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SENIOR PROJECT REPORT

FitMind

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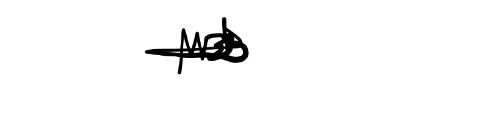
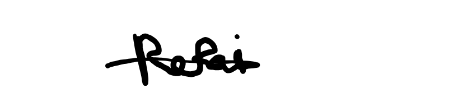
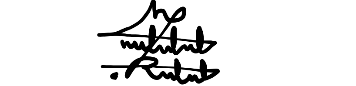
2025 First Semester

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**Date:17/2/2025**

**FitMind**

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**Abstract**

FitMind is a mobile application that provides users with personalized nutrition and workout plans based on their individual characteristics and goals. Unlike generic fitness apps that offer standard recommendations, FitMind utilizes a rule-based recommendation model to generate tailored plans. The application is developed using Flutter for the frontend and Firebase for backend integration, while the recommendation module is implemented in Python.

This study addresses the lack of personalization in fitness applications by designing a module that considers user-specific factors such as age, gender, dietary preferences, and fitness objectives. The methodology involves data collection, preprocessing, and applying a structured recommendation approach to generate customized health plans. Results show that FitMind effectively delivers individualized recommendations, enhancing user experience and engagement. These findings emphasize the importance of personalized fitness solutions in helping users achieve their health goals more efficiently.

**Keywords:** Personalized fitness, recommendation module, nutrition planning, workout planning, mobile app.

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**chapter I**

## INTRODUCTION

FitMind is a health recommendation module designed to help individuals improve their overall well-being by providing personalized advice on fitness and nutrition.

In today’s fast-paced world, many people struggle to maintain a healthy lifestyle due to lack of time, knowledge, or motivation. It can be challenging to determine the right diet, exercise routine, or mental health practices without expert guidance. Additionally, generic health recommendations found online often fail to consider individual needs, leading to ineffective or unsustainable habits.

To address these challenges, FitMind offers a personalized approach by analyzing user data and generating tailored recommendations. Whether it’s suggesting workout plans, or optimizing nutrition. the module ensures that every user receives guidance that suits their lifestyle and goals. Users simply input their information, and FitMind generates a structured plan that adapts to their progress over time.

The overall objective of this application is to make health management, continuously learning from user interactions to provide

effortless by offering a smart, data-driven system that helps users stay on track with their fitness and nutrition, all in one place.

### Background

In today's fast-paced world, maintaining a healthy lifestyle can be challenging due to time constraints, lack of knowledge, and the overwhelming amount of generic health advice available. Many individuals struggle to find personalized guidance that considers their unique fitness levels, dietary needs, and mental well-being. FitMind was developed to bridge this gap by offering a tailored health recommendation module that integrates fitness, nutrition, and mindfulness. By analyzing user data, the app provides customized suggestions to help individuals achieve their wellness goals effectively. In the future, FitMind aims to evolve into an AI-driven platform that continuously learns from user interactions, enhancing the accuracy and personalization of its recommendations.

### Motivation

The HRM team has faced challenges in determining the most suitable meals and exercises, while also encountering limitations in accessing human expertise, which can be both costly and unavailable at all times. After evaluating multiple health applications, we found that most provide generic workout and meal plans rather than personalized solutions. This gap in the market led to the creation of FitMind—to offer tailored health and wellness plans that meet individual needs effectively.

### Literature review

The development of FitMind was informed by extensive research into existing fitness and nutrition applications, as well as academic literature on personalized workout and meal planning. This section provides a review of similar applications and research that served as a foundation for our approach, what makes our app stands out.

**1.3.1 Existing Fitness and Nutrition Applications**

Several mobile applications currently offer gym workout plans and meal tracking solutions. Notable examples include MyFitnessPal, Nike Training Club, Freeletics, and JEFIT. These applications provide users with exercise routines and dietary recommendations, but they often rely on standardized programs rather than truly personalized, adaptive solutions.

* **MyFitnessPal**: Primarily focused on calorie tracking and nutrition logging, MyFitnessPal provides insights based on user input. However, it lacks dynamic adaptability to an individual’s metabolism and fails to integrate personalized workout adjustments (Smith & Jones, 2021).
* **Nike Training Club**: Offers a variety of structured workout programs, but most are designed for broad audience segments rather than individualized fitness levels or goals (Williams et al., 2020).
* **Freeletics**: Uses AI-driven training programs, but personalization is limited to user-defined goals rather than real-time adaptation based on physical progress and biometric data (Brown & Lee, 2019).
* **JEFIT**: A strength training-focused app that offers workout logging and tracking. However, it lacks an integrated nutrition component and does not provide real-time workout adjustments (Carter & Hughes, 2020).

**1.3.2 Personalization in Fitness and Nutrition Tech**

The need for individualized fitness solutions has been extensively documented in research. AI-driven models and machine learning have been increasingly integrated into fitness applications to enhance personalization. Studies suggest that adaptive algorithms—which adjust workout intensity and dietary recommendations based on user progress—lead to better adherence and results (Miller et al., 2022). However, most current solutions still lack real-time adaptability and fail to integrate nutrition with physical fitness in a seamless way (Johnson & Patel, 2021).

**1.3.3 Gaps in Existing Solutions**

Through this literature and product review, several key limitations were identified in existing solutions:

* **Lack of real-time personalization**: Most apps rely on pre-set workout plans or static meal recommendations, failing to adapt dynamically to user progress.
* **Limited integration between nutrition and fitness**: While some apps focus on workouts and others on diet tracking, few provide a comprehensive solution that links the two for optimized performance and results.

**1.3.4 How FitMind Stands Out**

FitMind was designed to address these gaps by incorporating:

