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Personalised Meal Planning Web Application

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***Abstract*--The Personalized Meal Planning Application Using Photo Recognition is an Artificial Intelligence (AI)-based web application designed to promote healthy eating through automatic food recognition and personalized nutrition guidance. Unlike traditional calorie-tracking apps that require manual food entry, the proposed system identifies food items directly from uploaded images using AI.**

The application analyzes meal images, estimates nutritional values such as calories, proteins, carbohydrates, fats, fiber, and sugar, and compares them with the user's dietary goals, including weight loss, maintenance, or weight gain. Based on this analysis, it provides personalized meal recommendations and tracks daily calorie intake.

The system is developed using React 18, Vite, TypeScript, Tailwind CSS, and Supabase, while Google Gemini 2.5 Flash AI is used for food recognition and nutritional analysis through the Lovable AI Gateway. The application offers a responsive and user-friendly interface for convenient dietary monitoring.

The proposed system improves the accuracy and efficiency of calorie tracking by reducing manual effort and providing real-time nutritional insights. It demonstrates the practical application of Artificial Intelligence and Computer Vision in nutrition management and can be further enhanced with features such as wearable device integration, barcode scanning, voice-based food logging, and real-time health monitoring.

I. Introduction

Maintaining a healthy lifestyle has become increasingly challenging due to unhealthy eating habits, sedentary lifestyles, and the widespread availability of processed foods. Poor nutrition is a major contributor to obesity, diabetes, cardiovascular diseases, and other lifestyle-related disorders, making effective diet management essential.

Traditional calorie-tracking methods rely on manual food logging, which is often time-consuming and inaccurate. Recent advances in Artificial Intelligence (AI), Machine Learning (ML), and Computer Vision have enabled automated food recognition and nutritional analysis, offering a more efficient approach to dietary management.

The Personalized Meal Planning Application Using Photo Recognition is an AI-powered web application that identifies food items from uploaded images and estimates their nutritional values, including calories, proteins, carbohydrates, fats, fiber, and sugar.

Based on the user's age, height, weight, gender, and fitness goals, the system provides personalized meal recommendations and tracks daily calorie intake. The application is developed using React 18, Vite, TypeScript, Tailwind CSS, and Supabase, while Google Gemini 2.5 Flash AI is integrated through the Lovable AI Gateway for food recognition and nutritional analysis. Its cloud-based architecture ensures fast processing, secure data storage, and accessibility across multiple devices.

By automating food recognition and meal planning, the system reduces manual effort, improves nutritional awareness, and supports healthier eating habits. It serves as an intelligent solution for individuals seeking effective diet management and demonstrates the practical use of AI and Computer Vision in modern healthcare and nutrition.

1.1 Problem Statement

Maintaining a healthy diet has become increasingly difficult due to busy lifestyles, unhealthy eating habits, and the widespread consumption of processed foods. Many people struggle to monitor their daily calorie and nutrient intake, increasing the risk of obesity, diabetes, cardiovascular diseases, and other lifestyle-related health problems.

Traditional calorie-tracking applications require manual food entry, which is time-consuming, inconvenient, and often inaccurate. These systems also rely on food databases or barcode scanning, making them less effective for homemade meals, restaurant dishes, and mixed food items. In addition, most existing applications provide only general nutritional information without offering personalized meal recommendations based on individual health profiles and fitness goals.

Although Artificial Intelligence and Computer Vision have enabled automated food recognition, many existing solutions still face challenges such as limited recognition accuracy, poor support for diverse food types, and lack of personalized diet planning.

To address these issues, the proposed Personalized Meal Planning Application Using Photo Recognition uses AI-based image recognition to identify food items from uploaded images, estimate their nutritional values, and generate personalized meal recommendations based on user profiles and fitness goals. The system reduces manual effort, improves dietary tracking, and promotes healthier eating habits through intelligent nutrition management.

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1.2 Objectives Of The Project

1. To develop an intelligent and user-friendly nutrition management system that helps individuals track their dietary intake effortlessly and maintain a healthier lifestyle.
2. To utilize Artificial Intelligence (AI) and Computer Vision technologies for automatically recognizing food items from images captured through a smartphone camera or uploaded the user.
3. To simplify the process of meal logging by eliminating the need for manual food entry, thereby reducing time consumption and increasing user convenience.
4. To provide accurate nutritional analysis of recognized food items, including calorie count and essential nutrients such as proteins, carbohydrates, fats, fiber, vitamins, and minerals.
5. To generate personalized meal plans tailored to each user's individual characteristics, including age, gender, height, weight, Body Mass Index (BMI), activity level, and health objectives.
6. To support users in achieving specific fitness goals such as weight loss, weight maintenance, muscle gain, or overall health improvement through customized dietary recommendations.
7. To calculate daily calorie requirements using scientifically accepted nutritional formulas and provide meal suggestions that align with the user's energy needs.
8. To monitor and maintain records of users' daily food consumption, allowing them to track their eating patterns and nutritional progress over time.
9. To provide real-time feedback on dietary choices, helping users understand whether their meals are balanced, excessive, or lacking in essential nutrients.
10. To increase awareness about healthy eating habits by educating users about the nutritional content of the foods they consume regularly.
11. To encourage healthier food choices and promote long-term behavioral changes that contributes to improved physical well-being and disease prevention.
12. To reduce human errors commonly associated with manual calorie counting and dietary tracking, thereby improving the reliability and consistency of nutrition monitoring.
13. To provide a seamless and interactive user experience through an intuitive web interface that can be accessed from smartphones, tablets, laptops, and desktop computers.
14. To integrate cloud-based technologies for secure storage, management, and retrieval of user dietary information and meal history.
15. To demonstrate the practical application of emerging technologies such as Artificial Intelligence, Machine Learning, Image Processing, Computer Vision, and Cloud Computing in the field of healthcare and nutrition management.
16. To assist individuals suffering from lifestyle-related health conditions such as obesity, by
17. diabetes, hypertension, and cardiovascular diseases by providing informed dietary guidance.
18. To offer data-driven recommendations that help users make smarter nutritional decisions based on their dietary habits and personal health requirements.
19. To create a scalable and adaptable platform capable of supporting future enhancements such as barcode scanning, voice-based food logging, wearable device integration, allergy detection, fitness tracking, and advanced health analytics.
20. To improve user engagement through automated meal analysis and personalized recommendations, making nutrition management more accessible and less burdensome.
21. To provide a reliable and efficient digital solution that combines food recognition, nutritional assessment, and meal planning within a single platform.
22. To bridge the gap between technology and healthcare by making professional-level nutritional guidance available to a wider population at minimal cost.
23. To help users develop sustainable eating habits and achieve their long-term health, wellness, and fitness goals through continuous monitoring and personalized dietary support.
24. To contribute toward preventive healthcare by encouraging balanced nutrition, healthier lifestyles, and greater awareness of the relationship between diet and overall well-being.

