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45424- Introdução à Computação Móvel/ Introduction to Mobile Computing - Sem2 - 2023-2024
G5 Project Report

PULSEPATH

Fitness Tracking & Wellness Application

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Contents

1 Introduction

The report presented here is the first project undertaken as part of the "Introduction to Mobile Computing" curricular plan. The primary objective of this project was to design and develop a mobile application that addresses a specific need or problem within the realm of mobile computing. In line with this objective, we create PulsePath, a fitness tracking and wellness application.

In the following sections, we provide a comprehensive overview of PulsePath, detailing the motivation, solution approach, the architecture, and assessment of objectives achieved, individual contributions, and a tutorial/manual for users. This report serves as a documentation of our project.

2 Motivation

The development of PulsePath is driven by a deep motivation to address the evolving landscape of health and wellness in today's society. In an era marked by sedentary lifestyles and growing health concerns, there is a huge need for tools that not only track fitness activities, but also inspire people to actively engage in their well-being.

The goal of our app, PulsePath, is to inspire users to take care of their health. We believe that every step, every heartbeat and every drop of water counts towards a healthier person. PulsePath is more than just an app, it is your personal wellness companion, designed to help you understand and improve your daily habits.

Why PulsePath?

- **Heartbeat Monitoring**: Keep a pulse on your cardiovascular health with continuous heart rate tracking.
- **Step Counter**: Every step is a step forward. Track your progress and set new milestones.
- **Hydration Tracking**: Stay refreshed and replenished by monitoring your water intake.
- **Calorie Management**: Make informed dietary choices with a detailed record of your caloric burn.

3 Solution

To ensure a cohesive and easy-to-use experience, we started by thinking about the ideal structure and main components of the PulsePath application. We began this process by sketching the application's layout and identifying the main widgets and functionalities that would be integral to its operation. We arrived at the following comprehensive design for the smartphone and WearOS versions of PulsePath:

Smartphone App:

- **Login and Registration Page:** Users can login if they already have an account or register as new users to access the app's features.
- **Main page:** Provides an overview of essential health metrics including step count, heart rate, calories burned, and water intake.
- **Graphics page:** Displays detailed tables and graphs of sensor data, allowing users to analyze their fitness and well-being trends over time.
- **Profile Page:** Allows users to view and manage their profile information.

WearOS App:

In the WearOS version of PulsePath, our main focus is to provide users with instant access to key health metrics and essential information directly on their wearable devices. It is possible, if the user prefers to use PulsePath only on their WearOS device, without the need for a smartphone. Therefore, we have ensured that the WearOS version of PulsePath is fully functional as a standalone app, offering a comprehensive fitness tracking and wellness monitoring experience regardless of the smartphone app.

- **Heart Rate Widget**: Displays the user's current heart rate directly on the WearOS device, providing instant feedback on their cardiovascular health.
- **Workout Widget:** Offers quick access to ongoing workout sessions, allowing users to track their progress and performance seamlessly.
- **Water Intake Widget:** Provides a convenient way for users to monitor water intake throughout the day, promoting hydration and overall well-being.
- **Weather widget:** Displays current weather conditions, ensuring users can plan their outdoor activities and workouts accordingly.

3.1 Features

The main features implemented in our application are:

1. Weather Integration:
    - Provides users with real-time weather updates directly in the wear os app.
    - Allows users to plan their outdoor activities more effectively based on current weather conditions.

2. WearOS Compatibility:
    - Ensures seamless compatibility and synchronization between the smartphone app and WearOS devices.
    - Users can effortlessly access and manage fitness data on their WearOS smartwatches and in their smartphones

3. Broker (MQTT) for data transmission:
    - It uses the MQTT (Message Queuing Telemetry Transport) protocol to facilitate efficient and reliable data transmission between WearOS sensors and smartphones.
    - Ensures secure and timely exchange of fitness data and notifications.

4. Sensor integration:
    - Step Counter: Utilizes the device's step counter sensor to accurately track the number of steps taken by the user.
    - Heart Rate Monitor: Monitors the user's heart rate in real time, providing information about workout intensity and cardiovascular health.
    - Calorie Counter: Calculates the calories burned during physical activities, helping the user to monitor their energy expenditure.
    - Speed and distance tracking: Measures the speed and distance covered by the user during activities such as running, walking or cycling.

These features have been incorporated to enhance the functionality and usability of the app, providing users with comprehensive fitness tracking and wellness monitoring capabilities.

