# Mobile Lab: Web Application

Capstone Project Proposal

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# Introduction

Laboratory tests are an essential procedure for human health, they are performed to observe changes in health and to follow up on a patient. They are usually administered by a physician or health professional who collects a sample of blood, urine, or other body fluid or tissue to obtain information for analysis, in short, routine monitoring. This helps physicians diagnose health conditions and detect diseases.

Often, people have trouble scheduling an appointment at a laboratory because the methods available are somehow complicated and not very automated. Currently, there is a need to optimize and provide an efficient service to the elderly community and people without reliable transportation to be able to separate laboratory appointments, and attend to them without compromising or risking their health or simply the need for an efficient, automated service which is easy to use and not have to make calls to make an appointment.

The team wants to develop a website application where the user can create, modify or cancel appointments and which has the option to obtain different types of laboratory tests in the comfort of their home. This idea can be achieved by delivering a user friendly website design, our principal goal is to design professional looking but with minimized jargon level from user interaction perspective. In this way the user doesn't have to know too much about technology or app functionality.

This application will help people who for some reason can not get to the appointment, this is because they do not have transportation or they are handicapped or elderly. Some of the advantages are reducing the number of patients waiting, reducing focus of infection as we are going through a pandemic (Covid 19) is a very viable way to prevent the spread of this virus, patients would avoid long lines and therefore save them time. The team's main motivation are the elderly people who in these times are not given the attention they deserve and spend long hours in a laboratory room, they are a population that is estimated to grow and become the majority in the country and people who do not have viable transportation. Also, This application would help laboratory companies to get more patients and help them to reduce costs in services and resources.

# Problem Statement

There is a very common problem in all laboratories and it is that not all people have the necessary resources to reach the facilities, either because they do not have reliable transportation, or they suffer from some condition which makes it more difficult for them to get to the testing sites. In most cases, they may be elderly people who cannot drive and their family members are in charge of them and many times they have jobs and the time they have is more limited. This affects a large part of the Puerto Rican community since 20% of our population is elderly, 65 years of age or older. The problem is not only the access to get there, but they must wait long hours if they go in person to a laboratory and may even be exposed to diseases in these. This problem is important because it is necessary to create more accessible health services and that all people have a better quality of life.

Basically, we seek to create a system as automated as possible and solve or minimize these problems which are our elderly and people who have a disability or medical condition. A more accessible system in which they can make lab appointments and have them in the comfort of their home with privacy and security. We want to create a web application that is easy to use and efficient, in this way we take into account people with basic knowledge or not knowledge at all of this technology.

## Target Domain

- Health Care
- Laboratory Testing

## Client

- Laboratory companies
- Users/patients who makes an appointment for laboratories
- Lab Tech/Physicians
- Hospitals

The proposed innovation is to create a web page that allows the user to create, modify or cancel appointments and has the option of obtaining different types of laboratory tests in the comfort of their home. This will allow you to have a laboratory staff come to your doorstep to perform the necessary tests without having to physically go.

# Project Objectives

The proposed software solution will be a web application, objectives can be divided into database, django(python backend framework), and UI/frontend:

- Database
    - Create ER diagram
    - Compile ER into table diagram
    - Start a database with a 3rd party service (like heroku)
    - Implement table diagram into database
    - Integrate with Django
    - Implement CRUD operations in DB API
- Django
    - Setup a new Django application
    - Implement user authentication
    - Create routes for the UI
- UI
    - figure out what language/framework is best suitable for out needs
    - brainstorm ideas for specific views of the UI
    - come up with wireframes or sketches
    - start implementation of those designs

The completion of these tasks will be measured when the developers conduct a review of the work and decide that it meets the requirements. For tasks related to the UI and UX of the application, surveys will provide enough data to determine whether the solution was successful. For more technical tasks, running unit tests will determine that the requirements are met.

# Solution Approach

As we all know, the laboratories in Puerto Rico at a time of the pandemic (Covid 19) were overcrowded with people. Given this situation, it was almost impossible to test many people who really needed it. For this and many reasons we have decided to create our "Mobile Lab" application. The proposed solution is to avoid going to the laboratories in person in order to prevent long waiting lines and infections with any type of disease. While saving time and money on fuel. This will greatly benefit people now and in the future if something similar happens.

