 　6.　System will navigate to the homepage. 　7.　End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 15

As the Customer,

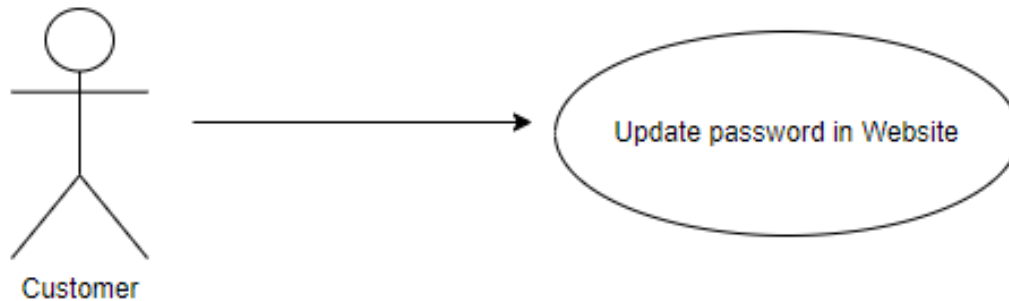I want to be able to logout from the Website so that I can exit the system.

Customer — Logout from Website
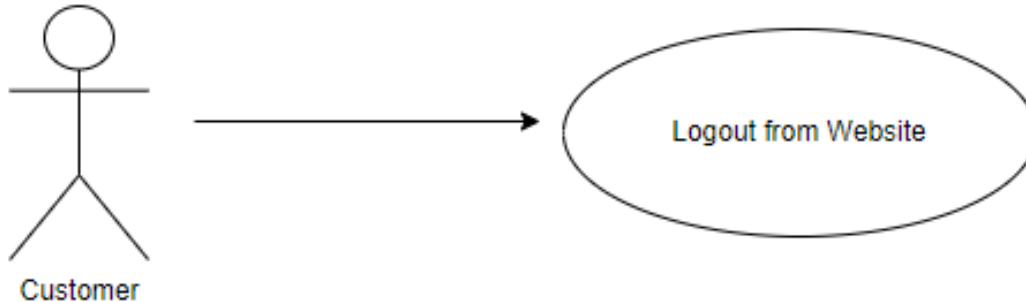
Name: Logout	ID: 15
Stakeholders and goals: Customer - wants to log out from the website.	
Description: The Customer wants to log out from the website.	
Actors: Customer	
Trigger: The Customer clicks on "Log Out" button	

Normal flow:
    1. Customer clicks on the "Log Out" button
    2. System will direct them to the Login page
    3. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 16

As the Customer,

I want to be able to update the password in the Website so that I can edit the password.

Customer

Name: Update a hotel booking	ID: 15
Stakeholders and goals: Customer - wants to update password from the Website.	
Description: The Customer wants to update the password from the Website to edit the password.	
Actors: Customer	
Trigger: The Customer clicks on "Change Password" button	
Normal flow: 1. Customer logs into the website. 2. System will display the login page. 3. Customer logs into the account. 4. System navigates the customer to the hotel website homepage. 5. Customer clicks on the "Profile" settings. 6. Customer clicks on "Change Password". 7. System direct to customer profile page. 8. Customer enters a new password. 9. System displays a message "Password has successfully changed." 10. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 17

As the Customer,

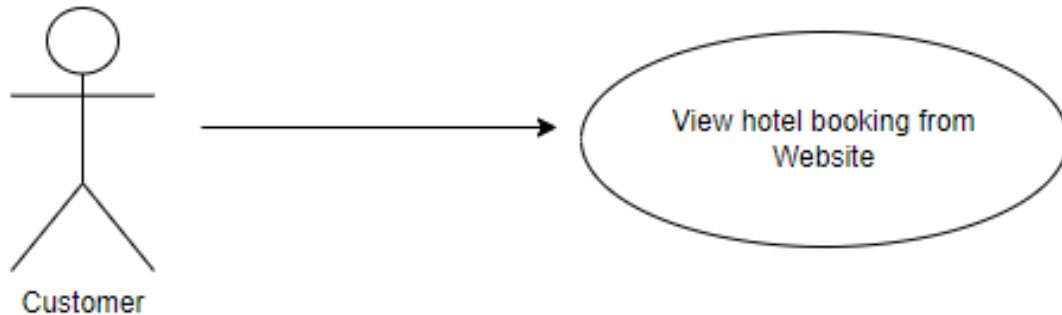I want to be able to create a hotel booking from the Website so that I can book a room to stay in.

Name: Create a hotel booking	ID: 17
Stakeholders and goals: Customer - wants to create a hotel booking from the Website.	
Description: The Customer wants to create a hotel booking from the hotel website to book a room to stay in.	
Actors: Customer	
Trigger: The Customer clicks on "create hotel booking" button	
Normal flow: 1. System will display the login page. 2. Customer log into their account on the website. 3. System directs the customer to the hotel website homepage. 4. Customer keys in the check-in & check-out details. 5. Customer clicks on the "create hotel booking" button. 6. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 18

As the Customer,

I want to be able to view my hotel booking(s) from the Website so that I can retrieve the hotel booking details.

