NANYANG
TECHNOLOGICAL
UNIVERSITY

CZ2006: Software Engineering

Project Title: SickGoWhere

Submission Date:

11 April 2021

Lab Group:

BCG2, Team 1

Names of group members:

Name:	Matriculation Number:
Ernest Ang Cheng Han (L)	U1921210H
Goh Tse Yinn, Sheryl (D)	U1922180C
Ernest Tan Yan Heng	U1920436K
David Tay Ang Peng	U1910603L
Heng Jiu Xiao	U1922496D
Kim HeonJung	U1920224C

1 Product Overview

1.1 Purpose

With an increasingly volatile health climate because of COVID-19, we wanted to create a simple and intuitive app which could enhance the accessibility of clinics throughout Singapore.

Our application mainly serves two purposes. They are as follows:

(1) To provide users with information (including travelling times, directions) to the nearest 5 clinics based on the geolocation of an individual.

(2) To allow users to create and manage (View, Edit, Delete) appointments at the clinic of their choice.

1.2 Target Audience

Our application targets anyone who wants to visit a doctor, and do not have a regular family doctor. In Singapore, more than 50% of people do not have a regular family doctor that they visit whenever they require a consultation. This application is designed to allow for greater accessibility to healthcare for everyone in Singapore.

1.3 Initial UI Mockup

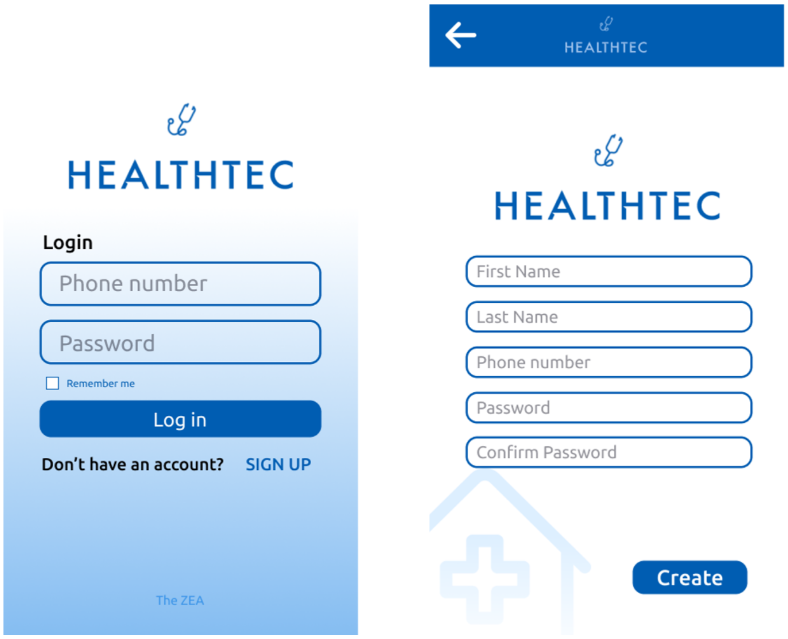


Figure 1. Log in & Sign Up page

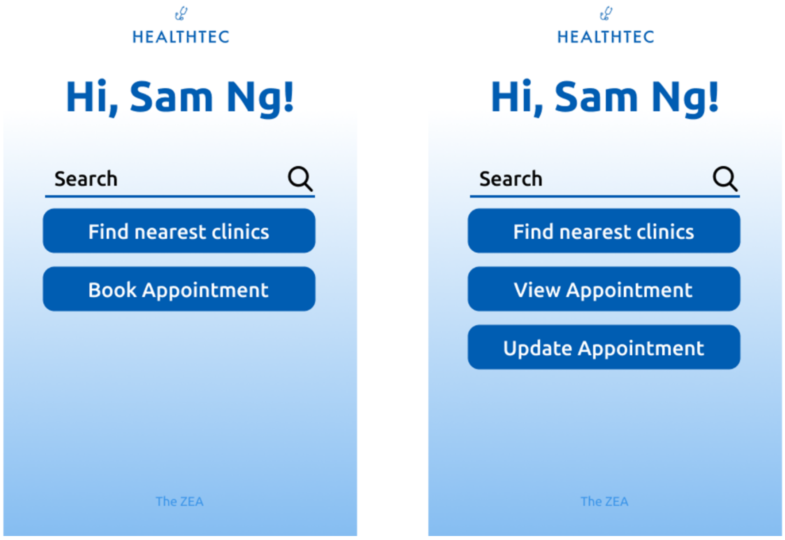
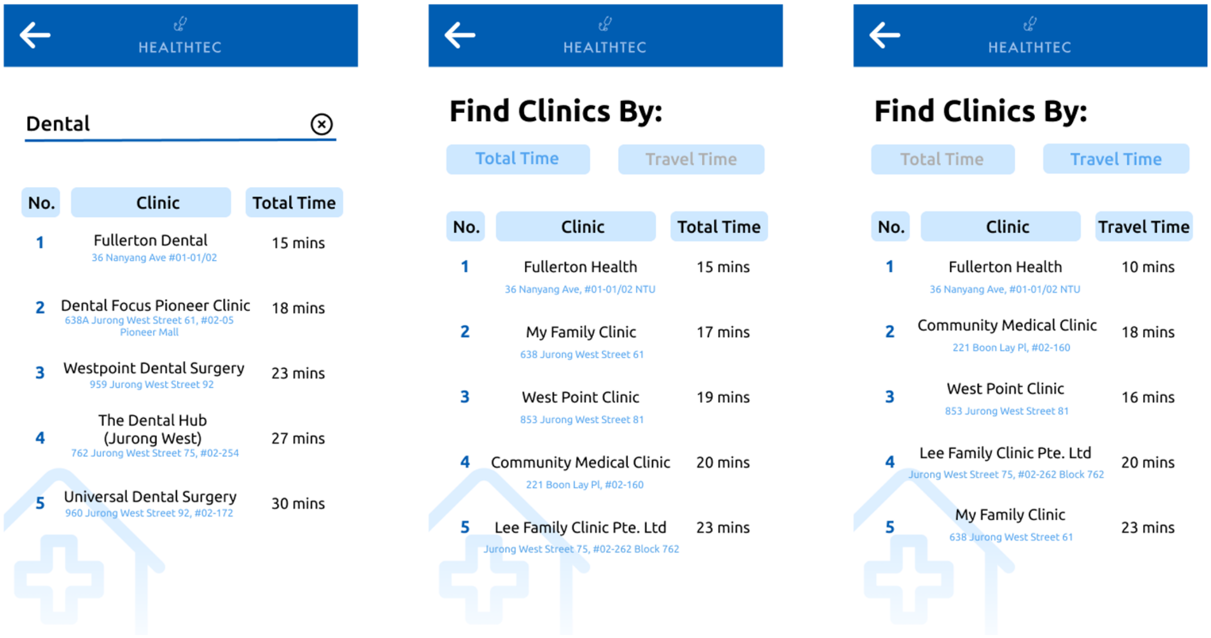


Figure 2. Main Page -   i) If the user doesn't have any appointment ii) If the user has an appointment booked before

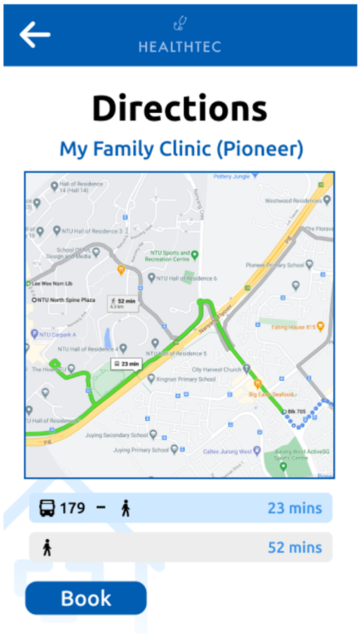


No.	Clinic	Total Time
1	Fullerton Dental 36 Nanyang Ave #01-01/02	15 mins
2	Dental Focus Pioneer Clinic 638A Jurong West Street 61, #02-05 Pioneer Mall	18 mins
3	Westpoint Dental Surgery 959 Jurong West Street 92	23 mins
4	The Dental Hub (Jurong West) 762 Jurong West Street 75, #02-254	27 mins
5	Universal Dental Surgery 960 Jurong West Street 92, #02-172	30 mins

No.	Clinic	Total Time
1	Fullerton Health 36 Nanyang Ave, #01-01/02 NTU	15 mins
2	My Family Clinic 638 Jurong West Street 61	17 mins
3	West Point Clinic 853 Jurong West Street 81	19 mins
4	Community Medical Clinic 221 Boon Lay Pl, #02-160	20 mins
5	Lee Family Clinic Pte. Ltd Jurong West Street 75, #02-262 Block 762	23 mins

No.	Clinic	Travel Time
1	Fullerton Health 36 Nanyang Ave, #01-01/02 NTU	10 mins
2	Community Medical Clinic 221 Boon Lay Pl, #02-160	18 mins
3	West Point Clinic 853 Jurong West Street 81	16 mins
4	Lee Family Clinic Pte. Ltd Jurong West Street 75, #02-262 Block 762	20 mins
5	My Family Clinic 638 Jurong West Street 61	23 mins

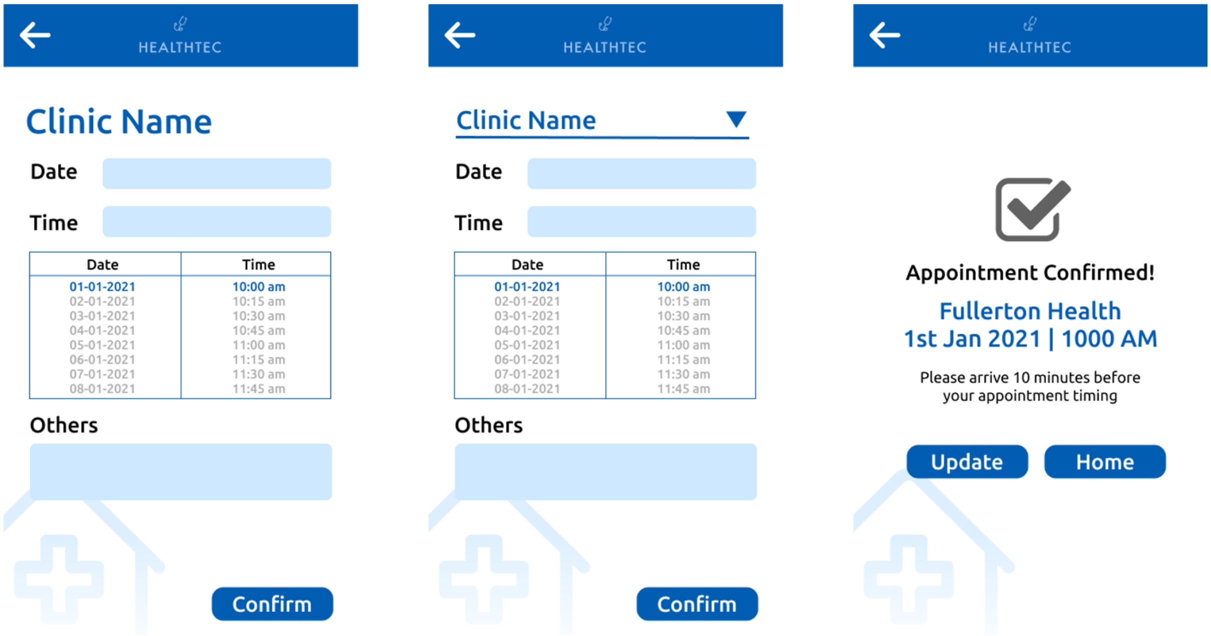
Figure 3. Search by Clinic's name, Find nearest clinics by travelling time & travel time page



Directions

My Family Clinic (Pioneer)

Figure 4. Direction page



Clinic Name

Date

Time

Date	Time
01-01-2021	10:00 am
02-01-2021	10:15 am
03-01-2021	10:30 am
04-01-2021	10:45 am
05-01-2021	11:00 am
06-01-2021	11:15 am
07-01-2021	11:30 am
08-01-2021	11:45 am

Others

Clinic Name ▼

Date

Time

Date	Time
01-01-2021	10:00 am
02-01-2021	10:15 am
03-01-2021	10:30 am
04-01-2021	10:45 am
05-01-2021	11:00 am
06-01-2021	11:15 am
07-01-2021	11:30 am
08-01-2021	11:45 am