The gap between the current solutions and the desired solution is to be able to expand the laboratory services to more people. The current solutions do not allow you to have the comfort and privacy that the desired solution can give you. Currently the solution provided by the system gives you convenience as it allows you to schedule the appointment on the day you want but requires more human intervention, either calling a clinical laboratory or going to the laboratory to schedule the appointment. The desired solution will solve this problem as it will be a more automated system in which the user only has to create a one-time account and by performing a couple of clicks to schedule an appointment. It will save you time and money.

## Value that it provides

“At your on comfort and convenience, Mobile Lab”

Laboratory companies that buy our services will opt for a greater reach of clients consequently their business will grow as a result of more incomes. In addition, they will not need to have large laboratories since not all patients will come to the laboratory, which will reduce the cost of services and resources for the company. In addition to that, you will have less work because a large part of our services are automated.

## Benefits

- Accessibility
- Time saving
- Security (Avoid diseases)
- Saving  Money

## Limitations

- Internet access
- Laboratories need to provide transportation to their employees
- There are some things that cannot be automated
    - Medical Orders

- Plan Coverage

## Commercial Potential

When the software solution is completed, it can be sold to laboratories. The vision is that this application will serve as a base engine. Laboratories can buy our services, which include a software solution more customized for the stakeholder that is built on top of said base engine, and then, software support for the future as well as database management.

## Resources To Bring Into Operation

- **Labor**- It is necessary to have different members of the team who possess different skills necessary to complete a project successfully. These people are the main part of any plan (Programming and administration skills).
- **Team**- The team is credited with any necessary tool for the completion of the project that is being worked on, ranging from system engineers, human resources, Drivers, Nurses, Lab Technicians among other positions.
- **Materials**- It ranges from raw materials to any tools necessary to generate the desired results (Transportation, Lab equipment)
- **Budget**- This is probably the most important of all which allows us to obtain everything mentioned above and can end the project(To sustain Hosting platforms and labor)

## Intellectual Property

No intellectual property is used, although the completed system might qualify as IP.

# Technical Description

## Architecture

The team has decided to create a web application that will present a variety of lab test types from which the patient, with their respective account, can choose to make and schedule a lab appointment in the comfort of their home or at their nearest lab. They will also be able to modify or cancel these appointments. Users will be able to create their accounts with their personal data, such as name and surname, date of birth, medical insurance and email address which they will be able to access from any computer or mobile device.

With this goal in mind, and given the skills and knowledge that each team member has, it was decided to use the Python programming language and Django as the web framework. Python was chosen as the programming language because most of the team members already had some knowledge of Python. On the other hand, Django offered excellent documentation and tutorials. This web framework also offered some tutorials on connecting to databases, and since the system must be built to store user data, this only increased its chances of being used. Since user data must be stored, it was necessary to add a database management system to our software architecture. For this, the team decided to use PostgreSQL.

## Modules

Data models describe the entities and relationships that will be used throughout the application to store the relevant system data. The following shows the relationships between the different data models that are planned to be used in the system. Current data models include, but are not limited to:

- ➔ **User**
- ➔ **Laboratory**
- ➔ **Lab_Test**
- ➔ **User_Lab_Tests**
- ➔ **Lab_Technician**
- ➔ **Payment_Method**
- ➔ **Address**
- ➔ **Appointment**
- ➔ **Healthcare_Plan**

Each data model can be represented as a table in the database. These models are represented in the Django Framework as classes, and translated by the Django ORM into tables in our PostgreSQL database. These tables were designed with the description of the current domain, note that the module tables can be updated as the project progresses and its needs. The relationships in the current

model allow easy access to the information needed in the application. See the ER below for more information about the structure of each module.

