Computer Science and Engineering degree - Project and Seminar 22/23

Project Proposal
IPC – Intelligent Personalized Care

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I. Introduction

According to the WHO[1], about 20% of the world's population lives with a painful musculoskeletal condition. Continuous rehabilitation exercises are needed and there are not enough professionals to do this. It is necessary to avoid injuries and other physical problems that result from weakened and inflexible muscles. Keeping in mind that the lack of physical activity/exercise is one of the biggest causes of death, through chronic diseases.

There is a need to rethink prevention, treatment and improvement of the quality of life. It is imperative to discover the best way to combine human capabilities with technology to ensure better services and experience for people.

Our *Intelligent Personalized Care* project aims to respond to the rapidly increasing sedentary lifestyle and isolation of the population. Using advanced artificial intelligence technologies to provide personalized and effective remote care for patients in different health scenarios, it will be possible to reduce and prevent sedentary lifestyle, and promote physical exercise and rehabilitation in people.

This project is based on an Android application to promote physical agility and recovery, through (tele) exercise and (tele) rehabilitation using immersive approaches with vision techniques and artificial intelligence. In addition, the application will offer advanced patient monitoring and follow-up features, allowing physiotherapists to monitor the patient progress.

II. Requirements

In order to achieve the project's objectives, a set of requirements was defined.

Mandatory requirements:

- Create a relational database to store all data related to the application's resources;
- Create a database based on Firebase to store all media files;
- Create a RESTful Web API to access database resources;
- Use Artificial Intelligence techniques to validate physical exercises;
- Create a mobile application that allows the recording of exercises, using the services provided by the aforementioned API;

Opcional requirements:

- Use “TextToSpeech” to improve user experience;
- “Conversational AI” in the app, which uses NLP (natural language processing) and intents, to help and improve user experience;

III. Similar Existing App

There are already some applications with a goal similar to ours, an example is RXRFisio[8]. **Similarities:** it has the same objective of promoting physical agility and providing personalized guidance for each exercise for rehabilitation. **Differences:** it doesn’t have the monitoring of a verified expert, nor can it check through the artificial intelligence whether the exercise is being performed correctly.

IV. Proposed Architecture

The architecture of the proposed system is composed of the Backend component, which contains the two databases and the servers that implement the Web API, and the Frontend part, which corresponds to the visual presentation of the functionalities implemented in the Android application scope.

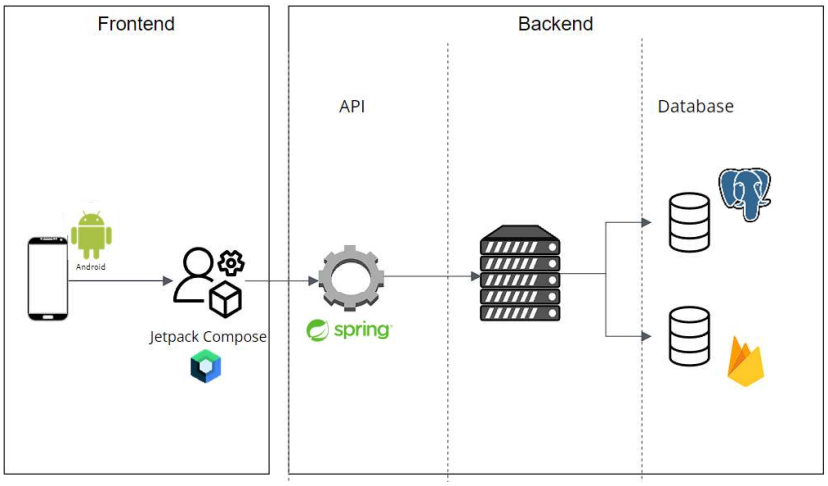

Figure 1: Proposed Architecture Diagram

Backend: To store the relevant system information in the database we will use PostgreSQL[2], while to save the recorded videos, the Firebase[3] platform will be used. In order to deal with data from the relational database, we will use the JDBI[4] library, which will pass the information to the services. These will be exposed through an HTTP API, where we will use the Spring[5] framework as a server.

Frontend: As we are going to implement an Android application, we found the choice of the Kotlin programming language essential, as well as the Jetpack Compose[6] library for creating the UI. To deal with reading information from the camera, the API ML Kit Pose Detection[7] will be used, as it is a lightweight and versatile solution to detect body position in real time.

Use Cases

A primary screen that will only appear once for each user. It serves to create an account, having to insert your credentials and choose what type of user you are. If you are a client, you must define the type of rehabilitation that will be carried out (you can change it later), after that the account is automatically created. If you are a monitor, your submission must go through validation to verify the authenticity of your qualifications.