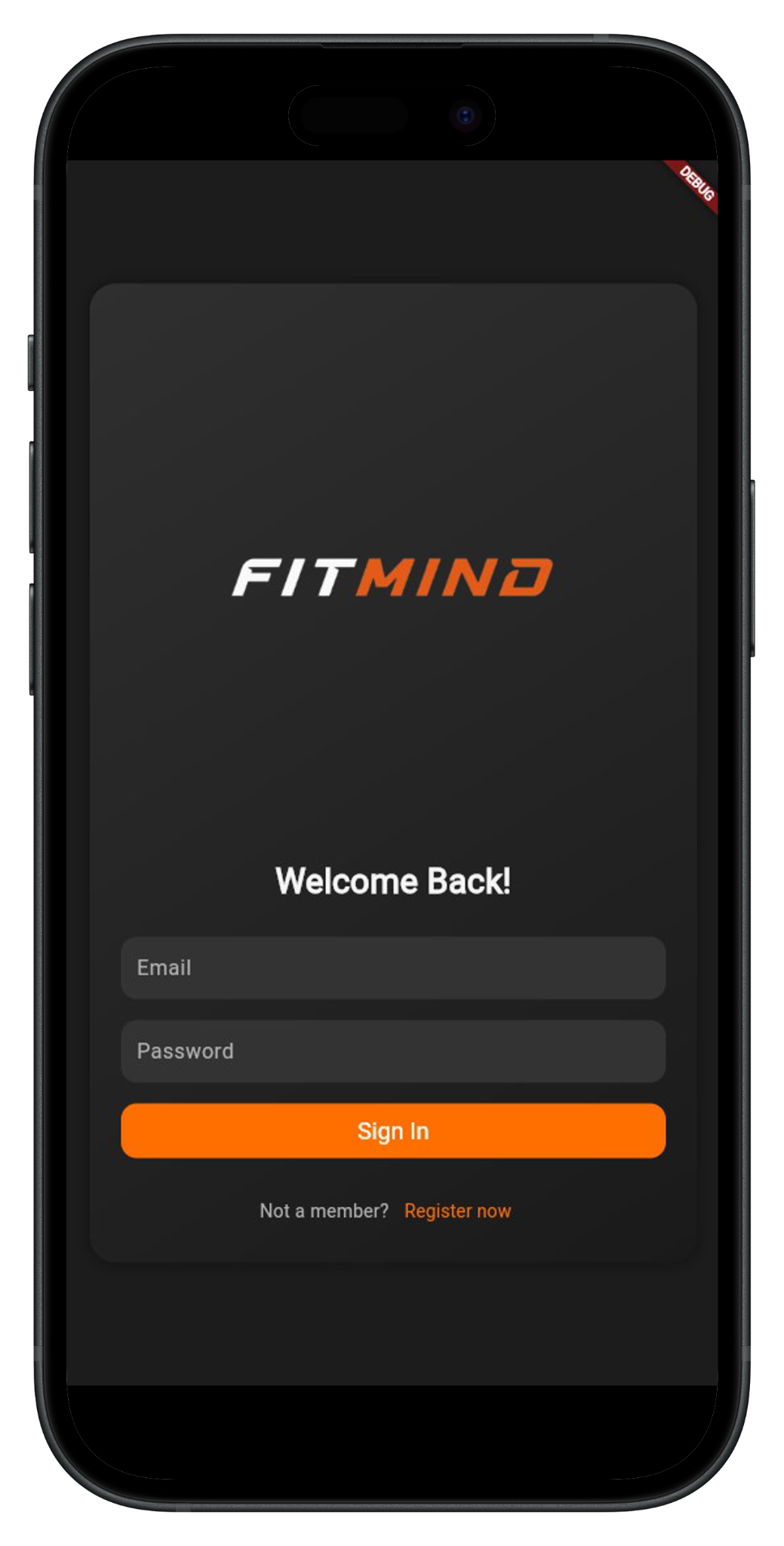
* **Seamless integration of fitness and nutrition**: Unlike Freeletics and JEFIT, FitMind provides a fully integrated system where workout intensity and meal plans are continuously updated.
* **Real-time adaptation**: Instead of relying on pre-set programs like most competitors, FitMind adjusts training loads and macronutrient intake in real time to optimize performance and recovery.

**chapter II**

## PROPOSED DESIGN AND METHODOLOGY

### Mobile Application Interfaces

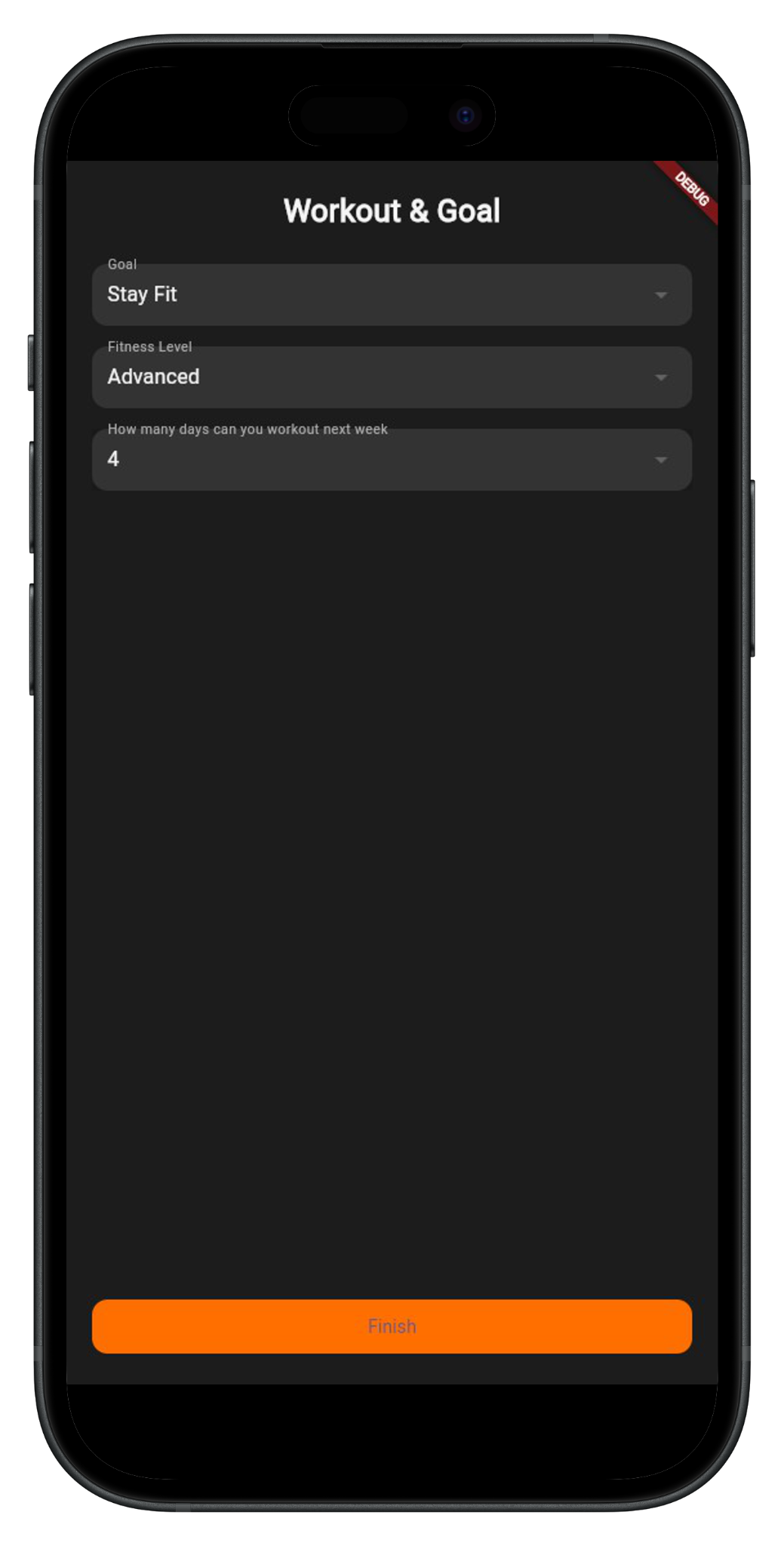
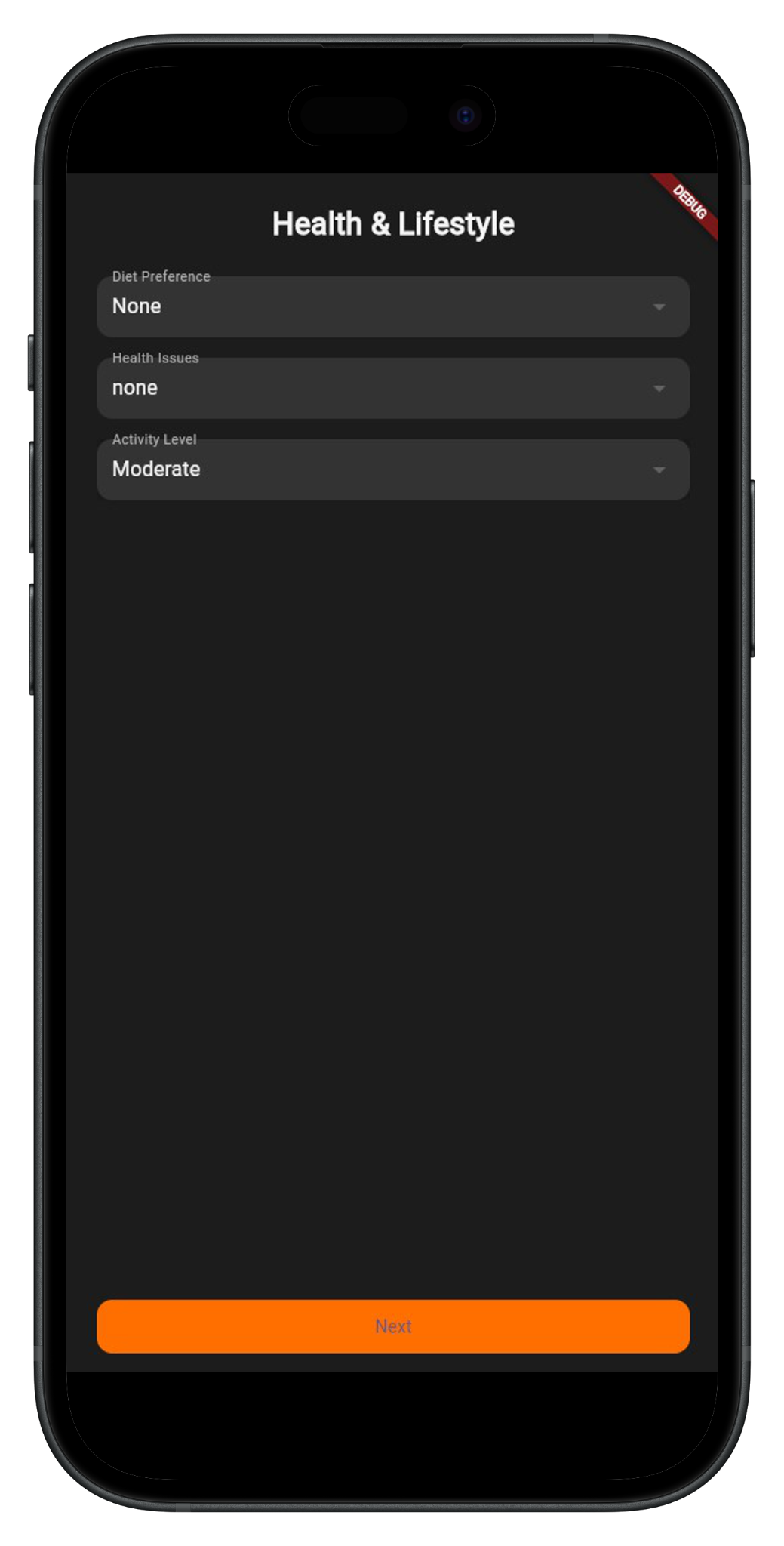
**1- Log in and Sign up screen**



