A Final Report
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Diagnostic Centre Client Management System

BY

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Introduction

The application aims at bridging the gap between the diagnostic centre and end-users. It is essential in today's world where technology is taking over most domains. The project requires rigorous planning so that the execution can be smooth.

End-users expect the security of their data while clients want the process to be faster and easier for them. Some competitors in this domain are MedLife, Alosan, EliHealthMR, DoctorLive365, etc. To set us apart from the competition, we are ensuring better security and easier navigation within the website. The website is going to be easy-to-use and will ensure maximum transparency between the clients & end-users.

The website has clear requirements from the end-users. However, the resources that will be received from the clients are not very clear. This is due to the privacy policy that varies for different diagnostic centres. Knowing this, a Waterfall approach or even the iterative approach could help to move this project forward. Initially, a Waterfall approach will be tested. Consequently, merging of Waterfall and Iterative approaches will take place.

The project will involve a hierarchical structure. The project has one leader who will ensure that the project is moving at a sensible pace and that deadlines are being met. The project team will be divided to ensure that work is done parallelly in order to finish the website faster. One team will take care of the client end while another will handle the end-users. The integration of both will be done towards the latter half of the project. Once the website is up and ready to run, it can be used indefinitely. However, there will be periodic updates which will be intimated to both the clients and end-users.

End-User Requirement Specifications

- Once the user visits the website, the user should be able to login to book/view/cancel their appointments. If the user does not have an account, then they should be able to register themselves.
- Once logged in, the user should be redirected to the home page. The user must be able to read the testimonials.
- The user selects his preferable location and chooses the diagnostic centre in that location.
- Then the user should be able to select the tests that are offered by the diagnostic centre.
- Then the user should be able to choose if they want the tests at home or at the centre. After this, they can choose the preferred time slot and the date (either Today, Tomorrow, Day After). And then book the slots.

  They should be able to choose more than one test.

- The user must be able to cancel the appointment they booked.
- After the cancellation, the user should be redirected back to the home page, where they can make/view/cancel appointments freshly.
- After giving the tests, the user should receive an email about the report.

Client Requirements

- There must be a unique admin account which allows only that person to sign in to the system.
- The registration must not be done manually, everything should happen very quickly using online forms.
- They should be able to upload the test name, type, price, schedule and turnaround time.
- Email must be sent to the user on a successful booking of appointment.

- The report must be generated and uploaded using only selection, no form of manual typing will be preferred.
- No one other than the admin must be allowed to upload the report and that must be ensured in some manner of authentication.
- The report must be emailed to the end-user with a message.

Software Requirements

- Test Selection: The system shall allow users to search for and select tests based on preferences they enter.
- Slot Addition: The system shall allow users to choose a slot.
- Book Appointments: The system shall allow the user to finally book an appointment
- Verification Information: The system shall provide verification information for hospitals, diagnostic centres and patients.
- Payment Portal: The system shall allow a user to make a payment
- Reports: The system should allow the user to see and download reports.
- View Centres: The system shall allow the end-user to view all the clients that are part of this system.
- Doctor Verification: The system shall allow the end-user to view which doctor from which diagnostic centre has signed off on the report.
- History: The system shall allow the user & client to see the history of appointments that have been booked.
- Rating: The system shall allow the user to rate the diagnostic centre from where the test was taken. This rating will, later, affect the diagnostic centre's popularity.
- Escalation: The system will provide contact numbers that will allow the end-user to escalate emergency issues to higher authorities that are beyond the Medilab Team.
- Analysis:
    a. The system shall allow the user to choose the centre with most reliable cost or best rating for that test.
    b. Patient recommendations will boost/deteriorate the rating.

c. The system will recommend centres depending on the location of the user.

Hardware Requirements

Minimum Hardware Requirements:

a. CPU - 830MHz
b. Internal Memory - 32 MB
c. Cache - 16 KB
d. RAM - 16 MB

Preferred Hardware Requirements:

e. CPU - 1GHz
f. Internal Memory - 64 MB
g. Cache - 32 KB
h. RAM - 32 MB

Non-functional Requirements

Performance Requirements

This quality attribute describes the responsiveness of the system to various user interactions with it.

The performance requirements of this project are:

- The front-page load time must not be longer than 2secs for people using the website with LTE connection.
- The application must load within 5 secs for people using a 3G or 2G network.

- The system should have a higher throughput performance to perform a large number of transactions (up to 10) within 30 secs.
- The application can support up to 1000 customers.
- The application must handle the incoming requests appropriately varying with time such as in typical hours or peak hours.
- The application will be available 24/7 for 365 days in any calendar year.
- Upon submitting a request for creating a new user profile, the profile shall be created within 2 seconds (+/- 0.5 seconds).
- The application shall transmit data at 9600 bits/second.

Safety Requirements

If there is extensive damage to a wide portion of the database due to catastrophic failure, such as a disk crash, the recovery method restores a past copy of the database that was backed up to archival storage (typically tape) and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backed-up log, up to the time of failure.

We follow IEC 61511 / ISA-84-00.01

Security Requirements

User Authentication Requirements:

- The user is required to login with a username and password.
- The password and the username given to the user must be kept confidentially by the user and must not be shared with anyone at any cost.
- The user will be prompted by the system to change the password once every three months to a new password that hasn't been used in the last 9 months.
- Unsuccessful attempts must be logged.
- More than three unsuccessful login attempts must be alerted to the user.

- In case of a forgotten password, the new password will be sent to the registered mail-id of the user.

Information Security Requirements:

- Vendors must choose their database partner carefully.
- The passwords and the medical records of the user is stored in encrypted form in our database.
- Access permissions for particular system information must be changed by system's data administrator.

System Security Requirements:

- Suspicious activities like a sudden and unexpected surge in the number of requests will be logged.
- Intrusion detection and prevention is employed to check for malicious attacks on the system.
- Firewalls and anti-virus software must be installed in the systems used by the client.

Project Organisation

The development of project will require an iterative model with continuous phases of development followed by phase-by-phase testing, with a window to accept new requirements, if any are required.

The project will move through the following personnel in the order given:

a. Requirement Manager and Analyser:
   - Responsible for eliciting all requirements, and verifying that software developed is aligned with the requirements specified initially.

b. Project Manager/Lead:
   - Oversee all aspects of the project including backend and frontend development.

c. Software Developers:
   - Responsible for setting up and maintaining the database, and managing all code for communication between the front end and the database.

d. Front-End Developers:
   - Responsible for developing the user interface for the product.

e. Tester:
   - Responsible for stress-testing the product and identifying any bugs/faults in the product development phases.

Risk Analysis

The possible risks that may be faced during the course of the project:

Process Risks:
- Taking a lot of time to reach the market
- Schedule overruns
- Market Risks
- Disaster (Natural Calamity) Risks

Product Risks:
- Low product quality
- Process overruns

Miscellaneous Risks:
- Experienced staff leaving the project and new staff coming in.
- Change in organizational management.
- Requirement change or misinterpreting the requirement.
- Under-estimation of required time and resources.
- Technological changes

- Business competition.

To manage and reduce this risk we take the following steps:

- Risk Avoidance: We store all our user data in highly secure databases making it highly difficult for hackers to gain access to sensitive healthcare data.

- Risk Mitigation: We store the passwords of our customers by using secure encryption techniques.
- Transfer of Risks: Errors and omissions insurance taken to protect the company from lawsuits.
- Loss Reduction: We have consulted with Health Administration and public health department to make sure all our policies are compliant with law enforcement authorities. These laws by default are meant to reduce losses in case of breaches.

Work Breakdown

The project development team have each been assigned responsibilities. At certain phases of development, the clear demarcation of responsibilities may disappear, if necessary, to keep the project development up to speed with the decided project schedule.

1. Preeti Agrawal
    a. Project Plan
    b. Design & Architecture
    c. Implementation of upload report module

2. Prerana Jayakumar
    a. Project Plan
    b. Software Architecture
    c. Integration of back-end to front-end on the end-user side
    d. Implementation of filtering by location module
    e. Implementation of filtering by centre module

3. Priya Nayak
    a. Project Plan
    b. Software Architecture
    c. System Requirement Specifications

d. Integration of back-end to front-end on the client side
e. Verification using OTP and sendEmail module

4. Rachana Aithal
    a. Project Plan
    b. Design and Architecture
    c. Implementation of upload schedule module

5. Rhiya Ramesh
    a. Project Plan
    b. Software Architecture and Organisation structure
    c. Implementation of filtering by test module
    d. Implementation of booking module
    e. Implementation of Cancelation module
    f. Implementation of Viewing module

6. Rhythm Girdhar
    a. Project plan
    b. Design and Architecture
    c. Front-end development
    d. Implementation of Login and Register modules

High Level Design

End-User Process

- The users can login/register to the website.
- The user can filter based on tests or based on their location. If the user decides to filter by test, he is given a list of tests to choose from. Once he chooses the test all the centres get displayed to him. He must choose the centre, the timeslot and if he wants to get the test done at home or at the diagnostic centre. On submitting all this an appointment is booked and the user receives a confirmation email.
- If he decides to filter by location, he can enter the location of his preference and all the diagnostic centres close to that location will be displayed. He must choose the centre, the test, the timeslot and if he wants to get the test done at home or at the diagnostic centre. On submitting all this an appointment is booked and the user receives a confirmation email.

Client Process

- The diagnostic centres are able to register or login themselves as the clients.
- The centres are responsible for uploading the schedule and for uploading the reports.
- While uploading the schedule, they select tests, the days for example today, tomorrow, the day after, then the time-slots and the capacity of people either at home and/or diagnostic centre. And the cost of each of the tests are retrieved from the database. And the schedule is uploaded by the client.
- To upload the report, the client filters the reports based on tests, and then by the names of the people who took those tests.
- On submitting the confirmation appears where the Name of the patient, their age and the test they chose are displayed. The client attaches the particular report of the patient and uploads the report.
- On clicking upload report button, an OTP is generated and sent to the client representative of the particular diagnostic centre, once the client is verified, he can email the report to the patient.

Modules Implemented

Login Module

Name: Login

Participating actor: Existing users

Entry conditions: User should enter correct email and password

Exit condition: Either the user is valid or invalid

Booking Module

Name: Booking appointment

Participating actor: New or old users

Entry conditions: User should have logged in.

Exit condition: User gets a booking confirmation email.

Flow of events:

The user logs in using the email-id and password.

