



UNIVERSITY OF WOLVERHAMPTON

PROJECT AND PROFESSIONALISM

(6CS007)

PROJECT PROPOSAL REPORT

FITNESS COMPANION APPLICATION

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Abstract

This report presents the development of the Fitness Companion Application, a comprehensive system designed to enhance fitness journeys through real-time pose estimation, personalized nutrition planning, and progress tracking. I sincerely thank my supervisor, Bipul Bahadur Pradhan, reader Yogesh Bikram Shah, and module leader Aashish Acharya for their invaluable guidance. My gratitude also extends to Herald College Kathmandu for providing this platform to explore and implement my research ideas. This project deepened my understanding of fitness technology and introduced me to innovative tools that ensure user safety, engagement, and effectiveness. This opportunity has been pivotal in advancing my technical and research skills.

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1. Statement of project Details

Project Title: Fitness Companion Application (Fit Hub)

1.1. Introduction

The Gym Companion Application is developed with the aim of making your fitness journey easier and fun. It helps you find exercises based on how hard they are, what machines you have, or what equipment you use. It also creates a nutrition plan for you by checking your height, weight, age and other metrics, so you eat right for your goals. The coolest part introduces the use of smart technology to check your squats and deadlift poses. You can choose beginner or pro mode, and it will give you tips to improve and keep you safe while working out. It's like having your own fitness coach on your phone.

1.2. Academic Question

1. In what ways does real-time pose estimation enhance workout safety and effectiveness?
2. How does integrating nutrition planning into a fitness app provide comprehensive user experience?
3. What impact does categorizing exercises by difficulty, equipment, or machines have on user engagement and progress?
4. How can advanced features like MediaPipe-based feedback revolutionize home fitness applications?

1.3. Aims and Objectives

1. Aim: Browse a library of exercises sort by difficulty, equipment, or machine.

Objective: Allow users to search for exercises based on difficulty level, equipment, or machine type.

2. Aim: Let users save their daily workout routines with set timers for exercises.

Objective: Allow users to log and save their daily workout routines and set timers for each exercise.

3. Aim: Track which muscles are targeted in each workout and show progress.

Objective: Keep track of the muscle groups worked in each exercise and help users see their progress over time.

4. Aim: Provide exercise suggestions based on user goals or preferences.

Objective: Recommend exercises based on the user's goals (e.g., strength, endurance) or their preferred workout style.

5. Aim: Offer step-by-step exercise guides and videos.

Objective: Provide users with easy-to-follow instructions and videos for each exercise to ensure correct form.

6. Aim: Allow users to customize their workouts.

Objective: Let users create their own custom workout routines by selecting exercises based on their needs or preferences.

7. Aim: Browse a library of exercises organized by difficulty, equipment, or machine.

Objective: Allow users to search for exercises based on difficulty level, equipment, or machine type and can calculate sets with their weight and repetitions.

8. Aim: Let users save their daily workout.

Objective: Allow users to log and save their daily workout routines and set timers for each exercise.

9. Aim: Provide exercise suggestions based on user goals or preferences.

Objective: Recommend exercises based on the user's goals (e.g., strength, endurance) or their preferred workout style.

10.Aim: Offer step-by-step exercise guides and videos

Objective: Provide users with easy-to-follow instructions and videos for each exercise to ensure correct form.

11.Aim: Allow users to customize their workouts

Objective: Let users create their own custom workout routines by selecting exercises based on their needs or preferences.

1.4. Problem Statement

Many fitness enthusiasts and new gym rats struggle to organize and track their workout routines, dietary plans and fitness workouts, and managing personalized nutrition often make achieving fitness goals challenging. Additionally, users frequently lack access to tools that integrate all aspects of their fitness journey I'm one seamless platform.

Current fitness applications often fall short in providing real-time feedback for proper exercise techniques, leading to inefficient workouts and a higher risk of injuries. The absence of guided suggestions tailored to user goals and body types, along with the inability to track muscle engagement or progress accurately, further hinders their fitness experience. Managing nutrition is another pain point, with most tools offering generic meal plans that fail to consider the user's unique height, weight, age, and fitness objectives

Another challenge is the complexity of navigating between multiple applications or tools or fitness, nutrition, progress tracking. Users find it difficult to switch between apps for pose analysis, dietary recommendations, and exercise routines. The lack of integration makes overall fitness time-consuming, unintuitive, and less effective.