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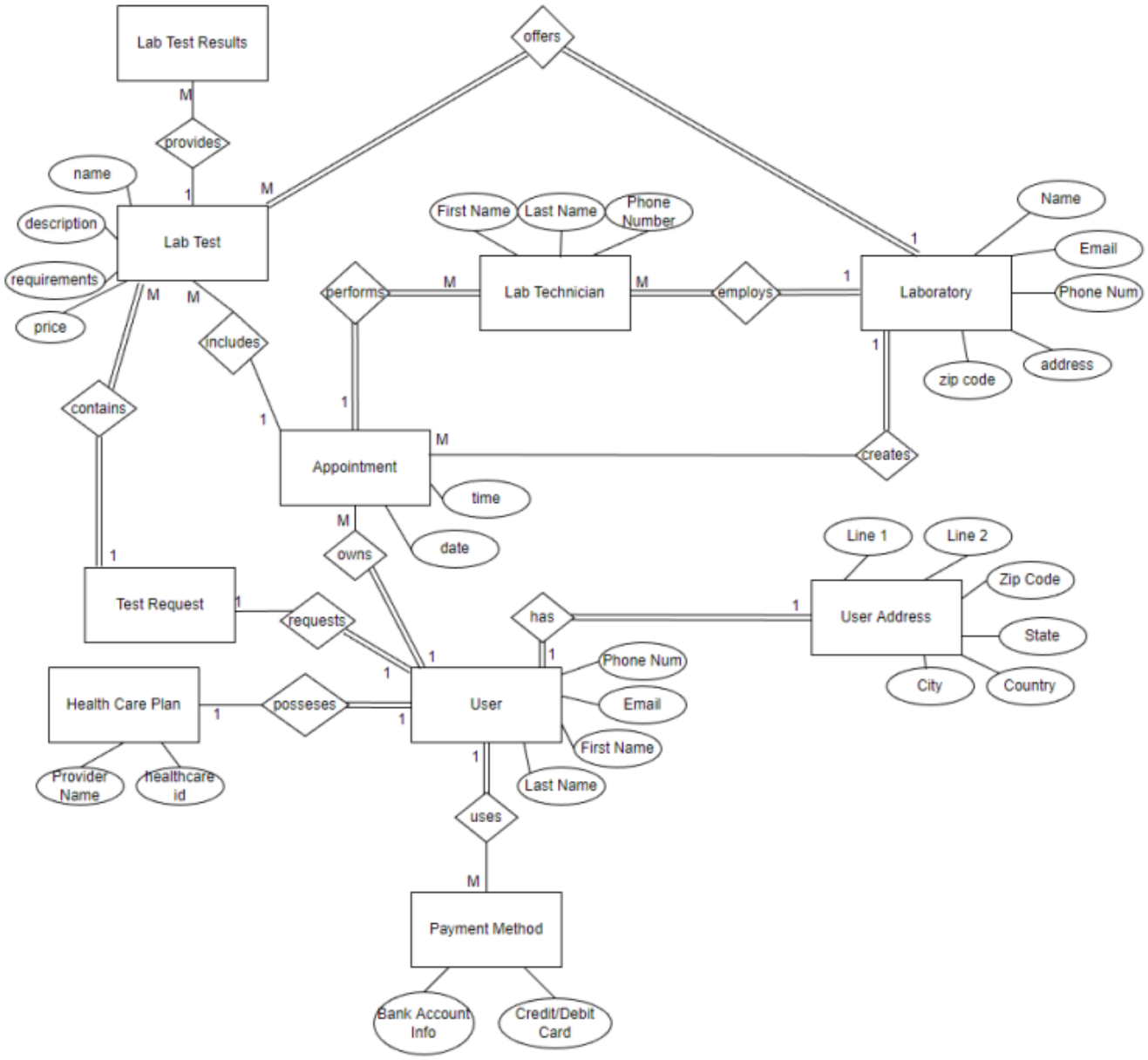
## Entity Relations Diagram



## Wireframes for UI

Demonstration of how the team has designed the web application **views**. We can see some mockup representations, note that this is a prototype and not a final version which may change throughout the development depending on the needs. These views will be created with a Python function that takes a web request and returns a web response via a template. The view itself contains whatever arbitrary logic is needed to return that response. These views encompass all the requirements where the system needs a user to see something, such as the booked lab tests view, the currently available lab tests view, the home view, the sign up view, and the start session view. Each view is represented in Django as a function written in the views.py file, and returns the request to render the view. The UI sketches for the views are shown below.