Others

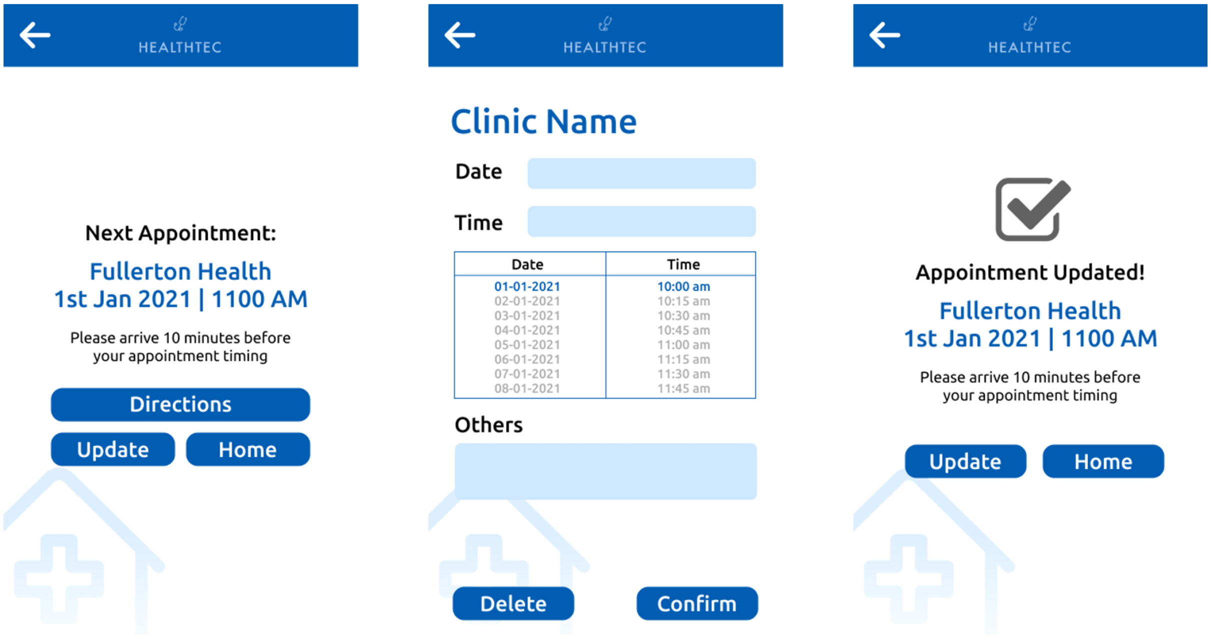
☑

Appointment Confirmed!

Fullerton Health
1st Jan 2021 | 1000 AM

Please arrive 10 minutes before
your appointment timing

Figure 5. Create an appointment, Appointment Confirmation page



Next Appointment:

Fullerton Health
1st Jan 2021 | 1100 AM

Please arrive 10 minutes before your appointment timing

Clinic Name

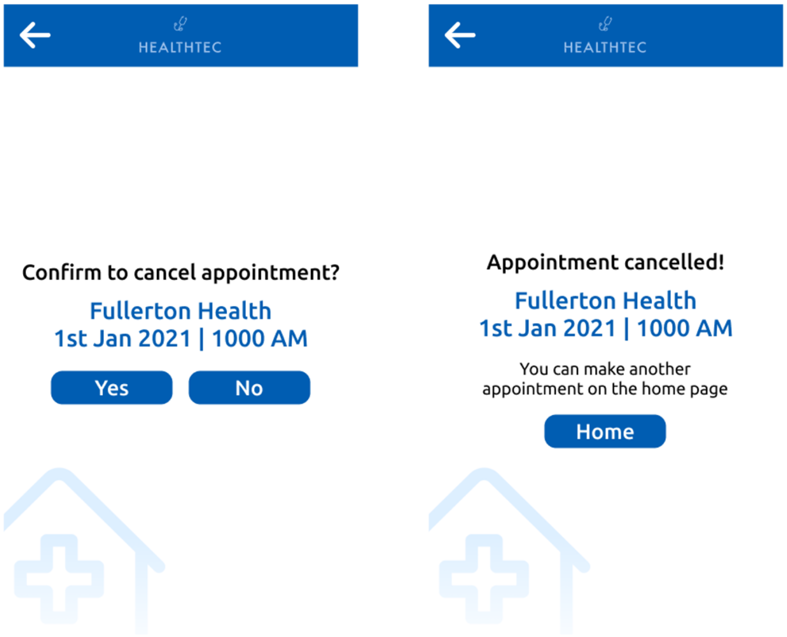
Date	Time
01-01-2021	10:00 am
02-01-2021	10:15 am
03-01-2021	10:30 am
04-01-2021	10:45 am
05-01-2021	11:00 am
06-01-2021	11:15 am
07-01-2021	11:30 am
08-01-2021	11:45 am

Appointment Updated!

Fullerton Health
1st Jan 2021 | 1100 AM

Please arrive 10 minutes before your appointment timing

Figure 6. View Appointment & Update Appointment & Update Confirmation page



Confirm to cancel appointment?

Fullerton Health
1st Jan 2021 | 1000 AM

Appointment cancelled!

Fullerton Health
1st Jan 2021 | 1000 AM

You can make another appointment on the home page

Figure 7. Delete Appointment & Delete Appointment Confirmation page

2 Functional Requirements

1. User registration
    - 1.1 User must be able to input information for account registration
        - 1.1.1 User must be able to enter name
        - 1.1.2 User must be able to enter email
        - 1.1.3 User must be able to enter password
        - 1.1.4 User must be able to enter password confirmation
    - 1.2 System must verify whether email already exists in system
    - 1.3 System must check for password validity
        - 1.3.1 System must check that password and password confirmation is identical
        - 1.3.2 System must check that password is at least 8 characters long
        - 1.3.3 System must check that password is at most 15 characters Long
    - 1.4 System must be able to encrypt password
    - 1.5 System must store registered information
    - 1.6 System must inform the user that the registration is successful
    - 1.7 System must inform the user that the registration is unsuccessful
    - 1.8 System must be able to ensure all field are entered

2. User Login
    - 2.1 User must be able to input information for logging in into system
        - 2.1.1 User must be able to enter email
        - 2.1.2 User must be able to enter password
    - 2.2 System must verify user input login credentials
        - 2.2.1 System must check that email exists in system
        - 2.2.2 System must retrieve the password tagged to the email from system
        - 2.2.3 System must be able to compare input credentials with retrieved email and password
    - 2.3 System must inform user on whether login is successful
        - 2.3.1 System must be able to inform the user that the login is successful if input credentials match with system
        - 2.3.2 System must inform the user that login has failed if input credentials does not match with system

3. Search for clinic by name
    - 3.1 User must be able to enter clinic name in the search bar on the main page
    - 3.2 System must be able to retrieve list of clinics from Google Maps API
    - 3.3 System must be able to display list of clinics that matches the search criteria
    - 3.4 System must be able to show the travelling time for each clinic on the list
        - 3.4.1 System must be able to retrieve the user’s current location using the Geolocation API
        - 3.4.2 System must be able to retrieve the shortest travelling time required To travel from user’s location to clinics using Google Maps API

4. Appointment System

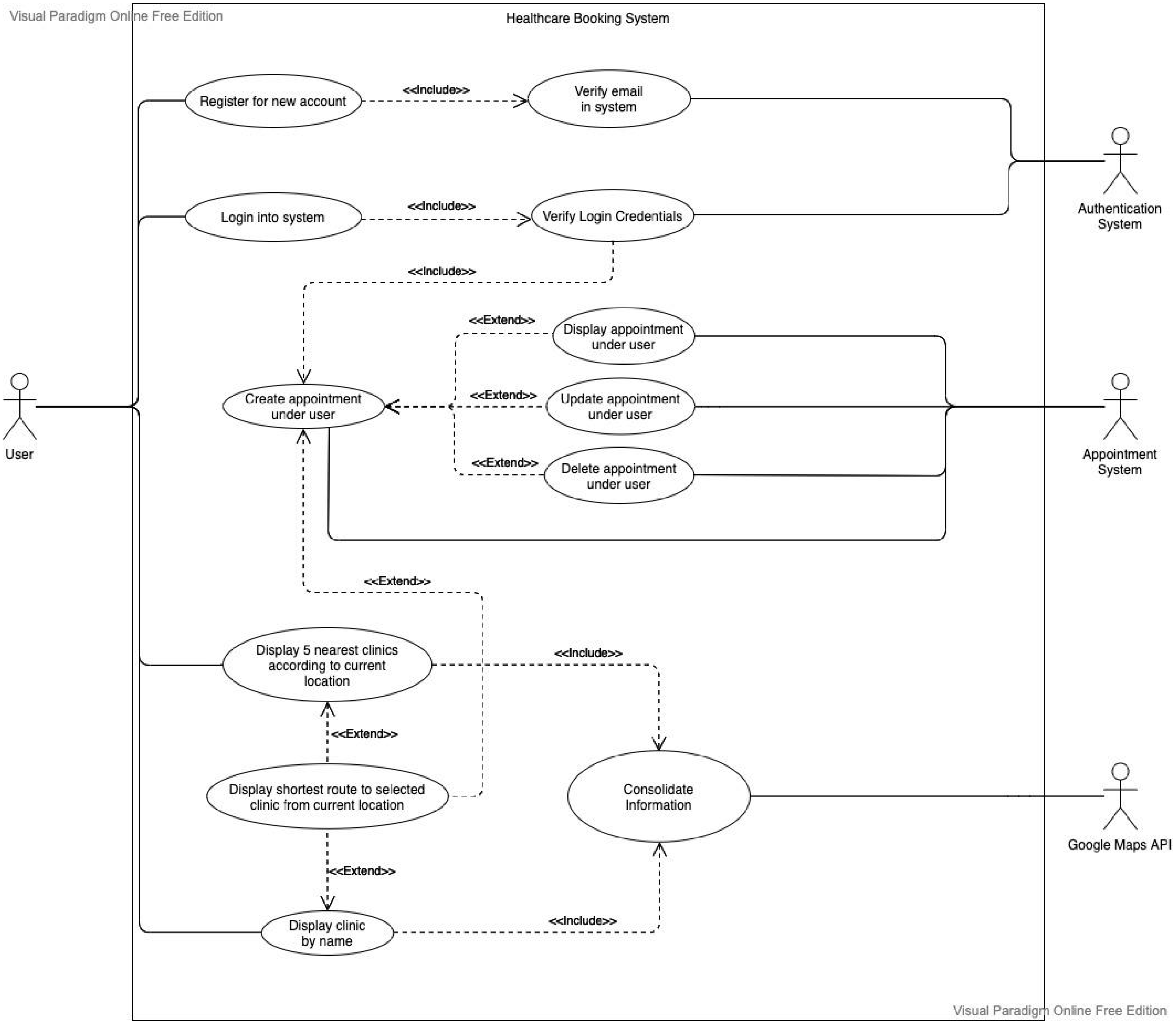
- 4.1 User must be able to schedule an appointment if they do not already have an appointment
  - 4.1.1 User must be able to choose appointment date
  - 4.1.2 User must be able to choose appointment time
- 4.2 User must be able to view details of their scheduled appointment
  - 4.2.1 User must be able to view date of appointment
  - 4.2.2 User must be able to view time of appointment
  - 4.2.3 User must be able to view location of appointment
- 4.3 User must be able to edit the details of their scheduled appointment
  - 4.3.1 User must be able to change date
  - 4.3.2 User must be able to change time
- 4.4 User must be able to delete their scheduled appointment
- 4.5 System must be able to allow users to schedule appointment
  - 4.5.1 System must be able to show the available time slots only
  - 4.5.2 System must allow user to choose appointment date
  - 4.5.3 System must allow user to choose appointment time
- 4.6 System must be able to allow users to edit their scheduled appointment
  - 4.6.1 System must be able to show the available time slots only
  - 4.6.2 System must allow user to choose appointment date
  - 4.6.3 System must allow user to choose appointment time
- 4.7 System must be able to store all details of scheduled appointments
- 4.8 System must be able to show details of scheduled appointments
  - 4.8.1 System must be able to show date
  - 4.8.2 System must be able to show time
  - 4.8.3 System must be able to show location