 **Sign Up Screen**: Users enter email, password, and confirm password to register.

 **Sign In Screen**: Users enter email and password to log in.

**2- On-boarding screens**



 **User Info**: Collects age, gender, weight, and height.

 **Health & Lifestyle**: Captures diet preferences, health issues, and activity level.

 **Workout & Goal**: Sets fitness goals, fitness level, and workout frequency.

**3- Health Screens**

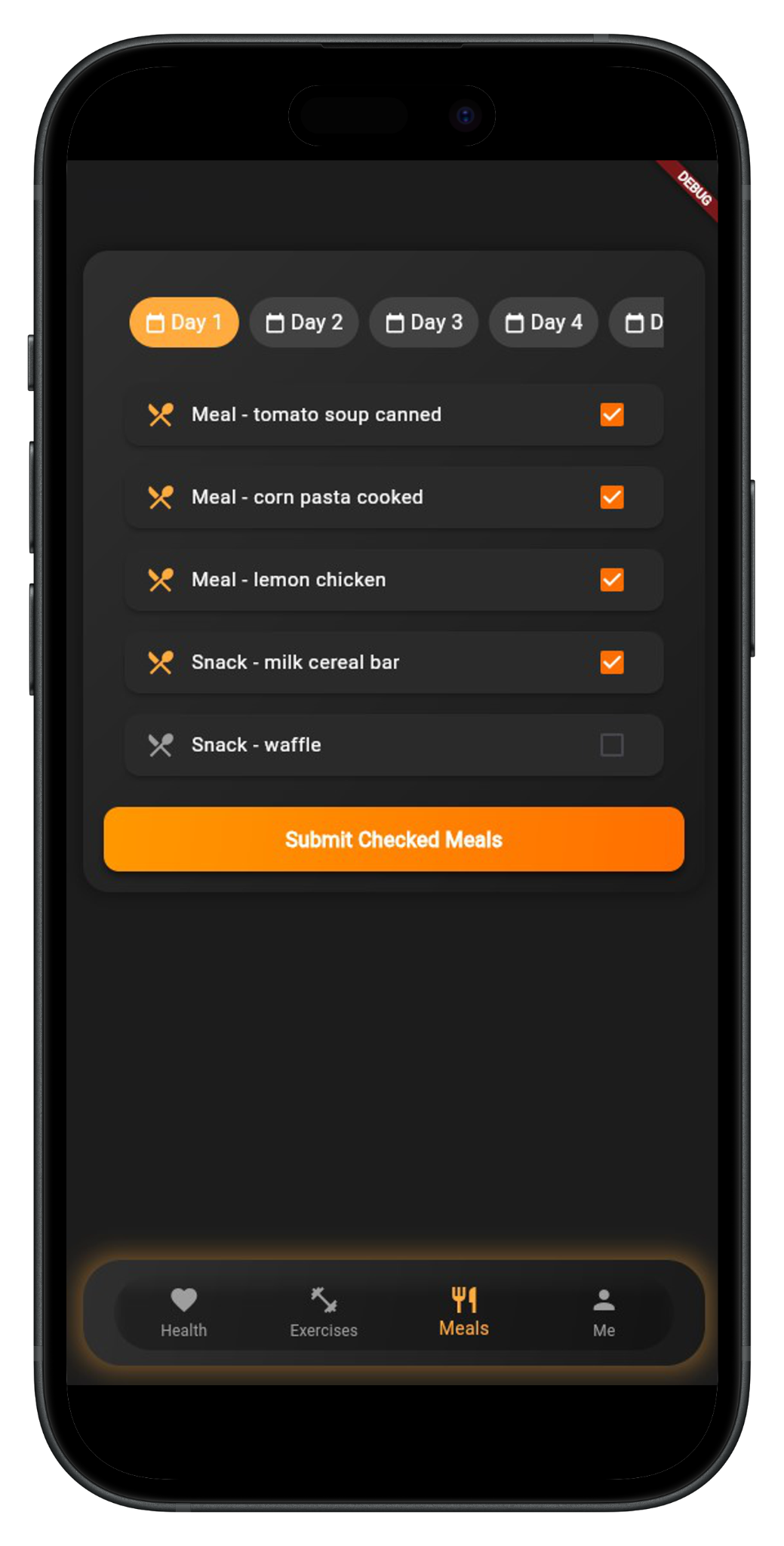
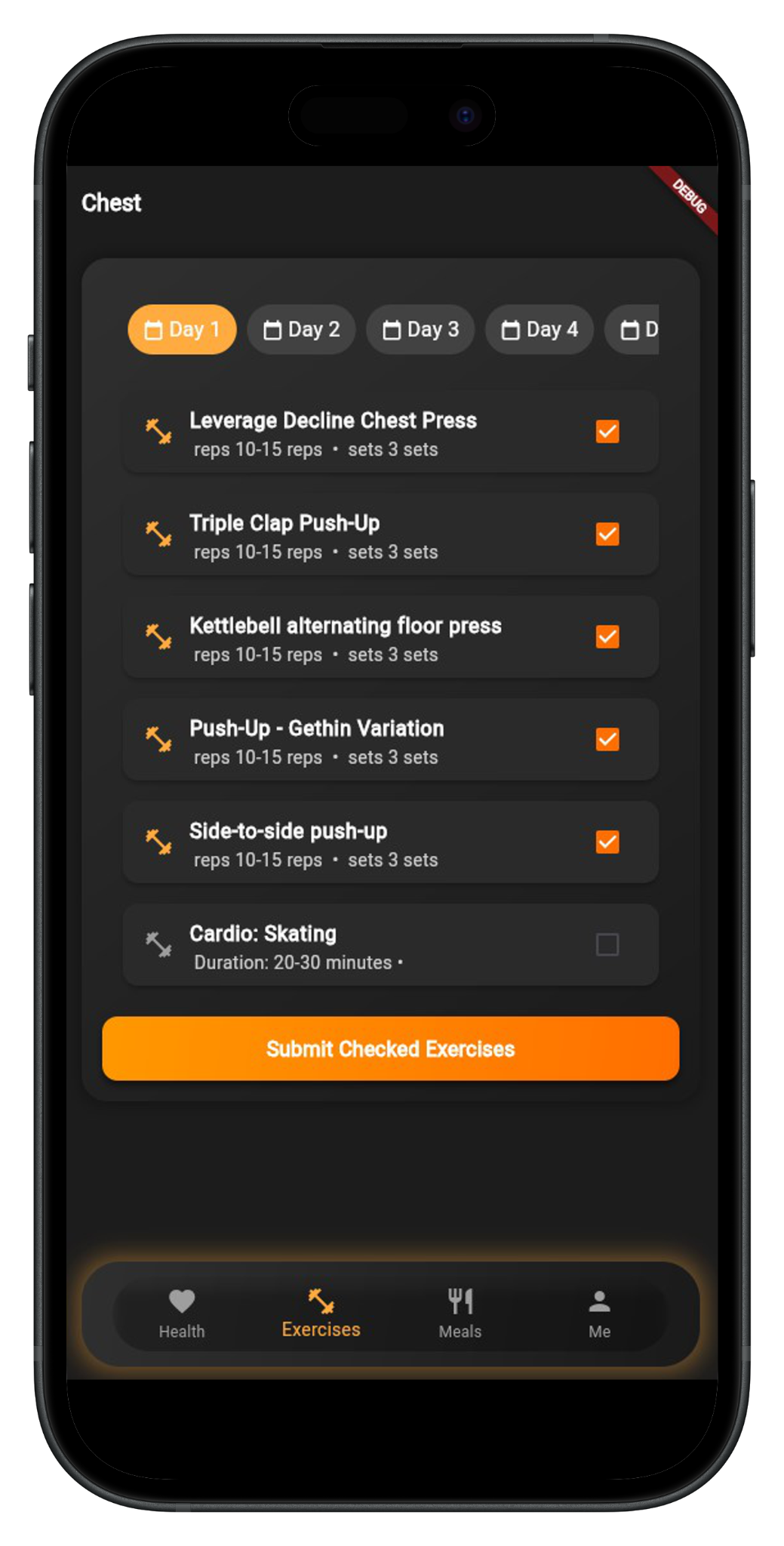
A screen shot of a phone

