



Faculty of Computer Science and Information Technology

NUTRIFIT AI – DIET AND FITNESS MOBILE APP WITH AI-DRIVEN NUTRITION

QUEENIE LEE SU HUA

Bachelor of Software Engineering with Honours

2025

NUTRIFIT AI – DIET AND FITNESS MOBILE APP WITH AI-DRIVEN NUTRITION

QUEENIE LEE SU HUA

This project is submitted in partial fulfilment of
the requirements for the degree of Bachelor of Software Engineering with Honours

Faculty of Computer Science and Information Technology

UNIVERSITI MALAYSIA SARAWAK

2025

**NUTRIFIT AI – APLIKASI MUDAH ALIH DIET DAN KECERGASAN DENGAN
CHATBOT PEMAKANAN BERPANDUKAN AI**

QUEENIE LEE SU HUA

Project ini merupakan salah satu keperluan untuk
Ijazah Sarjana Muda Kejuruteraan Perisian dengan Kepujian

Fakulti Sains Komputer dan Teknologi Maklumat
UNIVERSITI MALAYSIA SARAWAK

2025

Declaration

I hereby declare that the work contained in this project entitled "NutriFit AI – Diet and Fitness Mobile App with AI-Driven Nutrition Chatbot" is my original work except where explicitly stated otherwise. This project has been carried out as part of the requirements for the degree of Bachelor of Software Engineering (Honors) at Universiti Malaysia Sarawak (UNIMAS). I confirm that this work has not been submitted for any other academic qualification at this or any other institution of learning. All sources of information and literature used in this project have been acknowledged appropriately. I understand that the university has a policy regarding plagiarism and academic integrity, and I affirm that this work complies with all such policies.

Signed by,



QUEENIE LEE SU HUA,

Faculty of Computer Science and Information Technology

Universiti Malaysia Sarawak.

Acknowledgement

I would like to extend my heartfelt gratitude to all those who have contributed to the successful completion of this project. First and foremost, I am deeply thankful to my supervisor, Dr. Liew Siaw Hong, for his expert guidance, insightful feedback, and constant encouragement throughout this journey. His support has been invaluable in overcoming challenges and achieving the objectives of this project.

I am immensely grateful to Universiti Malaysia Sarawak (UNIMAS) for providing the necessary resources, facilities, and a conducive environment for academic and personal growth.

I would also like to thank my friends and peers, who have offered their time and assistance whenever needed. Their support, whether in the form of constructive discussions or moral encouragement, has made this experience more fulfilling.

A special note of appreciation goes to my family, whose unwavering belief in my abilities has been my source of strength. Their understanding and emotional support have allowed me to focus fully on this project, and I am forever indebted to them.

Finally, I extend my gratitude to all individuals and organizations whose work and research have inspired and guided me throughout this journey. To everyone who has been a part of this endeavor, thank you for your contributions, encouragement, and belief in my efforts.

Abstract

NutriFit AI – Diet and Fitness Mobile App with AI-Driven Nutrition Chatbot aims to provide an efficient and convenient way for users to manage their diet and fitness in one platform. The app will enable users to view personalized meal plans, track their workouts, and receive real-time nutrition advice through an AI-driven chatbot. Additionally, users can input symptoms and receive tailored health recommendations, making the app a comprehensive tool for maintaining a healthy lifestyle. The main objective of this project is to develop an intuitive mobile application that simplifies diet and fitness management, providing users with personalized guidance to achieve their health goals. By leveraging advanced AI technologies and user-friendly design principles, the app delivers a seamless and engaging user experience. This project is expected to provide significant benefits by saving time, enhancing accessibility, and promoting sustainable health habits through a single, easy-to-use solution for fitness and dietary needs.

Abstrak

NutriFit AI – Aplikasi Mudah Alih Diet dan Kecergasan dengan Chatbot Pemakanan Berpanduan AI bertujuan untuk menyediakan cara yang cekap dan mudah bagi pengguna menguruskan diet dan kecergasan mereka dalam satu platform. Aplikasi ini akan membolehkan pengguna melihat pelan pemakanan yang diperibadikan, menjejak senaman mereka, dan menerima nasihat pemakanan masa nyata melalui chatbot berasaskan AI. Selain itu, pengguna boleh memasukkan simptom dan menerima cadangan kesihatan yang disesuaikan, menjadikan aplikasi ini alat yang komprehensif untuk mengekalkan gaya hidup sihat. Matlamat utama projek ini adalah untuk membangunkan aplikasi mudah alih yang intuitif yang memudahkan pengurusan diet dan kecergasan, menyediakan panduan yang diperibadikan kepada pengguna untuk mencapai matlamat kesihatan mereka. Dengan memanfaatkan teknologi AI yang canggih dan prinsip reka bentuk mesra pengguna, aplikasi ini menyediakan pengalaman pengguna yang lancar dan menarik. Projek ini dijangka memberikan manfaat yang ketara dengan menjimatkan masa, meningkatkan aksesibiliti, dan mempromosikan tabiat kesihatan yang mampan melalui satu penyelesaian yang mudah digunakan untuk keperluan kecergasan dan diet.

TABLE OF CONTENTS

Declaration	i
Acknowledgement	ii
Abstract	iii
Chapter 1: Introduction	10
1.1 Introduction	10
1.2 Problem Statement	11
1.3 Objectives	12
1.4 Methodology	13
1.5 Project Scope	15
1.6 Significance Of Project	16
1.7 Project Schedule	17
1.8 Expected Outcome	17
1.9 Project Outlines	19
Chapter 2: Literature Review	21
2.1 Introduction	21
2.2 Reviews Of Similar Existing Systems	21
2.2.1 Calorie Counter	22
2.2.2 Macros – Calorie Counter	27
2.2.3 Home Workout – No Equipment Required	32
2.3 Comparison Of Features Among Different Systems	38
2.4 AI In Meal Recommendations	42

2.5	AI In AI-Nutrition Chatbot	43
2.6	How Do AI Nutrition Chatbot Implement In Nutrifit AI.....	44
2.7	Summary	45
Chapter 3:	Requirements Analysis And Design.....	46
3.1	Introduction.....	46
3.2	Project Development Methodology	46
3.2.1	Prototype Model.....	46
3.3	Requirements Analysis of The Proposed System	47
3.3.1	Analysys Of the Current Fitness and Diet Situations	47
3.3.2	The Proposed Solutions	47
3.3.3	Requirement Elicitation	48
3.4	System Requirements.....	61
3.4.1	Functional Requirements	61
3.4.2	Non-Functional Requirements	65
3.5	System Design	66
3.5.1	Use Case Diagram.....	66
3.5.2	Activity Diagram	85
3.5.3	Sequence Diagram	96
3.6	User Interface Design	106
3.6.1	Login Page	107
3.6.2	Home Page	108
3.6.3	Adding Food from Food Library Page.....	109

3.6.4	Meal Recommendation Page	110
3.6.5	Workouts Page	111
3.6.6	Statistic Page.....	112
3.6.7	AI Chatbot Page.....	113
3.6.8	Profile Page.....	114
3.6.9	Notification Page	115
Chapter 4:	System Implementation	116
4.1	Introduction.....	116
4.2	Hardware And Software Development Tools Requirements	116
4.2.1	Hardware Setup.....	116
4.2.2	Software Setup.....	117
4.3	Implementation Of Integrated Development Environment (Ide).....	118
4.4	Implementation Of Framework (Flutter)	120
4.5	Implementation Of Database Tool (Firebase)	122
4.6	System Architecture	124
4.6.1	Presentation Layer	125
4.6.2	Business Logic Layer.....	127
4.6.3	Data Storage Layer	128
4.7	Nutrifit Ai Module Implementation	129
4.8	Interfaces Of Nutrifit AI.....	131
4.9.1	Login Page	132
4.9.2	Register Page	133

4.9.3	Forgot Password Page	134
4.9.4	Home Page	135
4.9.5	Food Logger Page	136
4.9.6	Meal Recommendation Page	138
4.9.7	Workout Page	139
4.9.8	Statistic Page	140
4.9.9	AI Chatbot Page	141
4.9.10	Profile Page	142
4.9.11	Edit Profile Page	143
4.9.12	Notification Page	144
Chapter 5:	System Testing	146
5.1	Introduction	146
5.2	Functional Testing	146
5.2.1	Test Cases For Register Functionality	147
5.2.2	Test Cases For Registration Functionality	148
5.2.3	Test Cases For Login Functionality	149
5.2.4	Test Cases For Login Functionality	150
5.2.5	Test Cases For Login Functionality	151
5.2.6	Test Cases For Reset Password Functionality	152
5.2.7	Test Cases For Reset Password Functionality	153
5.2.8	Test Cases For Food Log Functionality	154
5.2.9	Test Cases For Food Log Functionality	155

5.2.10	Test Cases For Food Log Functionality	156
5.2.11	Test Cases For Meal Recommendation Functionality	158
5.2.12	Test Cases For Meal Recommendation Functionality	159
5.2.13	Test Cases For Meal Recommendation Functionality	161
5.2.14	Test Cases For Meal Recommendation Functionality	162
5.2.15	Test Cases For Meal Recommendation Functionality	164
5.2.16	Test Cases For Workout Functionality	165
5.2.17	Test Cases For Workout Functionality	166
5.2.18	Test Cases For Workout Functionality	167
5.2.19	Test Cases For Workout Functionality	168
5.2.20	Test Cases For Statistics Functionality	169
5.2.21	Test Cases For Statistics Functionality	170
5.2.22	Test Cases For AI Nutrition Chatbot Functionality	171
5.2.23	Test Cases For AI Nutrition Chatbot Functionality	172
5.2.24	Test Cases For AI Nutrition Chatbot Functionality	173
5.2.25	Test Cases For Profile Module Functionality	175
5.2.26	Test Cases For Profile Module Functionality	176
5.2.27	Test Cases For Profile Module Functionality	177
5.2.28	Test Cases For Profile Module Functionality	178
5.2.29	Test Cases For Profile Module Functionality	179
5.2.30	Test Cases For Notification Page Functionality.....	180

5.2.31	Test Cases For Notification Page Functionality.....	181
5.3	Non-Functional Testing.....	182
5.3.1	Performance Testing	182
5.3.2	Usability Testing	184
5.3.3	Reliability Testing	186
5.4	User Acceptance Testing (UAT)	188
Chapter 6:	Conclusion And Future Work.....	201
6.1	Conclusion	201
6.2	Achievement	201
6.3	Limitations And Constraints	202
6.4	Future Work	203
References		205
Appendix A: Questionnaires		
Appendix B: User Acceptance Testing (UAT) Questionnaire for NutriFit AI		

LIST OF TABLES

Table 2.1: Comparison of the Features, Strengths, Weaknesses of the Three Similar App	38
Table 2.2: The Comparison Among Three Similar Existing System	40
Table 3.1: Use Case Specifications of Login/Logout	68
Table 3.2: Use Case Specifications of Meal Recommendations.....	70
Table 3.3: Use Case Specifications of Doing Food Log	72
Table 3.4: Use Case Specifications of Viewing Daily Calorie Intake	74
Table 3.5: Use Case Specifications of Tracking Workout Progress	76
Table 3.6: Use Case Specifications of Interaction with AI Chatbot	78
Table 3.7: Use Case Specification of Processing Users' Request by Chatbot	80
Table 3.8: Use Case Specifications of Statistic Module	82
Table 3.9: Use Case Specifications of Managing Notifications	84
Table 4.1: Hardware Requirements to Develop NutriFit AI	116
Table 4.2: Software Requirements to Develop NutriFit AI	117
Table 4.3: File Structure of NutriFit AI	126
Table 5.1: Test Case For User Registration in NutriFit AI.....	147
Table 5.2: Test Case for Validation of Missing Required Information During User Registration in NutriFit AI.....	148
Table 5.3: Test Case for User Ligin in NutriFit AI	149
Table 5.4: Test Case for Validation of Invalid User Account During User Login in NutriFit AI	150
Table 5.5: Test Case for Validation of Incorrect Password During User Login in NutriFit AI	151
Table 5.6: Test Case for Validation of Password Reset Email Sent During Reset Password in NutriFit AI.....	152

Table 5.7: Test Case for Reset Password in NutriFit AI	153
Table 5.8: Test Case for Food Search and Food Log to Meal Section in Home Page of Nutrofit AI.....	154
Table 5.9: Test Case for Validation of Invalid Search Query when Log Food in NutriFit AI	155
Table 5.10: Test Case for Validationof Food Log for Multiple Meals in NutriFit AI	156
Table 5.11: Test Case for Meal Recommendation by System in NutriFit AI.....	158
Table 5.12: Test Case for Verification of Meal Recommended when no Specific References Selected in NutriFit AI.....	159
Table 5.13: Test Case for Vaidation of Meal Recommended when High User's BMI in NutriFit AI.....	161
Table 5.14: Test Case for Vaidation of Meal Recommended when Low User's BMI in NutriFit AI	162
Table 5.15: Test Case for Vaidation of Meal Recommended when Normal User's BMI in NutriFit AI.....	164
Table 5.16: Test Case for Playing Workout Type Chosen By Use in NutriFit AI.....	165
Table 5.17: Test Case for Cancellation of Workout in NutriFit AI	166
Table 5.18: Test Case for Tracking Calories Burned After Workout in NutriFit AI	167
Table 5.19: Test Case for Verification of Complete Workouts Appear in Workout History Page in NutriFit AI.....	168
Table 5.20: Test Case for Verification of Displaying Correct Workout Calories Burned in Workout History Page in NutriFit AI.....	169
Table 5.21: Test Case for Verification of Displaying Correct Calories Burned in Graph in NutriFit AI.....	170
Table 5.22: Test Case for Verification of Chatbot Response to Health Symptom-Related Questions in NutriFit AI.....	171

Table 5.23: Test Case for Verification of Chatbot Response to Non-Symptom-Based Questions in NutriFit AI.....	172
Table 5.24: Test Case for Verification of Chatbot's Ability to Provide Answers for Follow-Up Symptom Queries in NutriFit AI.....	173
Table 5.25: Test Case for Verification of Profile Page Displaying Correct User Information in NutriFit AI.....	175
Table 5.26: Test Case for Editing Profile Information in Profile Page in NutriFit AI	176
Table 5.27: Test Case for Updating Profile Picture in Profile Page in NutriFit AI.....	177
Table 5.28: Test Case for Logout Function in NutriFit AI.....	178
Table 5.29: Test Case for Validation of Empty Fields in Edit Profile in NutriFit AI.....	179
Table 5.30: Test Case for Notification Page in NutriFit AI	180
Table 5.31: Test Case for Notification Settings in NutriFit AI	181
Table 5.32: Test Case for Performance and Responsiveness of NutriFit AI System	182
Table 5.33: Test Case for Usability Testing in NutriFit AI	184
Table 5.34: Test Case for Reliability Testing in NutriFit AI.....	186

LIST OF FIGURES

Figure 1.1: Prototyping Model.....	13
Figure 1.2: Project Schedule for Final Year Project.....	17
Figure 2.1: Screenshots of Installation of Track Mobile Application.....	22
Figure 2.2: Screenshots of Notification Settings and User’s Basic Information Page	23
Figure 2.3: Screenshots of Food Library and List of Restaurants in Track	24
Figure 2.4: Screenshots of Adding New Recipe and Total Calories of New Recipe Page	25
Figure 2.5: Screenshots of Installation of Macros Mobile Application	27
Figure 2.6: Screenshots of User’s Basic Information Page in Macros	28
Figure 2.7: Screenshots for Intake of Macronutrients Per Day by User	29
Figure 2.8: Screenshots of Adding Food from Food Library in Macros	30
Figure 2.9: Screenshots of Installation of Home Workout Mobile Application	32
Figure 2.10: Screenshots of Home Page and Adding Weekly Goal Page.....	33
Figure 2.11: Screenshots of Exercise Activity and Tutorials for Every Workouts Page.....	34
Figure 2.12: Screenshots of Summary Page After Completing All Workout Tutorials in One Session	35
Figure 2.13: Screenshots of Daily Report of User Page	36
Figure 3.1: The Questionnaires - What is your primary health and fitness goal?.....	49
Figure 3.2: The Questionnaires - What challenges have you faced in achieving your fitness or diet goals in the past?.....	50
Figure 3.3: The Questionnaires - Would you like to receive notifications for meal reminders or workout suggestions throughout the day?	51
Figure 3.4: The Questionnaires - What kind of guidance would you like for improving your diet?.....	52
Figure 3.5: The Questionnaires - How often do you use fitness or diet apps?	53

Figure 3.6: The Questionnaires - What is your level of experience with fitness or diet management?	54
Figure 3.7: The Questionnaires - What features do you think most helpful in your fitness or diet app?	55
Figure 3.8: The Questionnaires - What kind of exercise routines would you like the app to provide?.....	56
Figure 3.9: Have you ever used an AI-powered chatbot for health-related advice?	57
Figure 3.10: The Questionnaires - Would you find it beneficial if a fitness and diet app included an AI chatbot that offers personalized nutrition advice based on your health symptoms (e.g., Headache, Stomachache)?	58
Figure 3.11: The Questionnaires - How important is it for the app to provide suggestions on how to modify meals based on personal preferences (e.g., vegetarian, gluten-free)?	59
Figure 3.12: The Questionnaires - How important is it for you to be able to track both fitness and diet in one app instead of using multiple apps?	60
Figure 3.13: Use Case Diagram of NutriFit AI System	66
Figure 3.14: Use Case of Users' Login/Logout.....	68
Figure 3.15: Use Case of User Get the Meal Recommendation Based on Their Input Data...	70
Figure 3.16: Use Case of Log Food Intake	72
Figure 3.17: Use Case of Viewing Daily Calorie Intake.....	74
Figure 3.18: Use Case of Tracking Workout Progress.....	76
Figure 3.19: Use Case of User Interact with AI Chatbot	78
Figure 3.20: Use Case of Processing Users' Requests by Chatbot	80
Figure 3.21 Use Case of Statistic Module	82
Figure 3.22: Use Case of Manage Notifications	84
Figure 3.23: Activity Diagram for Login Module	85

Figure 3.24: Activity Diagram of Meal Recommendations Module	86
Figure 3.25: Activity Diagram of Calorie and Macronutrients Calculation Module	87
Figure 3.26: Activity Diagram of Food Log Module.....	89
Figure 3.27: Activity Diagram of the Workout Module.....	91
Figure 3.28: Activity Diagram of Statistic Page	92
Figure 3.29: Activity Diagram of AI Chatbot Module.....	93
Figure 3.30: Activity Diagram of My Profile Page.....	94
Figure 3.31: Activity Diagram of Notification Page.....	95
Figure 3.32: Sequence Diagram of Login Page	96
Figure 3.33: Sequence Diagram of Meal Recommendations Module	98
Figure 3.34: Sequence Diagram of Food Logger Module	100
Figure 3.35: Sequence Diagram of Workout Module	101
Figure 3.36: Sequence Diagram of AI Chatbot Module	102
Figure 3.37: Sequence Diagram of Statistic Page.....	104
Figure 3.38: Sequence Diagram of Notification Page	105
Figure 3.39: Screenshots of Login Page	107
Figure 3.40: Screenshots of Home Page	108
Figure 3.41: Screenshot of Adding Food from Food Library	109
Figure 3.42: Screenshot of Meal Recommendation Page.....	110
Figure 3.43: Screenshots of Workout Page	111
Figure 3.44: Screenshots of Statistic Page.....	112
Figure 3.45: Screenshot of AI Chatbot Page.....	113
Figure 3.46: Screenshots of Profile Page	114
Figure 3.47: Screenshot of Notification Page	115
Figure 4.2: Android Studio (Google Developers, 2024).....	118

Figure 4.5: Flutter (Flutter, 2024)	120
Figure 4.4: Firebase (Google, 2024)	122
Figure 4.7: Architecture Diagram of NutriFit AI Application	124
Figure 4.8: The Home Page coding of NutriFit AI Application	126
Figure 4.9: Firebase User Authentication of NutriFit AI	128
Figure 4.10: Firebase Firestore Database of NutriFit AI	129
Figure 4.11: NutriFit AI Login Page	132
Figure 4.12: Register Page for NutriFit AI	133
Figure 4.13: Forgot Password Page for NutriFit AI	134
Figure 4.14: Home Page for Nutrifit AI	135
Figure 4.15: Food Log for NutriFit AI	136
Figure 4.16: Meal Recommendation for NutriFit AI	138
Figure 4.17: Workout for NutriFit AI	139
Figure 4.18: Statistics Page for NutriFit AI	140
Figure 4.19: AI Nutrition Chatbot for NutriFit AI	141
Figure 4.20: Profile Page for NutriFit AI	142
Figure 4.21: Edit Profile Page for NutriFit AI	143
Figure 4.22: Notification Page for NutriFit AI	144
Figure 5.1: NutriFit AI app was easy to navigate	189
Figure 5.2: The instructions and labels were clear.	190
Figure 5.3: The app performed smoothly without any significant delays or crashes	191
Figure 5.4:How do you rate the user interface (UI) of NitriFit AI?.....	192
Figure 5.5: Rate your experience with the registration process of NutriFit AI.	193
Figure 5.6: The app provides all the features I expected for managing my diet and fitness.	194
Figure 5.7: The meal recommendations suit my preferences and dietary needs.	195

Figure 5.8: The workout reminders and tracking features are useful and easy to use.	196
Figure 5.9: The AI-Driven Nutrition Chatbot provides helpful and relevant recommendations.	197
Figure 5.10: Did you encounter any issues or bugs when using NutriFit AI app.	198
Figure 5.11: Please rate your overall satisfaction with NutriFit AI.	199
Figure 5.12: Would you recommend NutriFit AI to others?	200

Chapter 1: Introduction

1.1 Introduction

In recent years, more people in Malaysia have become interested in health and fitness, which has led to a rise in the use of fitness and diet mobile apps. This trend is part of a larger global shift towards fitness, driven by concerns about health issues like obesity, diabetes, and heart disease. These apps have become popular in Malaysia for helping people track their physical activity, manage their diet, and follow personalized workout plans. They include useful features like calorie counting, meal planning, and fitness tracking, making it easier for Malaysians to live healthier lives, especially as many are moving away from traditional gyms and turning to mobile apps instead. (Data Bridge Market Research, 2021)

There are currently 3.8 billion smartphone users around the world, and about half of them say they can't imagine living without their phones. Many apps have been created to do more than just make calls or send texts—they also help with social media, gaming, and managing health and fitness. By June 2021, there were 98,406 health and fitness apps in the Google Play Store and 159,758 in the Apple App Store. These apps are designed to encourage people to stay active and live healthier lives (Yang, Y. & Koenigstorfer, J., 2021).

During the COVID-19 pandemic, lockdowns forced people to stay at home, which made fitness apps more popular as many looked for ways to stay healthy and active indoors. These apps offer features like tracking physical activity, guiding workout routines, and providing personalized health tips to help people stay on top of their fitness goals. According to Eshet and Bouwman (2015), these apps serve as third-party programs on smartphones or wearable devices which enable users to record physical activity and access tailored health resources. Digital fitness shows a bigger

trend where technology is being used to help people live healthier lives, especially since access to gyms was limited during the pandemic.

