# Project Requirements Document V2

Team: Bacta Health, Project Fysio

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## Introduction

Physical therapy is often a battle between mental fortitude and physical ability. Doctors will give wildly different predictions and without a clear future you need muster the willpower to keep pushing to make what seems like negligible progress in the short window you have. Currently few or no solutions exist to motivate, engage, monitor, and assess patients in physical therapy without inpatient care or physician care. If PT stops being "medically necessary" insurance won't provide coverage and physical therapy can stop. We believe that a one stop solution to make physical therapy more effective and more affordable, especially for un-covered patients is missing. What's missing is a software to motivate the user with rewards or gamification, engage the user with prompts and reminders, monitor the user's progress and medications with smart easy-to-use tools, and assess progress using data from other users to provide best-case scenarios. The key improvement we aim to make in this domain is providing accurate predicted outcomes to users and given enough time, gamification of the experience.

## Existing Solutions

Typically, physical therapy progress is tracked by consistent monitoring of pain and range of motion through check-ups with a doctor. Outside of check-ups, it is the responsibility of patients to take their medications and complete their exercises.

Currently, there are several applications that track if patients are keeping up with their exercises and medications and provide PTs with access to their progress. There are also a couple of companies, like Exer, that are utilizing computer vision to track range of motion in patients. However, there are no single-platform solutions for the issues that we are looking to solve in physical therapy, nor or any platform that provides predictions of recovery timelines.

## Our Solutions

Our vision is a central application where patients not only are able to track their progress but are incentivized to do so through some sort of rewards system or gamification of their exercises. In addition to this, we would like to use the data collected by users in order to give patients best-case scenario expectations if they follow through with their recovery plan.

Given the limited scope of the aforementioned existing solutions, it is apparent that a robust central application that utilizes a reward system and user data would be beneficial for those who are undergoing physical therapy.

## Project Specification:

The goal of our project is to make a physical therapy tracker program to help those patients recover. The main users of our program are expected to be the physical

therapy patients who need additional help to decide the next step therapy plan. The project will focus on designing a user-friendly format so that the user could easily check their current recovery progress by digitalizing and visualizing their current physical condition with minimal effort and professional knowledge. Also, the project will allow the user to communicate with other similar users to decide their following recovery plan without going to the hospital.

Our team goals are to
1. Design a data structure to store the data we get from users
2. Implement an algorithm/machine learning model to find the similar patients
3. Develop a website and a mobile app to help the patient interact with the database and track their recovery progress
4. Develop a more enjoyable to stay on track

Our project makes a couple of assumptions. As we need to have some initial data to do the classification, we can assume that some users have already uploaded their data to our database.

# System Architecture Overview (WIP):
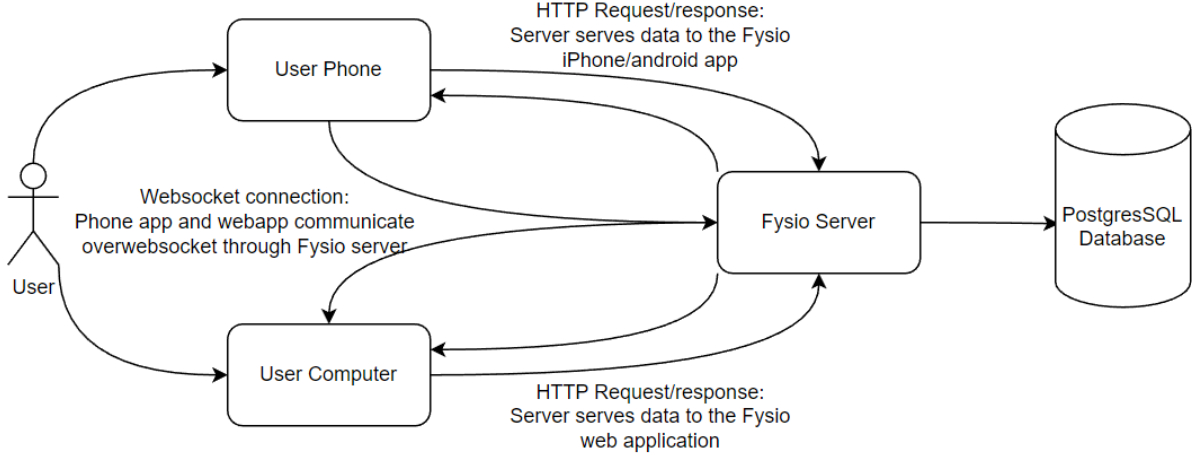


The user uses a web app or a phone application. The applications share functionality in all modes except during exercise in which the web app receives data from the phone app. The backend server uses a colocated postgresql instance to persist data.