5. Find nearest clinics

- 5.1 User must be able to select how the top 5 clinics are ranked
- 5.2 System must be able to compute travel time for the clinics
  - 5.2.1 System must be able to retrieve list of clinics using the API
  - 5.2.3 System must be able to retrieve the user’s current location using the API
  - 5.2.4 System must be able to retrieve the shortest travelling time required to travel from user’s location to clinics using API
- 5.3 System must display the travelling time to the top 5 clinics
  - 5.3.1 System must filter out the top 5 clinics with least travel time
  - 5.3.2 System must display the names of the clinic
  - 5.3.3 System must display the travel time to the respective clinics
- 5.4 User must be able to click on the clinics to access the shortest route to the selected clinic

6. Show the shortest route to the selected clinic
    - 6.1 System must detect the user’s current position using API
    - 6.2 System must show the shortest route to the selected clinic on the map
    - 6.3 System must show the various routes to the selected clinic based on type of transport
        - 6.3.1 System must be able to show various types of transportation mode below the map
        - 6.3.2 System must show the estimated time of each route
    - 6.4 User must be able to click on the booking button to create an appointment for the selected clinic

2.1 Use Case Diagram


Visual Paradigm Online Free Edition
Healthcare Booking System
Register for new account
<<Include>>
Verify email in system
Login into system
<<Include>>
Verify Login Credentials
<<Include>>
Authentication System
<<Extend>>
Display appointment under user
<<Extend>>
Update appointment under user
<<Extend>>
Delete appointment under user
Create appointment under user
User
Appointment System
<<Extend>>
Display 5 nearest clinics according to current location
<<Include>>
<<Extend>>
Display shortest route to selected clinic from current location
Consolidate Information
Google Maps API
<<Extend>>
Display clinic by name
<<Include>>
Visual Paradigm Online Free Edition

2.2 Use Case Descriptions

Use Case ID:	U1		
Use Case Name:	Register for new account		
Created By:	Heng Jiu Xiao	Last Updated By:	Heng Jiu Xiao
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	Allow users to register for an account
Preconditions:	1. User’s device must be connected to the Internet through Wi-Fi / Mobile Data
Postconditions:	1. User’s account is created 2. User’s personal and login information are stored in the database 3. Existing users are denied repeated registration
Priority:	High
Frequency of Use:	Once in entire lifetime
Flow of Events:	1. User selects “Register for new account” option 2. User will enter their email 3. User will enter password 4. User will enter confirm password 5. User will enter First Name 6. User will enter Last Name 7. User will press on the “Create” button 8. System will check against database to verify if email already exists 9. System will save login information into database 10. System will create a verification object with the User’s Id and verification code 11. System will send an email with the verification code to the user’s email 12. User will enter the verification code 13.User will press the “verify” button 14. User will be redirected back to Verify page
Alternative Flows:	AF-S9: If the email already exists in database

	1. User would be prompted that account already exists with a warning message 2. User will be redirected back to the account creation page
Exceptions:	-
Includes:	1. Verify email in system
Extends:	-
Special Requirements:	-
Assumptions:	1. User inputs **accurate** information during registration process in steps 2 to 6 of Flow of Events 2. User will enter proper and identical passwords 3. User will enter a valid email address
Notes and Issues:	-

Use Case ID:	U2		
Use Case Name:	Verify email in system		
Created By:	Heng Jiu Xiao	Last Updated By:	Heng Jiu Xiao
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

Actor:	Authentication System
Description:	Check whether the email already exists in the database
Preconditions:	1. System must be connected to the authentication system 2. System must be connected to Internet through Wi-Fi
Postconditions:	1. Authentication system updates the verification status of the user
Priority:	High
Frequency of Use:	Depends on number of account creation
Flow of Events:	1. User will enter 6 character code sent to email address

	2. Authentication system will verify if the email is in the database and that the entered 6 character code corresponds to the unverified email 3. Authentication system will update the verification status of the account
Alternative Flows:	-
Exceptions:	-
Includes:	-
Extends:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U3		
Use Case Name:	Login into system		
Created By:	Heng Jiu Xiao	Last Updated By:	Heng Jiu Xiao
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	Login into system
Preconditions:	1. User’s device must be connected to the Internet through Wi-Fi / Mobile Data 2. User is logged into the application
Postconditions:	1. User is brought forward to home page
Priority:	High
Frequency of Use:	1-2 times a month
Flow of Events:	1. User will input email address 2. User will input password 3. User selects the “Login” button

	4. System will verify if email exists in the database 5. System will verify if password is correct for the tagged phone number 6. System will display “Login successful” 7. User will press the “Home” button 8. User will be brought to home page
Alternative Flows:	AF-S6: Email address does not exist in database 1. System will display the following warning message “Email doesn’t exist!” 2. User will click the “Dismiss” button 3. System returns user to login page AF-S6: Password does not tally with database’s password 1. System will display the following warning message “Phone number doesn’t exist!” 2. User will click the “Dismiss” button 3. System returns user to login page AF-S6: Account is not verified 1. System will display account is not verified 2. System will redirect to the verification page
Exceptions:	EX-S6: If email field is left blank 1. System displays “Please enter valid email” 2. User will click the “Dismiss” button 3. User is returned to login page EX-S6: If password is left blank, 1. System displays “Please enter valid password” 2. User will click the “Dismiss” button 3. User is returned to login page
Includes:	1. Verify login credentials
Extends:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U4

Use Case Name:	Verify login credentials		
Created By:	Heng Jiu Xiao	Last Updated By:	Heng Jiu Xiao
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

Actor:	Authentication System
Description:	Check whether the entered password corresponds to the tagged password for a email address in the database
Preconditions:	1. System must be connected to the authentication system 2. System must be connected to Internet through Wi-Fi
Postconditions:	1. Authentication system returns a binary value to indicate if password corresponds to tagged email address
Priority:	High
Frequency of Use:	Depends on number of login attempts
Flow of Events:	1. System will send an email address and a password to authentication system 2. Authentication system will verify if the password entered corresponds to the tagged password in the database 3. Authentication system sends a binary value to the system to indicate whether the login information tallies
Alternative Flows:	-
Exceptions:	-
Includes:	-
Extends:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U5		
Use Case Name:	Create appointment under user		
Created By:	Ernest Tan	Last Updated By:	Ernest Tan
Date Created:	27/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	To create an appointment at clinic of choice
Preconditions:	1. User is connected to the Internet via Wi-Fi / Mobile Data 2. User does not have an existing appointment in the system
Postconditions:	1. Database is updated with the new booking 2. User will not be able to create a new appointment
Priority:	High
Frequency of Use:	1-3 times per month
Flow of Events:	1. User selects the “Book” option on the Directions page 2. System will display the appointment page 3. User must select the date of appointment 4. System will return available time slots based on location and date input 5. User selects one time slot from the available time slots 6. System displays appointment details consisting of date, location, and time 7. User selects the “Confirm” button 8. System displays “Appointment confirmed” page 9. User is sent to the “View Appointment” page 11. System will send the details of the appointment back to the database
Alternative Flows:	AF-S3: User inputs a date with no available time slots 1. System displays message “There are no more available time slots! Please change your time or date!” 2. Return to Step 3
Exceptions:	-
Includes:	-
Extends:	1. Display appointment under user 2. Update appointment under user

	3. Delete appointment under user 4. Display shortest route to selected clinic from current location
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U6		
Use Case Name:	Display appointment under user		
Created By:	Ernest Tan	Last Updated By:	Ernest Tan
Date Created:	27/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	To view the details of the current appointment
Preconditions:	1. User is connected to the Internet via Wi-Fi / Mobile Data 2. User must have a pre-existing appointment within the app 3. User must be logged in to the app
Postconditions:	1. User is able to view the location, date, time and comments of their existing appointment
Priority:	Medium
Frequency of Use:	3-5 times per month
Flow of Events:	1. User selects the “View Appointment” button 2. System will check the user’s phone number for a pre-existing appointment in the database 3. System returns details of the user’s appointment, including location, date and time
Alternative Flows:	AF-S3: System cannot find a pre-existing appointment tagged to user 1. System will return an error message “There are no prior appointments!” 2. User will be returned to the application homepage

Exceptions:	-
Includes:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U7		
Use Case Name:	Update appointment under user		
Created By:	Ernest Tan	Last Updated By:	Ernest Tan
Date Created:	27/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	To change the date or time of the current booking
Preconditions:	1. User is connected to the Internet via Wi-Fi / Mobile Data 2. User must have a pre-existing appointment within the app 3. User must be logged in to the app
Postconditions:	1. User's booking details will be successfully updated and saved in the database
Priority:	Medium
Frequency of Use:	1-3 times per month
Flow of Events:	1. User selects the "Update Appointment" button on homepage 2. System will check the user's phone number for a pre-existing appointment in the database 3. System will display the appointment page 4. User must select the new date of appointment 5. System will return available time slots based on location and date input 6. User selects one time slot from the available time slots 7. System displays appointment details consisting of date, location, and time

	8. User selects the “Confirm” button 9. System displays “Appointment updated” 10. User clicks on the “Dismiss” button 11. User is sent to the “View Appointment” page 12. System will send the details of the appointment back to the database
Alternative Flows:	AF-S1: User selects “Edit” button on “View Appointment” page 1. Return to step 2 AF-S3: System cannot find a pre-existing appointment tagged to user 1. System will return an error message “There are no prior appointments!” 2. User will be returned to the homepage AF-S4: User inputs a date with no available time slots 1. System returns an error message stating that there are no more available time slots, and that user must change either the location or date of booking 2. Return to Step 3
Exceptions:	-
Includes:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U8		
Use Case Name:	Delete appointment under user		
Created By:	Ernest Tan	Last Updated By:	Ernest Tan
Date Created:	27/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	To delete the current appointment
Preconditions:	1. User must be logged in to the application 2. User is connected to the Internet via Wi-Fi / Mobile Data 3. User must have pre-existing appointment

Postconditions:	1. User’s appointment is successfully deleted from the system’s database 2. User will be able to create a new appointment
Priority:	Medium
Frequency of Use:	1-3 times per month
Flow of Events:	1. User selects the “Delete” button 2. System will check the user’s phone number for a pre-existing appointment in the database 3. System will display the message, “Do you want to delete your current appointment?” 4. User selects “Confirm” button 5. System will delete the user’s appointment from the system’s database 6. System displays “Appointment deleted” 7. User clicks on the “Dismiss” button 8. User is sent to the Home page
Alternative Flows:	AF-S3: User does not have a pre-existing appointment in the database 1. System will display the message “You do not have an appointment!” 2. User will be returned to the application homepage
Exceptions:	-
Includes:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U9		
Use Case Name:	Display 5 nearest clinics according to current location		
Created By:	David Tay	Last Updated By:	David Tay
Date Created:	27/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	To display to the user the 5 nearest clinics by distance
Preconditions:	1. User is connected to the Internet via Wi-Fi / Mobile Data 2. User’s device must have location services turned on on their device 3. User must be logged into application
Postconditions:	1. User will be shown the 5 nearest clinics with the respective distances from the current location
Priority:	High
Frequency of Use:	1-3 times a month
Flow of Events:	1. User selects the “Find nearest clinics” option on the application homepage 2. System will compute the distances of the 5 nearest clinics based on the user’s current location 3. System will display a list of 5 nearest clinics based on distance, sorted in descending order
Alternative Flows:	-
Exceptions:	-
Includes:	1. Consolidate information
Extends:	1. Display shortest route to selected clinic from current location
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U10		
Use Case Name:	Display clinic by name		
Created By:	David Tay	Last Updated By:	David Tay
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	Returns a list of clinics that names matches the user's search condition
Preconditions:	1. User is connected to the Internet via Wi-Fi / Mobile Data 2. User's device must have location services turned on on their device 3. User must be logged into application
Postconditions:	1. User will be given a list of clinics that names matches the search condition
Priority:	High
Frequency of Use:	1-3 times per month
Flow of Events:	1. User will input a search phrase in the search bar 2. User will select button to find clinics from input 3. System will retrieve the travelling time from the user's location to each clinic using the Google Maps API 4. System will display a list of clinics that fulfill the search requirement and their respective travelling time
Alternative Flows:	-
Exceptions:	-
Includes:	1. Consolidate information
Extends:	1. Display shortest route to selected clinic from current location
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U11		
Use Case Name:	Display shortest route to selected clinic from current location		
Created By:	David Tay	Last Updated By:	David Tay