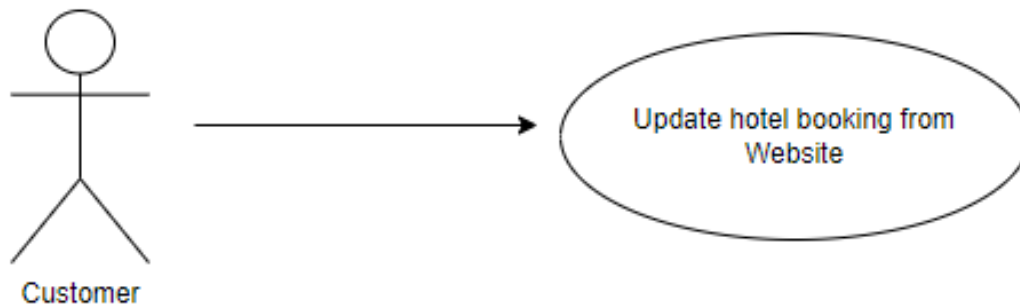| Name: View my hotel booking(s)	ID: 18
Stakeholders and goals: Customer - wants to view my hotel booking(s).	
Description: The Customer wants to view their hotel booking(s) from the Website to retrieve the hotel booking details.	
Actors: Customer	
Trigger: The Customer clicks on "My Bookings" button	
Normal flow: 1. System will display the login page. 2. Customer logs into the account. 3. System directs the customer to the homepage. 4. Customer clicks on the "My Bookings" button. 5. System directs the customer to the "My Bookings" page. 6. Customer will be able to view their hotel booking(s). 7. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 19

As the Customer,

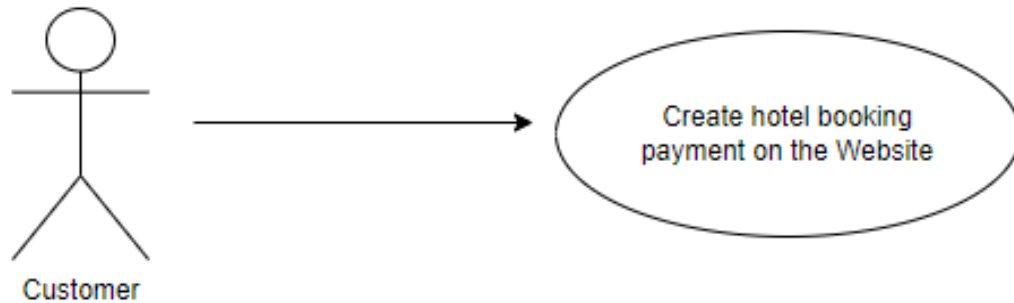I want to be able to update my hotel booking from the Website so that I can edit the hotel booking details.

Name: Update my hotel booking	ID: 19
Stakeholders and goals: Customer - wants to update hotel booking from the Website.	
Description: The Customer wants to update hotel booking from the Website so that I can edit the hotel booking details.	
Actors: Customer	
Trigger: The Customer clicks on "edit" button	
Normal flow: 1. System will display the login page. 2. Customer logs into the account. 3. System directs the customer to the homepage. 4. Customer clicks on the "My Bookings" button. 5. System directs the customer to the "My Bookings" page. 6. Customer click the "edit" button to edit the booking. 7. System displays "Successfully edited". 8. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 20

As the Customer,

I want to be able to create payment for hotel booking on the Website so that I can make payment for booking.

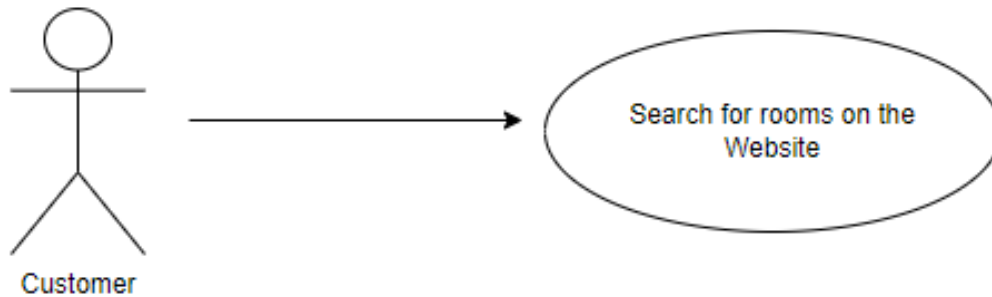| Name: Create hotel booking payment	ID: 20
Stakeholders and goals: Customer - wants to create payment for hotel booking.	
Description: The Customer wants to create payment for hotel booking to secure booking.	
Actors: Customer	
Trigger: The Customer clicks on "My Bookings" button	

Normal flow:
   1. System will display the login page.
   2. Customer logs into the account.
   3. System directs the customer to the homepage.
   4. Customer clicks on the "My Bookings" button.
   5. System directs the customer to the "My Bookings" page.
   6. Customer clicks on the "Payment" button to make payment for the booking.
   7. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

<u>Use Case # 21</u>

As the Customer,

I want to be able to search for rooms on the Website so that I can retrieve the hotel details to book.