# User Interactions and Design:

| Homepage | Clerical Actions Page |
|----------|----------------------|



The homepage enables a brief overview of the users recovery journey, it includes simple charts with estimated recovery dates, upcoming alerts for exercises and medications, and a medication level indicator so you can schedule refills.

The clerical page enables the user to add or remove personal info, medications, exercises, and causes/disabilities

| Roadmap Graphs View Page | Roadmap Information View Page |
| --- | --- |

**Roadmap Graphs View Page:**

3:47

Fysio
By Bacta

N

Recovery Progress: 38%

**Tricep Tear**
10

Pain

Mobility

1

1 Month Ago — 1 Month Ahead

Mobility > 8 expected by December 10th 2022
Pain < 3 expected by December 27th 2022
(Prediction is based on 100 users with similar injuries)

**Rotator Cuff Strain**
10

Pain

Mobility

1

1 Month Ago — 1 Month Ahead

Mobility > 8 expected by February 8th 2023
Pain < 3 expected by January 15th 2023
(Prediction is based on 100 users with similar injuries)

**Humerus Fracture**
10

Pain

Mobility

1

1 Month Ago — 1 Month Ahead

Mobility > 8 expected by February 24th 2022
Pain < 3 expected by February 9th 2022
(Prediction is based on 100 users with similar injuries)

Shoulder Injury ‹

**Roadmap Information View Page:**

3:47

Fysio
By Bacta

N

**Nov 7   est time: 35 min**

**Exercises**
- Pendulum
- Crossover Arm Stretch
- Passive Internal Rotation
- Passive External Rotation

**Medication**
- 0.4% Solution Dexamethasone
- 325mg Acetaminophen

**Nov 8   est time: 30 min**

**Exercises**
- Sleeper Stretch
- Standing Row
- Internal Rotation
- Elbow Flexion

**Medication**
- 0.4% Solution Dexamethasone
- 325mg Acetaminophen

**Nov 9   est time: 35 min**

**Exercises**
- Pendulum
- Crossover Arm Stretch
- Passive Internal Rotation
- Passive External Rotation

**Medication**
- 0.4% Solution Dexamethasone

Shoulder Injury ‹

The roadmap is intended to give the user a birds eye view of their path to recovery, on the first screen they can see their compound recovery estimation charts for each resulting disability of a cause. Then by switching to the info view, they can see their daily regimen of exercises and medications that they'll be undertaking on their way to recovery.