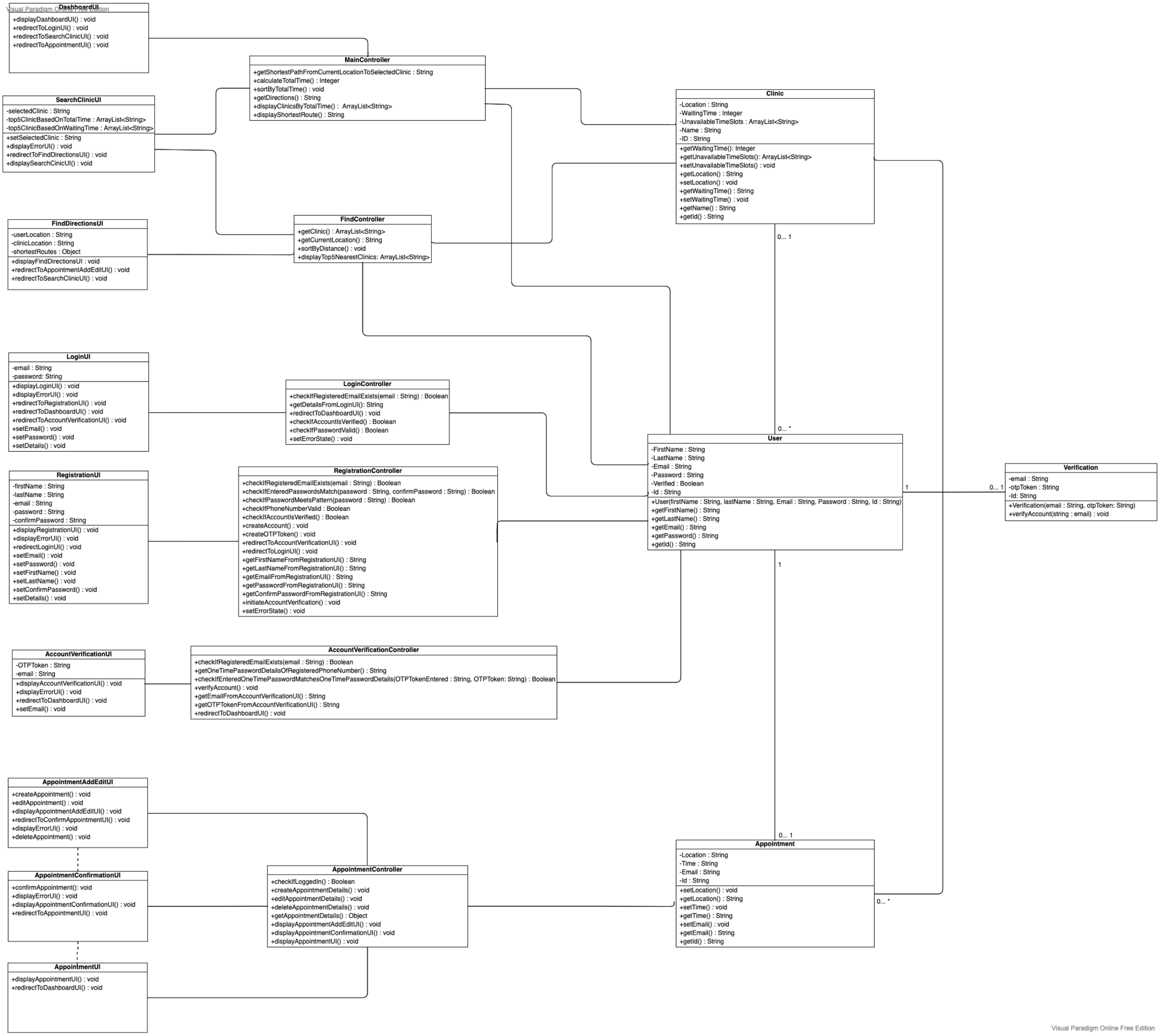
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

Actor:	User
Description:	Displays the shortest route to the selected clinic from current location
Preconditions:	1. User is connected to the Internet via Wi-Fi / Mobile Data 2. User's device must have location services turned on on their device 3. User must be logged into application
Postconditions:	1. User will be shown the shortest route to the selected clinic from current location
Priority:	High
Frequency of Use:	1-3 times a month
Flow of Events:	1. User will select a clinic from the list of clinics provided 2. System will display a map with the selected clinic and current location marked with a pin and a line displaying the shortest route
Alternative Flows:	-
Exceptions:	-
Includes:	-
Extends:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

Use Case ID:	U12		
Use Case Name:	Consolidate Information		
Created By:	David Tay	Last Updated By:	David Tay
Date Created:	28/01/2021	Date Last Updated:	01/04/2021

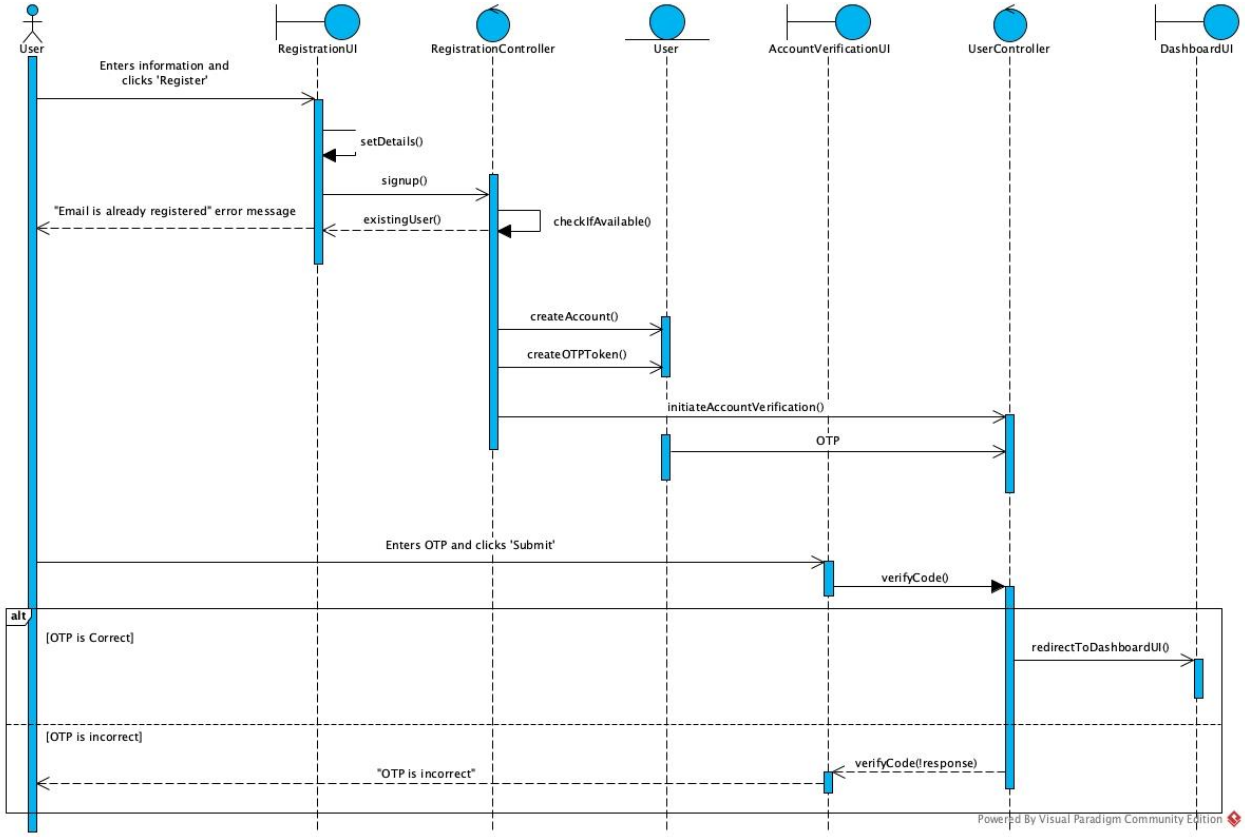
Actor:	Google Maps API
Description:	Retrieve list of clinics, location and distance from Google Maps API
Preconditions:	1. User’s device is connected to the Internet via Wi-Fi / Mobile Data 2. User’s device must have location services turned on on their device
Postconditions:	1. Application will receive list of clinics and their details from Google Maps API 2. Application will receive user’s current location from Google Maps API
Priority:	High
Frequency of Use:	Dependent on number of application users
Flow of Events:	1. System will retrieve list of clinics and their details from Google Maps API 2. System will receive user’s current location from Google Maps API 3. System will store all information within the database for further use
Alternative Flows:	-
Exceptions:	-
Includes:	-
Extends:	-
Special Requirements:	-
Assumptions:	-
Notes and Issues:	-