AI-generated content may be incorrect.

 **Current Status & Weight History**: Displays weight, BMI category, and a progress graph.

 **Meal & Workout Tracking**: Shows meal adherence (eaten vs. skipped) and workout consistency.

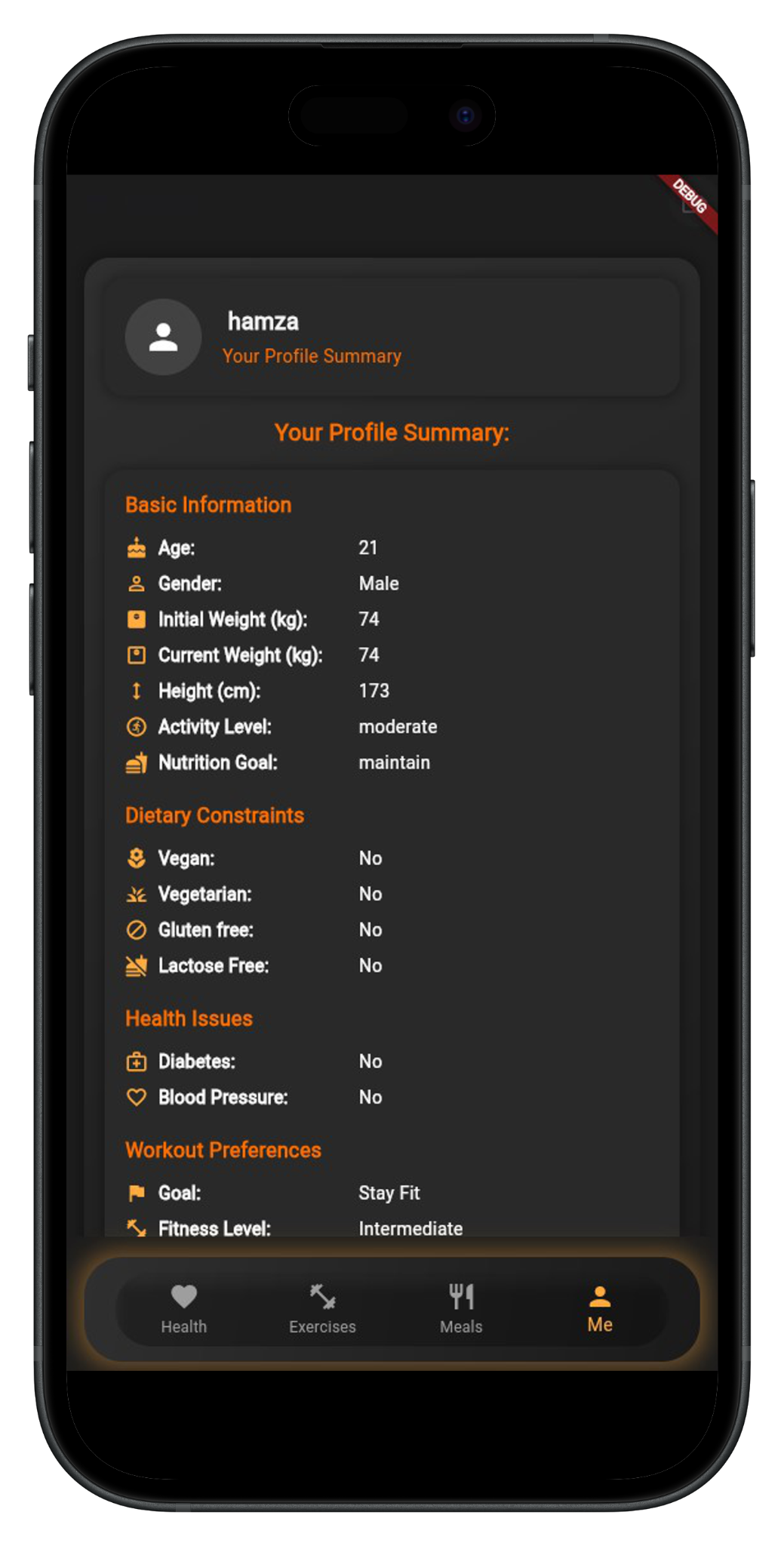
**4- Exercises and Meals screen**



 **Exercise Tracking**: Displays a daily workout plan with exercises, sets, reps, and a submission button.

 **Meal Tracking**: Lists daily meals and snacks, allowing users to check completed meals.

**5- user information screen**

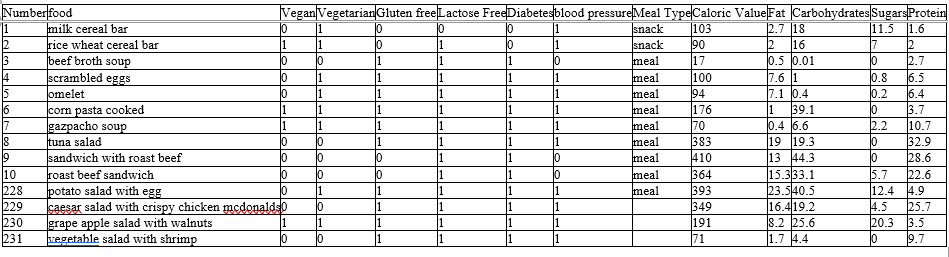


 **Profile Summary Screen:** Displays user details, including **basic information**, **dietary constraints**, **health issues**, and **workout preferences**.