1.5. Project as Solution

The Comprehensive Fitness Management System is designed to solve common fitness challenges by offering an all-in-one platform for fitness tracking, pose analysis, and nutrition planning. It gives real-time feedback to help users perform exercises correctly, reducing the risk of injuries and making workouts more effective. Users also receive personalized meal plans based on their height, weight, age, and fitness goals, along with a library of exercises sorted by difficulty, equipment, and target muscles. This helps users create workouts that match their needs and preferences.

The system simplifies fitness management by combining multiple tools into one platform, making it easier for users to track progress, improve their form, and get nutrition advice without using multiple apps. The goal is to provide a simple, efficient experience that helps users stay consistent and achieve their fitness goals.

Features like real-time pose tracking ensure users perform exercises like squats and deadlifts safely, with instant feedback to improve their posture and form. The personalized meal plans include suggestions for breakfast, lunch, and dinner, with reminders to keep users on schedule and motivated.

1.6. Artifacts to be Developed

The project will contribute on making of Comprehensive fitness management system that will guide you along your fitness journey from beginner to professional. The project comprises:

1. Exercise Library
2. Personalized Nutrition Planner
3. Real-Time Pose Estimation
4. Meal Reminder System
5. Workout Routine Tracker
6. Progress Dashboard
7. Muscle Group Tracker
8. Exercise Timer
9. Beginner and Pro Workout Modes
10. Feedback on Exercise Form and Posture
11. Categorized Exercise Search (Difficulty, Equipment, Machines)
12. User Profile Customization

2. Project proposal

2.1. Introduction

The Fitness Companion Application is designed to revolutionize fitness by making workouts more accessible, engaging, and personalized. During the COVID-19 lockdown, many people found it challenging to maintain their fitness routines as gyms were closed, and outdoor exercise was restricted. This situation highlighted the need for a solution that supports fitness from home while ensuring proper guidance to prevent injury and maintain effectiveness.

This application addresses these challenges by providing a virtual gym instructor through real-time pose estimation technology. Users can perform exercises like squats and deadlifts with instant feedback on posture and form, ensuring they exercise safely and correctly. With beginner and professional modes, the app caters to individuals at all fitness levels, enabling them to progress at their own pace.

The app also features a comprehensive exercise library categorized by difficulty, equipment, and muscle groups, making it easy for users to find suitable workouts. Additionally, it generates personalized nutrition plans based on metrics such as height, weight, and age, promoting a holistic approach to fitness.

By combining technology, detailed guidance, and personalized features, the Fitness Companion Application not only bridges the gap left by gym closures during lockdowns but also empowers users to take control of their fitness journey from the comfort of their homes. This app acts as a virtual coach, making fitness management easier, safer, and more enjoyable for everyone.

2.2. Initial Research into source of information

Before starting my project, I got ideas from a few of the documents available on the internet. Here, I have review for some documents that are related throughout my projects. They are not on detail, but I have provided you some relevant information that signifies the article correspondence to my project.

1. Accuracy Evaluation of 3D Pose Estimation with MediaPipe Pose for Physical Exercises

This paper investigates the accuracy of the MediaPipe Pose library for camera-based pose estimation. It examines its suitability for applications such as physical therapy, highlighting how accuracy varies with viewing angles and types of exercises.

This source is highly relevant as it explores MediaPipe Pose's functionality, the key library for pose detection in the Fitness Companion Application. It provides insights into the library's strengths and limitations, aiding the development of accurate pose estimation for squats and deadlifts. (Sebastian, et al., 2023)

2. Changes in physical activity and sedentary behaviors from before to during the COVID-19 pandemic lockdown: A systematic review

This review highlights changes in physical activity habits during the COVID-19 pandemic, including a shift toward home-based fitness solutions and increased use of fitness apps.