1.2 Problem Statement

In 2024, the NCD Risk Factor Collaboration (NCD-RisC) published findings more than one billion people in the world are now living with obesity, nearly 880 million adults and 159 million children and adolescents aged 5-19 years. (World Obesity Federation, 2024) Being overweight or obese can have a serious impact on health. Carrying extra fat leads to serious health consequences such as cardiovascular disease (mainly heart disease and stroke), type 2 diabetes, musculoskeletal disorders like osteoarthritis, and some cancers (endometrial, breast and colon). Thus, developing a mobile app with the focus on diet and fitness becomes a crucial step in combating this global health issue.

A key issue is that most existing apps fail to integrate fitness and dietary planning effectively. They tend to focus exclusively on either physical activity, such as workout tracking, or dietary management, like calorie counting, forcing users to rely on multiple apps for a comprehensive health plan. This lack of integration not only complicates the user experience but also reduces long-term adherence. (AlSlaity et al, 2022)

Chatbots have shown promise in improving user engagement and dietary habits, but their current capabilities are limited (Fadhil, 2018). Most fail to adapt their recommendations based on changes in the user's health journey, such as weight fluctuations or evolving fitness levels. This lack of deep personalization reduces their effectiveness in supporting sustained healthy behaviors.

To address these challenges, a mobile app that seamlessly integrates fitness and dietary planning, offers personalized, adaptive recommendations, and leverages dynamic chatbot technologies is essential for supporting long-term health management and tackling obesity.

1.3 Objectives

- a. To provide meal recommendations that enable users to track their diet for breakfast, lunch and dinner based on users' input data.
- b. To provide users with personalized workout plans.
- c. To integrate an advanced AI-powered nutrition chatbot using Gemini API to deliver real-time, symptom-based dietary suggestions.

1.4 Methodology

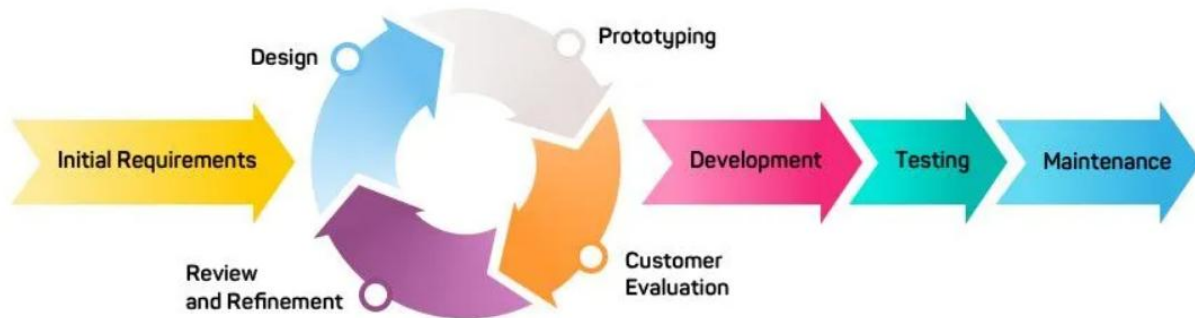


Figure 1.1: Prototyping Model

In this project, a prototype model is used to guide the development process. This methodology is particularly suitable for building an interactive mobile app, as it allows for continuous testing, feedback, and improvement. The Prototyping Model is one of the most popular Software Development Life Cycle Models (SDLC models). This model is used when the customers do not know the exact project requirements beforehand. Prototyping Methodology involves gathering initial requirements, creating a quick design, building a prototype, evaluating it with user feedback, refining the prototype, developing the system, testing it, and finally, maintaining post-deployment as shown in Figure 1.1.

1. Initial Requirements Gathering is the first step of this methodology. It involves collecting the basic requirements from stakeholders or users. This helps to understand what the system should accomplish, its key features, and the primary goals of the project.
2. The second step of prototype model is quick design. In this stage, a preliminary design of the system is created to outline the fundamental structure and flow. This is a rough design focusing on the main features to provide a foundation for the prototype.
3. Prototyping is the third stage. The initial prototype is built based on the quick design. It is a working model that demonstrates the core features and provides a visual and interactive representation of the proposed system.

4. In the fourth stage, customer feedback and suggestions are gathered and given to the developer. Users or stakeholders interact with the prototype and provide feedback on its functionality, user experience, and design. These feedback and suggestions help identify any gaps between user expectations and the current prototype.
5. If the user is not happy with the current prototype, refinement of the prototype will be conducted according to the user's feedback and suggestions. This cycle of feedback and refinement continues until the prototype aligns with user requirements.
6. Once the prototype is finalized, the actual development of the system begins. The detailed design is expanded, and the system is built to include all necessary functionalities.
7. The developed system then undergoes thorough testing to ensure that it meets quality standards, performs well, and is free of significant bugs.
8. After the system is deployed, ongoing maintenance is provided to fix issues, make necessary adjustments, and ensure that the system remains functional and relevant over time.

1.5 Project Scope

This system is designed to help individuals in Malaysia struggling with obesity by offering a comprehensive, all-in-one health management solution. Instead of juggling multiple apps for fitness tracking, meal planning, and calorie monitoring, NutriFit AI brings everything together in one place, making it easier for users to stay on top of their health.

The app is built using Flutter and Dart for smooth functionality on both Android, while Firebase is used for secure data storage and user authentication. With a strong focus on personalization, NutriFit AI offer AI-powered meal recommendations, customized workout plans, food tracking, and an interactive nutrition chatbot that provides real-time dietary suggestions based on user symptoms. Users are also have access to progress tracking features, including visual charts to monitor calorie burned after workout. Additionally, push notifications and reminders help users stay on track with their health routines, making it easier to build sustainable habits.

1.6 Significance Of Project

The development of NutriFit AI, a diet and fitness app with an AI-powered nutrition chatbot, makes a big impact on both computer science and digital health technology. This project shows how software engineering can be used to build a powerful, easy-to-use mobile app that integrates artificial intelligence. It focuses on creating a simple user interface, developing smart systems for personalized meal plans and workouts, and ensuring secure data storage and user login. These features connect to important areas of computer science, like how people interact with computers, managing databases, and the software development process.

With obesity and health problems related to lifestyle becoming more common around the world, digital health tools are more important than ever. Many people find it difficult to use different apps to track their fitness, diet, and overall health, which can be confusing and frustrating. NutriFit AI makes things easier by offering a one-stop solution, so users can manage everything in one place. The app gives personalized recommendations in real-time based on their health data, which means meal and fitness advice can adjust as their progress and needs change. This approach helps keep users motivated and focused on their long-term health goals.

By bringing together fitness and diet management with AI-powered support, NutriFit AI stands out in a market full of health apps. The app's AI chatbot, which gives personalized nutrition advice, is a special feature that improves user experience and satisfaction. Instead of offering general health tips, the app provides customized recommendations that fit each user's needs, making it easier, more interesting, and more sustainable for them to live a healthier life.

1.7 Project Schedule

FYP Project Schedule

Project start: **Wed, 10/9/2024**

Display week: **1**

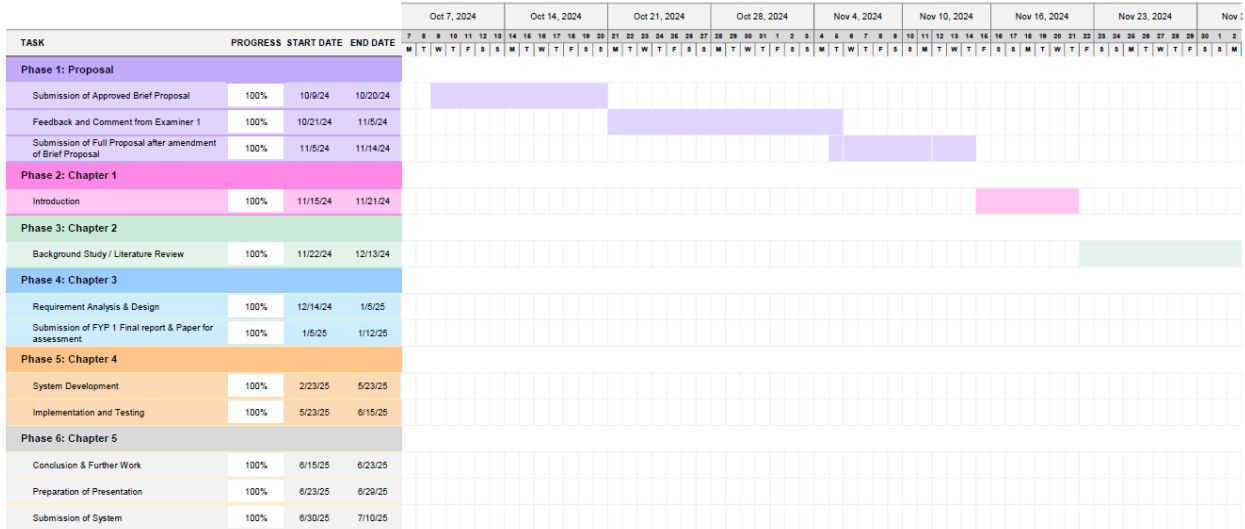


Figure 1.2: Project Schedule for Final Year Project

1.8 Expected Outcome

This Diet and Fitness mobile app will produce a comprehensive mobile platform that combines diet and fitness management, giving users access to customized meal planning for breakfast, lunch and dinner based on their individual health profiles by considering variables like BMI, weight and height.

The fitness section includes a range of exercise tutorials that users can easily follow, making it suitable for various fitness levels. The app provides different type of exercises, including warm-ups, stretches, and full-body workouts. Users can follow structured routines that encourage safe and effective physical activity, helping them to improve fitness and promote long-term health.

Users will also be able to get real-time, symptom-based food advice using the AI nutrition chatbot. For instance, if a user reports feeling fatigued, the chatbot can make health advice to user and also foods that can release their symptoms. This functionality allows the app to respond

dynamically to users' day-to-day needs, providing immediate, context-specific dietary advice to support overall wellness.

This app will also have the push notification function to keep users reminded to complete workouts, log meals, or take action on personalized diet recommendations. By integrating these features into a single platform, the app aims to solve the common problem of fragmented health management, allowing users to manage both fitness and nutrition seamlessly.

1.9 Project Outlines

This project consists of six chapters, which are **Chapter 1: Introduction**, **Chapter 2: Background Study or Literature Review**, **Chapter 3: Requirement Analysis and Design**, **Chapter 4: System Implementation**, **Chapter 5: System Testing** and **Chapter 6: Conclusion and Future Work**.

Chapter 1: Introduction

This chapter introduces the project by outlining the problem statement, objectives, methodology, project scope, significance of project, project schedule and project outcome. This chapter explains the rationale for developing the Diet and Fitness Mobile App and its importance in addressing issues like obesity and promoting healthier lifestyles. It also discusses the expected outcomes and contributions of the project.

Chapter 2: Background Study or Literature Review

This chapter delves into existing research and systems related to fitness and diet management. It critically evaluates similar apps and highlights the gaps this project aims to address, such as integrating AI-driven nutrition chatbots and providing personalized meal and fitness plans tailored to individual needs.

Chapter 3: Requirement Analysis and Design

This chapter focuses on identifying the system requirements, including functional and non-functional aspects. It details the system architecture and incorporates diagrams such as data flow diagrams, use-case diagrams, and wireframes to visualize the application's structure, functionalities, and user interactions.

Chapter 4: System Implementation

This chapter documents the development process using the Prototype Methodology. It includes the tools and technologies employed, such as Flutter and Firebase, and elaborates on how the prototypes were refined based on feedback.

Chapter 5: System Testing

This chapter outlines the testing procedures used to evaluate system performance, usability, and reliability. The results from these tests provide valuable insights into the app's strengths and areas for improvement, ensuring that it delivers a reliable and seamless experience for users.

Chapter 6: Conclusion and Future Work

This chapter summarizes the achievements of the project and assesses whether the objectives have been met. It reflects on the app's contributions to solving the identified problem and its limitations. Future enhancements, such as integrating wearable devices or leveraging machine learning for advanced personalization, are also discussed.

Chapter 2: Literature Review

2.1 Introduction

This chapter discusses the literature review on existing mobile application systems that are comparable to NutriFit AI (Diet and Fitness Mobile App with AI-Driven Nutrition Chatbot). It focuses on understanding what features are commonly offered by similar apps, how effective and user-friendly they are, and what limitations they face. Furthermore, this chapter studies about the tools and technologies including the software and hardware required to develop the proposed application.

2.2 Reviews Of Similar Existing Systems

This section discuss three similar existing mobile application systems which are MyFitnessPal, Macros and Home Workout. These three examples of current mobile apps were selected for review. Their features and functions were studied to help design a better mobile system for this project, taking inspiration from what works well and identifying areas for improvement.

2.2.1 Calorie Counter

This review talk about the existing Track as a comparable mobile application system to NutriFit AI.

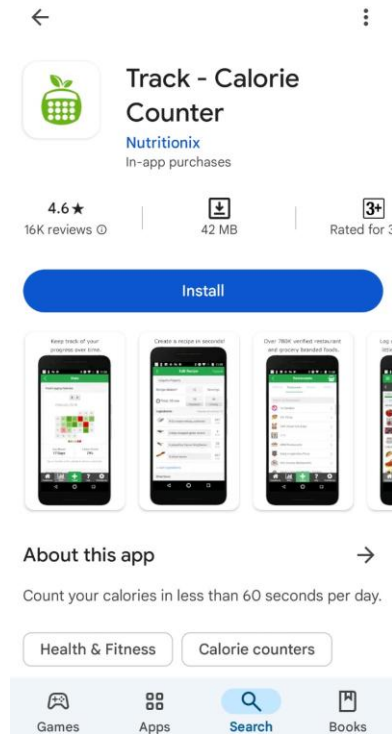


Figure 2.1: Screenshots of Installation of Track Mobile Application

Track is a fitness tracking app developed and maintained by a team of registered dietitians. Making fitness tracking a daily habit is an effective way to work towards our health goals, so the mission of the Track app is to take the heavy lifting out of keeping up with our food log. (Nutritionix, 2024). Track is a comprehensive tool for tracking food intake and exercise, focusing on ease of use and extensive nutritional data. With this app, users can track their food log as a daily habit in order to work towards their health goals. This mobile application makes the tracking process as simple as possible so that the users find it convenient to use it. By using this mobile application, users can track their food intake, nutrients intake, exercises, weight progress, calorie

intake, macro goals and water intake. The database of this app offers more than 800 thousand unique foods.

The figure consists of two side-by-side screenshots of the Nutritionix app interface.

Left Screenshot: Signup

- Optional Settings**
 - Weekday Push Notifications**: If enabled, we send a push alert at 9PM on any weekday (Mon-Fri) when you forget to log your foods. (Toggle is off)
 - Weekend Push Notifications**: If enabled, we send a push alert at 9PM on any weekend (Sat-Sun) when you forget to log your foods. (Toggle is off)
- Which nutrition topics do you follow?**
 - Pick Topics** (Blue button)
 - ☐ I agree to Nutritionix Track [Terms of Service](#) and [Privacy Policy](#)
 - ☐ I confirm that I am at least 13 years of age.
- Start Logging Foods!** (Green button)

Right Screenshot: Calculate Daily Calories

- Units**: Metric (Dropdown)
- Sex**: Female (Dropdown)
- Weight**: 52 kg (Input field with edit icon)
- Height**: 150 cm (Input field with edit icon)
- Age**: 23 years (Input field with edit icon)
- Recommended Calorie Values**
 - 1550** Maintain Current Weight
 - 1050** Lose ~0.5 kg per week
 - 2050** Gain ~0.5 kg per week
- Enter daily calorie limit:**
 - My Daily Calorie Limit:** 1500 (Input field)
- Disclaimer**: This information is for use in adults defined as individuals 18 years of age or older and not by younger people, or pregnant or breastfeeding women. This information is not intended to provide medical advice. A health care provider who has examined you and knows your medical history is the best person to diagnose and treat your health problem. If you have specific...
- Save** (Green button)

Figure 2.2: Screenshots of Notification Settings and User's Basic Information Page

Upon starting the app, the users must select a nutrition topic at the beginning depending on their preferences. The system has a push notification option that users can turn on to remind them to keep a meal diary. This feature is particularly beneficial for users who often forget to track their dietary intake due to busy schedules. Then, users need to fill in their basic information such as gender, weight, height and age. The system automatically calculate the recommended calorie values for the users, so the users do not need to be worried if they have insufficient knowledge on how to calculate the calorie intake. Furthermore, the system recommend three calories' values for users so that the users can utilize the 3 suggestions to determine their daily calorie limit.

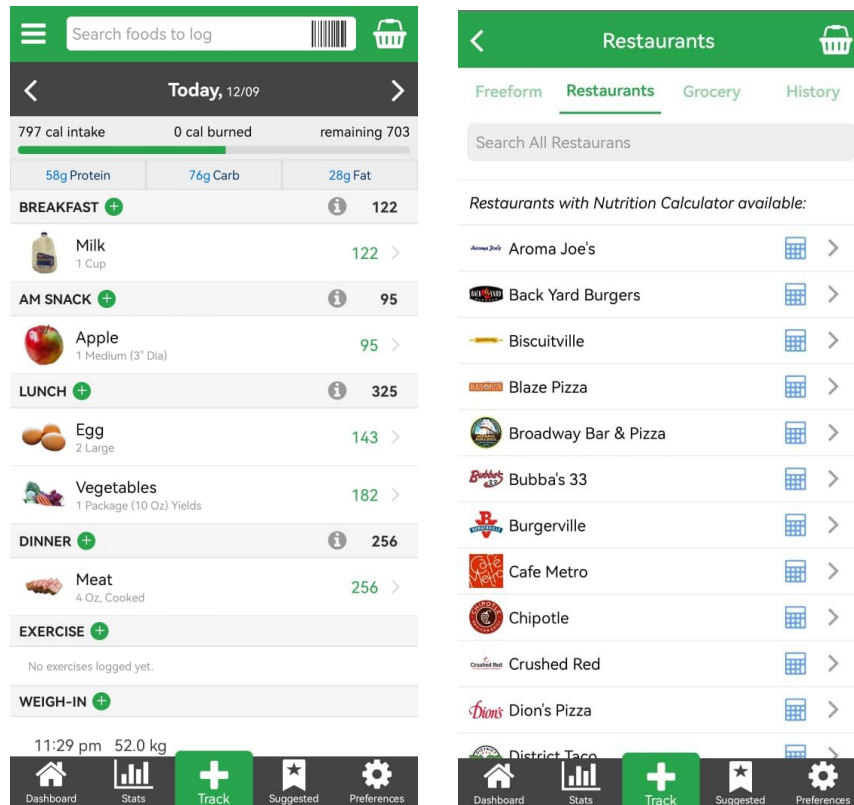


Figure 2.3: Screenshots of Food Library and List of Restaurants in Track

Furthermore, the users can easily add food to their food log by selecting items from the app's built-in restaurant menu and grocery food options. These options already include nutritional facts, so users don't need to look up information or manually enter details about their meals. This makes it much easier and faster to track what they eat for breakfast, lunch, and dinner. Manually entering food details can be tiring and time-consuming, but this app simplifies the process, making it more relaxed and convenient. This approach increases the likelihood that users will stick with logging their meals consistently. Once the food log is completed, the app will show whether the user has gone over their daily calorie limit.

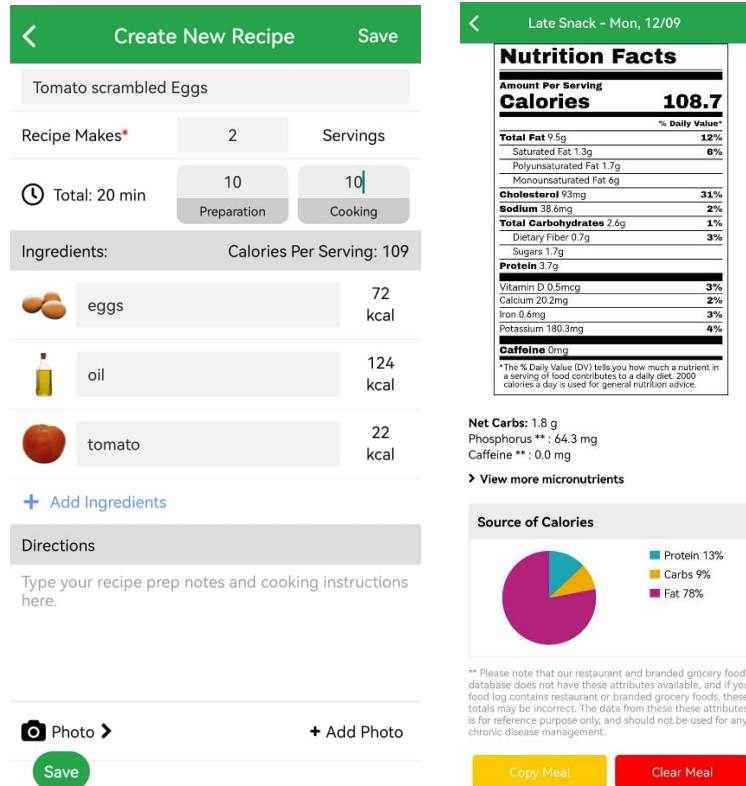


Figure 2.4: Screenshots of Adding New Recipe and Total Calories of New Recipe Page

Besides that, the users can create their own recipes in this app by adding details such as preparation time, cooking time, ingredients, and directions. The app will automatically calculate the calories per serving based on the entered ingredients, making it easier and faster to log meals without having to do additional research. The app also provides a food log calendar where users can track their meals from previous days and view their nutrition statistics. This helps them adjust their diet if necessary.

However, while the app has many useful features, it may not fully address the needs of people trying to lose weight. Although users can record their meals, this doesn't directly solve issues like obesity or being overweight. Counting calories alone might not be effective for everyone.

Additionally, the app's library of restaurant menus and grocery food items is only fully accessible to users in the United States. Users from other countries must manually add food items to their log, which can be time-consuming and inconvenient. To make the app more appealing, it could include features like a simple, personalized diet plan based on users' specific situations. Moreover, adding an AI-driven nutrition chatbot could help by offering real-time, personalized nutrition advice. This chatbot could guide users with tailored recommendations, helping them stay on track and achieve their goals more efficiently.

