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Final Year Project, Project Report, Gym Personal Training & Analytics App.

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1. Introduction

In today's fast-paced world, an efficient and effective personal fitness solution is essential. This gym personal trainer application, Fitness Bro addresses this need by providing a platform that connects personal trainers with their clients and teams. With this application, personal trainers can create, manage, and share tailored workout and nutrition plans, while users can develop their own fitness plans, track their progress, and work towards their goals.

The development of this application required the integration of several advanced technologies. React Native and Expo CLI were used for the frontend, creating an engaging and responsive user interface. Firebase database played a crucial role in user authentication, as well as storing and retrieving real-time data. Python was employed to implement machine learning models, which aimed to predict whether users would reach their target weight within a specified time frame.

As a result of these collaborative efforts, Fitness Bro comes as a comprehensive solution to the online fitness world. By combining these technologies with user-friendly features, this application has the potential to transform the way personal trainers and fitness enthusiasts alike approach their workout and nutrition goals, eventually creating a healthier and more active community.

In this report, we will analyse the project's challenges and solutions, highlight its achievements, and offer the important lessons learned. Furthermore, we will present the application design, including screenshots and screen descriptions, to demonstrate its functionality and database structure. The report will also discuss the differences between the initial plans and the end result, and it will conclude with a summary of the project's performance and the technologies used.

2. Project Challenges and Outcomes

2.1 Challenges Encountered and Resolutions

1. **Firebase Database Structure**: One of the initial difficulties was understanding the Firebase database and determining the appropriate structure for effective client interaction. The available Firebase documentation proved to be insufficient and outdated, necessitating the use of external resources, such as Stack Overflow, to seek help. While the advice obtained did not provide a complete solution, it facilitated a better understanding of the database structure. Drawing the database plan on paper proved to be really helpful, as it allowed for a clearer visualization of the structure, which in turn enabled the correct implementation of collection references.

2. **Displaying User-Specific Data:** Another challenge was ensuring that data displayed on the application was relevant to each individual user. To achieve this, the user's unique identifier (UID) was utilised, but proved tough to grasp the concept of how to store it with the user's data in collection and document references. Once again, writing the structure on paper proved beneficial in deciphering the appropriate references and finally resolving the issue.

3. **Styling Screens with CSS:** As a developer with limited experience in CSS, styling the application's screens proved to be a significant challenge. To overcome this hurdle, many tutorials and lessons were studied to gain a deeper understanding of CSS and its application in styling the pages and objects within the app.

4. **Machine Learning Models:** The implementation of machine learning models, such as decision tree, regression, k-means, and random forest, was faulted by overfitting, resulting in 100% or near-perfect accuracy. This indicated that the models were not suitable to include in the project. Given more time, it would have been possible to collect additional data from the app to improve the models' performance and avoid overfitting. Therefore, the decision to leave out this feature was made.

2.2 Achievements

1. **Easy Interaction between Trainers and Clients:** A key accomplishment of this project was making it simple for trainers and clients to communicate. Trainers can add a single client where they will be added to the client list. The app also lets trainers create teams, where they can add a bunch of clients and manage them all together. This way, trainers can easily give workout and nutrition plans to the whole team or just to specific clients based on their needs and goals. Trainers can add workouts and nutrition plans for their clients just by clicking on the client's name, making it faster and simpler to update and manage their clients' fitness routines. Once the plans are assigned, they show up in the user's assigned workouts and nutrition plans area, so clients can always see their most recent fitness routines and meal plans. Here clients can mark workouts as completed to show their trainer their progress. This easy communication between trainers and clients, and the helpful team management, makes the whole fitness experience better for everyone involved. By offering a user-friendly and organized way for trainers and clients to interact, the app makes sure that clients get the help and support they need to reach their fitness goals, while trainers can manage their work effectively and provide a great service.

2. **Managing Workout and Nutrition Plans:** One of the key strengths of the application is the simple and easy management of workout and nutrition plans. The app provides an intuitive interface that empowers users to easily create personalised workout routines

and nutrition plans tailored to their unique goals, preferences, and lifestyle. This customisation ensures that users have the most relevant and effective plans to achieve their fitness objectives. When creating a new workout, the user can also select whether they want to do cardio or strength training. This gives the user more freedom to do whatever workout they like and being able to record it in anyway. In addition to creating new plans, users can effortlessly edit their existing workout routines and nutrition plans to accommodate any changes in their fitness goals, schedules, or dietary requirements. This adaptability is essential in a fitness app as it helps users stay committed to their fitness journey while adjusting to their changing demands. The application also makes it simple to remove workout and nutrition plans that are no longer relevant or useful. This is accomplished by simply swiping left on any exercise or nutrition card. Swiping left is a frequent method for deleting items in many different applications. This clean up tool organises, focuses, and maintains the user's fitness program, resulting in a more efficient and pleasurable experience.

3. **Clean and Easy-to-Use Design:** The application has a clean, simple, and nice-looking design that makes it easy for users to navigate. The well-organized layout and presentation of features make the app user-friendly for people of all skill levels. A good user interface is important for creating an enjoyable experience, which encourages users to keep using the app and working on their fitness goals. It was noted the app might have lacked a bit of colour and looked plain, which is a fair comment, but the use of more colour when not really needed could have ended up making the app look messy and confusing which is not the design intended.

4. **Tracking Progress:** Another notable achievement of the project is the implementation of an analytics screen that provides users with a comprehensive view of their progress. The screen features a visually appealing graph displaying the user's weight over time, allowing them to easily track their progress and make adjustments as needed. By clicking on data points within the graph, users can also view the specific dates when they recorded their weights, offering a more detailed understanding of their journey. Furthermore, the analytics screen highlights the number of workouts the user has completed, as well as those they have not. This feature encourages users to stay on track and maintain consistency in their fitness routines, leading to better results and a more satisfying experience using the app.

2.3 Lessons Learned

During the development process of Fitness Bro, numerous valuable lessons were learned that contributed to personal growth and enhanced skills. These insights demonstrate the ability to learn from mistakes and become a better developer:

1. **Importance of Database Planning**: The challenges faced when trying to set up the Firebase database showed just how important it is to plan the database layout ahead of time. Before jumping into building the database, it is a good idea to map out its structure, thinking about the relationships between the different elements and how they'll be organized. This is essential to make sure that the database works well and supports the app's features. In this project, drawing the database plan on paper turned out to be extremely beneficial. It made it easier to visualise the structure and understand how everything fits together, which then made implementing the database much more straightforward. By having a clear plan in place, it was possible to avoid mistakes and confusion during the development process, saving time and effort. This experience taught a valuable lesson - planning and organisation are key to any successful software project. Taking the time to carefully plan out the database structure, or any other important aspect of the app, can lead to a quicker, smoother, and more efficient development process.

2. **Effective Use of External Resources:** Working on this project made it clear that using external resources like Stack Overflow and online tutorials can be a huge help when it comes to overcoming challenges and expanding knowledge. It's not always possible to have all the answers, and that's where the expertise of others can really prove to be useful. Being open to seeking help when needed is a valuable skill for any software developer. Sometimes, even just a small tip or piece of advice from someone more experienced can help solve a problem or point in the right direction. This project was a great reminder that there's a huge amount of information and support out there, and it's important to make use of it when needed.

3. **Mastering CSS:** Working with CSS to style the screens proved to be a challenge at first, but it turned into a fantastic learning opportunity. Diving deeper into CSS and putting in the time to understand its usage helped create a polished and user-friendly app. This experience showed that investing time and effort in learning new technologies is essential for developing high-quality applications. This project was a reminder that it's important to keep learning and improving one's skills, even when it gets tough. Sometimes, struggling with a new language or technology can lead to a breakthrough and a better understanding of the topic.

4. **Recognizing the Limitations of Machine Learning:** Facing issues with overfitting in the machine learning models helped realise the limitations of these models and the importance of having enough data to train them effectively. This valuable insight can be applied to future projects, where it's essential to carefully consider data collection and model selection to ensure the best possible results. This experience highlights that it's important to be aware of the limitations of the tools and technologies being used in a project. Sometimes, things might not go as planned, but it's crucial to learn from these setbacks and use that knowledge to make better decisions in future projects. By understanding and acknowledging the limitations of machine learning models, it's

possible to make more informed choices about their implementation and improve the overall quality of the projects.

5. **Importance of Iterative Development:** During the project, constantly refining and adjusting the features and functionality of the application was crucial. This iterative approach to development made it possible to identify and fix problems, as well as incorporate new ideas, which ultimately led to a more successful outcome. This experience shows the importance of being open to making changes and improvements throughout the development process. By adopting an iterative mindset, it's possible to be more adaptable and responsive to the needs of the project, ensuring a better final product.

6. **Utilizing Version Control Software:** The project highlighted the value of using version control software, like GitHub, for managing the codebase efficiently. By taking advantage of version control, it became easier to track changes, keep a history of the project, and revert to previous versions when needed. This experience demonstrates the importance of understanding and effectively using version control software as a crucial skill for software developers. Mastering version control can help prevent issues related to lost work, conflicting changes, and overall project organisation. Learning to use version control software effectively can lead to smoother collaboration, better management of project progress, and ultimately, more successful software development outcomes.

7. **Learning React Native:** Getting the Hang of React Native: As someone who hadn't worked with React Native or mobile app development before, this project was a great chance to learn a new programming language. Getting better at React Native not only added to my skills, but also let me build a high-quality, cross-platform app. This whole experience made me realize how important it is to keep learning and adapting in the fast-changing world of software development. Picking up new technologies can really help us find better solutions and grow both personally and professionally.