2.3 Class Diagram

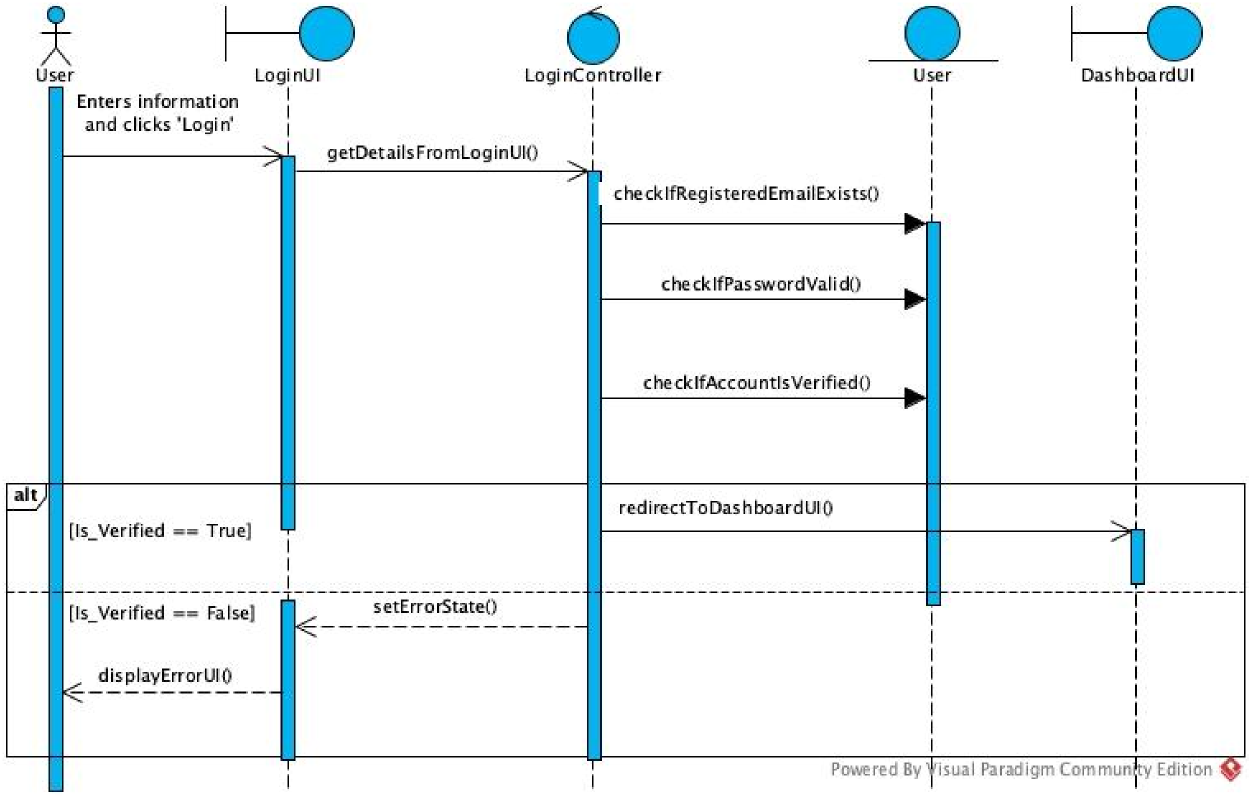

DashboardUI
+displayDashboardUI() : void
+redirectToLoginUI() : void
+redirectToSearchClinicUI() : void
+redirectToAppointmentUI() : void
MainController
+getShortestPathFromCurrentLocationToSelectedClinic : String
+calculateTotalTime() : Integer
+sortByTotalTime() : void
+getDirections() : String
+displayClinicsByTotalTime() : ArrayList<String>
+displayShortestRoute() : String
SearchClinicUI
-selectedClinic : String
-top5ClinicBasedOnTotalTime : ArrayList<String>
-top5ClinicBasedOnWaitingTime : ArrayList<String>
+setSelectedClinic : String
+displayErrorUI() : void
+redirectToFindDirectionsUI() : void
+displaySearchCinicUI() : void
Clinic
-Location : String
-WaitingTime : Integer
-UnavailableTimeSlots : ArrayList<String>
-Name : String
-ID : String
+getWaitingTime(): Integer
+getUnavailableTimeSlots(): ArrayList<String>
+setUnavailableTimeSlots() : void
+getLocation() : String
+setLocation() : void
+getWaitingTime() : String
+setWaitingTime() : void
+getName() : String
+getId() : String
FindDirectionsUI
-userLocation : String
-clinicLocation : String
-shortestRoutes : Object
+displayFindDirectionsUI : void
+redirectToAppointmentAddEditUI() : void
+redirectToSearchClinicUI() : void
FindController
+getClinic() : ArrayList<String>
+getCurrentLocation() : String
+sortByDistance() : void
+displayTop5NearestClinics: ArrayList<String>
0... 1
LoginUI
-email : String
-password: String
+displayLoginUI() : void
+displayErrorUI() : void
+redirectToRegistrationUI() : void
+redirectToDashboardUI() : void
+redirectToAccountVerificationUI() : void
+setEmail() : void
+setPassword() : void
+setDetails() : void
LoginController
+checkIfRegisteredEmailExists(email : String) : Boolean
+getDetailsFromLoginUI(): String
+redirectToDashboardUI() : void
+checkIfAccountIsVerified() : Boolean
+checkIfPasswordValid() : Boolean
+setErrorState() : void
0... *
User
-FirstName : String
-LastName : String
-Email : String
-Password : String
-Verified : Boolean
-Id : String
+User(firstName : String, lastName : String, Email : String, Password : String, Id : String)
+getFirstName() : String
+getLastName() : String
+getEmail() : String
+getPassword() : String
+getId() : String
1
0... 1
Verification
-email : String
-otpToken : String
-Id: String
+Verification(email : String, otpToken: String)
+verifyAccount(string : email) : void
RegistrationUI
-firstName : String
-lastName : String
-email : String
-password : String
-confirmPassword : String
+displayRegistrationUI() : void
+displayErrorUI() : void
+redirectLoginUI() : void
+setEmail() : void
+setPassword() : void
+setFirstName() : void
+setLastName() : void
+setConfirmPassword() : void
+setDetails() : void
RegistrationController
+checkIfRegisteredEmailExists(email : String) : Boolean
+checkIfEnteredPasswordsMatch(password : String, confirmPassword : String) : Boolean
+checkIfPasswordMeetsPattern(password : String) : Boolean
+checkIfPhoneNumberValid : Boolean
+checkIfAccountIsVerified() : Boolean
+createAccount() : void
+createOTPToken() : void
+redirectToAccountVerificationUI() : void
+redirectToLoginUI() : void
+getFirstNameFromRegistrationUI() : String
+getLastNameFromRegistrationUI() : String
+getEmailFromRegistrationUI() : String
+getPasswordFromRegistrationUI() : String
+getConfirmPasswordFromRegistrationUI() : String
+initiateAccountVerification() : void
+setErrorState() : void
1
AccountVerificationUI
-OTPToken : String
-email : String
+displayAccountVerificationUI() : void
+displayErrorUI() : void
+redirectToDashboardUI() : void
+setEmail() : void
AccountVerificationController
+checkIfRegisteredEmailExists(email : String) : Boolean
+getOneTimePasswordDetailsOfRegisteredPhoneNumber() : String
+checkIfEnteredOneTimePasswordMatchesOneTimePasswordDetails(OTPTokenEntered : String, OTPToken: String) : Boolean
+verifyAccount() : void
+getEmailFromAccountVerificationUI() : String
+getOTPTokenFromAccountVerificationUI() : String
+redirectToDashboardUI() : void
AppointmentAddEditUI
+createAppointment() : void
+editAppointment() : void
+displayAppointmentAddEditUI() : void
+redirectToConfirmAppointmentUI() : void
+displayErrorUI() : void
+deleteAppointment() : void
0... 1
Appointment
-Location : String
-Time : String
-Email : String
-Id : String
+setLocation() : void
+getLocation() : String
+setTime() : void
+getTime() : String
+setEmail() : void
+getEmail() : String
+getId() : String
0... *
AppointmentConfirmationUI
+confirmAppointment(): void
+displayErrorUI() : void
+displayAppointmentConfirmationUI() : void
+redirectToAppointmentUI() : void
AppointmentController
+checkIfLoggedIn() : Boolean
+createAppointmentDetails() : void
+editAppointmentDetails() : void
+deleteAppointmentDetails() : void
+getAppointmentDetails() : Object
+displayAppointmentAddEditUI() : void
+displayAppointmentConfirmationUI() : void
+displayAppointmentUI() : void
AppointmentUI
+displayAppointmentUI() : void
+redirectToDashboardUI() : void

2.4 Sequence Diagrams

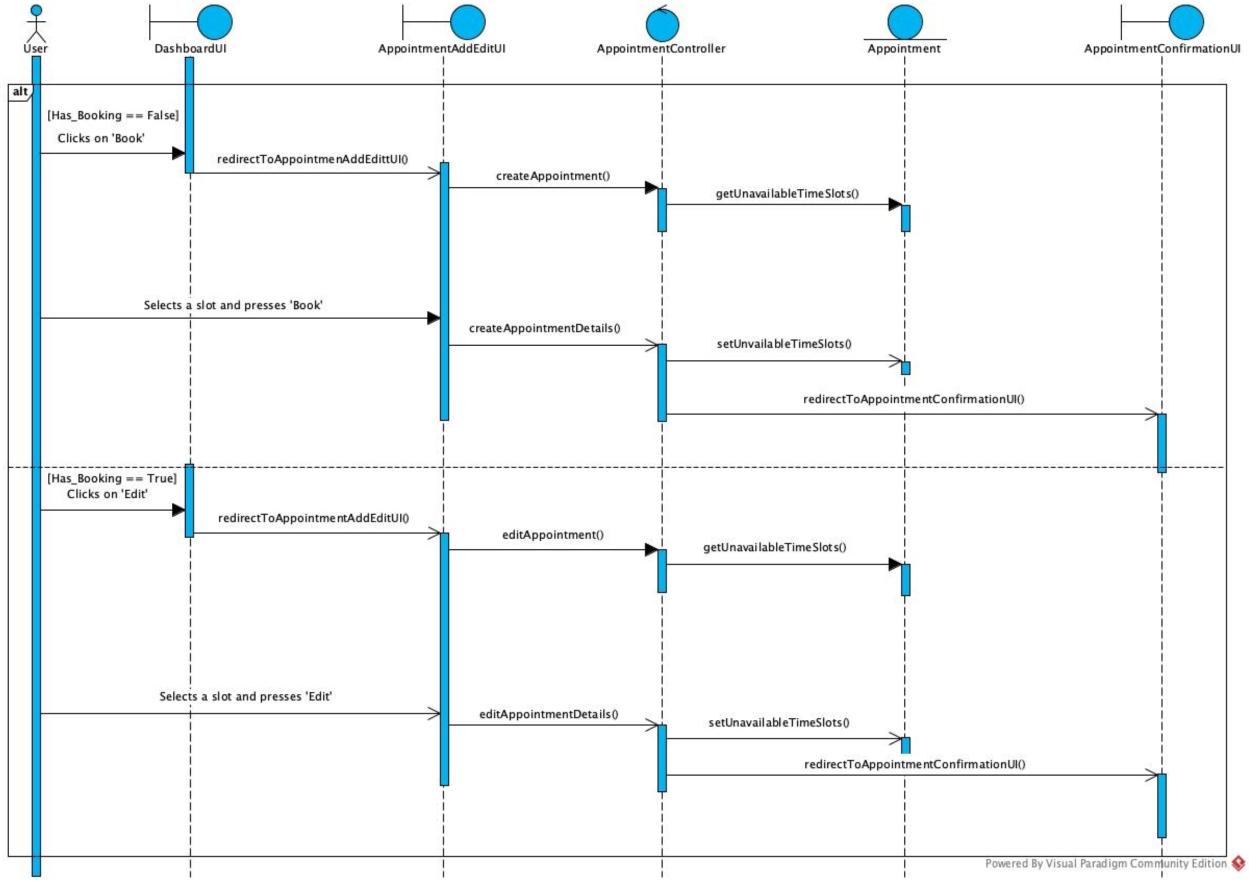
2.4.1 User Registration Sequence Diagram



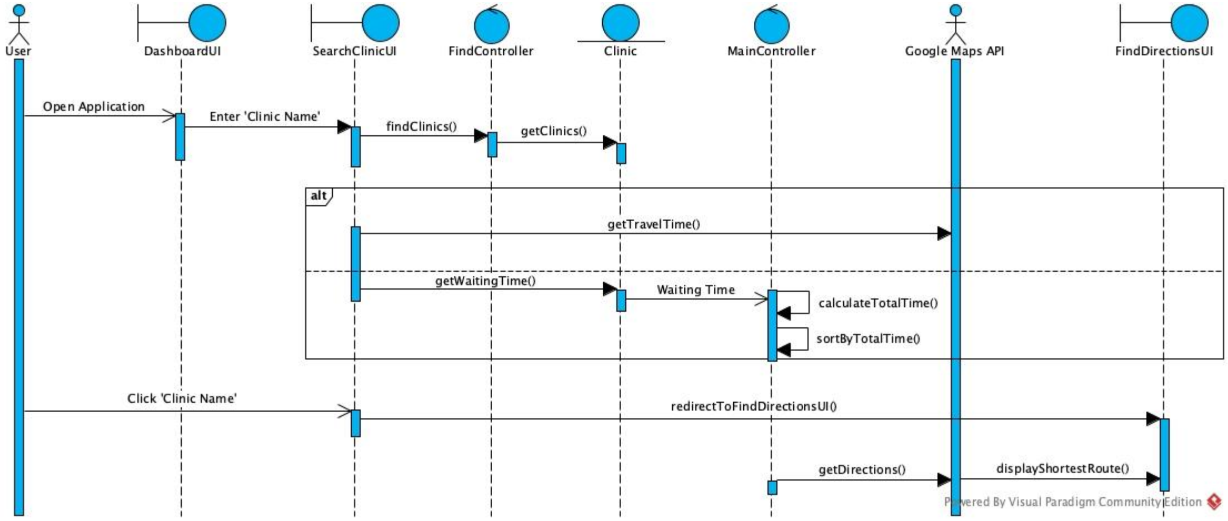
2.4.2 User Login Sequence Diagram



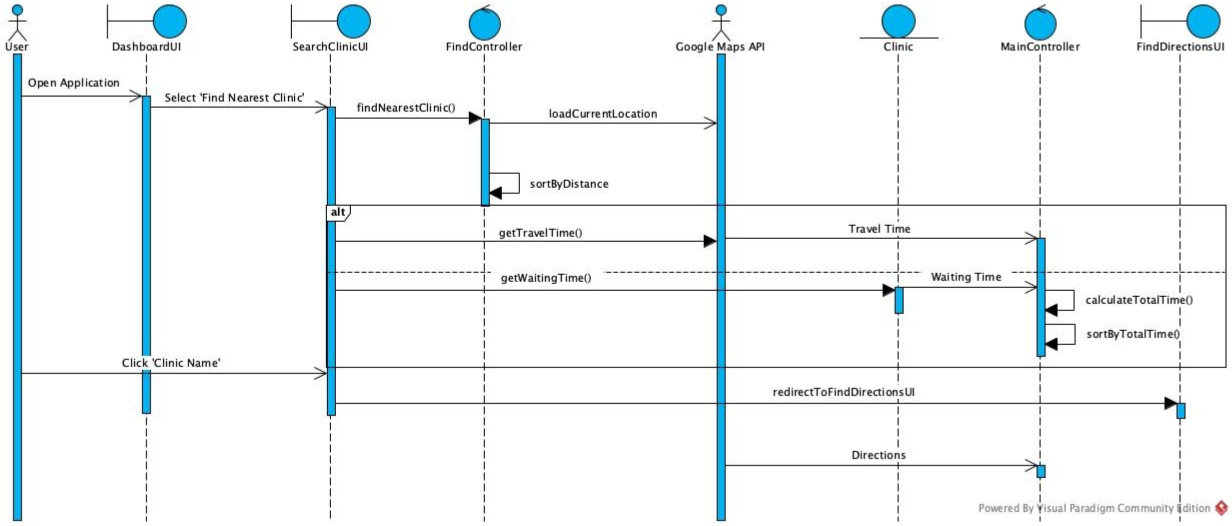
2.4.3 Create/Edit Appointment Sequence Diagram


