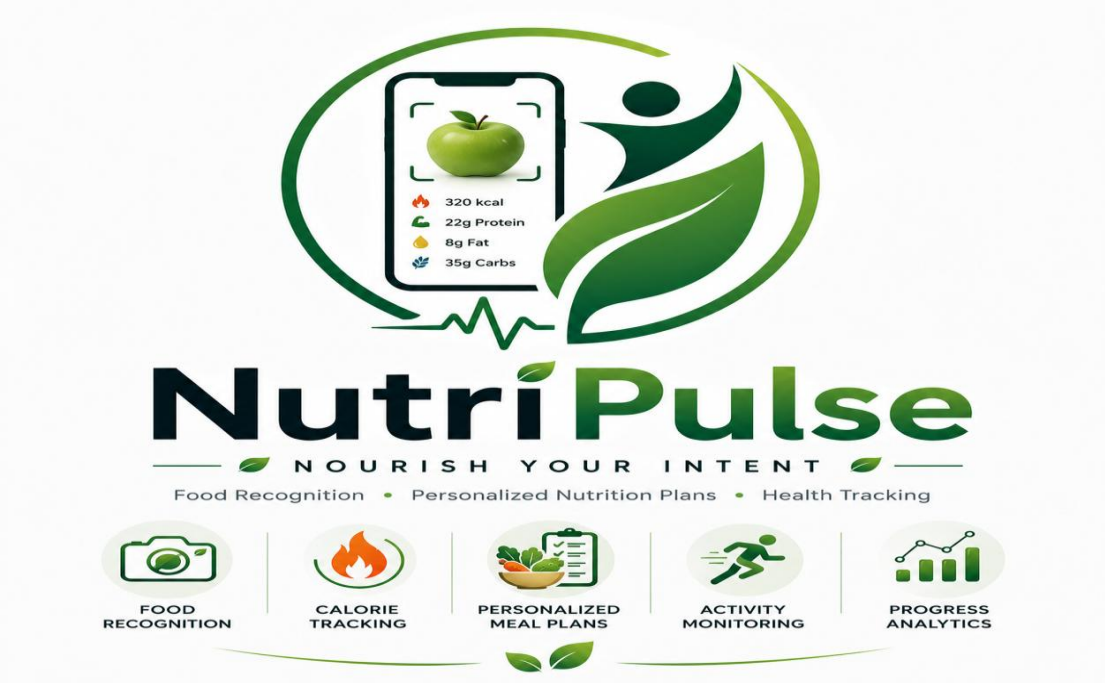
Computer engineering department

Software Graduation Project



Students: Ghada Montaser Qanazea
Nora Montaser Qanazea

Supervised by:
Dr. Khalid Daoud

TABLE OF CONTENTS

Acknowledgements

First and foremost, we express our deepest gratitude to Almighty God for granting us the strength, patience, and determination to successfully complete this project. His guidance and blessings have been our source of motivation throughout this journey.

We would like to extend our sincere appreciation to our beloved families, especially our parents, for their endless support, encouragement, and sacrifices. Their belief in us has been a constant source of inspiration and strength.

With great respect and gratitude, we would like to express our heartfelt thanks to our supervisor, **Dr. Khalid Daoud**, for his invaluable guidance, continuous support, constructive feedback, and encouragement throughout the development of this project. His expertise, dedication, and insightful suggestions played a significant role in shaping and improving our work.

We would also like to thank all the professors and staff members of the Computer Engineering Department at An-Najah National University for providing us with the knowledge, skills, and academic foundation that enabled us to complete this project successfully.

Finally, we extend our gratitude to our friends and colleagues who supported us throughout our academic journey. Their encouragement, cooperation, and shared experiences made this journey both memorable and rewarding.

We are proud of what we have achieved together, and we sincerely thank everyone who contributed to the successful completion of this project.

Abstract

Maintaining a healthy lifestyle has become increasingly challenging due to unhealthy dietary habits, limited nutritional awareness, and the lack of personalized health monitoring tools. To address these challenges, this project presents **NutriPulse**, a smart health and nutrition tracking mobile application designed to help users monitor their dietary intake, physical activities, and overall health progress.

The system integrates several key functionalities, including secure user authentication, personalized calorie calculation based on Basal Metabolic Rate (BMR) and Total Daily Energy Expenditure (TDEE), meal tracking, weight monitoring, and health progress visualization. Users can set specific goals such as weight loss, weight maintenance, or weight gain, and receive personalized nutrition plans accordingly. In addition, the application incorporates an AI-based food recognition feature that enables users to capture food images and

automatically obtain nutritional information, including calories, protein, carbohydrates, and fat values.

Furthermore, NutriPulse provides reminder notifications for water intake, meals, and weight tracking, while an administrative dashboard allows system

administrators to manage users, recipes, and diet plans efficiently. The application aims to simplify health management by combining nutrition analysis, calorie tracking, progress monitoring, and intelligent food recognition within a single platform.

The developed system provides users with an accessible and user-friendly solution for improving nutritional awareness, supporting healthier lifestyle choices, and facilitating long-term health management through personalized and data-driven insights.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

Chapter 1: Introduction

1.1 Problem

Many individuals are interested in improving their health and maintaining a balanced lifestyle; however, they often face difficulties in monitoring their daily nutritional intake and health-related activities. Calculating the required daily calories, determining suitable nutrition plans, tracking meals, and monitoring weight progress usually require the use of multiple applications or manual calculations, which can be time-consuming and inaccurate.

In addition, many users are unaware of the nutritional values of the food they consume. Estimating calories, protein, carbohydrates, and fat content for different meals can be challenging, especially when dealing with homemade meals or unfamiliar food items. This lack of awareness often leads to poor dietary decisions and makes it difficult for users to achieve their health goals, whether weight loss, weight maintenance, or weight gain.

Another challenge is the absence of a unified platform that combines calorie calculation, nutrition tracking, food recognition, activity monitoring, and personalized nutrition planning in a single user-friendly system. As a result, users struggle to maintain consistent health records and effectively monitor their progress over time.

Therefore, there is a need for an integrated smart solution that simplifies nutritional management, automates calorie and nutrition calculations, assists users in identifying food items, and provides personalized nutrition plans based on individual health goals. NutriPulse was developed to address these challenges and support users in making healthier and more informed lifestyle decisions.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

1.2 Objectives

The main objective of NutriPulse is to develop a smart and user-friendly mobile application that helps users manage their nutrition and health by tracking meals, monitoring daily activities, calculating calorie requirements, and supporting healthy lifestyle decisions.

The specific objectives of the project are:

- To provide a secure user authentication and account management system.
- To calculate users' Basal Metabolic Rate (BMR) and Total Daily Energy Expenditure (TDEE).
- To determine personalized calorie targets based on weight loss, weight maintenance, or weight gain goals.
- To enable users to record and track their daily meals.
- To provide nutritional information, including calories, protein, carbohydrates, and fats.
- To implement an AI-based food recognition system that identifies food items from images and estimates their nutritional values.
- To generate personalized nutrition plans according to users' health goals and calorie requirements.
- To allow users to monitor their weight records and health-related information.
- To track daily activities such as water intake, sleep duration, and physical activity.
- To provide reminder notifications that encourage users to maintain healthy habits.
- To develop an administrative dashboard for managing users, recipes, and nutritional content within the system.
- To improve nutritional awareness and support users in making healthier lifestyle choices.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

1.3 Scope of the Work

NutriPulse is a smart health and nutrition management mobile application designed to help users monitor their dietary habits, track health-related activities, and achieve their personal wellness goals.

The scope of this project includes the development and implementation of the following functionalities:

- User registration, authentication, and password recovery.
- User profile management and personal health information setup.
- Basal Metabolic Rate (BMR) and Total Daily Energy Expenditure (TDEE) calculations.
- Personalized calorie target generation for weight loss, maintenance, and weight gain goals.
- Meal tracking and nutritional intake monitoring.
- AI-based food recognition through image capture.
- Automatic estimation of nutritional values, including calories, protein, carbohydrates, and fats.
- Personalized nutrition plan generation based on user goals.
- Weight monitoring and health record management.
- Daily activity tracking, including water intake, sleep duration, and physical activity.
- Reminder and notification services.
- Administrative dashboard for managing users, recipes, and nutritional content.
- User interface support for both Light Mode and Dark Mode to improve accessibility and user experience.

The current version of NutriPulse focuses on nutrition and health monitoring functionalities and does not include multilingual translation features, wearable device integration, online medical consultations, or advanced healthcare services.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

1.4 Importance

The importance of NutriPulse lies in its ability to provide users with a comprehensive and accessible platform for managing their nutrition and health-related activities in a simple and efficient manner. As awareness of healthy lifestyles continues to grow, individuals require reliable tools that help them monitor their dietary habits, understand their nutritional needs, and make informed health decisions.

NutriPulse assists users in calculating their daily calorie requirements, tracking meals, monitoring physical activities, and maintaining personal health records within a single application. By integrating food recognition technology and personalized nutrition planning, the system reduces the effort required for manual nutritional calculations and improves users' understanding of the foods they consume.

Furthermore, the application encourages healthier lifestyle habits through activity tracking and reminder notifications, helping users remain committed to their wellness goals. The project also contributes to increasing nutritional awareness and promoting preventive healthcare practices by enabling users to monitor and manage their health data more effectively.

Therefore, NutriPulse serves as a practical solution that combines health monitoring, nutrition management, and user convenience, ultimately supporting individuals in achieving and maintaining healthier lifestyles.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

Chapter 2

2.1 Practical Challenges and Limitations

Throughout the development of the NutriPulse project, several practical challenges were encountered.

Learning and Integrating Multiple Technologies:

The project involved the integration of several technologies, including Flutter for mobile development, React for the web application, ASP.NET Core for backend services, SQL Server for database management, and artificial intelligence technologies for food recognition. Learning, coordinating, and integrating these technologies into a unified system required considerable effort and continuous testing.

Authentication and Security Implementation:

Implementing a secure authentication system using ASP.NET Identity and JWT-based authentication required careful configuration to ensure secure user registration, login, password management, and protected access to system resources while maintaining a smooth user experience.

AI Food Recognition Integration:

One of the main challenges was implementing the food recognition feature. The model was trained using a Kaggle dataset containing approximately 72 food categories. Preparing the dataset, training the model, evaluating its performance, and integrating the prediction results into the application workflow required significant experimentation and testing to achieve reliable classification results.

Frontend–Backend Communication:

Ensuring reliable communication between the Flutter mobile application, React web interface, and ASP.NET Core backend required the design and implementation of multiple API endpoints. Maintaining data consistency and handling data exchange between different system components was a continuous challenge during development.

Nutritional Data and Dietary Plan Management:

Managing nutritional information such as calories, protein, carbohydrates, and fats required careful organization of data within the database. Additionally, maintaining predefined dietary plans and linking them to users' health goals while ensuring accurate calorie calculations presented further complexity.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

Administrative Dashboard Development:
Developing the administrative dashboard required implementing features for user management and recipe management, including adding, editing, and deleting recipes. Proper access control was necessary to separate administrative functionalities from regular user operations.

Time Constraints and Project Scope:
As a graduation project developed alongside academic responsibilities, managing time effectively while implementing a wide range of features was a significant challenge.

Prioritizing core functionalities and ensuring their stability required careful planning throughout the development process.

Despite these challenges, the project provided valuable experience in full-stack development, mobile application development, database management, software architecture, artificial intelligence integration, and collaborative teamwork. These experiences contributed significantly to the successful completion of NutriPulse.

2.2 Design Constraints

The design and development of NutriPulse were guided by several practical, ethical, and technical constraints to ensure that the system is reliable, secure, and beneficial to users.

Economic Constraints

The project was developed using open-source and freely available technologies, including Flutter, React, ASP.NET Core, SQL Server Express, and publicly available datasets from Kaggle. This approach minimized development costs and ensured that the system could be implemented within the limited budget available for a graduation project. In addition, the design aims to reduce future maintenance costs by using widely adopted technologies and modular software architecture.