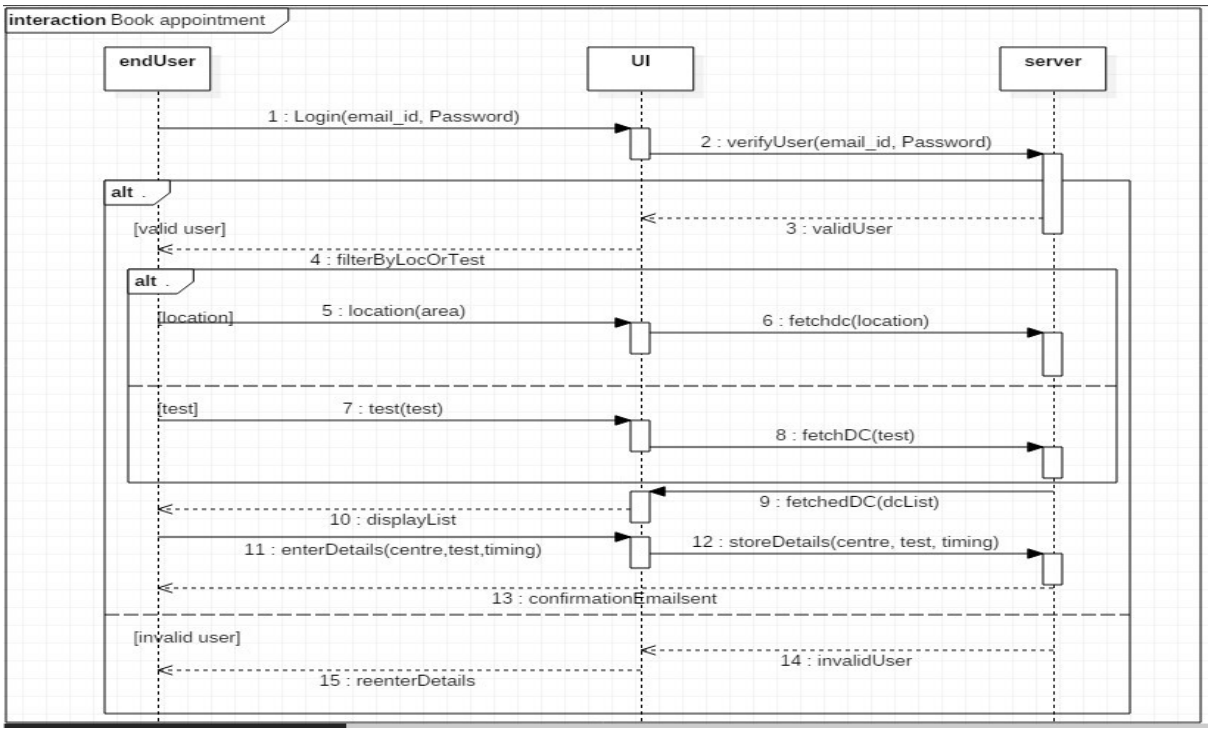
The user enters the details using the following template.

He selects the tests, timings location.

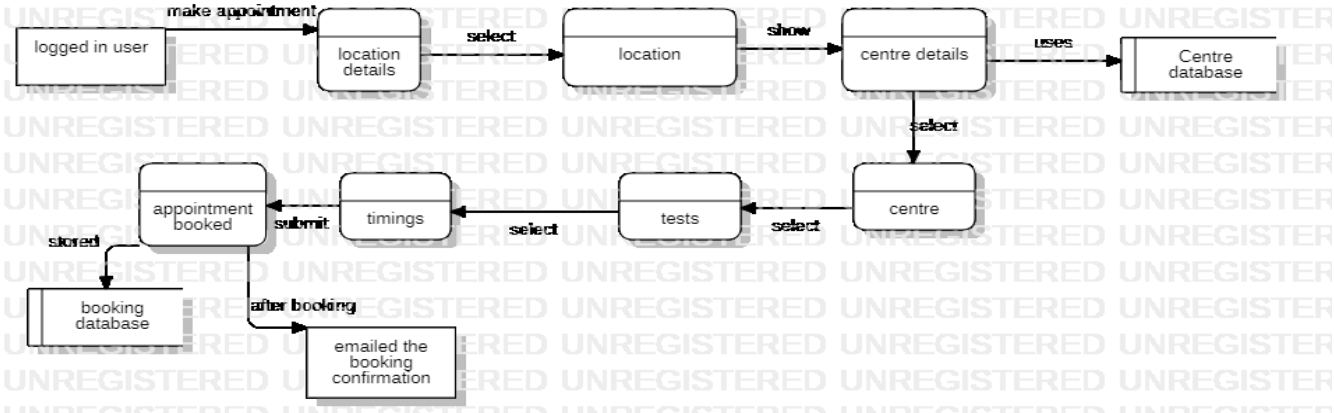
The user then books an appointment.

The user receives an email on booking confirmation.

Sequence Diagram –



Data Flow Diagram –



Viewing module

Name: View Appointments

Participating actor: Diagnostic centre

Entry conditions: The centre should have logged in.

Exit conditions: The report via email is sent to the user/patient.

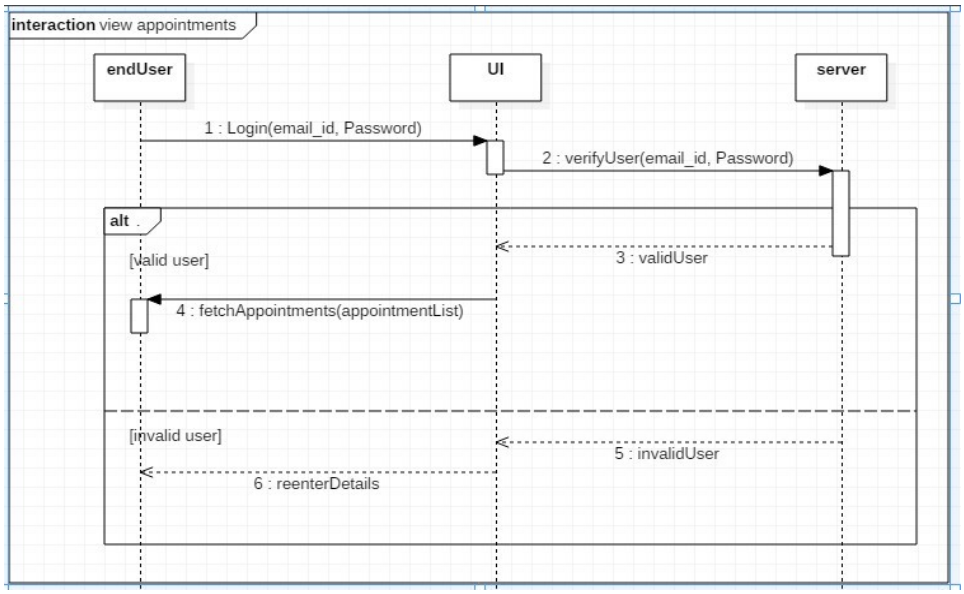
Flow of events:

The user logs in using the email-id and password.

The user views his appointments on clicking view appointment button.

All the up-coming appointments of the user are displayed.

Sequence Diagram –



Data Flow Diagram –

Report Module

Name: Upload Report

Participating actor: Diagnostic centre

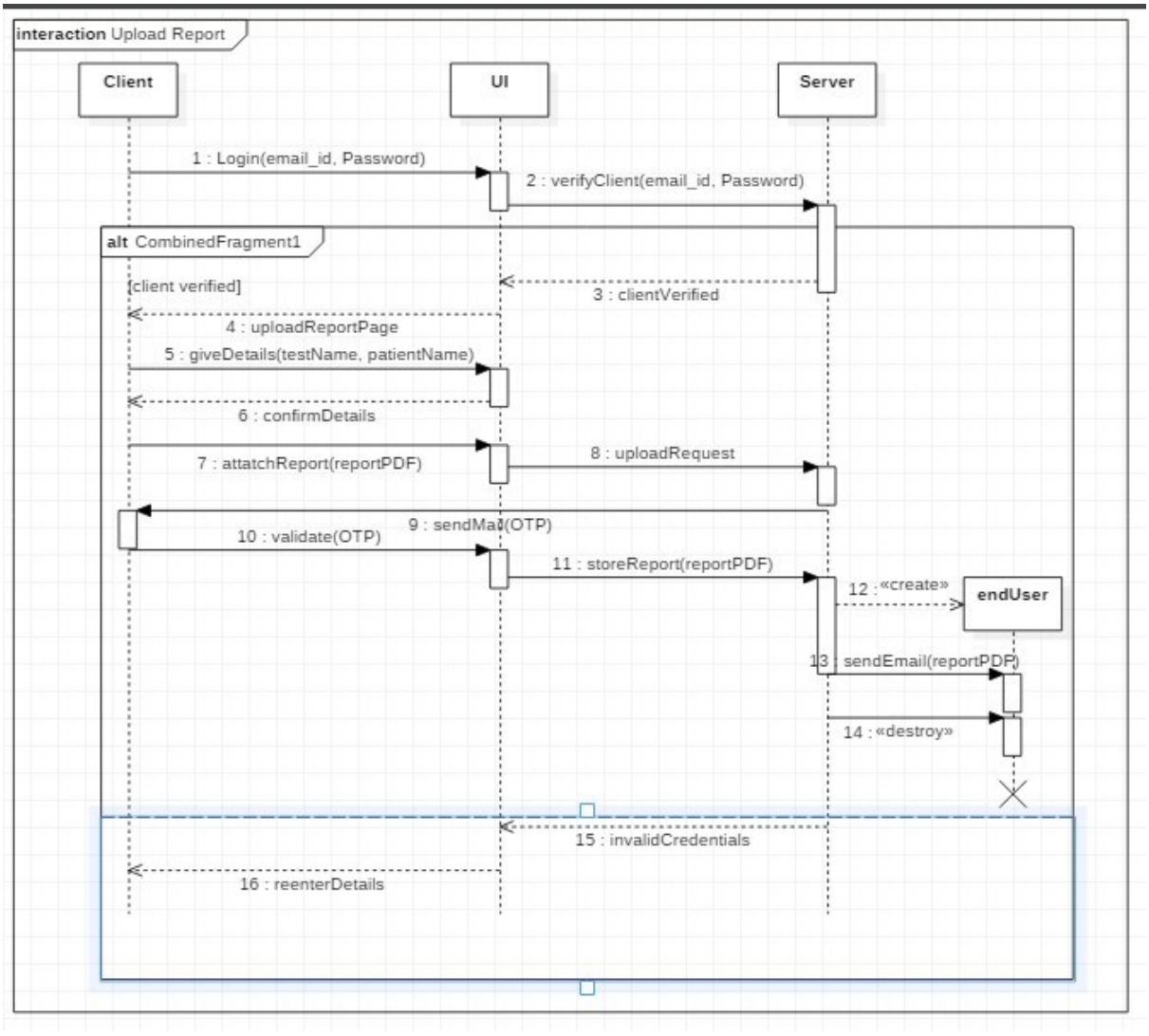
Entry conditions: The centre should have logged in.