Name: Search for rooms	ID: 21
Stakeholders and goals: Customer - wants to search rooms on the Website.	
Description: The Customer wants to search rooms from the Website to retrieve the hotel details to book.	
Actors: Customer	
Trigger: The Customer clicks on the search bar	

Normal flow:
   1. System will display the login page.
   2. Customer log into their account.
   3. System directs the customer to the homepage.
   4. Customer search for rooms in the search bar.
   5. End.	

Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Mobile App

Use Case # 22

As the Customer,

I want to be able to login into the Mobile App so that I can access the system.

Customer

Name: Login to the Mobile App	ID: 22
Stakeholders and goals: Customer - wants to login into the Mobile App.	
Description: The Customer wants to login into the Mobile App to access the system.	
Actors: Customer	
Trigger: The Customer opens the Mobile App.	
Normal flow: 1. Customer will open the Mobile App. 2. System will display a login page. 3. Customer will enter the username and password. 4. Customer clicks on the "Login" button. 5. System will validate the username and password combination. 6. System will navigate to the mobile app homepage. 7. End.	
Sub-flows: Login	
Alternative/Exceptional flows: NIL	

Use Case # 23

As the Customer,

I want to be able to logout from the Mobile App so that I can exit the system.
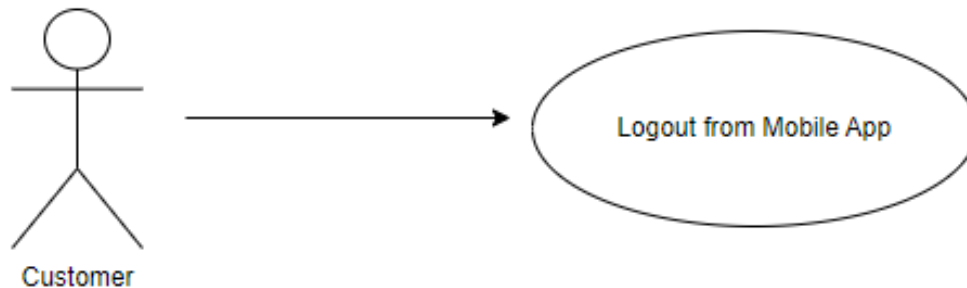
Name: Logout from the Mobile App	ID: 23
Stakeholders and goals: Customer - wants to log out from the Mobile App.	
Description: The Customer wants to logout from the Mobile App.	
Actors: Customer	
Trigger: The Customer clicks on "Logout" button	
Normal flow: 1. Customer clicks on "Log Out" button 2. System will direct them to the Login page 3. End.	
Sub-flows: Logout	
Alternative/Exceptional flows: NIL	

Use Case # 24

As the Customer,

I want to be able to use the QR code scanner from the Mobile App so I can scan the QR code to access the hotel room that I have booked / check-out (sub flow).

Customer

Name: Use QR code scanner from the Mobile App	ID: 24
Stakeholders and goals: Customer - wants to use QR code scanner through the Mobile App.	
Description: The Customer wants to use the QR code scanner through the Mobile App to access the hotel room or check-out.	
Actors: Customer	
Trigger: The Customer clicks on "Scan QR code" button	

Normal flow:
  1. System will display the login page.
  2. Customer logs into the account.
  3. System directs the customer to the mobile app homepage.
  4. Customer clicks on the "Scan QR code" button.
  5. System directs the customer to the QR code scanner.
  6. Customer scans the QR code.
  7. System displays two buttons: "Open the hotel room" and "Check-out".
  8. Customer clicks on one of the buttons.
  9. End.	

Sub-flows: 8a. If the Customer clicks the "Open the hotel room" button, the System displays "The door is opened successfully". 8b. If the Customer clicks the "Check-out" button, the System displays "Successfully Check-out".	
Alternative/Exceptional flows: NIL	

6. Non-Functional Requirements

This section contains the non-functional requirement for our platform, such as

6.1. Usability

The platform, both on the website and mobile application, should be user-friendly and easy to use and navigate. This will be achieved using a simple and intuitive user interface with clear and concise navigation, making it accessible and straightforward to use. The use of a consistent design with similar layouts, fonts, and colours is to reduce confusion and improve the user experience.

6.2. Scalability

The platform should be able to handle a huge number of users - both our customers, hotel operators and an increasing number of bookings. The platform's database will be designed with this in mind.

6.3. Compatibility

The platform should be compatible with multiple devices and browsers. Currently, the team is only planning on making the mobile application available on android devices. The system should be optimised for mobile devices, with a responsive design that adapts to different screen sizes and orientations. Our website should be compatible with multiple web browsers, such as Google Chrome, Mozilla Firefox, and Microsoft Edge to ensure a consistent user experience for all customers.

