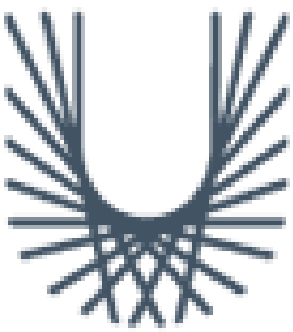

Ollscoil Teicneolaíochta an Oirdheiscirt

South East Technological University

Final Year Project, Functional Specification, Gym Personal Training & Analytics App

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1. Abstract

The purpose of this project is to create a cross platform (Android & iOS) application which will enable personal trainers or coaches to interact with their clients or players via mobile. They can manage their client's workout plans and see how they are progressing with each workout completed. They will also be able to provide meal plans and nutritional advice. Additionally, users will be able to create and edit their own plans using the app without interacting with a coach or personal trainer. Machine learning will also be implemented to perform different methods of statistical analysis and try predicting users' goals and give relevant feedback to improve time spent in the gym and the ultimate goal of using this app, to get healthier. This document will describe the design of the application and show how it will be used. It will provide information on the relationships between models and the architecture of the system.

2. Introduction

The purpose of this document is to define what the application is and what it does. It will also go into detail about the different functionalities the app will provide and specify whether they are core or non-core pieces of functionality. The application is at its core, will be a fitness application. It should allow personal trainers or coaches to effectively interact with their clients or players to manage and track their workout plans and or nutritional plans. The application will also allow for solo users to create and track their own workout and nutritional plans without the help of a personal trainer.

The application may benefit from the implementation of machine learning techniques, offering the potential to provide personalized and useful feedback to users based on the data they upload while tracking their workouts. Further research is required to fully understand the scope of machine learning implementation for this app, as there are several possible approaches. One approach could involve utilizing machine learning to analyse user-uploaded images or videos of their workouts, providing feedback on their form and technique. Another approach could involve analysing user data, such as workout performance, to suggest personalized feedback and adjustments to improve the effectiveness of their workout routines. By leveraging machine learning, the app can help users achieve their fitness goals more efficiently and effectively.

3. Requirements of the Mobile Application (FURPS)

3.1 Functionality

This section of the document will go into detail about each area of functionality and explain if it is a core or non-core functionality. There will be three main sections of functionality to consider while developing this app.

- The first being the foundation or the core of the app. This will include basic features like logging in, changing password etc.
- The second section will cover all the important features of the app and the main reasons why people will download the app. This being the ability for a personal trainer to actually interact with their clients and being able to manage their workout / nutritional plans. This section will also include the feature which lets a solo user create and manage their own workout / nutritional plans.
- The third section will cover the machine learning aspects of the project. These functionalities include analysing user data while giving relevant feedback and analysing image and video data to provide feedback to the user.

3.1.1 Basic Application Features (Core Features)

Core features are basically functionalities that the app is built upon. The core features lay out the foundation for the app and act as building blocks for the other features. Some of the core features for this app include:

- Creating an account
- Log in / out.
- Change password.

Making sure the user has access to their profile is essential to this app as this is where they will manage their own workouts and interact with their personal trainer. Another core functionality is the ability for a person to sign up for a certain type of account. They will either have a personal trainer or a regular user account. This will influence what the user sees when they log into the app and see the dashboard.

3.1.2 Important Application Features (Core Features)

Continuing on with the core features, the main goal of this application the implementation of personal trainers actually interacting with the clients. This feature will allow the personal trainer to effectively and easily interact with their client. This is where choosing the different account types either personal trainer or general user will come into effect. The personal trainer account will allow the user to manage their clients easily. Simple logic and UI must be used here as the user could have thousands of clients. The user can upload and assign all their clients a workout or nutrition plan. The user can add exercises of different types and provide notes and videos for their clients help. This user type should also be able to view their clients progress and see the data they input after each session. Furthermore, it should give the user the ability to create and track their own workout plans like a normal user.

Another core functionality is for the general user account type. It should allow the user to be assigned to a personal trainer and view any assigned workout/nutrition plans. The user should also be able to create, edit and view their own workouts from a library of exercises. The user can also track their daily food intake and view their nutritional plan to see if they me their goals, for example, calorie counting. The user should be able to monitor and track their weight and see relevant data according to their workouts and nutrition intake each day. This data should be all their recent workouts and the weights/reps they did for that session.