2.2.2 Macros – Calorie Counter

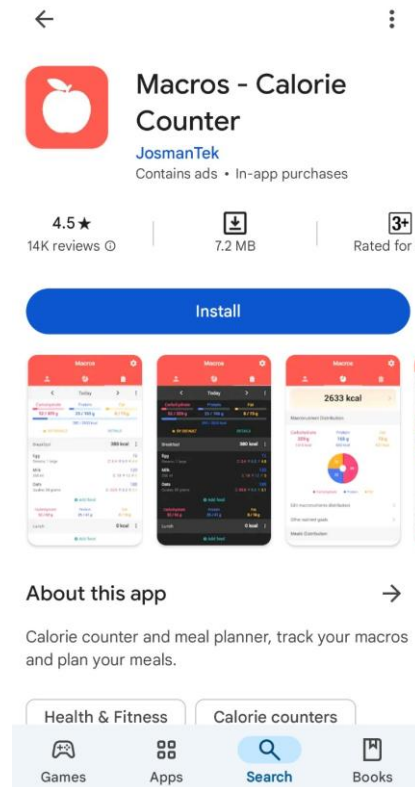


Figure 2.5: Screenshots of Installation of Macros Mobile Application

The Macros mobile application is a simple and user-friendly tool designed to help users manage their diet and track their macronutrients which are carbohydrates, fats, and proteins. Macros can be used as a calorie counter and meal planner (Josmantek, 2024). The developer introduced this mobile application to let users have a balanced diet by calculating the calories for every meal in order to reduce the problem of obesity and overweight. People who would like to have a balanced diet should utilize this mobile application to plan their diet properly and keep track of their calorie intake.

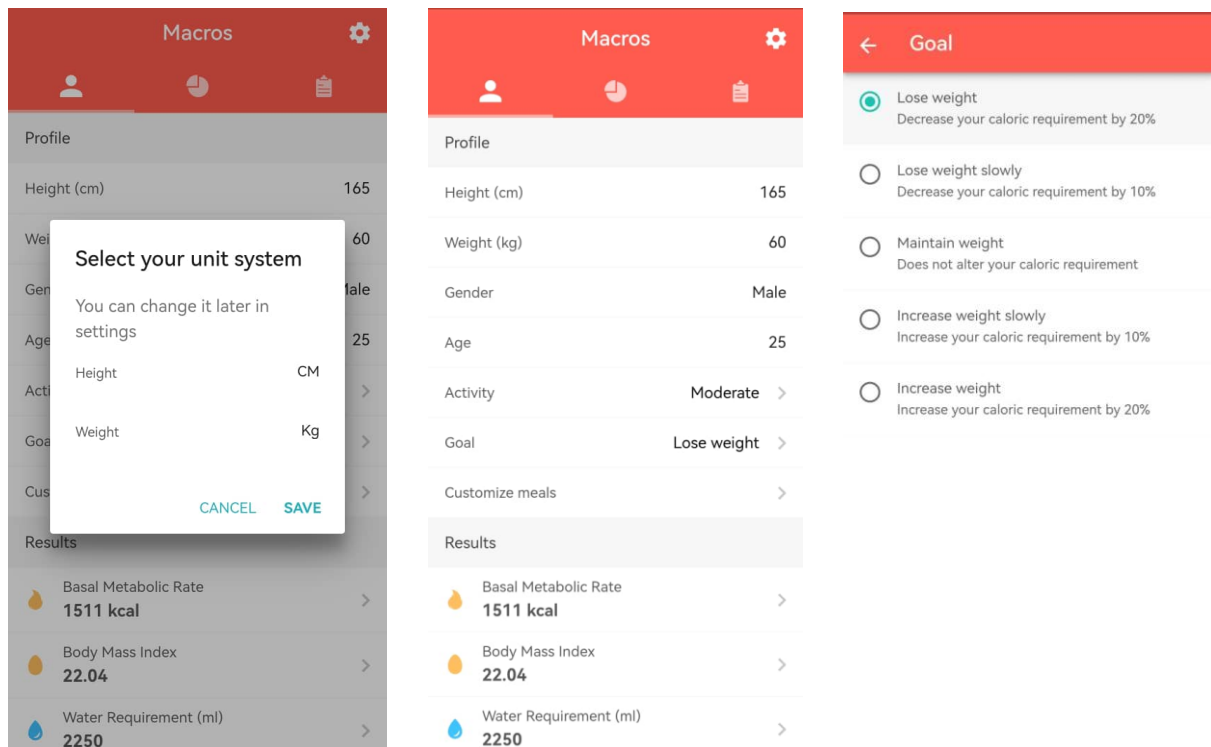


Figure 2.6: Screenshots of User's Basic Information Page in Macros

There are several main features in this mobile application. Users can calculate their caloric need, and their macronutrients based on their weight and height. Other than that, the users also need to choose their gender and age so that the system provides accurate caloric and macronutrient calculations tailored to their specific health profile. They can choose their goal whether they would like to lose weight, maintain weight or build muscle. Once the goal is selected, the app adjusts the recommended calorie and macronutrient intake, accordingly, making it easier for users to follow a structured plan that aligns with their objectives.

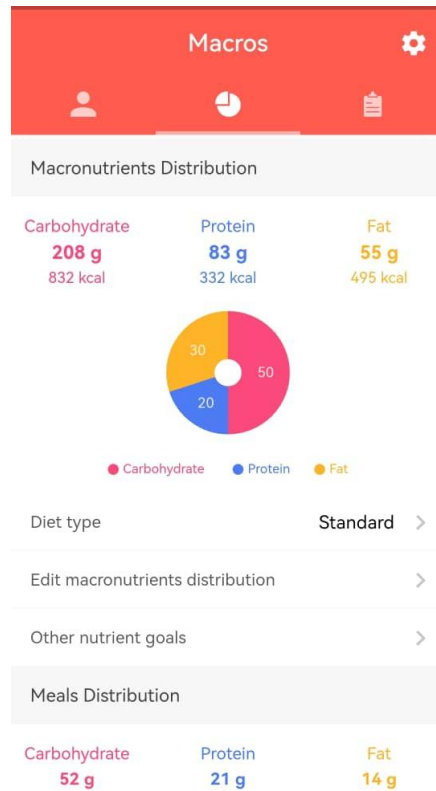


Figure 2.7: Screenshots for Intake of Macronutrients Per Day by User

Macronutrients can be divided into 3 main classes which are carbohydrate, protein and fat. These three classes of nutrients provide calories that we require to maintain our body functions and provide people with the main energy to carry out all the activities in a day. Basically, people do not really understand the calculation of macronutrients, so they can rely on this mobile application. In addition to macronutrient calculation, the app incorporates a meal distribution feature that breaks down the user's daily nutrient goals across individual meals. This ensures that carbohydrates, proteins, and fats are evenly distributed throughout the day, promoting steady energy levels and better nutrient absorption. For example, if a user needs 83 grams of protein daily, the app might allocate 21 grams for each main meal (breakfast, lunch, and dinner), with optional adjustments for snacks.

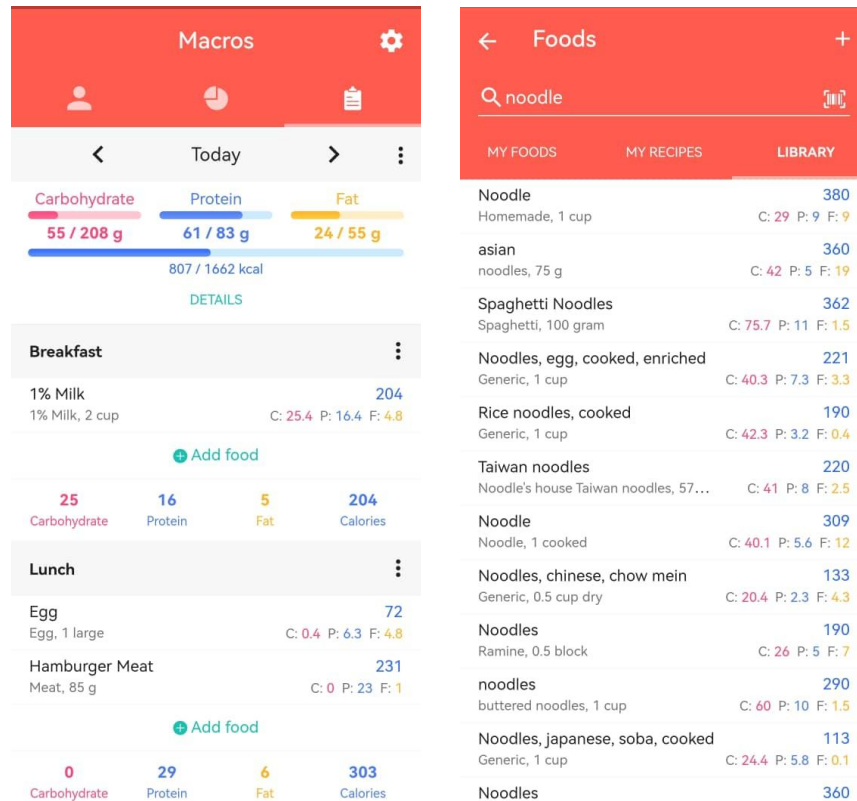


Figure 2.8: Screenshots of Adding Food from Food Library in Macros

The system will calculate the macronutrients distribution after users enter their breakfast, lunch, dinner or snacks intake. Users can utilize the meal planner function to keep track of their calorie intake. The meal planner function enables the users to design their meal by “Add food” function from the public food library. In case they could not find the food from the public food library, they can create new food and add it to their personal food library. The system will help the users to calculate the total macronutrients intake in a day and show it to users after adding food intake. This can inform users whether they have achieved their daily macronutrients target.

Although this mobile application allows users to track their daily meals, it has limitations for users who want to maintain a balanced diet. The app only lets users customize their meals, which may be challenging for those who lack the knowledge to create a nutritionally balanced plan. This might make the app less useful for such users. It would be better if the app could offer a variety of balanced diet plans for users to follow.

For obese people, this mobile application alone might not be enough to achieve significant weight loss. While controlling diet is an essential step in addressing obesity, combining it with regular exercise can lead to more effective and sustainable results. Unfortunately, this app does not include any exercise-related features, which might make it inconvenient for users who want a complete solution. Users may find it tedious if they need to use several apps to lose weight.

As a suggestion, a feature which can provide a variety of diet plans can be developed. As an illustration, the developer can seek nutritionists' advice to prepare some balanced diet plans based on different situations, so the developer can adopt it to develop a feature that is useful for users who do not have any idea on meal planning. It is recommended to integrate an exercise feature into the mobile application as users would prefer to use only one application rather than use multiple applications. Developing a complete exercise feature will make the mobile application more useful to solve users' problems. Additionally, integrating an AI-driven chatbot could provide users with personalized nutrition advice and real-time recommendations, further enhancing their experience and helping them stay on track with their fitness journey.

2.2.3 Home Workout – No Equipment Required

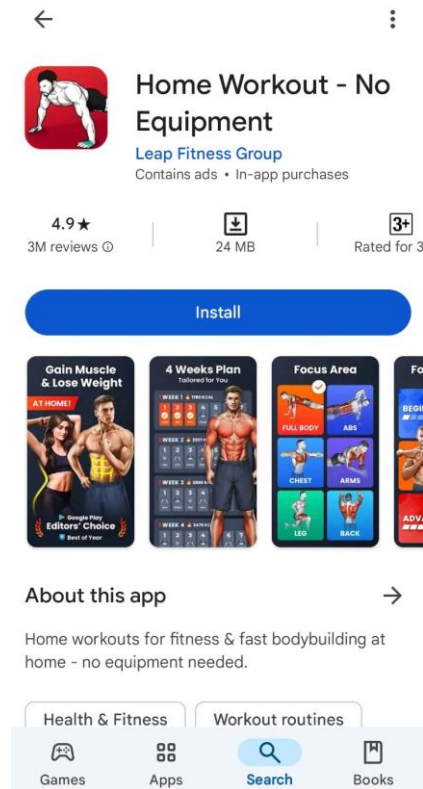


Figure 2.9: Screenshots of Installation of Home Workout Mobile Application

Home Workout is a mobile application that offers a variety of workouts and plans suitable for everyone, from fitness beginners to experts (AppAdvice, 2024). Home Workout provides daily workouts for all the major muscle groups in our body. In just a few minutes a day, the users can build muscle and get in shape at home without going to the gym. All exercises can be done with their own body weight, without any equipment or a gym trainer. It contains abs workout, chest workout, legs workout, arms workout and butt workout. To prevent users getting injury, warm-up exercise for pre-workout and stretching for post-workout are provided in the app. With the help of this app, users can perform the workout in a scientific way.

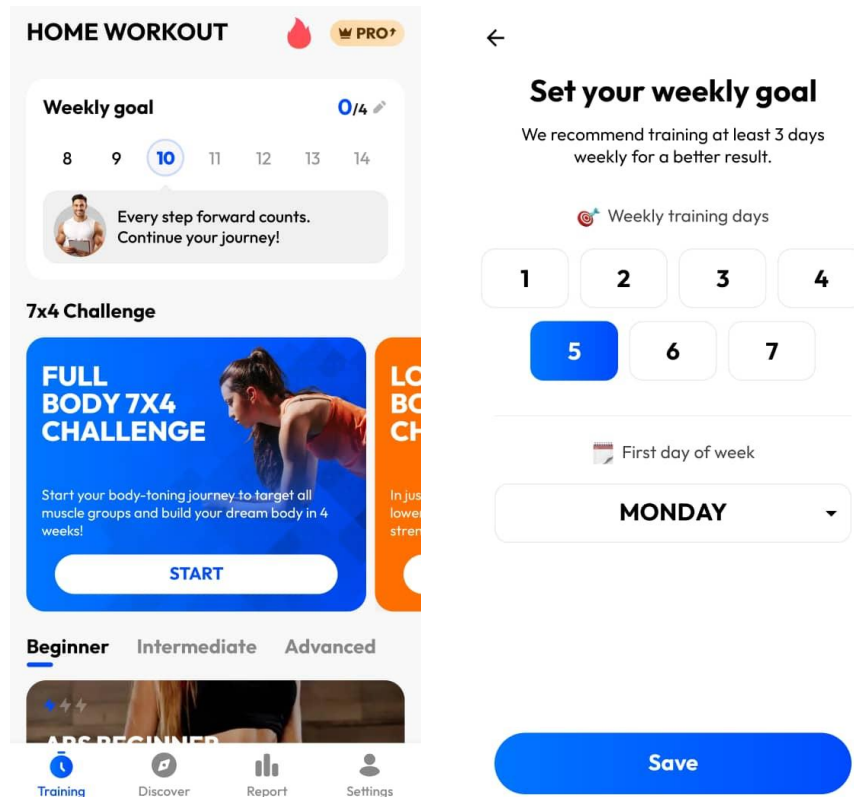


Figure 2.10: Screenshots of Home Page and Adding Weekly Goal Page

There are several features for users to enjoy using this app. There are videos and animation guides to be watched by users. Among the workout types provided are bodyweight training exercises, such as push-ups, squats, and planks. Additionally, the app includes fat-burning routines, often using high-intensity interval training (HIIT) and cardio exercises to boost metabolism and burn calories. There are also strength training, core workouts, leg and glute exercises, flexibility routines, full-body workouts, and muscle-building exercises, all designed to improve fitness without the need for special equipment. However, it is challenging for users to maintain interest in working out. This app allows users to set up a weekly goal, so that they can achieve it and reach their goal.

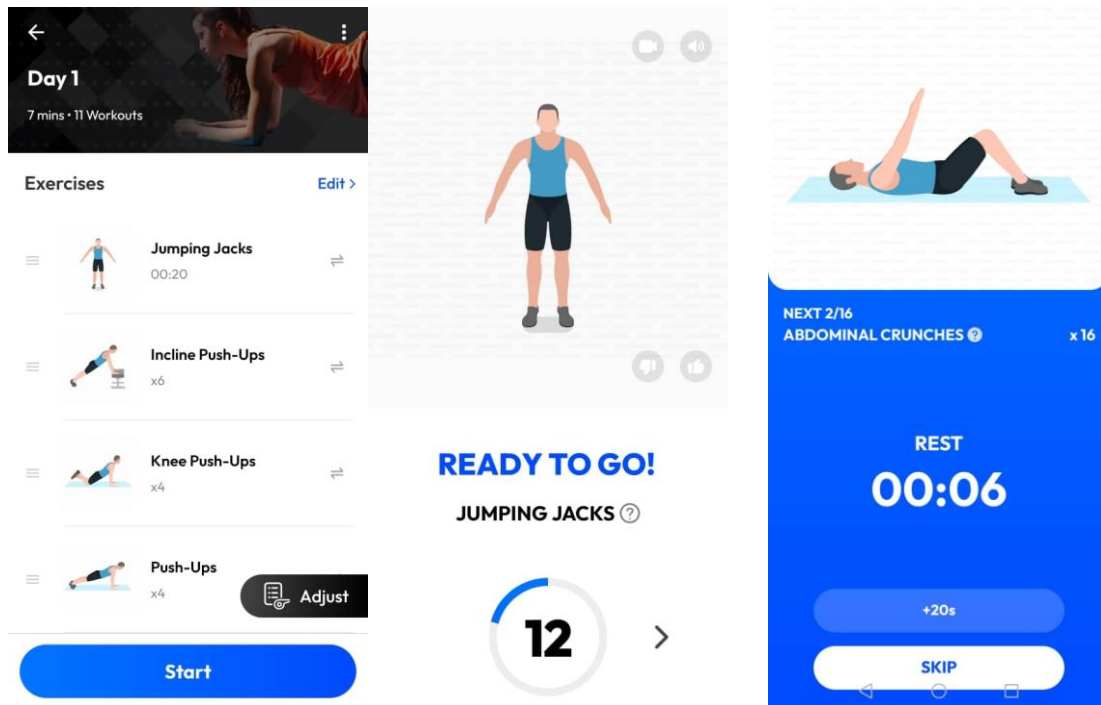


Figure 2.11: Screenshots of Exercise Activity and Tutorials for Every Workouts Page

There are several exercises in each session. Each of the exercises shown in the animation. By watching the animation, users can easily follow along with each exercise. The app features a countdown timer for each workout, and once one exercise is completed, the next one starts automatically. Rest times are included between each workout to allow users to relax. The app offers different workout levels, enabling users to choose the one that best matches their fitness level. This makes the experience fun and enjoyable, as users can progress at their own pace.

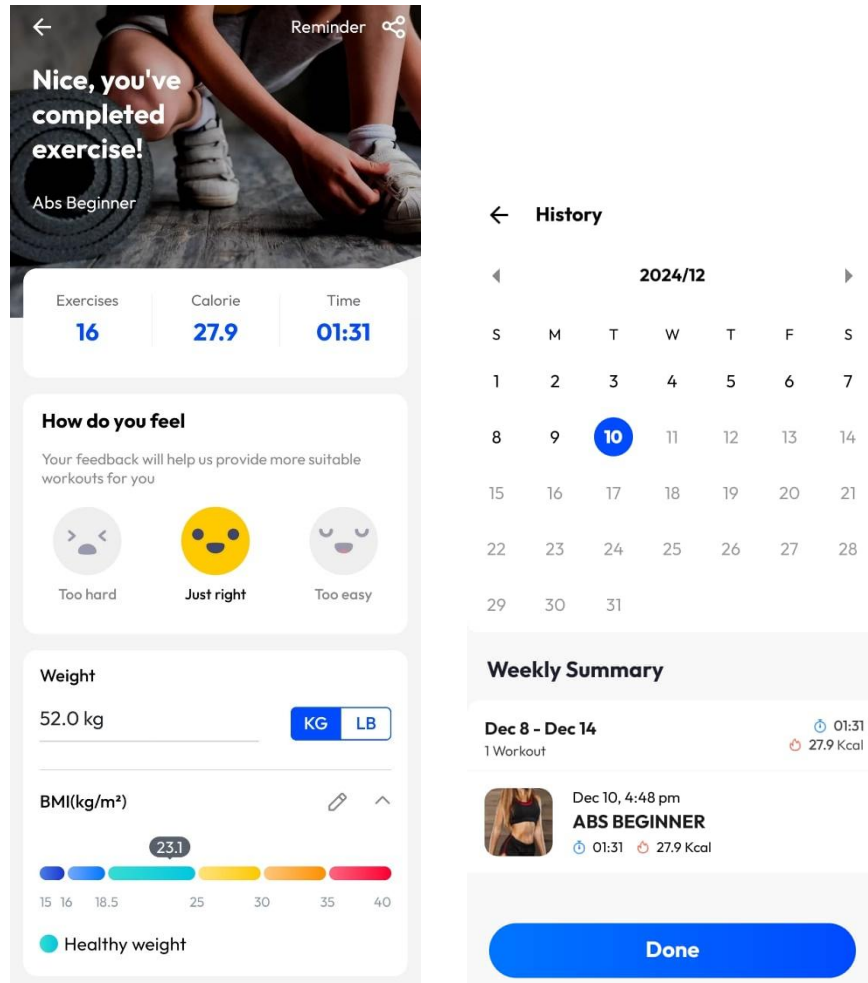


Figure 2.12: Screenshots of Summary Page After Completing All Workout Tutorials in One Session

Once users complete a workout session, the app shows how many calories they've burned. They can also share their achievements on social media and invite friends to join, making the workout experience more fun. For users who have been using the app for several days or months, the app allows them to track all the workouts they've done. It keeps a record of their total accumulated exercise, which they can refer to later for motivation and planning.

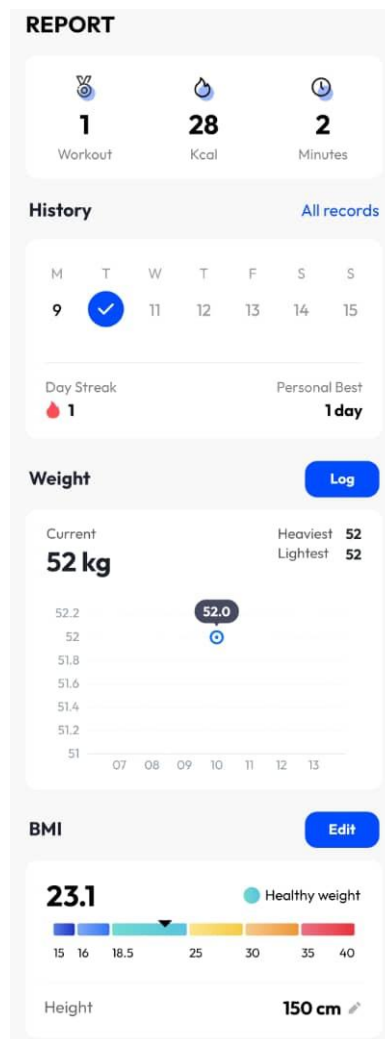


Figure 2.13: Screenshots of Daily Report of User Page

Additionally, the app provides a chart in the report section to track the user's weight progress. Users can easily share this information with friends on social media. The report also includes details about the number of workouts completed, calories burned, and the total time spent exercising.

The Home Workout mobile app is a great tool for those looking to exercise at home. It offers a variety of workouts for users to follow. Although the app provides several workouts for users, for those who do not have a proper direction on exercise, they may not be able to achieve the desired results for weight loss. Therefore, it is only useful to those people who have proper

knowledge on weight loss. Moreover, exercise cannot drive significant weight loss. Meaning to say people only using this app may not be able to tackle the problem of obesity or overweight. Diet also plays a crucial role in weight loss, but unfortunately, this app does not offer any features related to diet management.

It would be great if the app included diet-related features as well. Nutrition is essential for living a healthy life, and incorporating these features would greatly enhance the app's overall value. With both exercise and diet functions, users could follow a well-rounded routine, making it easier to achieve their fitness goals using just one app.