| Calendar Today View Page | Calendar Month View Page |
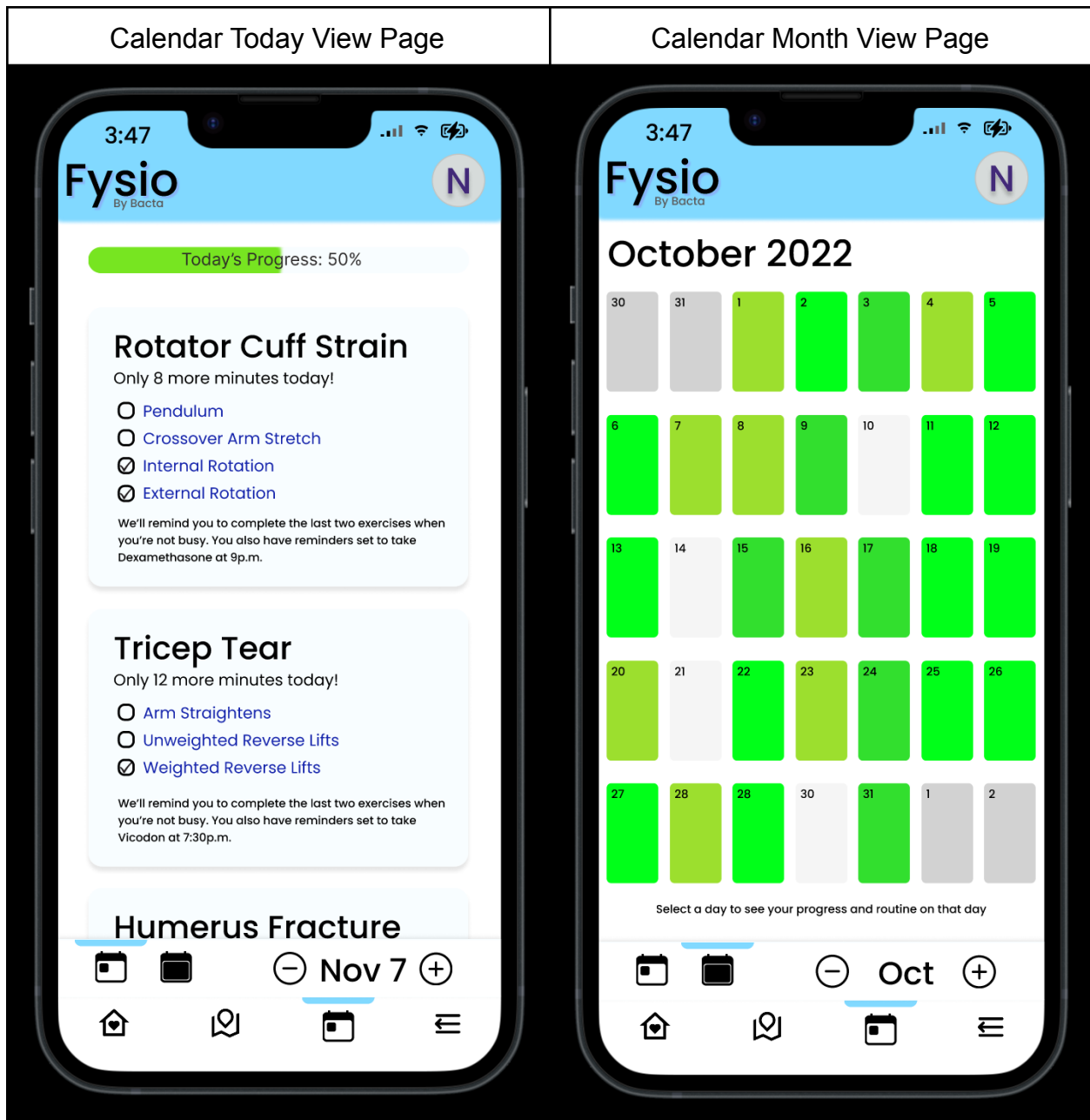


Finally, the calendar is meant to give the user a birds eye view of the path they've already taken and the current step they're on. The first view shows the user what they need to complete today, and clicking on an exercise enables them to read directions and complete the exercise. If supported for the specific exercise, the user will be able to play a game or go through guided exercise to complete it. Then the month view enables the user to get a sense of how well they're following their recovery plan.

# Functional Requirements (User Stories and Acceptance Criteria)

1. As a user, I want to be able to log into my google account with my email address and password.

   [GitHub Issue](GitHub Issue)

   a. Scenario 1: User enters a valid google email address and password and is granted access to the profile.

   b. Scenario 2: User enter's invalid google credentials and is given an error, but is able to re-enter a correct set of credentials.

2. As a user, I want to be able to navigate to several pages of the mobile application.

   [GitHub Issue](GitHub Issue)

   a. Scenario 1: User clicks on home icon, user is taken to home screen.

   b. Scenario 2: User clicks on map icon, user navigates to roadmap page.

   c. Scenario 3: User clicks on calendar icon, user is taken to calendar screen.

   d. Scenario 4: User clicks on plus icon, user navigates to actions page.

3. As a user, I want to be able to enter numerical data/metrics regarding pain level with the tissue injured.

   a. Scenario 1: User enters valid data, and data is sent to the backend.

   b. Scenario 2: User enters invalid data and error is provided to user.

4. As a user, I want to be able to see visual representation of my progress with pain levels through the use of line plots.

   a. Scenario 1: User has continuously entered daily metrics in regards to their pain level and is able to see a line plot of their progress.

   b. Scenario 2: User has not entered daily metrics and is not able to see any line plots.

5. As a user, I want to be able to see visual representation of my progress with muscle mobility through the use of line plots.

   a. Scenario 1: User has continuously entered daily metrics for their mobility and is able to see a line plot of their progress.

b. Scenario 2: User has not entered daily metrics and is not able to see any line plots.