3.1.3 Machine Learning Features (Non-Core Features)

There are two possible ways to incorporate machine learning features into the application. The first approach would involve training a machine learning model to analyse user's input data after each workout to provide feedback. This could potentially include analysing workout performance to suggest adjustments to weight or reps, but this may be challenging to implement and could require a significant amount of time and resources. An alternative approach could be to predict a user's future weight based on features like height, calorie intake, and workouts completed. This would be a valuable tool to help users set realistic goals and track their progress towards achieving them.

The second machine learning aspect of the application would be to implement image and video analysis to identify when the user is not performing a movement correctly, providing corrective feedback on how to improve their form. However, it should be noted that implementing this feature could also be challenging and time-consuming, potentially requiring significant resources. Therefore, it may not be feasible given the complexity and potential time requirements, incorporating the image and video analysis machine learning feature into the personal trainer app may not be feasible within the current project timeframe. However, this feature could be considered for future iterations of the app, offering an opportunity to enhance its overall functionality and provide greater benefits to users.

3.1.4 Monetization Features (Non-Core Feature)

This feature refers to how the application will make money. For a user to make an account of 'Personal Trainer' type will require a monthly subscription. It will not be a big fee, just a charge for using this platform to deliver their service to clients. It is free to make an account of type 'Normal User' but there will be in app purchases available. These in app purchases will include a variety of advanced workout and nutrition plans.

3.2 Usability

In terms of usability, this application must have a clean and simple user interface. The navigation of the app will be clear and easy to understand. The user experience is a vital part of every application and can determine whether the application will be successful or not. Steve Krug, a user experience professional, has a set of rules you should follow when designing an app and his first law is "Don't make me think".[1] This is a simple yet effective way of thinking. If you look at it from a user's point of view, if the app makes you think about how to navigate it then they could get fed up quickly and discard the app for another with a simpler UI. This application will achieve a good user experience by having a clear navigation bar with clearly labelled buttons and relevant information to the screen. It will also minimize the steps needed to preform actions. Instead of having to click into 4-5 different sections to add a workout plan, they should be able to achieve this in 3 steps or less from the home screen. This format could be Workout screen > Add Workout > Save Workout.

3.3 Reliability

Reliability is a vital feature of any application. The users will rely on the application to manage important parts of their daily lives. If the user cannot log in because of database problems, they will not be able to record their workouts and nutrition intake for the day. This application is going to use Firebase for backend and database use. It provides strong reliability and security. Firebase's security rules are a vital part of the platform, ensuring both security and reliability. They also give developers a strong set of tools for controlling access to their data and services, allowing them to define detailed permissions based on a user's authentication status, location, device information, and other factors. These rules also enable developers to enforce data validation and prevent unauthorized access. This makes it more challenging for attackers to exploit application vulnerabilities. Firebase has an advanced security model that can help protect data from numerous types of threats by enforcing these security standards. Furthermore, Firebase provides reliable data storage and high availability, allowing developers to consistently store and retrieve data even during unforeseen situations such as server outages.

Overall, Firebase's security rules provide developers with a solid foundation to build secure and reliable applications which influenced the decision to choose this technology.

3.4 Performance

The performance of an application also contributes to the user experience. The ideal load time after clicking is 1-2 seconds any longer and the user will get impatient and feel like something is wrong.[2] When this happens users tend to click again, reload or try preforming a different action. This is why performance is key to developing a successful application. This thinking process influenced the decision to choose React Native as the frontend framework as it provides excellent performance even as the project scales up and becomes a larger project. It also provides quick response times when requesting from APIs which will have to be done when the user requests to view the library of exercises.

3.5 Supportability

The goal for this project is to develop an application that supports both the iOS and Android platform. All functionalities should be available to both platforms with no differences between them. This application could also include a feature where the user can click a 'Help' button which will provide them a set of instructions on how to perform a task on that screen, for example, adding a workout would have instructions on which button to click and how to manage it.

4. Objectives

The main objective of this application is to help users reach their fitness goals. It will do this in many ways:

- First of all, it will provide users a straightforward and user-friendly interface for monitoring their exercise, nutrition, and other health-related data. This may contain functions like activity logging weight and tracking calorie intake.
- Secondly, to connect users with personal trainers and allow trainers to easily manage their clients. The application can provide trainers with the ability to upload a plan and see how their clients are progressing. It will also provide the client with an easy way to access and see their assigned plans.
- Furthermore, the application will allow a user to create and manage their own plans with ease. They will be able to fully customize their plans and choose which workouts they would like.