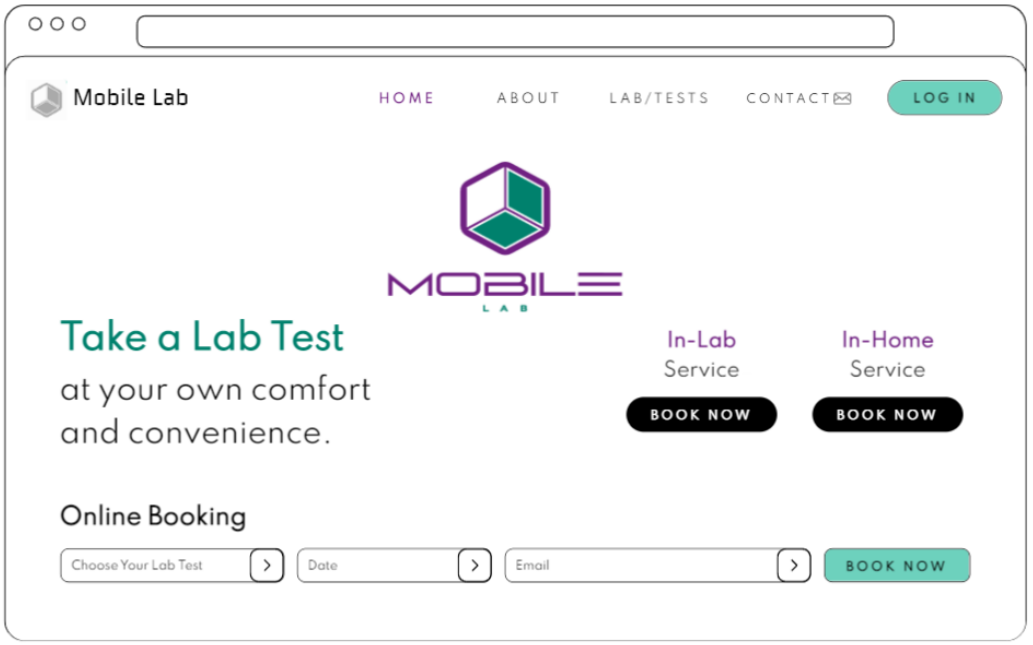



***Image 1.*** **Main View -** This is the main view of the app, the user when entering will find this perspective in which you can access the different tabs, if you select book now for the first time and the user is not in an account will take you to the page to create account or access account, otherwise it will take you to the page where you will find the variety of laboratory tests that the user can select to take at home or in the laboratory clinic.

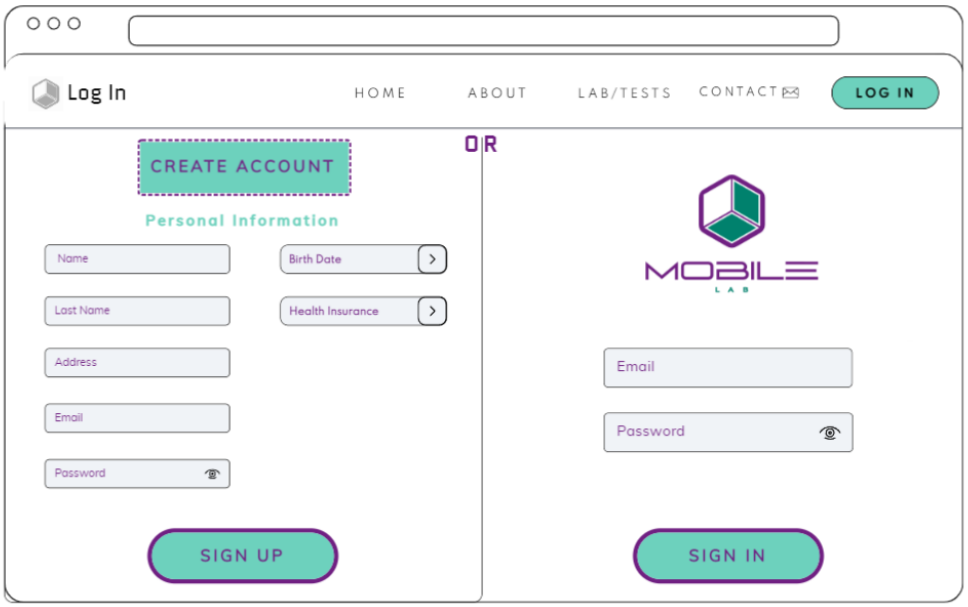



***Image 2. Log In/ Register view:*** In this view or perspective, users will have the opportunity to access their account or create a new one if they do not have one.