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25. To establish a smart, innovative, and practical meal planning system that enhances nutritional management while showcasing the transformative potential of AI-powered healthcare applications.

1.3 Scope Of The Project

This project involves the development of a web-based personalized meal planning application with integrated AI-based food photo recognition. The system enables users to identify food from images, track calorie and nutritional intake, and receive personalized meal recommendations based on their fitness goals. It is designed with a scalable architecture, allowing future expansion to support regional cuisines, additional dietary categories, and enhanced nutritional analysis.

The application is intended as a self-help dietary management tool and does not replace professional medical or nutritional advice. Its food recognition accuracy depends on the quality of uploaded images, with the best results achieved using clear, well-lit photographs.

II. Literature Survey

Tan et al. (2019) introduced EfficientNet, a convolutional neural network architecture that improves image classification by balancing network depth, width, and resolution. Evaluated on the ImageNet dataset, EfficientNet achieved high accuracy while using fewer parameters and lower computational resources than previous CNN models. However, it requires large-scale datasets for effective training.

He et al. (2016) proposed ResNet (Residual Network), a deep learning architecture that uses residual blocks to overcome the vanishing gradient problem. Tested on the ImageNet dataset, ResNet significantly improved image classification accuracy and enabled the development of much deeper neural networks. Despite its strong performance, the model is computationally intensive and requires substantial processing power.

Vaswani et al. (2017) presented the Transformer architecture based on the self-attention mechanism. Evaluated using the WMT 2014 English–German translation dataset, the model achieved state-of-the-art performance and became the foundation for many modern AI applications, including recommendation systems and large language models. However, training Transformer models requires significant computational resources.

Brown et al. (2020) introduced GPT-3, a transformer-based large language model trained on Common Crawl, WebText2, Books1, Books2, and Wikipedia datasets. The model demonstrated exceptional language understanding and few-shot learning capabilities, making it useful for recommendation systems and intelligent applications. However, GPT-3 suffers from hallucination issues and requires significant computational resources.

Cimpoi et al. (2015) proposed DeepFood, a CNN-based food image recognition system evaluated on the Food-101 dataset. The model improved food classification accuracy by automatically recognizing food items from images, making it suitable for nutrition-related applications. Its performance, however, is affected by poor image quality and complex food presentations.

Bossard et al. (2014) introduced Food-101, a benchmark dataset for food image recognition containing 101 food categories. Using Random Forests and feature extraction techniques, the study established a standard dataset for evaluating food classification models. Despite its usefulness, the dataset contains noisy labels that may affect model performance.

Bengio et al. (2003) proposed a Neural Probabilistic Language Model trained on large text corpora. The model improved language representation and laid the foundation for modern recommendation systems and natural language processing applications. However, its scalability is limited when handling very large datasets.

III. Methodology

3.1 Software Engineering Approach

Development Methodology – Agile Model

The project follows the Agile software development model, an iterative and incremental approach that emphasizes flexibility, collaboration, and continuous feedback. Development is carried out in short sprints (1–2 weeks), each including planning, development, testing, and review. This enables rapid delivery of features, quick adaptation to changing requirements, and continuous improvement, resulting in a high-quality product.

Key Principles

- **Customer Collaboration:** Regular stakeholder feedback ensures the system meets user needs.
- **Iterative Development:** Features are delivered incrementally through short sprints.
- **Flexibility:** Changes can be incorporated at any stage of development.
- **Team Collaboration:** Cross-functional teams work together to improve efficiency.
- **Continuous Improvement:** Frequent reviews enhance product quality and performance.

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Agile Workflow

1. **Sprint Planning:** Define objectives, prioritize tasks, and assign responsibilities.
2. **Development & Testing:** Features are implemented and tested during each sprint.
3. **Daily Stand-ups:** Short meetings track progress and resolve issues.
4. **Sprint Review & Retrospective:** Completed work is demonstrated, feedback is collected, and improvements are identified for future sprints.

Additional Practices

- **Backlog Management:** Tasks and bug fixes are prioritized and updated regularly.
- **User-Centric Development:** Continuous stakeholder involvement and user testing improve usability and functionality.
- **Quality Assurance:** Continuous manual and automated testing, along with regular code reviews, ensures reliable and maintainable software.

This Agile approach enables rapid development, effective collaboration, adaptability to change, and continuous delivery of high-quality software.

A concise version of your Analysis Section (SRS) is given below while retaining all essential information.

3.2 Analysis Section

3.2.1 Software Requirements Specification (Srs)

The Personalized Meal Planning Application Using Photo Recognition helps users maintain a healthy diet by recognizing food from uploaded images, estimating calories and nutrients, and generating personalized meal recommendations based on fitness goals.

System Workflow

1. **Login:** User registers or logs in securely.
2. **Profile Setup:** User enters age, gender, height, weight, and fitness goal.
3. **Food Image Upload:** User uploads or captures a food image.
4. **Food Recognition:** AI identifies the food item.
5. **Nutrition Estimation:** System estimates calories, proteins, carbohydrates, fats, and fiber.
6. **Calorie Tracking:** Daily calorie intake is updated and compared with the user's target.
7. **Meal Planning:** Personalized meal suggestions are generated.
8. **Dashboard:** Users can view calorie intake, nutrition summary, meal history, and progress.

3.2.2 Introduction

Purpose

To provide AI-based food recognition, calorie estimation, nutrition analysis, and personalized meal recommendations that help users achieve their fitness goals.