### Development Pipeline

### 2.2.1 Data Preparation

We began by collecting extensive data on nutrition and workout routines from **Kaggle**. Leveraging our experience in data analysis, we systematically processed the dataset through multiple stages, starting with **data preprocessing and cleaning** to ensure accuracy and consistency. We then applied **data reduction techniques** to filter out less relevant entries, focusing only on **popular foods and well-known workouts** that users would easily recognize and implement. This approach ensures that our final dataset is both practical and user-friendly.



**Figure 2.1: Meals Plan Dataset (Sample)**

* + This is a sample of the sheet that is used to generate the meals plan

A table of weights with text

AI-generated content may be incorrect.

**Figure 2.2: Workout Plan Dataset (Sample)**

* + This is a sample of the sheet that is used to generate the Workouts plan

### 2.2.2 App Development

For the development of our application, we selected **Flutter** as the primary framework due to its numerous advantages in performance, user experience, and development efficiency. With our extensive experience in mobile app development, we determined that Flutter provides the optimal balance between cross-platform compatibility, maintainability, and responsiveness.

**Key advantages of using Flutter:**

1. **High Performance and Responsiveness**
   * Flutter utilizes Dart’s ahead-of-time (AOT) compilation, enabling faster execution and improved responsiveness.
   * The framework supports rendering at 60 or 120 frames per second (FPS), ensuring smooth animations and seamless user interactions.
   * Unlike frameworks that rely on WebViews or interpreted code, Flutter compiles directly to native machine code, resulting in better performance.
2. **Consistent and Intuitive User Interface**
   * Flutter enables the development of applications with a native-like appearance and performance across platforms.
   * It supports both Material Design (Android) and Cupertino (iOS) styles, ensuring a uniform and aesthetically pleasing user experience.
   * The framework allows for a cohesive and polished design across different screen sizes and resolutions.
3. **Cross-Platform Compatibility**
   * Applications developed using Flutter provide a consistent user experience across iOS, Android, web, and desktop platforms.
   * By utilizing a single codebase, the development process is streamlined, reducing time and effort required for platform-specific adjustments.
4. **Offline Functionality**
   * Flutter supports local database integration, such as SQLite, Hive, and Shared Preferences, allowing users to access the application’s core functionalities without requiring an internet connection.
5. **Security and Data Protection**
   * Flutter enables the integration of Google’s latest security protocols, including secure authentication, encryption, and data protection mechanisms.
   * The unified codebase facilitates faster implementation of security updates, enhancing overall data integrity.
6. **Integration with Native Device Features**
   * Flutter allows seamless interaction with device-specific functionalities, further improve in the future. such as camera, GPS, Bluetooth, sensors, and push notifications, ensuring a fully functional and feature-rich application. Which will help us

By utilizing Flutter, our development process has been **more efficient, cost-effective, and scalable**, while delivering an application that is **high-performing, visually consistent, and easy to maintain across multiple platforms**.

### 2.2.3 Backend

For the development of our application's backend, we selected **Python with Flask** due to its efficiency, flexibility, and scalability. Flask provides a lightweight yet powerful foundation for API development, making it an ideal choice for our project.

### 2.2.4 Database and Authentication

For our project, we implemented **Firebase Realtime Database** for **data storage** and **Firebase Authentication** for secure user login and management. These technologies were chosen for their scalability, real-time capabilities, and seamless integration with Flutter.

**Database implementation**

Our system stores and manages user data using **Firebase Realtime Database**, ensuring **efficient and secure data retrieval and updates**. The database structure includes:

* **User Profile Information**
  + Age, weight, height, gender
  + Activity level and fitness goals
  + Dietary constraints (e.g., vegan, vegetarian, gluten-free)
  + Health conditions (e.g., diabetes, blood pressure)
* **Meal Plan Storage**
  + The backend generates a **personalized nutrition plan** through **Flask** and stores it in Firebase.
  + Each week’s meal plan is structured with **daily meals and dietary constraints**.
  + Users can **check off meals** they have consumed to track adherence to their plan.
* **Workout Plan Storage**
  + The backend generates **customized workout routines** using **Flask** and saves them to Firebase.
  + Workouts are structured into **daily splits** based on the user’s training frequency.
  + Users can **mark completed workouts** to track progress, and use the data later to develop an AI model.
* **Weekly Progress Tracking**
  + User progress is stored to analyze **weight changes, activity levels, and adherence to plans**.
  + The system logs **weekly check-ins**, allowing users to **update weight and workout frequency** for future plan adjustments.

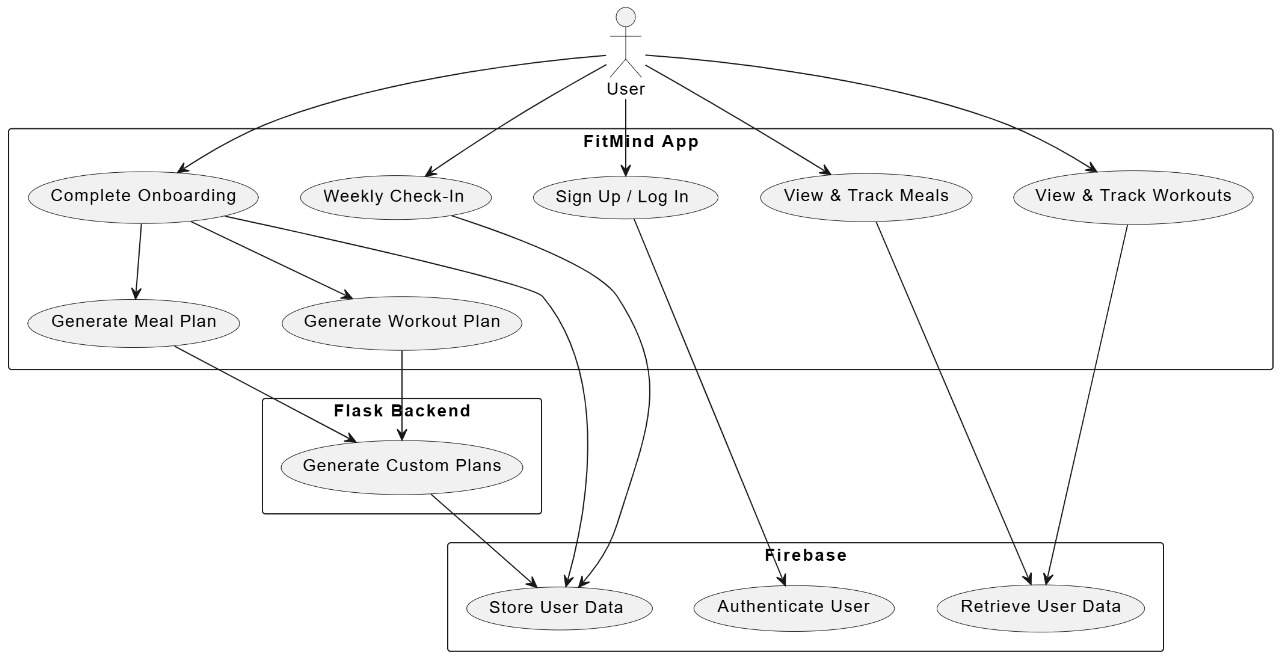
**Authentication system**

For secure user management, we integrated **Firebase Authentication**, enabling users to sign in and out securely. Authentication supports:

* **Email and Password Login**
  + Users can create accounts and log in using their email and password.
  + Firebase securely handles password encryption and authentication.
* **Third-Party Authentication (Future Scope)**
  + The system can be extended to support **OAuth login methods** (Google, Facebook, GitHub) for a smoother user experience.
* **User Session Management**
  + Firebase Authentication manages user sessions to maintain login states.
  + The app automatically retrieves stored user data upon login, ensuring seamless access to **nutrition and workout plans**.