The findings highlight the necessity and value of an app that offers a comprehensive fitness platform for users who prefer or require home-based workout solutions, especially in post-pandemic scenarios. (Stockwell, et al., 2021)

3. Effects of a personalized fitness recommender system using gamification and continuous player modeling: System design and long-term validation study

This paper explores a gamified 24/7 fitness assistant system that integrates player modeling and wearable tracking to deliver personalized content and recommendations. It includes a study with 40 participants over 60 days to assess the long-term effectiveness of personalized gamification in promoting physical activity.

The research informs the implementation of gamified features and personalized fitness recommendations in the Fitness Companion Application. It highlights how dynamic user modeling can enhance user engagement, aligning with the app's goals of providing tailored workout plans and nutrition guidance. (Zhao, et al., 2020)

4. Digital applications for diet monitoring, planning, and precision nutrition for citizens and professionals: a state of the art

This review critically evaluates digital applications designed for diet monitoring, planning, and precision nutrition. It highlights the strengths, weaknesses, and future potential of such tools. The study underscores the significance of AI and machine learning in enhancing the functionality and personalization of these applications, while addressing issues such as data accuracy, accessibility, and affordability.

The findings provide valuable insights for incorporating diet planning and nutrition-tracking features into the Fitness Companion Application. By leveraging AI, the application can offer more accurate and personalized diet recommendations based on user data, such as height, weight, and age. (Abeltino, et al., 2024)

5. FitSight: Tracking and feedback engine for personalized fitness training

This paper introduces a system that utilizes YOLOv7 and webcams to provide real-time feedback on exercise posture, counting repetitions, and offering textual guidance. The system was tested in a simulated gym environment and showed improvements in users' exercise techniques.

The study aligns closely with the Fitness Companion Application's squat and deadlift tracking feature, reinforcing the importance of real-time feedback and posture correction in promoting safe and effective workouts. (Hitesh, et al., 2024)

6. Motivation and user engagement in fitness tracking: Heuristics for Mobile Healthcare Wearables

Explores user engagement and long-term motivation associated with fitness trackers, using a 4-week diary study with 34 participants. Highlights design implications for improving UX and self-efficacy in mobile healthcare applications.

Provides insights into how UX influences motivation and engagement, which can be applied to design the Fitness Companion Application's interface and gamification features to maximize user interaction and adherence. (Stavros, et al., 2017)

2.3. Artefacts

The proposed artefact is a comprehensive Fitness Companion Application designed to enhance workout experience for users through innovative features. The application will integrate real-time pose estimation, personalized nutrition planning, progress tracking, and gamification. It aims to provide a holistic approach to fitness, addressing user needs in both exercise and diet, while promoting long-term engagement through interactive and adaptive functionalities. Primarily Key features include of:

1. Real-time pose estimation using advanced computer vision techniques.
2. A dynamic and personalized nutrition planner.
3. Categorized exercise library based on difficulty, equipment, and machines.
4. Gamified progress tracking and tailored workout modes for users of varying skill levels.

The artefact is designed to address critical challenges in fitness technology, directly aligning with the academic questions of enhancing workout safety, providing comprehensive user experiences, and innovating home fitness applications. By incorporating technologies like real-time pose estimation and advanced tracking, the artefact ensures improved safety and effectiveness for users. Additionally, the integration

of nutrition planning and progress dashboards offers a unified fitness solution, setting it apart from existing applications.

The inclusion of categorized exercises and gamified engagement ensures the application caters to diverse fitness levels and preferences, encouraging sustained user interaction.

2.3.1. Consideration of Other Artefacts

Existing fitness applications and wearable devices often specialize in specific areas, such as calorie tracking, guided workouts, or basic fitness tracking. However, they lack the integration of real-time feedback, personalized nutrition analytics, and gamified features that this artefact will provide. For example:

1. MyFitnessPal

MyFitnessPal is one of the most well-known fitness apps globally, with a primary focus on calorie counting, meal tracking, and weight management. It provides an extensive database containing over 11 million food items, enabling users to log their meals and monitor caloric intake. The app also allows users to track their physical activities and syncs with various fitness devices to integrate workout data. MyFitnessPal's user-friendly interface and community forums make it a go-to option for people looking to achieve their dietary goals. However, its focus is limited to diet tracking and basic exercise logging, lacking features like real-time pose estimation, personalized workout routines, or gamified engagement tools.