6. As a user, I want to be able to obtain my mobility range for a particular muscle using my smart phone's accelerometer.
    a. Scenario 1: User does the mobility check exercise correct and is given his/her range of mobility.
    b. Scenario 2: User does not do the mobility check exercise correctly and is given an error.

7. As a user, I want to be able to see a list of exercises appointed to me based on my injury.
    a. Scenario 1: The user sees a list of exercises.
    b. Scenario 2: The user does not see a list of exercises and is given the error message that mentions that there are no exercises to be displayed.

8. As a user, I want to be reminded to do my daily PT and take my required medication so that I do not forget.
    a. Scenario 1: User does not do daily exercises by a set time of day and is sent a phone notification to remind them.
    b. Scenario 2: User does exercises early in the day and is not sent a notification.

9. As a user, I want to be able to receive PT exercises with a plan based on the injury I provide.
    a. Scenario 1: Users are given a list of exercises that best fits their needs based on their injury and the data of other users who use the app.

10. As a user, I want to have an estimate as to how long my daily exercises will take so that I am able to fit them into my busy schedule.
    a. Scenario 1: Users will be shown the estimated time to complete the remaining exercises for the day.

11. As a user, I want to be able to see my level of completion of exercises to get a good understanding of how consistent I have been.
    a. Scenario 1: User will see a color-coded calendar view of the previous month to see daily levels of completion.