User
DashboardUI
AppointmentAddEditUI
AppointmentController
Appointment
AppointmentConfirmationUI
alt
[Has_Booking == False]
Clicks on 'Book'
redirectToAppointmenAddEdittUI()
createAppointment()
getUnavailableTimeSlots()
Selects a slot and presses 'Book'
createAppointmentDetails()
setUnvailableTimeSlots()
redirectToAppointmentConfirmationUI()
[Has_Booking == True]
Clicks on 'Edit'
redirectToAppointmentAddEditUI()
editAppointment()
getUnavailableTimeSlots()
Selects a slot and presses 'Edit'
editAppointmentDetails()
setUnavailableTimeSlots()
redirectToAppointmentConfirmationUI()
Powered By Visual Paradigm Community Edition

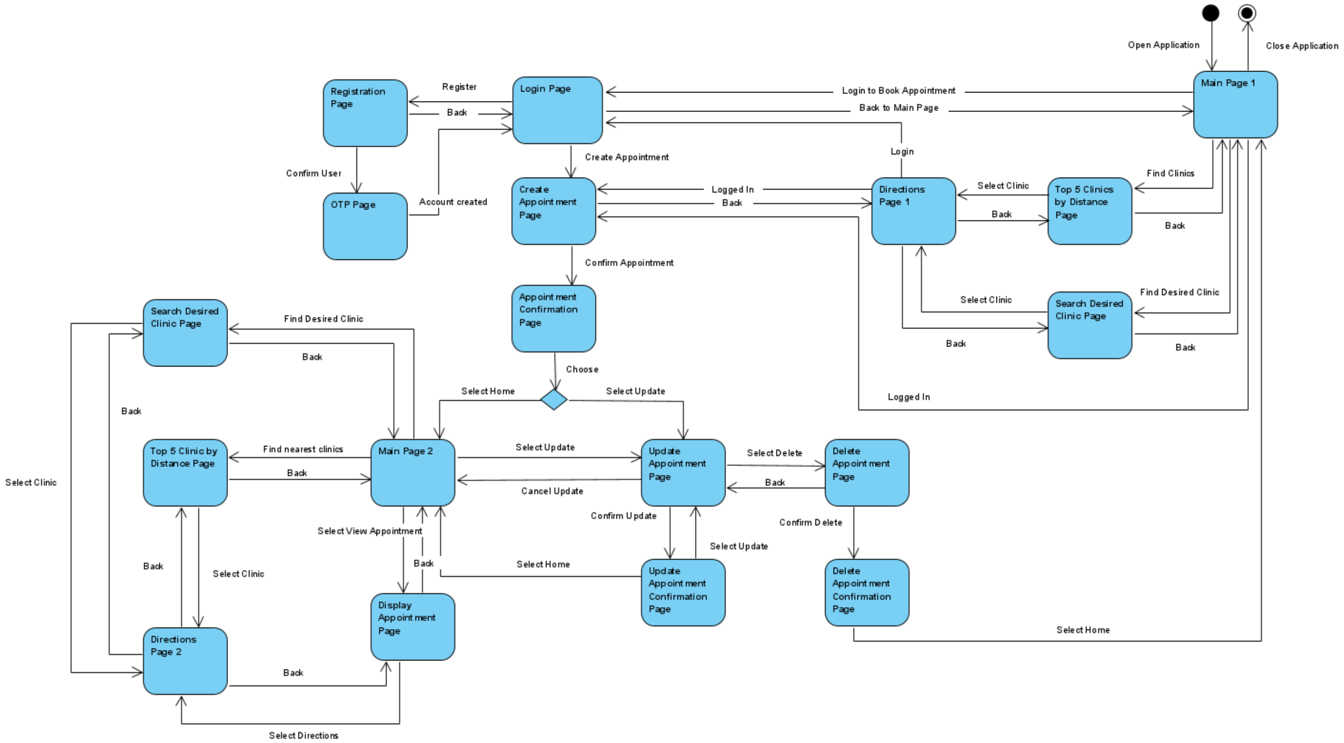
2.4.4 Search by Clinic name Sequence Diagram



2.4.5 Find Nearest Clinic Sequence Diagram



2.5 Dialog Map



3 Non Functional Requirements

3.1 Usability Requirements

- 3.1.1 The system must strive to be universally usable
  - 3.1.1.1 The system must support different languages
- 3.1.2 The system must try to reduce memory load
  - 3.1.2.1 The UI must be kept simple while allowing users to find desired clinic
  - 3.1.2.2 The users require minimal instructions to use the system
- 3.1.3 The system must strive for consistency
  - 3.1.3.1 A consistent series of actions to perform similar types of tasks such as booking a consultation through the three different access points
  - 3.1.3.2 A consistent design of UI must be achieved (Colors, Buttons, Fonts etc.)

3.2 Reliability Requirements

- 3.2.1 The system must not crash when user opens the application
- 3.2.2 The system must maintain information consistency
- 3.2.3 The system must be able to restart to full functionality within 10 minutes of crashing
- 3.2.4 The system must be able to work at any time of the day
- 3.2.5 The system must not lose any information
  - 3.2.5.1 The system must not lose appointment information
  - 3.2.5.2 The system must not lose user information

3.3 Performance Requirements

- 3.3.1 The system should take no more than 3 seconds to load after every action by the user
- 3.3.2 The system must offer informative feedback
  - 3.3.2.1 System must display an error message that allows the users to know what went wrong when an error occurs
- 3.3.3 The system must allow easy reversal of the user's actions

3.4 Supportability Requirements

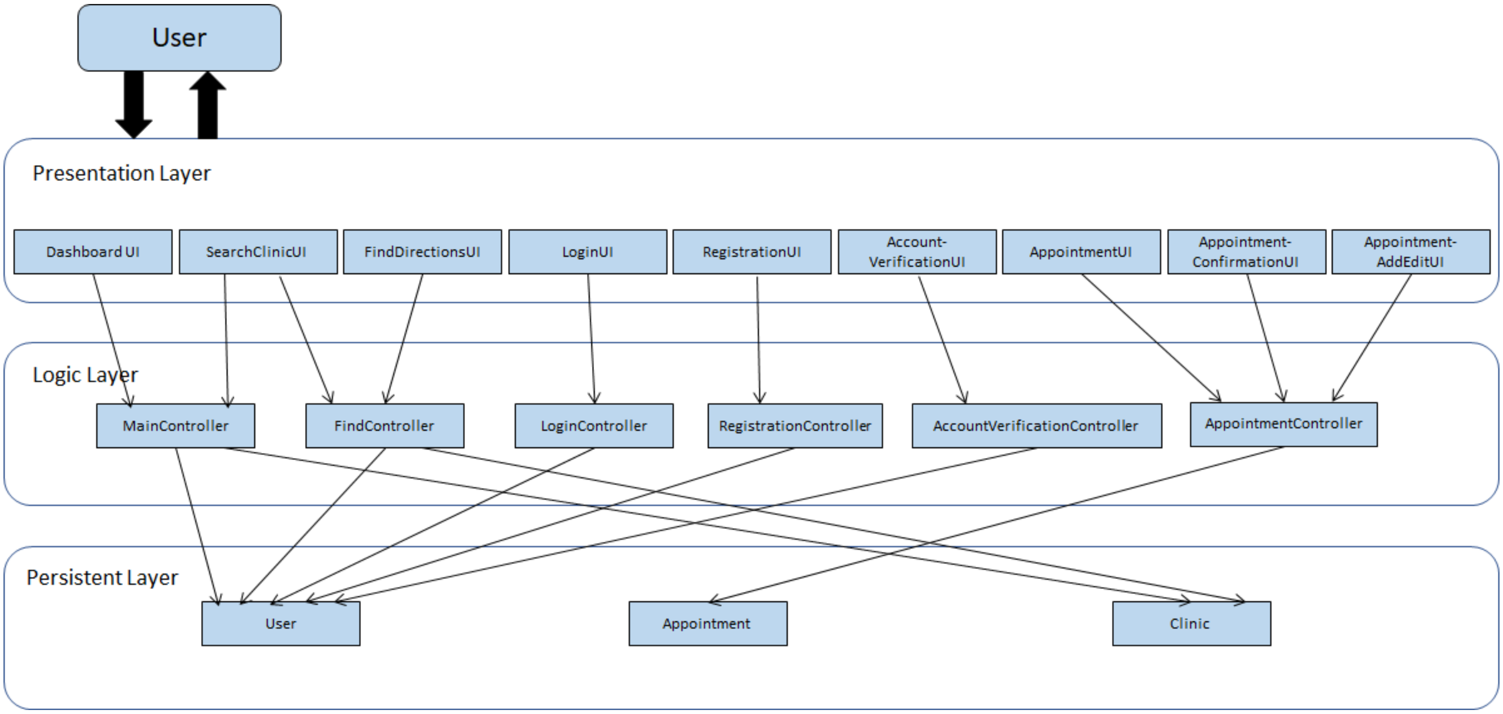
- 3.4.1 The system must have ease of maintainability
  - 3.4.1.1 Object-Oriented Design to ensure that debugging or maintenance is affordable and efficient
  - 3.4.1.2 Test-cases must be comprehensive but succinct
- 3.4.2 The system must work across different platforms
  - 3.4.2.1 Built on hybrid app development so that it can work across different mobile operating systems
- 3.4.3 The system must be portable
  - 3.4.3.1 The app can be migrated from legacy system to a new platform in accordance to technology changes/updates

3.5 Security Requirements

- 3.5.1 The system must ensure password is secure
  - 3.5.1.1 To mask the input password characters during login
  - 3.5.1.2 To mask password inputs during password creation at registration
  - 3.5.1.3 To ensure password meets stringent criteria (i.e minimum length 8, one special character etc.)
- 3.5.2 The system must ensure accounts' information is inaccessible by unauthorised personnel
  - 3.5.2.1 The account information is only accessible by the system administrators
  - 3.5.2.2 The account information is encrypted in database

4 Architecture Design

4.1 System Architecture Diagram



3-layered architecture:

1. Presentation Layer: user interface and communication layer of the application, which the end user uses to interact with the application. Its main purpose is to display and collect information to and from the user
2. Logic Layer: contains all the functional business logic, which controls the application's functionality by performing detailed processing
3. Persistence Layer: also known as the database layer, this layer stores and manages all of the information processed by the application

Main Advantage

Easily extend, modularize, and configure the layers of the application accordingly, without impacting the other layers.
Functional process logic, data access, computer data storage and user interface are developed and maintained as separate and independent modules.

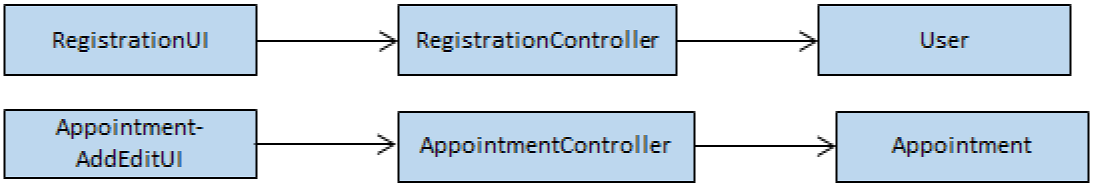
Other Advantages

Layering the system allows us to focus more on our areas of expertise (Front-end designed by the more creative, back-end by those who are more familiar with APIs and routing). It also gives developers the ability to scale up and out (persistence layer/ back end can be deployed to a variety of databases, scale up by adding multiple web servers). Furthermore, it enhances reliability and gives more independence of underlying servers or services. Ease of code maintenance, as changes made in one layer do not affect the other layers

4.2 Design Patterns

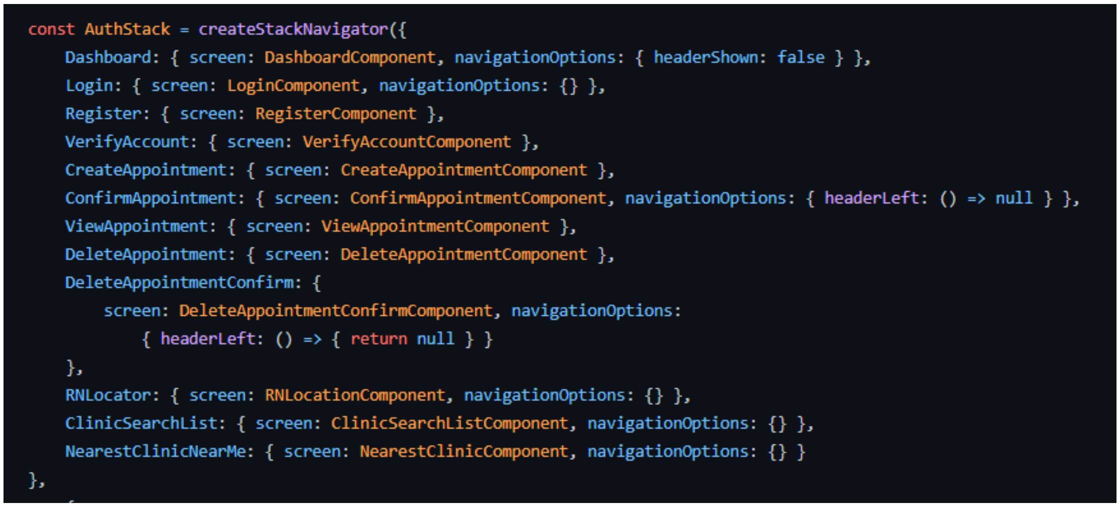
1. Factory Pattern (Creational)
   Application contains a set of classes that may or may not be instantiated until runtime. These include the User class, Appointment class etc.