2.3 Comparison Of Features Among Different Systems

When comparing the features of the Track, Macros and Home Workout to NutriFit AI, it is important to consider the specific needs and requirements. Table 2.1 will compare all three of the existing mobile application system with NutriFit AI.

Table 2.1: Comparison of the Features, Strengths, Weaknesses of the Three Similar App

Category	Track	Macros	Home Workout
Features	- Tracks food intake, nutrients, exercise, weight, calorie intake, and water intake. - Push notifications. - Restaurant food library.	- Calorie counter. - Macronutrient tracker. - Food library with user customization options (User can create their own food.	- Variety of workouts. - Animations that guide the lessons of exercising - Calorie tracking - Progress sharing.
Usability	- Comprehensive but mainly for U.S people. - Easy to use. - Auto calorie calculation.	- User-friendly. - Calculates caloric and macronutrient needs	- Beginner to expert-level workouts. - Social sharing for motivation.
Strengths	- Extensive food database. - Push notifications.	Focus on macronutrient distribution.	Covers a wide range of exercises.

	• Easy logging.	• Clear calorie goals.	• No equipment needed. • Tracks workout progress.
Weaknesses	• Limited global usability. • Calorie counting alone may not address obesity.	• Lacks built-in balanced diet plans. • No integration with exercise features.	• No diet-related features • Exercises alone may not be effective for weight loss.

Table 2.2: The Comparison Among Three Similar Existing System

Features	Track	Macros	Home Workout	NutriFit AI
Meal Plans Recommendation by System according to user input data using AI	✗	✗	✗	✓
Able to add, edit or delete BMI, weight and height	✓	✓	✗	✓
Able to add, edit or delete food from Food Library	✓	✓	✗	✓
Able to display graph or chart showing the daily calorie burned	✓	✓	✗	✓
Able to display the calorie burnt in workout history for workout section	✗	✗	✓	✓
Able to choose specific exercises they want to perform	✗	✗	✓	✓
Push notification	✓	✓	✓	✓
AI Nutrition Chatbot	✗	✗	✗	✓

Table 2.1 compares the features of three existing diet and fitness mobile applications (Track, Macros, and Home Workout) against the NutriFit AI. The comparison highlights key functionalities such as meal tracking, food logging, workout integration, calorie monitoring, push notifications, and AI-driven assistance.

From the table, it is clear that Track and Macros focus primarily on diet tracking, allowing users to log meals from food library. However, they lack workout sections, making them less comprehensive for users who want a holistic fitness solution. On the other hand, Home Workout

specializes in exercise routines but lacks any meal-tracking functionalities, making it unsuitable for users who want an all-in-one diet and fitness solution.

NutriFit AI was designed to address these gaps by integrating both meal tracking and workout functionalities into a single app. Unlike the existing apps, it features an AI-powered chatbot that provides personalized meal recommendations and real-time health advice based on user input. Additionally, NutriFit AI includes features from all three apps, such as graphical calorie tracking, customizable meal plans, and exercise selection, making it a more well-rounded health management tool.

This comparison influenced the design of NutriFit AI by emphasizing the need for an all-in-one solution that seamlessly integrates diet, fitness, and AI-driven nutrition guidance. By incorporating the best features of existing applications while addressing their limitations, NutriFit AI offers users a more personalized and engaging health management experience.

2.4 AI In Meal Recommendations

AI is a technology that allows machines and computers to imitate various skills/activities of a human being such as learning processes, understanding concepts, solving problems, making decisions, showcasing creativity and autonomy (IBM., 2024). Applications and devices with AI can recognize objects, understand and respond to human language, learn from experience, and provide detailed suggestions for users and experts. They can act independently, replacing the need for human intelligence or intervention.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing data for correlations and patterns, and using these patterns to make predictions about future states. In general, AI systems work by ingesting large amounts of labeled training data, analyzing data for correlations and patterns, and using these patterns to make predictions about future states. For example, an AI Chatbot that is fed examples of text can learn to generate lifelike exchanges with people. (Craig et al., 2024)

Artificial Intelligence (AI) powers meal recommendation systems by leveraging data-driven algorithms to create personalized and dynamic dietary suggestions. The process begins with the collection of user-specific information, including weight, height and dietary preferences. This data is used to build a unique nutritional profile for each user, which acts as the foundation for tailored meal recommendations. APIs such as Spoonacular and Edamam play a significant role in this process by providing access to extensive food databases, including nutrient compositions and recipes. These APIs enable the system to analyze user preferences and identify the most suitable meal options. The system queries these APIs to generate meal suggestions based on the user's preferences and nutritional needs. As the user interacts with the system, meal suggestions can be adjusted in real-time, reflecting any updates in the user's dietary preferences or goals.

By incorporating nutritional standards from these APIs, the recommendations ensure an optimal balance of macronutrients like carbohydrates, proteins, and fats. This direct integration of APIs provides a reliable and efficient method for meal planning without the need for complex machine learning models.

Dynamic meal planning is a key feature of AI in meal recommendations. The system can adjust suggestions in real-time based on updates such as dietary preference changes. Additionally, AI integrates nutritional guidelines to ensure that recommended meals meet the optimal balance of macronutrients, including carbohydrates, proteins, and fats. This blend of personalization and adherence to health standards sets AI apart as a reliable tool for dietary management. (Malve et al, 2024)

2.5 AI In AI-Nutrition Chatbot

AI-powered chatbots for food suggestions use advanced technologies to provide personalized dietary recommendations based on users' health symptoms. Instead of using complex machine learning models, the chatbot leverages APIs like Gemini API to process user inputs, interpret health-related data, and generate actionable advice in real time. The chatbot collects user inputs, such as symptoms (e.g., headache, fatigue), and uses the API to analyze these symptoms and provide relevant dietary recommendations.

The Gemini API accesses extensive health and nutrition databases, which include information about macronutrients, micronutrients, and their effects on various health conditions. Based on the symptoms reported by the user, the API returns tailored dietary suggestions. For instance, if a user reports fatigue, the chatbot might suggest foods rich in iron, magnesium, or energy-boosting nutrients like bananas or whole grains. This direct integration of the Gemini API

allows the chatbot to provide instant, accurate recommendations without the need for complex processing or machine learning models.

By relying on the Gemini API, the chatbot offers a comprehensive solution for dietary management based on health symptoms. This system not only helps address immediate nutritional needs but also supports long-term adherence to healthier eating patterns by offering personalized and relevant guidance.

2.6 How Do AI Nutrition Chatbot Implement In Nutrifit AI

The NutriFit AI chatbot is powered by the Gemini API, an advanced AI tool designed to understand and generate human-like responses, making it an ideal choice for a nutrition assistant. Rather than providing generic answers, the chatbot is programmed to respond only to symptom-related questions by identifying specific keywords in the user's input. Users can ask questions related to health symptoms, and the chatbot will generate tailored advice based on the symptoms entered.

One of the primary strengths of the Gemini API-powered chatbot is its ability to analyze symptom-related queries. The chatbot is programmed to recognize keywords related to health concerns, such as "headache," "fatigue," "bloating," and others. When a user enters a symptom-related query, the chatbot cross-references these keywords with a symptom-based food database and provides meal suggestions that may help alleviate the reported symptoms.

The chatbot's design ensures that it stays focused on symptom-related queries by filtering out non-relevant questions. This is done through keyword recognition in the code, where the system only processes queries containing recognized symptoms or health concerns. If a user asks about

food for a general health question or meal preference, the chatbot will not generate a response unless the query includes specific symptoms.

To improve the accuracy of its responses, the chatbot is further enhanced by fine-tuning the Gemini API with nutrition-specific datasets. It integrates structured rule-based responses for meal suggestions and calorie tracking, combining both conversational guidance and scientifically backed nutritional information.

Through this approach, the NutriFit AI chatbot ensures a focused, accurate, and personalized experience for users seeking dietary advice based on specific health symptoms. As the chatbot learns from past interactions, it continues to refine its suggestions to better meet the user's needs.

2.7 Summary

In summary, Home Workout emphasizes exercise routines and calorie burn tracking but lacks diet-related features. Macros specializes in macronutrient tracking and recipe creation, whereas Track provides basic tools for managing BMI and food logs. Overall, each app caters to specific user needs, but NutriFit AI offers a more balanced approach to achieving fitness and healthy living goals. The tools and technologies needed to develop the app were also carefully reviewed and explained in the sections about software and hardware.

Chapter 3: Requirements Analysis And Design

3.1 Introduction

This chapter will cover the system requirements analysis and design phase of the project. The prototype model is used throughout the entire development process of this project, including the system requirements analysis and design phase.

For this project, a mobile application has been developed. An overview of the app's design and functionality will also be included. This provides a clear preview of how the application will look and operate. Additionally, a system architecture and use case diagram are included to illustrate the structure and interactions within the system. These diagrams will help visualize the relationships between components and how users interact with the application.

3.2 Project Development Methodology

For this project, the prototyping approach was used to develop the mobile app. This methodology was selected due to its flexibility and ability to incorporate user feedback at various stages of development, ensuring the final product aligns with user needs and expectations.

3.2.1 Prototype Model

The prototype model is a software development approach that involves creating a preliminary version of the final product, called a prototype. System prototypes allow users to see how well the system supports their work. As the prototype is developed, it may reveal errors and omissions in the requirements that have been proposed. A function described in a specification may seem useful and well defined. (Sommerville, 2011)

The prototype will include the most essential features of the app, such as calorie and macronutrient tracking, and personalized recommendations based on user input like weight, height,

and health goals. Based on user feedback, additional features will be added, and the prototype will be refined until the final product is completed.

3.3 Requirements Analysis of The Proposed System

This section outline the requirement analysis for the proposed system, focusing on both functional and non-functional requirements. Functional requirements define the essential features and capabilities of the mobile application. Non-functional requirements specify the performance, reliability, usability, and scalability standards the system must meet to ensure a seamless user experience. The questionnaires were administered to collect data for the system requirements.

3.3.1 Analysys Of the Current Fitness and Diet Situations

The project's idea comes from the fact that most of the current fitness and diet apps focus exclusively on either physical activity, such as workout tracking, or dietary management, like calorie counting, forcing users to rely on multiple apps for a comprehensive health plan. Besides that, people face challenges in achieving their health goals, such as lack of motivation, not enough time, lack of fitness or dietary knowledge, difficulty in meal preparation or physical limitations.

Furthermore, current fitness and diet apps does not have AI assistant for them to guide users in real-time, making it harder for them to receive personalized advice. They often must spend time searching for information or asking others for help, which can be frustrating and discouraging.

3.3.2 The Proposed Solutions

After analysing the problem, the main issue of NutriFit AI is the lack of an all-in-one application that seamlessly integrates fitness and diet management with personalized recommendations. Many users struggle with fragmented tools that either focus on fitness or dietary tracking, making it challenging to achieve their health goals consistently. NutriFit AI aims to unify

all related features into one app, simplifying the process for users who wish to manage their fitness, nutrition, and health effectively.

The app would allow users to log their meals, track their workouts, and monitor their calorie intake and burned calories all in one place. It would also provide personalized meal recommendations based on user inputs which are weight, height, and calculated BMI. Additionally, the app would feature an AI-driven nutrition chatbot that offers real-time, symptom-based dietary advice and suggestions to release the symptoms. This feature ensures users receive tailored support throughout their health journey.

NutriFit AI would also include a statistic module where users can view weight changes and calorie trends through the chart. This feature would help users stay motivated by providing a clear visualization of their progress. Furthermore, the app would incorporate a notification system to remind users about meals and workouts. This can ensure the user stays on track with their health goals.

3.3.3 Requirement Elicitation

In this project, questionnaires are used to collect system requirements analysis. The questionnaires are designed to gather insights into user preferences, challenges, and expectations for a fitness and diet app. Key areas covered include features users find most important, the needs of AI Chatbot, and the types of support they need to achieve their health goals. The targeted respondents are the public, particularly individuals who are interested in fitness, healthy eating, and improving their overall lifestyle. A total of 66 respondents were chosen to distribute the surveys. The questionnaire's design had been carefully studied to ensure that it properly collects

the required information. This might include questions on the respondents' existing experiences with fitness and diet app and their desired app features and functionality.

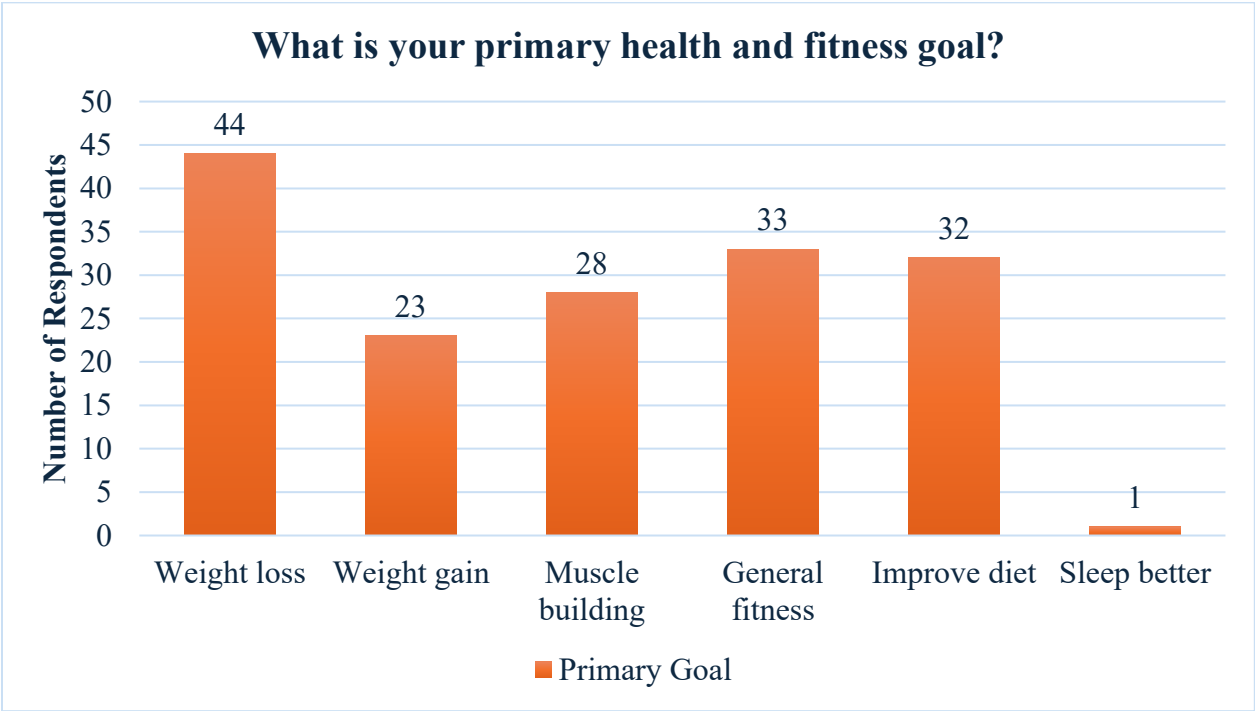


Figure 3.1: The Questionnaires - What is your primary health and fitness goal?

According to Figure 3.1, the primary health and fitness goal for most respondents is weight loss, with 44 individuals selecting this option. This is followed by general fitness, chosen by 33 respondents, and improving their diet, selected by 32 respondents. Muscle building is the goal for 28 respondents, while 23 respondents aim for weight gain. Lastly, only one respondent indicated their primary goal as sleeping better. This distribution highlights that weight loss, general fitness, and dietary improvement are the most common goals among the participants.

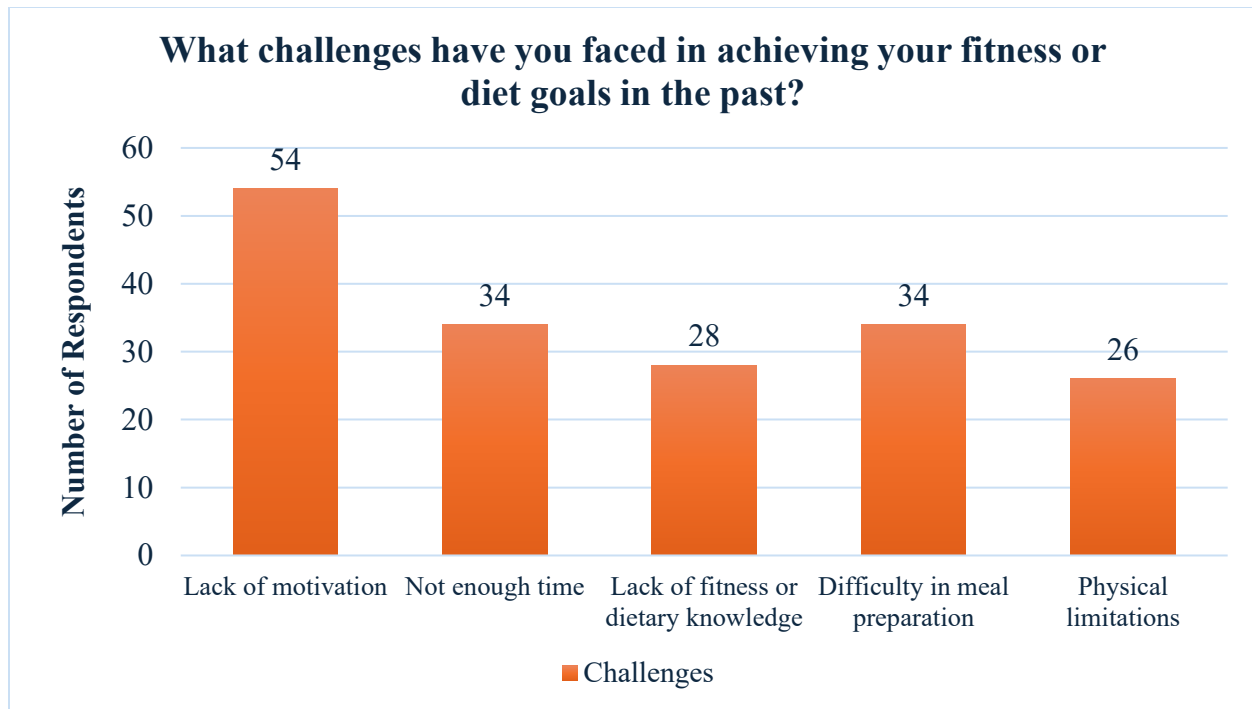


Figure 3.2: The Questionnaires - What challenges have you faced in achieving your fitness or diet goals in the past?

Figure 3.2 shows that most of the respondents lack motivation in achieving their fitness or diet goals in the past, which are 54 respondents. Both not having enough time and difficulty with meal preparation were problems for 34 respondents each. Meanwhile, 28 respondents struggled with not knowing enough about fitness or diet, and 26 respondents mentioned physical limitations. This shows that motivation, time, and meal preparation are the main difficulties for most people.

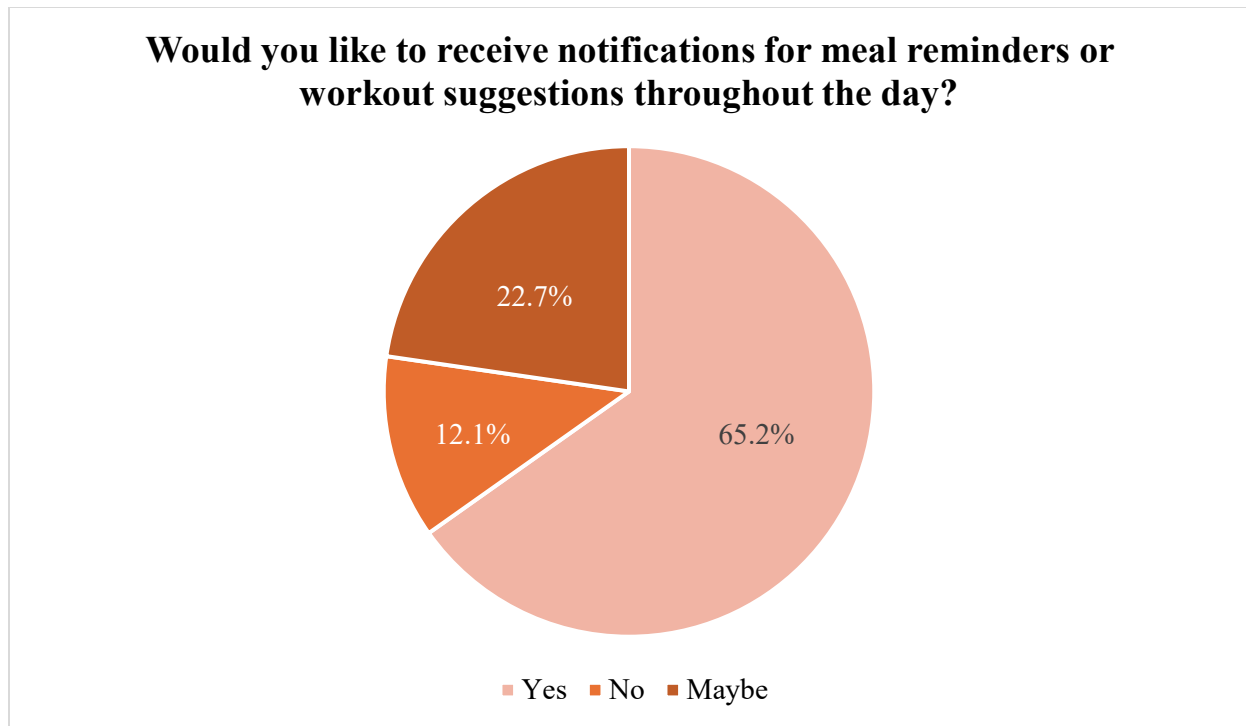


Figure 3.3: The Questionnaires - Would you like to receive notifications for meal reminders or workout suggestions throughout the day?

The pie chart of Figure 3.3 shows responses to whether respondents would like to receive notifications for meal reminders or workout suggestions. The majority, 65.2% (43 respondents), answered "Yes," indicating a strong interest in receiving notifications. Meanwhile, 12.1% (8 respondents) said "No," and 22.7% (15 respondents) were unsure, selecting "Maybe." This suggests that most users find notifications helpful for staying on track with their fitness and diet goals.