4 Architecture

Frontend:
The frontend of the application is developed using Flutter, providing user interfaces (UI) for both Android smartphones and WearOS devices.

Backend:
The backend infrastructure handles data processing, storage, and communication between the application frontend and external services.

MQTT Broker:
Implemented to facilitate communication between the WearOS device and the smartphone application.Ensures continuous transmission of sensor data, enabling real-time synchronization of fitness data and notifications.

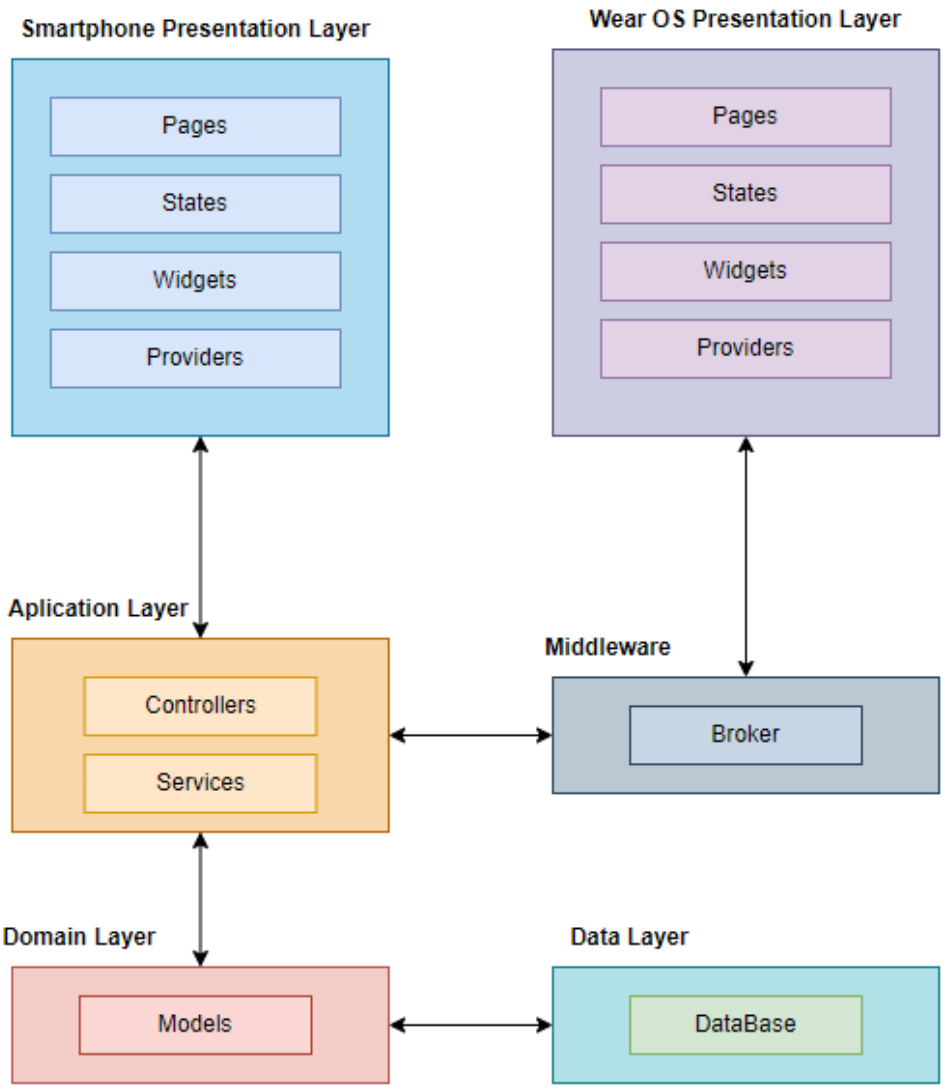
Wear OS Integration:
The WearOS component communicates with the smartphone app via Bluetooth and MQTT Broker to synchronize fitness data and notifications.

Weather Integration:
Weather data is fetched from external APIs and seamlessly integrated into the WearOS app UI.Users receive real-time weather updates directly on their WearOS devices.

Sensor Integration:
Step Counter Sensor: Integrated into the WearOS device to accurately track the user's steps during physical activities.
Heart Rate Sensor: Used on WearOS devices for real-time monitoring of the user's heart rate.
Other Sensors: Additional sensors such as calorie counters, speed sensors, and distance tracking are also integrated into the WearOS device.