Scope

- Food recognition using uploaded images.
- Calorie and nutrient estimation.
- Daily calorie tracking.
- Personalized meal planning based on user profile and fitness goals.

Intended Audience

- Fitness enthusiasts
- Gym users
- Health-conscious individuals

Non-Functional Requirements

The system should provide:

- Fast and accurate food recognition.
- Simple and user-friendly interface.
- High reliability with minimal downtime.
- Scalability for increasing users.
- Secure storage of user data and images.
- Easy maintenance and portability across devices.

3.2.3 Use Cases

Users upload food images, and the AI identifies the food and estimates calories. Based on the user's profile, diet preferences, and fitness goals, the system generates personalized meal plans. Users can track calorie history, update profiles, and provide feedback to improve prediction accuracy. The backend stores user data, food records, and nutritional information to support personalized recommendations.

3.2.4 Data Flow

The user uploads a food image, which is processed by the AI model to identify the food and estimate calories. The results are stored in the database along with the user's history. Using profile information and stored data, the system generates meal recommendations and displays them on the dashboard. User logs and feedback are continuously stored to improve future recommendations.

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3.2.5 Assumptions And Constraints

Assumptions

- Users upload clear food images.
- The training dataset contains accurate and diverse food information.
- Users provide correct personal details.
- Internet connectivity is available for image processing.

Constraints

- Prediction accuracy depends on the AI model and dataset quality.
- Rare or regional foods may not be recognized accurately.
- Performance may vary with server load and hardware limitations.
- A stable internet connection is required for real-time functionality.

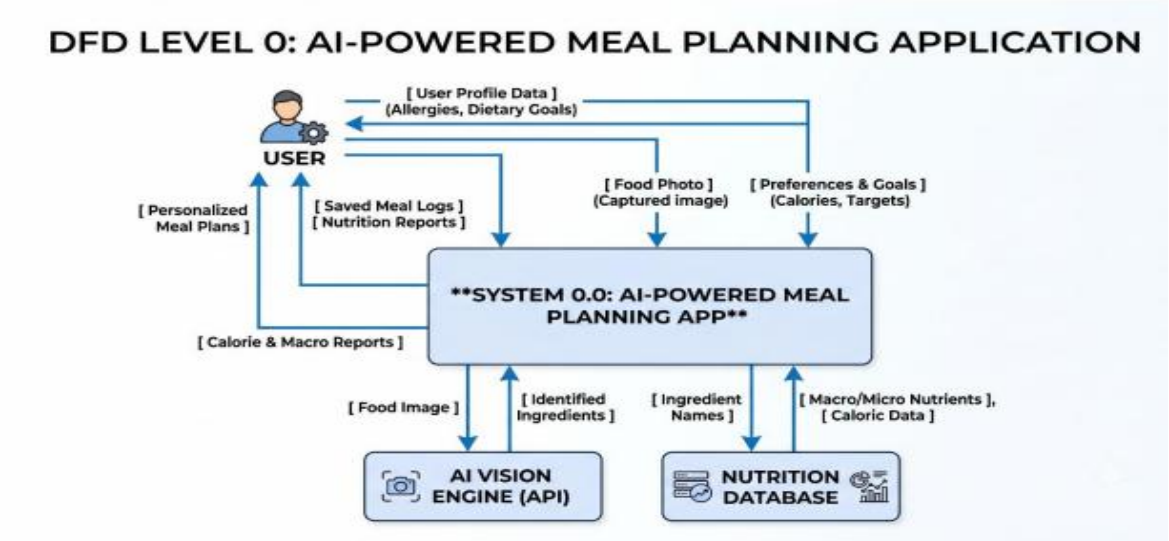
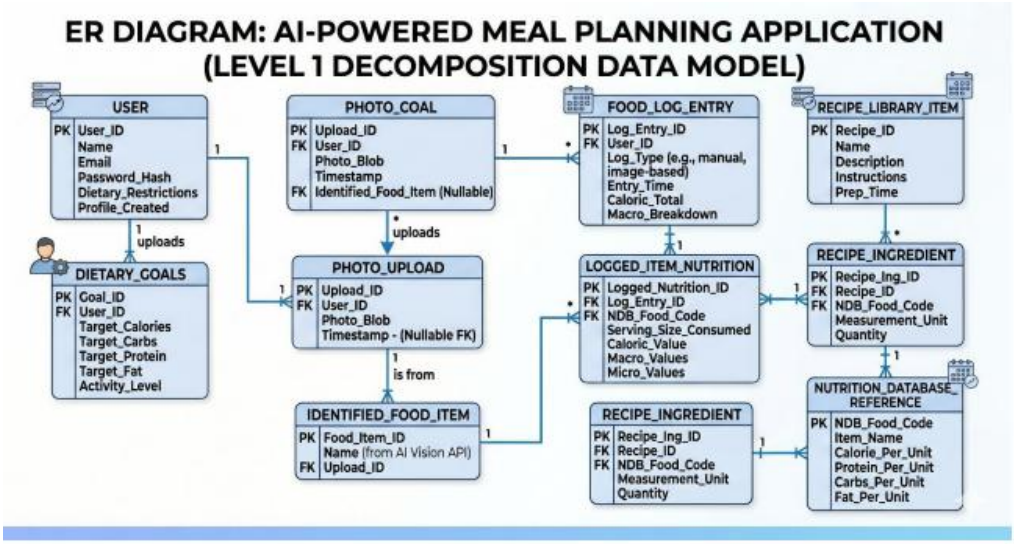