Exit conditions: The report via email is sent to the user/patient.

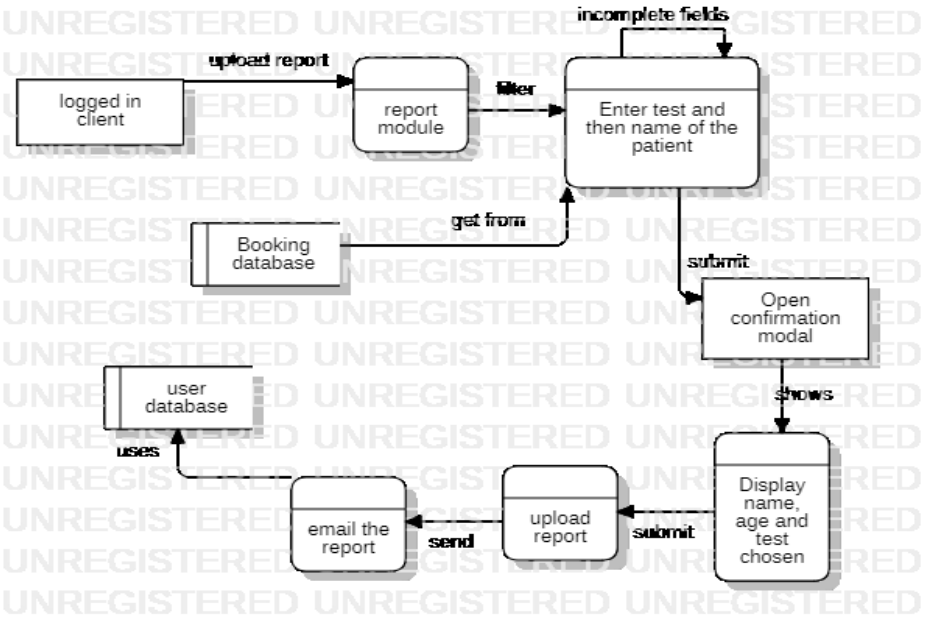
Flow of events:

- The client logs in
- He enters the test and the customer name
- An email is sent to the diagnostic centre client representative with an OTP to make sure only the authorized person can upload the report
- Once the client is verified, he is allowed to upload the report
- The report is mailed to the respective user.

Sequence Diagram –



Data Flow Diagram –



Feedback Module

1. A feedback is asked from each user after completion of the appointment.
2. The feedback from each user is sent to client via a third-party mail application.

Upload schedule

Name: Upload schedule

Participating actor: Diagnostic centre

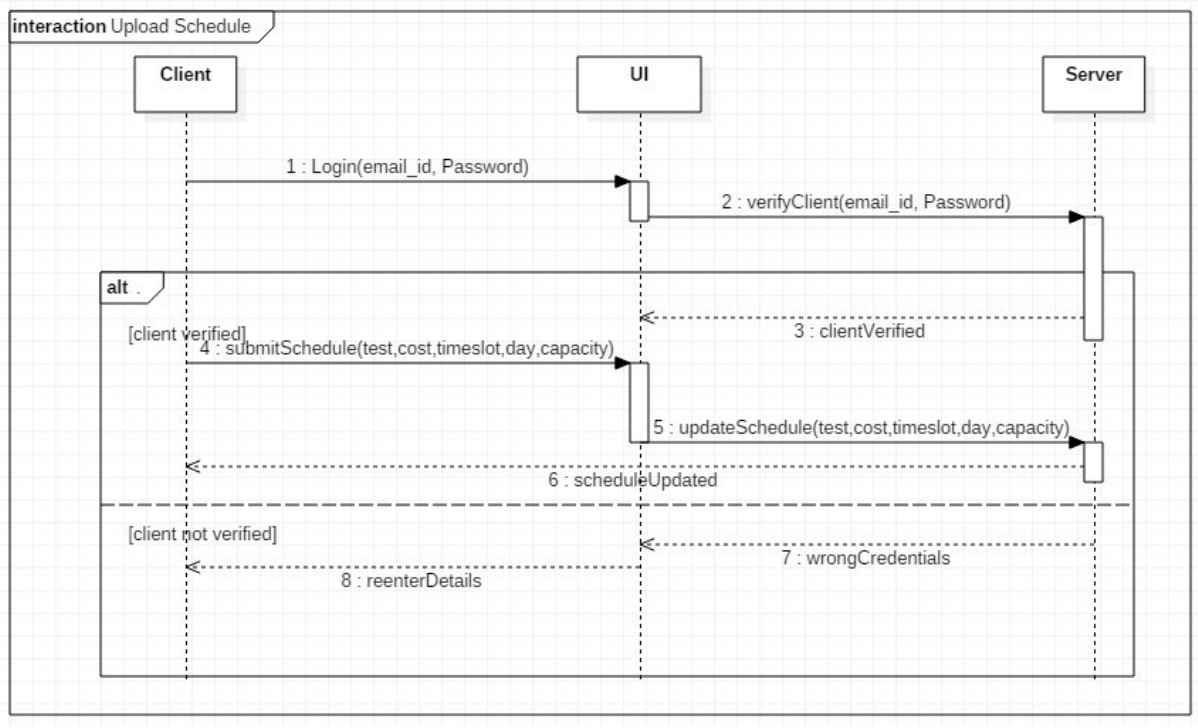
Entry conditions: The centre should have logged in.

Exit conditions: The details (test name, capacity, timeslot etc.) must be submitted after entering.

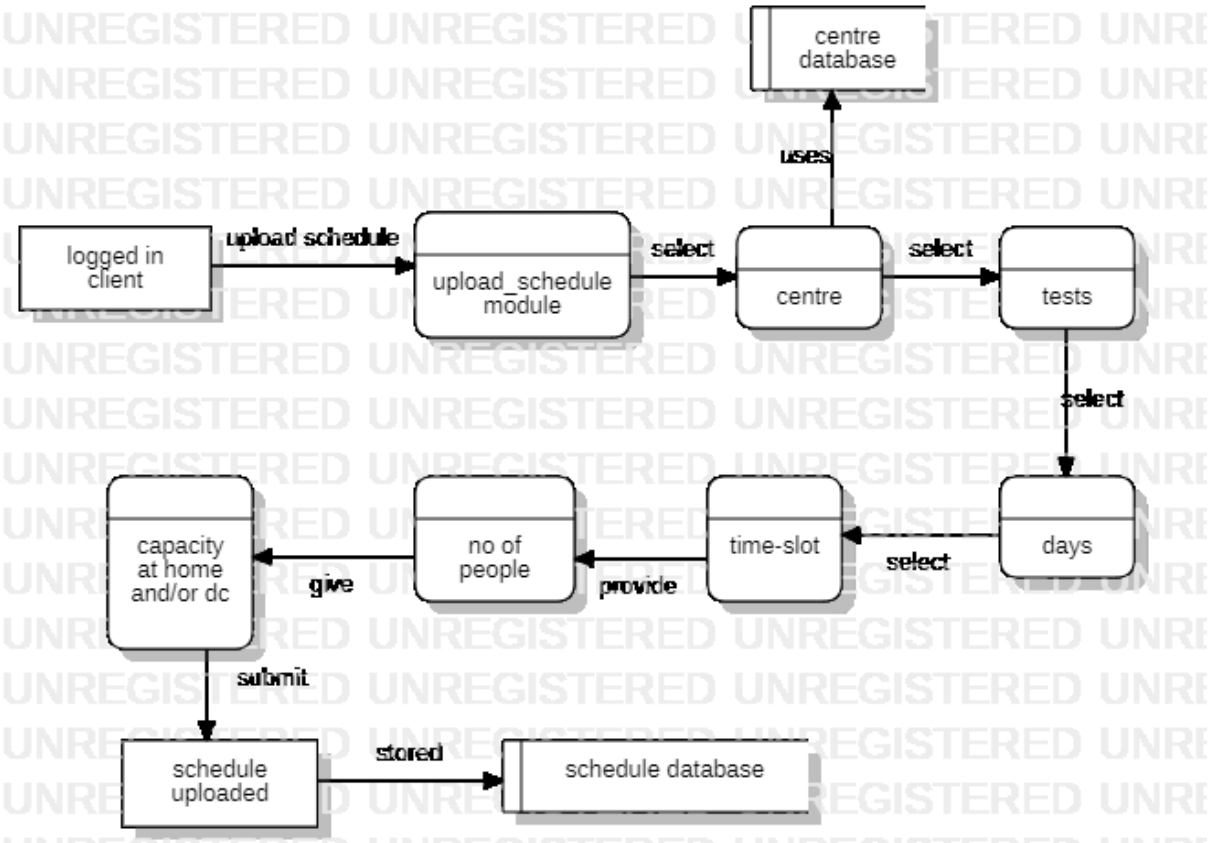
Flow of Events:

- The client logs in using the issued email-id and password.
- He enters the details in the provided template.
- To add a new test, he clicks on Add Row
- After entering the schedule, he clicks on the submit button.

Sequence Diagram –



Data Flow Diagram –



Detailed Design

System Overview

This SDS will cover the software for Diagnostic Centre Client Management.
The tool will help end users(patients) book appointments for conducting medical tests with our clients (diagnostic centres). These tests can be scheduled to be conducted at the centre or at home.

End User Mode:

The end-user will be able to login and key in the location manually or allow the application to automatically detect the user's location.

Once logged in the user will be able to view all the diagnostic centre in and around the area and the tests available in each of them.

On choosing the diagnostics centre and the test, depending on test the user will either be allowed to take it up at home or schedule an appointment.

The end-user will be given the option of either paying by cash or card.

If he chooses the latter, he will be guided to a payment gateway and a bill will be generated.
The user will be allowed to cancel or reschedule the appointment, given he does so 12 hours in advance.

Client Mode:

The client is provided a template. He creates the schedule based on this template and is allowed to upload it using the application.

The schedule for the current day, the next day and the day after is made visible to the client and the user.