Data Flow:
The user interacts with the app UI on their smartphone or WearOS device.
Frontend components communicate user input and requests to the backend.
The backend processes requests, retrieves or stores data in the SQFLite database, and sends relevant notifications or data updates to the frontend.
MQTT Broker facilitates seamless data transmission between the WearOS device and the smartphone application, ensuring timely synchronization of fitness data.

4.1 Architecture Diagram



5 Overall Assessment

After completing the application, we think we did a good job and learned how to work with the Flutter framework, MQTT Broker and SQFLite, although, due to lack of time, it was not possible to further explore some features that we enjoyed having implemented. We would like to have added a few more features, such as detection of nearby devices to perform joint workouts, training pre-sets such as running, cycling, swimming, etc., sleep sensors and improve our application such as adding friends and sharing the progress of my workout life.

5.1 Achieved objectives

As a main objective we wanted to develop a functional, ready-to-use application that achieved its goals of providing users with a comprehensive fitness and wellness tracking solution, seamlessly integrated into Android smartphones and WearOS devices.

5.2 Issues Found

During the development process we faced several significant challenges, mainly related to communication and access to sensor data. One of the main obstacles we faced was establishing effective communication protocols for seamlessly sharing sensor data between devices. Furthermore, accessing sensor data represented a notable challenge, especially with regard to sleep sensors, which was a feature we would have liked to have implemented but due to time constraints it was not possible.

5.3 Contribution Assessment

Cristiano Nicolau (50%)
Tiago Cruz (50%)
GitHub Repository - Click Me

6 Tutorial

WearOS

When the user opens the app on their Wear OS, a list of widgets appears to provide instant information. Starting with the heart rate widget in image 1, if the user swipes up, they will be taken to the second widget in image 3, which shows information about their physical health, step counter, calories and distance covered. In the next section, there is a widget with weather information based on the user's location, as shown in image 2. Finally, the last widget displays a water consumption counter, as seen in image 4.

Smartphone

When the user opens the application on their smartphone, they are greeted with the home screen, as depicted in image 5. Upon clicking the arrow, the system checks for a token and associated information within our application. If a token is present, signifying that the user is logged in, they are automatically redirected to the subsequent screen, illustrated in image 6. If no token is found, the user is directed to the login page, as shown in image 7.