Environmental Constraints

As a software-based solution, NutriPulse has minimal environmental impact compared to hardware-intensive systems. The application was designed to operate efficiently on mobile devices while minimizing unnecessary resource

consumption, network usage, and battery utilization. Furthermore, the system promotes healthier lifestyle practices that may contribute positively to long-term public health awareness.

Social Constraints

The application was designed to improve nutritional awareness and support users in managing their health more effectively. Since NutriPulse stores personal health information, user privacy and data confidentiality were considered important social requirements. Secure authentication and controlled access mechanisms were implemented to protect user information and promote trust in the system.

Political Constraints

The system was designed to be accessible and usable by all users regardless of gender, race, nationality, or social background. NutriPulse promotes equal access to health and nutrition management tools without discrimination and supports broader public health improvement objectives.

Ethical Constraints

Ethical considerations played an important role throughout the project. The system respects user privacy by protecting personal and health-related data through secure authentication and authorization mechanisms. In addition, all external resources, datasets, frameworks, and
software libraries used in the project were obtained from publicly available or properly licensed sources while respecting intellectual property rights.

Health and Safety Constraints

NutriPulse is intended to support healthy lifestyle decisions by providing nutritional information, calorie calculations, and health monitoring tools. However, the system is not intended to replace professional medical advice, diagnosis, or treatment. Users should consult qualified healthcare professionals when making critical health-related decisions. The application was designed to provide safe and informative recommendations based on user-provided data.

Manufacturability Constraints

The system was developed using currently available software development technologies and can be deployed using standard computing infrastructure. The architecture and implementation are fully compatible with existing mobile

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

devices, web technologies, and database management systems, ensuring practical deployment and operation.

Sustainability Constraints

The system follows a modular architecture that facilitates future maintenance, scalability, and feature enhancement. New functionalities such as wearable device integration, multilingual support, advanced AI services, and cloud-based deployment can be added in future versions without requiring major architectural changes. This design approach improves the long-term sustainability and adaptability of the system.

Chapter3

3.1 Literature Review

Several nutrition and health management applications have been developed to assist users in monitoring their dietary habits and improving their overall health. These applications provide various features such as calorie tracking, meal planning, weight management, and nutritional analysis. However, the available solutions differ in their focus areas and implementation approaches.

MyFitnessPal

MyFitnessPal is a widely used nutrition application that allows users to record meals, track calorie intake, monitor physical activities, and manage weight-related goals. The application provides nutritional information for a large number of food items and supports progress tracking over time.

YAZIO

YAZIO is a health and nutrition platform that focuses on calorie tracking, meal planning, and weight management. It provides personalized dietary recommendations and enables users to monitor their nutritional intake and health goals through an easy-to-use interface.

Foodvisor

Foodvisor is a nutrition application that utilizes artificial intelligence technologies to analyze food images and estimate nutritional information. The application aims to simplify meal tracking by reducing the need for manual food entry.

Comparison with NutriPulse

NutriPulse was developed as an integrated health and nutrition management system that combines multiple functionalities within a single platform. In addition to calorie tracking and nutritional monitoring, the system provides personalized

calorie calculations based on Basal Metabolic Rate (BMR) and Total Daily Energy Expenditure (TDEE), AI-based food recognition, personalized nutrition plans, weight monitoring, water intake tracking, health progress visualization, and administrative management tools.

The system allows users to track their meals, monitor their daily health-related activities, and receive personalized recommendations based on their individual goals. Furthermore, NutriPulse incorporates an administrative dashboard that enables the management of users, recipes, and nutritional content, which contributes to efficient system administration and content organization.

By integrating these functionalities into a single application, NutriPulse aims to provide users with a centralized and user-friendly solution for managing nutrition, monitoring health progress, and supporting healthier lifestyle decisions.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

Chapter4

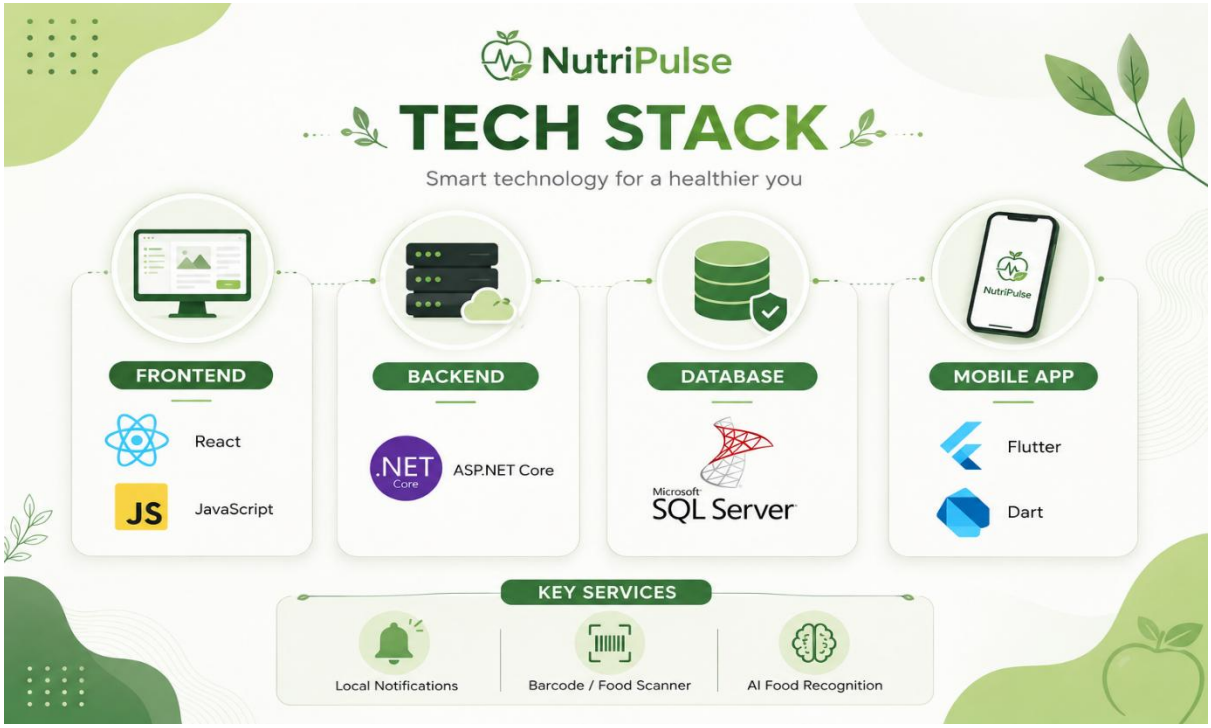
4.1 Methodology

The development of NutriPulse followed an iterative software development methodology. The project was implemented through multiple development phases, including requirements analysis, system design, implementation, testing, and refinement. Each phase focused on a specific module of the system, such as user authentication, nutrition management, health tracking, and AI-based food recognition.

The development process emphasized continuous testing and integration to ensure reliable communication between the mobile application, backend services, database, and AI model. Git was used for version control throughout the development process, allowing efficient collaboration, code management, and feature implementation.

4.2 Tools, Programming Languages, and Technologies

The following technologies were used to develop the NutriPulse platform:



University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.3 Client Side — Mobile Application Design

The NutriPulse mobile application was designed to provide a clean, user-friendly, and health-focused experience. The interface follows a modern design approach using the application's green color palette to promote wellness and healthy lifestyle awareness. The application supports intuitive navigation and responsive layouts optimized for mobile devices.

Frameworks and Libraries

The mobile application was developed using Flutter and Dart. Key libraries include:

- Provider for state management.
- Dio for communication with backend REST APIs.
- Image Picker for capturing and selecting food images.
- Mobile Scanner for barcode scanning functionality.
- Flutter Local Notifications for reminders and notification management.
- Shared Preferences for local data persistence.
- Health Package for health-related integrations.

Programming Languages

Dart is used as the primary programming language for the mobile application. Flutter provides a single codebase that enables efficient development and maintenance while ensuring a responsive and consistent user experience.

4.4Client Side — Administration Dashboard

Design

The NutriPulse administration dashboard was designed to provide administrators with centralized access to system management functions. The dashboard offers a structured interface for monitoring users, managing nutritional content, dietary plans, recipes, and reviewing system statistics.

Frameworks and Libraries

The administration dashboard was developed using React.js and utilizes:

- React Router for client-side navigation.
- Axios for API communication.
- Material UI (MUI) for user interface components.
- Recharts for displaying user statistics and analytics.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

Programming Languages

JavaScript is used as the primary language for dashboard development. HTML and CSS are used to structure and style the user interface components.

4.5 Server Side

Frameworks

The backend system was developed using ASP.NET Core Web API. The framework provides a scalable and secure environment for handling application requests, business logic, and communication with the database.

Programming Languages

C# is used as the primary backend programming language. Entity Framework Core is utilized to manage database operations and simplify data access.

API Architecture

The backend follows RESTful API design principles. Key features include:

- JWT-based authentication and authorization.
- ASP.NET Identity for user management and security.
- Secure communication between mobile and web applications.
- CRUD operations for meals, dietary plans, reminders, recipes, and user profiles.
- AI integration endpoints for food recognition and nutritional analysis.
- Data validation and error handling mechanisms.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.6 Database Structure

NutriPulse uses SQL Server as its relational database management system. The database was designed to support nutrition management, health tracking, and food recognition functionalities through several key entity groups:

Users & Authentication

- User accounts.
- User profiles.
- Authentication credentials.
- JWT-based security information.

Nutrition Management

- Meals.
- Ingredients.
- Nutritional information.
- Food categories.

Dietary Plans

- Personalized dietary plans.
- User goals.
- Daily nutrition recommendations.

Health Tracking

- Weight records.
- Hydration tracking.
- Activity tracking.
- Sleep monitoring.
- Progress monitoring.

Notifications & Reminders

- Reminder schedules.
- Notification records.
- User-defined reminders.

Artificial Intelligence Module

- Food recognition results.
- Nutritional prediction data.
- personalized health Recommendations .

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.7 System Architecture

The NutriPulse platform follows a three-tier architecture:

Presentation Layer (Frontend)

- Flutter mobile application for end users.
- React administration dashboard for administrators.

Business Logic Layer (Backend)

- ASP.NET Core Web API handles business logic, authentication, authorization, and API responses.
- AI food recognition service processes food images and returns nutritional information.

Data Layer

- SQL Server database stores all persistent application data.

Integration Points

- Both the mobile application and administration dashboard communicate with the same backend APIs.
- JWT authentication provides secure access across all system components.
- AI services integrate with the backend to support food recognition and nutrition analysis.
- Reminder and notification services provide automated user alerts and tracking support.