Figure 3.1 DFD



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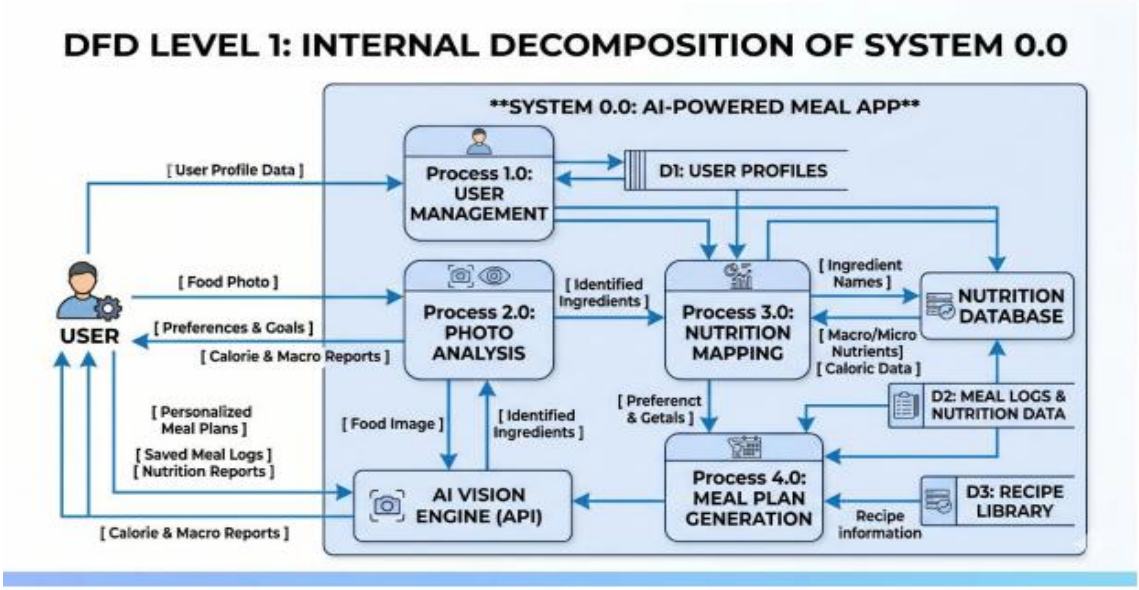
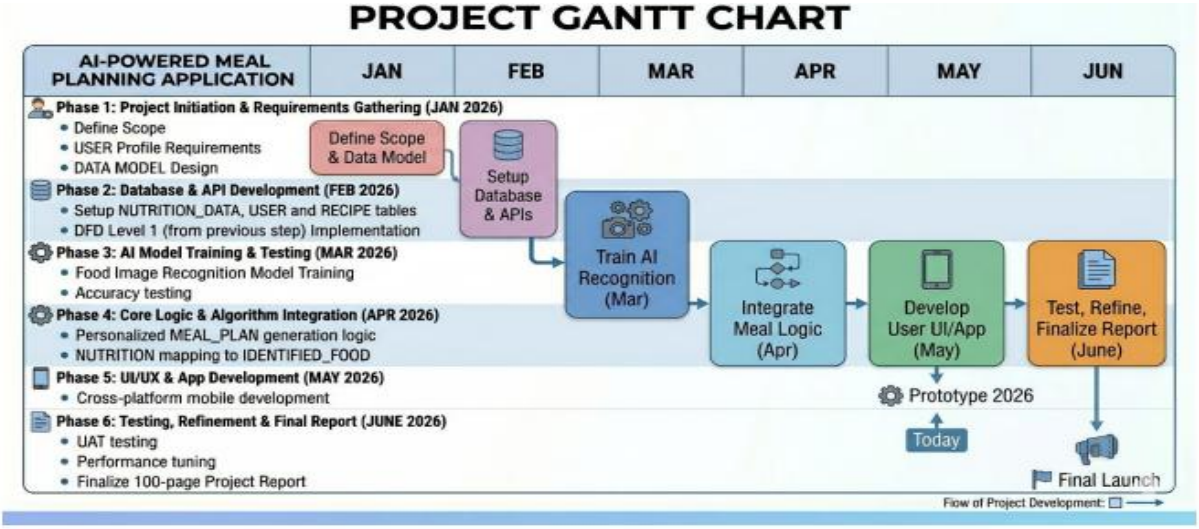


Figure 3.2 ER Diagram

3.3 Project Planning Section

Project Charts

Gantt Chart



The **Gantt chart** illustrates the project schedule from **January to June 2026**, showing the duration and sequence of each development task. It provides a clear overview of project progress, helping monitor timelines, manage deadlines, and identify overlapping activities or potential delays throughout the software development lifecycle.

3.4 Tools And Technologies

3.4.1 Web Application – Nutriai

Technologies Used

- **React 18 & TypeScript:** Build a responsive, type-safe user interface.

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- **Vite:** Fast frontend development and optimized production builds.
- **Tailwind CSS & shadcn/ui:** Responsive layouts and reusable UI components.
- **React Router:** Client-side navigation.
- **TanStack Query:** API communication, caching, and state management.
- **Lucide React & Sonner:** Icons and notification system.

Purpose

Provides an interactive interface for uploading food images, viewing nutritional information, tracking daily intake, and accessing personalized health insights.

3.4.2 Artificial Intelligence & Backend

Technologies Used

- **Supabase Edge Functions:** Secure backend processing and AI integration.
- **Google Gemini 2.5 Flash:** Food image recognition and nutrition analysis.
- **Browser localStorage:** Stores user profiles, meal history, hydration, and progress locally.
- **TypeScript Validation:** Ensures data consistency and minimizes runtime errors.

Purpose

Processes food images, generates nutritional data, calculates health metrics, and delivers real-time dietary recommendations while ensuring efficient and secure performance.