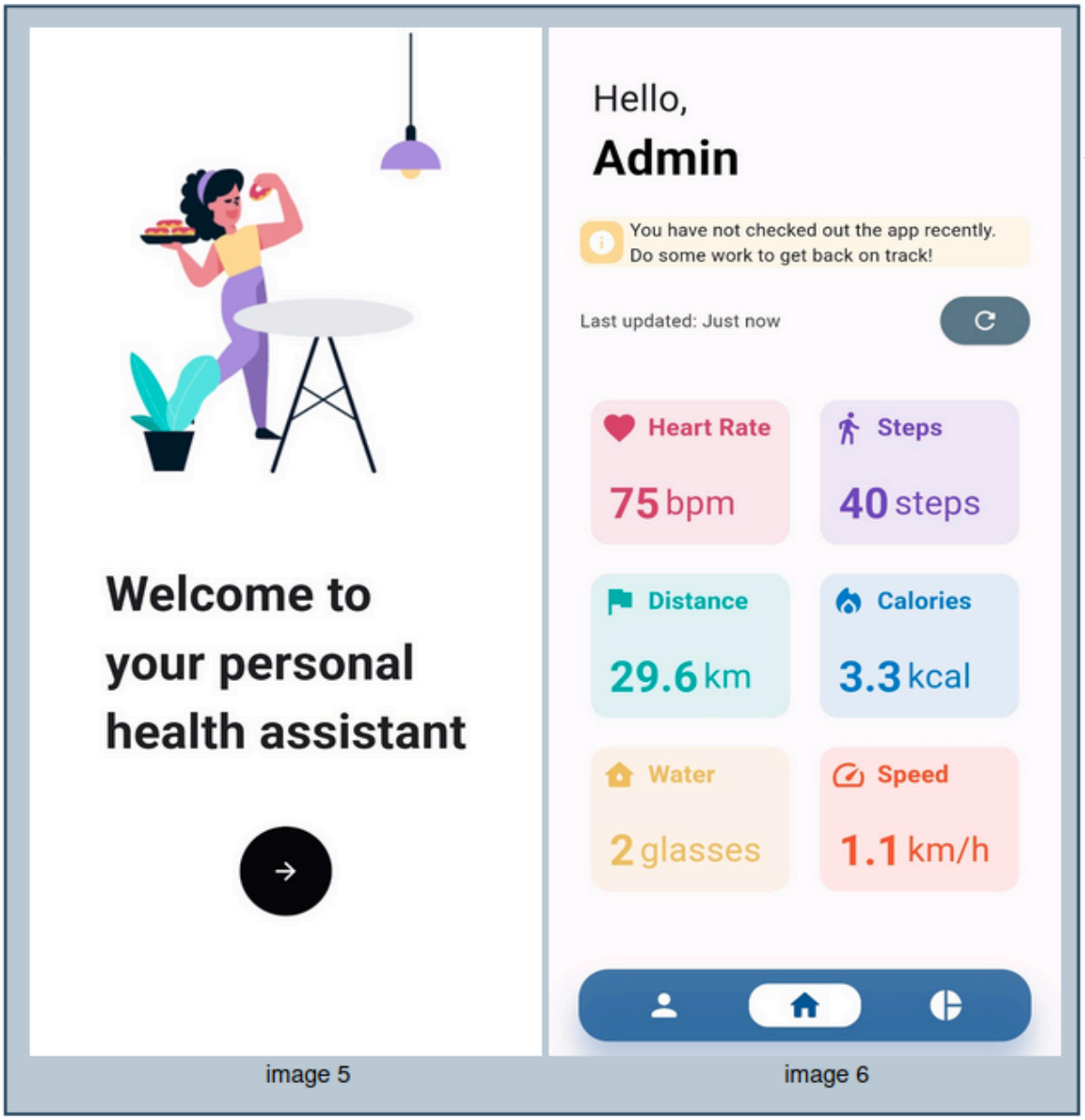


image 5 image 6

On the main page, users can view real-time sensor data and access their profile. Additionally, they can navigate to the charts page, where more detailed information about each sensor is available.