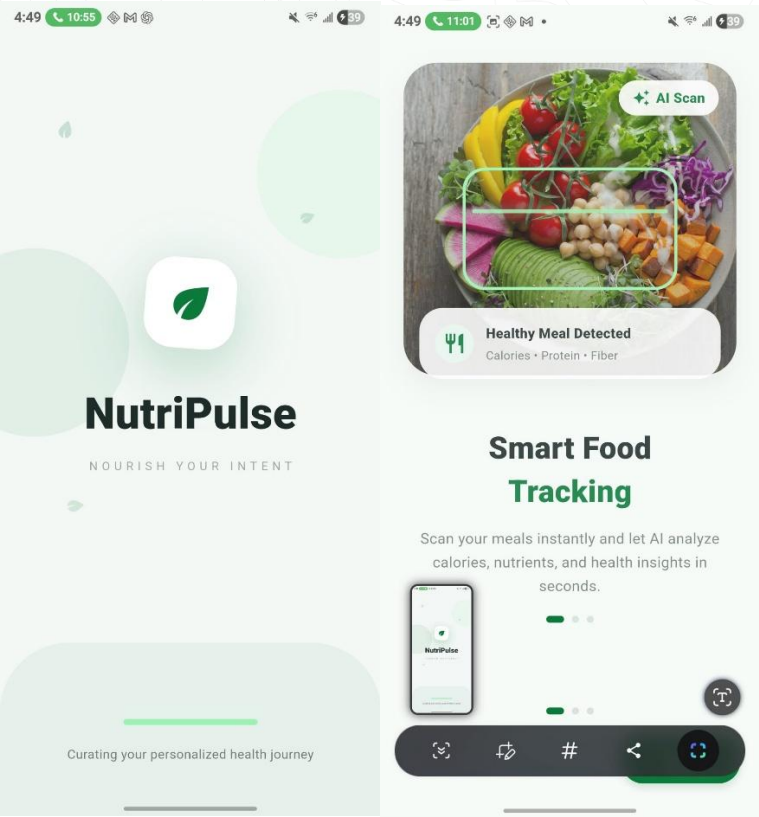
4.9 Features of the Application

The NutriPulse application provides several health and nutrition management features designed to improve the user experience. These features include meal tracking, AI food recognition, barcode scanning, reminder management, and health monitoring functionalities.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.10 Application Interface Design

The NutriPulse user interface was designed to provide a simple, modern, and user-friendly experience. The application adopts a health-oriented design using a green color palette and intuitive navigation to improve usability and user engagement

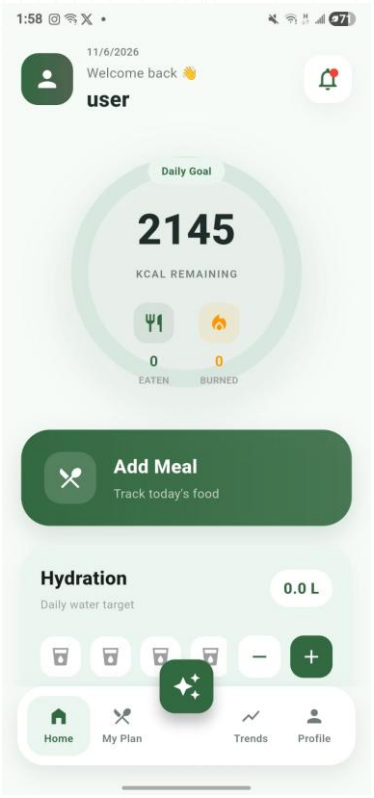


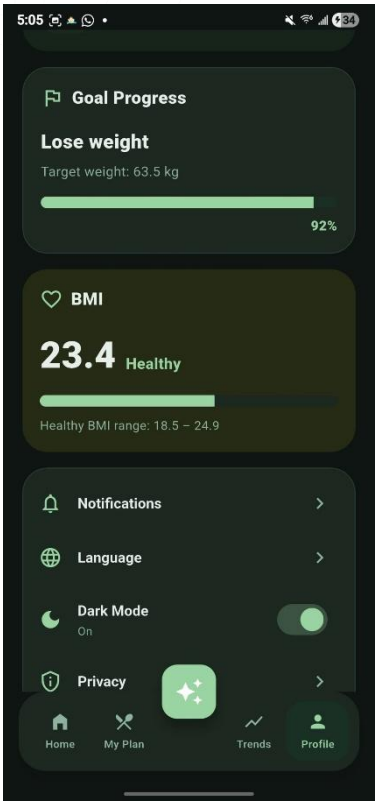
University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.11 Cross-Platform Features

Theme Modes

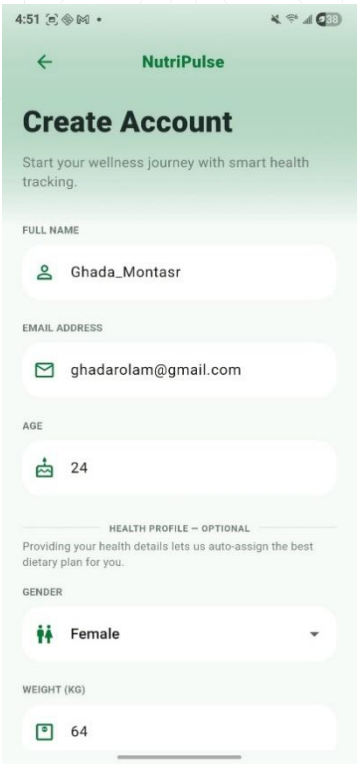
The application supports both Light Mode and Dark Mode themes, allowing users to customize the interface according to their preferences. This feature improves usability, accessibility, and overall user experience across different environments.

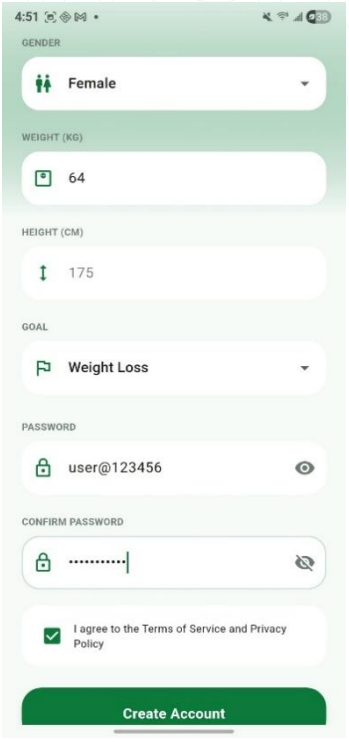


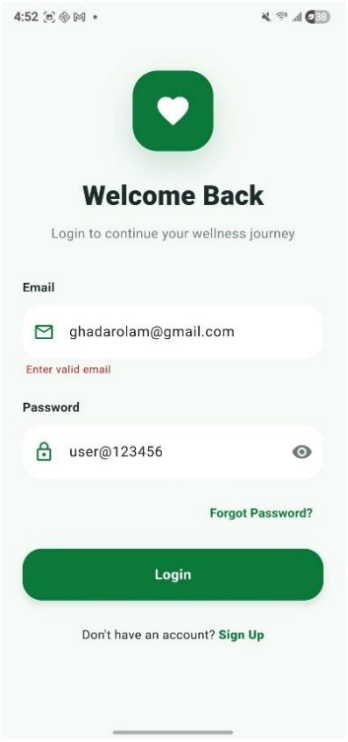


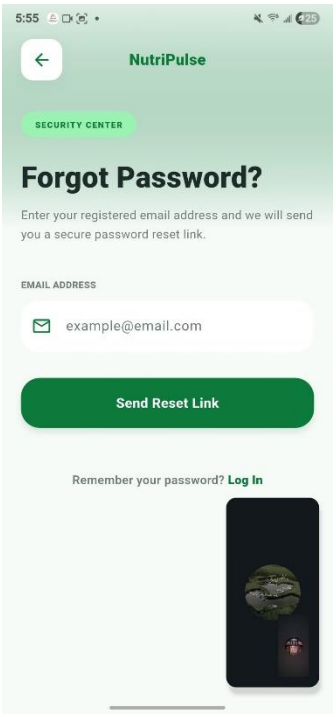
4.10 Authentication System

A secure authentication system was implemented to manage user registration and login processes. Users can create new accounts, log in securely, and recover their passwords when needed, ensuring protected access to personal health information.



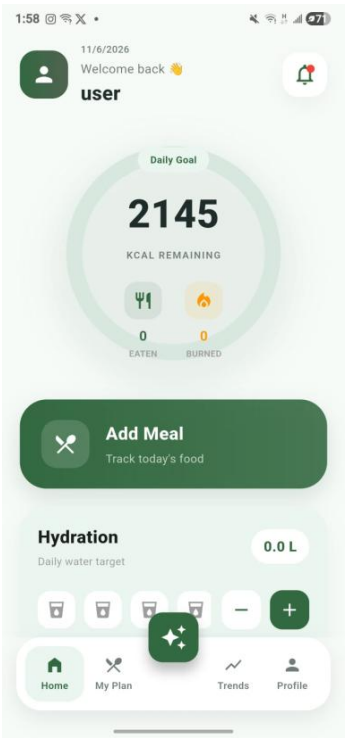


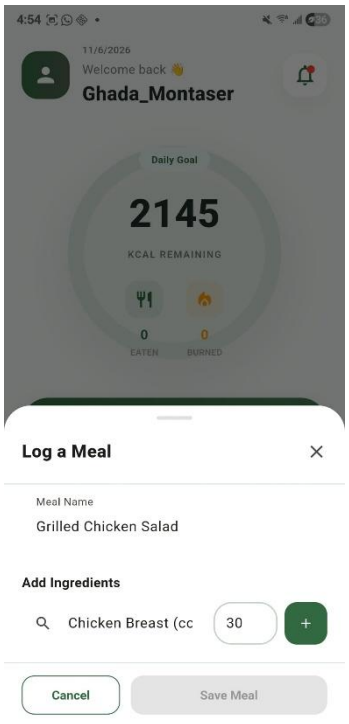


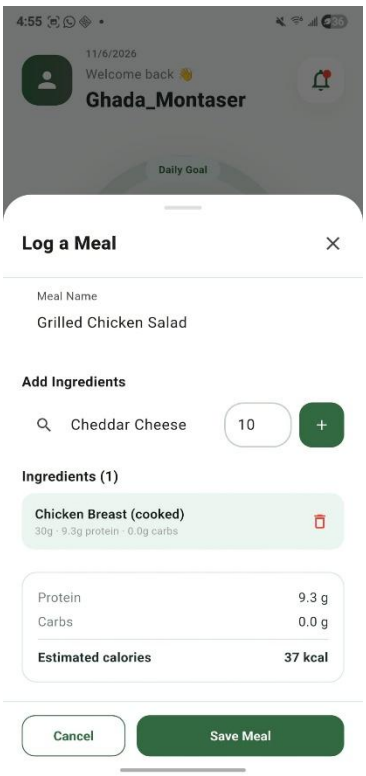


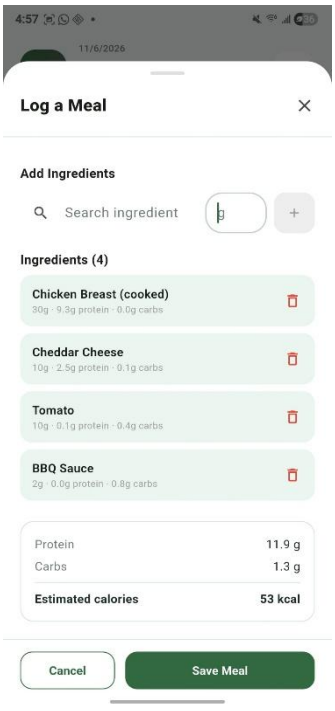
4.13 Home Dashboard

The Home Dashboard was implemented as the central interface of the NutriPulse application. It provided users with access to daily calorie tracking, meal management, hydration monitoring, sleep tracking, and physical activity tracking. Users were able to add, edit, and delete meals while viewing real-time nutritional information and daily progress. The dashboard centralized the application's main functionalities into a single interface, allowing users to monitor their nutritional and health-related activities efficiently. The integration of meal tracking, hydration monitoring, sleep quality recording, and step counting improved usability and provided a comprehensive health management experience.