2. Nike Training Club

Nike Training Club is a fitness app designed to bring professional-quality workout routines to users' fingertips. It features a variety of guided programs created by fitness experts, covering strength, endurance, mobility, and yoga exercises. The app caters to individuals of all fitness levels, from beginners to advanced athletes. It provides audio and video instructions for workouts, ensuring users can follow along seamlessly. Nike Training Club also includes programs tailored to specific fitness goals, such as weight loss or building

muscle. However, it focuses primarily on workout guidance, with no integrated nutrition planning or real-time feedback mechanisms for posture correction. Its customization options are also limited compared to more personalized fitness apps.

3. Strong Workout Tracker Gym Log

Strong is a strength training-focused app ideal for fitness enthusiasts who want to track their progress in weightlifting and resistance training. The app allows users to log sets, reps, and weights for various exercises, making it easy to monitor their progress over time. Strong's minimalistic design is optimized for quick data entry, and it includes useful features like rest timers and detailed workout statistics. Despite being a powerful tool for tracking workouts, Strong does not provide guidance on exercise form, offer real-time pose feedback, or include features like nutrition planning or gamification. It primarily serves as a digital logbook for strength training.

Here, this is a comparison table for different features comprised by other similar applications available on the web.

Feature	MyFitnessPal	Nike Training Club	Strong Workout Tracker	Fitness Companion Application
Real-time Pose Estimation	Not Available	Not Available	Not Available	Tracks exercises like squats and deadlifts using MediaPipe.
Personalized Nutrition Plans	Basic calorie tracking	Not Available	Not Available	Fully customized meal plans based on height, weight, and fitness goals.

Exercise Library	Limited workout guidance	Guided programs by trainers	Minimal	Extensive library is categorized by difficulty, equipment, and machines.
Progress Tracking	Calorie-focused	Basic workout tracking	Tracks weightlifting progress	Tracks muscles worked and overall fitness progress.
Beginner and Pro Modes	Not Available	General guidance	Not Available	Tailored workout modes for beginners and pros.
Exercise Suggestions	Not Available	Not Available	Not Available	Recommend exercises based on user goals and preferences.
Exercise Timer	Not Available	Not Available	Basic stopwatch	Includes customizable interval times for exercises

While MyFitnessPal shines in meal tracking and calorie counting, it lacks the advanced workout and feedback features found in the Fitness Companion Application. Similarly, Nike Training Club is an exception for guided workouts but falls short in areas like real-

time feedback, personalized nutrition plans, and progress tracking. Lastly, Strong Workout Tracker is an excellent choice for weightlifting enthusiasts but does not provide tools for posture correction, exercise suggestions, or gamified features, making it less comprehensive than the Fitness Companion Application. The proposed artefact bridges these gaps, offering a seamless blend of functionalities in a single platform.

2.3.2. Artifact Development

The development of the Fitness Companion Application will follow a well-defined cycle to ensure that it is built efficiently, can adapt to changes, and meet user needs. The cycle will include the following phases:

1. Planning and Requirement Analysis:

In this phase, I will gather and define user needs and expectations for the app. I will prioritize features based on what is most important for users and ensure that the app will meet those needs.

2. Design:

During the design phase, I will focus on creating the look and feel of the app. This will include designing the user interface (UI) wireframes (layout) and creating a structure for the database to manage user data effectively.

3. Development:

This phase will involve the actual coding of the app. Features will be developed in iterations, meaning that I will build a feature, test it, and integrate it into the app, refining it as I go.

4. Testing:

Once the app's features are developed, I will test them to find any bugs or problems. Testing will include ensuring the app runs smoothly, performs well, and is easy for users to navigate.

5. Deployment:

After testing, I will release a final version of the app that is ready for users to use. This will be the production version, meaning it's stable and fully functional.

6. Maintenance and Updates:

After deployment, I will keep the app updated based on user feedback and any new requirements that come up. Regular updates will ensure the app remains useful and relevant over time.

2.3.3. Tools And Techniques

For building Fitness Companion Application, I will use a variety of tools and technologies to make sure that the app works well and is easy to maintain:

1. Frontend Development:

Native React.js will be used to create the user interface. This will ensure the app is responsive (which works well on different devices) and provides smooth experience for users.