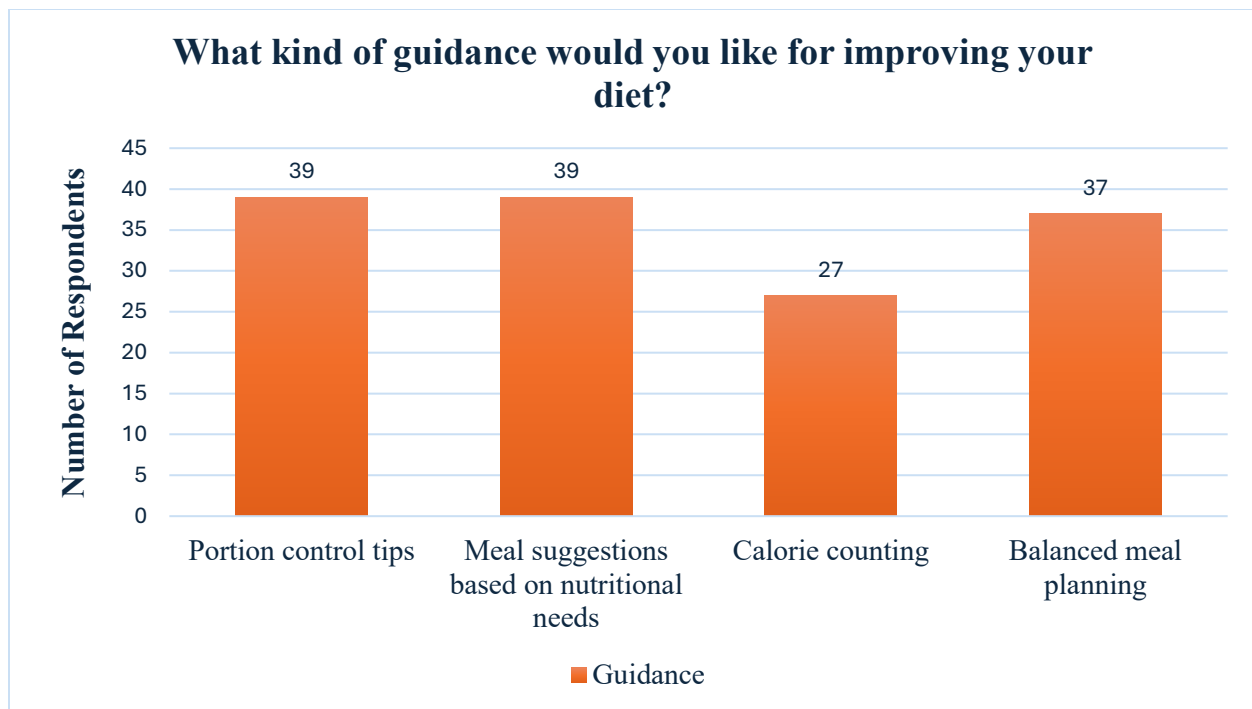


Figure 3.4: The Questionnaires - What kind of guidance would you like for improving your diet?

The figure shows the types of guidance users want to improve their diet. The most popular choices, with 39 respondents each, are portion control tips and meal suggestions based on nutritional needs. Balanced meal planning is also a popular option, chosen by 37 respondents. Calorie counting is the least selected, with 27 respondents, but it's still important. This indicates that users are more likely to prioritize portion control tips and personalized meal suggestions for better dietary management.

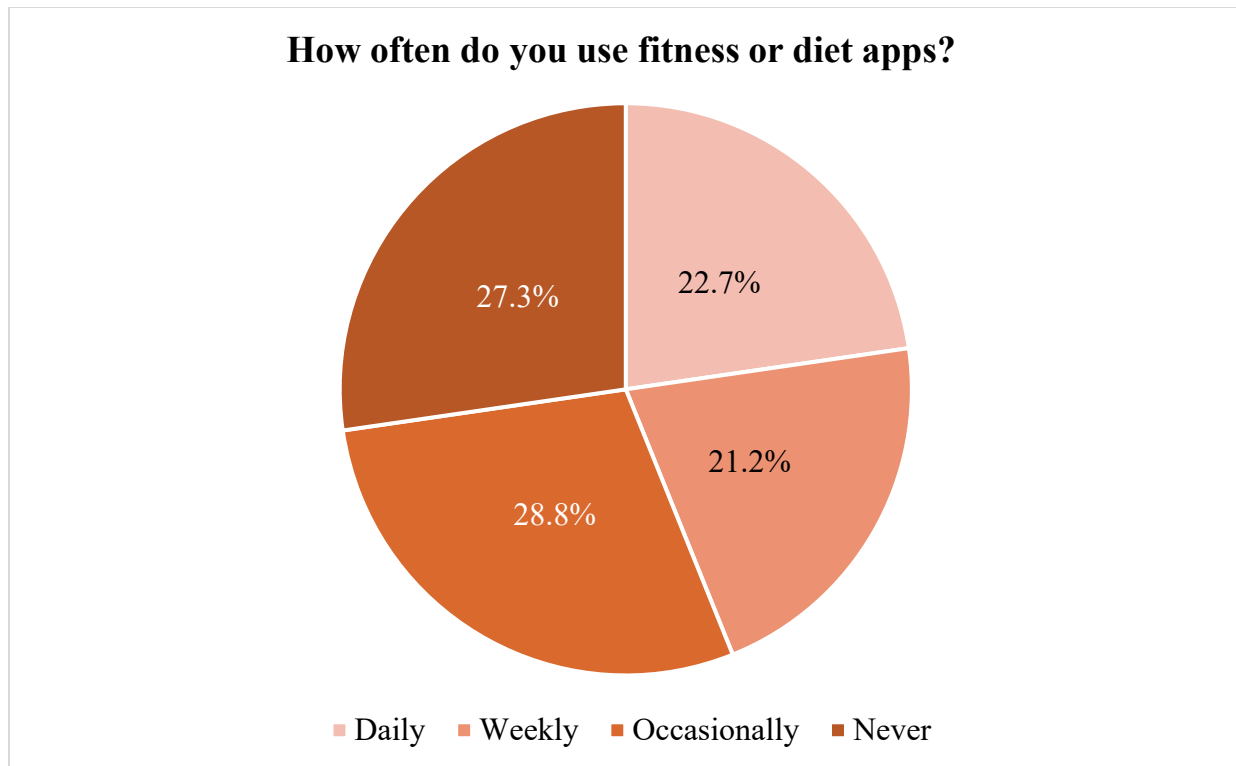


Figure 3.5: The Questionnaires - How often do you use fitness or diet apps?

Figure 3.5 shows how often users engage with fitness or diet apps. The largest group, 19 respondents (28.8%), use the fitness or diet apps occasionally. This is followed closely by those who never use these apps, with 18 respondents (27.3%). Similarly, 18 respondents (22.7%) use fitness or diet apps daily, while 14 respondents (21.2%) use them weekly. These results show that many users do not use fitness or diet apps regularly. This might imply that a smartphone app for health monitoring and workouts management would be well-received because it would be convenient and accessible to them.

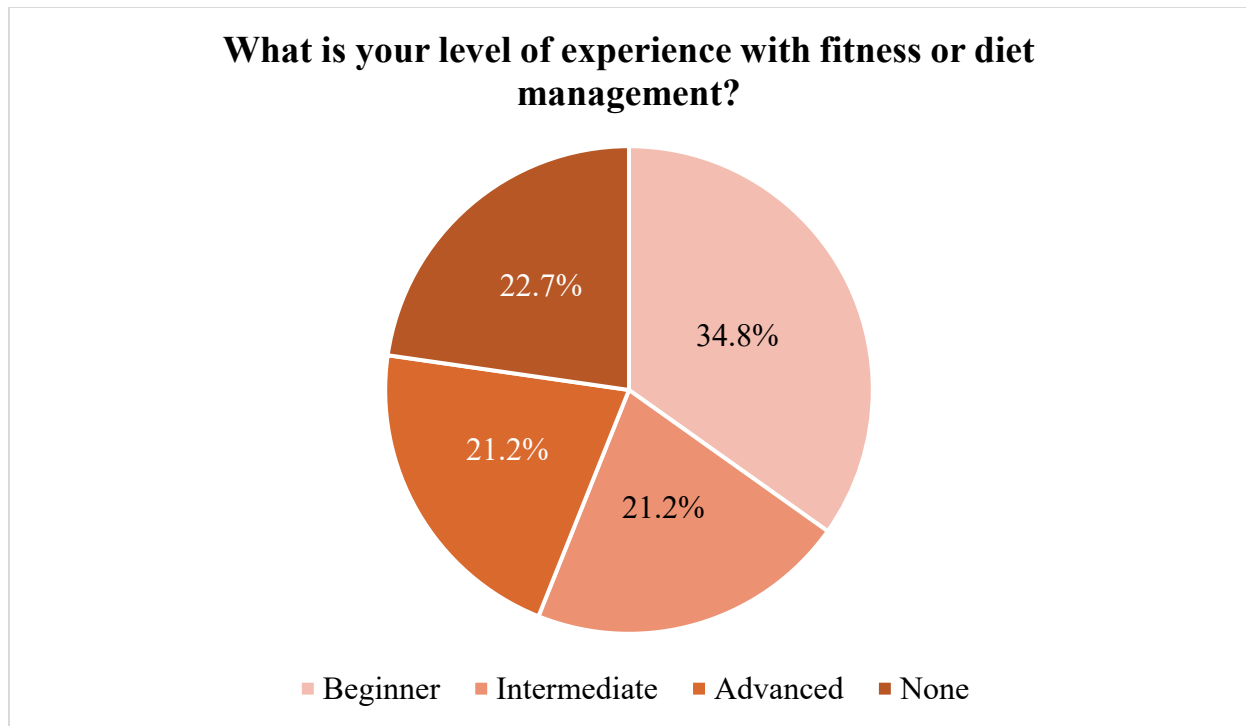


Figure 3.6: The Questionnaires - What is your level of experience with fitness or diet management?

Figure 3.6 presents the level of experience users have with fitness or diet management. The largest group, 23 respondents (34.8%), consider themselves beginners in fitness or diet management. This is followed by 14 respondents (21.2%) each identifying as having an intermediate or advanced level of experience. Additionally, 15 respondents (22.7%) reported having no experience in fitness or diet management. This suggests that most users are either beginners or have no experience, which means an app with simple user interface can be designed for users and could be very helpful.

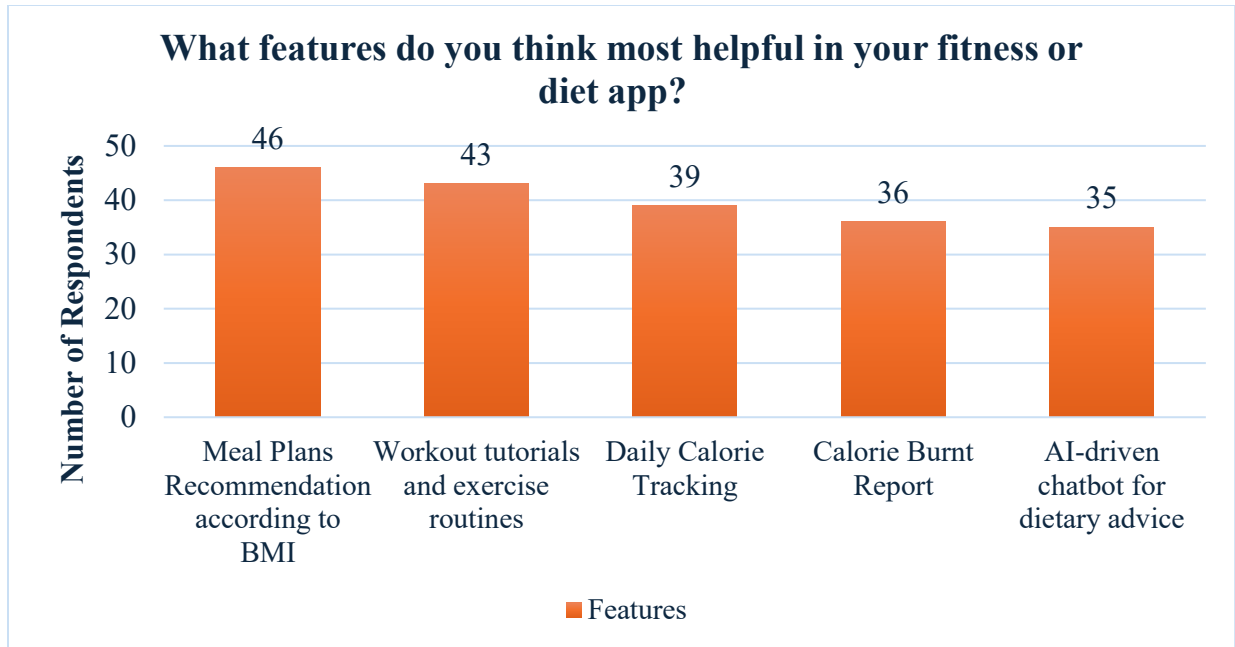


Figure 3.7: The Questionnaires - What features do you think most helpful in your fitness or diet app?

Figure 3.7 shows the features that users find most helpful in a fitness or diet app. The most popular feature is meal plan recommendations based on BMI using AI, which 46 respondents chose. Next is workout tutorials and exercise routines, selected by 43 respondents. Daily calorie tracking is important for 39 respondents, while 36 respondents find calorie burnt reports helpful. Lastly, 35 respondents would like an AI-driven chatbot for dietary advice. These results show that all the features above are important for users to go to their healthy journey. The high demand for AI-driven features, such as meal plan recommendations based on BMI and a chatbot for dietary advice, suggests that users are looking for smarter, more tailored solutions. Additionally, the interest in workout tutorials, exercise routines, and progress tracking features highlights the need for a comprehensive app that not only helps users track their food intake but also supports their fitness journey. These findings indicate that a fitness or diet app with a variety of helpful features would be well-received by users.

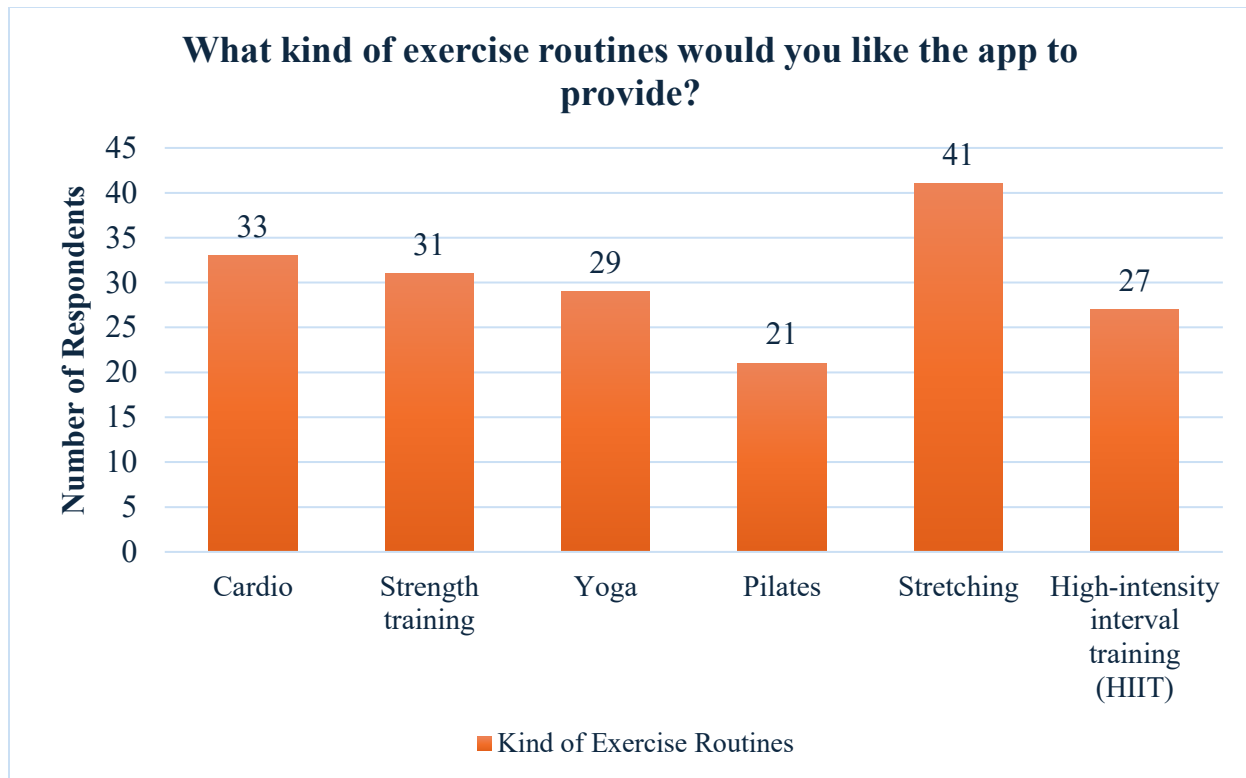


Figure 3.8: The Questionnaires - What kind of exercise routines would you like the app to provide?

Figure 3.8 shows the types of exercise routines users would like the app to provide. The most requested type is stretching, chosen by 41 respondents (62.1%). Cardio exercises are also popular, selected by 33 respondents (50%). Strength training is desired by 31 respondents (47%), while 29 respondents (43.9%) would like yoga routines. Pilates is preferred by 21 respondents (31.8%), and high-intensity interval training (HIIT) is chosen by 27 respondents (40.9%). These results indicate that all the exercise types are important to users, with stretching and cardio exercises being the most popular. The variety of preferences suggests that an app offering a wide range of exercise options would cater to the diverse needs of users.

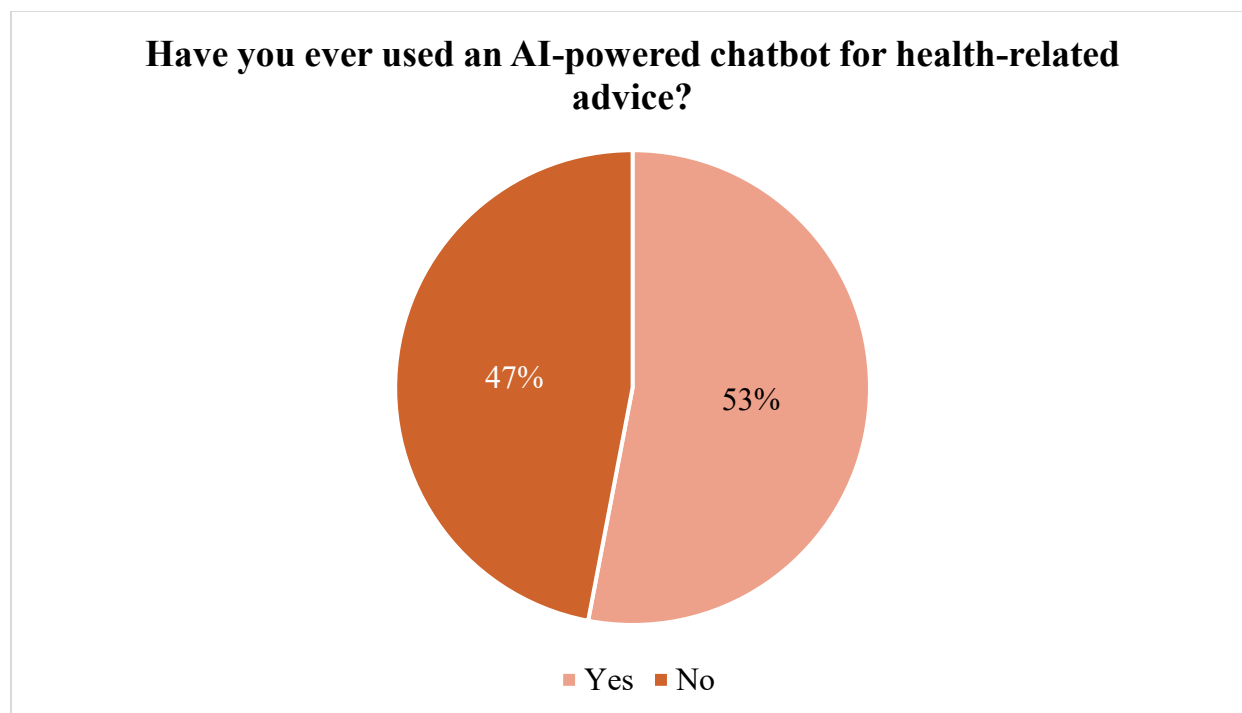


Figure 3.9: Have you ever used an AI-powered chatbot for health-related advice?

Figure 3.9 shows the responses to the question of whether users have ever used an AI-powered chatbot for health-related advice. 35 respondents (53%) answered "Yes," while 31 respondents (47%) answered "No." This indicates that more than half of the respondents have used an AI-powered chatbot for health advice, suggesting a growing interest in AI-driven tools for health management. However, almost half of the respondents have not yet used such chatbots, which may indicate a potential area for growth in this area.

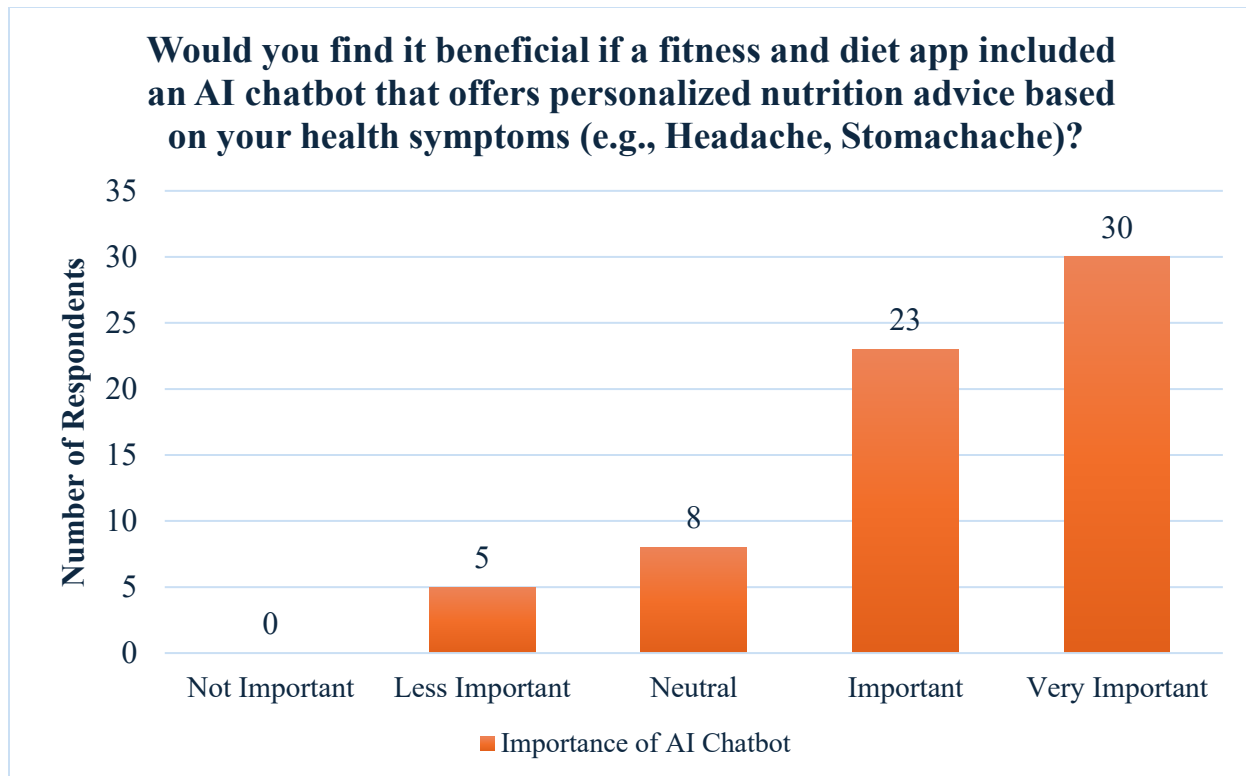


Figure 3.10: The Questionnaires - Would you find it beneficial if a fitness and diet app included an AI chatbot that offers personalized nutrition advice based on your health symptoms (e.g., Headache, Stomachache)?