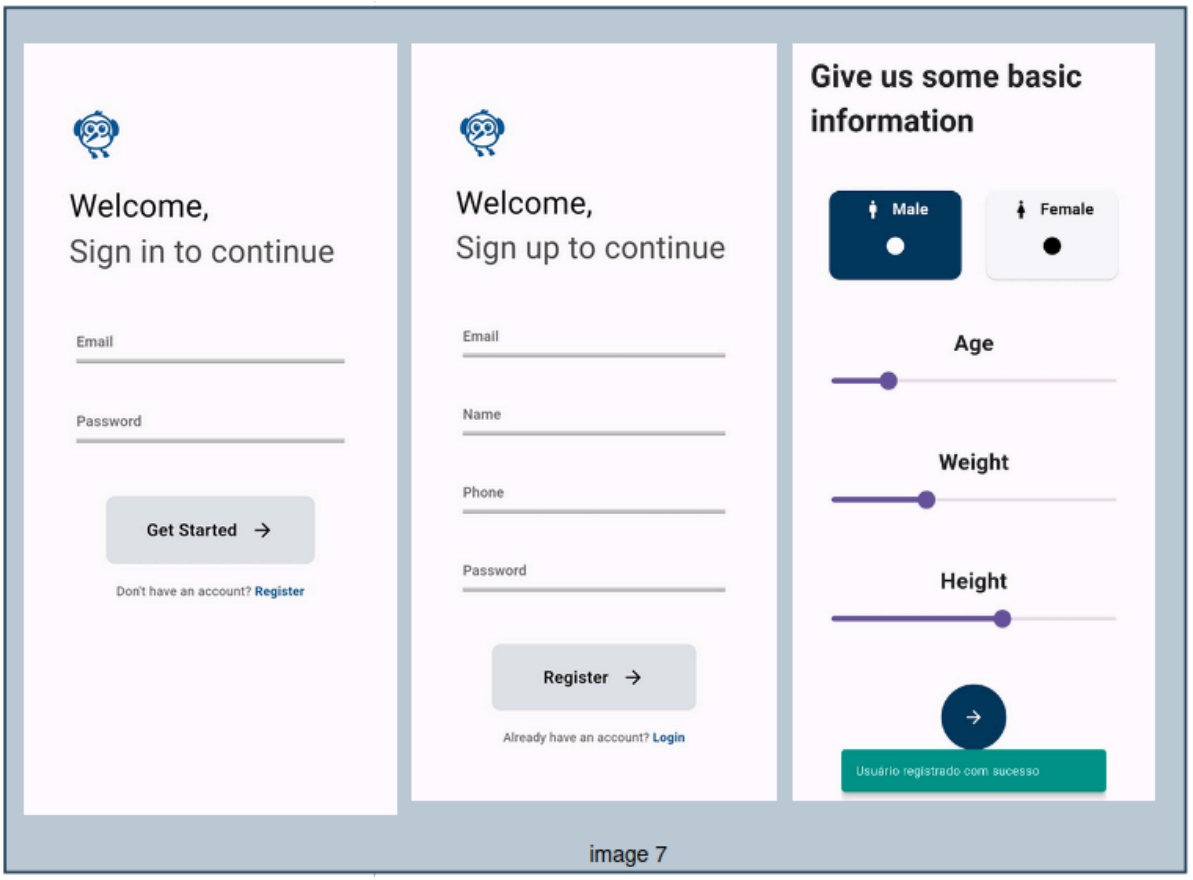


image 7

If you do not have an account, you can register within the application. After registration, you will be prompted to provide basic information about yourself, including age, gender, weight, and height. Once completed, you can begin using the application.

If the user wishes to view their profile, they can click on the user icon in the navigation bar, which will direct them to the profile page, as illustrated in image 8. Additionally, if they want to connect another account or log out of the current one, they can do so by clicking on the logout icon represented in image 9.