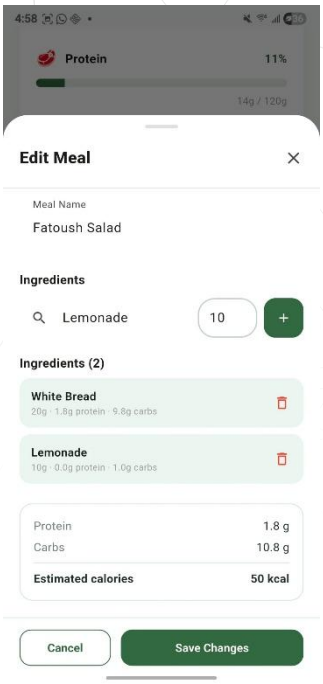


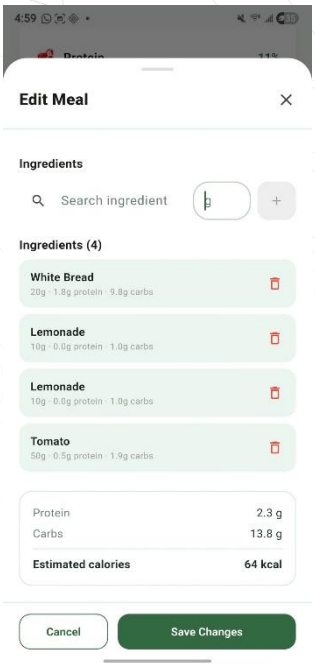


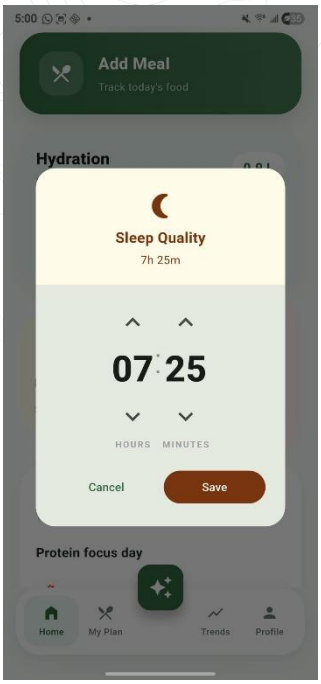


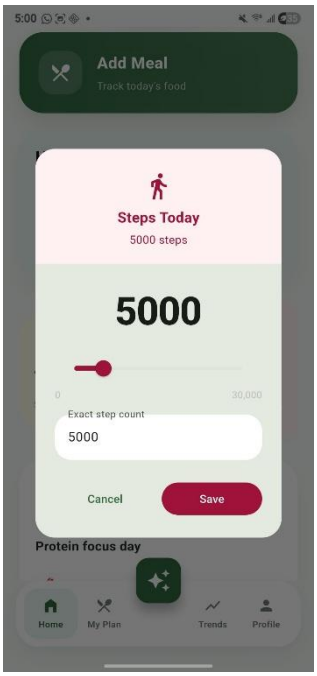


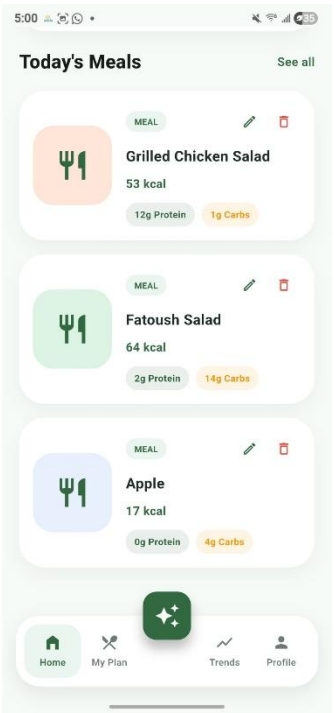
University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

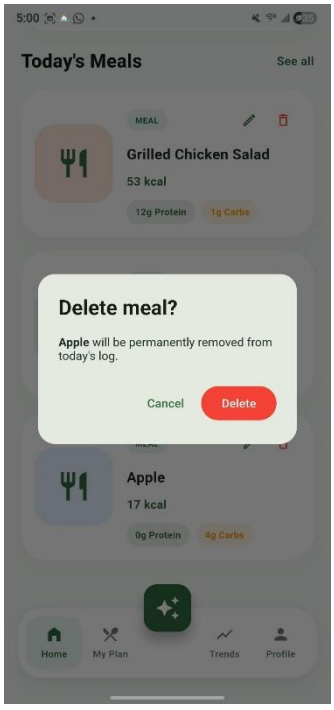


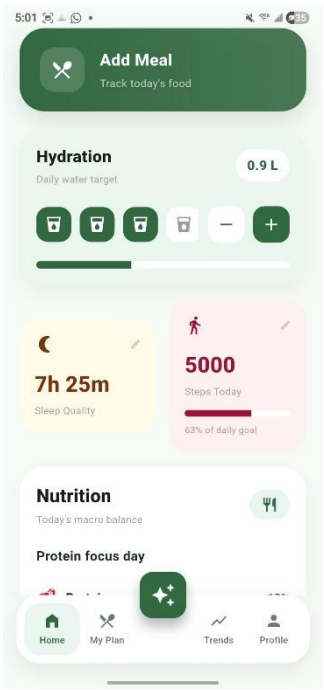








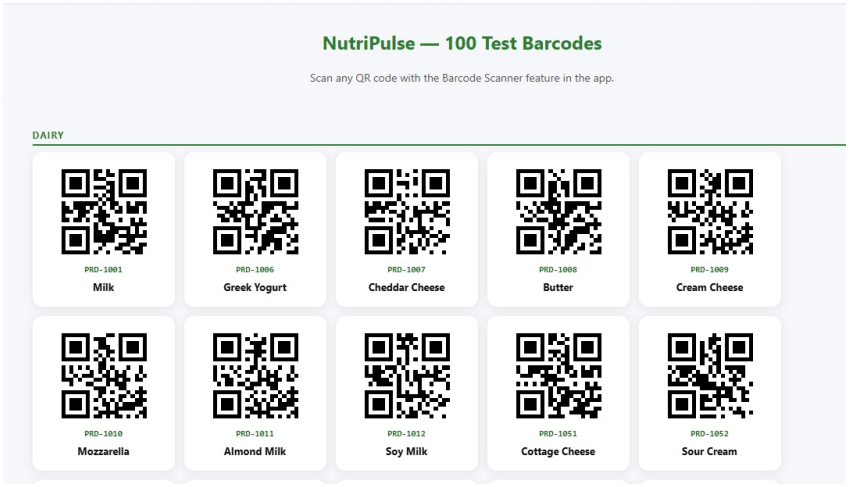


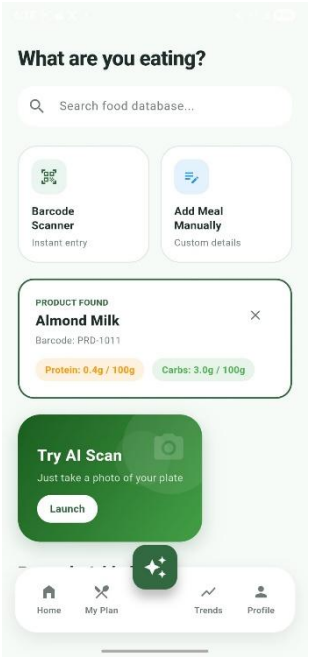


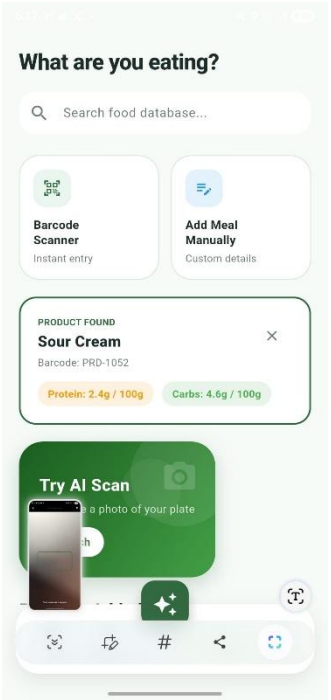
University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

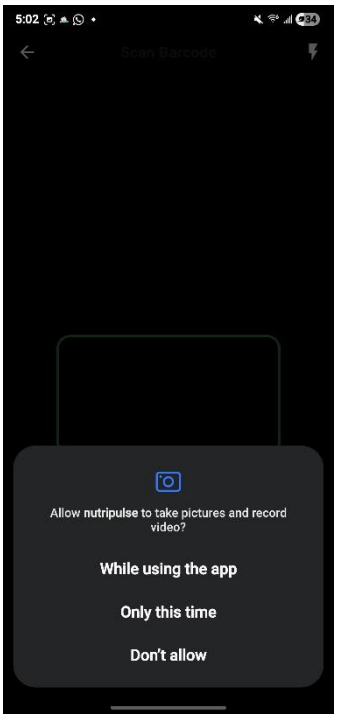
4.14 Barcode Scanner

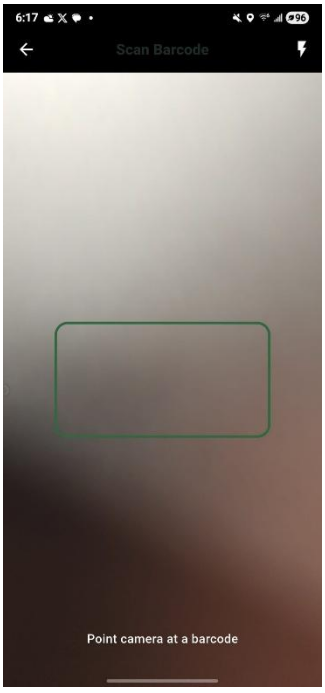
The barcode scanner feature was implemented to simplify food tracking by allowing users to scan product barcodes and automatically retrieve nutritional information. This functionality reduced manual data entry and provided quick access to food details such as calories, protein, carbohydrates, and fats.