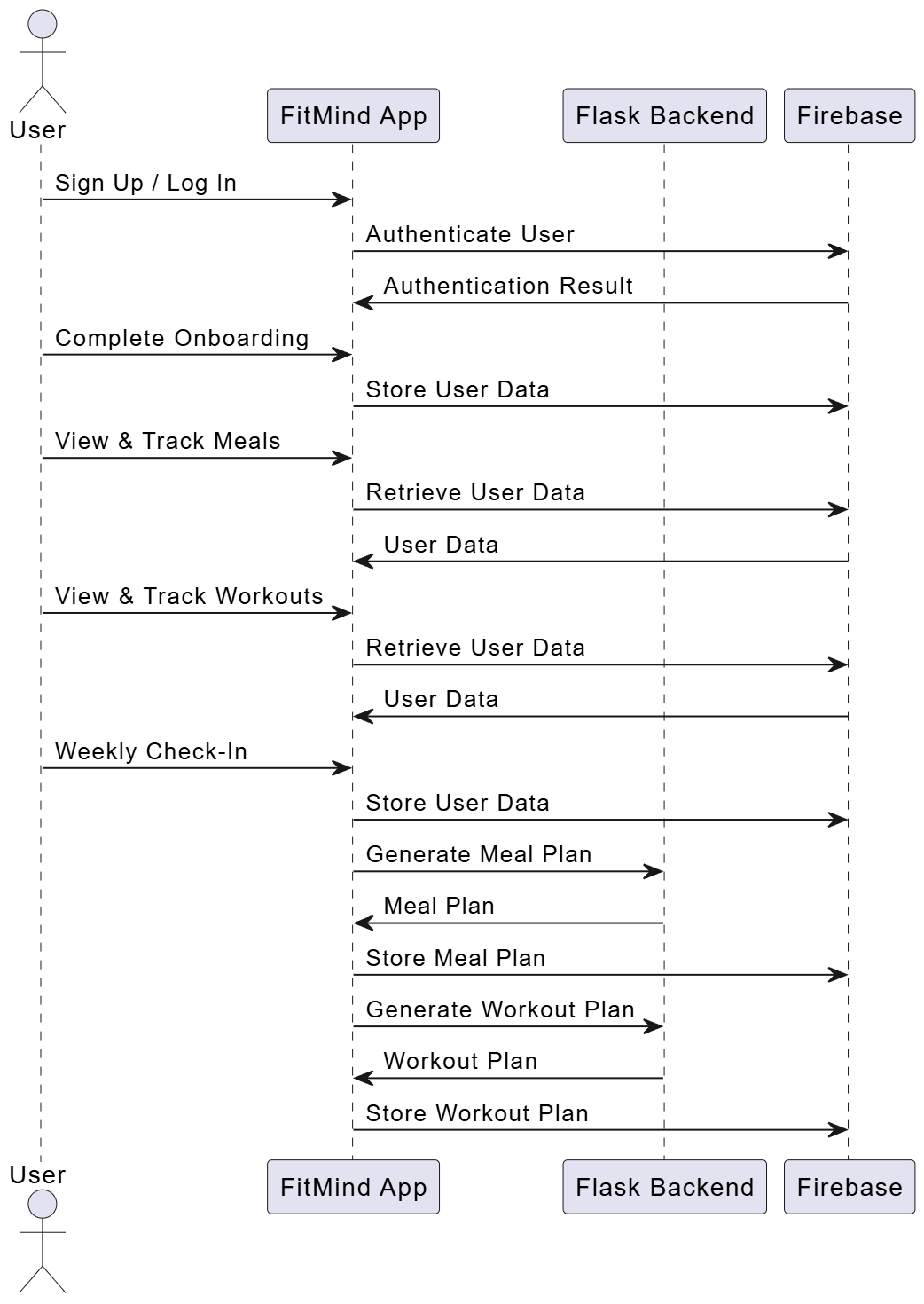
By leveraging **Firebase Realtime Database and Firebase Authentication**, our system ensures **real-time synchronization, secure authentication, and scalable data storage**, enhancing user experience and system efficiency.