Client:

- The client, after receiving a request to be monitored, has the authority to accept or reject the monitor that sent the request.
- It has a home screen with the planned exercises to be done and the already done exercises waiting for feedback, it also has the possibility of choosing free exercises without being monitored.
- When clicking on an exercise, you are redirected to the exercise description and a preview. There you can press a button to turn on the camera and record the video. At the end, you can send this video or record it again, if it was incomplete.
- At the end of the plan sent by the monitor, the client can rate the experience with the monitor from 1-5 stars.
- You can see your credentials in the profile screen.

Monitor:

- Has a home screen with all his clients.
- It has a screen to search clients. When choosing one of them to be their monitor, the client must accept it. Once accepted, the monitor has to define a plan suited to the client's problem with a certain time limit.
- By clicking on one of your clients you can see all of their history. It has a button to send a new plan with exercises that exist in the application to be carried out. You can also evaluate an exercise that the client has recorded and attached, sending feedback to the client.
- You have the profile screen, where you can see your credentials and the average of your rating.

V. Risks

- Use the ML Kit Pose Detection API which is still in Beta version.
- Taking into account the innovative nature of the project, its scope has to be well defined to avoid wasting time and problems outside its scope.

VI. Major Milestones

- Project Proposal - March 20^{th}
- Presentation of Progress - April 24^{th}
- Beta Demostration - June 5^{th}
- Final version - July 10^{th}

VII. Project Planning

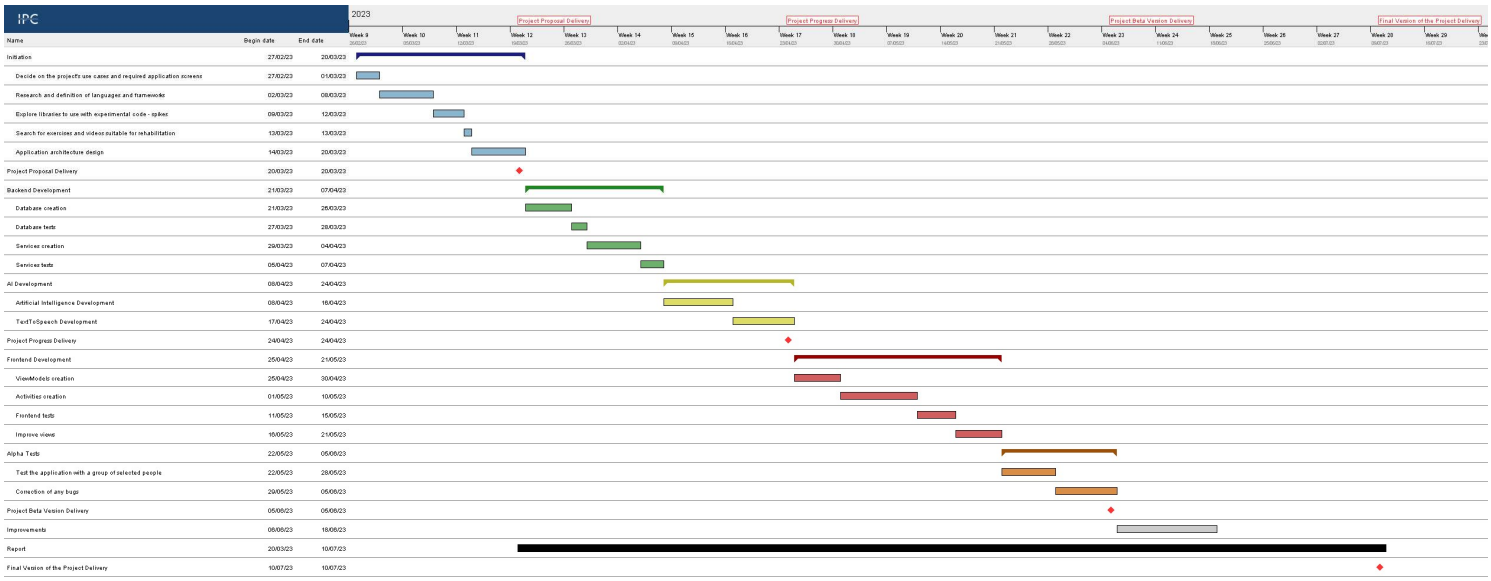

Figure 2: Project Planning Gantt Chart

VIII. References

[1] World Health Organization – Musculoskeletal health. https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions, 2022. [Online; accessed 20-03-2023].
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[4] JDBI. https://jdbi.org/, 2023. [Online; accessed 20-03-2023].
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[6] Jetpack Compose. https://developer.android.com/jetpack/compose?hl=pt-br, 2023. [Online; accessed 20-03-2023].
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