8. **Embracing Personal Responsibility and Time Management**: Working on this project independently taught me the importance of taking personal responsibility for my work and effectively managing my time. Without the support of a team, I had to rely on my own resources and abilities to overcome challenges and make progress. This experience helped me develop essential time management and problem-solving skills, as well as a stronger sense of self-reliance. Additionally, completing the project on my own has given me a sense of accomplishment and a greater appreciation for the value of perseverance and resourcefulness.

2.4 Recommendations for Future Projects

Based on the experiences and lessons learned during the development of the gym personal trainer application, the following recommendations are offered for future projects:

1. **Thorough Planning:** Before starting the development process, invest more time in planning and designing the application, including the database structure, user interface, and feature set. Having a clear blueprint from the beginning can help streamline the development process and avoid potential issues.

2. **Improved Data Collection:** For projects that involve machine learning, it is crucial to have a comprehensive dataset to train the models effectively. Prioritise data collection early in the project and consider collaborating with others to obtain a diverse and representative sample.

3. **Alternative Technologies**: Evaluate and explore alternative technologies that might better suit the project's requirements or provide additional benefits. For example, consider using different machine learning algorithms or libraries that may yield better results or offer improved performance.

4. **Time Management and Prioritisation:** Allocate sufficient time for learning and mastering new technologies or frameworks, as well as for refining and iterating on the application's features. Prioritise tasks based on their importance and complexity and set realistic deadlines to ensure steady progress throughout the project.

5. **Continuous Learning:** Stay up to date with the latest developments in software development and actively seek opportunities to expand your skillset. Attend workshops, webinars, or online courses to learn new technologies, tools, or best practices that can be applied to future projects.

3. Adjustments from Original Plan and Design

In this section, we will discuss the differences between the original specifications and the final design of the application. One significant deviation was the decision not to provide user feedback based on machine learning due to insufficient data. Additionally, image/video analysis was deemed too labour-intensive for the value it would bring. Instead, we attempted to predict if users would achieve their goal weight, despite facing challenges with a limited dataset.

Another difference was the choice of Firebase over Django as the back-end server after thorough research. Time limitations prevented us from implementing the Stripe Payment API, but this issue can be addressed with more time allocated. Despite these changes, some aspects were kept true to the initial design, such as the interaction between clients, teams, and trainers, and the use of general user and personal trainer account types.

Limited data and time constraints resulted in a basic analysis tab for progress tracking, featuring a weight graph, weight history, completed vs. incomplete workouts, and a some nutrition stats. With additional time and effort, the analysis tab could be further enhanced, providing users with more comprehensive progress tracking.

4. Application Design

In the following section, a detailed walkthrough of the application's screens and their functionalities will be provided, as well as the database structure. This visual guide, accompanied by comprehensive descriptions, aims to offer a clear understanding of how users interact with various features within the app. By showcasing the application's design, layout, and user experience, this section will highlight the app's overall effectiveness in supporting users' fitness goals and facilitating communication between trainers and clients. The carefully selected screenshots will provide a glimpse into the app's user-friendly interface, and the accompanying explanations will further clarify the app's workflow and functionality.

4.1 Application Screens
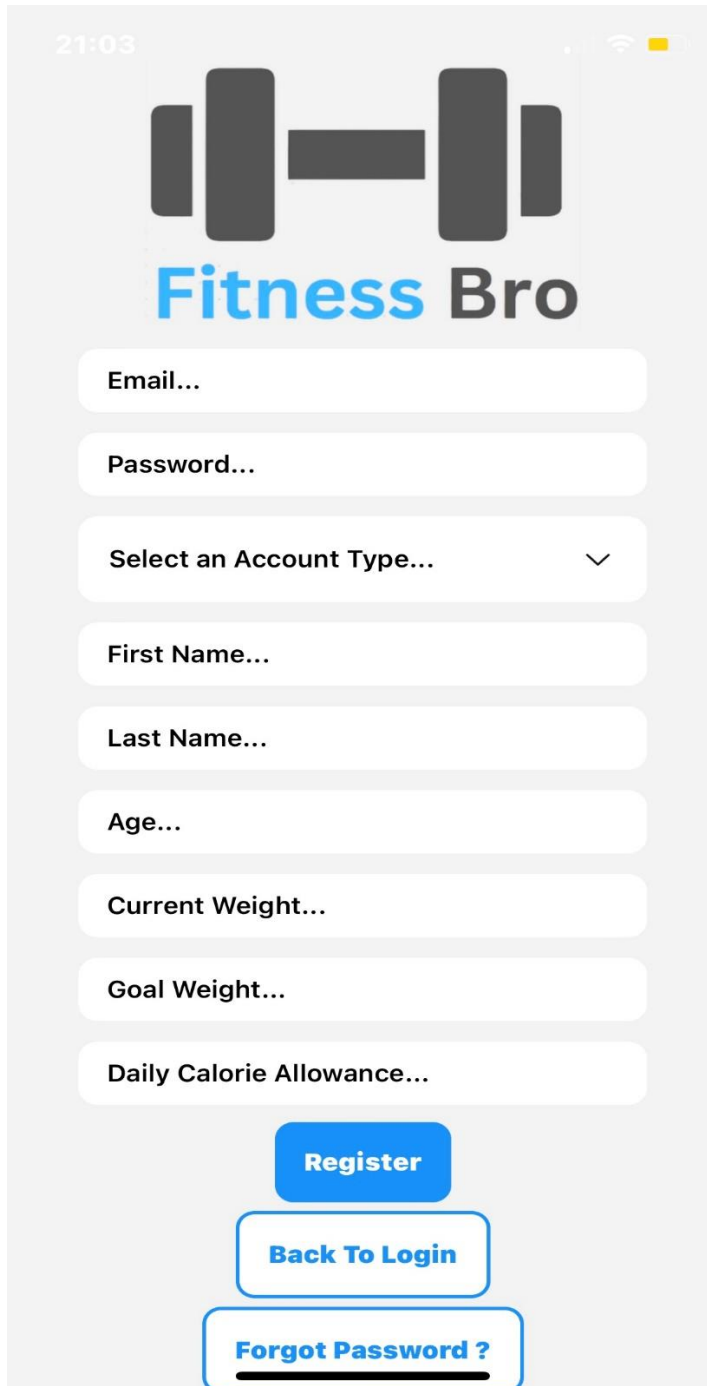
Login / Landing Screen
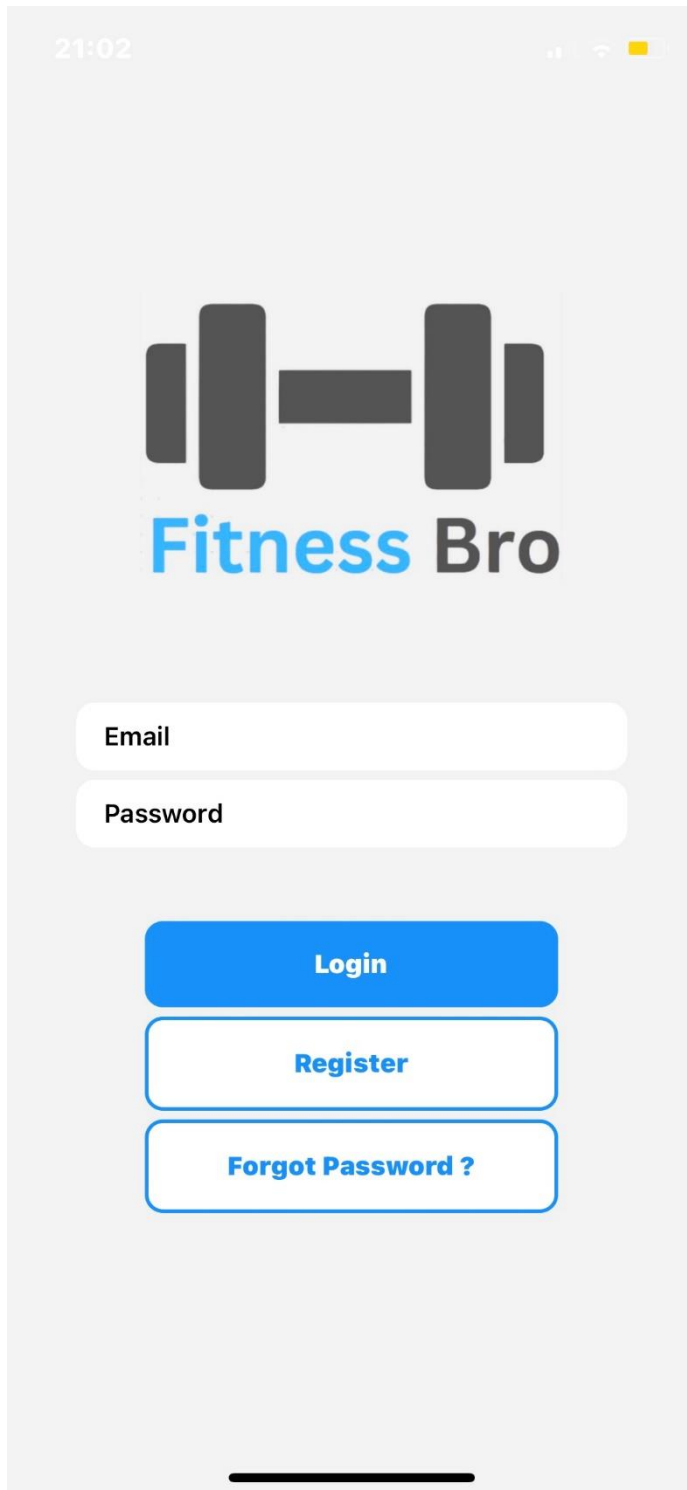
The login screen offers a simple and user-friendly experience with options to sign in, register, or reset a forgotten password. It sets the stage for a straightforward and engaging fitness journey within the app.
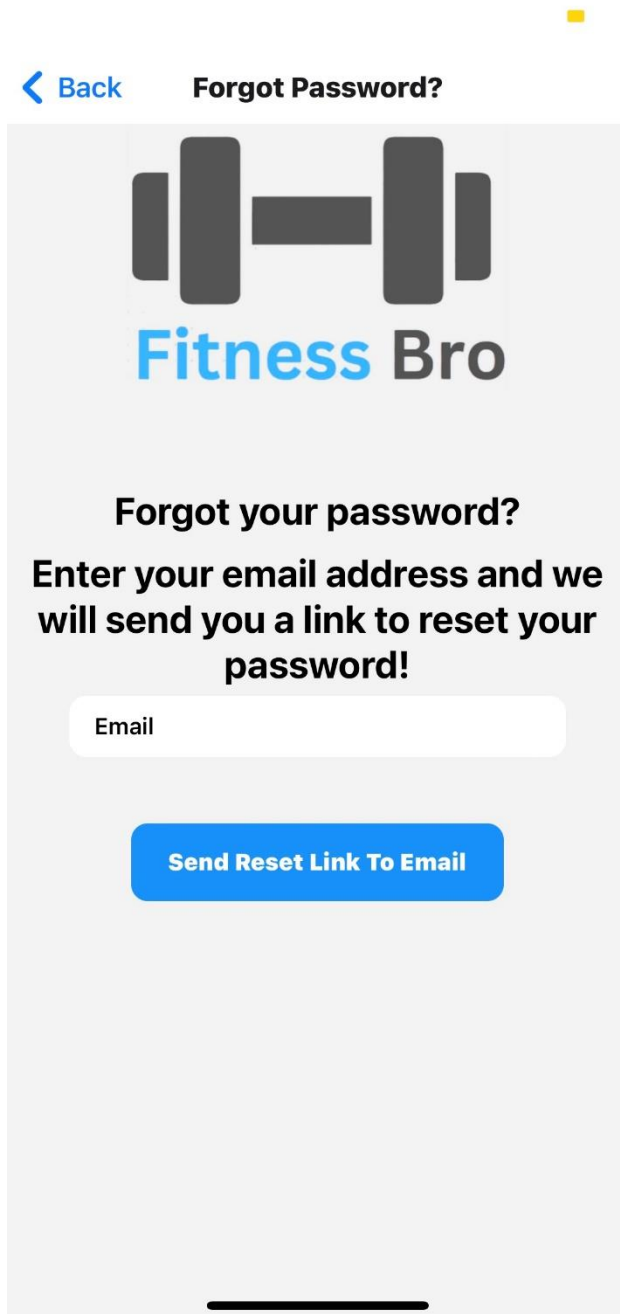
Figure 1 - Login / Landing Screen