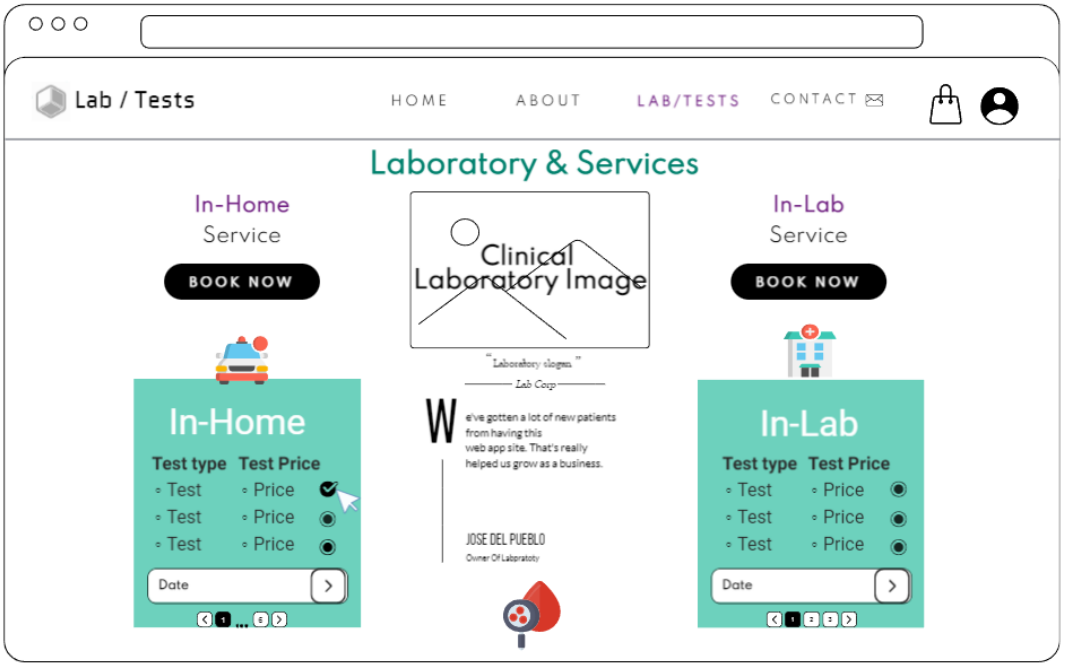



***Image 3. Lab/Test view:*** The user can view the different laboratory tests available for In-home or clinical laboratory testing as well as the cost of the test. They can select the test by clicking in the respective checkbox and also choose the day to be performed.

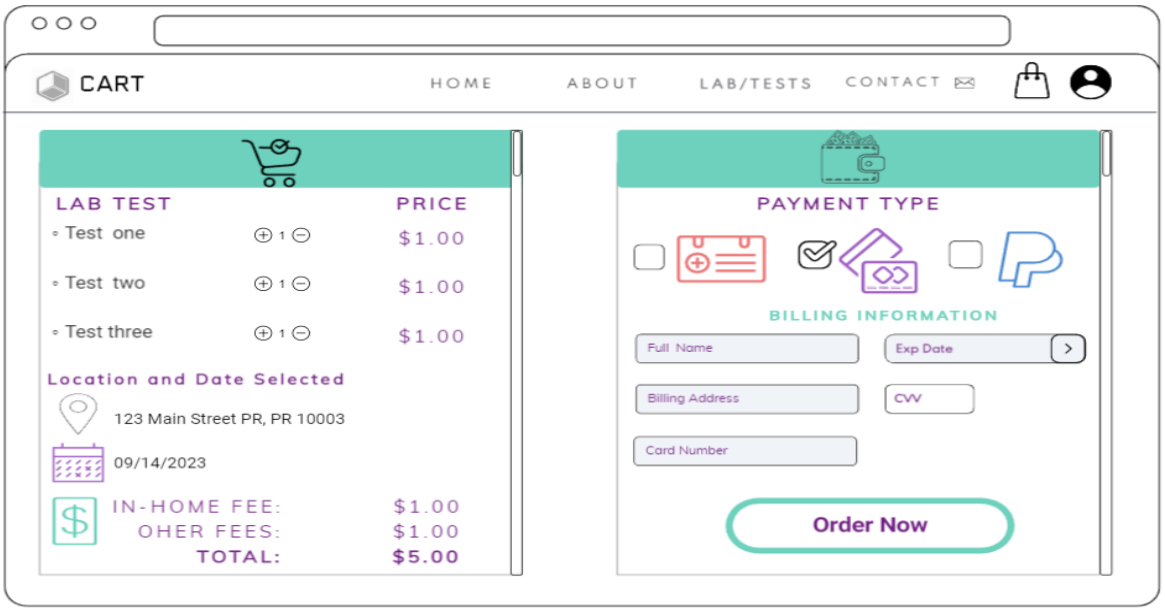



***Image 4. Cart View:*** In this view the user can see the laboratory tests he/she has decided to have done, the cost, the date and the location selected. This facilitates the purchase of the service and the user can get an idea of the total cost and taxes. The user can select their payment method and complete the order. In this way the system can accept payment from the customer and arrange for the distribution of that information to the payment processor.