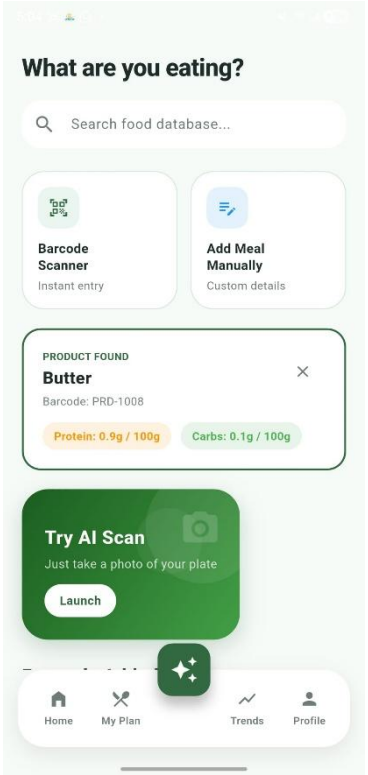






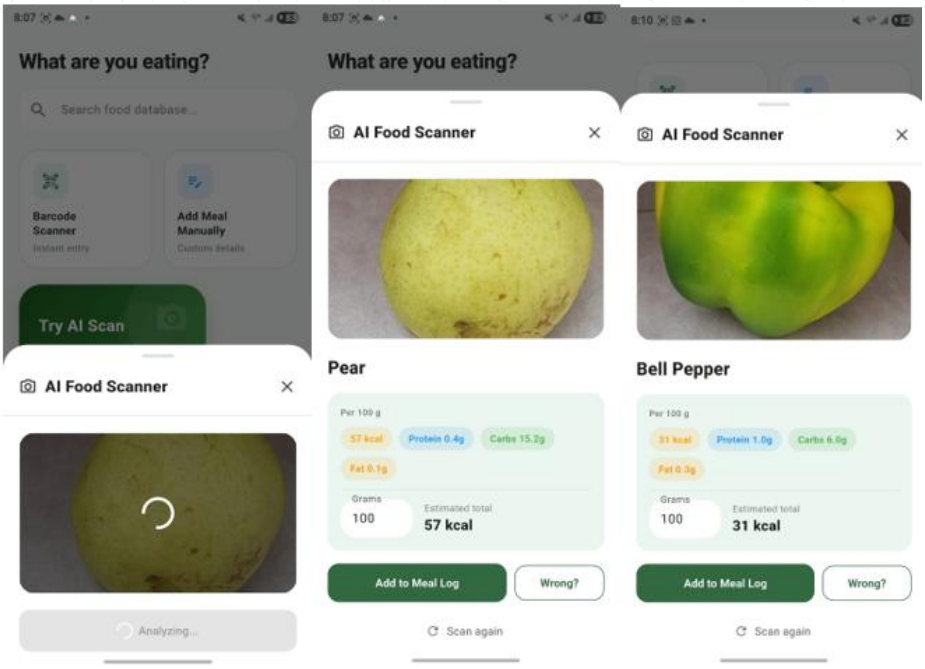


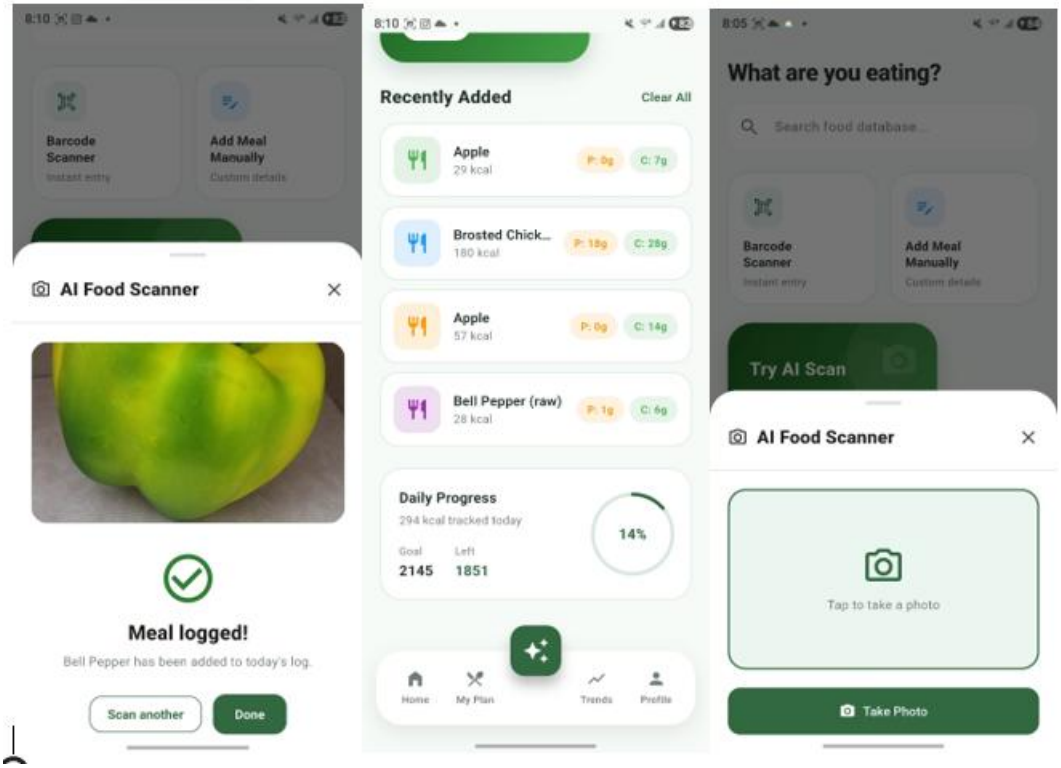




4.15 AI Food Scanner

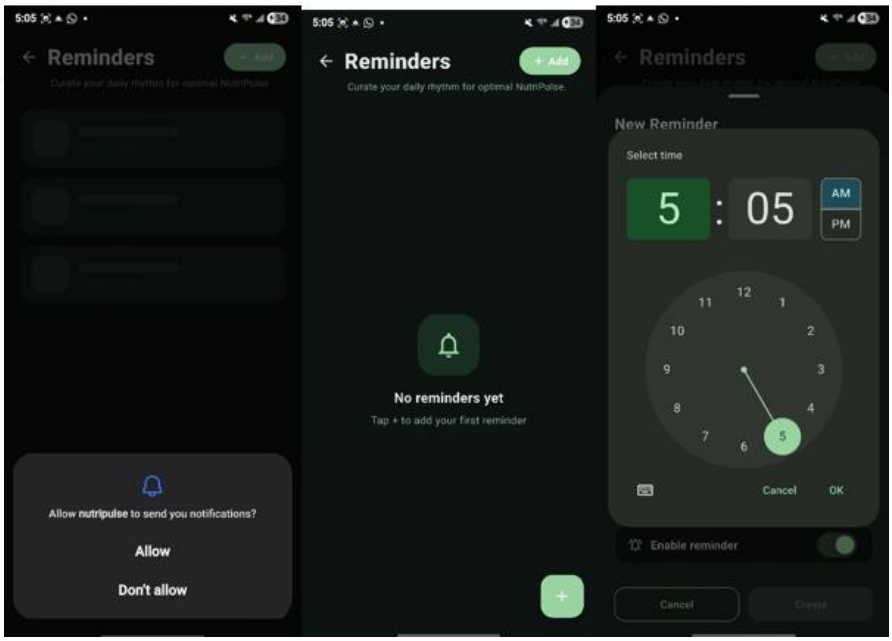
The AI Food Scanner was developed to identify food items from images captured using the device camera or selected from the gallery. This feature enhanced user convenience by enabling automatic food recognition and supporting nutritional analysis without manual searching.

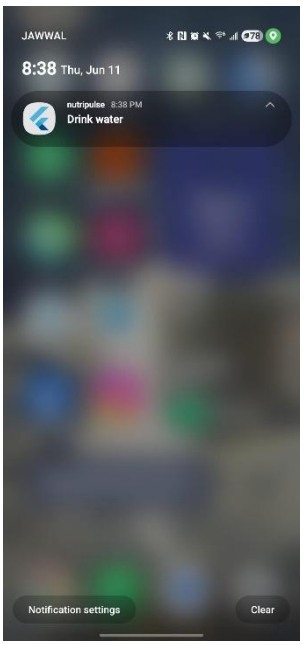


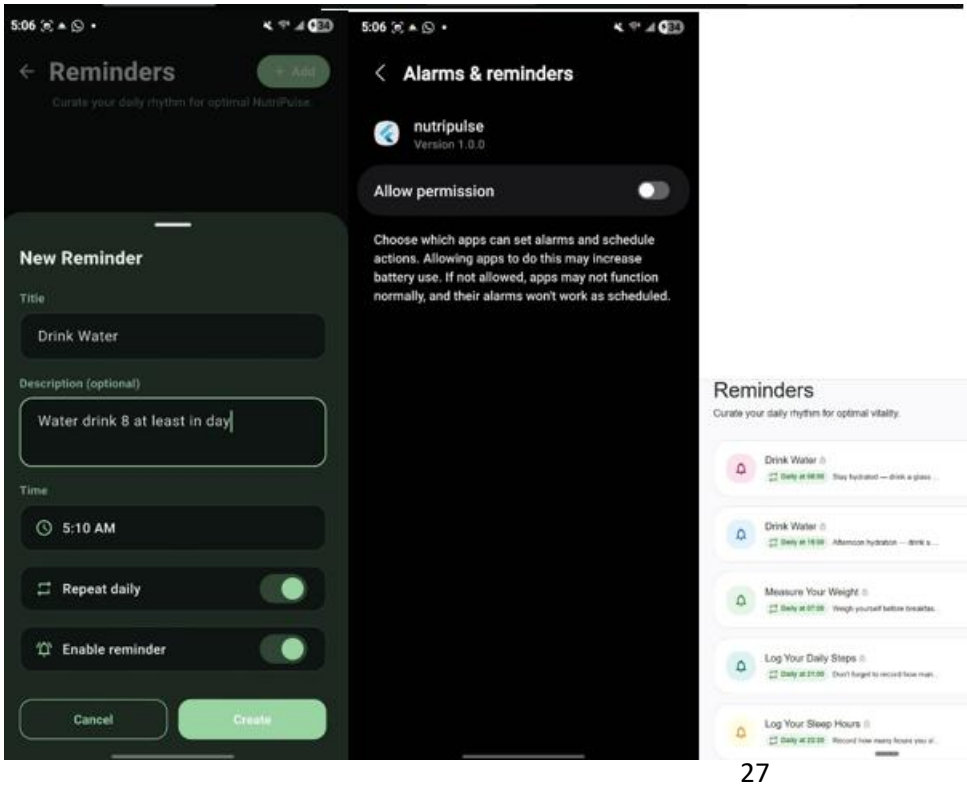


4.16 Reminder Management System

The reminder management system was implemented to help users maintain healthy habits and follow their nutrition plans consistently. Users were able to create personalized reminders, select reminder times, and configure daily repetition according to their preferences.