Register Screen

The register screen provides a seamless sign-up process, allowing users to choose between Personal Trainer or General User account types. It also includes links to return to the login screen or access the forgot password feature, ensuring a smooth and efficient experience.

Figure 2 - Register Screen

Forgot Password Screen

Figure 3 - Forgot Password Screen

The forgot password screen offers a simple interface for users to reset their password. By entering their email address, users can request a password reset link, ensuring a user-friendly and secure recovery process.

Home Tab Screen
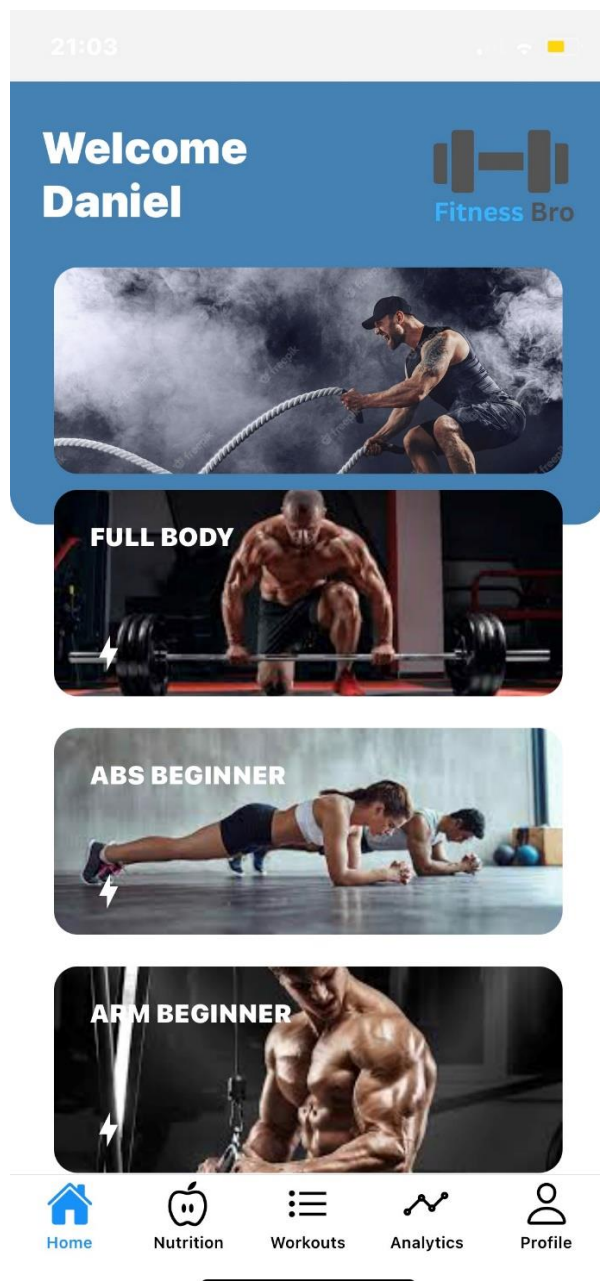
Figure 4 - Home Tab Screen

On the home tab screen, users are greeted with their name and a selection of sample workout cards designed to kick-start their exercise sessions. This layout offers users a variety of workouts to choose from, making it simple to find one that suits their needs or adds variety to their existing fitness routine.

Home Workout Screen

The home workout screen displays a detailed view of the selected workout card from the home tab. It features a list of exercises, complete with the recommended sets and reps for each, and an accompanying GIF to demonstrate the correct technique. This layout allows users to easily follow along and ensure they perform the exercises accurately, enhancing their overall workout experience.

Figure 5 - Home Workout Screen

Home Exercise Screen
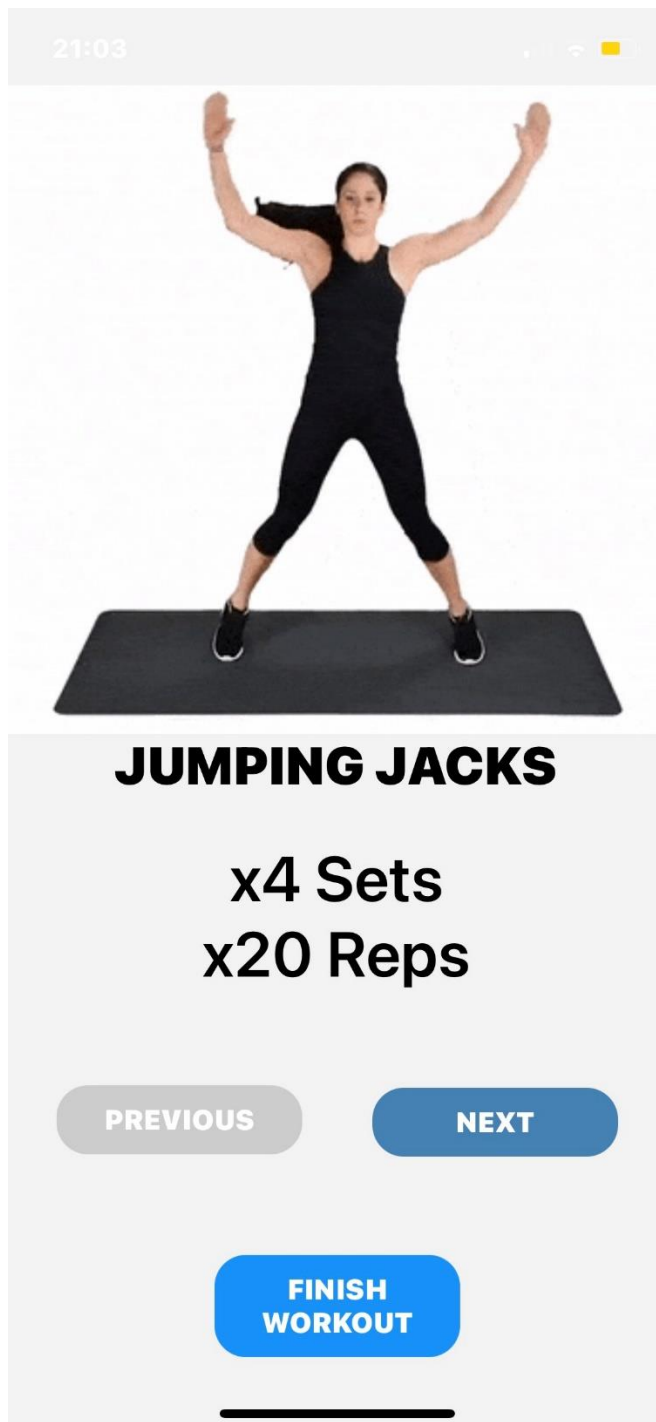
Figure 6 - Home Exercise Screen