2. Backend Development:

Django will be the main framework for the backend. It will help manage the server-side logic, database connections, and secure APIs that interact with the frontend.

3. Database:

PostgreSQL will be used to store user data securely. It is a robust database system that will allow me to store, manage, and retrieve data efficiently.

4. Version Control:

Git will be used to manage changes in the app's codebase. It will allow multiple developers to work together and track changes to ensure nothing is lost.

5. Project Management:

Jira will be used to track tasks, monitor progress, and manage workflows. It will help me stay organized and ensure that the project is completed on time.

2.3.4. Methodology

For this project, I will follow the Scrum methodology, which is well-suited for individual development due to its flexibility and iterative nature. Although Scrum is typically used in teams, it can be adapted for solo development by breaking the project into manageable tasks and delivering them incrementally. This approach allows me to focus on one feature at a time, regularly assess progress, and make improvements based on feedback.

Key benefits of using Scrum include:

1. Flexibility:

Scrum allows me to adapt the project scope and features based on feedback or changing requirements without being locked into a rigid plan.

2. Frequent Deliverables:

By completing small tasks and releasing them frequently, I can ensure steady progress and gain a better understanding of what works and what needs adjustment.

3. Self-Management:

Using tools like Jira will help me keep track of my tasks, deadlines, and progress, ensuring that I stay organized and efficient throughout the project.

By combining Scrum with the right tools and technologies, I will ensure that the development process remains focused, efficient, and flexible, allowing me to create a user-centered Fitness Companion Application