The client will be able to upload the report onto the application.

Design Considerations

Assumptions and Dependencies

- Resources:
    - The client will have a set of employees who have been trained to use our system
- Budget:
    - Project costs will stay the same as initially budgeted costs
    - Training will be conducted internally with no additional training costs incurred
- Finances:
    - Funding for licenses will be provided by various departments as needed
- Scope:
    - Project scope will not change once the stakeholders sign off on the scope statement
- Operational
    - The webpage must be allowed to access the location in order to accurately search for the diagnostic centres nearby.

General Constraints

- Platform:
  - must work on Macintosh and PC
- Operating system:
  - for Macintosh: must have OS X.4
  - for PC: must have at least Windows 8 or above
- Hardware:
  - at least 128 MB of RAM
  - minimum 800x600 screen resolution with 256 colours

Goals and Guidelines

- The Diagnostic Centre for Client Management focuses on developing and supporting healthcare software solutions.
- It aims to be the first choice of doctors, hospitals and the patients looking forward to a one-point solution for healthcare software services which are delivered through efficient use of knowledge and technology.
- Our goal is to digitize the healthcare industry which will help the doctors, hospitals and the patients, by maintaining all activities that an onsite diagnostic centre performs like collecting samples, performing tests, preparing reports, collection of amounts etc.
- This Diagnostic centre for client management software can be used for the automation of any medical diagnostic centre.
- It also aims to provide an easy and user-friendly GUI to help its end users use the services effortlessly and quickly.

Development Methods

The software development method used for this project is the V model which stands for validation and verification model. In this method each phase of software development life cycle starts after the completion of earlier phase.
In this method both the test and development of the software starts in parallel so as to avoid the downward flow of defects.

Product – the end-to-end flow of the application is smooth leading to a high degree of certainty.
Process – the development and testing can be done simultaneously because of the number of independent modules. Therefore, the degree of certainty is quite high.

Resource – since the resources required, vary from client to client, the degree of certainty is relatively low.
From the above points, it can be concluded that the V model will be apt for the project.

Architectural Strategies

Overview

In a three-tier architecture the data access, computer data storage, functional process logic and user interface are developed and maintained as independent modules. Modularising different tiers of an application gives development teams the ability to develop and enhance a product with greater speed.

The system will follow the three-tier architectural style and be organized into three layers: the interface layer, application layer and the storage layer. The interface layer will be a graphical user interface that allows users to interact with the system. It will be implemented using the Python and Flask framework, and will allow the users to add tests, book slots, show tests, display report and download reports.

The application layer will contain the logic and rules for storing data in the database layer and also retrieving it in accordance with the user's needs. This is the layer that will contain the data file parsers and will allow controlled access to the data files. Finally, the storage layer will store the metadata required for the system.

Rationale

The three-tier architecture style shall be used because it not only separates the user interface and the metadata, but also provides an application logic layer. The application layer provides a middle layer that allows the data files and the GUI components to be loosely coupled.

The application layer has to be modified if there are any changes to the format of the data files and the interface layer will need little or no modification. This will make it easy for clients of this software to modify the data file format and attributes for further research purposes if they wish to do so. This layer makes the

system more maintainable and reusable and also hides the complexity of processing data from the users.

Testing Plan

Scenario 1:

Navigate to the Landing Page.
Click on the "Login as Diagnostic Centre" button

a. Login with the right credentials –
   Expected Observation – navigated to Home Page of Diagnostic Centre. You are able to view the name of the Diagnostic Centre associated with the credentials.

b. Login with incorrect credentials –
   Expected Observation – page is reloaded and *Invalid Credentials* error is shown to the user.

Scenario 2:

Navigate to the Landing Page.
Click on the "Login as User" button

a. Login with the right credentials –
   Expected Observation – navigated to Home Page of User. You are able to view your name in the navigation bar.

b. Login with incorrect credentials –
   Expected Observation – page is reloaded and *Invalid Credentials* error is shown to the user.

In case user/client is not registered, *"Register"* button must navigate to Register Page and right credentials must be entered to gain access to the respective portal.

Scenario 3:

After logging in as client, upload Schedule.

a. Right data is fed in and in the right order (Today, Tomorrow, Day-After)
   On clicking "Add Row", an alert pops up "Successfully Added <Test Name>"
b. Wrong Data fed in and order is mixed up
   On clicking "Add Row", an alert pops up "Order is incorrect. Upload schedule again."

The schedule MUST be updated for 3 days. Any other input from the user **must** trigger an error in the UI.

Scenario 4:

After logging in as client, upload Report.

a. Select the test –
   Tests according to the diagnostic centre must be shown.
b. Select the patient –
   Patients who have taken that test must be shown.
c. Modal Opens and correct client information is displayed in the Modal.
d. OTP must be asked every time a report has to be uploaded.
e. Once email is sent successfully, "Email Sent Successfully!" alert is shown.
f. Else, "Couldn't send email. Try again!" alert is shown.

User Validation must be done in order to ensure that the right report is sent to the right end-user.

Scenario 5:

Navigate to the user's home page.
Clicking *"Make an Appointment"* or *"View My Appointments"* or *"Sign In"* buttons must take you to the Login Page.
On successful login,

a. Make an Appointment –
   Location, Centre, Test, and Timeslots must be shown according to the database with no discrepancies.

   Booking confirmation must send an email to the end-user with details of the test and diagnostic centre. Date of the test must also be included.
b. View My Appointments –
   Must display in a tabular fashion, all the appointments that have been made for that user.

Cancellation is allowed only **up to 18 hours prior to booking.** Appropriate alerts ("Appointment can't/can be cancelled") must be displayed on the UI.

User Document

Purpose

The purpose of this user document is to guide the users through the booking process. This includes searching for centres, viewing and filtering tests, etc.

Selecting Tests

A user once logged in, can search for a centre that provides the required test. This can be done by searching for the tests provided by a specific centre based on location or by a test directly.

After selecting the centre, one can see the tests cost, available slots and whether it can be done at home or not.

From there you can either book an appointment or continue searching. On selecting the slot and clicking the “book” button, the user is asked for payment option and redirected to payment gateway if necessary.

Post booking

After booking, the user is directed to home page to view upcoming appointments. The user can then cancel an appointment by clicking on the cancel button next to that appointment. If there are at least 18 hours left prior to appointment, the appointment is cancelled. Otherwise the user is informed that it can’t be cancelled.

Client document

Purpose

The purpose of this user document is to guide the client users through the right process. This includes uploading schedules, reports etc.

Uploading Schedule

Once a client has logged in, the client can upload schedule for the next 72hours by a self-explanatory table. This has to be updated every 72 hours in case of any changes in the schedule.

Uploading Report

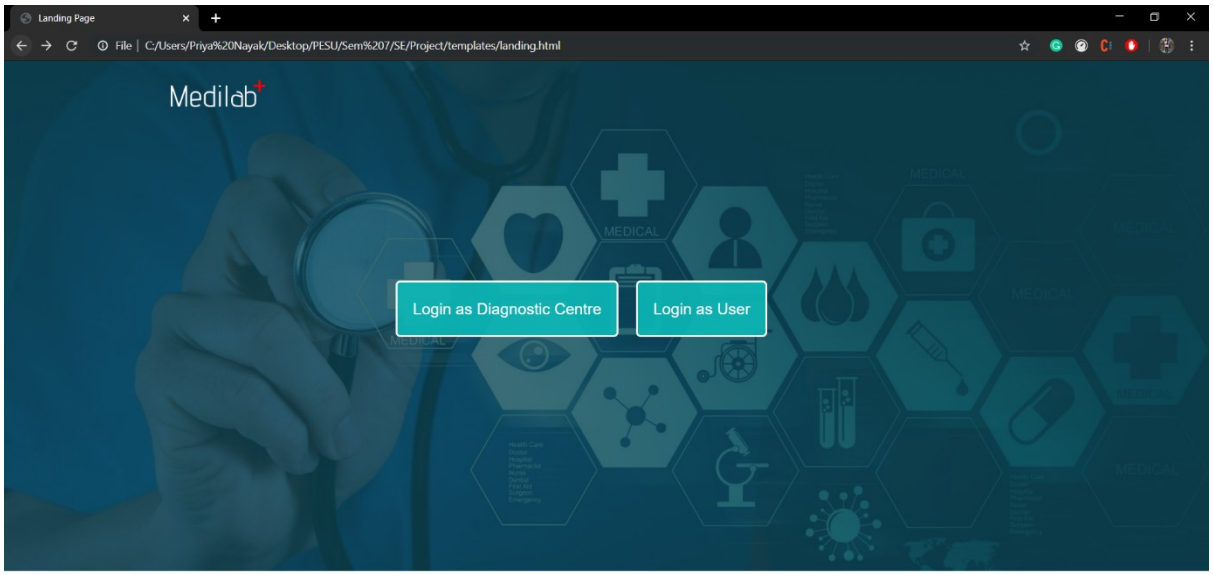
The reports of each patient can be uploaded by a single representative of the diagnostic centre. The report asks for OTP which is sent to the representative's mail id. This has to be filled while uploading the report to ensure confidentiality. Only on matching with the OTP, the client can upload the report which is sent to the patient on uploading.

Viewing feedback

The client can view feedback from various patients(users) about their service and centre by clicking on the view feedback button which redirects to feedback section.