The home exercise screen is accessed by clicking on an exercise from the home workout screen. It presents a larger view of the exercise GIF, allowing users to closely observe the proper technique. The recommended sets and reps and navigation buttons for moving to the next or previous exercise are provided, enabling a seamless workout flow. Once all exercises are completed, users can click the "Finish Workout" button to mark the workout as complete and return to the main screen.
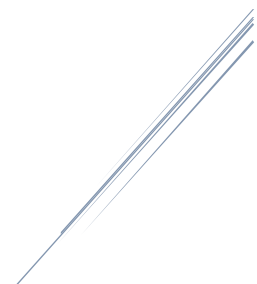
Nutrition Tab Screen
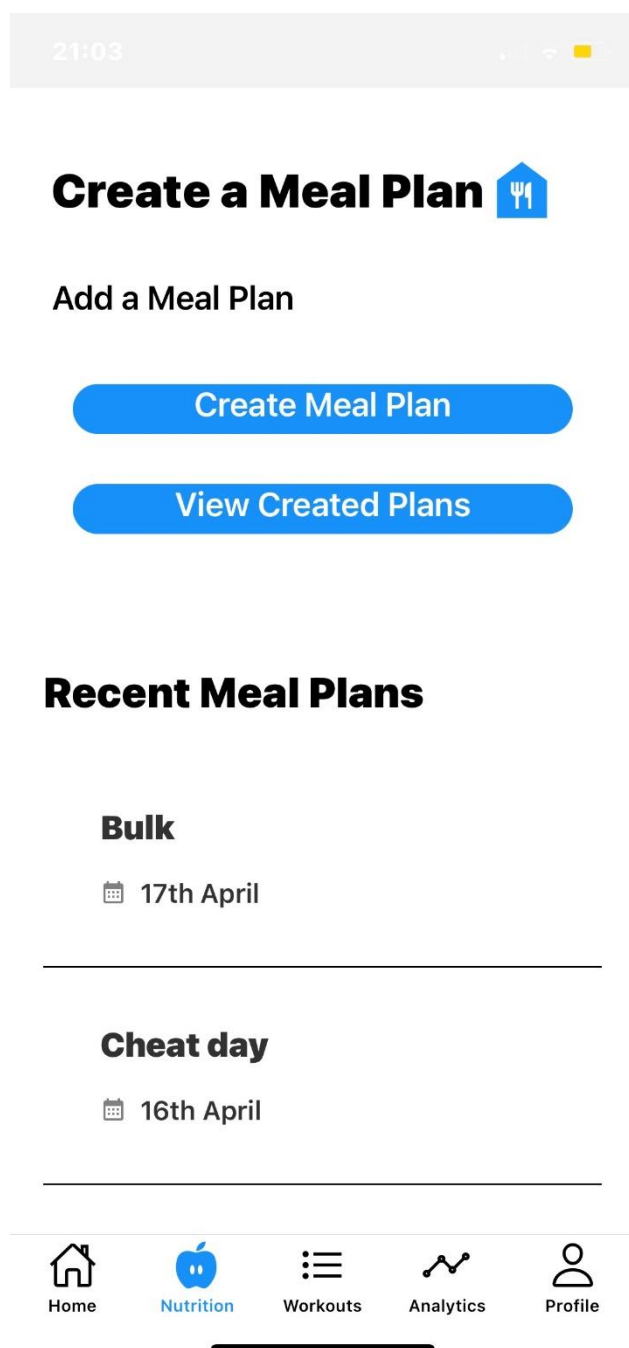
Figure 7 - Nutrition Tab Screen

The nutrition tab screen for personal trainers showcases three of the most recent nutrition plans in the form of nutrition cards. It also features a "Create Nutrition" button for designing new nutrition plans, and a "View All Nutrition" button for browsing the complete list of nutrition plans created by the user. This is what the screen looks like for a personal trainer (note there is no assigned workouts). This layout makes it easy for trainers to access, manage, and create nutrition plans for their clients.

Create Nutrition Screen

The create nutrition screen allows users to build a custom nutrition plan by adding meal details. The screen displays fields for entering meal information, such as meal name, calories, and other nutritional facts. Users can effortlessly add or remove meals using the corresponding buttons, providing flexibility to design nutrition plans tailored to their specific needs and preferences.
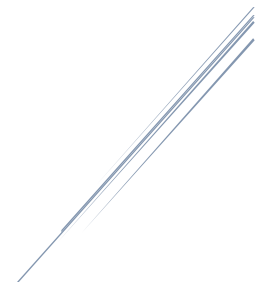
Figure 8 - Create Nutrition Screen

View All Nutrition Screen

Figure 9 - View All Nutrition Screen
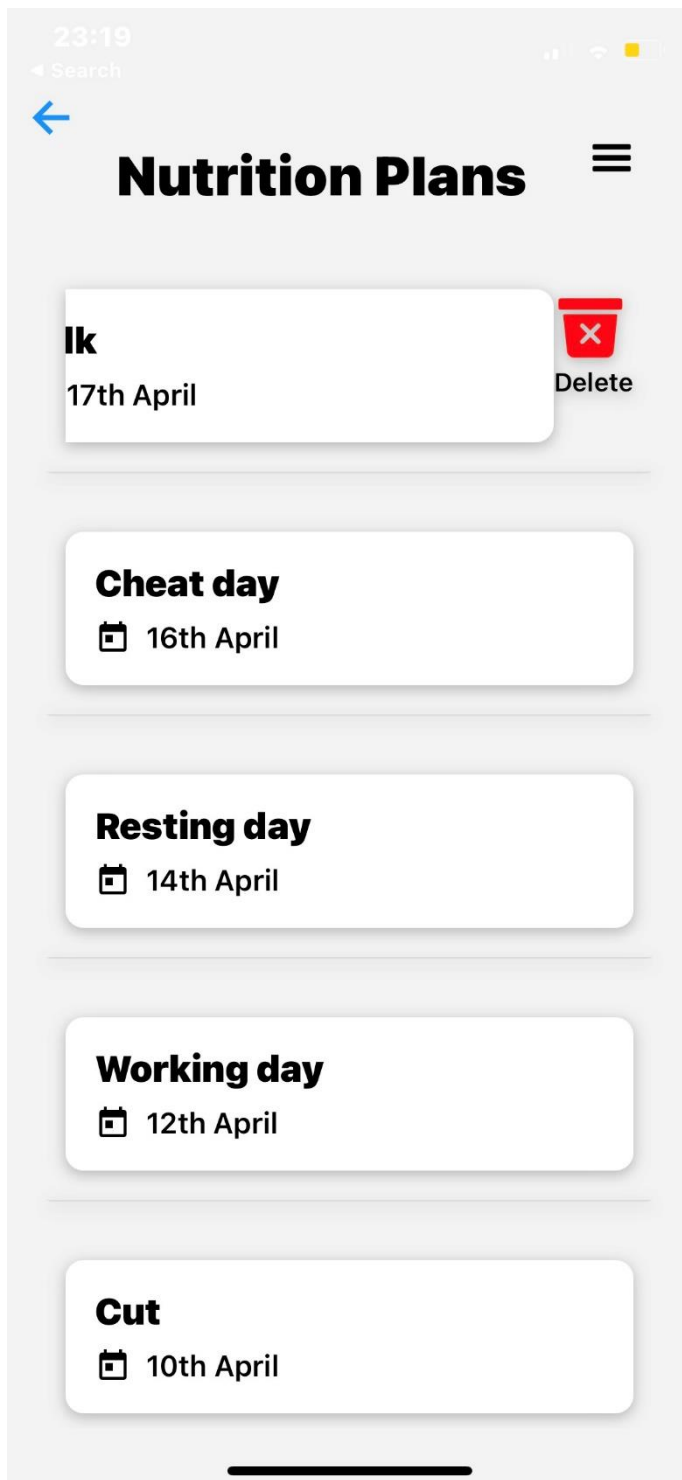
The view all nutrition screen displays a list of all the nutrition plans created by the user. Each plan is presented in a card format for easy navigation. Users can swipe left on any plan to reveal the delete icon, providing a convenient way to manage and remove nutrition plans as desired. This screen makes it simple to keep track of and organise multiple nutrition plans in one place.
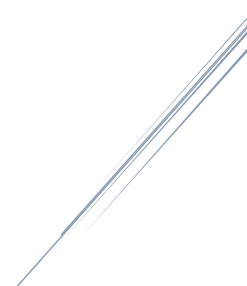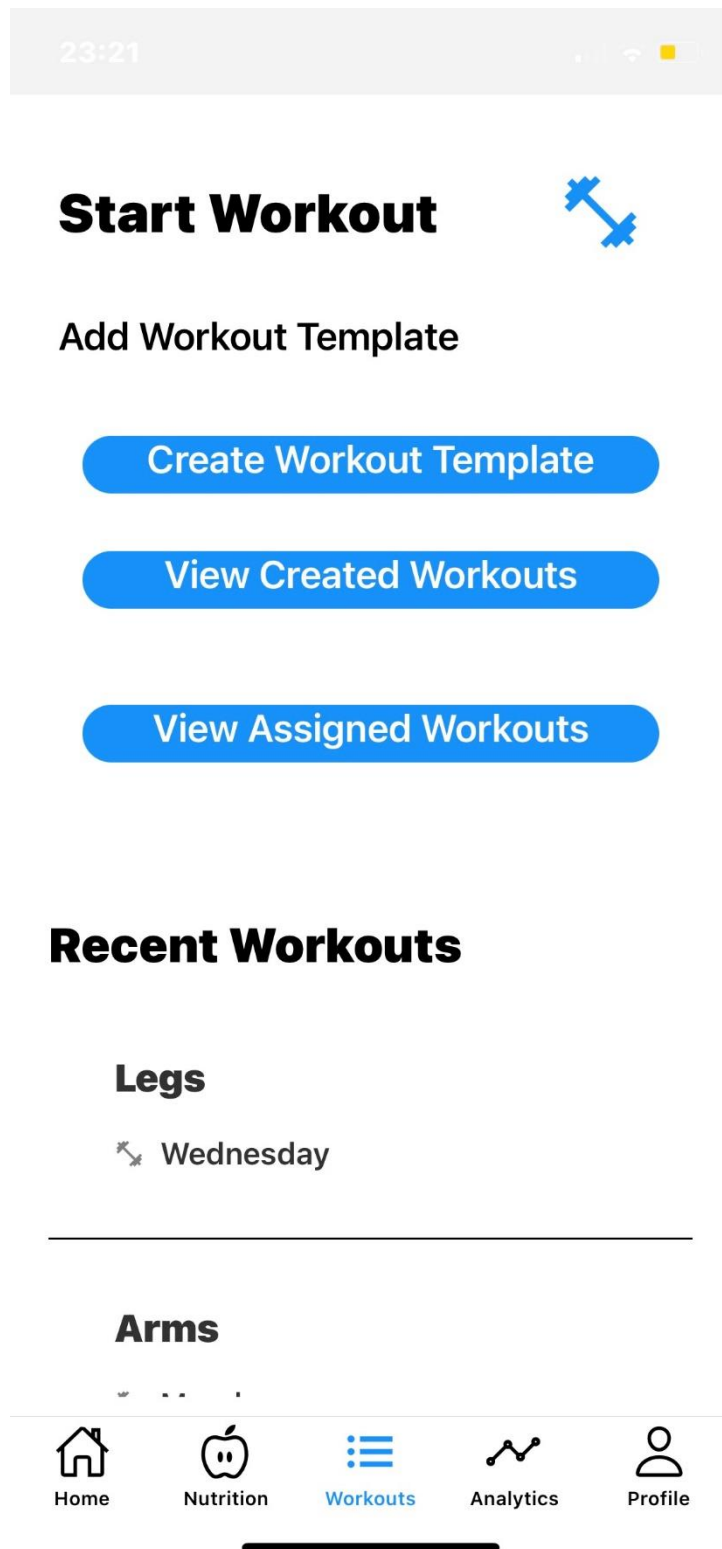
Created Nutrition Plan Screen