3. References

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4. Appendix

1. Work Breakdown Structure



Figure 1: WBS Diagram

2. Gantt Chart

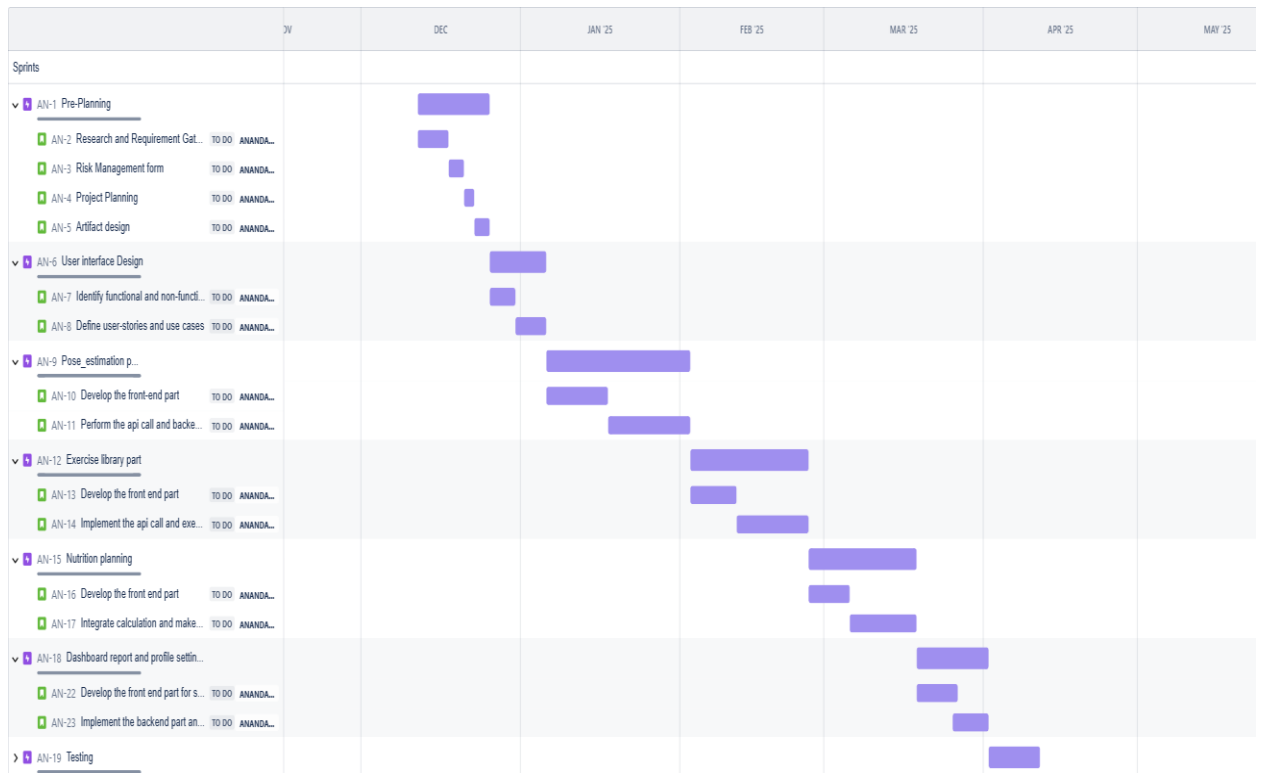


Figure 2: Gantt Chart

3. Architecture Diagram

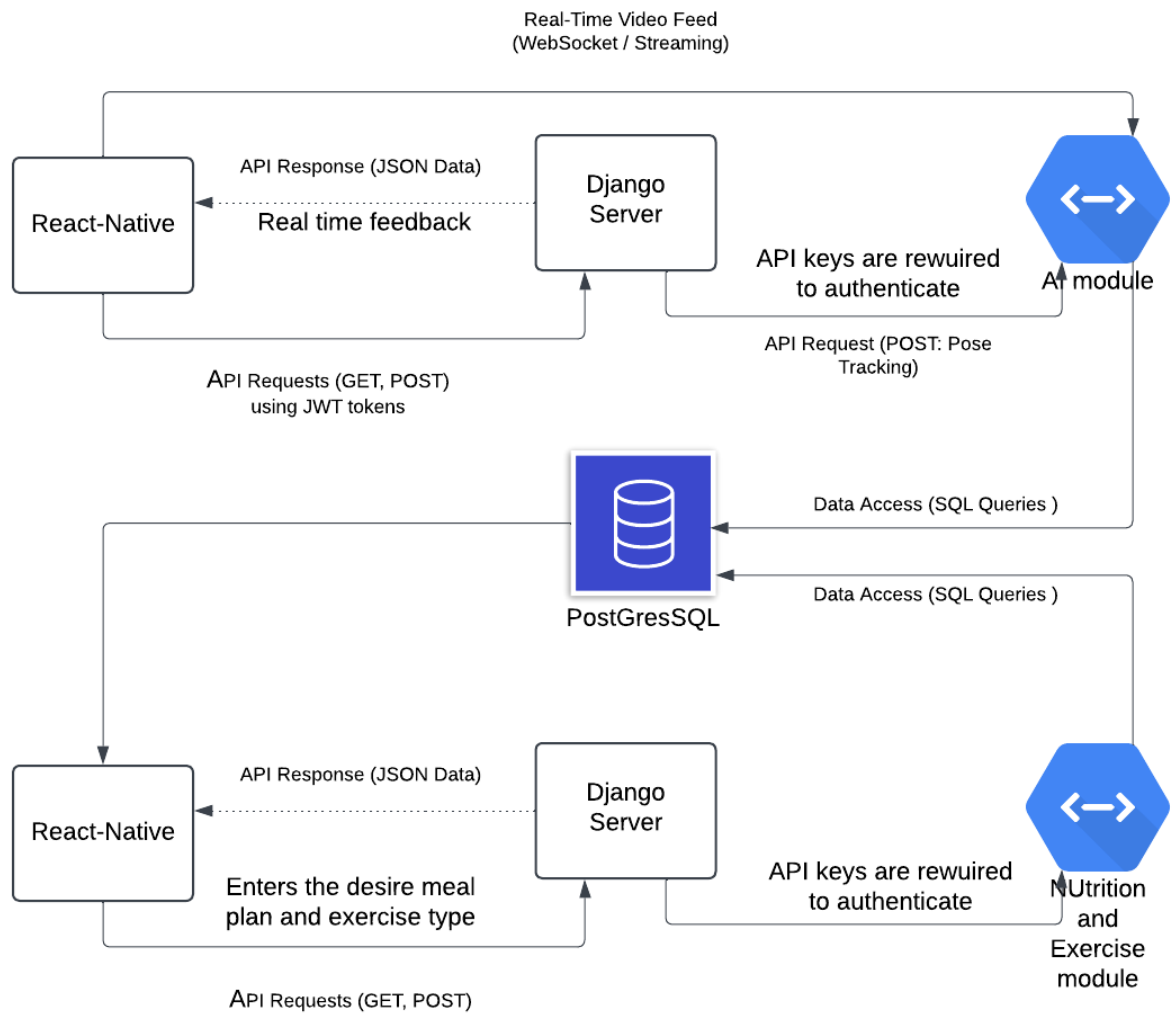


Figure 3: Architecture diagram

4. User flow diagram