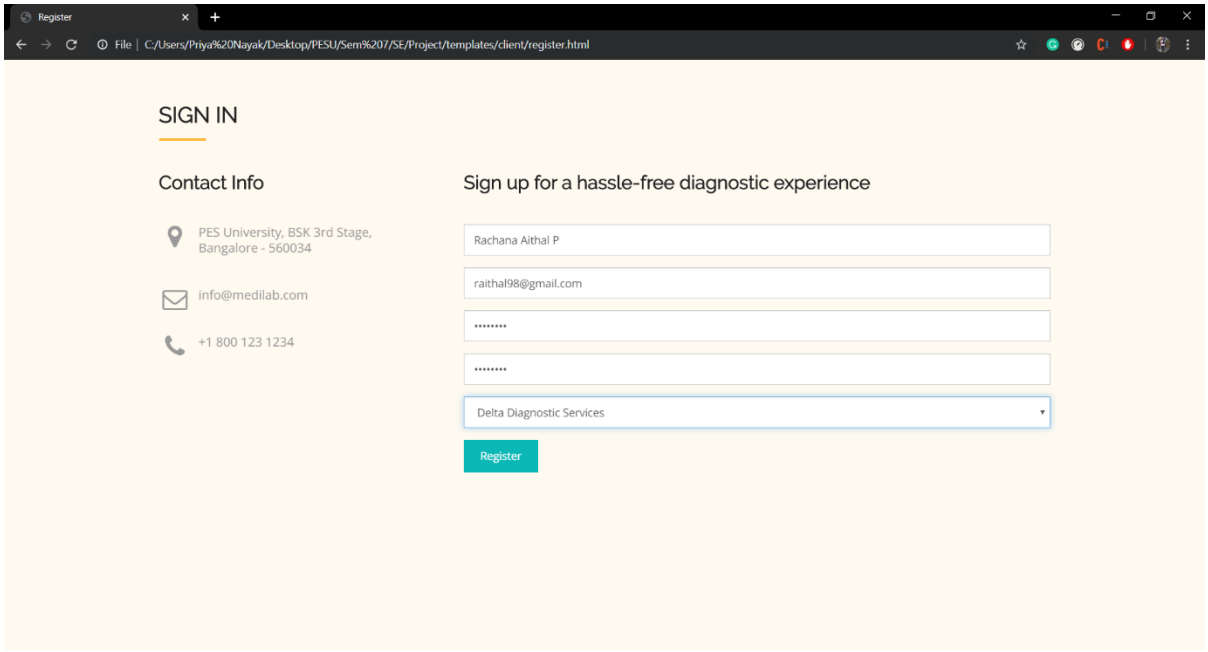
Screenshots

Landing Page –

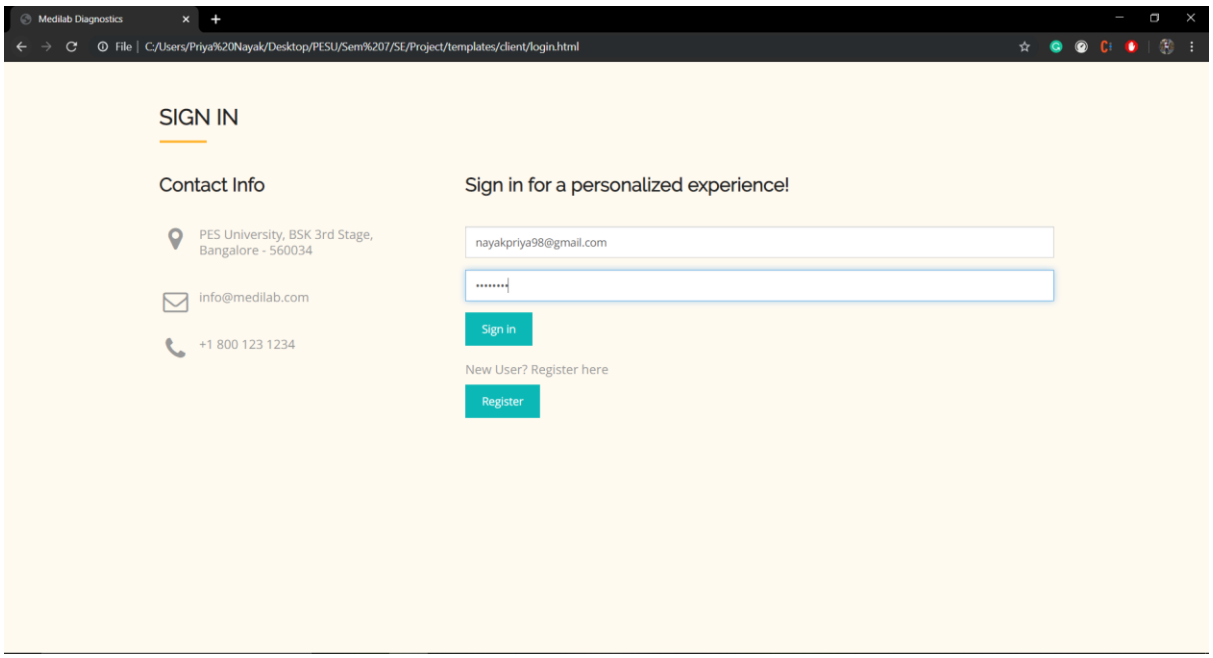


Client –

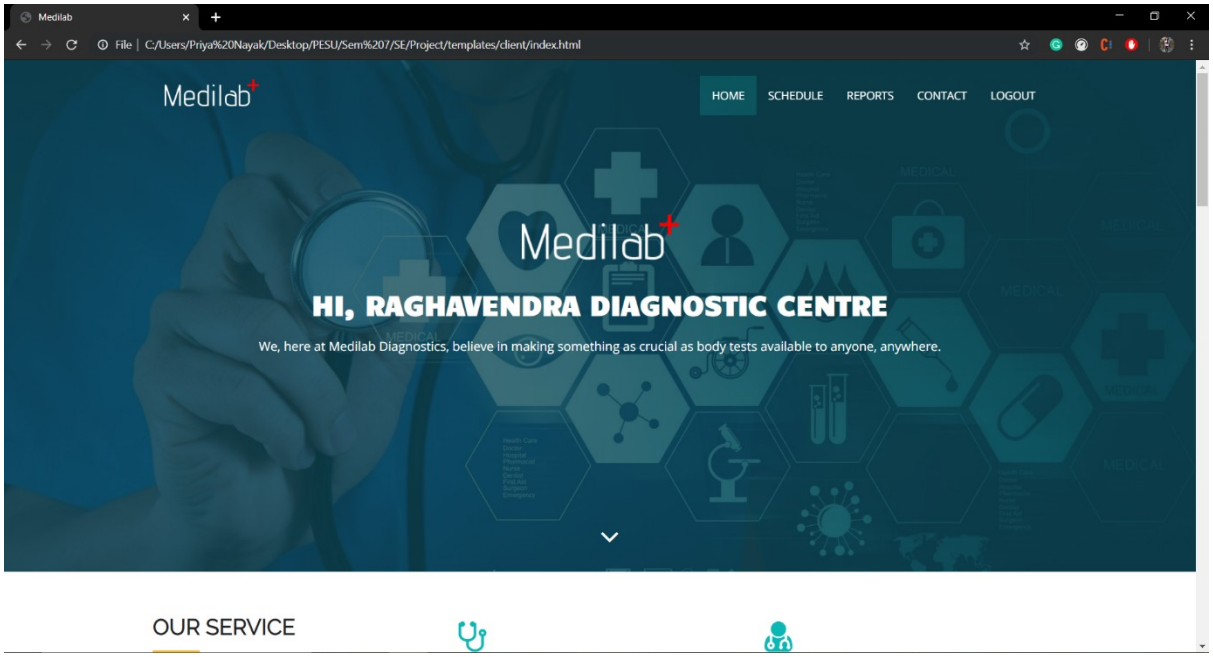
a. Register



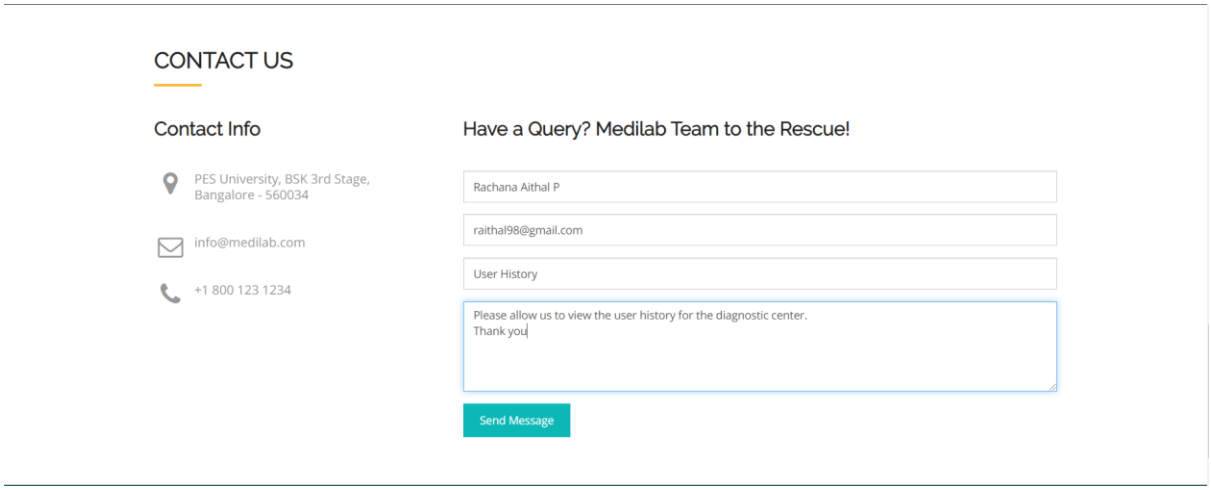
b. Login



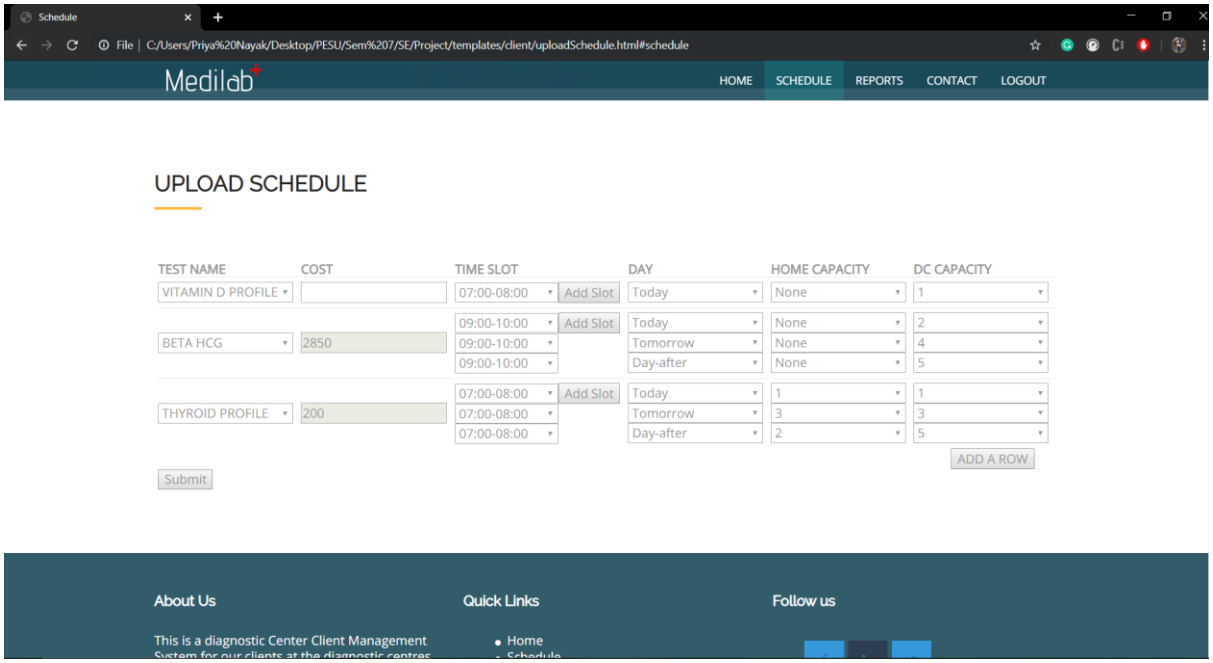
c. Home Page



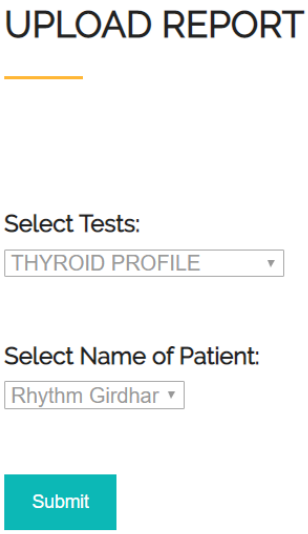