12. As a user, I want to be able to display my range of motion and pain level history by a given injury, as well as a composite graph displaying when I should be feeling better overall.
    a. Scenario 1: The graph is populated by a specific injuries history on the graphs page.
    b. Scenario 2: The user sees a composite graph showing the user's overall trajectory given all injuries on the main page.
13. As a user, I want to be able to see a detailed description of exercise that is in my app so that I know how to properly perform the motion.
    a. Scenario 1: The user clicks on a specific exercise and is shown a small infographic that displays descriptions and pictures for the exercise.
14. As a user, I want to be reminded to drink water, get enough rest, and eat healthy enough to ensure my recovery is on track.
    a. Scenario 1: User is sent a sleep summary notification in the morning and is reminded to drink water and eat healthy throughout the day.
15. As a user, I want to be able to look back at previous days to be able to see how much progress I have made in terms of pain level and range of motion.
    a. Scenario 1: User can see a calendar view of the previous month color-coded by the pain level and range of motion of each day.
16. As a user, I want my phone to be able to tell me when I am doing a given exercise incorrectly, as well as provide positive feedback when performing the motion correctly.
    a. Scenario 1: During my exercise, the user's phone emits a positive sounding tone upon proper completion of a rep.
    b. Scenario 2: The user's phone emits a negative sounding tone upon improper form.
17. As a user, I want to be able to enter my kind of injury on the app and have it return an approximate recovery time based on other people with a similar injury.
    a. Scenario 1: User inputs the area of injury, subjective pain level, and subjective range of motion and is shown a suitable PT regime.
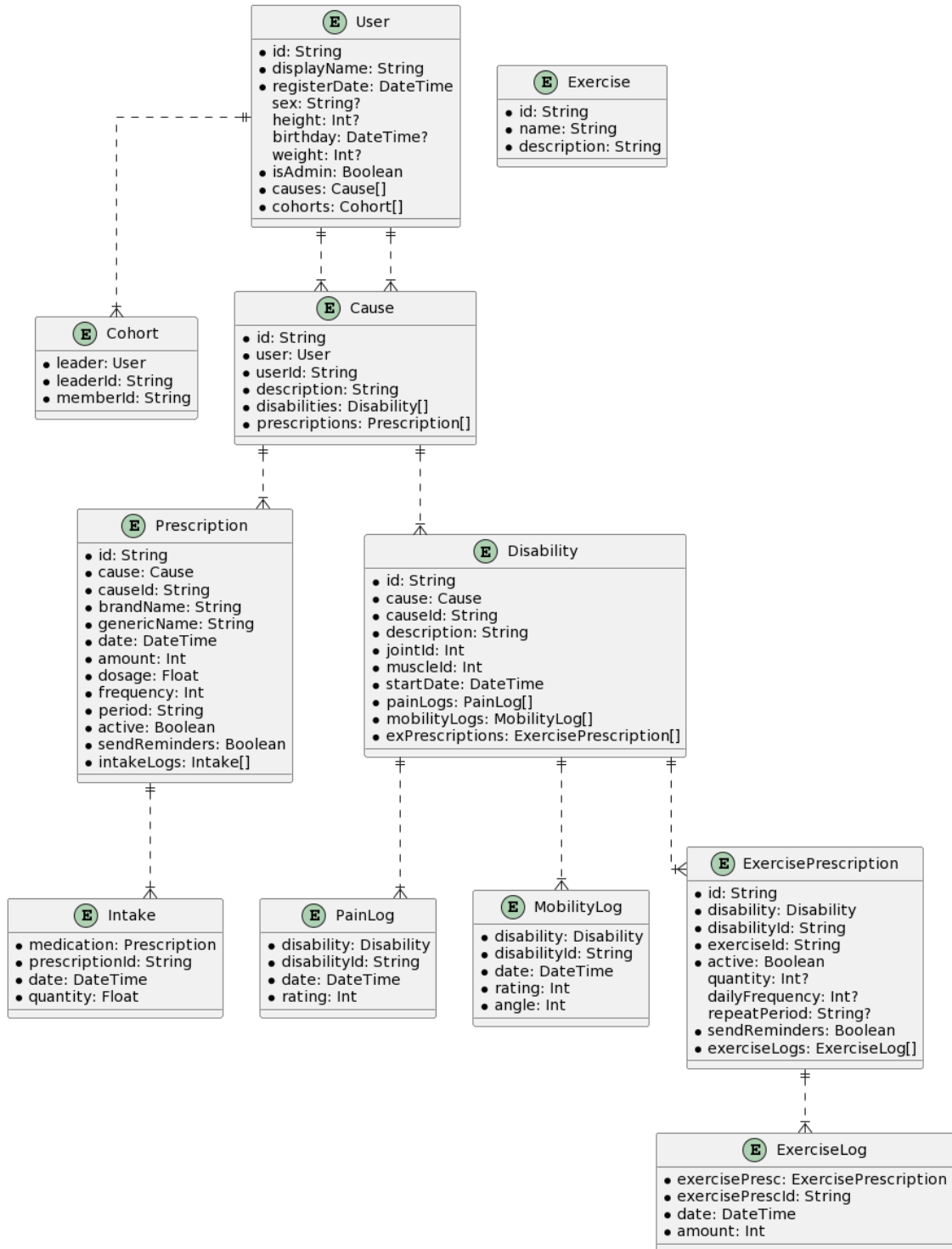
18. As a user, I want to be able to play fun games that prompt me to do the exercises given.
    a. Scenario 1: User clicks on an exercise and is given the option to play a game that will have the user properly do the exercises and have fun.
19. As a user, I want to be able to check off my daily exercises as I complete them, to properly keep myself on schedule.
    a. Scenario 1: User completes an exercise and can check the box next to it.
    b. Scenario 2: User can uncheck a box if necessary.
20. As a user, I want to be able to see how my range of motion compares to the full range of motion for my area of injury.
    a. Scenario 1: User completes an exercise/range of motion check and is given a score based on the percentage of the full range of motion achieved.

## Non-functional Requirements

- The app should be secure so that users' profiles can only be accessed by them or any authorized personnel.
- The app should maintain data integrity and serious privacy measures so that sensitive information is not exposed.
- The app should have an organized data center and backend so that the app runs smoothly and efficiently.
- The app should be efficient and quick to load information from APIs and any visual representations (graphs, charts, pictures).
- The app should note to users the prediction uncertainty that it may have when setting a recovery timeline.
- The app should ask for the user's consent to use their data in helping other users get more accurate predictions.