3.4.3 DATABASE & DATA MANAGEMENT

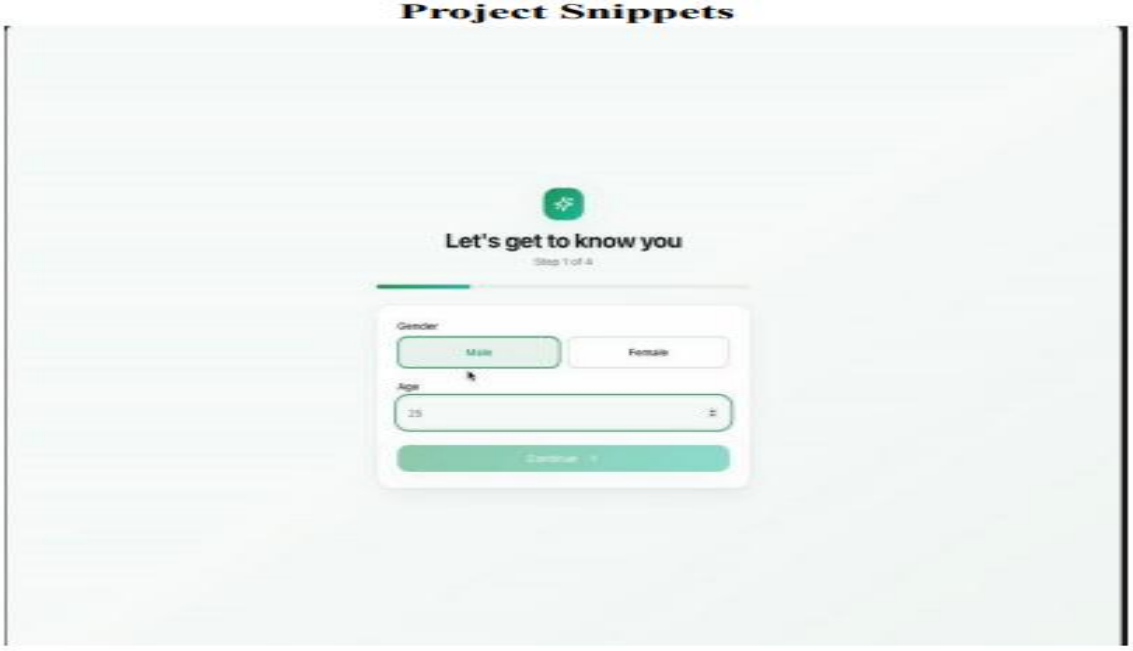
Technologies Used

- **Local Storage:** Stores meal history, user preferences, hydration, and nutrition records.
- **Supabase Services:** Backend communication and AI request handling.
- **Nutrition Calculation Module:** Calculates BMI, BMR, TDEE, and daily calorie targets.

Purpose

Manages user and nutrition data, enabling efficient storage, quick retrieval, and seamless integration between the web application and AI components.

Project Snippets



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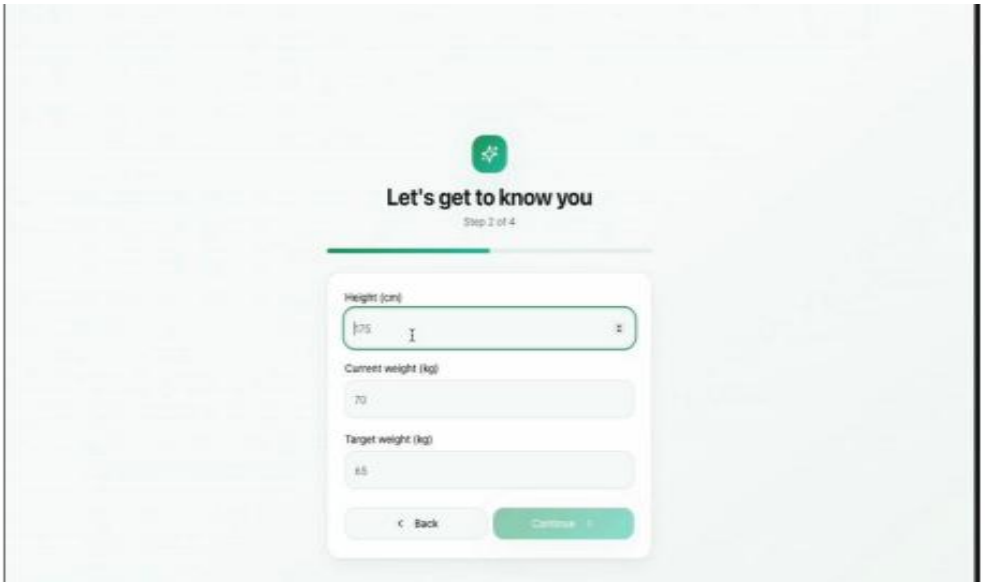