6.4. Availability

The platform should be available 24/7 and have a high uptime to ensure the customer experience is never compromised due to downtime caused by our servers. To ensure this, the team will choose the most reputable and reliable database servers and web hosting platforms.

6.5. Security

Since our platform requires customers to log in with sensitive information such as passwords to access the platform, our system should protect sensitive customer information and secure payments. Sensitive customer information and payments will be encrypted to prevent unauthorised access.

The QR code generation process should also be encrypted using secure algorithms. The sensitive data encoded in the QR code such as the customer's passwords and payment information, will also be encrypted to prevent unauthorised access to sensitive information

7. Other Requirements

This section contains the other requirements for our platform which does not fit in the previous sections of the document

7.1. System Features

The front-end system would consist of the website and the mobile application. This will also work hand-in-hand with our back-end database system. The majority of the services will be done on the website itself however the customer has to use the mobile application to authenticate themselves to unlock the hotel room door and check-out of the hotel. Hence, our mobile application and the website need to work together for the customer to carry out the authorisation of QR codes.

7.2. Security Requirements

As for the security perspective, each customer of the hotel will only be able to make one booking at a time. This prevents the customer from making many dummy bookings and helps the hotel to prepare and adhere to the customers' necessary requirements. By preventing customers from booking more than once at one time, it would also help the hotel to prevent business loss from happening due to the customer's absence and accommodate more customers.

Before confirming the booking, we would request the customer to pay their full accommodation fees to confirm their booking and reserve the room. Through this, we can prevent customers from not showing up for their reservation, as the customer has paid the full amount ahead of time.

7.3. Regulations

7.3.1. Personal Data Protection Act (PDPA)

The Personal Data Protection Act (PDPA) in Singapore helps to ensure that an individual's personal data is collected, used and disclosed in a way that respects their privacy rights. By appointing a Data Protection Officer (DPO) and implementing reasonable security arrangements, organisations can demonstrate their commitment to complying with the PDPA and protecting each individual personal data.

It is important to note that the PDPA applies to personal data stored in both electronic and non-electronic formats, which provides a comprehensive framework for protecting personal data in Singapore.

The exclusion of certain categories of data such as business contact information and information collected by public agencies is designed to balance the need to protect personal data with the need for organisations to collect and use data for legitimate purposes.

By following the PDPA guidelines, organisations can help to build trust with their customers and clients by demonstrating their commitment to responsible data management practices.

7.3.2. Cybersecurity Act

The Singapore Cybersecurity Act plays a critical role in protecting sensitive information and ensuring the overall security of the digital space in Singapore.

By regulating the owners of critical information infrastructure and cybersecurity service providers, the Cybersecurity Act helps to create a secure and trustworthy digital environment for businesses and individuals to operate in.

Moreover, the Cybersecurity Act requirements for certain cybersecurity incidents and data breaches help to keep authorities informed and enable them to respond quickly to potential threats. The practices and performance standards imposed by the act help to ensure that businesses and organisations are following the best practices for cybersecurity.

In the current digital age where exchange of information and data is becoming increasingly common, it is very important to prioritise cybersecurity and ensure the protection of sensitive information.

By implementing measures such as the Cybersecurity Act, we can help to build a safe and secure digital landscape for all.

8. Marketing Research

8.1. What is QR Code?

QR Codes are two-dimensional barcodes that may accommodate more data than traditional barcodes because information is stored in both the horizontal and vertical axes of the code. The additional data is what gives QR Codes their wide range of applications. A smart device's camera, which is readily available, can be used to scan QR Codes. Most frequently, online links or arbitrary data like text or images are stored in QR Codes. The data can still be retrieved even if up to 30% of the QR Code is damaged or difficult to see.

8.2. Security Issues Regarding QR Code

https://www.jotform.com/blog/qr-code-security/

The security issues associated with QR Codes come from their destination rather than the codes themselves because QR Codes cannot be hacked. Hackers can replace valid QR Codes with malicious ones or manipulate the system so the customer is directed to a phishing website rather than the real one. Additionally, a lot of individuals are unable to identify between a safe QR Code and one that is malicious, which raises a lot of security issues.

8.3.   How are we going to tackle this issue?

To tackle this issue, our team will split into two groups where the red group will be doing weekly penetration testing and spoof testing while the blue group will be doing weekly patches with tools and processes. The red group will inform the blue group of the loopholes that they have found in the system. This is a pseudo activity for the project.

The red group will act as the hacker to do penetration testing into the system, they will write down the problems that they have seen and the blue group will be the defenders/troubleshooters. They will defend the system and see how the system security can be improved.

After testing, the team will gather together to revise and rectify the system according to the weaknesses that the groups spotted to assure the customers that our system is safe to use.