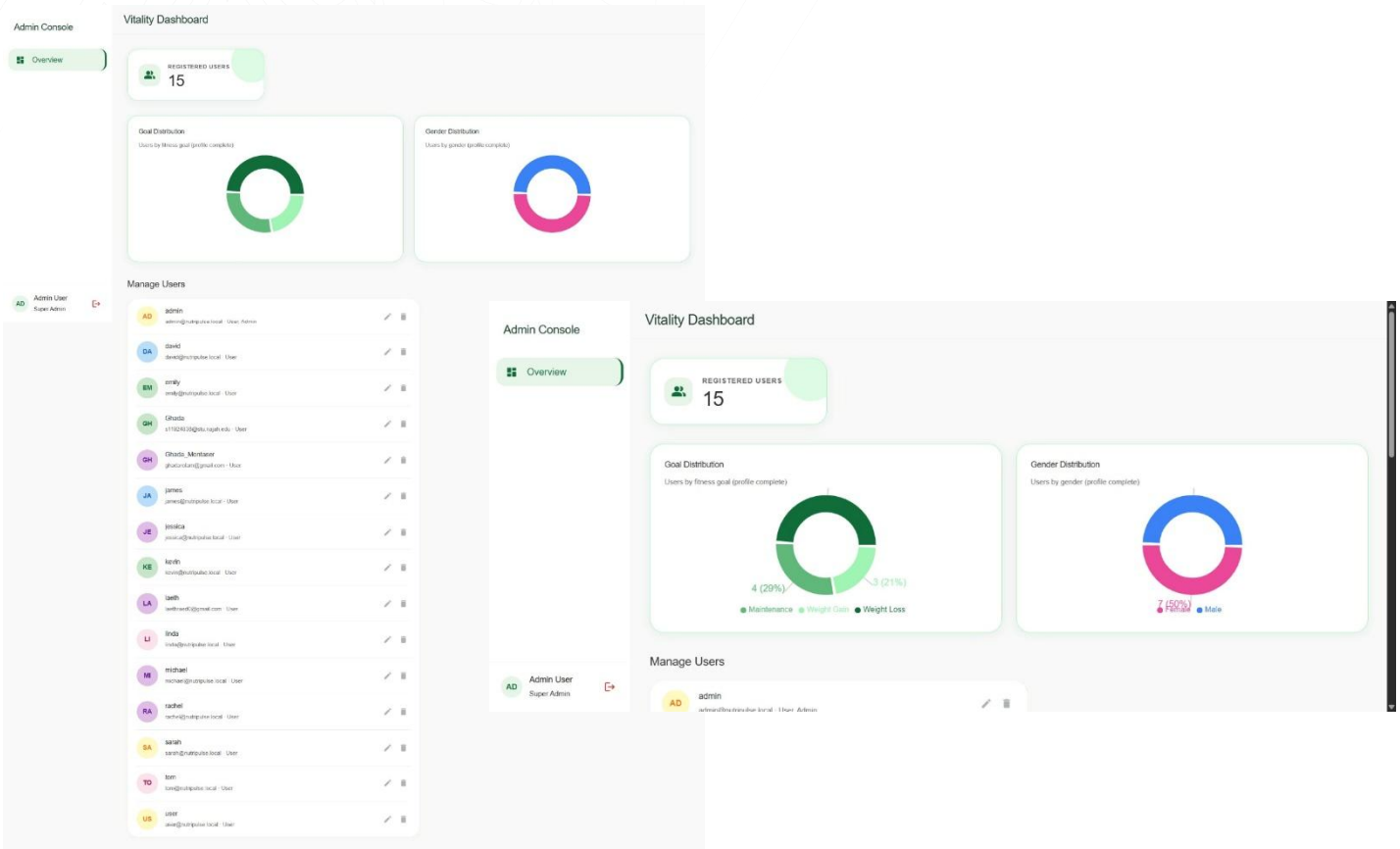




University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

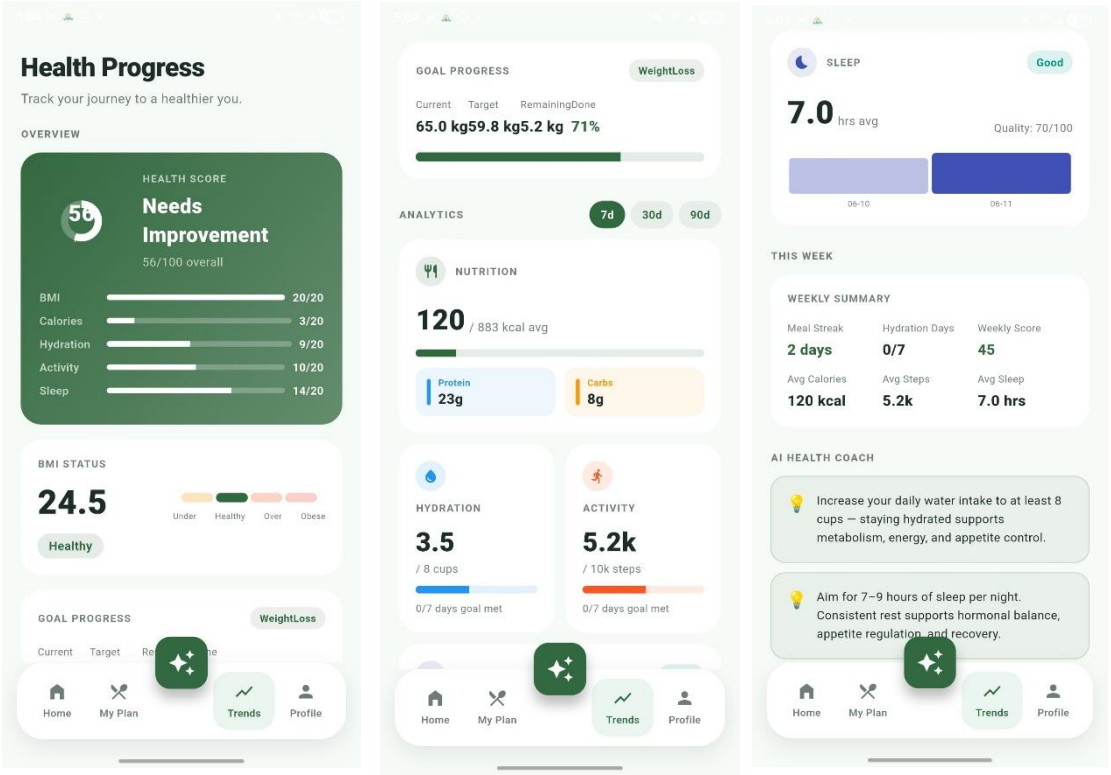
4.17 Admin Dashboard

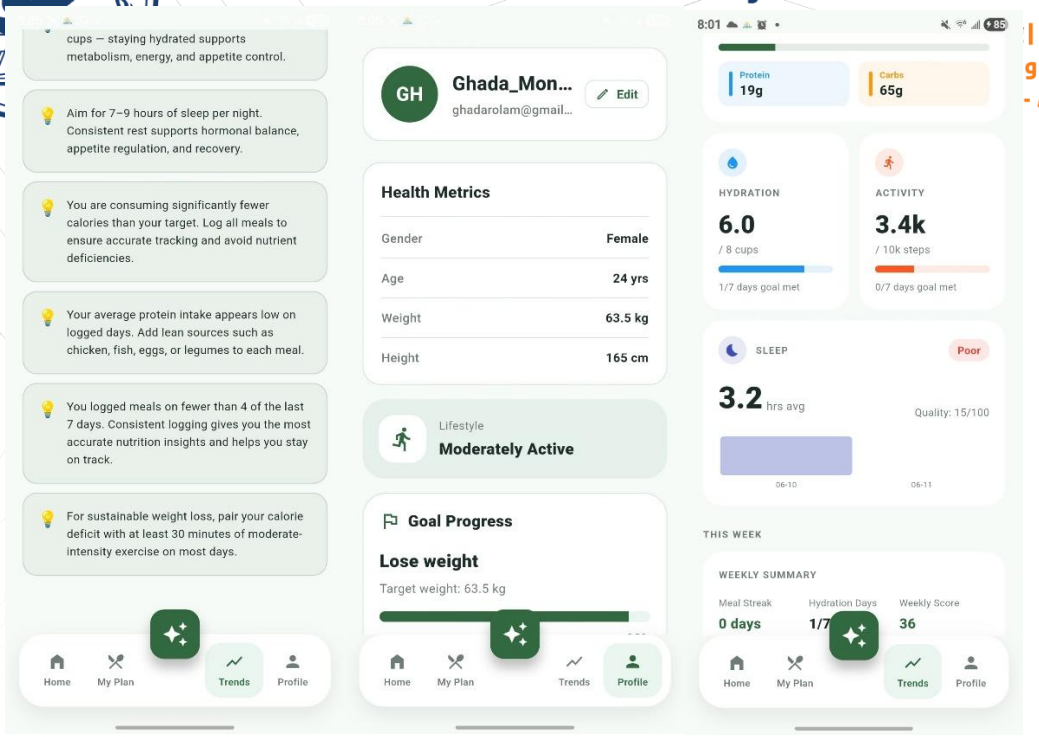
The Admin Dashboard was developed to provide administrators with a centralized interface for monitoring and managing the NutriPulse system. The dashboard displayed key statistics, including the number of registered users, user goal distribution, and gender distribution through graphical visualizations. Additionally, administrators were able to manage user accounts by viewing, editing, and deleting user information. This functionality improved system administration and provided a clear overview of user activity and application usage.



4.18 Health Analytics and Progress Tracking

The Health Analytics and Progress Tracking module was implemented to provide users with comprehensive insights into their overall health status and goal achievement. The module monitored multiple health indicators, including Health Score, BMI status, weight goal progress, calorie consumption, protein and carbohydrate intake, hydration levels, physical activity, sleep quality, and weekly performance statistics. Users were able to visualize their progress through interactive charts, progress bars, health scores, and summary reports. This functionality enhanced users' ability to evaluate their health performance through clear visual analytics and progress indicators. By integrating nutrition, hydration, activity, sleep, BMI assessment, and goal-tracking metrics within a single interface, the system provided a comprehensive overview of user wellness. The presented statistics helped users identify areas requiring improvement and supported data-driven decision making for achieving their health and nutrition goals.

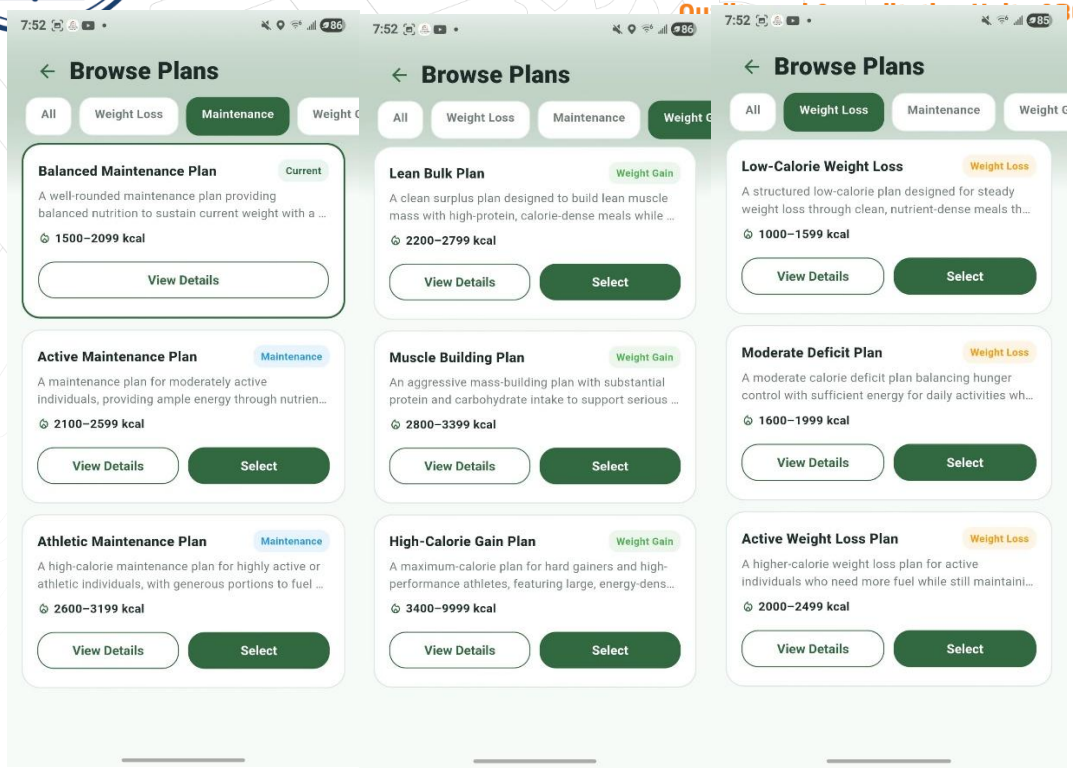


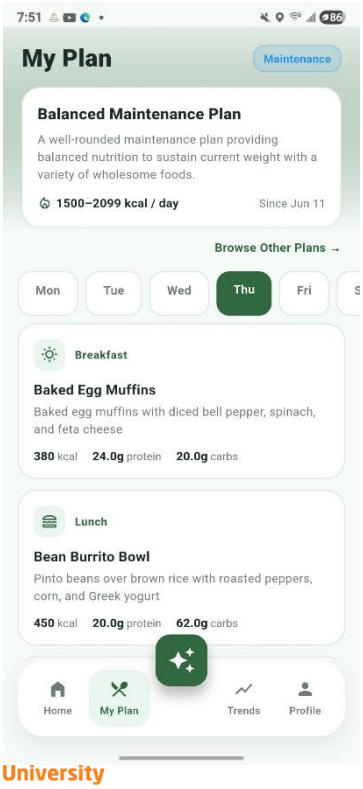


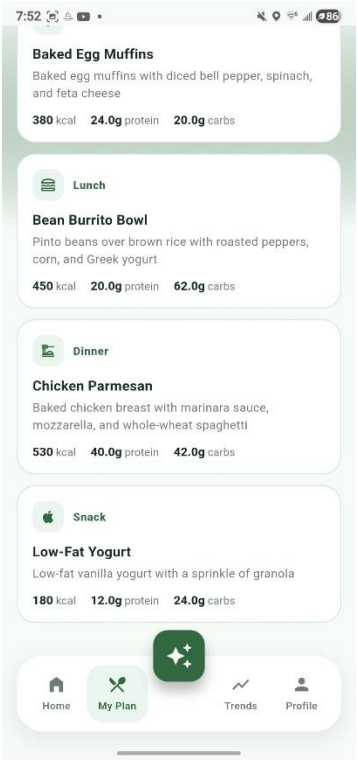
4.19 Nutrition Plans Management

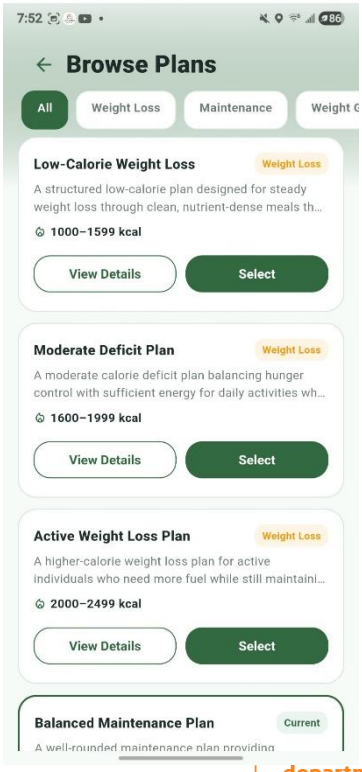
The Nutrition Plans Management module was implemented to provide users with personalized meal plans based on their selected health and fitness goals. The system offered multiple categories of nutrition plans, including Weight Loss, Maintenance, and Weight Gain plans, each containing different calorie ranges and meal recommendations. Users were able to browse available plans, view detailed nutritional information, select a preferred plan, and follow daily meal schedules consisting of breakfast, lunch, dinner, and snack recommendations. This functionality enhanced personalization within the application by allowing users to choose meal plans that align with their individual goals and caloric requirements, while providing structured nutritional guidance to support long-term health and dietary management.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu


Browse Plans
All
Weight Loss
Maintenance
Balanced Maintenance Plan
Current
A well-rounded maintenance plan providing balanced nutrition to sustain current weight with a ...
1500–2099 kcal
View Details
Active Maintenance Plan
Maintenance
A maintenance plan for moderately active individuals, providing ample energy through nutrien...
2100–2599 kcal
Select
Athletic Maintenance Plan
A high-calorie maintenance plan for highly active or athletic individuals, with generous portions to fuel ...
2600–3199 kcal
Lean Bulk Plan
Weight Gain
A clean surplus plan designed to build lean muscle mass with high-protein, calorie-dense meals while ...
2200–2799 kcal
Muscle Building Plan
An aggressive mass-building plan with substantial protein and carbohydrate intake to support serious ...
2800–3399 kcal
High-Calorie Gain Plan
A maximum-calorie plan for hard gainers and high-performance athletes, featuring large, energy-dens...
3400–9999 kcal
Low-Calorie Weight Loss
Weight Loss
A structured low-calorie plan designed for steady weight loss through clean, nutrient-dense meals th...
1000–1599 kcal
Moderate Deficit Plan
A moderate calorie deficit plan balancing hunger control with sufficient energy for daily activities wh...
1600–1999 kcal
Active Weight Loss Plan
A higher-calorie weight loss plan for active individuals who need more fuel while still maintaini...
2000–2499 kcal

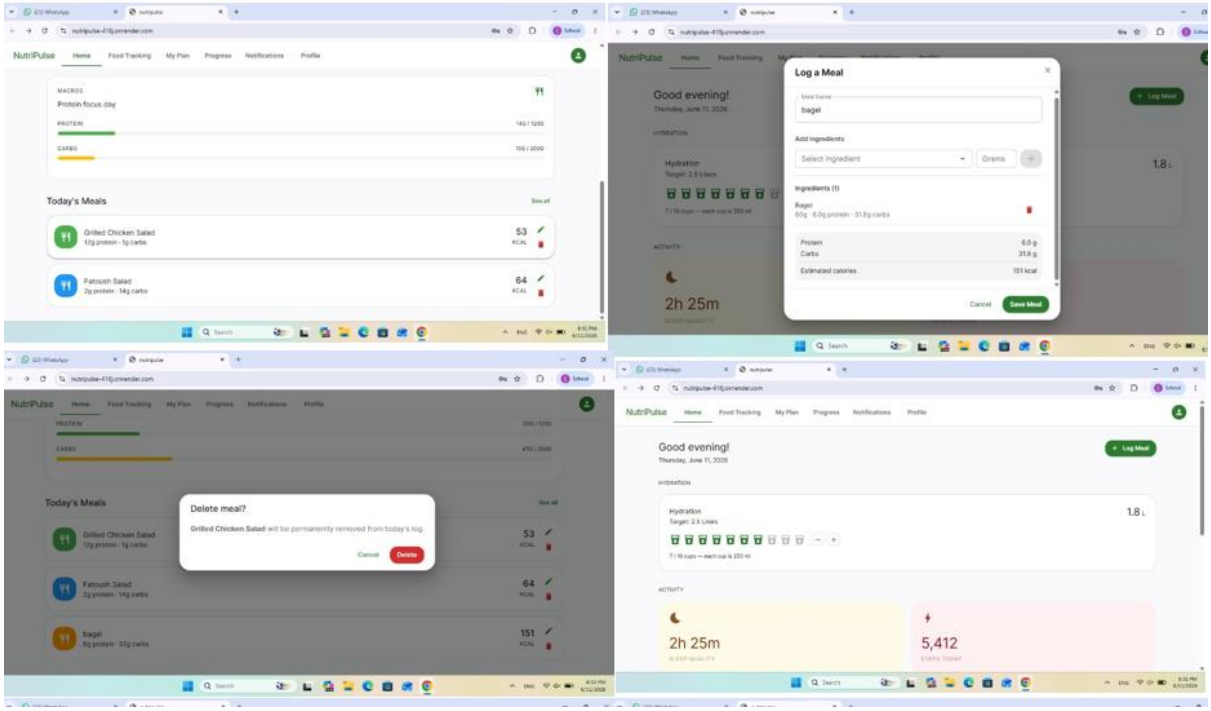

My Plan
Maintenance
Balanced Maintenance Plan
A well-rounded maintenance plan providing balanced nutrition to sustain current weight with a variety of wholesome foods.
1500–2099 kcal / day
Since Jun 11
Browse Other Plans →
Mon
Tue
Wed
Thu
Fri
Breakfast
Baked Egg Muffins
Baked egg muffins with diced bell pepper, spinach, and feta cheese
380 kcal 24.0g protein 20.0g carbs
Lunch
Bean Burrito Bowl
Pinto beans over brown rice with roasted peppers, corn, and Greek yogurt
450 kcal 20.0g protein 62.0g carbs
Home
My Plan
Trends
Profile


Baked Egg Muffins
Baked egg muffins with diced bell pepper, spinach, and feta cheese
380 kcal 24.0g protein 20.0g carbs
Lunch
Bean Burrito Bowl
Pinto beans over brown rice with roasted peppers, corn, and Greek yogurt
450 kcal 20.0g protein 62.0g carbs
Dinner
Chicken Parmesan
Baked chicken breast with marinara sauce, mozzarella, and whole-wheat spaghetti
530 kcal 40.0g protein 42.0g carbs
Snack
Low-Fat Yogurt
Low-fat vanilla yogurt with a sprinkle of granola
180 kcal 12.0g protein 24.0g carbs
Home
My Plan
Trends
Profile

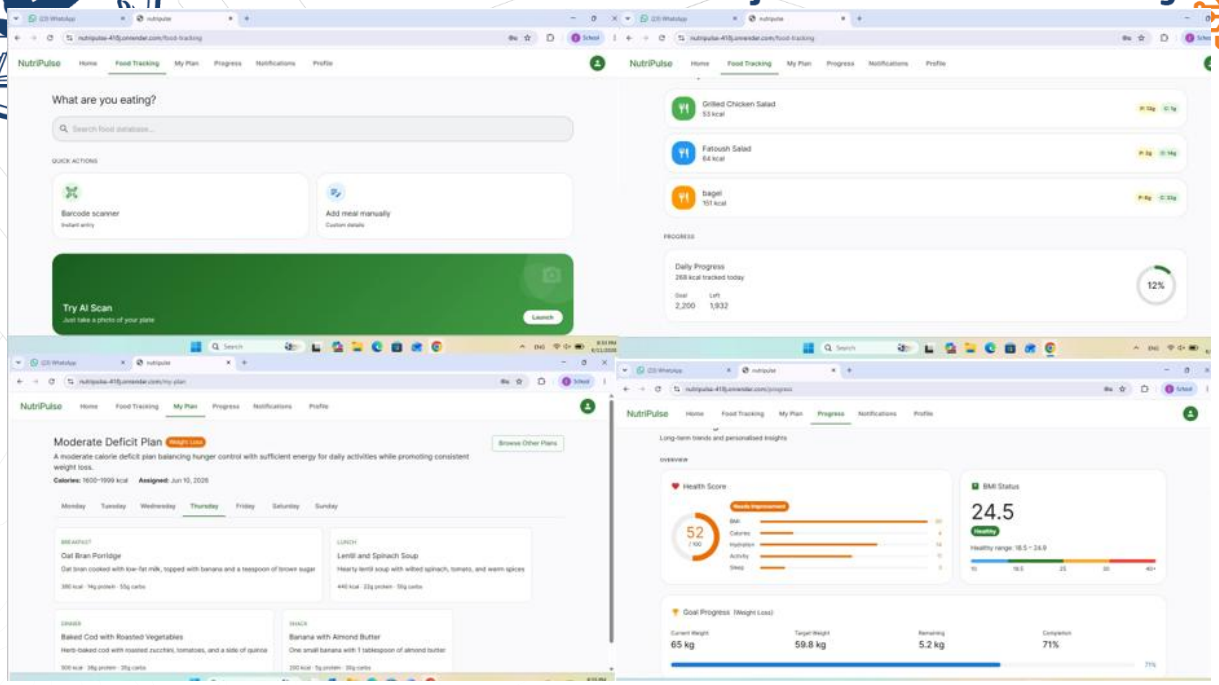

Browse Plans
All
Weight Loss
Maintenance
Low-Calorie Weight Loss
Weight Loss
A structured low-calorie plan designed for steady weight loss through clean, nutrient-dense meals th...
1000–1599 kcal
View Details
Select
Moderate Deficit Plan
A moderate calorie deficit plan balancing hunger control with sufficient energy for daily activities wh...
1600–1999 kcal
Active Weight Loss Plan
A higher-calorie weight loss plan for active individuals who need more fuel while still maintaini...
2000–2499 kcal
Balanced Maintenance Plan
Current