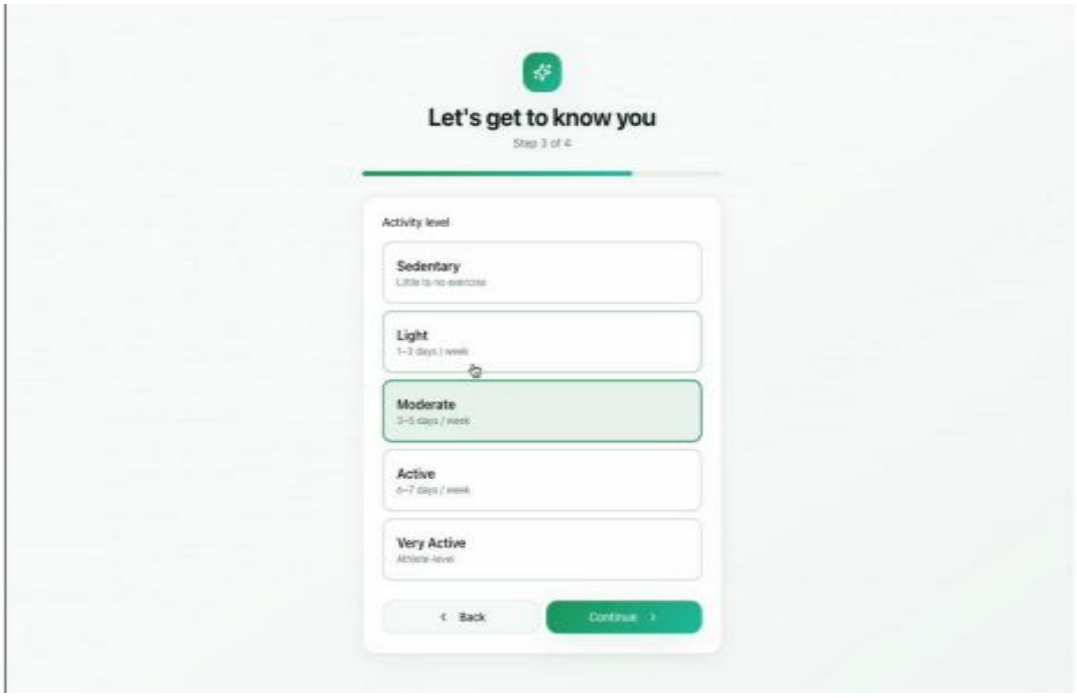

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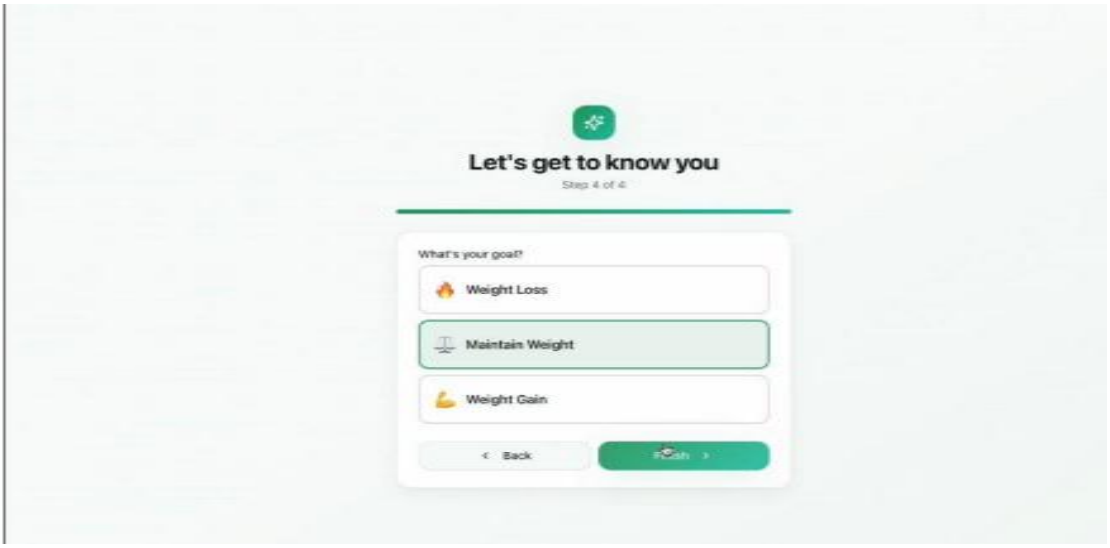