- Lastly, it will help users track their progress and motivate them to continue working towards their goals. The application will provide a way in which the users can easily see their progress overtime, as well as the ability to set and track personal goals.

Overall, the main objective of the application is to empower users to take control of their fitness journey and achieve their goals by providing them with the tools and resources they need to succeed.

5. Target Users

The application will be used by a variety of users, primarily people who are either working or interested in fitness. Personal trainers who don't see their clients in person and deliver their plans online will be a main user of this app. On the other hand, it could be a coach of any sports using it to monitor activity outside of training hours. Consequently, clients of personal trainers or players of any sport can use this to then interact with their personal trainer and coaches and keep track of their fitness journey. Another user of this application could include anyone who is embarking on their own fitness journey. This could be someone completely new to the fitness lifestyle looking to keep track of their progress and journey, or an experienced athlete looking to do the same thing. According to an article published by the Irish examiner, more than one in seven Irish people *"engage in some form of physical activity on five or more occasions per week"*.[3] When looking at these numbers we see there is a huge market for potential users. This is just looking at Irelands statistics, if we take into account the whole world, then we see an even bigger potential customer base.

6. Use Cases & Diagrams

6.1 Full System Use Case Diagram

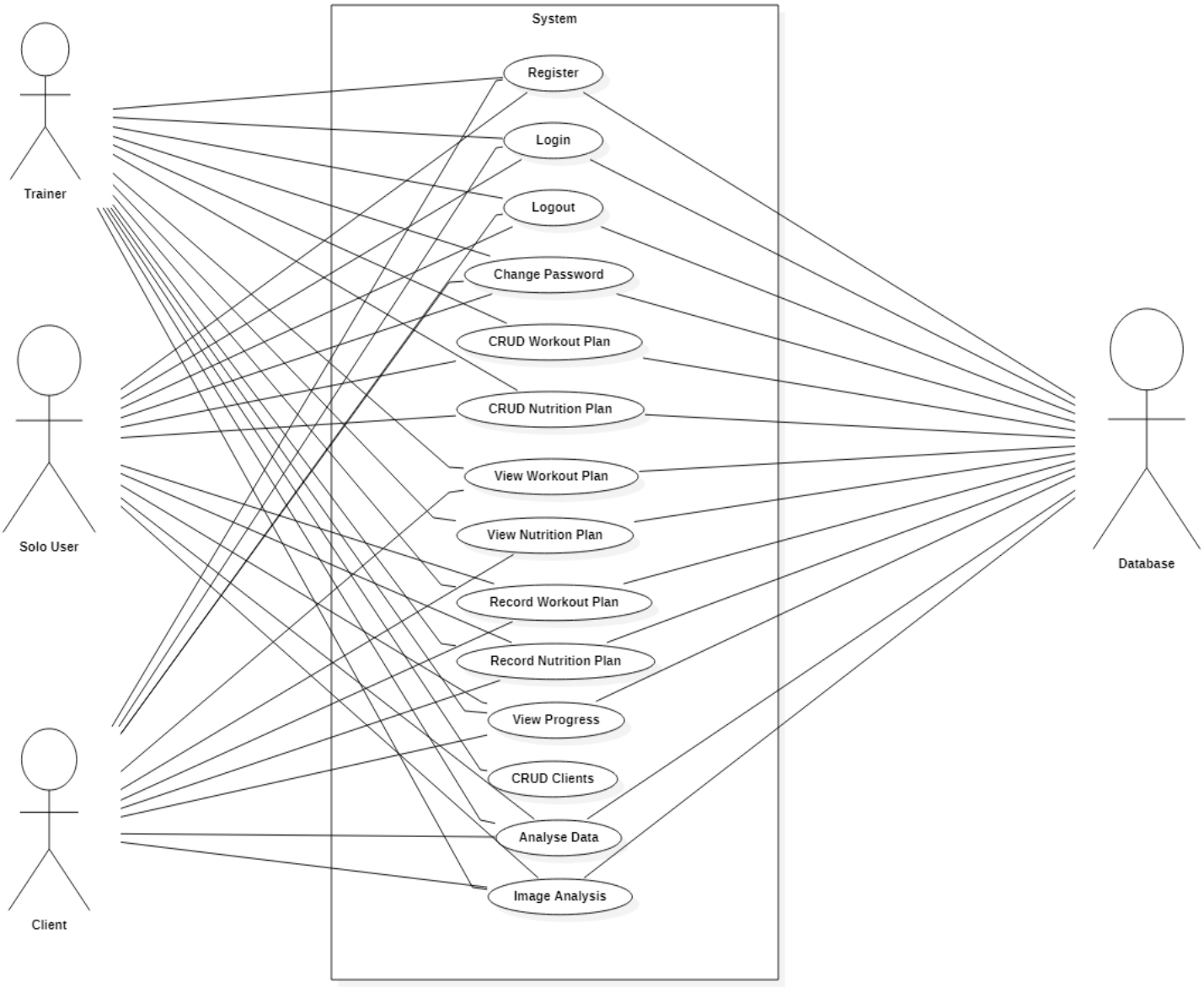

Figure 1 Full System Use Case Diagram

6.2 Register Use Case

Name	Register
Actors	Trainer, Solo User, Client, Database
Preconditions	The user has loaded up the application on their device.
Activity	This use case begins when the user loads up the application and is prompted to sign in or sign up. The user will select to sign up and will be asked to enter relevant information for example, name, email, password etc. The user will then confirm their password and submit the information which will be stored securely in the database so the user can then sign in with these credentials.
Consequences	The user is registered with the application.
Alternative(s)	1. The user enters a password that does not meet the password strength requirements. - The user is asked to enter a stronger password. 2. The user enters an email or username which is already in use. - The user is prompted with a message saying the username or email already exists.

Table 1 Register Use Case

6.3 Login Use Case

Name	Login
Actors	Trainer, Solo User, Client, Database
Preconditions	The user already has an account for the application.
Activity	This use case starts when the user wants to log in to the application. The user is prompted with the sign in / sign up screen where they will select sign in. The user will then be asked to enter their email / username and password. The user then enters the information, and the database will validate the credentials and give the user access to the application redirecting them to the home screen.
Consequences	The user successfully logs in to the application and can access its features.