The created nutrition screen provides an in-depth look at the details of a specific meal plan. Each meal within the plan is displayed along with its nutritional value, making it easy for users to understand the contents of their meal plan.

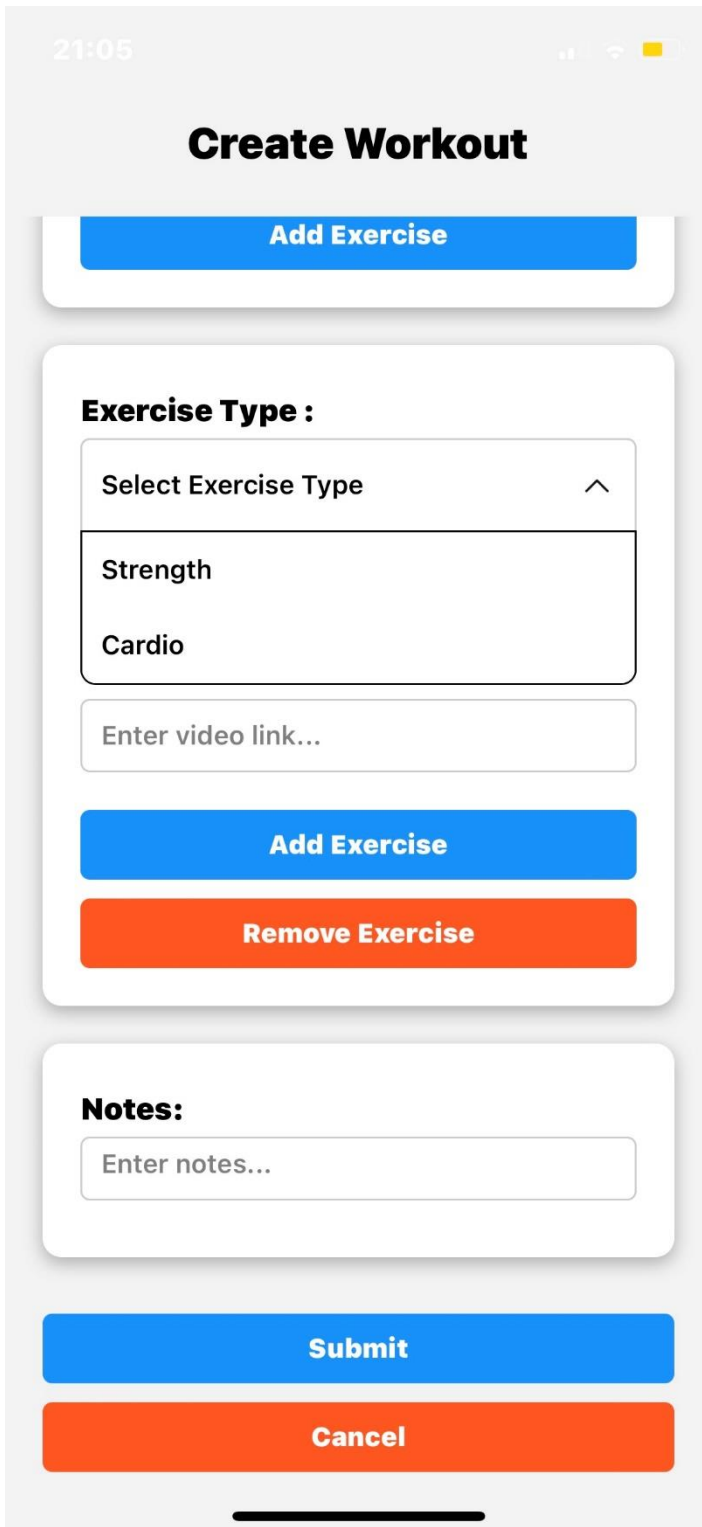*Figure 10 - Created Nutrition Plan Screen*

Workout Tab Screen

The workout tab screen for general user accounts offers a similar layout to the nutrition tab screen, displaying recent workouts, a 'Create Workout' button, and a 'View All Workouts' button. Unique to general user accounts, this screen also features a 'View Assigned Workouts' button, enabling users to easily access workouts assigned to them by their personal trainers. The same logic applies to the nutrition tab screen, where an additional button, 'View Assigned Nutrition', is available to cater to the needs of general users.