8.4.   Design Research
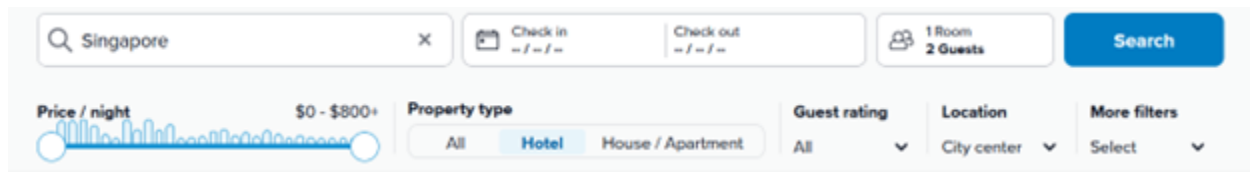
Our team did online research on some common and popular hotel booking websites and found out some of the important attributes when a customer is reserving the hotel. The attribute such as date for check in and check out, type of room, price per night and guest rating can be considered to implement into the website.
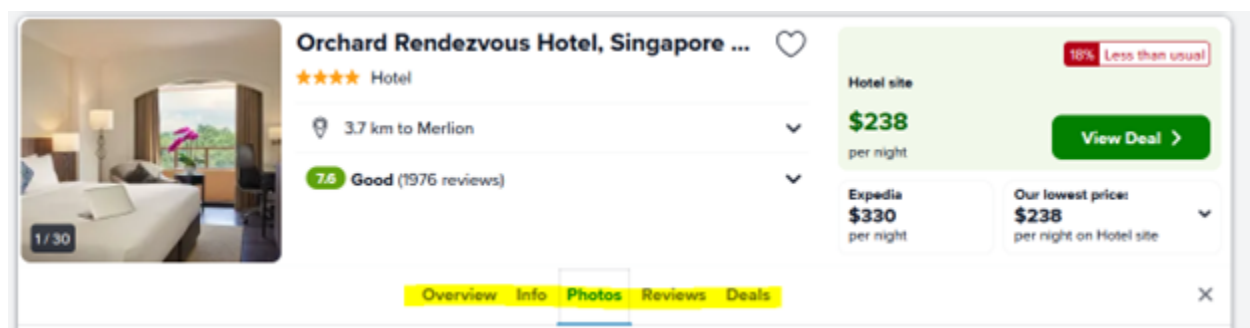
Some other features such as overview, information of the hotel room, photo, reviews, and hotel room deals are also important factors when customers select their hotel which are also a good consideration to implement into the website. Overview provides an overall description such as the location, price tending, amenities & facilities. Information provides the detailed location of the hotel. The photo provides images of the hotel room, facilities, and dining room. Reviews provide the rating overview and reviews of the guests that have stayed in that hotel.

The idea of QR code to unlock the hotel room and checking out of the hotel that my team came out with is due to Covid-19. Covid-19 is an ongoing global pandemic that has affected all the country since 2020. This virus has resulted in a lot of death cases in all the country. This virus is transmitted through the air and the risk of breathing it is high when the people are in proximity. To reduce the risk of getting Covid-19, people must reduce their point of contact in the public and follow strict community health protocols and practices.

By using QR code to unlock the door, customers can avoid touching the hotel room key. Using the QR Code also provides more security. This accelerates the check-in process for the customer, making it a seamless hassle-free experience. Checking out of the hotel with a QR code allows the customer to avoid interaction with the hotel front desk which reduces the risk of getting Covid-19.

8.5. Similar Multi-factor transaction authorisation done in other platforms

Other than using QR code, many other platforms use passwords, cards, retina scans, voice recognition and fingerprints to authorise the identity of the user for transactions to happen. Not only passwords will be used, but like some cases where the transaction is part of another transaction then authorisation would not be necessary as the computer or user would have been identified earlier.

8.5.1 OAuth2

OAuth2 is an industry-standard authorisation protocol. It offers specific authorisation flows for web applications, desktop applications, mobile phones and living room devices. The flow is considered high-level flow if it is done between user, application and identity server.

An example of high-level flow is shown below:

1) User requests access to the application
2) User authenticates with the Identity Server
3) Identity Server issues identity proof to Application
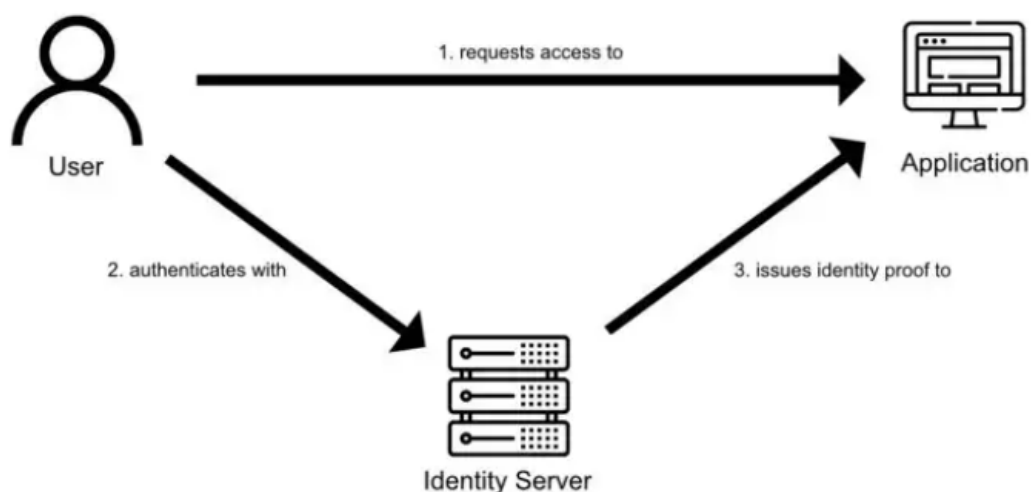
To briefly explain this flow:

1) User is redirected to the Identity Server where both authentication and authorisation are handled
2) Client (that is the application that requests the user information) gets authorisation by the user to get the necessary information. That is done by configuring the right scopes. Scopes resemble the type of data that a specific client has access to.
3) Scopes are requested by application during the authentication process.
4) Once the authentication is completed, the application might be able to give authorisation for the requested data.
5) When given authorisation, the data will be added to the payload of the token and passed to the application.
6) As there is a possibility that a user can have multiple roles, an identity server is set up for all of the clients or users of the application. Each user would be assigned to different roles depending their rights level
7) The identity server could share the assigned roles to a specific user in token

8.6. Research on places where application-specific authorisation logic should be built in

As the authentication is built in a separate centralised responsible service, it becomes harder for application-specific authorisation logic. In a small architecture, the authorisation and authentication services should not be exposed directly to the consuming application, if not managing the connections will not be manageable.

Through implementing an API gateway, it helps to create a single point for consumers to communicate with. The API gateway routes the requests to the upstream microservices. If multiple consumers use the application or software at one time, then creating specific API gateways could be a solution to create separate specific endpoints for each consumer. Hence this variation is called the Backens for Frontends pattern by which endpoints are specifically created and used for each and every customer. The only minus of this variation is that it adds another separate service per customer that needs to be maintained.

Another way to manage the authorisation in microservices is by API gateway should pass the JWT along with the request towards the microservice. This can be done for extensive application-specific authorisation checks. The JWT would contain roles assigned to users or customers. API gateway would be handling the authentication still and the validation of token will be done when the microservice receives the request. By searching through the JWT for the role, the microservice can now check whether the user is authorised for the wanted request. Through this way, the application-specific only request can only be implemented in one place. The downfall of this service is that when roles change frequently, there is more workload.