#### System Analysis



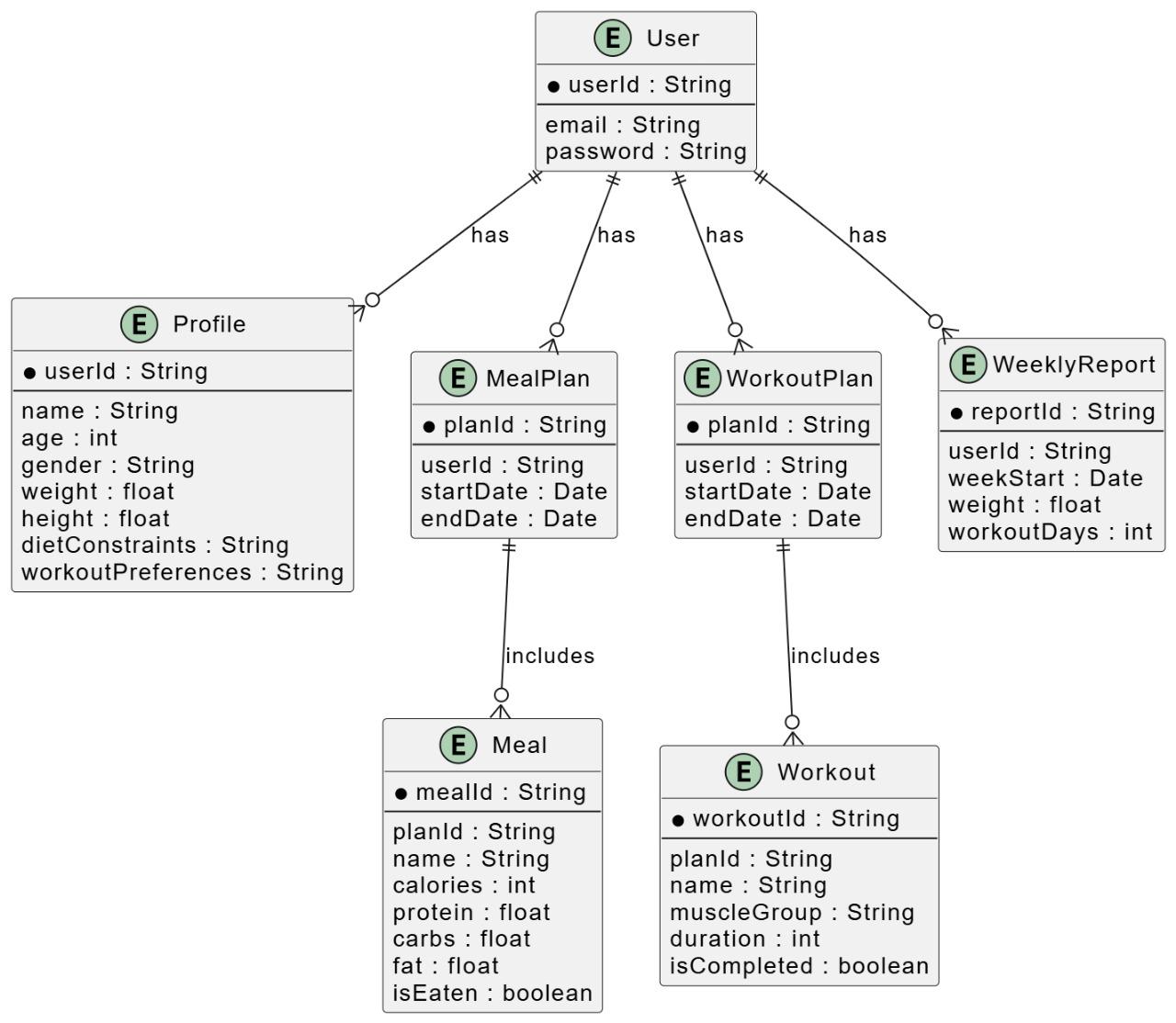
**Figure 2.3: Use Case Diagram**

This diagram illustrates the interaction between the user and the **FitMind** app, detailing key functionalities such as onboarding, meal and workout tracking, authentication via Firebase, and custom plan generation using a Flask backend.



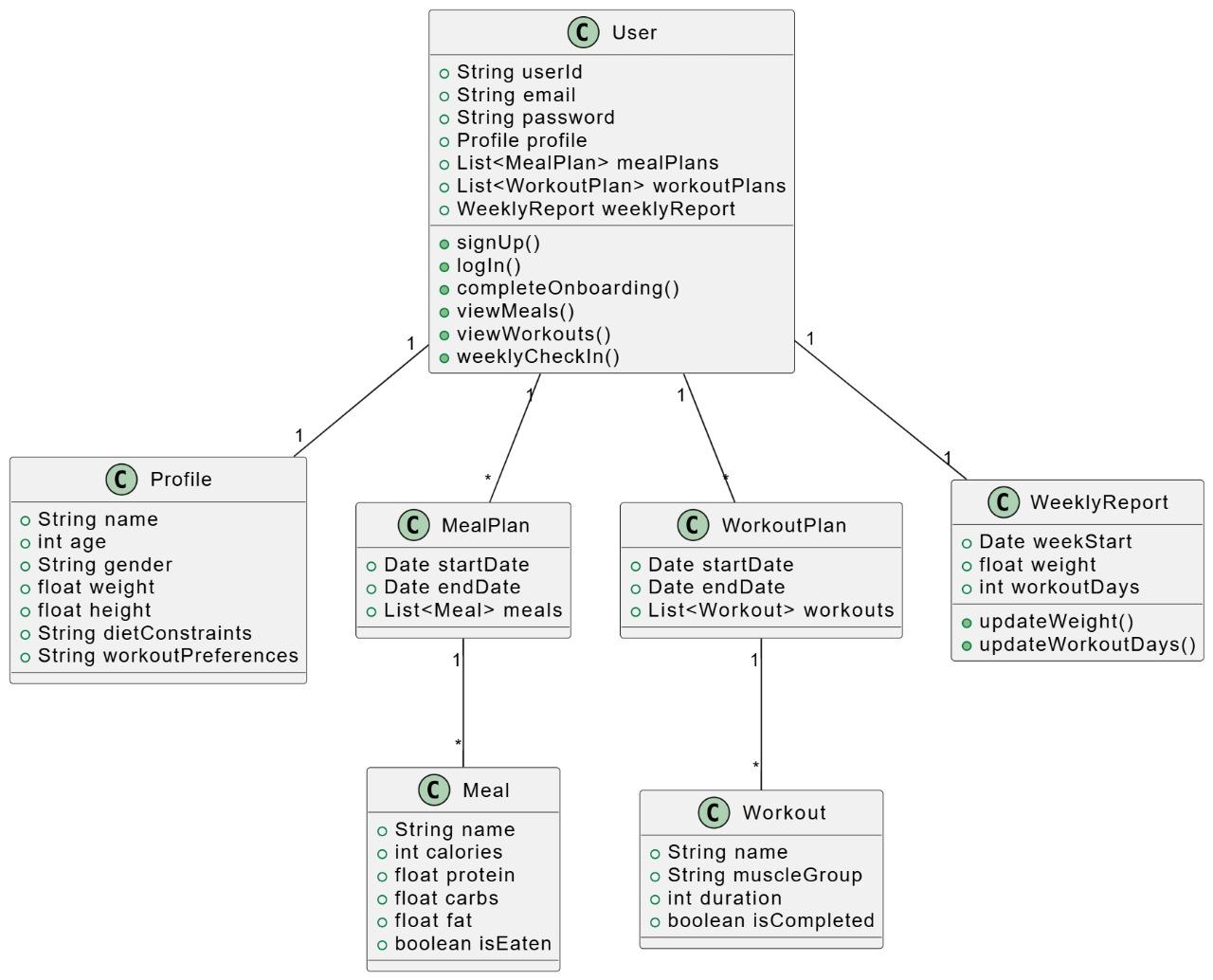
**Figure 2.4: Sequence Diagram**

This diagram represents the step-by-step interaction between the user, the **FitMind** app, Firebase, and the Flask backend. It details processes such as user authentication, data storage and retrieval, meal and workout plan generation, and tracking functionalities.



**Figure 2.5: Entity Relationship Diagram**

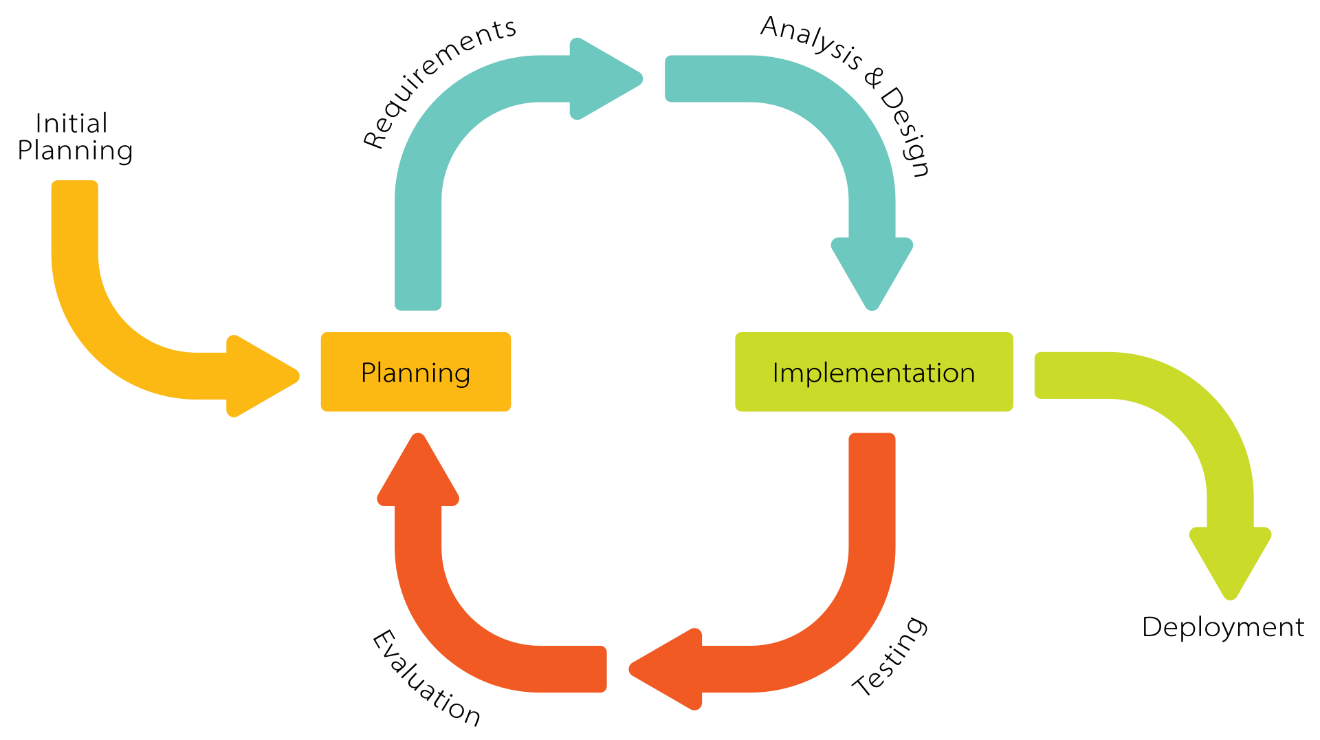
This diagram showcases the relationships between key entities in the **FitMind** app, including users, profiles, meal plans, workout plans, weekly reports, meals, and workouts. It illustrates how user data is structured and linked to support personalized fitness and nutrition tracking.