Alternative(s)	1. The user enters the wrong email / username or password. -The user is prompted with a message informing them the credentials are wrong and must be entered again.

Table 2 Login Use Case

6.4 Change Password Use Case

Name	Change Password
Actors	Trainer, Solo User, Client, Database
Preconditions	The user already has an account for the application.
Activity	This use case starts when a user has forgotten their password and clicks the forgot password button on the login screen. The user is prompted with a message asking them to enter their email. After the user enters their email and submits, an email is sent to their address with a link to change their password.
Consequences	The user has changed the password for their account.
Alternative(s)	1. The user enters an incorrect email address and does not receive the email with the link.

Table 3 Change Password Use Case

6.5 CRUD Workout Plan Use Case

Name	CRUD Workout Plan
Actors	Trainer, Solo User
Preconditions	The user is logged into the application.
Activity	This use case starts when the user wants to delete, edit, and create workouts. First, the user will get a list of all their workouts, with the option to delete or create a new one. If a person selects to view one, they will be able to edit it.
Consequences	The user will have successfully created, edited deleted or viewed a workout.
Alternative(s)	1. The user enters invalid input while adding or editing a workout. - The user is prompted a message saying invalid input try again.

Table 4 CRUD Workout Plan Use Case

6.6 CRUD Nutrition Plan Use Case

Name	CRUD Nutrition Plan
Actors	Trainer, Solo User
Preconditions	The user is logged into the application.
Activity	This use case starts when the user will be able to delete, edit and create nutrition plans. First, the user will get a list of all their plans, with the option to delete or create a new one. If a person selects to view one, they will be able to edit it.
Consequences	The user will have successfully created, edited, or deleted a nutrition plan.
Alternative(s)	1. The user enters invalid input while adding or editing a nutrition plan. -The user is prompted a message saying invalid input try again.

Table 5 CRUD Nutrition Plan Use Case

6.7 View Workout Plan Use Case

Name	View Workout Plan
Actors	Trainer, Solo User, Client
Preconditions	The user is logged into the application.
Activity	This use case starts when the user wants to view their workout plan. The user will navigate to the workout screen where they can view all their workouts. From here the user can click into a workout and view its contents. The user also has the option to edit it from here.
Consequences	The user has successfully viewed a workout.
Alternative(s)	1. The user has no workouts to display. - The user is prompted with a message informing them to create a workout as they have none.

Table 6 View Workout Plan Use Case

6.8 View Nutrition Plan Use Case

Name	View Nutrition Plan
Actors	Trainer, Solo User, Client
Preconditions	The user is logged into the application.
Activity	This use case starts when the user wants to view their nutrition plan. The user will navigate to the nutrition screen where they can view all their plans. From here the user can click into a plan and view its contents. The user also has the option to edit it from here.
Consequences	The user has successfully viewed a nutrition plan.
Alternative(s)	1. The user has no nutrition plans to display. - The user is prompted with a message informing them to create a nutrition plan as they have none.