9. Work Breakdown Structure
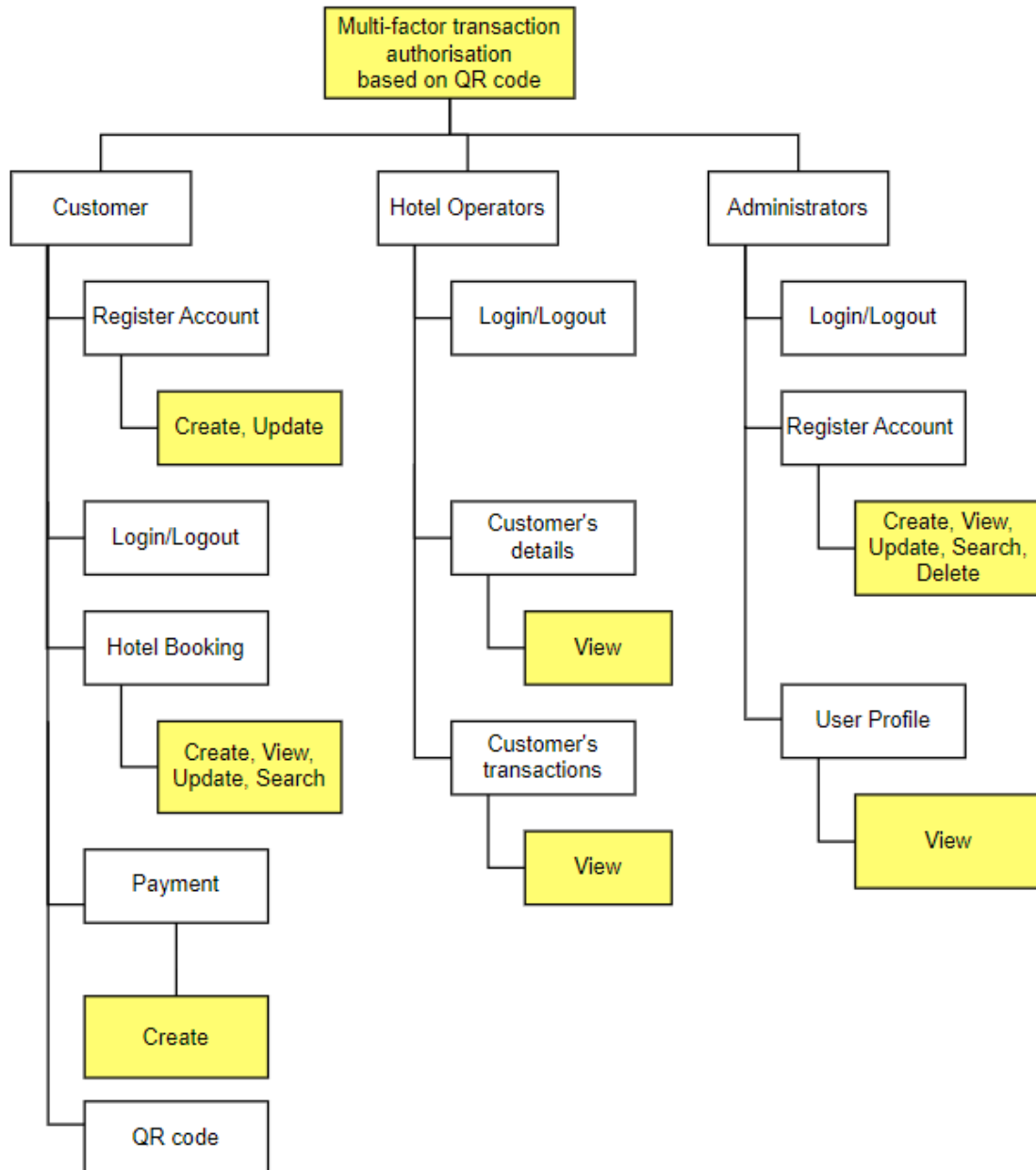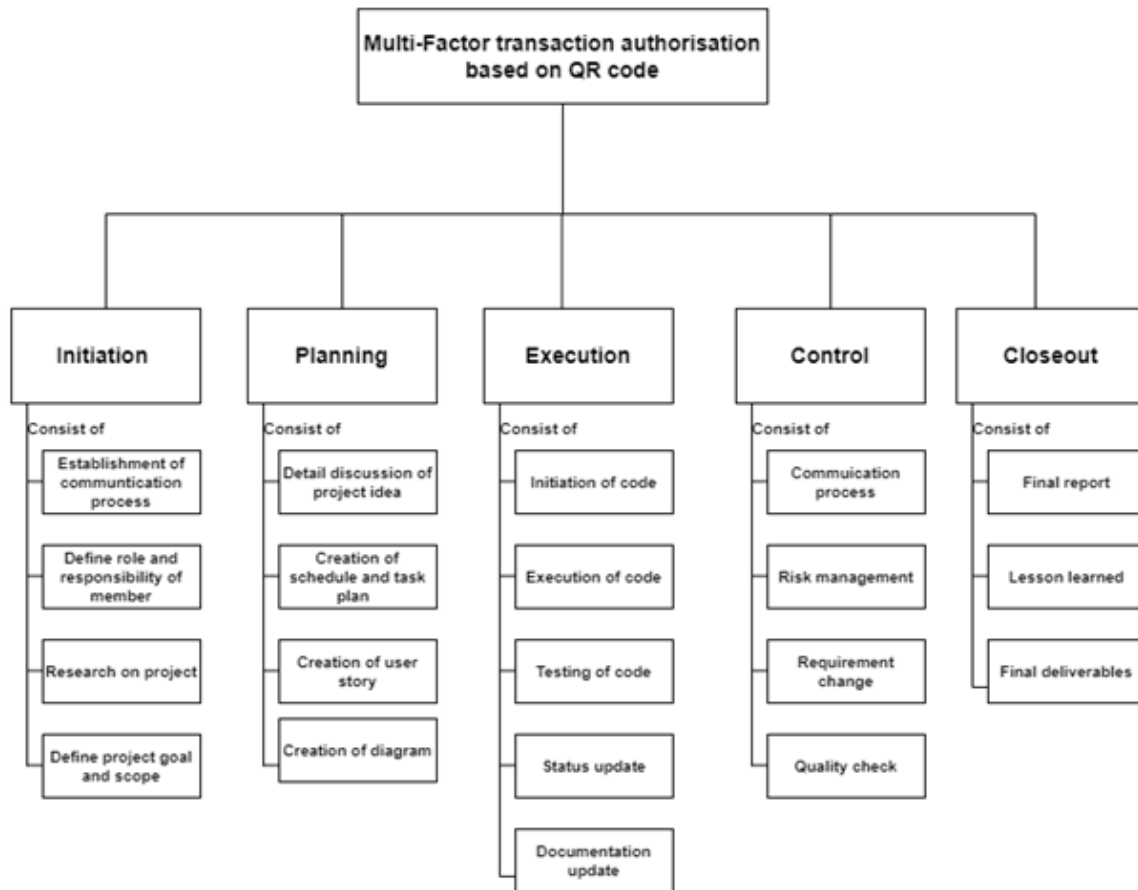
In the Initiation Phase, our team will be establishing a chain of communication with our teammate and project supervisor. Each team member will be given a role and responsibility based on the project. Our team will conduct a detailed research on the project and come out with the project requirement that inline with the project scope. Our team will define the project goal and list of requirements for our project.

In the Planning Phase, project ideas will be generated, and detailed team discussion is done to assess the feasibility of the project idea. The task schedule and plan will be going forward once the approval of the project idea is being done by our team. Detailed outline of user stories and diagrams help to provide more aid and visualise to our team when writing a program for our project.