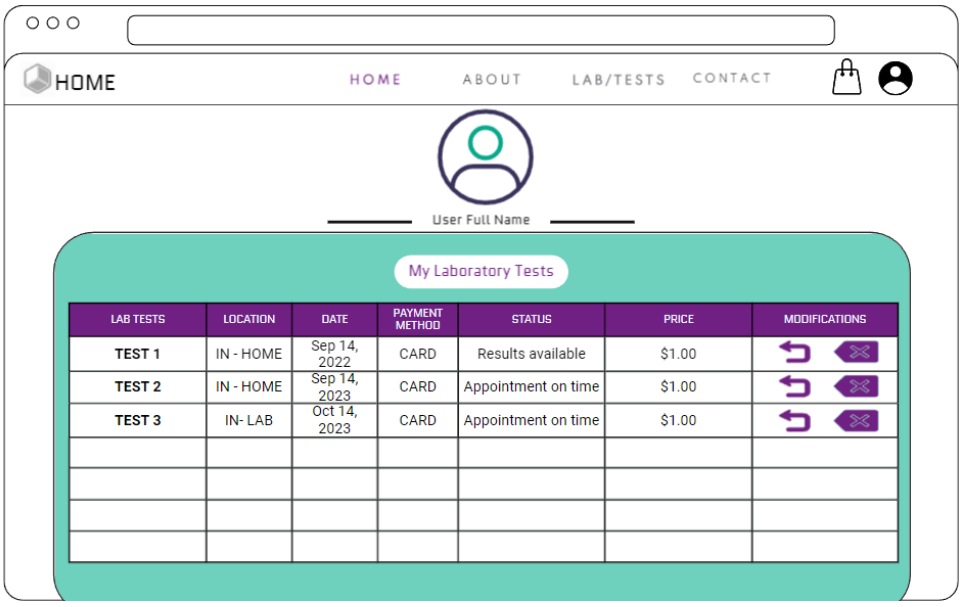
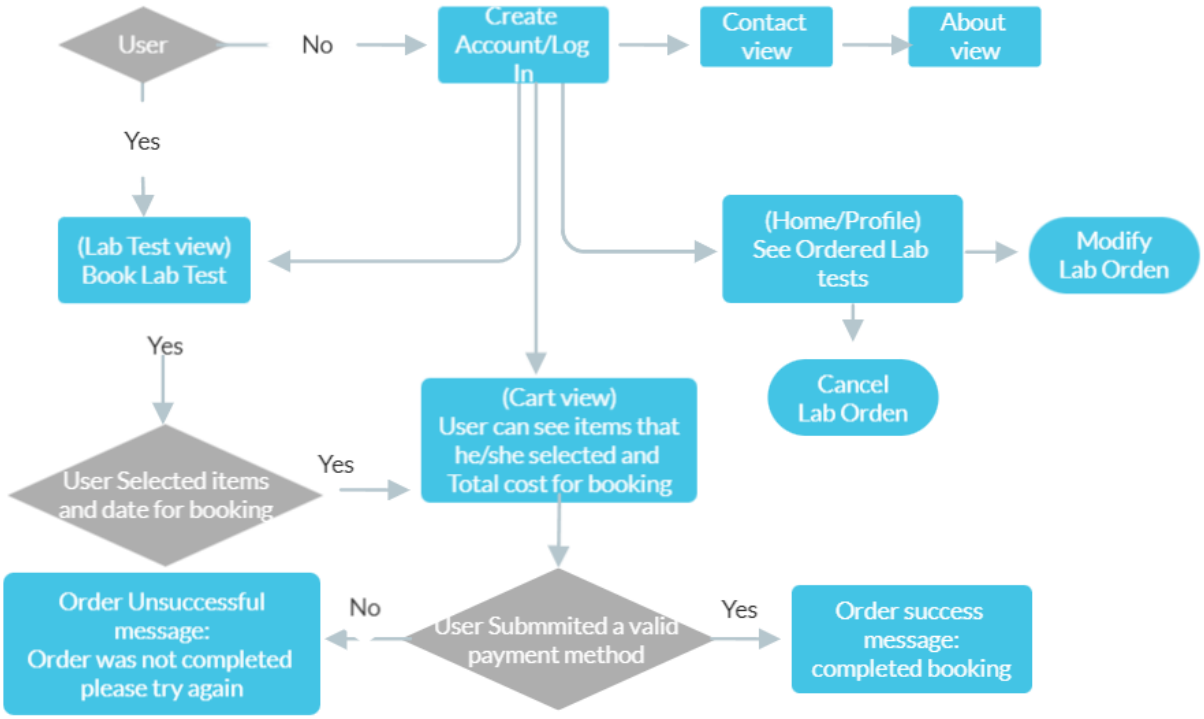



***Image 5. Profile view:*** The user can view his profile details as well as a table with information about the laboratory tests he has booked and can modify and delete them.