Figure 11 - Workout Tab Screen

Create Workout Screen

Figure 12 - Create Workout Screen
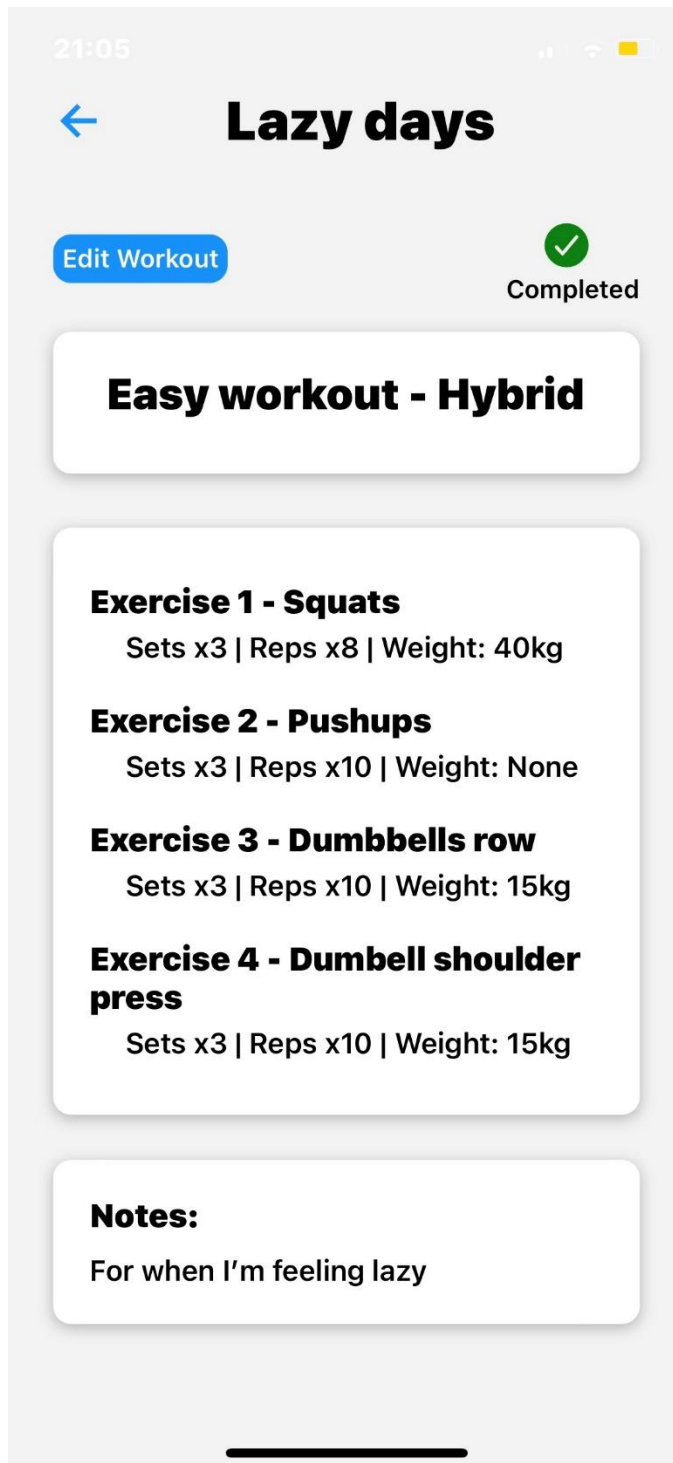
The Create Workout screen presents a user-friendly form, where users can easily add and remove as many exercises as they want. By selecting either 'Cardio' or 'Strength' as the exercise type, the form dynamically adjusts the displayed fields accordingly. For strength exercises, users input sets and reps, while for cardio exercises, users provide information about rounds and minutes.
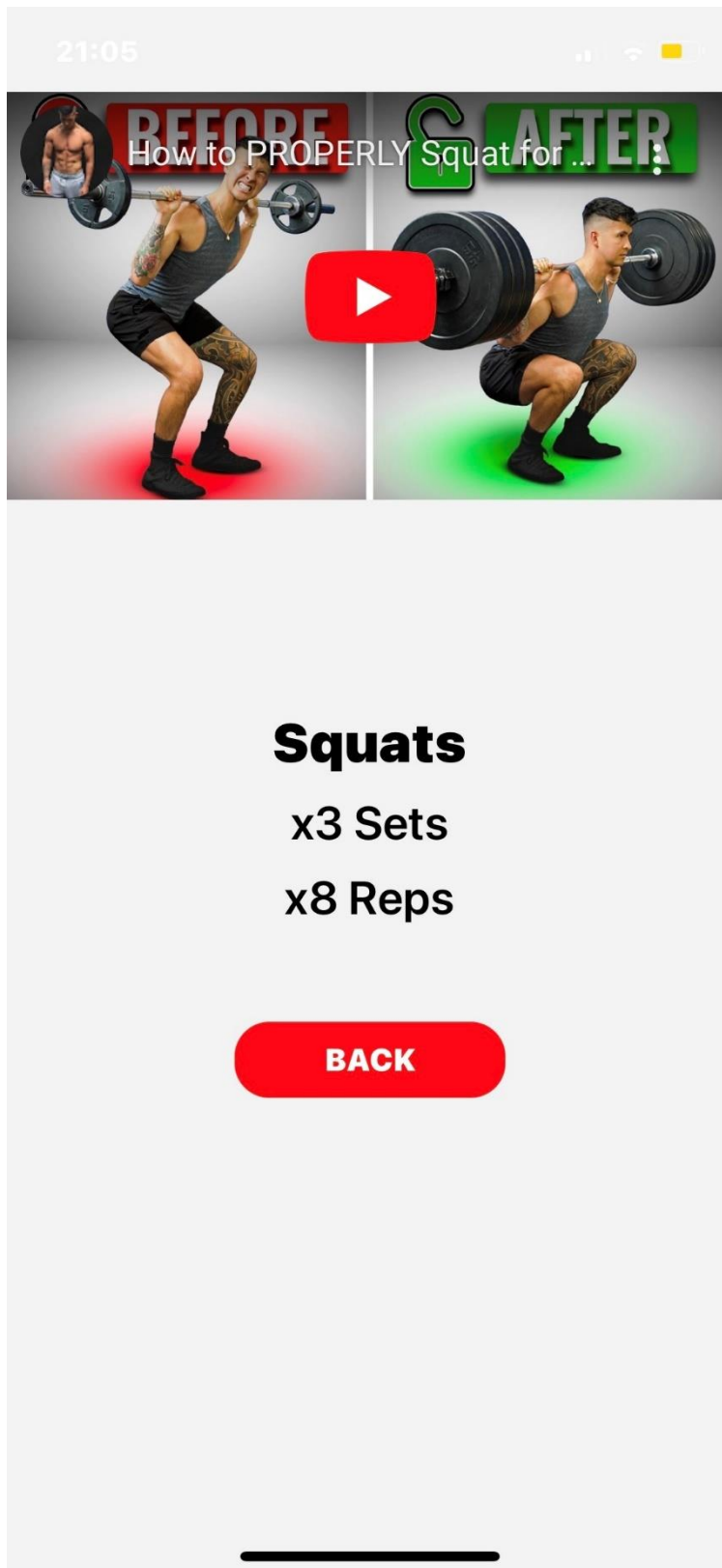
Created Workout Screen

Figure 13 - Created Workout Screen

The Created Workout screen is navigated to from view all or view assigned workout screen. This has the same layout as view all nutrition. This screen displays all the essential information about a workout, making it easy for users to review the details at a glance. An 'Edit Workout' button is provided, allowing users to make any necessary adjustments to the workout plan. Additionally, there is a 'Completed' button that indicates whether the workout has been finished or not.

Exercise Screen

The Exercise Screen presents the selected exercise with the YouTube video that was attached during the creation process, either by the user or their trainer. This screen ensures users have a clear visual guide to follow as they perform the exercise, helping them maintain proper form and technique throughout the workout.

Figure 14 - Exercise Screen

Analytics Tab

Weight Progress
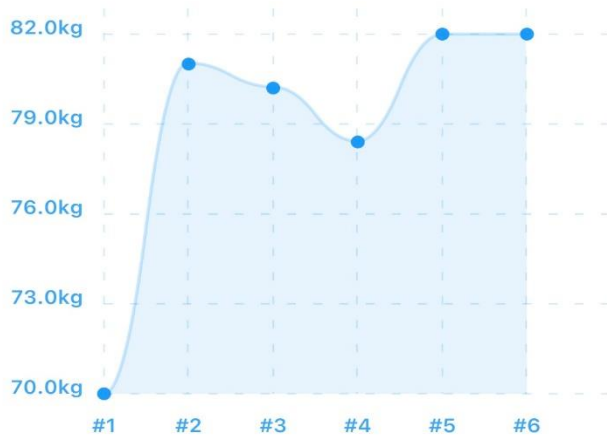
View Weight History

Workout Stats
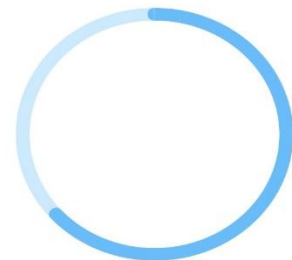
Completed Workouts: 3
Incomple Workouts: 3