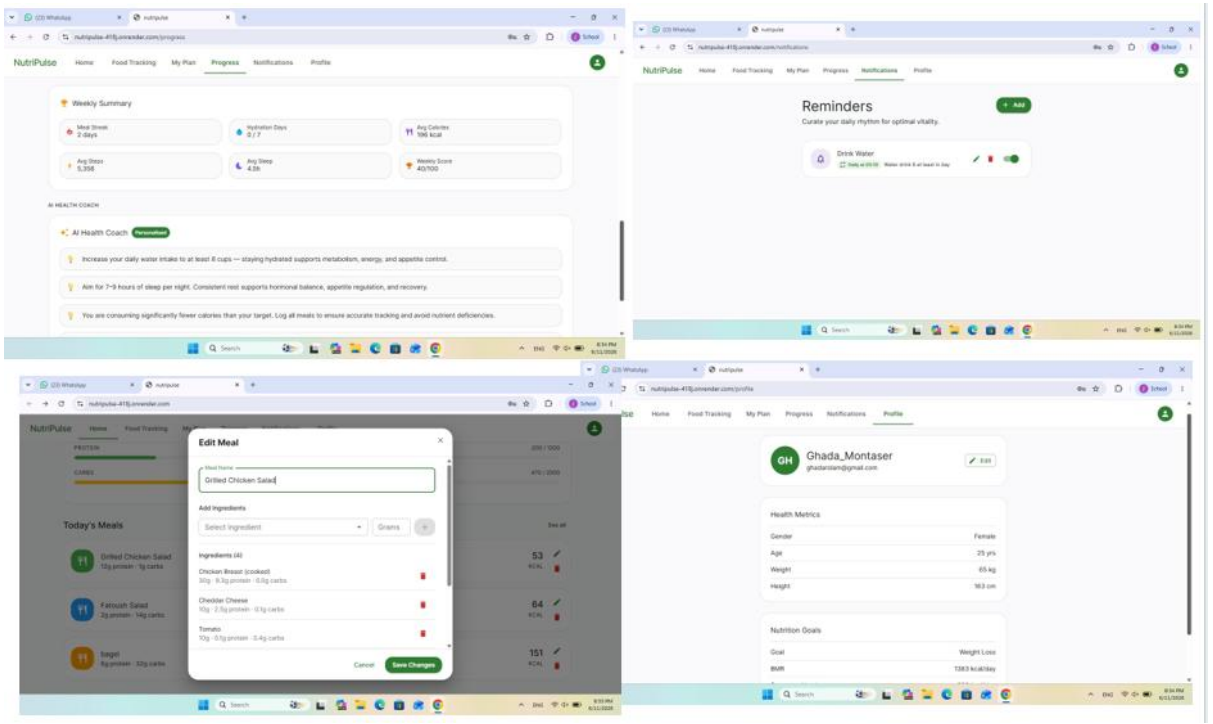
4.20 Web Application Implementation

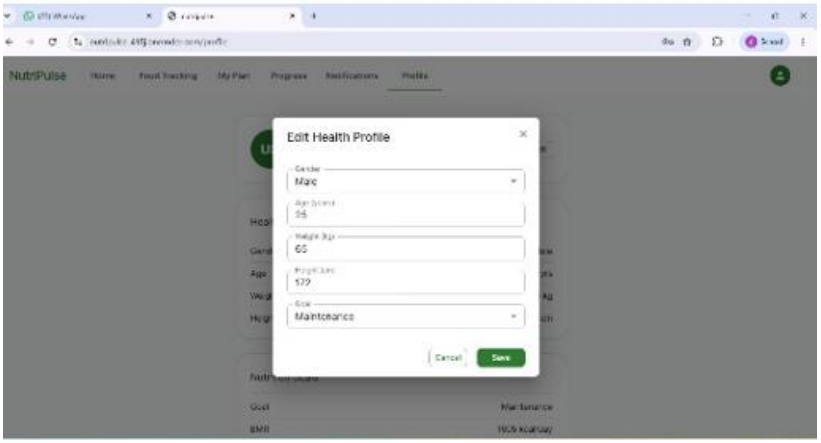
The web application extended the functionality of the mobile application by providing a desktop-based interface for nutrition and health management. Users could log meals manually, edit and delete meal records, monitor calorie and macronutrient intake, track hydration, activity, and sleep metrics, browse and follow personalized nutrition plans, manage reminders, update health profile information, and view detailed health analytics including BMI, health scores, goal progress, weekly summaries, and personalized health recommendations. The responsive web interface improved accessibility and enabled users to manage their health data conveniently across different devices.



University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu


NutriPulse
What are you eating?
Barcode scanner
Add meal manually
Try AI Scan
Grilled Chicken Salad
Fatoush Salad
bagel
Daily Progress
12%
Moderate Deficit Plan
Oat Bran Porridge
Lentil and Spinach Soup
Baked Cod with Roasted Vegetables
Banana with Almond Butter
Health Score
52
BMI Status
24.5
Goal Progress (Weight Loss)
65 kg
59.8 kg
5.2 kg
71%


Weekly Summary
AI Health Coach
Reminders
Drink Water
Edit Meal
Grilled Chicken Salad
Today's Meals
Ghada_Montaser
Health Metrics
Nutrition Goals


Edit Health Profile
Gender
Male
Age (years)
56
Weight (kg)
65
Height (cm)
179
Goal
Maintenance
Cancel
Save

4.21 AI-Based Food Recognition Module

The AI-Based Food Recognition module was developed to automatically identify food items from images and support nutrition tracking within the NutriPulse system. The module utilized a deep learning image classification approach based on transfer learning to recognize food categories and provide nutritional information associated with the detected food items. This feature aimed to reduce manual food logging effort and improve the overall user experience by enabling faster and more accurate meal tracking.

4.21.1 Dataset

Artificial intelligence was incorporated into NutriPulse to simplify food tracking and improve user experience. The AI module enables automatic food identification from images and provides nutritional information without requiring manual food searches or data entry.

The food recognition model was trained using the Fruits-360 dataset available on Kaggle. The dataset contains thousands of labeled fruit and food-related images captured under controlled conditions and organized into multiple categories. The dataset was selected because of its high image quality, large number of samples, and suitability for image classification tasks.
The dataset was divided into training and validation subsets to enable model training and performance evaluation. Each image was associated with a predefined class label representing a specific food category.

4.21.2 Data Preprocessing and Augmentation

Before training, several preprocessing operations were applied to improve model performance and generalization capability. All images were resized to a fixed resolution of 224 × 224 pixels to match the input requirements of the selected neural network architecture.
Additionally, data augmentation techniques were applied to increase dataset diversity and reduce overfitting. These techniques included:

- Random horizontal flipping.
- Random image rotation.
- Brightness and color adjustments.
- Image normalization.

These preprocessing steps allowed the model to learn robust visual features and improved its ability to classify food images under different conditions.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.21.3 Model Architecture and Training

The MobileNetV2 convolutional neural network architecture was selected as the foundation of the food recognition model. MobileNetV2 was chosen because it provides high classification accuracy while maintaining low computational complexity, making it suitable for deployment in mobile and web-based health applications.

Transfer learning was utilized by initializing the model with pre-trained ImageNet weights and replacing the final classification layer with a new output layer corresponding to the food categories used in the dataset.

The model was trained using the Adam optimizer and Cross-Entropy Loss function. During training, the network learned to extract discriminative visual features from food images and classify them into the appropriate categories.

Component	Description
Dataset	Fruits-360
Framework	PyTorch
Model	MobileNetV2
Optimizer	Adam
Loss Function	Cross Entropy Loss
Epochs	10
Output	Food Category + Nutrition Data

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.21.4 AI Integration within NutriPulse

After training, the food recognition model was integrated into the NutriPulse platform through the AI Scan functionality. Users can upload or capture food images, which are then processed by the trained model to predict the food category.

Once a prediction is generated, the system retrieves the corresponding nutritional information, including calories, protein, and carbohydrate values. The recognized food item can then be automatically added to the user's daily food log, reducing manual input and improving tracking efficiency.

The integration allows AI-powered food recognition to work seamlessly alongside the food tracking and health analytics modules.

4.21.5 Results and Analysis

The implemented food recognition module successfully demonstrated the ability to classify food images and support automated nutrition tracking. The AI Scan feature simplified meal logging by automatically identifying food categories and linking them to nutritional information stored within the system.

The integration of artificial intelligence improved user interaction by reducing manual data entry and accelerating the food tracking process. Furthermore, the module complemented the overall objectives of NutriPulse by enhancing dietary monitoring and supporting healthier
decision-making through intelligent food analysis.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

4.21.6 Challenges and Limitations

Several limitations were observed during the development of the food recognition module. The model performance may decrease when processing low-quality images, images captured under poor lighting conditions, or food items that are visually similar. In addition, the dataset did not cover all possible food categories, which may limit the system's ability to recognize uncommon meals. Future improvements may include expanding the dataset and training the model on a wider variety of real-world food images.

Chapter 5

5.1 Discussion

The results obtained from the implementation and testing of NutriPulse demonstrated that the developed system successfully addressed the main challenges identified at the beginning of the
project. The system provided an integrated platform that combines nutrition management, calorie tracking, food recognition, health monitoring, and personalized nutrition planning within a single application. This eliminated the need for users to rely on multiple independent applications to manage their health-related activities.

The implemented functionalities, including meal tracking, nutrition plan management, hydration monitoring, sleep tracking, activity tracking, and progress analytics, worked together to provide users with a comprehensive overview of their health status. The integration of these features improved accessibility and simplified the process of monitoring daily nutritional intake and health-related metrics.

One of the main contributions of this project was the integration of artificial intelligence into the nutrition management process. The AI-based food

recognition module enabled users to identify food items through images and obtain corresponding nutritional information automatically. This reduced manual data entry and enhanced the overall user experience. In addition, the he system provided personalized health recommendations based on user health metrics and tracked data.

Compared with existing nutrition tracking applications reviewed in the literature, NutriPulse combines multiple functionalities within a single platform, including calorie calculation based on BMR and TDEE, personalized nutrition plans, food recognition, health analytics, reminders, and administrative management tools. This integration represents an important contribution toward creating a more comprehensive health and nutrition management solution.

Despite the successful implementation of the proposed functionalities, several limitations were identified during development. The performance of the food recognition model depends on image quality, lighting conditions, and the categories included in the training dataset. In addition, the current implementation focuses primarily on Android and web platforms and does not yet provide native support for iOS devices. Furthermore, the nutritional recommendations generated by the system are intended for general wellness guidance and should not replace professional medical advice.

The obtained results indicate that intelligent health and nutrition management systems can significantly improve nutritional awareness and support healthier decision-making. The project demonstrates how artificial intelligence, mobile technologies, and modern web technologies can be combined to create practical tools that support preventive healthcare and long-term wellness management.

Future work may include expanding the food recognition dataset, improving model accuracy, integrating wearable health devices, supporting multilingual interfaces, and developing more advanced machine learning models for personalized health recommendations. These enhancements would further

improve system effectiveness and broaden its applicability to a larger user population.

Chapter 6

Conclusions and Recommendations

6.1 Conclusions

This project presented the design, development, and implementation of NutriPulse, an intelligent health and nutrition management system designed to assist users in monitoring their dietary habits, health activities, and wellness goals. The system successfully integrated multiple functionalities, including user authentication, calorie calculation, nutrition planning, meal tracking, food recognition, progress monitoring, reminder management, and health analytics within a unified platform.

The implementation results demonstrated that the developed mobile and web applications operated successfully and provided users with an effective environment for monitoring nutritional intake and health-related information. The integration of artificial intelligence through food recognition and personalized health recommendations enhanced user interaction and simplified several nutrition management tasks.

The project confirmed that combining modern software technologies with artificial intelligence can improve nutritional awareness, support healthier lifestyle choices, and provide users with convenient access to personalized health information. The developed system successfully achieved the objectives defined at the beginning of the project and demonstrated the feasibility of implementing an integrated nutrition and health management solution.

6.2 Lessons Learned

The development of NutriPulse provided valuable practical experience in several areas of software engineering and system development. The project enhanced knowledge of mobile application development using Flutter, web

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

application development using React, backend development using ASP.NET Core, database management using SQL Server, and API integration techniques.

In addition, the project provided practical experience in artificial intelligence development, including dataset preparation, image classification, model training, performance evaluation, and AI integration within real-world applications. The development process also improved skills related to software architecture, system testing, teamwork, problem solving, and project management.

The experience gained throughout the project highlighted the importance of user-centered design, continuous testing, modular software architecture, and effective integration between different system components.

6.3 Recommendations and Future Work

Several improvements can be considered for future versions of NutriPulse. Expanding the food recognition dataset and training the AI model on a larger collection of real-world food images could improve recognition accuracy and increase the number of supported food categories.

Future versions may also integrate wearable health devices and fitness trackers to enable automatic collection of health-related data such as heart rate, physical activity levels, and sleep patterns. Additional personalization features based on advanced machine learning algorithms could further improve the quality of nutrition plans and health recommendations.

Support for multiple languages, including Arabic and other international languages, would improve accessibility and broaden the application's user base. Furthermore, developing a native iOS version would allow the system to reach a larger audience.

Finally, future research may investigate the use of advanced artificial intelligence techniques, predictive analytics, and cloud-based health services to provide more comprehensive and personalized healthcare support.

University
Nablus, Palestine - Tel: +972(9)-2345113 - EX. 88-2223 - Fax: +972(9)-2345982 - E: info@najah.edu
department
equ@najah.edu
ANajahUni
https:// www.najah.edu

References

Microsoft. (2025). ASP.NET Core Documentation. Retrieved from https://learn.microsoft.com/en-us/aspnet/core/

Microsoft. (2025). ASP.NET Core Identity Documentation. Retrieved from https://learn.microsoft.com/en-us/aspnet/core/security/authentication/identity

Microsoft. (2025). SQL Server Documentation. Retrieved from https://learn.microsoft.com/en-us/sql/sql-server/

Flutter Team. (2025). Flutter Documentation. Retrieved from https://docs.flutter.dev/

Meta Platforms, Inc. (2025). React Documentation. Retrieved from https://react.dev/

Kaggle. (2025). Food Recognition Datasets. Retrieved from https://www.kaggle.com/datasets

World Health Organization. (2024). Healthy Diet. Retrieved from https://www.who.int/news-room/fact-sheets/detail/healthy-diet

MyFitnessPal. (2025). Official Website. Retrieved from https://www.myfitnesspal.com/

YAZIO GmbH. (2025). YAZIO Nutrition and Calorie Counter. Retrieved from https://www.yazio.com/