   Our solution is to define an interface for creating different users or appointments, without knowing beforehand what sort of user information is entered or the details of the appointment.



   The creation of Users and Appointments are encapsulated. Also, it is easy to replace, edit, add new subclasses, and change object creation logic, by just simply changing the parameters in the User/Appointment data.

2. Façade Design Pattern
   Application hides the complexities of the system and provides an interface to the users.



```
const AuthStack = createStackNavigator({
    Dashboard: { screen: DashboardComponent, navigationOptions: { headerShown: false } },
    Login: { screen: LoginComponent, navigationOptions: {} },
    Register: { screen: RegisterComponent },
    VerifyAccount: { screen: VerifyAccountComponent },
    CreateAppointment: { screen: CreateAppointmentComponent },
    ConfirmAppointment: { screen: ConfirmAppointmentComponent, navigationOptions: { headerLeft: () => null } },
    ViewAppointment: { screen: ViewAppointmentComponent },
    DeleteAppointment: { screen: DeleteAppointmentComponent },
    DeleteAppointmentConfirm: {
        screen: DeleteAppointmentConfirmComponent, navigationOptions:
            { headerLeft: () => { return null } }
    },
    RNLocator: { screen: RNLocationComponent, navigationOptions: {} },
    ClinicSearchList: { screen: ClinicSearchListComponent, navigationOptions: {} },
    NearestClinicNearMe: { screen: NearestClinicComponent, navigationOptions: {} }
},
```

   In React Native, we utilised stack navigator to provide a unified interface to a set of interfaces. Through the façade design pattern, the code is easier to understand, and reduce class dependency.

3. SOLID Principle

Classes abide by the Single Responsibility Principle. All classes are tied to one entity in the system. All classes have a single responsibility.

5 Data Dictionary

Term	**Definition**
User	User refers to a person who is using the application to search for clinics and schedule appointments
System	System refers to the mobile application
Appointment	Appointment refers to a medical consultation at selected clinic
Search	Search is a feature that allows users to find their desired clinic based on certain filters
Travel Time	Travel Time refers to the amount of time taken for the user to travel from their current location to the selected clinic
GPS	Global Positioning System which is used to pinpoint the user's current location
Geolocation	Geolocation refers to the exact geographic location of the user, found using GPS

6 Testing

6.1 Black Box Testing Overview

Login

Scenario	Expected Result	Actual Result
User has an existing account and login with correct credentials	Successful login and system redirects user to DashBoardUI	Successful login and system redirects user to DashBoardUI
User has an existing account but login with incorrect credentials	Unsuccessful login and system prompts users to try again	Unsuccessful login and system prompts users to try again
User did not fill in all required fields	Unsuccessful login and system prompts user to fill in all required fields	Unsuccessful login and system prompts user to fill in all required fields

Email	Password	Expected Result	Actual Result
sheryl_gtyinn@hotmail.com	(test)	Successful login	Successful login
sheryl_gtyinn@hotmail.com	test	Wrong Username/ Password!	Wrong Username/ Password!
wronguser@hotmail.com	(test)	Wrong Username/ Password!	Wrong Username/ Password!
sheryl_gtyinn@hotmail.com	Empty	Enter all fields please!	Enter all fields please!
Empty	(test)	Enter all fields please!	Enter all fields please!

Registration

Scenario	Expected Result	Actual Result
User does not have existing account and enters all required fields correctly	Successful creation of account and system redirects user to DashBoardUI	Successful creation of account and system redirects user to DashBoardUI
User has an existing account and tries to re-register	Unsuccessful creation of account and system shows an error message that email is already registered	Unsuccessful creation of account and system shows an error message that email is already registered
User enters passwords that do not match	Unsuccessful creation and system shows an error message to user that	Unsuccessful creation and system shows an error message to user that passwords do not match

	passwords do not match	
User did not fill in all required fields	Unsuccessful creation and system prompts user to fill in all required fields	Unsuccessful creation and system prompts user to fill in all required fields

First Name	Last Name	Email	Password	Confirm Password	Expected Result	Actual Result
testFirst	testLast	test@gmail.com	(test)	(test)	Success!	Success!
testFirst	testLast	user@gmail.com	(test)	(test)	Email already registered!	Email already registered!
testFirst	testLast	test@gmail.com	(test)	test	Passwords do not match	Passwords do not match
Empty	testLast	test@gmail.com	(test)	(test)	Enter all fields please!	Enter all fields please!
testFirst	Empty	test@gmail.com	(test)	(test)	Enter all fields please!	Enter all fields please!
testFirst	testLast	Empty	(test)	(test)	Enter all fields please!	Enter all fields please!
testFirst	testLast	test@gmail.com	Empty	(test)	Enter all fields please!	Enter all fields please!
testFirst	testLast	test@gmail.com	(test)	Empty	Enter all fields please!	Enter all fields please!

Create Appointment

Scenario	Expected Result	Actual Result
User enters all required	Successful creation of	Successful creation of

fields	appointment and system redirects user to confirmAppointmentUI	appointment and system redirects user to confirmAppointmentUI
User did not enter all required fields	Unsuccessful creation of appointment and system prompts user to fill in all required fields	Unsuccessful creation of appointment and system prompts user to fill in all required fields

Clinic Name	Date	Time	Other Comments	Expected Result	Actual Result
Chen Family Clinic	Apr 1 2021	12:00	test	Success!	Success!
Chen Family Clinic	Apr 1 2021	Empty	test	Enter All Fields!	Enter All Fields!

Edit Appointment

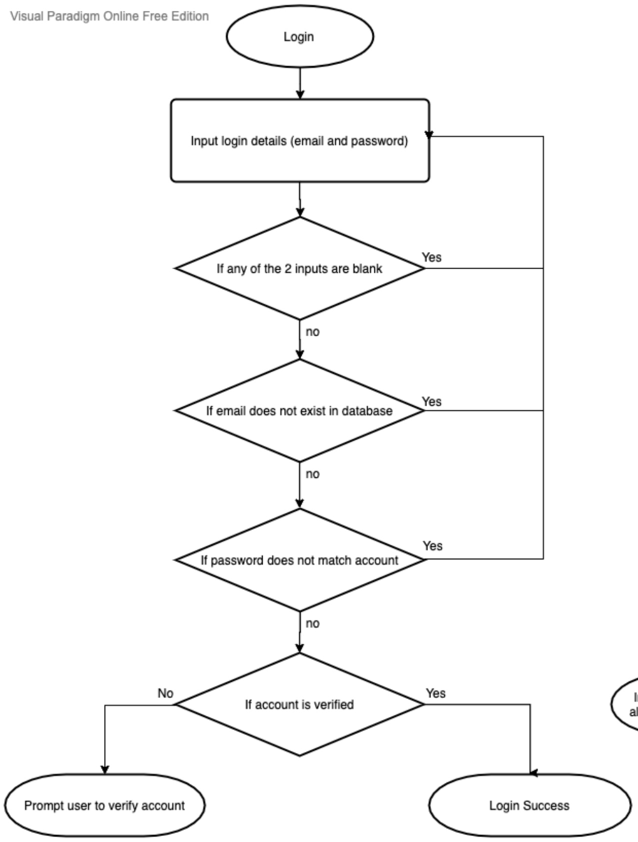
Scenario	Expected Result	Actual Result
User enters all required fields	Successful update of appointment and system redirects user to confirmAppointmentUI	Successful update of appointment and system redirects user to confirmAppointmentUI
User did not enter all required fields	Unsuccessful update of appointment and system prompts user to fill in all required fields	Unsuccessful update of appointment and system prompts user to fill in all required fields

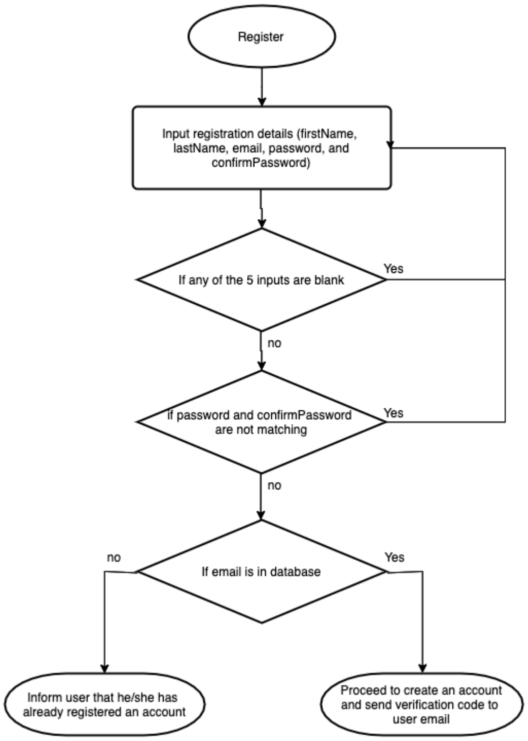
Clinic Name	Date	Time	Other Comments	Expected Result	Actual Result
Chen Family Clinic	Apr 2 2021	12:00	test	Success!	Success!
Chen Family Clinic	Apr 2 2021	Empty	test	Enter All Fields!	Enter All Fields!

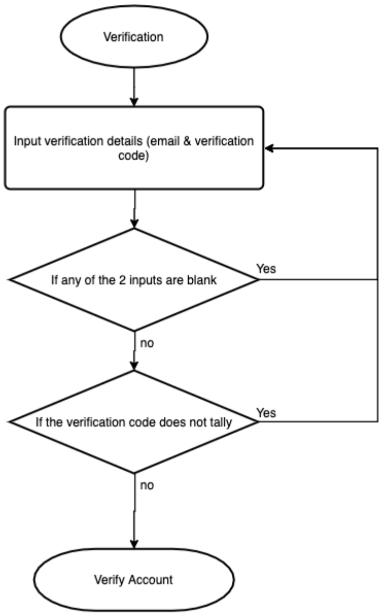
6.2 Black Box Testing Framework - Jest

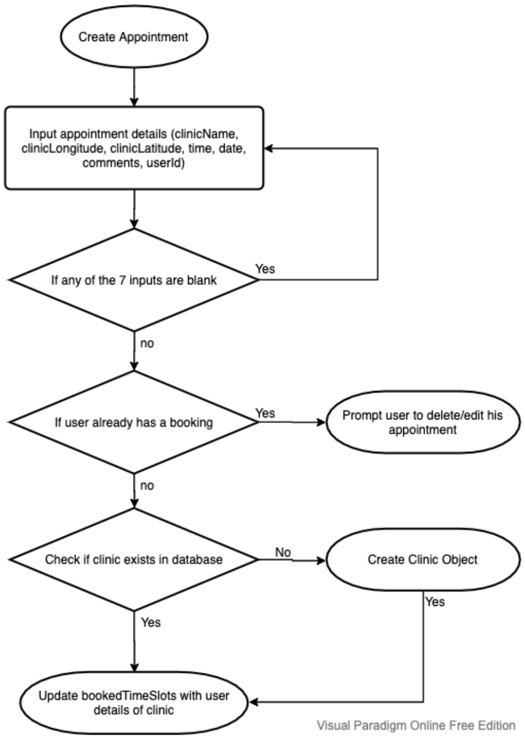
Since black box testing revolves around testing the functionalities of the applications without the knowledge of its internal structure, we wrote test cases using Jest, a frontend testing framework for React Native. Jest is the perfect tool to conduct black box testing given that frontend testing involves testing from the perspective of our end-users who most likely have no idea of the inner business logic of the application. We also used a plugin, Jest-stare, which generates a html report which organizes the details of all the test cases and its statuses everytime Jest is run.