d. Feedback



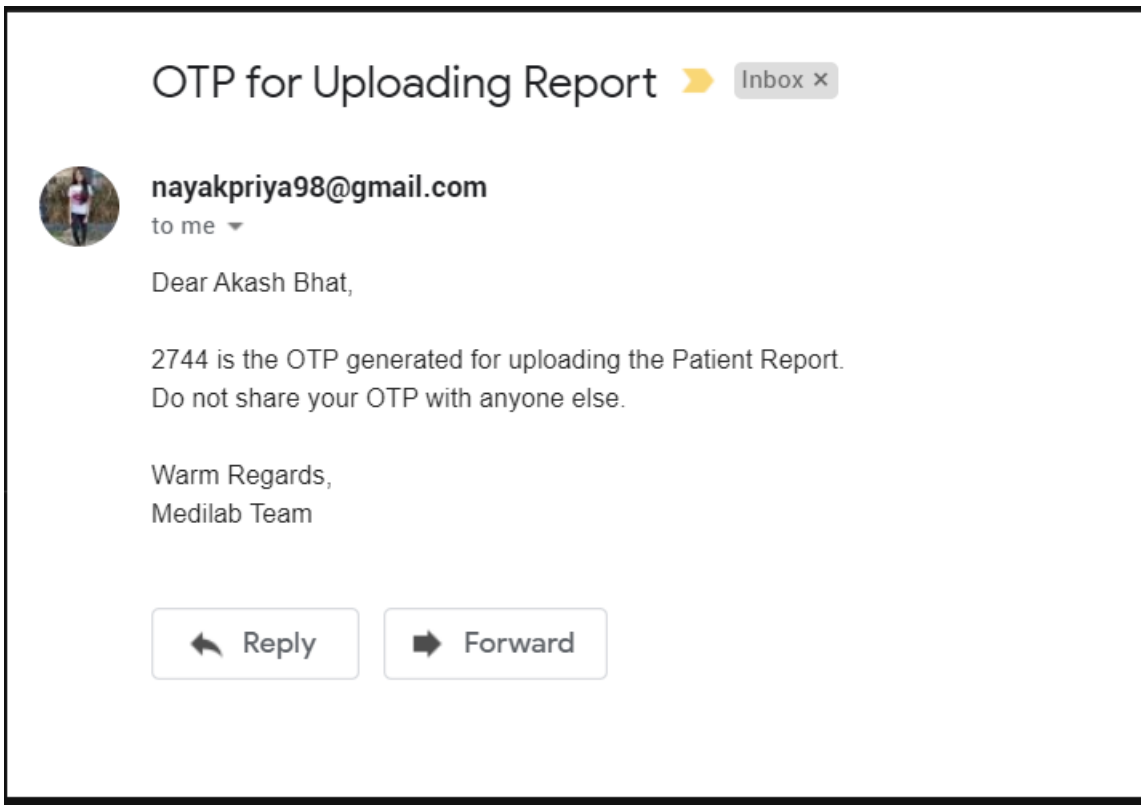
e. Schedule Uploaded



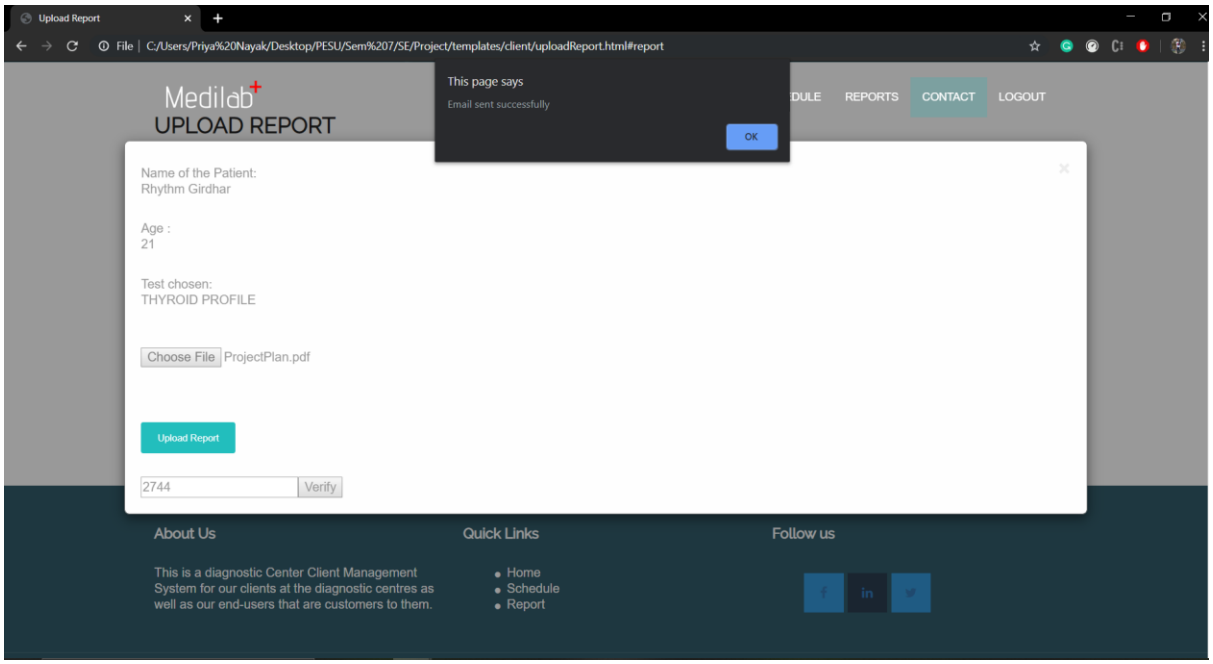
f. Report Uploaded



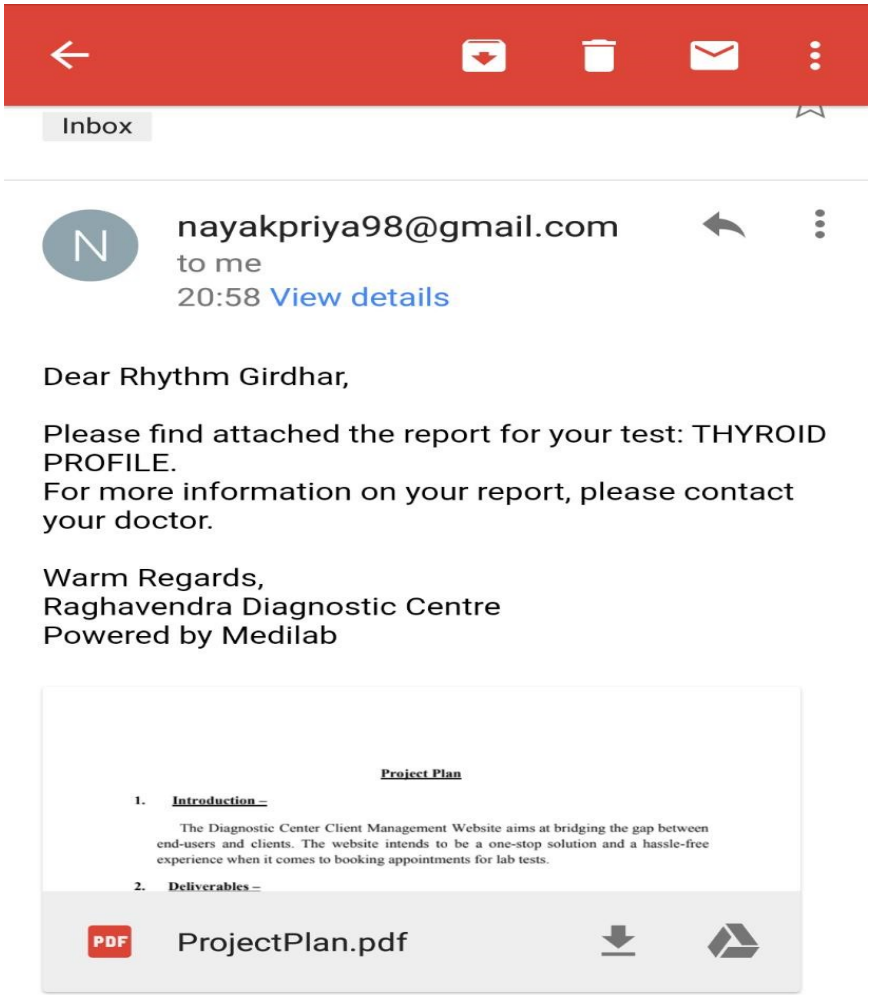
g. Email with OTP



h. Email Sent

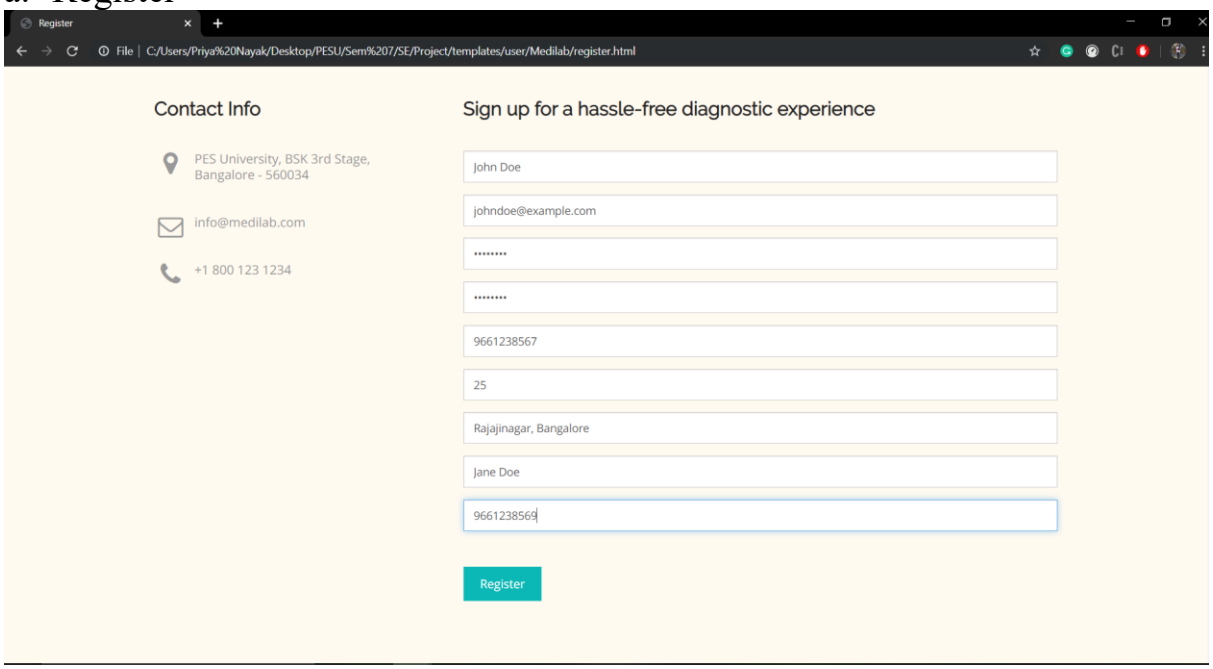


i. Email Received by End-User

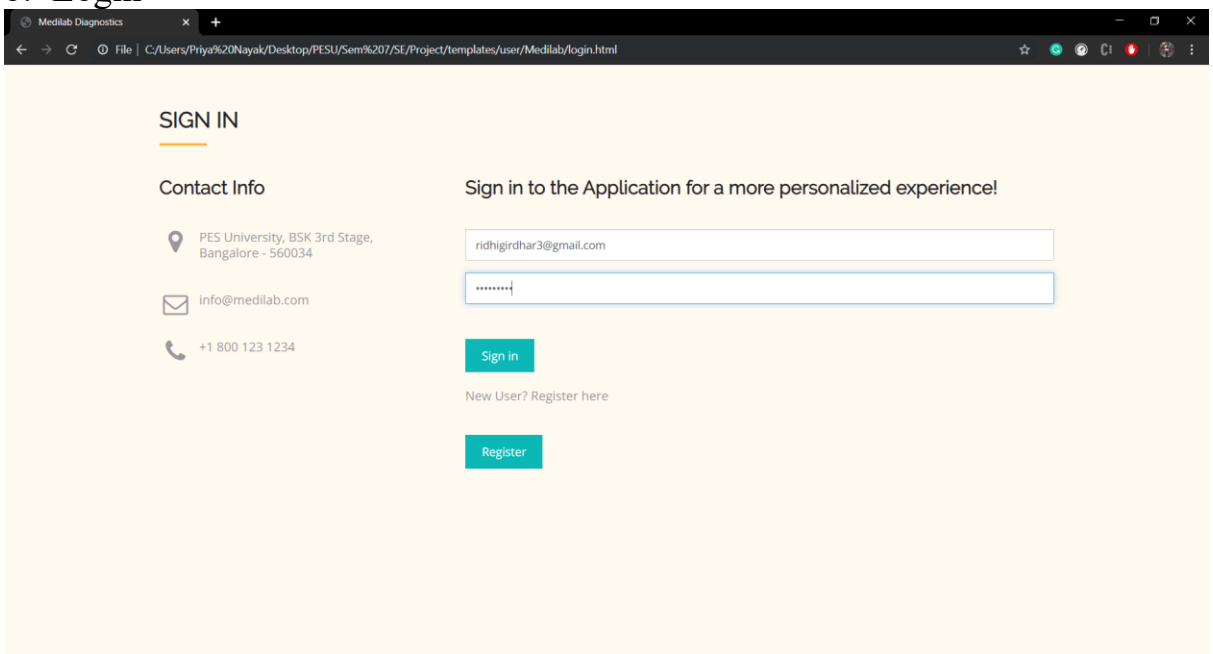