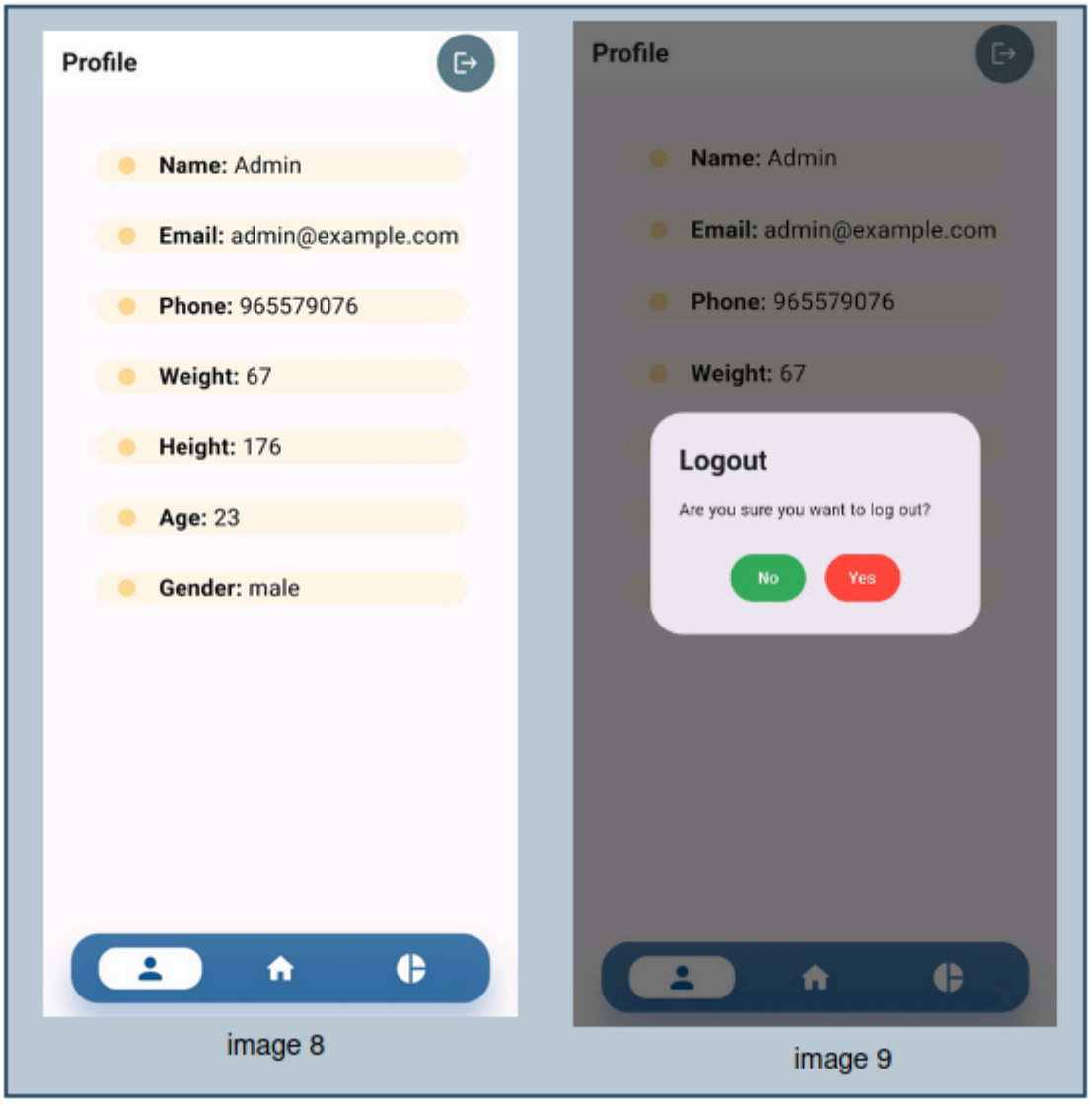


image 8 image 9

If the user prefers to view information related to various sensors more specifically, they can click on the 'Graphs' section in the navbar. Upon opening this page, information regarding the workout graph for the current day is displayed,image 10, with the option to also view data by month or week, image 11 and image 12.

image 10 image 11 image 12

In addition to the above charts, users can also view data related to heart rate sensors or information about water consumption counters. There is also a display showing the charts with different views for day, month, and week. Heart rate sensor data is depicted in image 13, while water consumption data is shown in image 14.

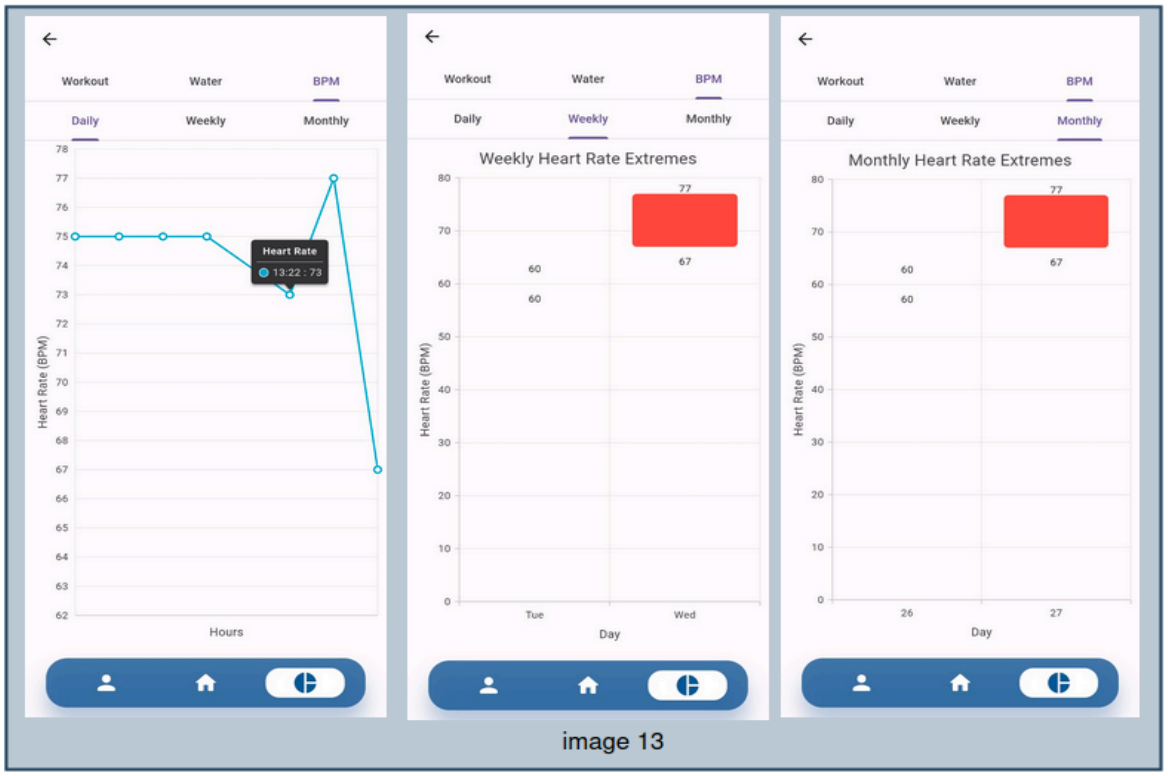


image 13

image 14