 In the Execution Phase, program codes are initialised in this stage. The code will be executed, and testing of code will be done to ensure each requirement is working. To ensure our schedules are on the same track, a weekly status update is done. Weekly update of the documentation on the progress is done to ensure the workload is lesser for the final report.

In the Control Phase, our team may encounter some miscommunication with each other as the project progresses. To reduce the risk of miscommunication, our team will have an informal short update of what they are doing every two days within ourselves. Some of the project requirements may require a longer period. Thus, it may result in other requirements not being able to finish on time.

To reduce the risk of failing the project requirements, our team will work on the program code together rather than doing it individually. After the prototype demonstration, our team will anticipate a change request. By knowing that there will be an upcoming change request, our team will be able to anticipate some of the problems that are bound to happen along the way and create solutions that might help to resolve the issue.

Our team will also conduct a quality check to fulfil our basic requirements and functionalities.

Finally for the Closure Phase, our team will write the final report, lessons learned and give a final presentation on our final product.

10. Gantt Chart

We have split the Gantt Chart into four parts.

1) Research and Discovery

WBS NUMBER	TASK TITLE	START DATE	DUE DATE	January																						February																
				12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	**Research and Discovery**																																								
1.1.1	Group Meeting	12/1/2023	12/1/2023	█																																					
1.1.2	Research related to the project	13/1/2023	15/1/2023		█	█	█																																		
1.1.3	Group Meeting with Supervisor	16/1/2023	16/1/2023					█																																		
1.1.4	Research on different types of similar usages	17/1/2023	19/1/2023						█	█	█																															
1.1.5	Functional Requirements	20/1/2023	21/1/2023									█	█																													
1.1.6	Non-functional Requirements	22/1/2023	23/1/2023											█	█																											
1.1.7	Other Requirements	24/1/2023	25/1/2023													█	█																									
1.1.8	Market Research	26/1/2023	27/1/2023															█	█																							
1.1.9	Introduction and Overview	28/1/2023	29/1/2023																	█	█																					
1.2	Workbreakdown Structure and Gantt Chart	30/1/2023	31/1/2023																			█	█																			
1.2.1	Project Requirement Documentation Report	1/2/2023	2/2/2023																					█	█																	
1.2.2	Group Meeting to review member's research	2/2/2023	2/2/2023																						█																	
1.2.3	Use Case Diagrams	2/2/2023	4/2/2023																						█	█	█															
1.2.4	Research on the different softwares	5/2/2023	7/2/2023																									█	█	█												
1.2.5	Project Requirement Documentation Report	8/2/2023	10/2/2023																												█	█	█									

2) Design and Development Phase of Web Page Development

WBS NUMBER	TASK TITLE	START DATE	DUE DATE	February																			March																
				10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2	**Design and Development Phase: Web Page Development**																																							
2.1	Wireframe Diagrams	10/2/2023	13/2/2023	■	■	■	■																																	
2.2	Web Page Structure	13/2/2023	20/2/2023				■	■	■	■	■	■	■	■																									
2.3	Login Page and Creation of Account	21/2/2023	25/2/2023												■	■	■	■	■																				
2.4	Insert Information and Pictures	25/2/2023	28/2/2023																■	■	■	■																	
2.5	Create "Hotel Selection" Page	1/3/2023	5/3/2023																				■	■	■	■	■												
2.6	Reservation Page	6/3/2023	10/3/2023																									■	■	■	■	■							
2.7	Payment Page	11/3/2023	15/3/2023																														■	■	■	■	■			
2.8	Testing	16/3/2023	16/3/2023																																			■		
2.9	Review	17/3/2023	17/3/2023																																				■	

3) Design and Development Phase of Database Development

WBS NUMBER	TASK TITLE	START DATE	DUE DATE	March																April																
				16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3	**Design and Development Phase: Database Development**																																	
3.1	Write SQL Queries	18/3/2023	22/3/2023			■	■	■	■	■																									
3.2	Populate Database	23/3/2023	27/3/2023								■	■	■	■	■																				
3.2.1	Testing	28/3/2023	30/3/2023													■	■	■																	
3.2.2	Review	31/3/2023	2/4/2023																■	■	■														
3.3	Prototype Demostration	3/4/2023	7/4/2023																			■	■	■	■	■									

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4) Design and Development Phase of Mobile Application Development

WBS NUMBER	TASK TITLE	START DATE	DUE DATE
4.1	Login Page and Creation of Account	8/4/2023	12/4/2023
4.2	Create "My Booking" Page	13/4/2023	21/4/2023
4.3	Create "QR Code" Scanner	22/4/2023	27/4/2023
4.4	Testing	28/4/2023	3/5/2023
4.5	Review	4/5/2023	8/5/2023
4.6	Report	9/5/2023	12/5/2023
4.7	Prototype Demostration	13/5/2023	19/5/2023

Timeline columns — April: 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30; May: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 26 27 28 29 30