# System Models:

**UML Design:**

**E User**
- id: String
- displayName: String
- registerDate: DateTime
  sex: String?
  height: Int?
  birthday: DateTime?
  weight: Int?
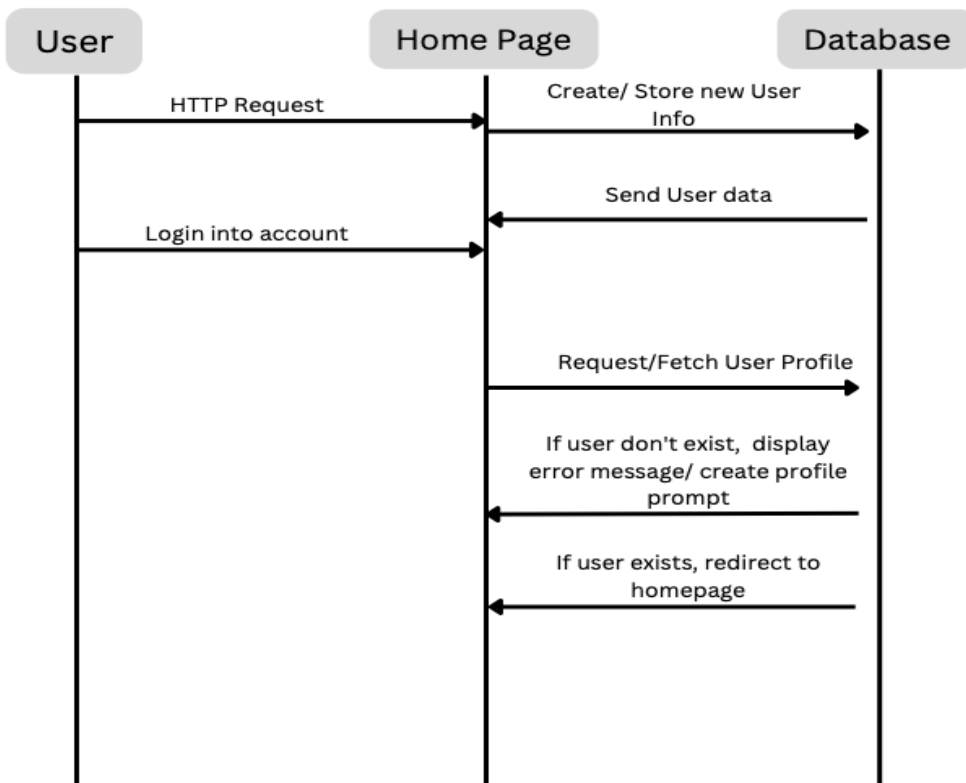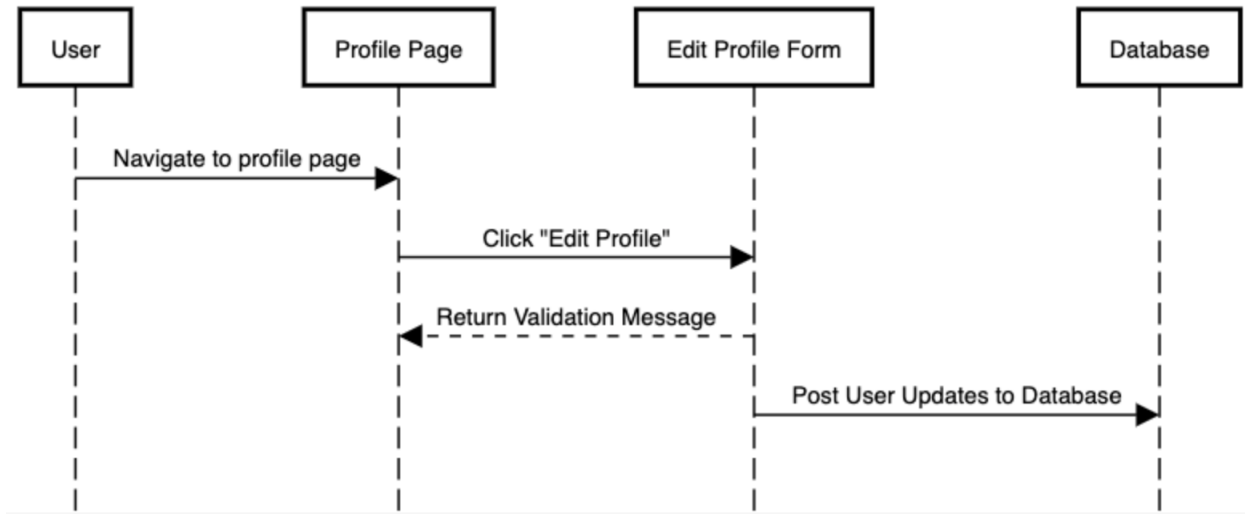- isAdmin: Boolean
- causes: Cause[]
- cohorts: Cohort[]