Today's Nutrition

Figure 16 - Analytics Tab 1

View Weight History

Workout Stats

Completed Workouts: 3
Incomple Workouts: 3

Today's Nutrition

1776 / 2800 kcal

Fat: 68.4g   Protein: 42.5g

Figure 15 - Analytics Tab 2

The Analytics Tab offers a comprehensive overview of the user's progress. It features a graph displaying the user's weight over time, with clickable data points to reveal specific dates. Additionally, a 'View Weight History' button allows users to see their entire weight history. The tab also highlights the number of completed versus incomplete workouts, providing a quick summary of the user's workout consistency. Furthermore, daily nutrition stats are displayed, showing how close the user is to their calorie limit.
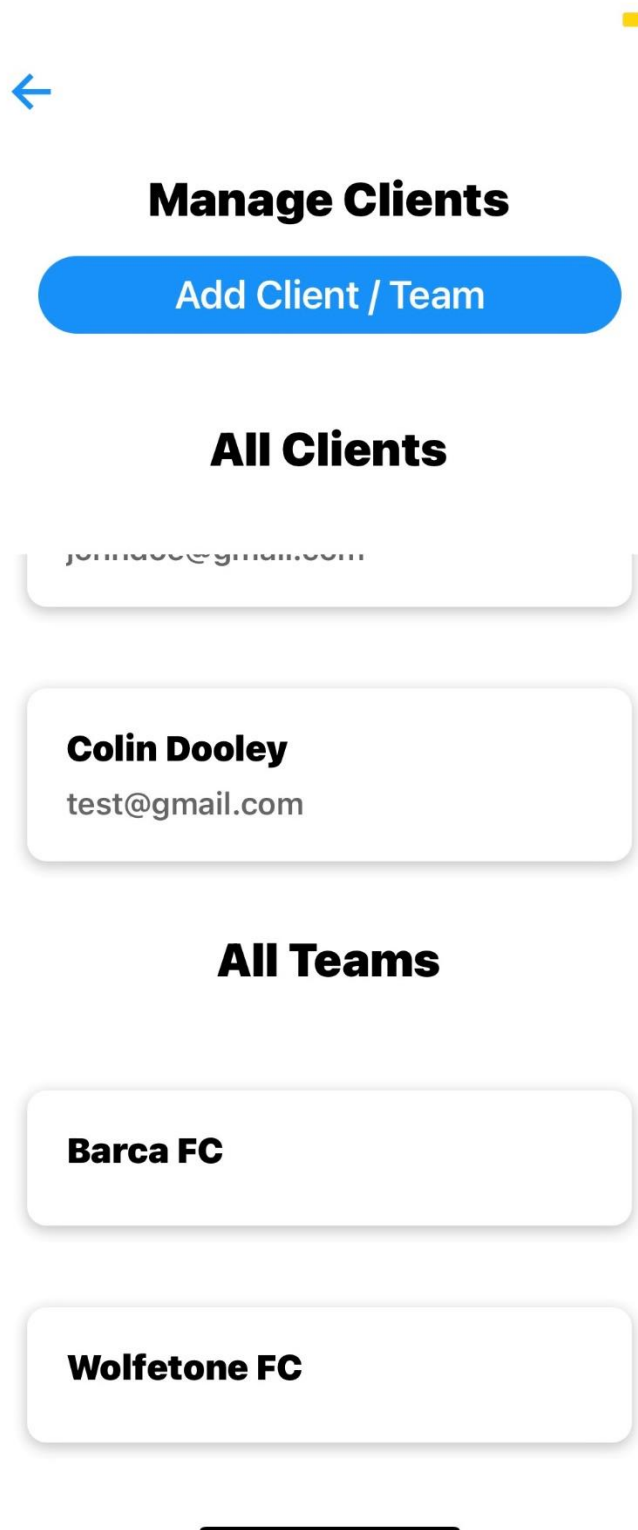
Profile Tab Screen
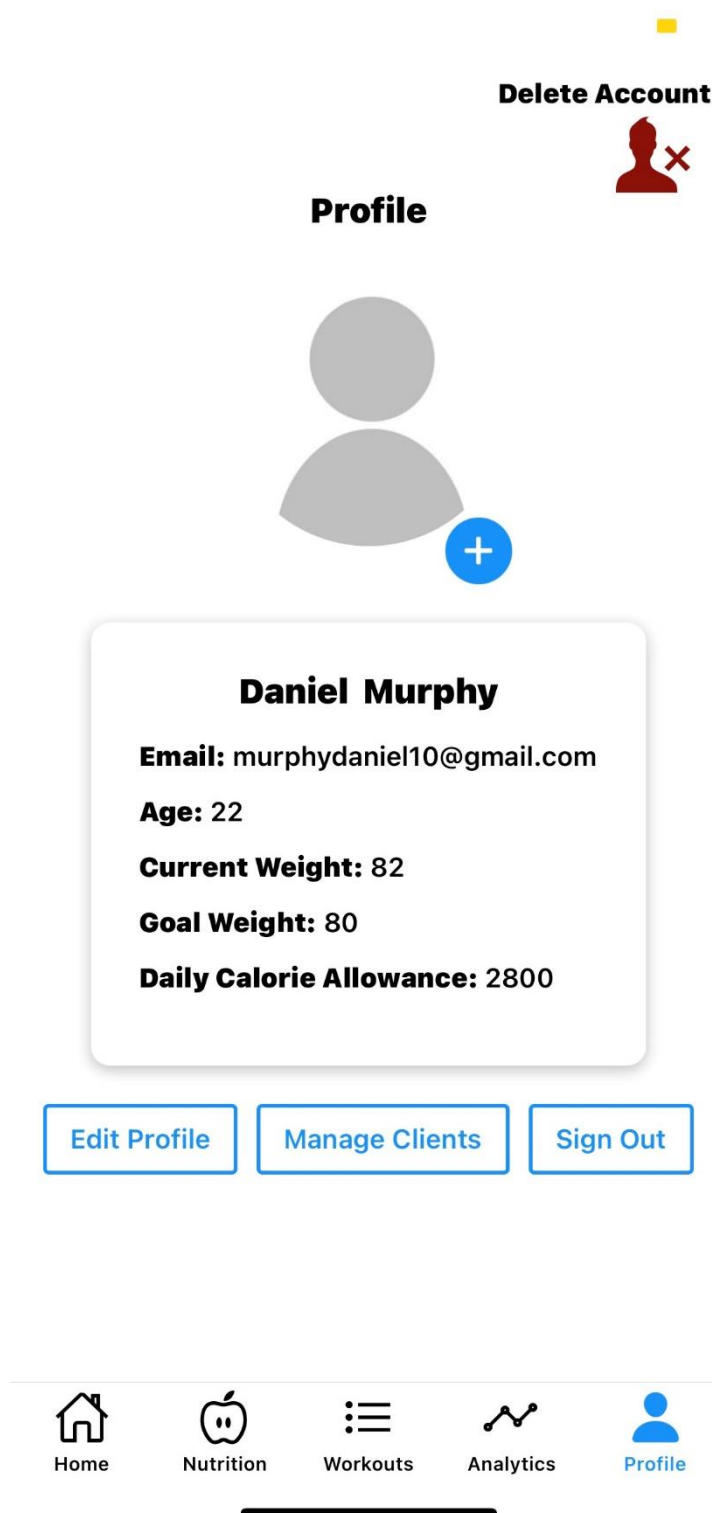
The Profile Tab screen allows users to manage their account information with ease. An 'Edit Profile' button enables them to update their user information as needed. The profile picture section displays a blank image until the user uploads a picture. Additionally, there's a 'Delete Account' button for those who wish to remove their account and a 'Sign Out' button for logging out. Only for Personal Trainer account types, is the 'Manage Clients' button visible, providing easy access to client management tools.

Figure 17 - Profile Tab Screen

Manage Clients Screen

Manage Clients

Add Client / Team

All Clients

johndoe@gmail.com

Colin Dooley
test@gmail.com

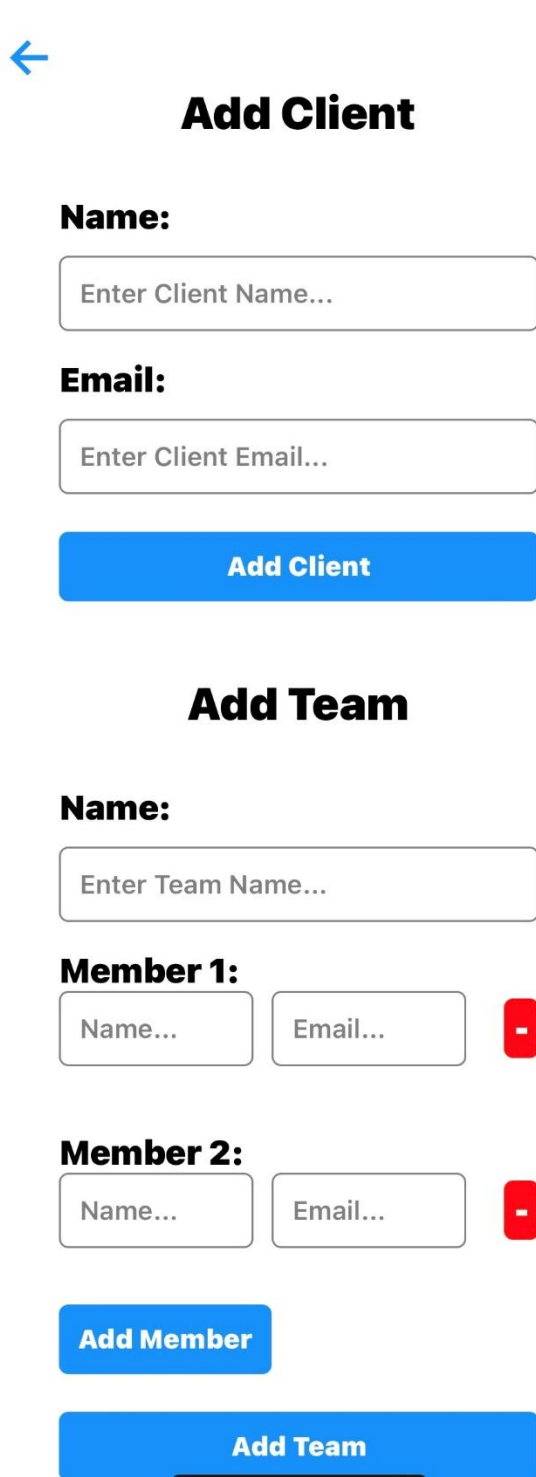## All Teams

Barca FC

Wolfetone FC

Figure 18 - Manage Clients Screen

The Manage Clients screen is only available for Personal Trainer account types and offers a view of clients and teams. The screen displays a list of clients and teams in a user-friendly format, with 'Add Client' and 'Add Team' buttons for conveniently adding new clients or creating new teams. A user creates workouts for a client or team by pressing on their name. The nutrition and workout forms shown before are used to create plans.