The data illustrates respondents' opinions on whether they would find it beneficial if a fitness and diet app included an AI chatbot that offers personalized nutrition advice based on health symptoms, such as headaches or stomachaches. The majority of respondents, 30 (45.5%), consider this feature "Very Important," while 23 (34.8%) deem it "Important." Only 8 respondents (12.1%) are neutral about it, and 5 respondents (7.6%) think it is "Less Important." No respondents selected "Not Important." This suggests that most users see significant value in an AI-driven feature that provides personalized nutrition advice based on their health symptoms, indicating a strong interest in such a tool.

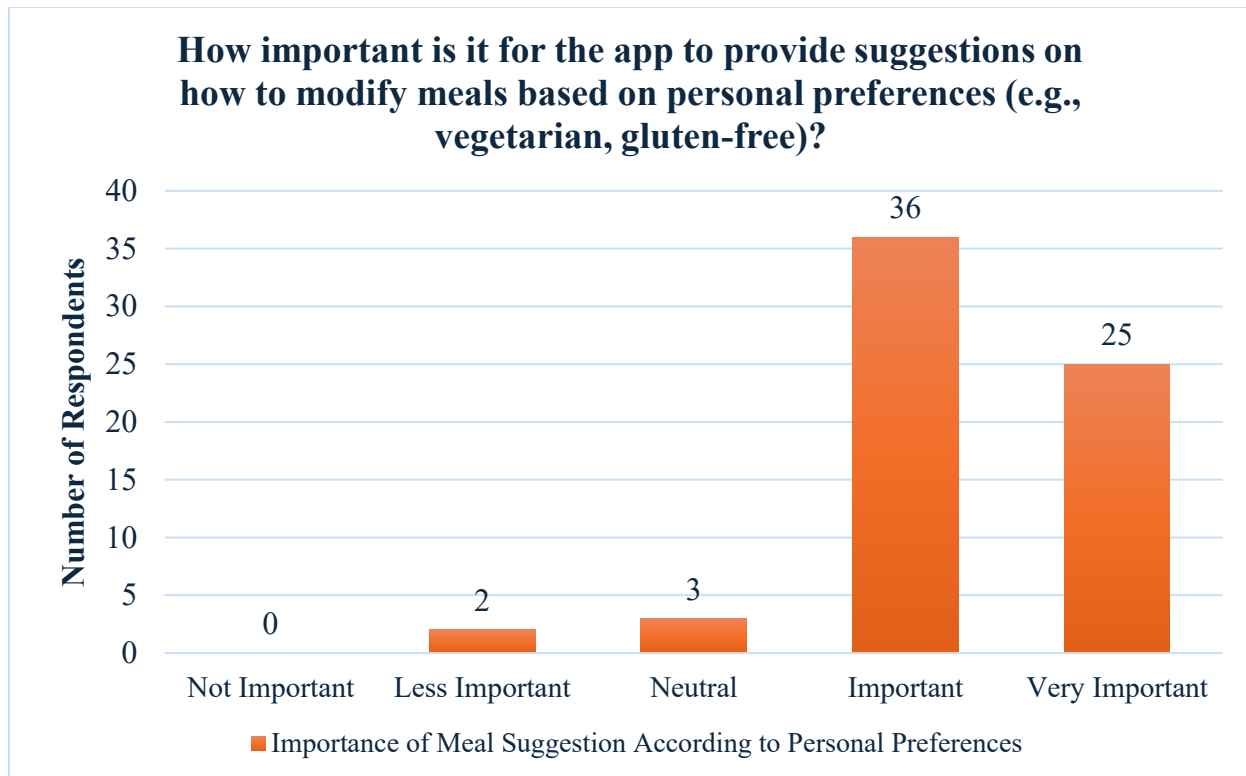


Figure 3.11: The Questionnaires - How important is it for the app to provide suggestions on how to modify meals based on personal preferences (e.g., vegetarian, gluten-free)?

The responses highlight how users feel about the importance of the app providing suggestions on how to modify meals based on personal preferences, such as vegetarian or gluten-free options. The majority of respondents, 36 (54.5%), consider it "Important," and 25 respondents (37.9%) view it as "Very Important." Only 3 respondents (4.5%) are neutral, and 2 respondents (3%) find it "Less Important." No respondents felt that this feature was "Not Important." This indicates that a large number of users see significant value in meal customization based on personal preferences, suggesting that this feature would be well-received in the app.

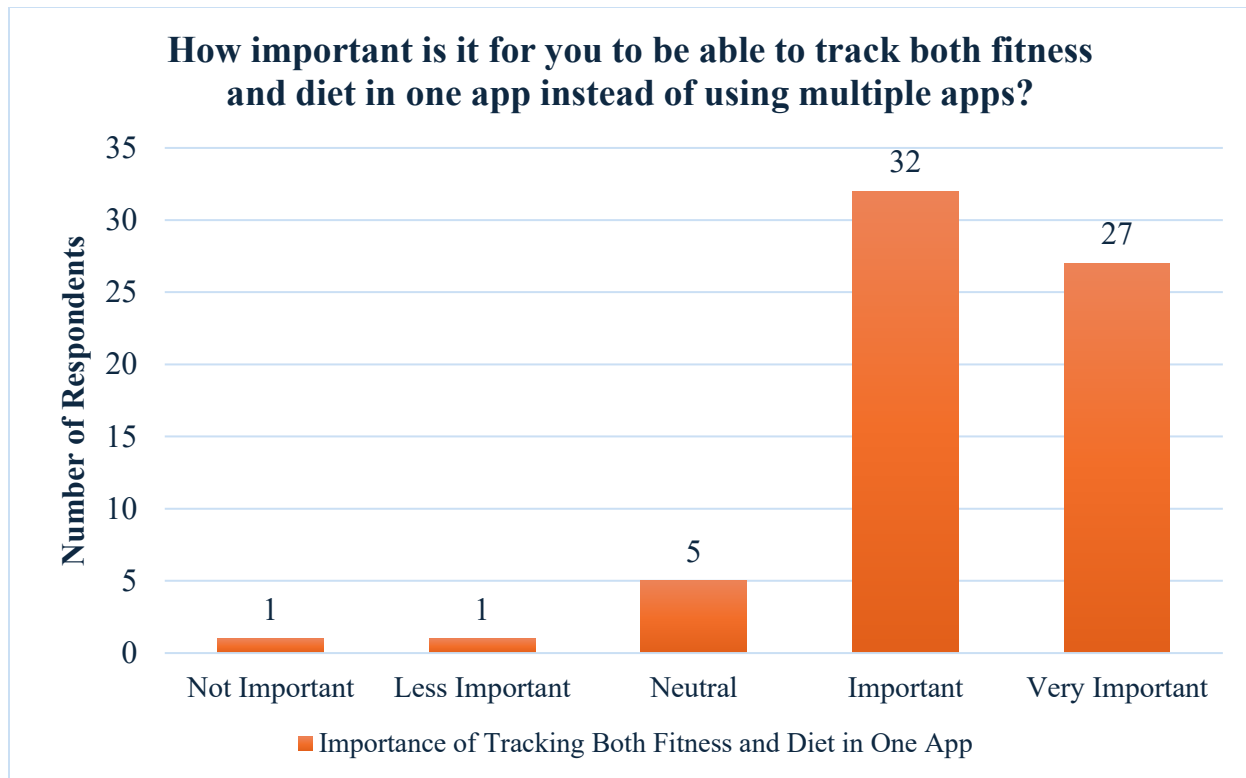


Figure 3.12: The Questionnaires - How important is it for you to be able to track both fitness and diet in one app instead of using multiple apps?

Figure 3.12 reflects respondents' views on the importance of tracking both fitness and diet in a single app rather than using multiple apps. The majority, 32 respondents (48.5%), consider it "Important," while 27 respondents (40.9%) find it "Very Important." Five respondents (7.6%) are neutral, and only 1 respondent (1.5%) feels that it is "Less Important" or "Not Important." This shows that most users prefer the convenience of having both fitness and diet tracking in one app, highlighting the potential demand for a comprehensive all-in-one solution.

3.4 System Requirements

3.4.1 Functional Requirements

Login Page

- The system shall allow new users to register accounts.
- The system shall allow users to log in to their account.
- The system shall allow users to reset password.

Home Page

- The system shall show the progress of caloric intake and micronutrients intake under the Macronutrients section.
- The system shall show the food log for three sessions, which are breakfast, lunch and dinner under “Meals Today” section.
- The system shall show the Basal Metabolic Index, weight and height under Body Measurement section.
- The system shall show the meal recommendations section which allow users to view the recommended food (breakfast, lunch, dinner) by system.
- The system shall show the notification button which allows users to view all the coming notifications.

Calorie And Macronutrients Calculation Module

- The sytem shall able to calculate the total calories and macronutrients after the user add their meal.

- The system shall be able to show the total calories and macronutrients in “Today’s Calories” section.
- The system shall allow user to edit their calories and macronutrients goals every day.

Meal Recommendation Module

- The system shall be able to recommend food (breakfast, lunch, dinner) based on the user’s information.
- The system shall be able to recommend food (breakfast, lunch, dinner) based on the user’s preferences (vegetarian, dairy-free and others).
- The system shall only be able to recommend food (breakfast, lunch, dinner) after all the required information (weight and height) is filled in so that the system can recommend food according to the BMI.
- The system shall display the food information which are calories, carbohydrates, proteins, fats and ingredients after they choose one of the recommended food to view.

Food Log Module

- The system shall show the calories of all the food in food library.
- The system shall allow users to do food logs for breakfast, lunch and dinner.
- The system shall allow users to add food to food logs from the food library.
- The system shall allow users to adjust the unit and amount of the food after press “Add” button for the specific food.
- The system shall allow users to update the food log.
- The system shall allow users to view the food log.

- The system shall allow users to search for food in the food library.
- The system shall allow users to view all foods in the food library.

Workout Module

- The system shall be able to display all types of workouts.
- The system shall be able to display the intensity of different type of workouts.
- The system shall allow users to choose the types of workouts.
- The system shall allow users to play the video of workouts.
- The system shall allow users to pause the workout.
- The system shall allow users to complete the workout when clicking “Finish” button.
- The system shall allow users to cancel the workout when clicking “Cancel” button.
- The system shall be able to update the calories burned to the workout history page after users click to complete or cancel the workout.

Statistic Module

- The system shall generate a statistical graph that concludes the calories burned.
- The system shall allow user to choose the date range for viewing calories burned.

AI Chatbot Module

- The system shall allow users to type messages in a text input field.
- The system shall allow users to send messages by pressing a “Send” button.
- The system shall be able to process the user’s message and generate an AI-driven response.

- The system shall be able provide nutrition suggestions and some tips based on user-provided health symptoms.
- The system shall be able to answer the follow up questions ask by users.
- The system shall only answer health symptoms-based questions.

My Profile Page

- The system shall allow users to edit name, age, gender, height and weight.
- The system shall allow users to choose their goal of health.
- The system shall allow users to log out from their account.
- The system shall allow users to switch on or off the notification.

3.4.2 Non-Functional Requirements

To ensure optimal performance and user experience, NutriFit AI incorporate several non-functional requirements outlined below:

Operational Requirements

- The system shall be able to operate on Android devices.
- The system shall require internet connectivity for real-time AI chatbot responses and data synchronization.

Performance Requirements

- The system shall respond to user actions (e.g., tapping buttons, navigating menus) within 2 seconds under normal operating conditions.
- The AI chatbot shall provide responses to user queries within 5 seconds when connected to the internet.
- Calculations for BMI, calories, and macronutrients shall be completed within 2 seconds of user input.
- The system shall be available every day.

Usability Requirements

- The system shall have an intuitive user interface and easy to use.
- Users shall be able to access key features within three taps or fewer.

3.5 System Design

3.5.1 Use Case Diagram

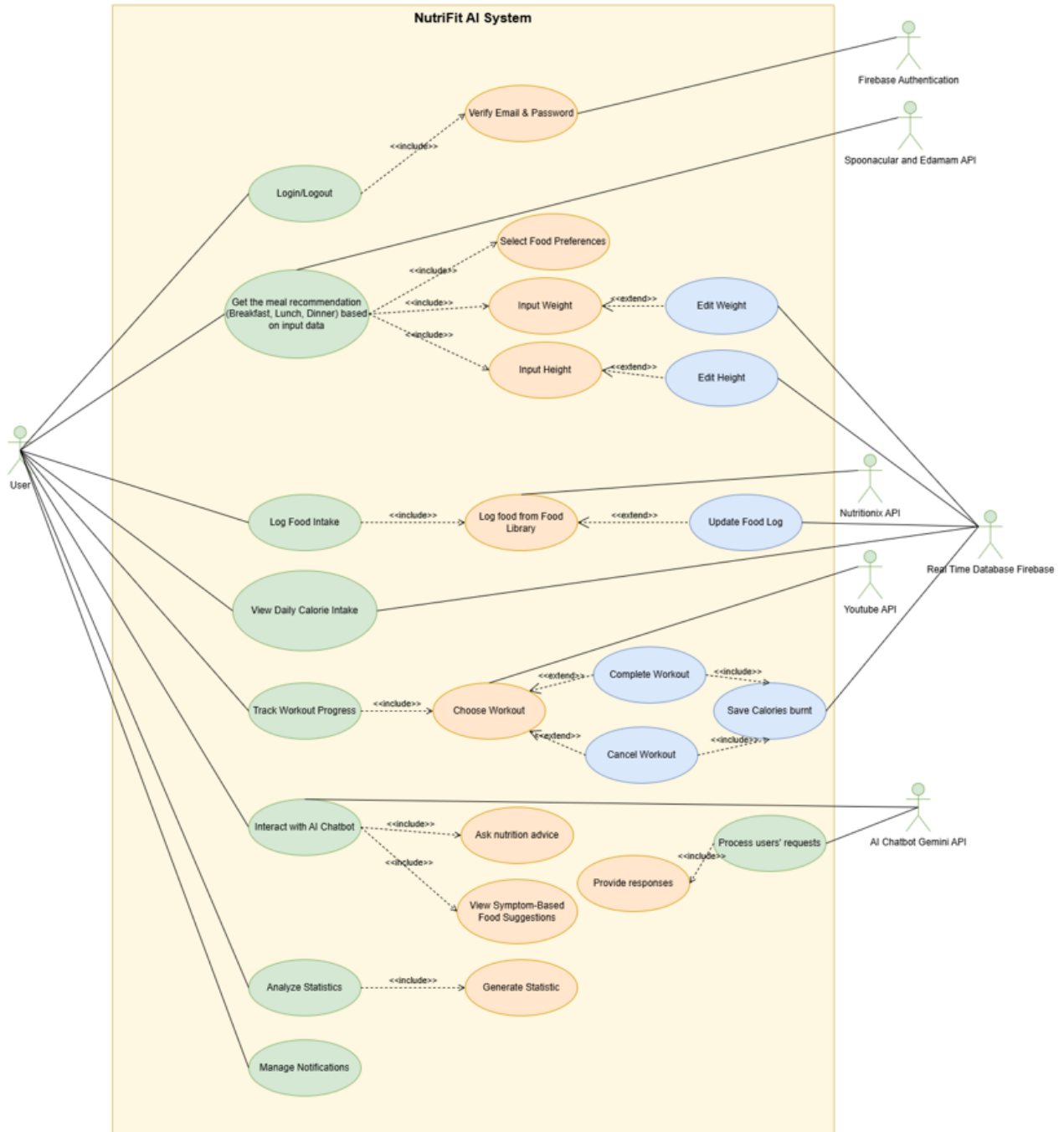


Figure 3.13: Use Case Diagram of NutriFit AI System

Figure 3.13 shows the use case diagram of the system. The system helps users manage their diet, fitness, and health goals in one platform. Users can log in or out to access their personalized data and features. The app generates the meals recommendation for breakfast, lunch and dinner based on the user's weight and height to generate BMI. The app also suggests meal plans based on the user's preferences, such as dietary free, peanuts free, vegetarian or gluten-free diets. Users can also update their personal details if needed to keep the information accurate.

The logging food intake feature allows users to track what they eat. They select items directly from the Food Library. The data entered is synced in real time with the Firebase Database and processed using the Nutrition API to keep track of calories and nutritional content.

Additionally, the system supports workout tracking. The user can choose a workout, monitor their progress, and log the calories burned. After completing a workout, the calories burned are calculated according to the timer in workout section, or if they decide to cancel, they can do so easily.

A key feature of the app is the AI Chatbot, which provides nutrition advice and some healthy tips. By interacting with the chatbot, the user can ask for dietary recommendations based on health symptoms or specific conditions. The chatbot processes these requests using the Gemini API and delivers tailored responses.

Finally, the user can view their statistics which is daily calorie burned. The system also allows them to manage notifications, ensuring they stay informed about their health goals and any updates related to their diet and fitness routines.

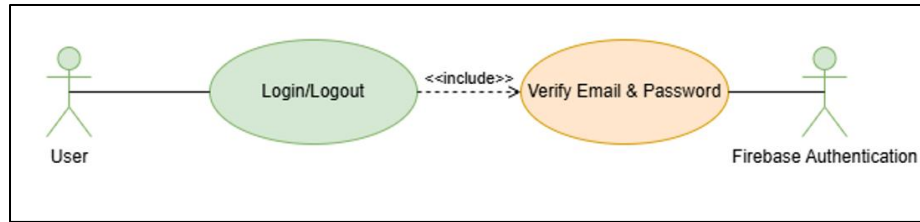


Figure 3.14: Use Case of Users' Login/Logout

Table 3.1: Use Case Specifications of Login/Logout

Use Case: Login/Logout	Primary Actor: User
Include Use Case: Verify Email & Password	
Exclude Use Case: N/A	
Precondition: The user must have an existing account to log in or can create a new one.	
Brief Description: User wants to login or logout from their account.	
Flow of Events: 1. The user opens the application. 2. The system displays the login page. 3. The user enters their email and password. 4. The system validates the credentials. 5. If valid, the user is logged in, and the system redirects them to the home page. 6. The user can choose to log out by clicking the "Logout" button from the profile page. 7. The system logs the user out and redirects them to the login page.	
Alternative Flow: i. Forgot Password • If the user forgets their password, they click the "Forgot your password?" link on the login page. • The user resets the password and logs in.	

ii. Invalid Credentials • If the user has not registered before, he or she are unable to login • The user needs to register an account.
Postconditions: i. For Login: The user is successfully logged into their account. ii. For Logout: The user is successfully logged out from their account.

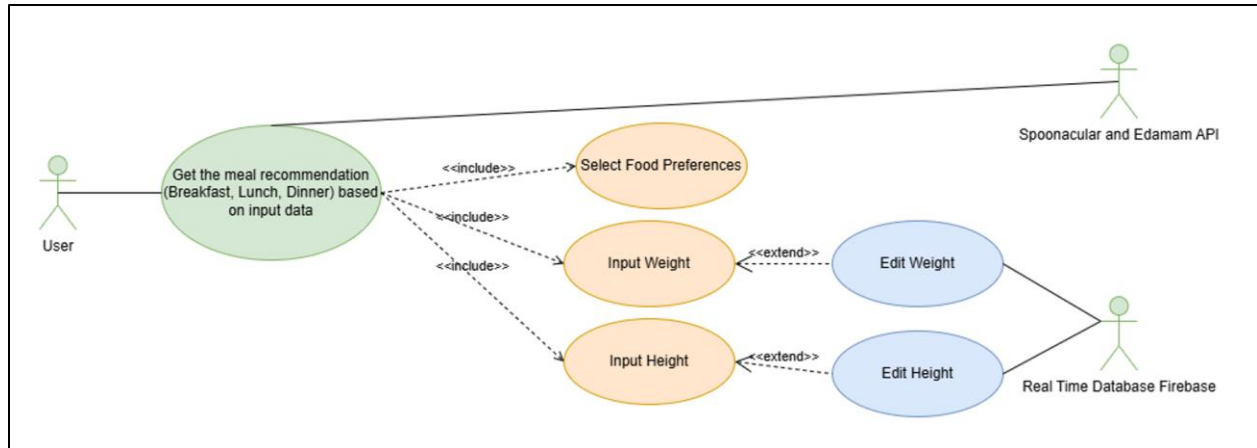


Figure 3.15: Use Case of User Get the Meal Recommendation Based on Their Input Data

Table 3.2: Use Case Specifications of Meal Recommendations

Use Case: Get the meal recommendation (Breakfast, Lunch, Dinner) based on input data (BMI which is calculated according to weight and height)	Primary Actor: User
Include Use Case: Input Height, Input Weight, Select Food Preferences	
Exclude Use Case: Edit Height, Edit Weight	
Preconditions: - The user must be logged into the system. - The user must have provided all necessary input data (e.g., BMI which is calculated according to weight and height).	
Brief Description: The system will recommend food for breakfast, lunch and dinner based on user's input data.	
Flow of Events: - The user input the following required details at the profile page: - Weight: Current body weight. - Height: User's height. - The user clicks on the “Meal Recommendation” at the home page. - The user selects their food preferences (e.g., dairy free, peanuts free, vegetarian, gluten-free, etc.). - The system calculates personalized meal recommendations for breakfast, lunch, and dinner based on the user's input data and preferences.	

5. The recommended meals are displayed to the user at the meal recommendation page, including calorie details.
Alternative Flow: i. Missing Input Data • If the user has not provided all required input data, the system displays a message prompting the user to complete the missing information. • The user enters the missing data, and the process continues. ii. Editing Inputs • The user can choose to edit any previously entered data, which are weight and height. • The system recalculates meal recommendations based on the updated inputs.
Postcondition: i. The system successfully displays personalized meal recommendations for the user.

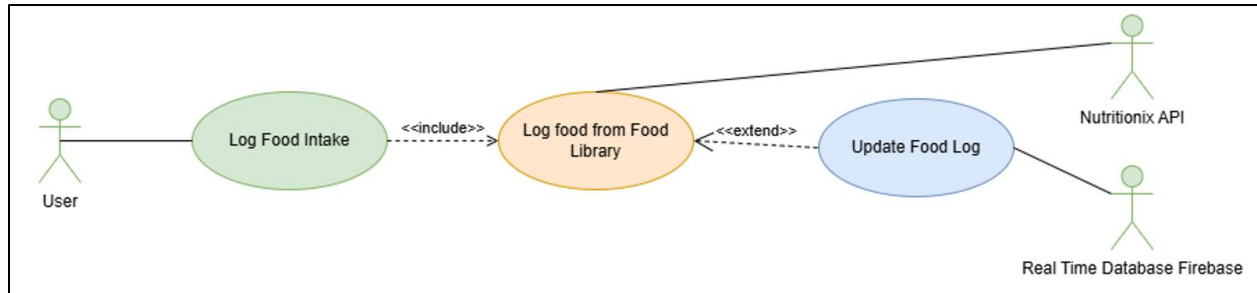


Figure 3.16: Use Case of Log Food Intake

Table 3.3: Use Case Specifications of Doing Food Log

Use Case: Log Food Intake	Primary Actor: User
Include Use Case: Log Food from Food Library	
Exclude Use Case: Update Food Log	
Preconditions: - The user must be logged into the system. - The user should have access to the food logging feature.	
Brief Description: The user wants to do the food log on daily meals (breakfast, lunch and dinner).	
Flow of Events: - The user selects whether to log their food (breakfast, lunch and dinner) at “Meals Today” section. - The user selects (breakfast, lunch or dinner) to log food from the food library. - The system displays a list of food items in the food library. - The user selects the food item(s). - The user enter the amounts and units for the selected food and click “Add” button to add the food.	