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**Figure 2.6: Class Diagram**

This diagram represents the object-oriented structure of the FitMind app, detailing the attributes and methods of key classes such as User, Profile, MealPlan, WorkoutPlan, WeeklyReport, Meal, and Workout. It illustrates relationships between these classes, emphasizing how data and functionality are organized within the system.

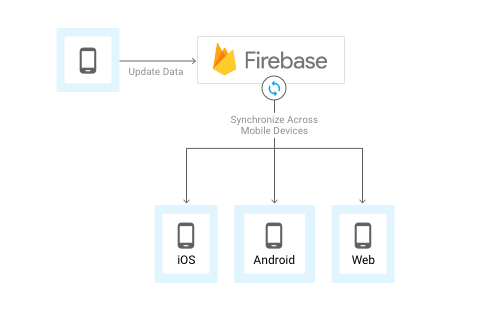
### Software Development Life Cycle



**Figure 2.7: Iterative lifecycle diagram**

This project was developed using an iterative lifecycle model, chosen specifically to accommodate the evolving nature of software design and implementation. Traditional methodologies, such as the waterfall model, were deemed unsuitable due to their rigid structure. In selecting the appropriate development approach, key factors such as project requirements, software architecture, customer involvement, and implementation considerations were carefully evaluated.

### System Diagram



**Figure 2.6: System Diagram**

Firebase enables real-time data synchronization across multiple platforms. A mobile device updates data to Firebase, which then synchronizes this data across various devices and platforms, including iOS, Android, and Web. This ensures that any changes made on one device are reflected across all connected platforms in real-time, making Firebase an efficient backend solution for cross-platform applications.

### The Recommendation module logic

Our **Flask-based backend** was developed after extensive research on how to generate optimal **nutrition and workout plans** tailored to individual users. The system is designed to take user inputs such as **age, weight, height, gender, dietary, activity level, health issues, fitness goals, fitness level, and how many days the user is free to workout** to generate personalized recommendations.

**Nutrition Plan Generation**

1. The backend collects user information, including **age, weight, height, gender, activity level, and goal (gain, lose, or maintain weight).**
2. It calculates **Basal Metabolic Rate (BMR) and Total Daily Energy Expenditure (TDEE)** using scientifically established formulas.
3. Based on the user's goal, the system determines **macronutrient distribution** (proteins, fats, and carbohydrates).
4. The system filters a **predefined food dataset** based on the user's dietary constraints.
5. It then generates a **personalized weekly meal plan** that matches the user's caloric and macronutrient needs.

**Workout Plan Generation**

1. Users specify their **fitness goal (muscle gain, weight loss, or general fitness), fitness level (beginner, or advanced)** and **how many days per week they plan to train.**
2. The system selects **appropriate exercises from a workout dataset** based on the muscle groups that should be trained each session.
3. The workout plan is divided into **splits (e.g., upper body, lower body, full-body workouts) based on the selected training frequency.**
4. Repetitions and sets are adjusted according to the fitness goal (**higher reps for fat loss, moderate reps for muscle gain**).
5. The system integrates **cardio exercises** when necessary.
6. The finalized **7-day workout plan** is structured to include both **training and rest days**.

**API Functionality**

* The system exposes two API endpoints:
  + **/generatePlan**: Generates a **weekly nutrition plan**.
  + **/generateWorkoutPlan**: Creates a **weekly custom workout plan**.
* The Flask backend is **lightweight, fast, and scalable**, ensuring smooth integration with **Flutter** for the mobile application.

This implementation ensures that each user receives **a tailored, science-backed fitness and nutrition plan** to help them achieve their health goals effectively.

**chapter III**

## Conclusion

In the future, FitMind aims to develop an advanced AI model that leverages the user data collected during the recommendation process. This AI-driven system will enhance the accuracy and personalization of health recommendations even smarter, more effective guidance. We plan to launch the application on the App Store and Google Play. In the future, the app will integrate a cutting-edge AI model that leverages user data collected during the recommendation process to enhance the accuracy and personalization of health suggestions.

## REFERENCES

**Flutter References**

1. Google. (n.d.). *Flutter - Build apps for any screen*. Retrieved from [https://flutter.dev](https://flutter.dev/)
2. Flutter Documentation. (n.d.). *Flutter: Beautiful native apps in record time*. Retrieved from [https://docs.flutter.dev](https://docs.flutter.dev/)
3. Bahga, A., & Madisetti, V. (2021). *Cloud Computing: A Hands-On Approach*. CreateSpace Independent Publishing Platform.

**Firebase References**

1. Google. (n.d.). *Firebase - App success made simple*. Retrieved from [https://firebase.google.com](https://firebase.google.com/)
2. Firebase Documentation. (n.d.). *Firebase Docs: Build better apps, faster*. Retrieved from <https://firebase.google.com/docs>
3. Pearson, T. (2019). *The Firebase Handbook: A Guide to Backend Development for Android & iOS*. Independently published.

**Flask References**

1. Grinberg, M. (2018). *Flask Web Development: Developing Web Applications with Python*. O'Reilly Media.
2. Palach, M. (2020). *Mastering Flask Web Development: Build enterprise-grade, scalable Python web applications*. Packt Publishing.
3. Flask Documentation. (n.d.). *Flask: The Python Microframework*. Retrieved from <https://flask.palletsprojects.com>

**Literature review References**

1. Brown, L., & Lee, P. (2019). AI in Fitness Apps: A Review of Personalization Techniques. *Journal of Digital Health, 15*(2), 120-135.
2. Carter, J., & Hughes, P. (2020). Strength Training Apps: A Comparative Analysis. *Human Performance Journal, 22*(1), 55-70.
3. Johnson, R., & Patel, S. (2021). Health Apps and Personalization: Current Trends and Future Prospects. *International Journal of Health Informatics, 8*(1), 45-60.
4. Miller, T., Green, C., & Thomas, R. (2022). Adaptive Fitness: The Role of Machine Learning in Personalized Health Solutions. *AI & Healthcare Journal, 18*(3), 200-220.
5. Smith, K., & Jones, M. (2021). Personalized Nutrition and Exercise: The Missing Link in Current Fitness Applications. *Journal of Applied Health Science, 10*(2), 75-92.
6. Williams, D., Carter, J., & Hughes, P. (2020). Effectiveness of Generic vs. Personalized Fitness Programs: A Comparative Study. *Human Performance Journal, 22*(1), 55-70.