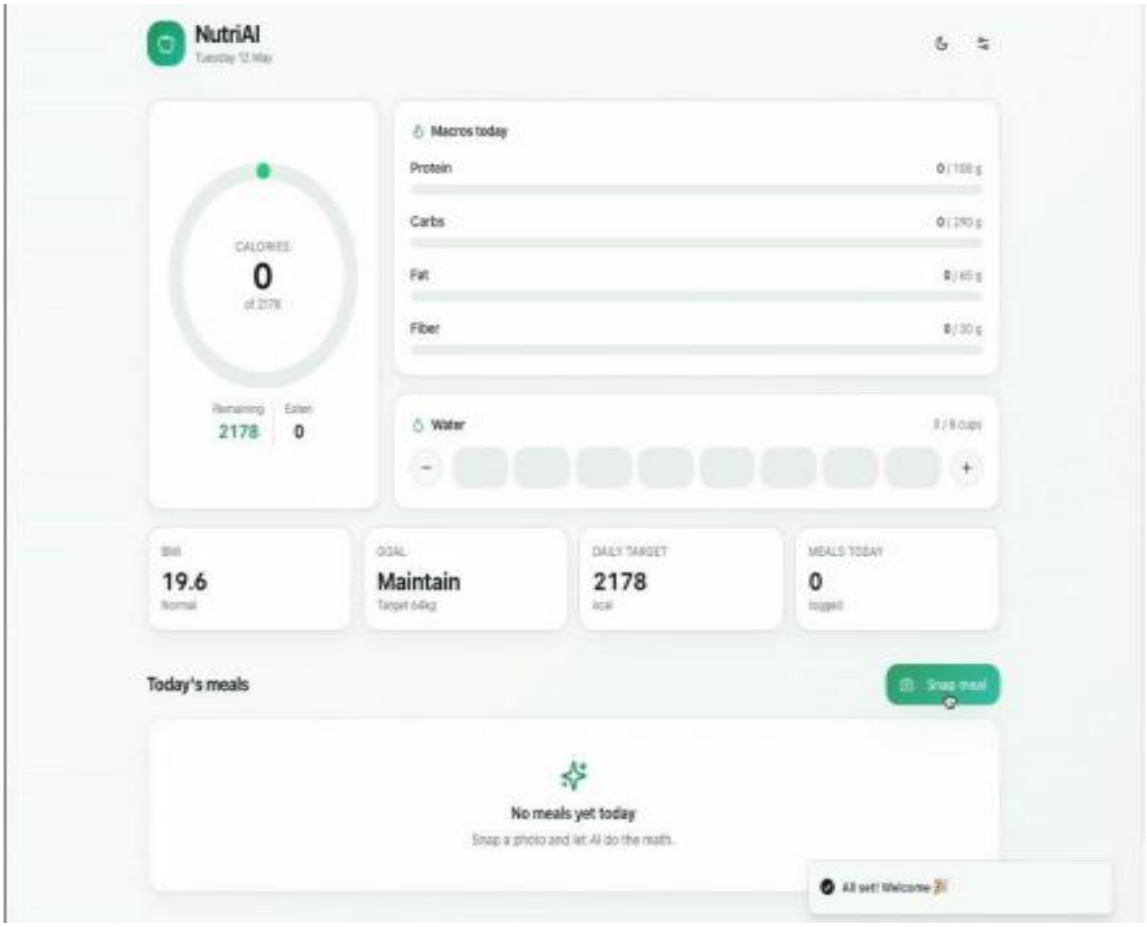

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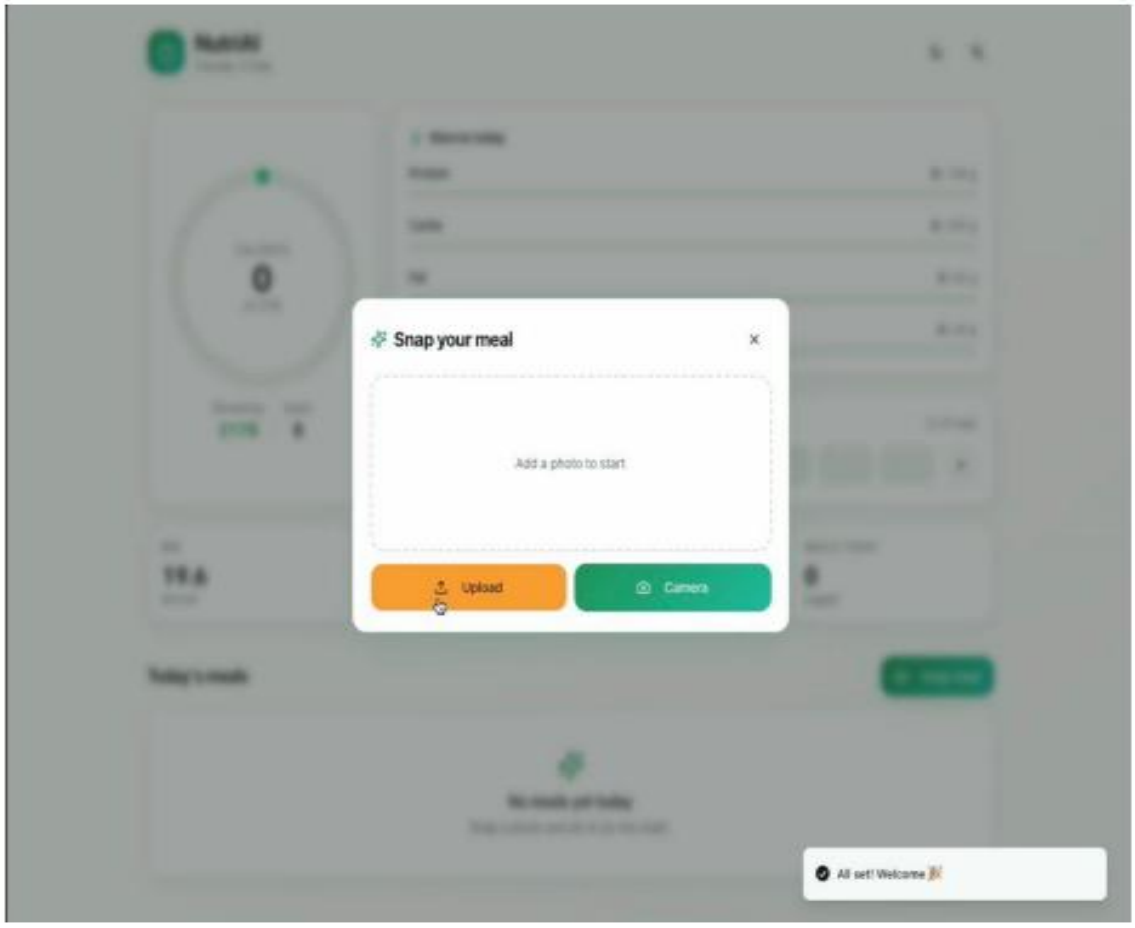

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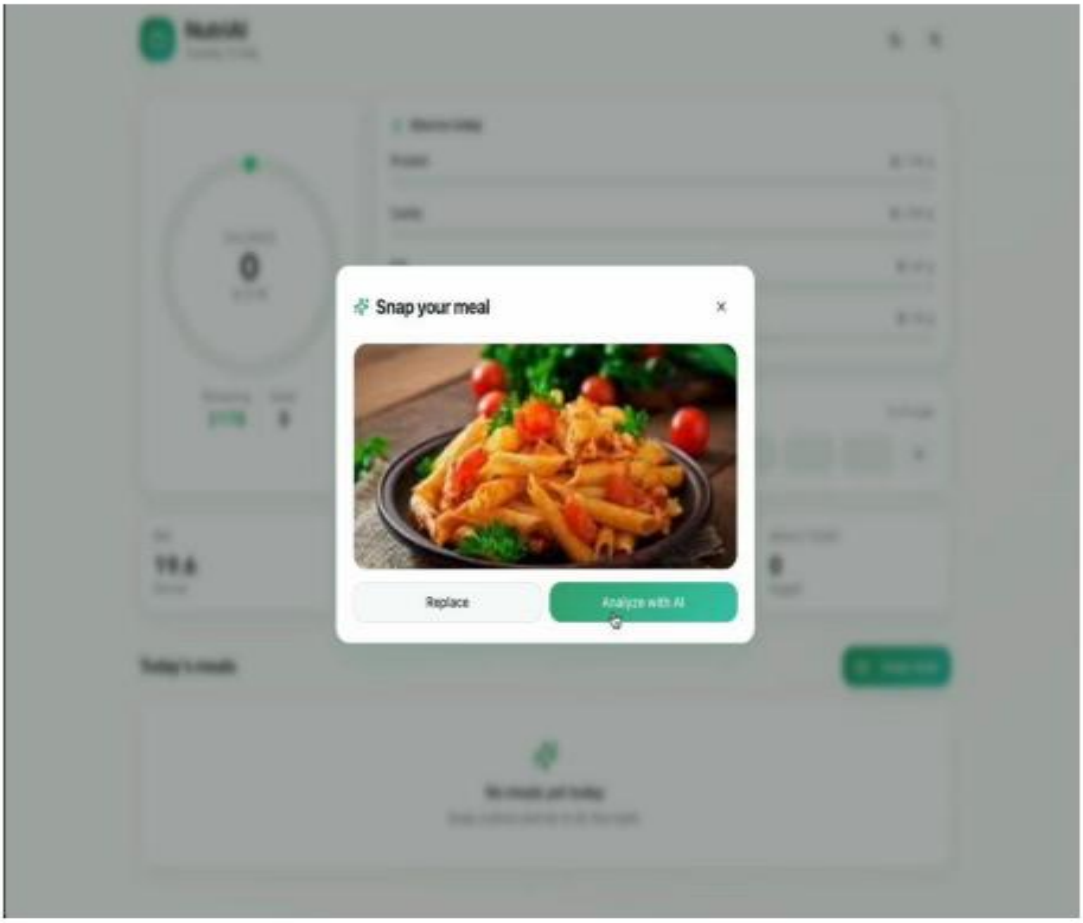