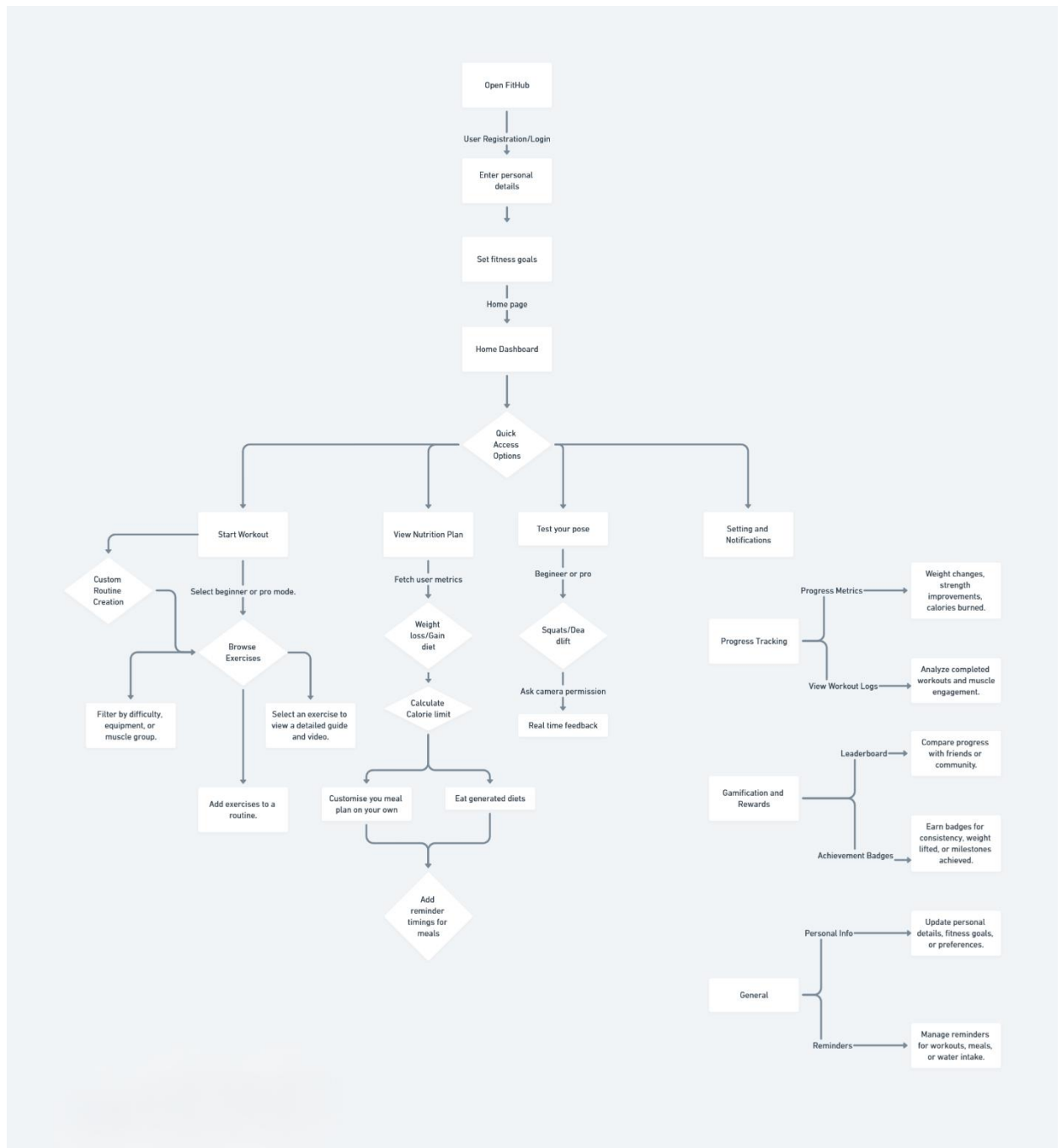


Figure 4: User Flow Diagram

5. Use case diagram

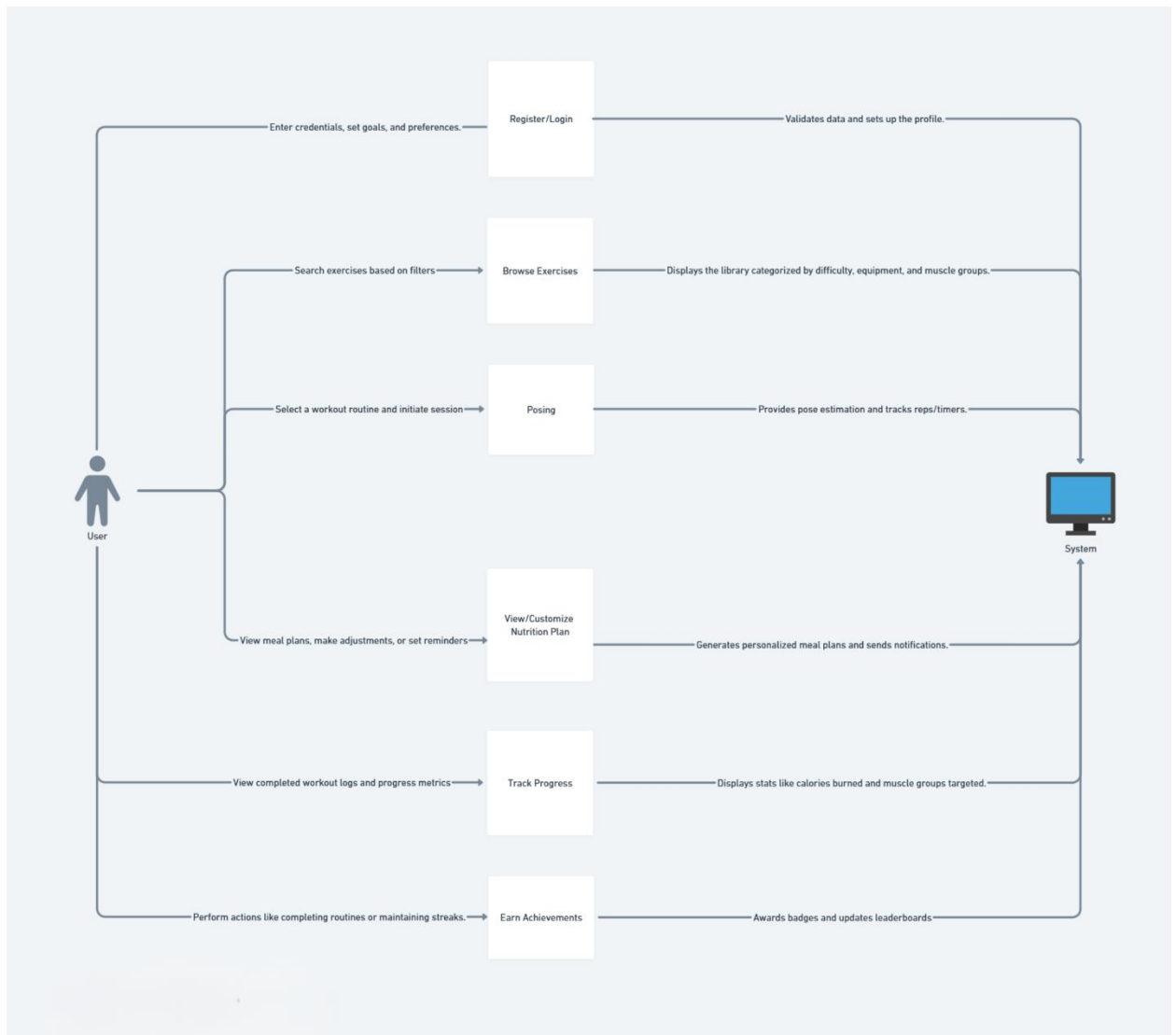


Figure 5: Use case diagram