6. The system calculates the total calorie intake based on the selected food items, amounts and units. 7. The system confirms that the food log has been successfully updated and stored in Firebase.
Alternative Flow: i. Invalid Food Item • No food will display out.
Postcondition: i. The user's food log is successfully recorded or updated. ii. The system recalculates and updates the total calorie intake for the day.

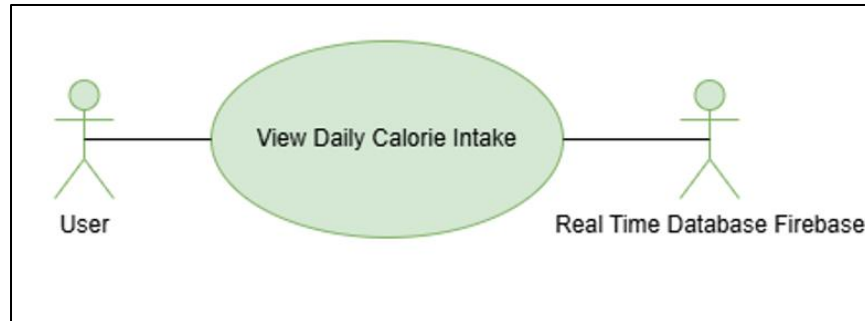


Figure 3.17: Use Case of Viewing Daily Calorie Intake

Table 3.4: Use Case Specifications of Viewing Daily Calorie Intake

Use Case: View Daily Calorie Intake	Primary Actor: User
Include Use Case: N/A	
Exclude Use Case: N/A	
Preconditions: - The user must be logged into the system. - The user must have logged meals or data for calorie tracking.	
Brief Description: The user wants to track and view the daily calorie intake after do the food log for breakfast, lunch and dinner.	
Flow of Events: - The system retrieves the data of all logged meals for the day (e.g., breakfast, lunch and dinner). - The system calculates the total calories consumed based on the food log entries. - The system displays the following information on the top section of the home page: - Total calories consumed for the day. - Macronutrient composition (e.g., carbs, protein, fat). - The user reviews the displayed information to track their calorie consumption.	
Alternative Flow:	

i.	No Food Logged
	• The calories, carbohydrates, proteins and fats will show 0.
Postcondition: The user has a clear view of their daily calorie intake.	

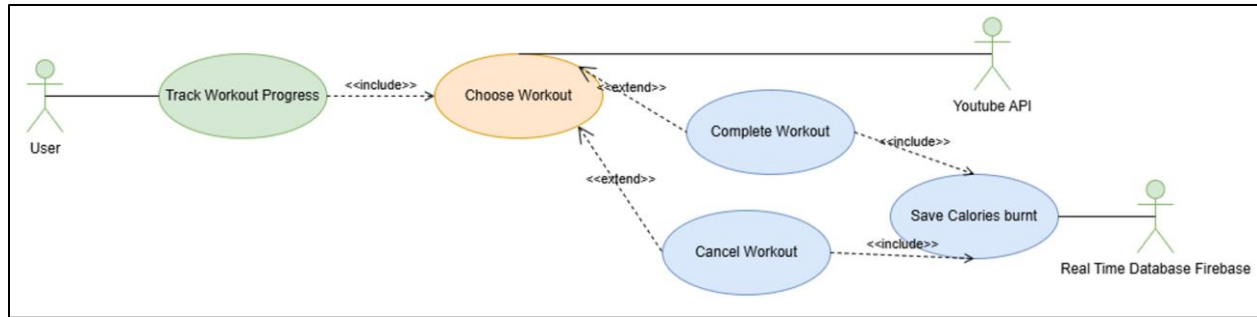


Figure 3.18: Use Case of Tracking Workout Progress

Table 3.5: Use Case Specifications of Tracking Workout Progress

Use Case: Track Workout Progress	Primary Actor: User
Include Use Case: Choose Workout, Save calories burnt	
Exclude Use Case: Complete Workout, Cancel Workout	
Preconditions: - The user must be logged into the system. - The system shall have a list of workouts available for the user to choose from.	
Brief Description: The user wants to choose workout activities that they want to do.	
Flow of Events: - The user navigates to the Workout Page. - The system displays a list of available workouts with details such as: - Workout type (e.g., cardio, strength training, yoga). - Duration. - Burned Calories. - The user chooses a workout from the list. - Once click “Start” button, the video will automatic display and start to calculate the calories burnt according to the timer.	
Alternative Flow:	

i.	Complete Workout (Extend) Once the user finishes the workout, the system will update the calories burned.
ii.	Cancel Workout (Extend) - If the user decides to stop mid-session, they select to Cancel playing the workout tutorial video. - The system stops the session. - The user can choose to start another workout.
Postcondition:	
i.	For Completed Workouts The system updates the user's workout history and calorie burned tracking.
ii.	For Canceled Workouts The system discards the session and the calories still can be calculated according to their workout timer.

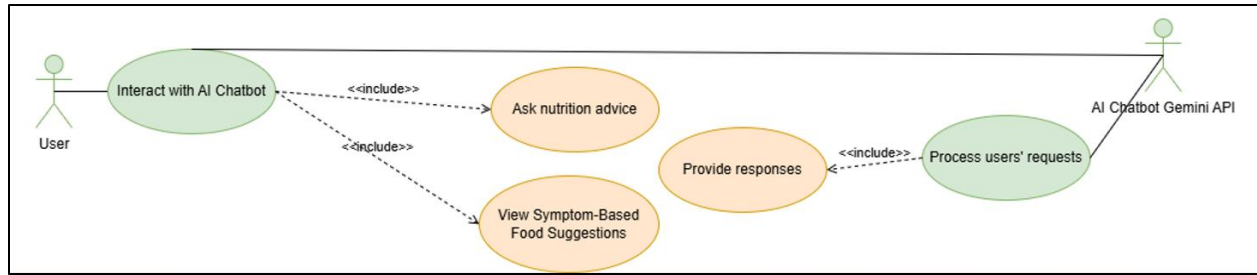


Figure 3.19: Use Case of User Interact with AI Chatbot

Table 3.6: Use Case Specifications of Interaction with AI Chatbot

Use Case: Interact with AI Chatbot	Primary Actor: User, AI Chatbot
Include Use Case: Ask nutrition advice, View Symptom-Based Food Suggestions	
Exclude Use Case: N/A	
Preconditions: i. The user must be logged into the system. ii. The system must have an active AI chatbot feature available.	
Brief Description: The user wants to interact with an AI assistant to receive advice of health symptoms.	
Flow of Events: 1. The user navigates to the AI chatbot interface. 2. The system displays a text input field and a “Send” button. 3. The user types a message (e.g., dietary query, symptom, or workout advice request) and clicks “Send”. 4. The AI chatbot processes the user’s message. 5. The chatbot generates a response. 6. The user views the symptoms-based food suggestion and health tips by AI assistant.	
Alternative Flow:	

i. Unclear Input • If the chatbot cannot understand the user's query, it will response that it unable to answer that question ask by user.
Postcondition: i. The user receives tailored health, or dietary advice.

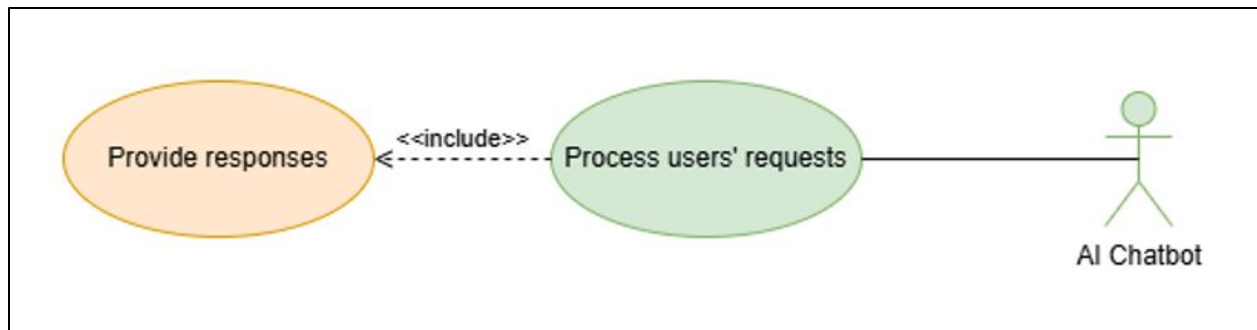


Figure 3.20: Use Case of Processing Users' Requests by Chatbot

Table 3.7: Use Case Specification of Processing Users' Request by Chatbot

Use Case: Process User's Requests	Primary Actor: AI Chatbot
Include Use Case: Provide Responses	
Exclude Use Case: N/A	
Preconditions: - The user must be logged into the system. - The user must ask for response.	
Brief Description: The chatbot wants to process user's requests.	
Flow of Events: - The user navigates to the AI chatbot interface. - The user types a message (e.g., dietary query, symptom, or workout advice request) and clicks "Send." - The AI chatbot processes the user's message. - The chatbot generates a response. - The system displays responses to the user.	
Alternative Flow: Unclear Input	

- | |
|---|
| <ul style="list-style-type: none">• If the chatbot cannot understand the user's query, it will response that it unable to answer that question ask by user. |
| <p>Postcondition:</p> <ul style="list-style-type: none">i. The user receives tailored health or dietary advice. |



Figure 3.21 Use Case of Statistic Module

Table 3.8: Use Case Specifications of Statistic Module

Use Case: Analyze Statistics	Primary Actor: User
Include Use Case: Generate Statistic	
Exclude Use Case: N/A	
Preconditions: i. The user must be logged into the system. ii. The system must have recorded data (e.g., calories burnt) for generating statistics.	
Brief Description: The user wants to view the graph of calories burnt.	
Flow of Events: 1. The user navigates to the Statistic Page. 2. The system retrieves the user's historical data which are burned calories over time. 3. The system generates statistics based on the retrieved data. 4. The system displays the generated statistics in visual formats which are calories burned chart (e.g., upward or downward).	
Alternative Flow: i. No Data Available • If the system does not have sufficient data to generate statistics, it will remain 0.	

Postcondition:

- i. The user can view and analyze their calories burnt.

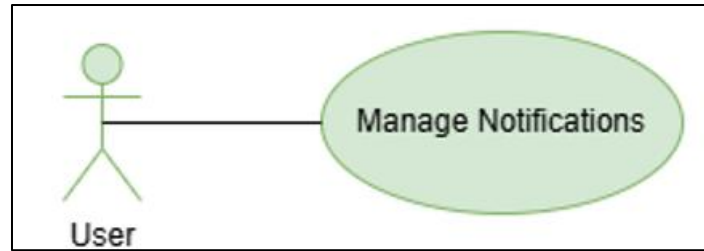


Figure 3.22: Use Case of Manage Notifications

Table 3.9: Use Case Specifications of Managing Notifications

Use Case: Manage Notifications	Primary Actor: User
Include Use Case: N/A	
Exclude Use Case: N/A	
Preconditions: The user must be logged into the system.	
Brief Description: The user wants to manage the notifications by viewing, deleting it from the notification page. Users are also able to turn on and off the notification.	
Flow of Events: 1. The user selects the notification button on the home page. 2. The system displays a list of available notifications. 3. The user reviews the current notification settings (e.g., on or off for each type). 4. The user chooses to enable or disable the push notification. 5. The system confirms that the notification settings have been updated successfully.	
Alternative Flow: N/A	
Postcondition: i. When turn on the notification setting, users will continue to receive notifications. ii. When turn off the notification setting, users will not receive the notifications.	

3.5.2 Activity Diagram

Login Module

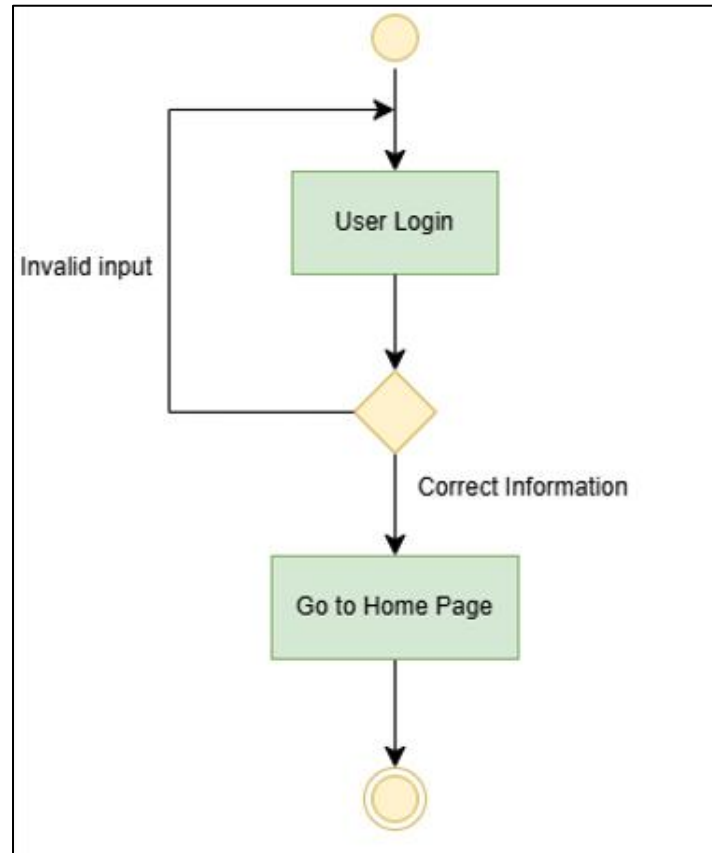


Figure 3.23: Activity Diagram for Login Module

This activity diagram shows how the login process works. It starts when the user enters their login details, which are email address and password. The system checks if the details are correct. If the information is incorrect, the system will ask the user to try again. If the details are correct, the system allows the user to access the home page.

Meal Recommendations Module

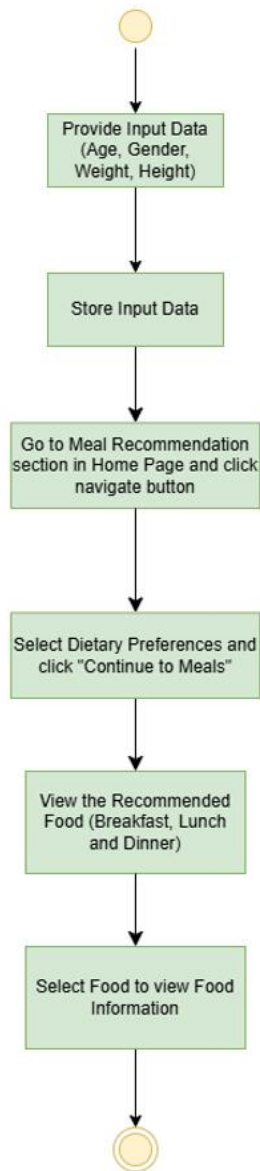


Figure 3.24: Activity Diagram of Meal Recommendations Module

This activity diagram explains the process of getting meal recommendations. The process starts when the user provides their input data, such as weight, and height for the BMI calculating purpose. The system then stores this input data for use in the recommendation process. Next, the user go to the “Meal Recommendation” section on the home page and clicks navigate button. Then, user is required to choose their dietary preference and click continue. The user will navigate to the

page where the system displays the recommended food options for breakfast, lunch, and dinner based on the user's BMI. Users can view the recommended food from the meal recommendations page. User can also view the food information by select the food recommend by the system.

Calorie And Macronutrients Calculation Module

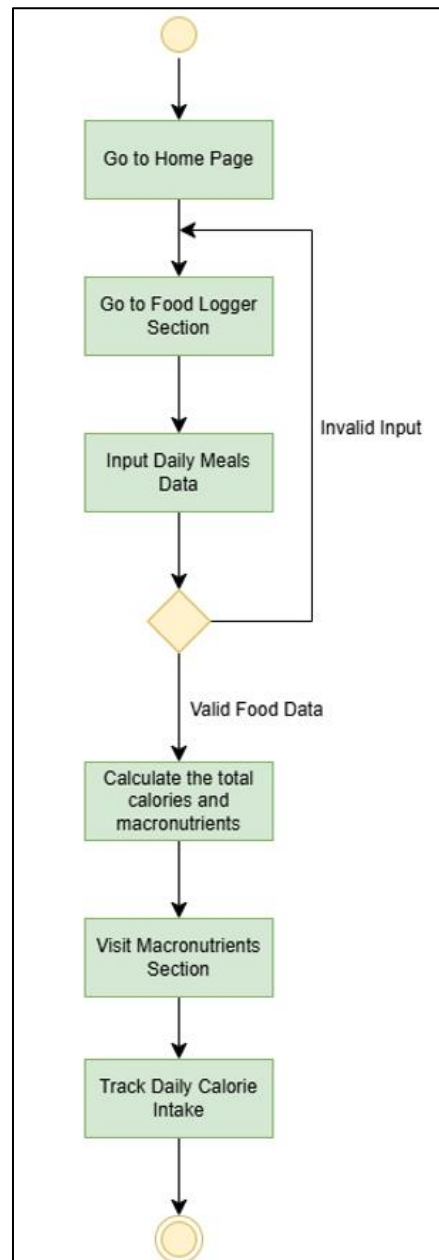


Figure 3.25: Activity Diagram of Calorie and Macronutrients Calculation Module

This activity diagram shows the steps for calculating Daily Calorie and Macronutrients. The process starts when the user goes to the home page and then navigates to the food logger section. The user enters their daily meal data, and the system checks if the input is valid. If the input is invalid, the user is prompted to correct it and try again. Once valid food data is provided, the system calculates the total calories and macronutrients. The user can then visit the macronutrients section to see detailed information. Finally, the user can track his or her daily calorie intake and macronutrients.

Food Log Module

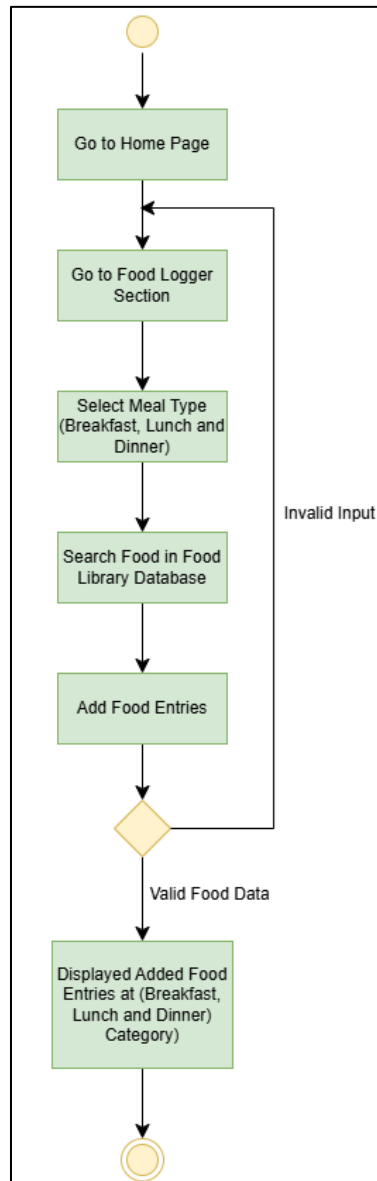


Figure 3.26: Activity Diagram of Food Log Module

This activity diagram shows how users can log their food entries to the Food Logger Section. First, users can go to the home page and scroll to the food logger section. The user then selects a meal type, such as breakfast, lunch, or dinner. Next, the user searches for food items in the food library database. After finding the items, the user adds the food entries. The system checks if the input data is valid. If the data is invalid, the user is prompted to correct it and try again. Once

the food entries are valid, the system displays the added food items under the selected meal categories (breakfast, lunch, or dinner).

Workout Module

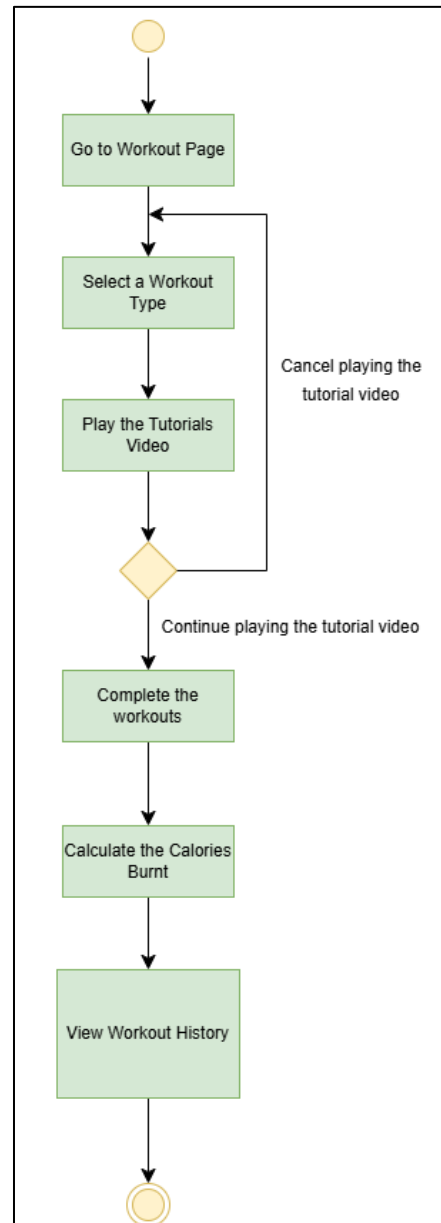


Figure 3.27: Activity Diagram of the Workout Module

This activity diagram shows the process of using the workout module. First, the user goes to the workout page. The user then selects a workout from workout type, such as cardio, strength training or others. After selecting a workout and click start, the video auto playing. During the video, the user has the option to cancel playing if they decide not to continue. If the user decides to proceed, they continue playing the tutorial video and complete the workout session. After

completing the workout, the system calculates the total calories burned. Finally, the user can view their workout history to track their progress.

Statistic Module

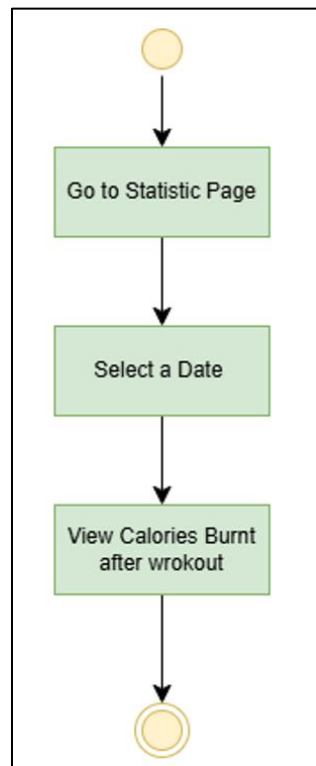


Figure 3.28: Activity Diagram of Statistic Page

This activity diagram explains the process of viewing statistics of calories burned and weight changes in the Statistic Page. First, the user navigates to the statistics page. On this page, the user selects a specific date range to view data. Once the range of date is selected, the system retrieves and displays the calories burned for the chosen date. Finally, the user can track their burning calories through the graph.