**Views** are going to be maintained in a views.py file. Each view is defined as a method in the file, and is passed in a parameter to the request. The request parameter will contain information about what the user is doing. Some of these methods are "POST" and "GET".

## Program Flowchart

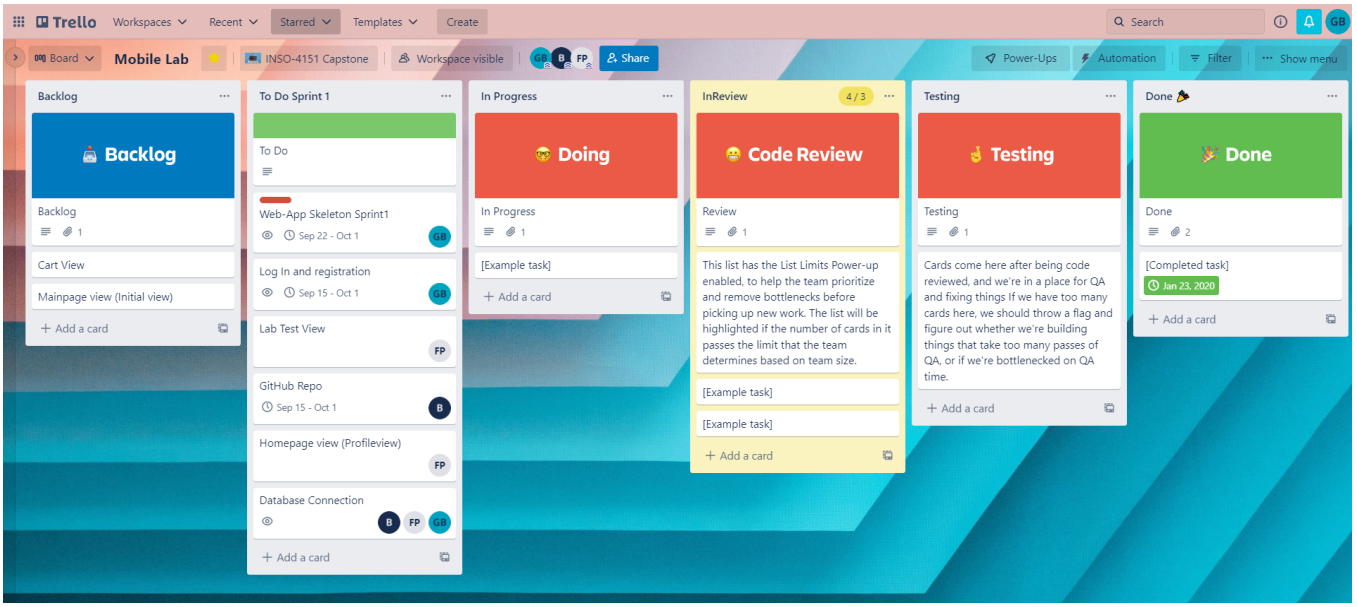


# Engineering standards

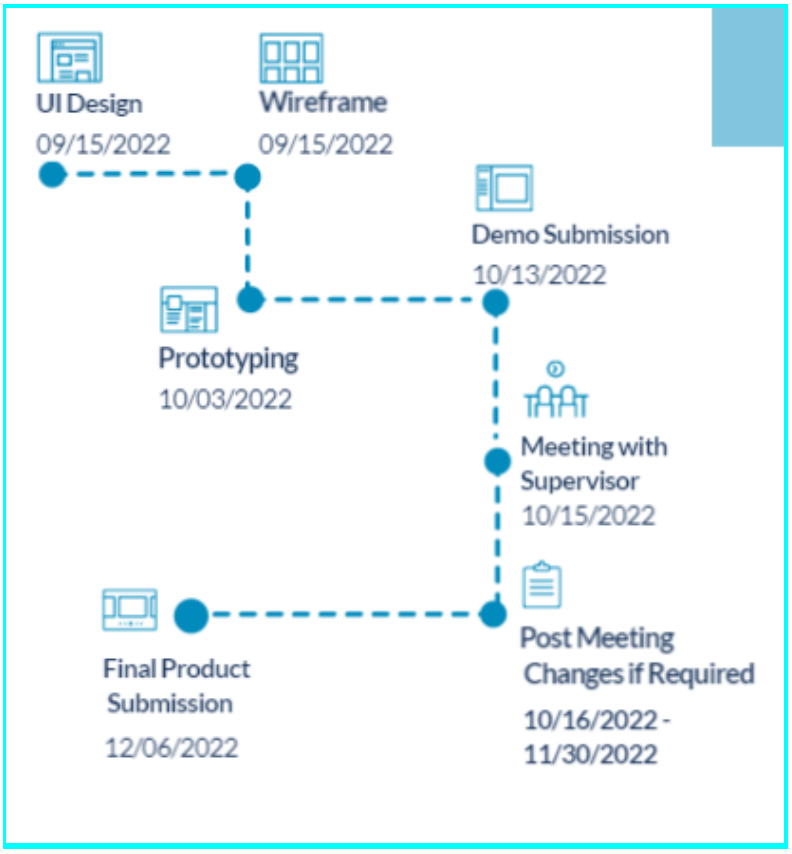
The team will follow an agile development process, in which iterates through each step of the software development process every two weeks. The implementation workflow is as follows. For each requirement, an issue will be created on GitHub corresponding to that requirement. A project is created in the GitHub repository, following a kanban template in which different cards are presented, such as Backlog, Current Sprint, In progress and Done. Initially, all issues created are placed in the backlog, and as a sprint starts, the issues will be moved from the project backlog to the This Sprint card. When a developer starts working on an issue, he or she moves it to the In Progress card. In addition, for each issue, the developer who is going to work on it creates a new branch so that the main branch is always running. Once the developer finalizes the feature, he or she needs to create a pull request and assign other team members as reviewers so that the majority of the team approves the changes. Once the pull request is approved, the branch is merged with the main branch and the issue is closed. Applying this control system will help the team to work in an organized environment and in an adaptable one that accepts changes throughout the project.

# Project Plan

Some of the planned activities are to make a Trello Workspace following a kanban template to have all the objectives to be achieved and assign them to the different team members, make weekly meetings through google meet to see their progress and answer questions or road blockers the developers may have. Meetings with stakeholders or supervisors to show prototypes demos and collect feedback to manage change requests, Prepare a realistic schedule with due dates. Create a project risk plan, This means that if something happens to the main idea we had and it doesn't work. Discuss it with the team and look for a plan B and so on to satisfy the problem