Table 7 View Nutrition Plan Use Case

6.9 Record Workout Plan Use Case

Name	Record Workout Plan
Actors	Trainer, Solo User, Client, Database
Preconditions	The user is logged into the application.
Activity	This use case starts when a user wants to record information about their workout. They will select the workout they want and click the record button. This will show the user a screen where they can enter notes, weight, and reps for each exercise. It is then saved and stored in the database.
Consequences	The user has successfully recorded a workout.
Alternative(s)	1. The user does not enter a number for the weight or reps. - The user will be prompted a message saying they must enter a number.

Table 8 Record Workout Plan Use Case

6.10 Record Nutrition Plan Use Case

Name	Record Nutrition Plan
Actors	Trainer, Solo User, Client, Database
Preconditions	The user is logged into the application.
Activity	This use case starts when a user wants to record information about their nutrition. They will enter their calories for each meal and other attributes like fat and carbs. It is then saved and stored in the database.
Consequences	The user has successfully recorded their nutrition for the day.

Table 9 Record Nutrition Plan Use Case

6.11 View Progress Use Case

Name	View Progress
Actors	Trainer, Solo User, Client, Database
Preconditions	The user is logged into the application.
Activity	This use case starts when the user wants to view their progress. The user will navigate to the progress screen where they can view all their past workouts. From here the user can click into each workout and view the weight, reps and notes from their workouts.
Consequences	The user has successfully viewed their progress.
Alternative(s)	1. The user has not completed any workouts and therefore cannot see any progress. -The user will be prompted with a message saying they have no workouts to view.

Table 10 View Progress Use Case

6.12 CRUD Clients Use Case

Name	CRUD Clients
Actors	Trainer, Database
Preconditions	The user is logged into the application.
Activity	This use case starts when the user wants to delete, edit, and create a client profile. The user will navigate to the manage client screen where they will see a list of clients. From here they can add, delete, or edit the client list.
Consequences	The user will have successfully created, edited deleted or viewed a workout.
Alternative(s)	1. The user enters an email not registered with the application. - The user will be prompted with a message saying the email address is not registered.

Table 11 CRUD Clients Use Case

6.13 Analyse Data Use Case

Name	Analyse Data
Actors	Trainer, Solo User, Client, Database
Preconditions	The user is logged into the application and has recorded a workout.
Activity	This use case starts when the user wants to get feedback on their workout. The user clicks the analyse workout button. This will then compare their weights and reps with previous workouts and the user will see feedback on whether to increase or decrease the weight or reps.
Consequences	The user will have received relevant feedback on their workout.
Alternative(s)	1. The user has not recorded a workout. - The user will be prompted a message saying they have not recorded a workout.

Table 12 Analyse Data Use Case

6.14 Image Analysis Use Case

Name	Image Analysis
Actors	Trainer, Solo User, Client
Preconditions	The user is logged into the application and has recorded a workout.
Activity	This use case starts when the user wants to get feedback on an exercise they performed during a workout. The user clicks the image analysis button. This will then prompt the user to upload a photo. The image will be classified and relevant feedback on form will be provided.
Consequences	The user will have successfully received feedback on their form.
Alternative(s)	1. The image did not upload correctly. - The user is prompted with a message to upload the photo again.

Table 13 Image Analysis Use Case

7. Metrics

The applications success will be measured on how well the functionality of the application preforms and if it meets the following standards:

- Basic application features including creating an account of both types, logging in, changing password etc.
- Allowing for a personal trainer or coach to interact with their clients or players to deliver a workout / fitness plan.
- Analysing inputted user data to give relevant feedback / data analysis using machine learning techniques.
- Performing machine learning techniques to train a model which could potentially predict a user's future weight.

8. Precedent for the Application

The precedent for the application comes from a personal experience of using similar applications to try and better my health. As I have used multiple fitness applications over the years, having this experience helps in the development of the application as requirements and needs are understood in how to make the application successful.

Some inspiration came from other applications with similar functionalities like Jefit [4] and MyFitnessPal [5]. If project development goes according to plan, then this application should take the best of both applications and puts them together. Jefit does not have any nutritional features and solely focuses on workouts. Although MyFitnessPal does contain workout features, the app focuses more on the nutrition side of things. As this application utilises both of features, it will attract people to use it and will make a well-developed successful application.

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