**E Exercise**
- id: String
- name: String
- description: String

**E Cohort**
- leader: User
- leaderId: String
- memberId: String

**E Cause**
- id: String
- user: User
- userId: String
- description: String
- disabilities: Disability[]
- prescriptions: Prescription[]

**E Prescription**
- id: String
- cause: Cause
- causeId: String
- brandName: String
- genericName: String
- date: DateTime
- amount: Int
- dosage: Float
- frequency: Int
- period: String
- active: Boolean
- sendReminders: Boolean
- intakeLogs: Intake[]

**E Disability**
- id: String
- cause: Cause
- causeId: String
- description: String
- jointId: Int
- muscleId: Int
- startDate: DateTime
- painLogs: PainLog[]
- mobilityLogs: MobilityLog[]
- exPrescriptions: ExercisePrescription[]

**E Intake**
- medication: Prescription
- prescriptionId: String
- date: DateTime
- quantity: Float

**E PainLog**
- disability: Disability
- disabilityId: String
- date: DateTime
- rating: Int

**E MobilityLog**
- disability: Disability
- disabilityId: String
- date: DateTime
- rating: Int
- angle: Int

**E ExercisePrescription**
- id: String
- disability: Disability
- disabilityId: String
- exerciseId: String
- active: Boolean
  quantity: Int?
  dailyFrequency: Int?
  repeatPeriod: String?
- sendReminders: Boolean
- exerciseLogs: ExerciseLog[]

**E ExerciseLog**
- exercisePresc: ExercisePrescription
- exercisePrescId: String
- date: DateTime
- amount: Int

# User Recording Exercise Sequence
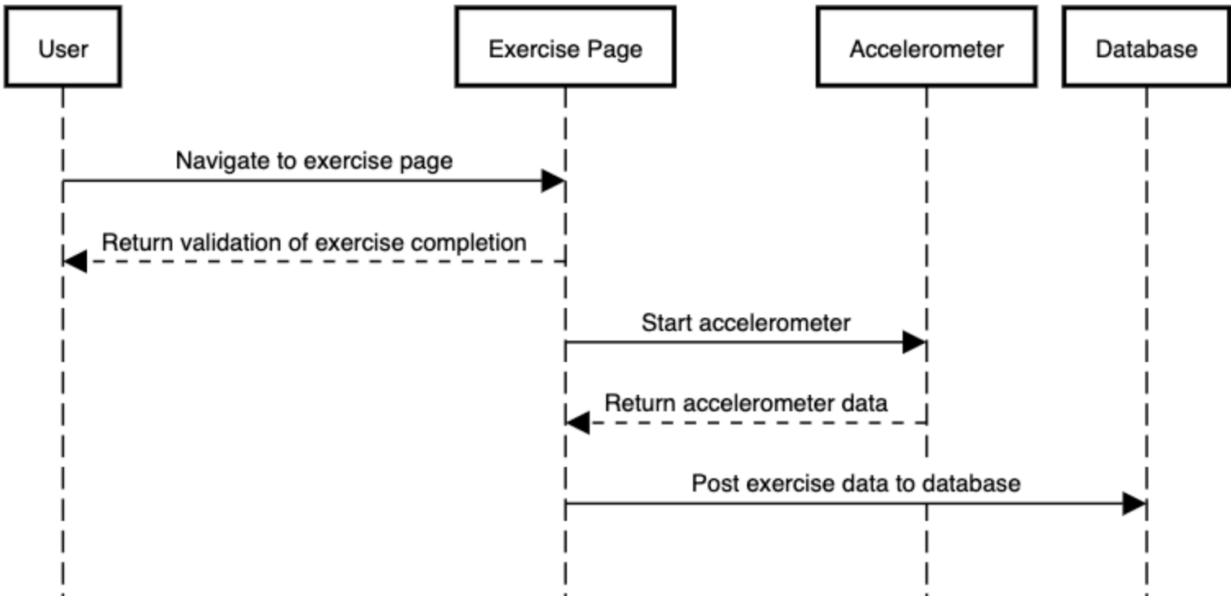


# User Login Sequence

## User Editting Personal Information Sequence



## Appendices

Technologies Applied

- Frontend: Flutter/ Xcode / Dart

- Backend - ExpressJS with NodeJS

- Database - PostgreSQL via Prisma

- APIs - none yet

- User Authentication: - GoogleAuth

- Deployment platform - Fly.io