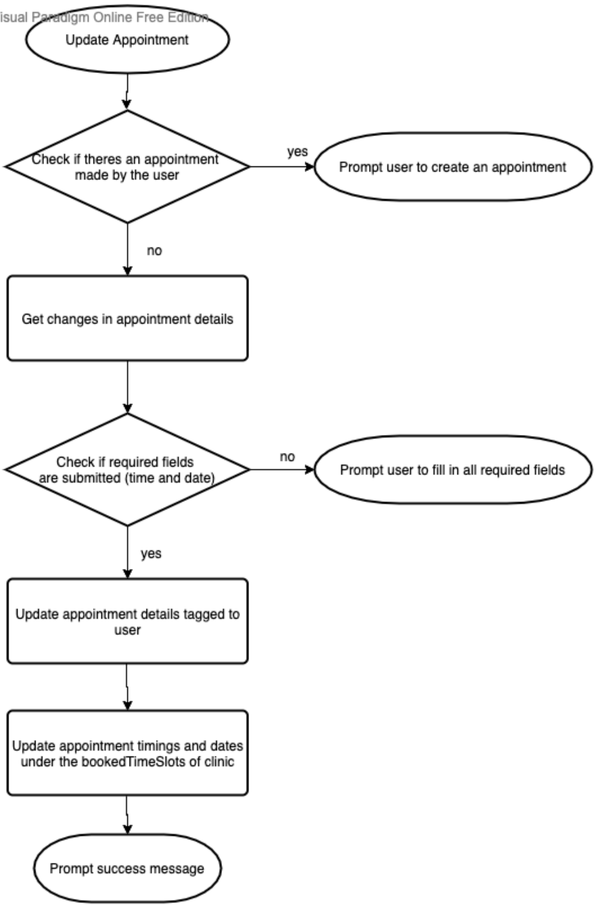
6.3 White Box Testing

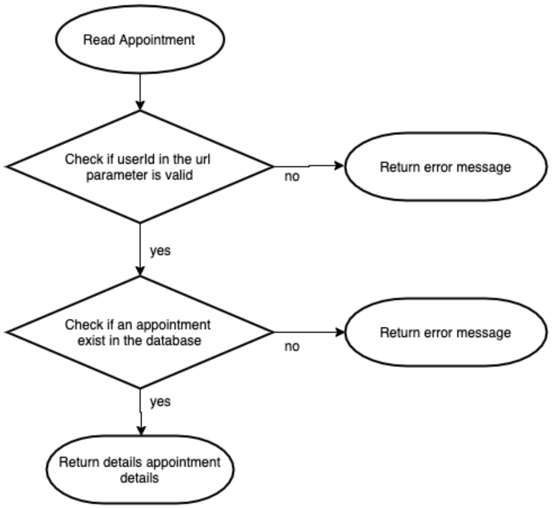

Login
Input login details (email and password)
If any of the 2 inputs are blank
Yes
no
If email does not exist in database
Yes
no
If password does not match account
Yes
no
If account is verified
No
Yes
Prompt user to verify account
Login Success

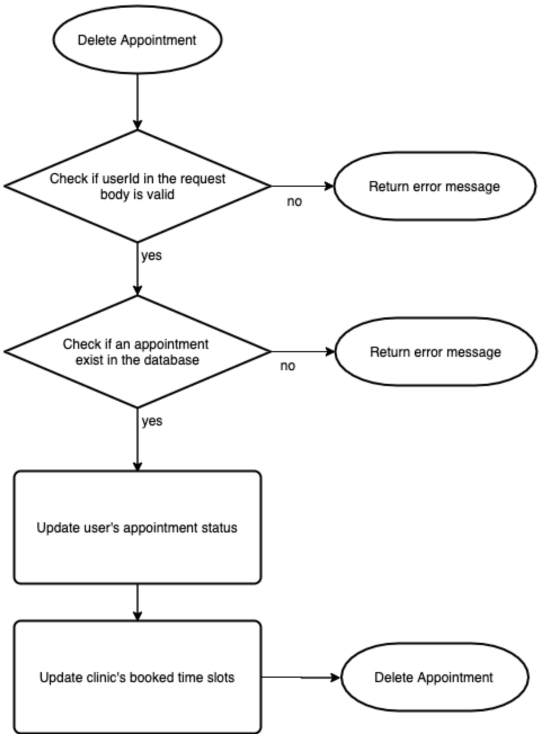

Register
Input registration details (firstName, lastName, email, password, and confirmPassword)
If any of the 5 inputs are blank
Yes
no
If password and confirmPassword are not matching
Yes
no
If email is in database
no
Yes
Inform user that he/she has already registered an account
Proceed to create an account and send verification code to user email

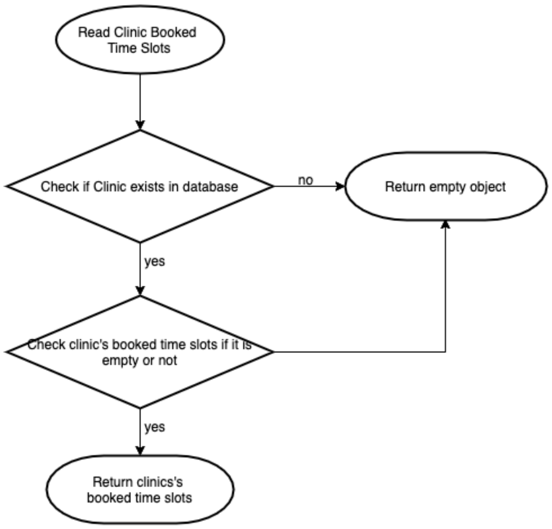

Verification
Input verification details (email & verification code)
If any of the 2 inputs are blank
Yes
no
If the verification code does not tally
Yes
no
Verify Account


Create Appointment
Input appointment details (clinicName, clinicLongitude, clinicLatitude, time, date, comments, userId)
If any of the 7 inputs are blank
Yes
no
If user already has a booking
Yes
Prompt user to delete/edit his appointment
no
Check if clinic exists in database
No
Create Clinic Object
Yes
Yes
Update bookedTimeSlots with user details of clinic


Update Appointment
Check if theres an appointment made by the user
yes
Prompt user to create an appointment
no
Get changes in appointment details
Check if required fields are submitted (time and date)
no
Prompt user to fill in all required fields
yes
Update appointment details tagged to user
Update appointment timings and dates under the bookedTimeSlots of clinic
Prompt success message


Read Appointment
Check if userId in the url parameter is valid
no
Return error message
yes
Check if an appointment exist in the database
no
Return error message
yes
Return details appointment details


Delete Appointment
Check if userId in the request body is valid
no
Return error message
yes
Check if an appointment exist in the database
no
Return error message
yes
Update user's appointment status
Update clinic's booked time slots
Delete Appointment

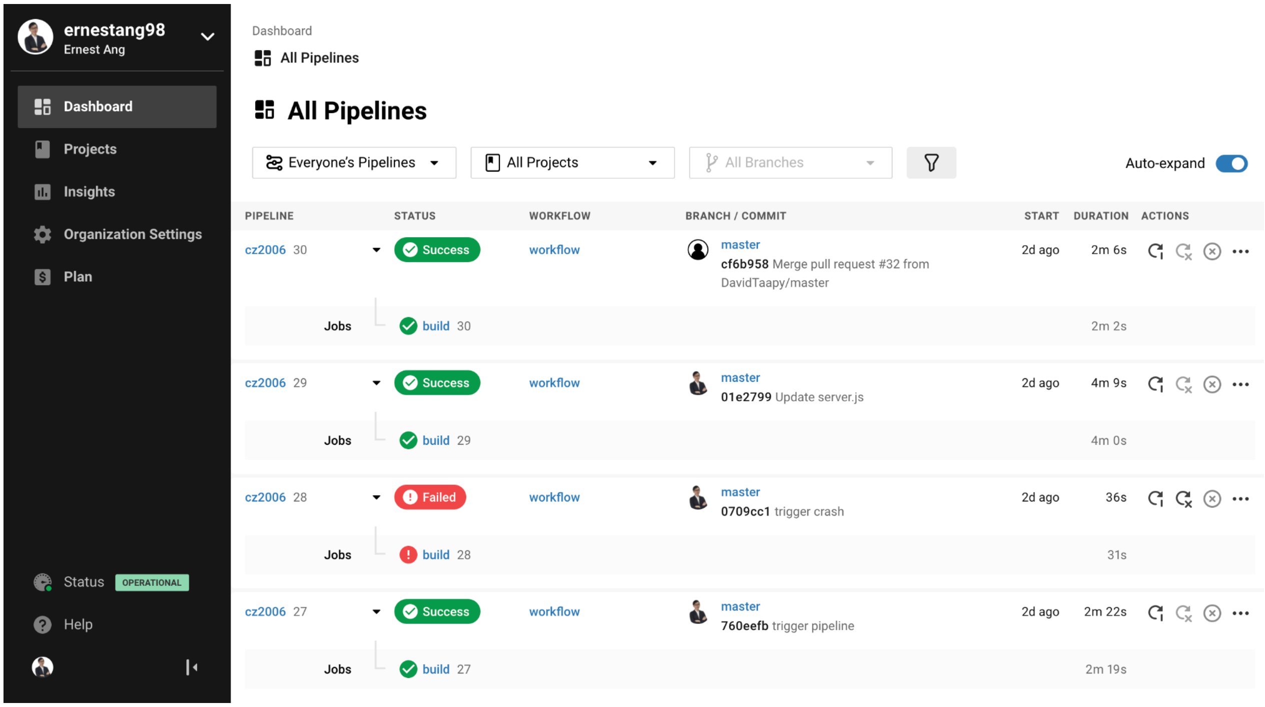

Read Clinic Booked Time Slots
Check if Clinic exists in database
no
Return empty object
yes
Check clinic's booked time slots if it is empty or not
yes
Return clinics's booked time slots

6.4 White Box Testing Framework - Mocha

Since white box testing revolves around testing the functionalities of the applications with the knowledge of its internal structure, we wrote test cases using Mocha, a backend testing framework which uses Chai, a Test Driven Development (TDD) and Behavior Driven Development (BDD) assertion library for Node.js. With Mocha, we are able to test our business logic layer thoroughly which is in charge of managing communications between the presentation layer which users interact with and the database layer or the APIs. Similar to our report generator plugin used with Jest, we leveraged on Mocha Awesome, a report generator plugin for Mocha which organizes all of the test cases and its statuses everytime Mocha is run.

6.5 Automated Testing with Continuous Integration (CI) Pipelines

Typically, after softwares are deployed into production on servers or hosting platforms such as Amazon Web Services or Heroku, developers that wish to integrate new features or perhaps commit new changes to fix any bugs surfaced by users would typically run the above mentioned test cases before integrating their code in order to have assurance that their changes will not affect any of the previous functionalities or cause crashes when these updates are pushed into production. CI pipelines can be constructed to aid developers to automatically run written test cases everytime commits are made. Our group used CircleCI to set up our CI pipeline and the building steps of our pipeline are configured using YAML files.



All Pipelines

PIPELINE	STATUS	WORKFLOW	BRANCH / COMMIT	START	DURATION	ACTIONS
cz2006 30	Success	workflow	master cf6b958 Merge pull request #32 from DavidTaapy/master	2d ago	2m 6s	
Jobs	build 30				2m 2s	
cz2006 29	Success	workflow	master 01e2799 Update server.js	2d ago	4m 9s	
Jobs	build 29				4m 0s	
cz2006 28	Failed	workflow	master 0709cc1 trigger crash	2d ago	36s	
Jobs	build 28				31s	
cz2006 27	Success	workflow	master 760eefb trigger pipeline	2d ago	2m 22s	
Jobs	build 27				2m 19s	

7 Appendix

7.1 Software Requirement Specification

7.2 Youtube Video Link For Demo

https://youtu.be/07jsQJjUuI8

Select 1080p for better quality