User –

a. Register



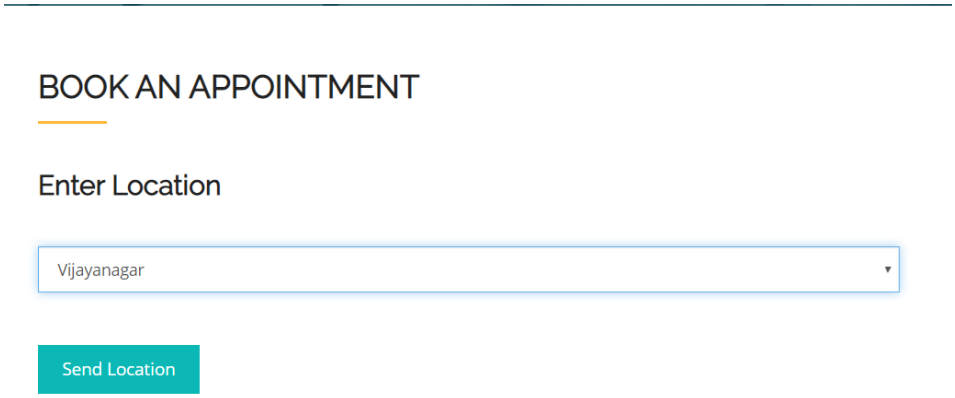
b. Login



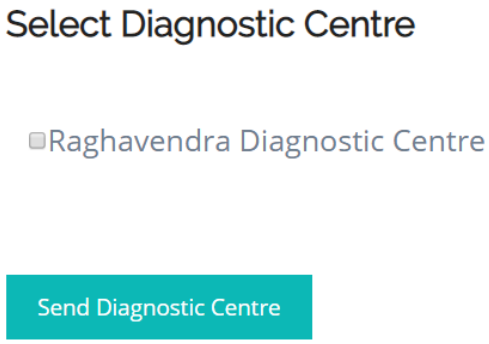
c. Home

d. View Clients

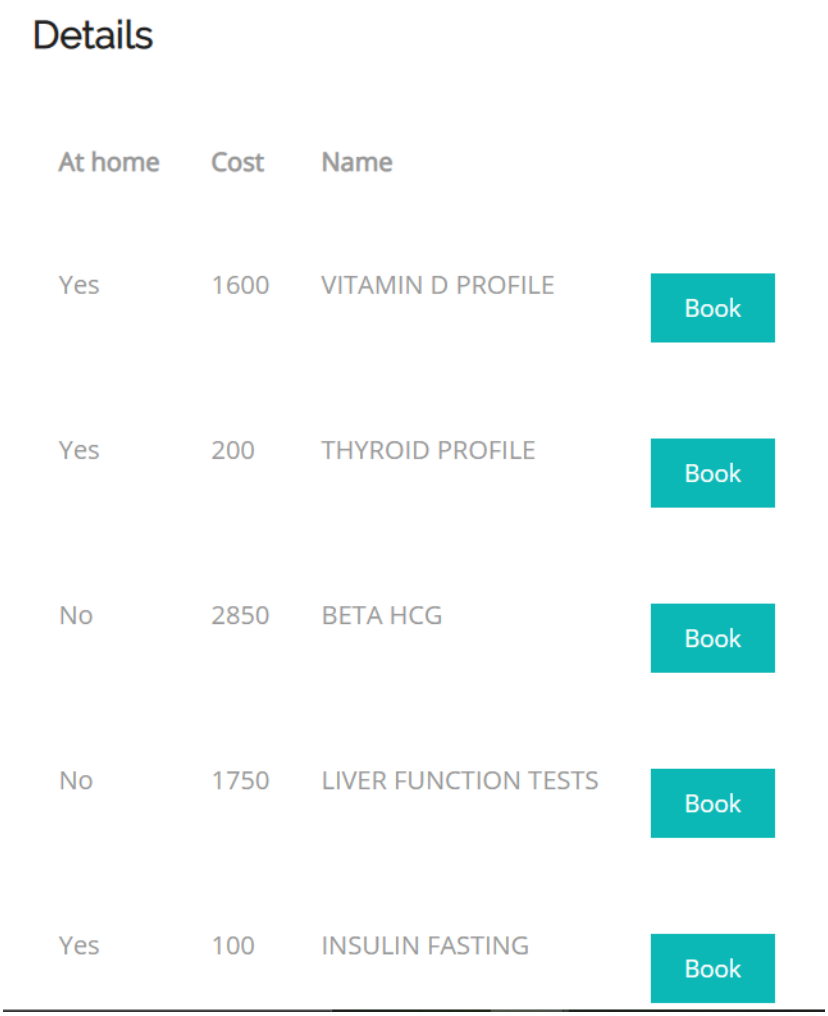
e. Choose Location



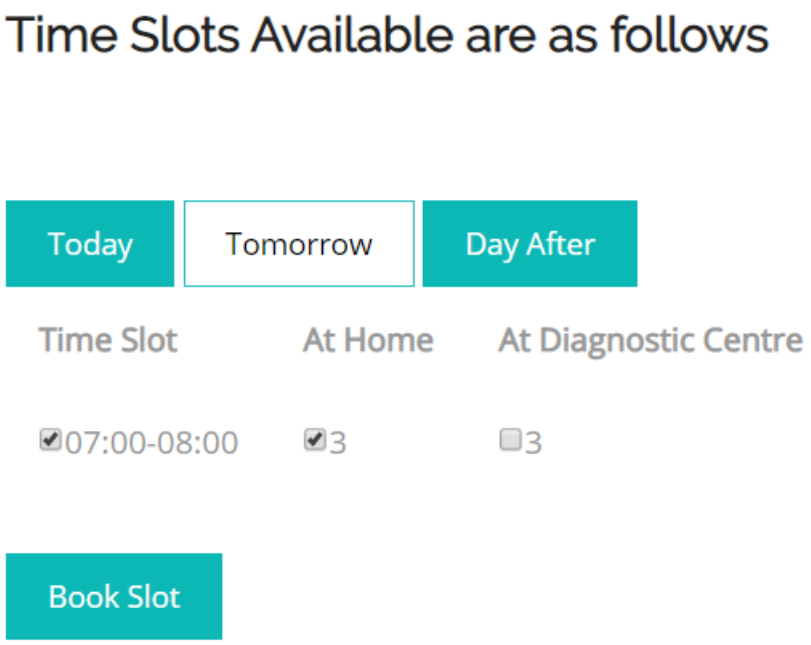
f. Choose Centre



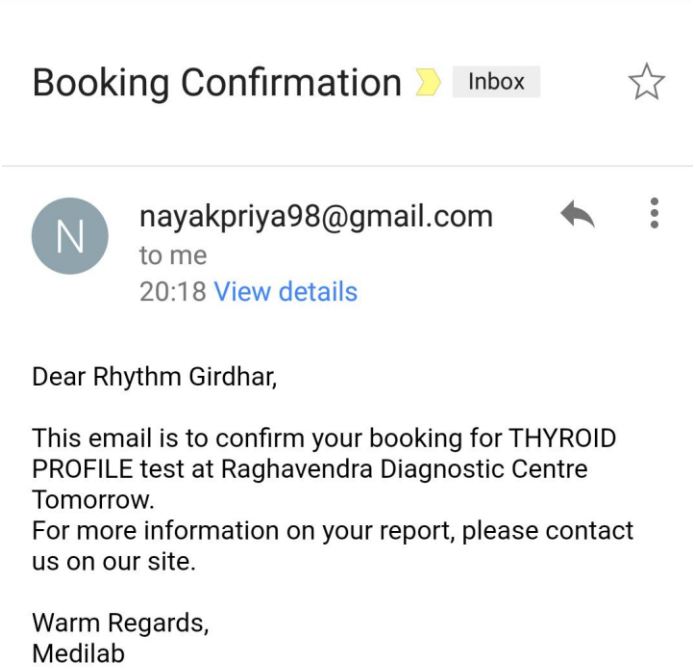
g. Choose Test