Add Client / Team Screen

Figure 19 - Add Client / Team Screen

The Add Client / Team screen presents two straightforward forms for users to add clients or teams. For clients, the form requires a name and email address, while for teams, the form asks for a team name and a list of team members, each with their own name and email address.
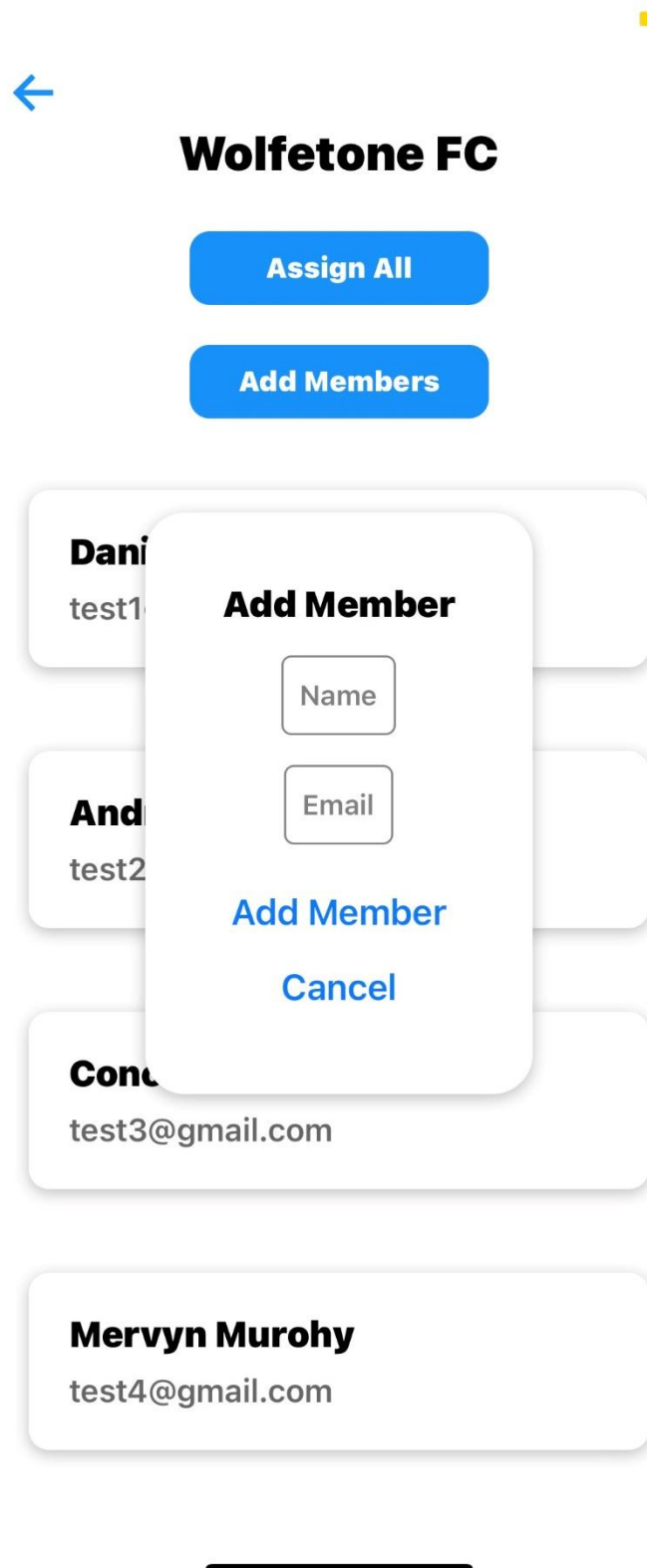
Team Screen

The Team screen displays a list of all team members, making it easy for personal trainers to manage their teams. A convenient pop-up allows the addition of more members, and a button is available to assign plans to the entire team at once. Additionally, trainers can assign plans to individual team members by simply clicking on their names. The nutrition and workout forms shown before are used for making plans.

Figure 20 - Team Screen

4.2 Database Structure
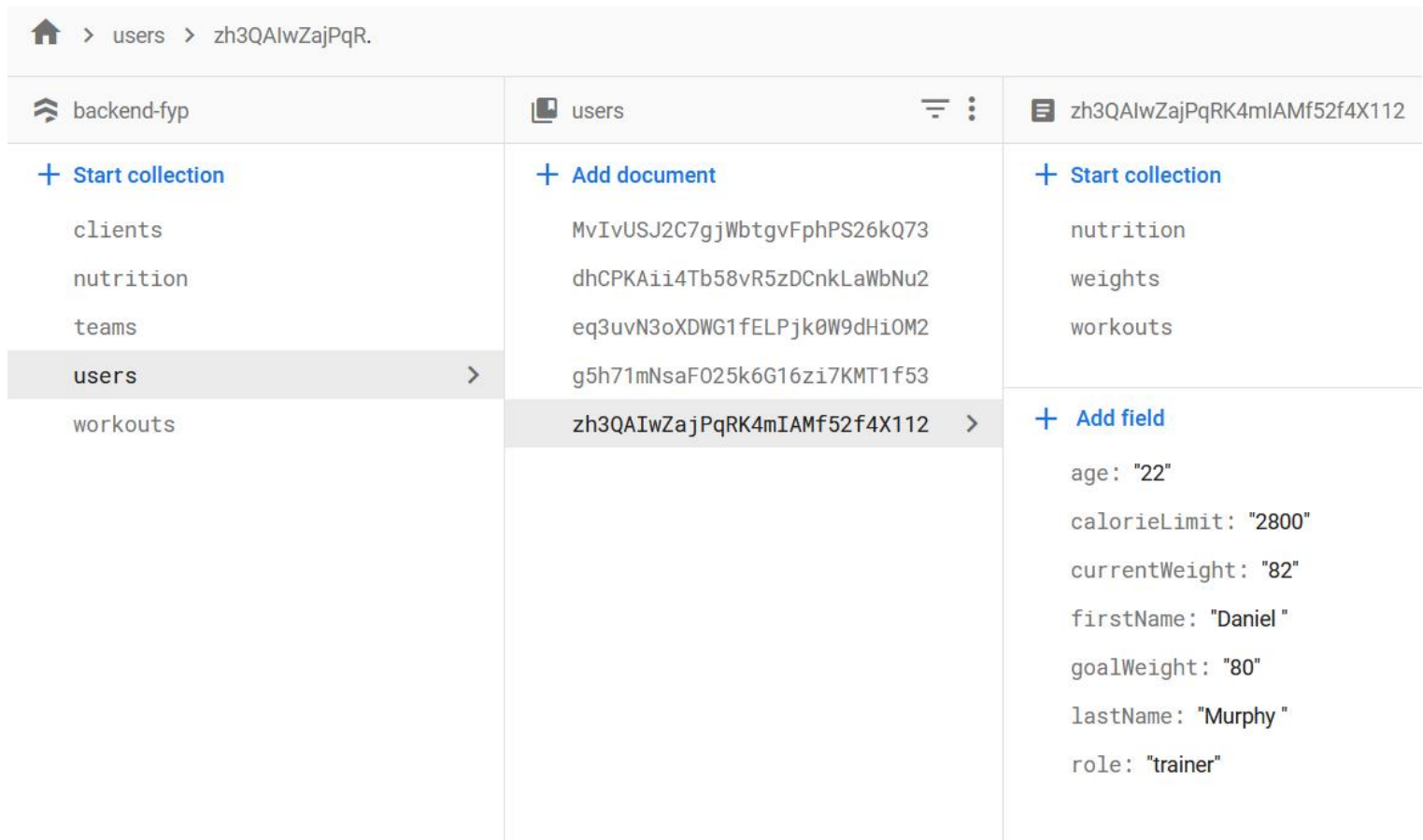
The Firestore database structure for this application consists of five primary collections. The first collection is "users," which contains documents matching each user's unique ID (uid). Within these documents, there are subcollections for "nutrition," "weights," and "workouts," as well as the user profile information. The "nutrition" and "workouts" subcollections store the user's created workouts and nutrition plans, allowing for easy organization and retrieval of user-specific data. The "weights" subcollection contains the user's weight history, enabling progress visualisation on the analytics screen via the weight chart.

The second collection, "clients," features documents with the uid and stores each user's clients, including their names and email addresses. Similarly, the "teams" collection follows the same logic as "clients" and stores team members' names and email addresses along with the team name. These collections facilitate the management of client and team information for personal trainers.

The final two collections, "workouts" and "nutrition," are dedicated to assigned workouts and nutrition plans. These collections are organised with the "workoutId" and "nutritionId" as documents, followed by their respective details. To retrieve workouts and nutrition plans assigned to users, the database is queried for the user's email address, allowing for efficient

access to the relevant information. This database structure ensures a well-organized and easily navigable system for handling user data, clients, teams, and assigned plans.

5. Conclusion

In conclusion, the fitness application project has been a valuable learning experience that resulted in a functional and user-friendly product. The application effectively provides users with the ability to manage their workout and nutrition plans, track progress, and communicate seamlessly with personal trainers or team members. Key technologies used in the development process include React Native, which enabled the creation of a cross-platform application, Firebase for a reliable and scalable backend.

Throughout the project, various challenges were faced and resolved, such as understanding the limitations of machine learning models and recognizing the importance of efficient database planning. Moreover, the project offered the opportunity to learn both personal and technical lessons, including the benefits of iterative development, leveraging external resources, and mastering new programming languages. The experience emphasised the significance of adaptability, determination, and continuous learning in software development.

In conclusion, the fitness app is a testament to the skills and expertise acquired throughout the development process. The final product effectively caters to users seeking to manage and track their fitness goals while offering personal trainers a platform to engage with clients and teams. The project's success can be attributed to the effective use of relevant technologies, diligent work ethic, and a strong commitment to ongoing improvement and learning.

6. Acknowledgement

I would like to express my sincere gratitude to my supervisor, Greg Doyle, for his continuous support, guidance, and encouragement throughout this project. His insights and suggestions have been invaluable in helping me complete this work. Furthermore, I would like to thank all of my lecturers this year for all of the knowledge and help given. I would also like to thank my peers and friends for their constructive feedback and assistance, as well as my family for their unwavering support during my college journey. Lastly, I would like to acknowledge the countless online resources and forums that have contributed to my understanding and knowledge in completing this project.

Declaration

*I declare that all material in this submission e.g. thesis/essay/project/assignment is entirely my/our own work except where duly acknowledged.

*I have cited the sources of all quotations, paraphrases, summaries of information, tables, diagrams, or other material; including software and other electronic media in which intellectual property rights may reside.

*I have provided a complete bibliography of all works and sources used in the preparation of this submission.

*I understand that failure to comply with the Institute's regulations governing plagiarism constitutes a serious offence.

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Student Number (Printed):   ___C00247818_____

X_____
Daniel Murphy

Signature (Original):

Date: ___06/05/2023_____