## Milestones


UI Design
09/15/2022
Wireframe
09/15/2022
Demo Submission
10/13/2022
Prototyping
10/03/2022
Meeting with
Supervisor
10/15/2022
Final Product
Submission
12/06/2022
Post Meeting
Changes if Required
10/16/2022 -
11/30/2022

# Team Members

Francis(Writer, Back-end Developer):

This team member is in charge of taking notes and creating documentation for the proposal and different phases of the project as well as being part of the back-end team in which he will be assigned duties as creating components and functionalities on the server side, accessed indirectly by a user through the web application. He will be in charge of creating, maintaining, testing and debugging the entire back end.

Gabriela (Writer, Full-Stack Developer, Frontend Design):

This team member is in charge of taking notes and creating documentation for the proposal and different phases of the project as well as being part of the Full-stack team. She will be in charge of the design and development of the web application and ensure that the design as well the user interactions on the web pages are intuitive and attractive. Also provide back-end functionalities.

Bryan (Writer, Front-end Developer) :

Like the other team members he is in charge of documentation, adding notes, comments and suggestions. He also belongs to the front-end team in which he is in charge of making sure that web application users can easily interact with the app. To do so, he will combine design, technology and programming in order to code the look and feel of it, as well as taking care of debugging.

# References

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Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK,Urgent and Ambulatory Care, Oxford Health NHS Foundation Trust, Oxford, Oxfordshire, UK, Institute of Applied Health Research, University of Birmingham, Birmingham, West Midlands, UK, ‘’Point-of-care blood tests during home visits by out-of-hours primary care clinicians; a mixed methods evaluation of a service improvement’’,https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7045021/(accesed Sep 10, 2022)