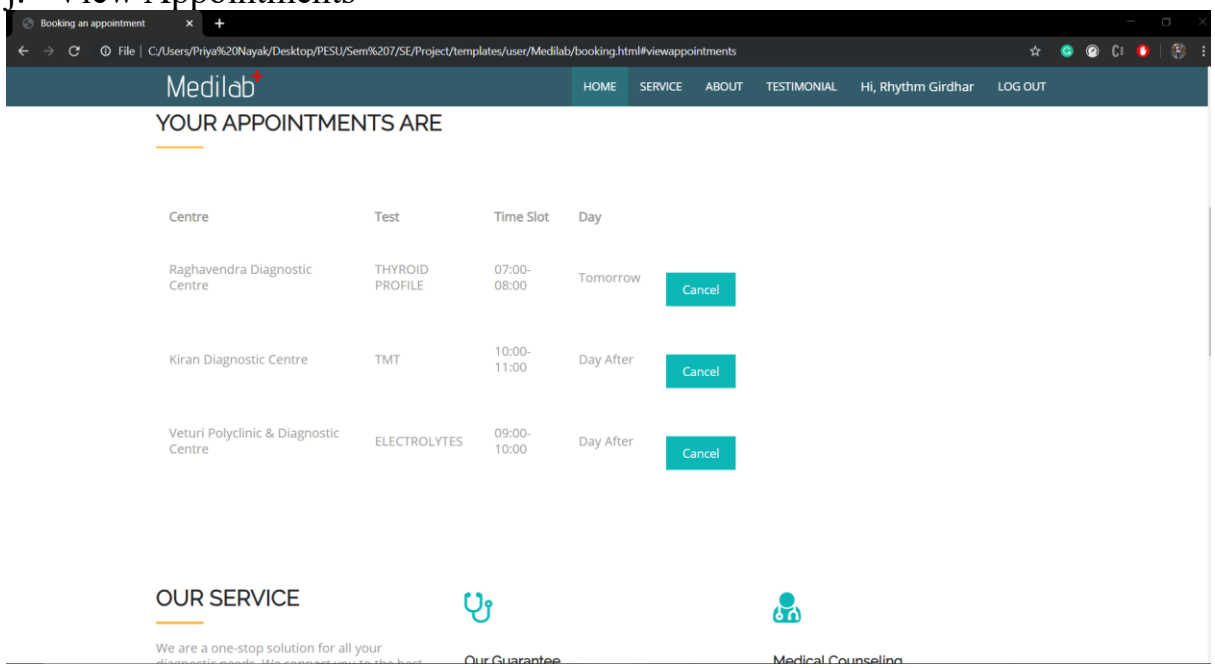
h. Choose Time



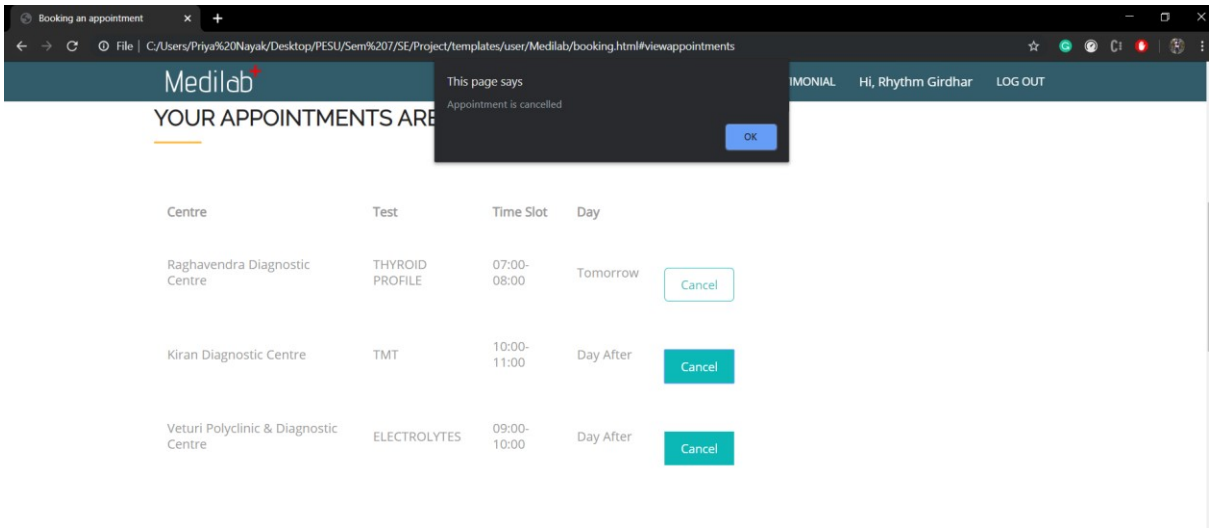
i. Booking Confirmation



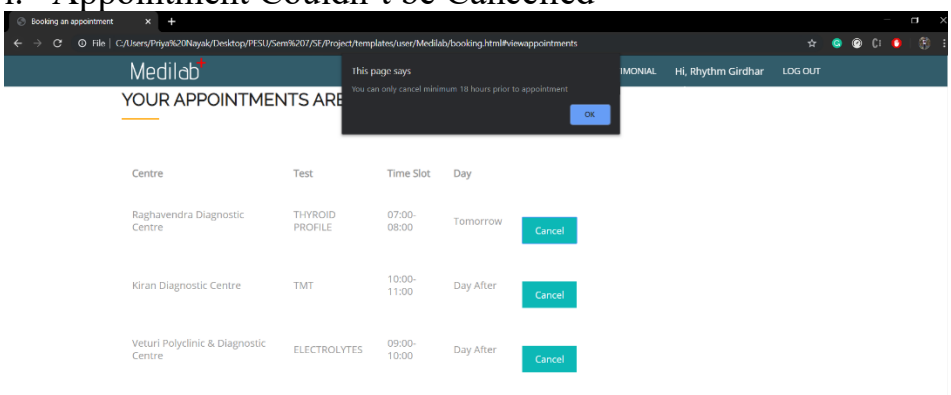
j. View Appointments



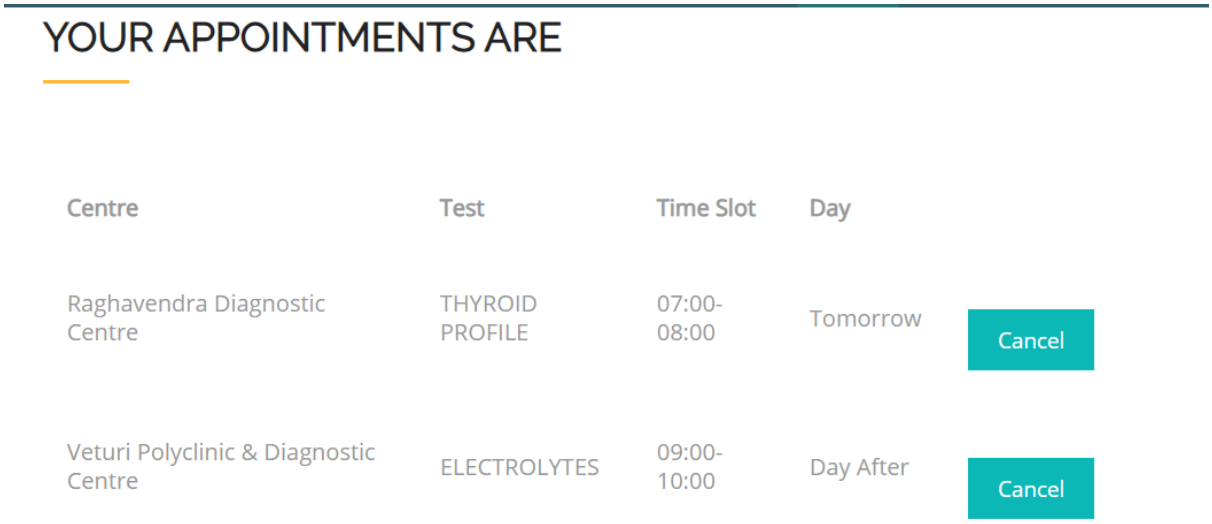
k. Appointment Cancelled



l. Appointment Couldn’t be Cancelled



m. Updated Booking



n. User Feedback