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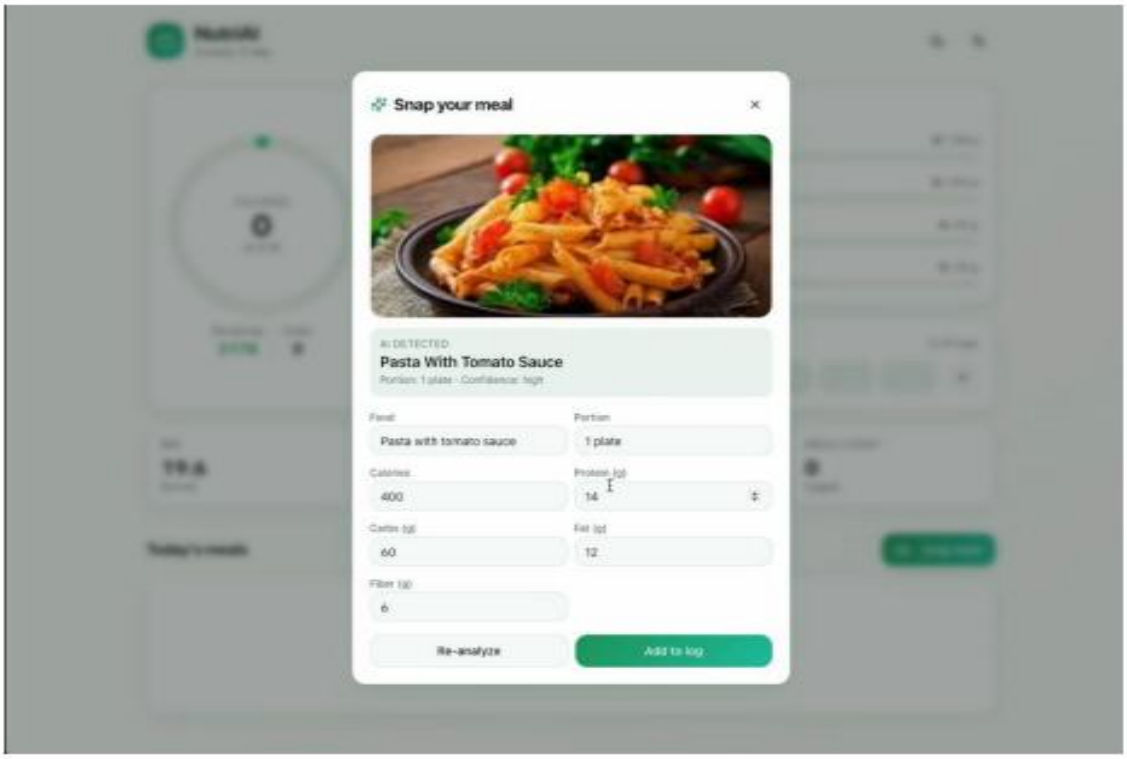

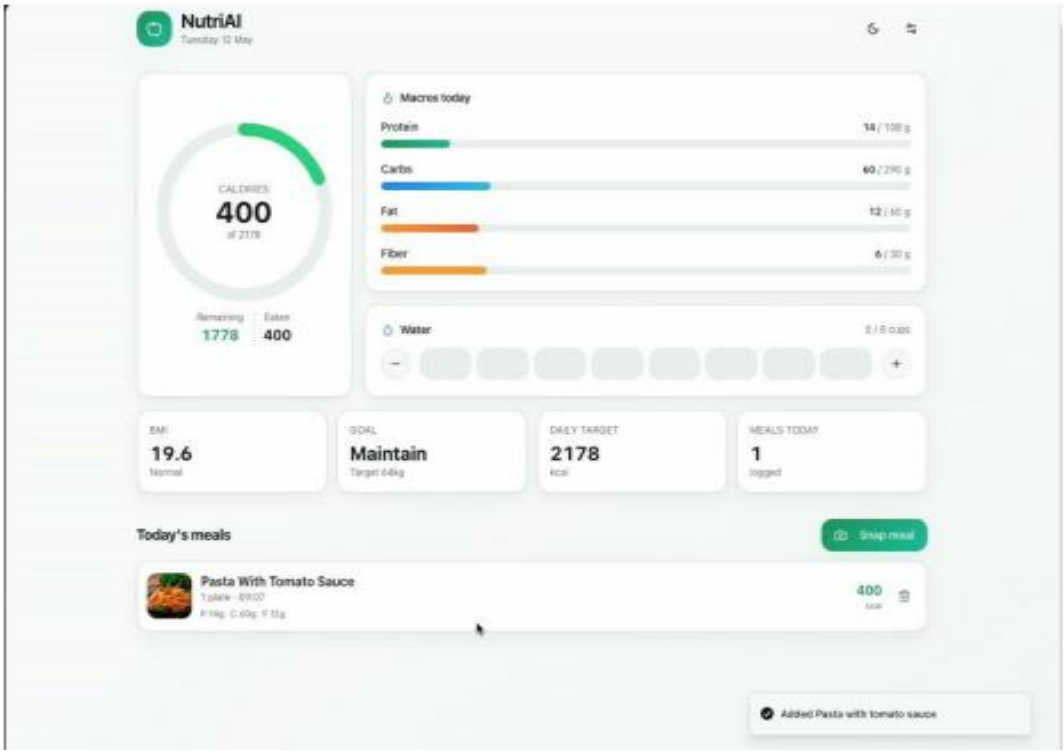

IV. Conclusion

The Personalized Meal Planning Using Photo Recognition system uses AI and image recognition to identify food, estimate calories and nutrients, and provide personalized meal recommendations. It simplifies diet tracking, promotes healthier eating habits, and supports users in achieving their fitness goals through an efficient and user-friendly platform.

V. Future Scope

Future improvements may include:

- More accurate AI food recognition.
- Automatic portion size estimation.
- Medical diet plans for specific health conditions.
- Integration with wearable devices.
- AI nutrition chatbot.
- Real-time camera-based food recognition.
- Cloud synchronization across devices.
- Voice-based interaction.
- Smart recipe and grocery recommendations.
- Predictive health analytics using long-term dietary data.

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