AI Chatbot Module

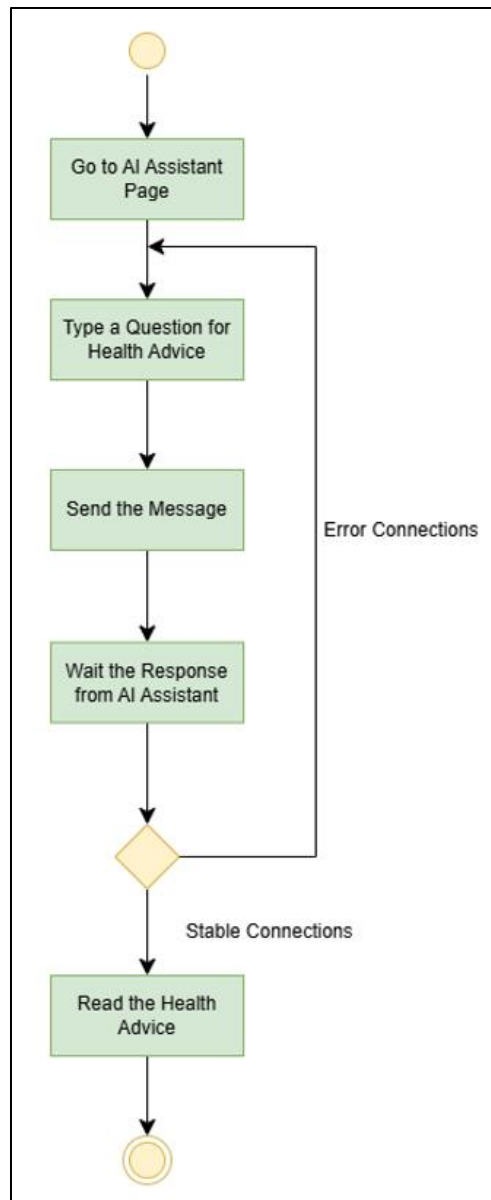


Figure 3.29: Activity Diagram of AI Chatbot Module

This activity diagram shows how users interact with the AI Assistant to get health advice. First, the user navigates to the AI assistant page. The user types a question related to health advice and sends the message to the system. The system processes the message and waits for a response from the AI assistant. Once the system successfully processes the request, it provides the health advice back to the user.

My Profile Page

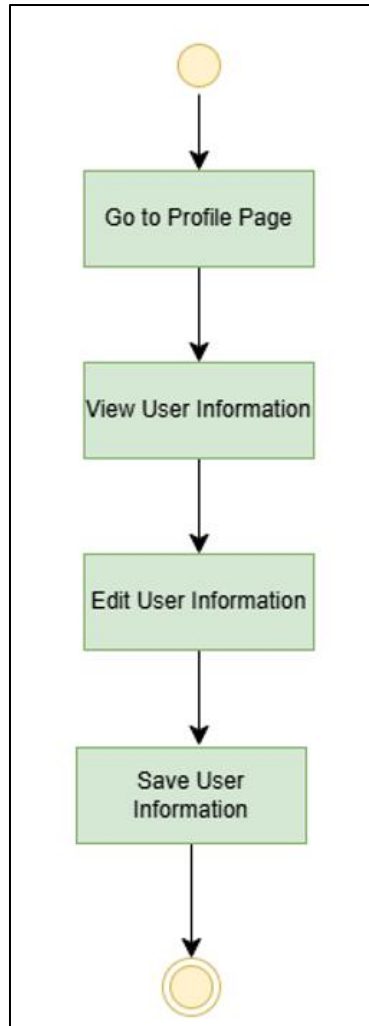


Figure 3.30: Activity Diagram of My Profile Page

This activity diagram shows the process of managing user profile information. First, the user navigates to the profile page. On this page, the user can view their existing information, such as name, age, gender, weight, height and goals. If the user wants to make changes, they proceed to edit their information. Once the changes are made, the system saves the updated information.

Notification Page

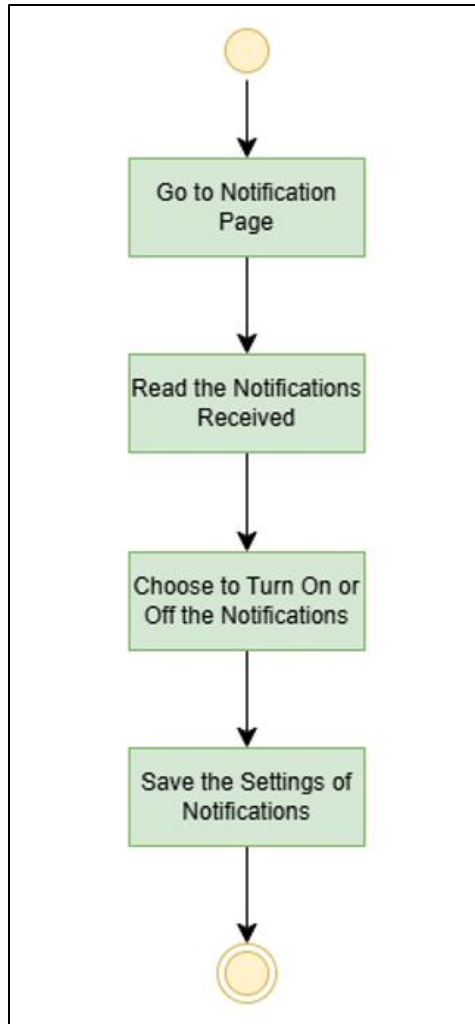


Figure 3.31: Activity Diagram of Notification Page

This activity diagram shows the process of managing notifications. First, the user clicks on the notification button on the home page and navigates to the notification page. On this page, the user can view the notifications they have received. The user can decide to turn notifications on or off based on their preference. Once the choice is made, the system saves the updated notification settings. If the user turns off the notification, he or she will not receive the notification anymore.

3.5.3 Sequence Diagram

Login Page

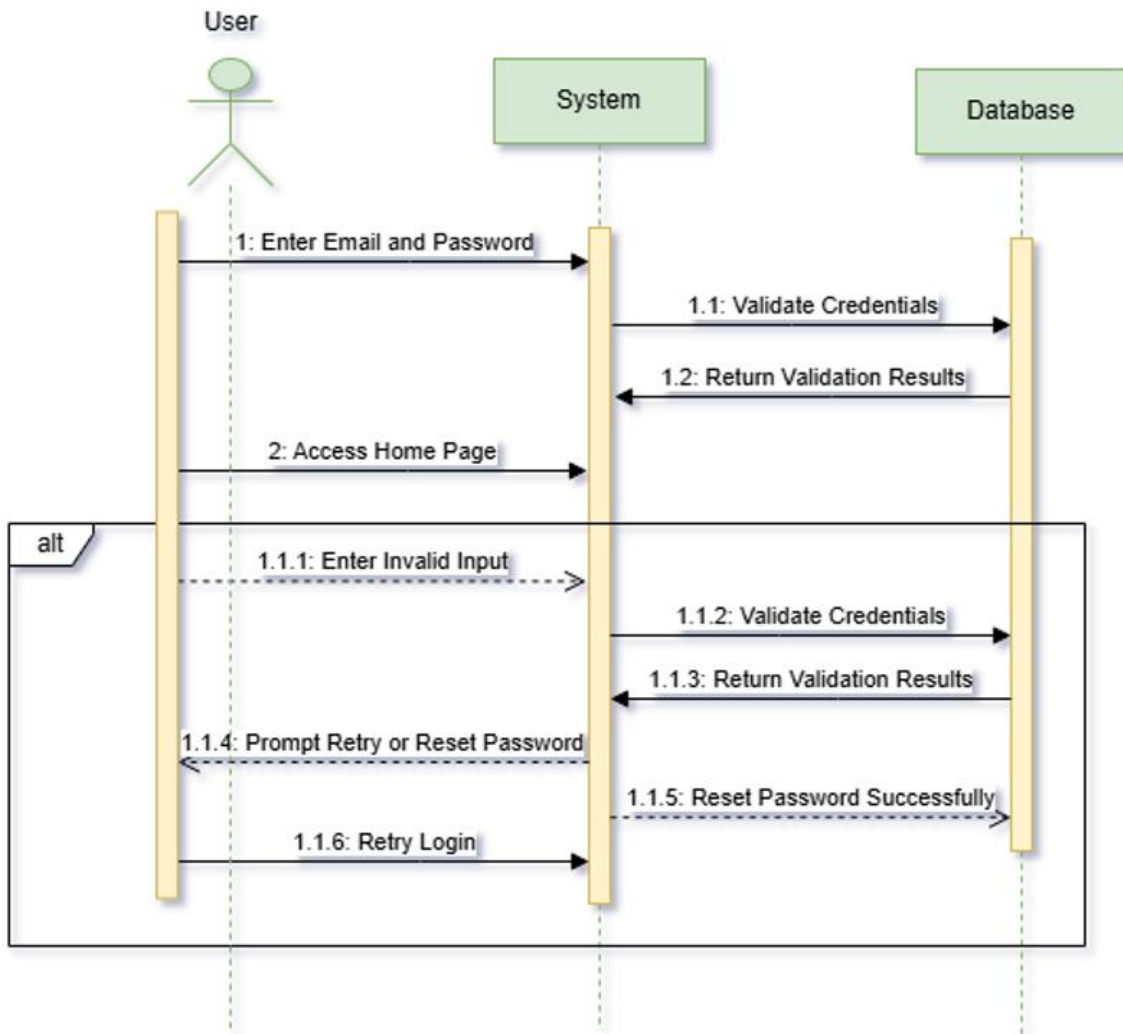


Figure 3.32: Sequence Diagram of Login Page

Main Flow:

1. The user enters their email and password.
2. The system sends these credentials to the database for validation.
3. The database returns the validation results.
4. If the credentials are valid, the system grants the user access to the home page.

Alternative Flow:

1. If the user enters invalid credentials, the system informs the user that their input is invalid.
2. The user is prompted to retry logging in or reset their password.
3. If the user opts to reset their password, the system interacts with the database to update the password.
4. Once the password is reset successfully, the system informs the user.
5. After resetting the password, the user can retry logging in with the new credentials.
6. The process follows the same validation steps until access is granted.

Meal Recommendations Page

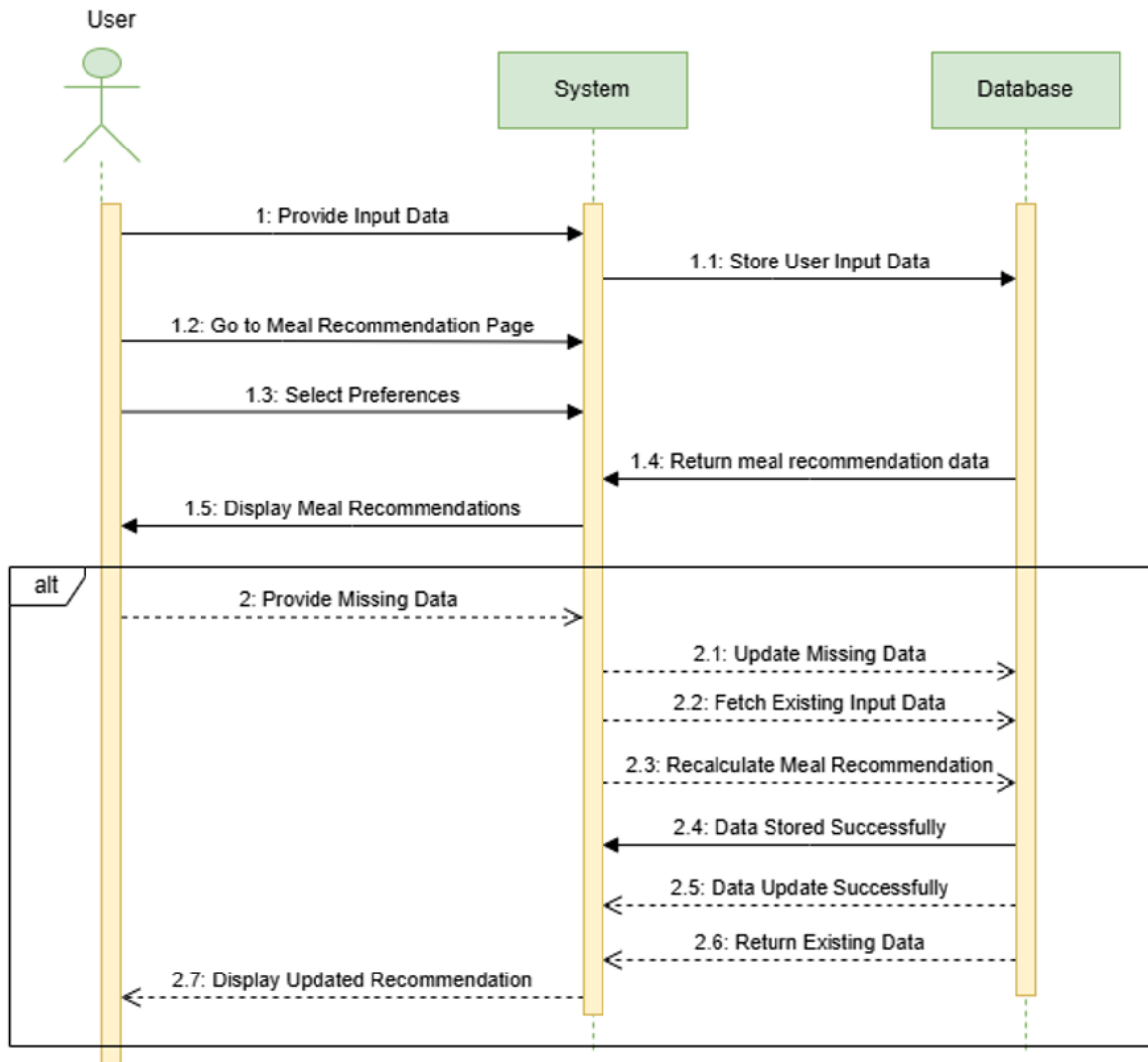


Figure 3.33: Sequence Diagram of Meal Recommendations Module

Main Flow:

1. The user provides their input data which are weight and height on the profile page for calculating BMI purpose.
2. The user navigates to the meal recommendation page.
3. Select dietary preferences.

4. The system retrieves the stored data from the database and generates meal recommendations according to the user dietary preference.
5. The user can view the recommended food on the Meal Recommendation Page.

Alternative Flow:

1. If the user does not provide all required input data, the system prompts the user to input the missing details.
2. Once the user provides the missing data, the system updates the data in the database.
3. After storing the updated input data, the system fetches the complete data from the database.
4. The system recalculates the meal recommendations and displays the updated suggestions to the user.

Food Logger Module

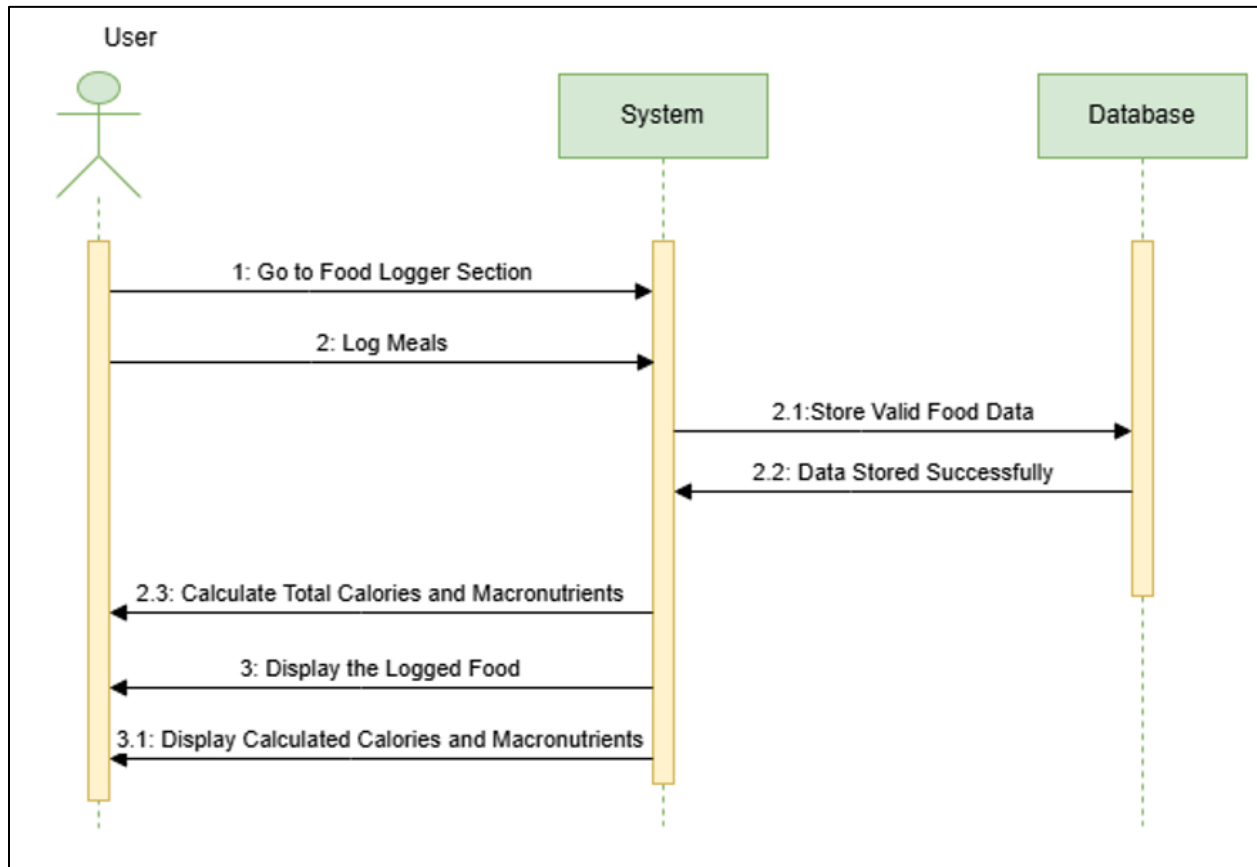


Figure 3.34: Sequence Diagram of Food Logger Module

Main Flow:

1. The user navigates to the food logger section on the home page.
2. The user can log their food data for breakfast, lunch or dinner.
3. The system validates the food data and stores it in the database.
4. The system processes the stored food data and calculates the total calories and macronutrients based on the user's food entries.
5. The system retrieves the logged food data and displays it to the user which allows them to review their input.
6. Finally, the system displays the calculated total calories and macronutrients to the user.

Workout Module

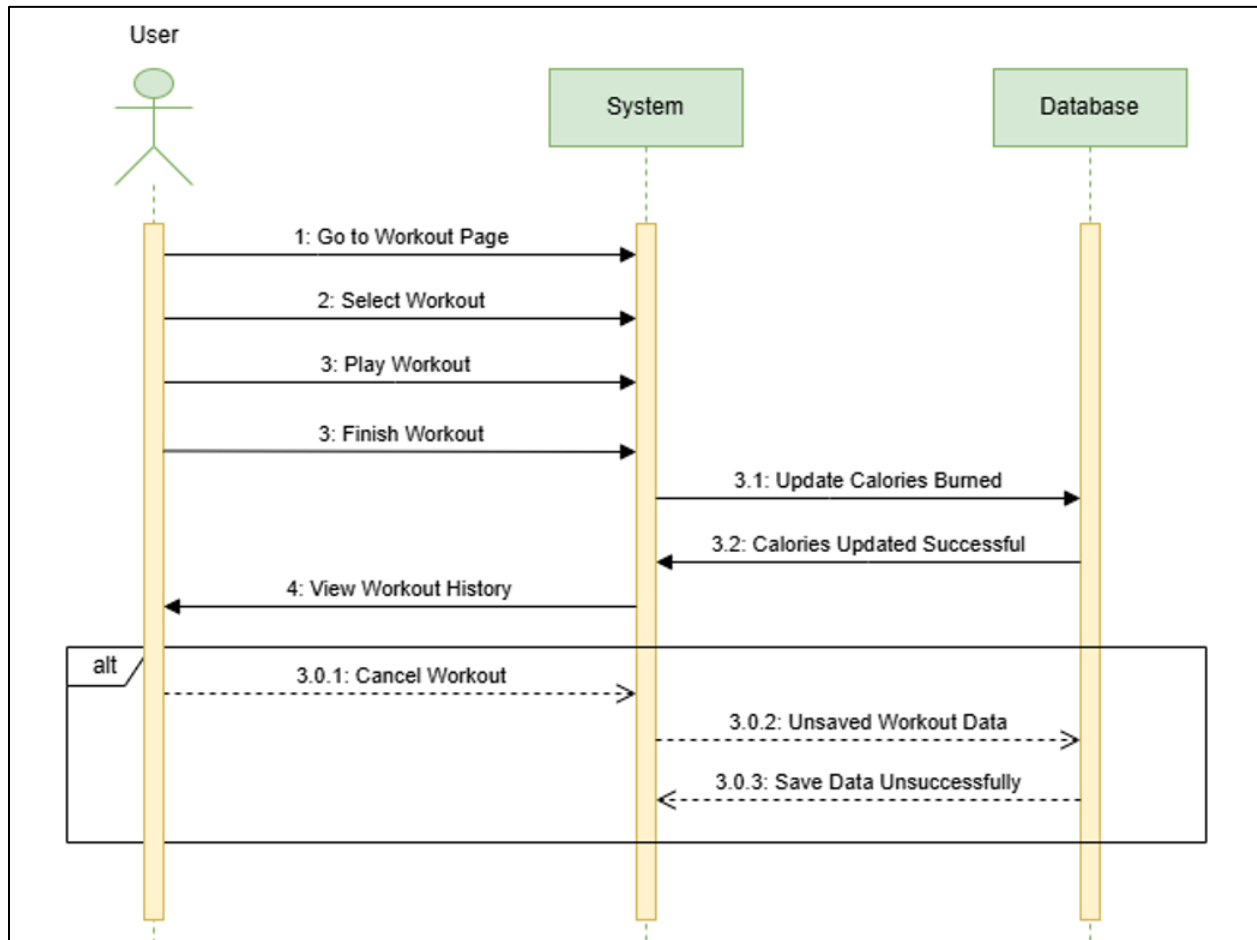


Figure 3.35: Sequence Diagram of Workout Module

Main Flow:

1. The user navigates to the workout page.
2. The user selects the workout that he or she wants to do.
3. After select the workout, the system wil automatically playing the tutorial video.
4. Once the user completes the workout, the system updates the calories burned in the database.
5. After completing or canceling the workout, the user can view their workout history.

AI Chatbot Module

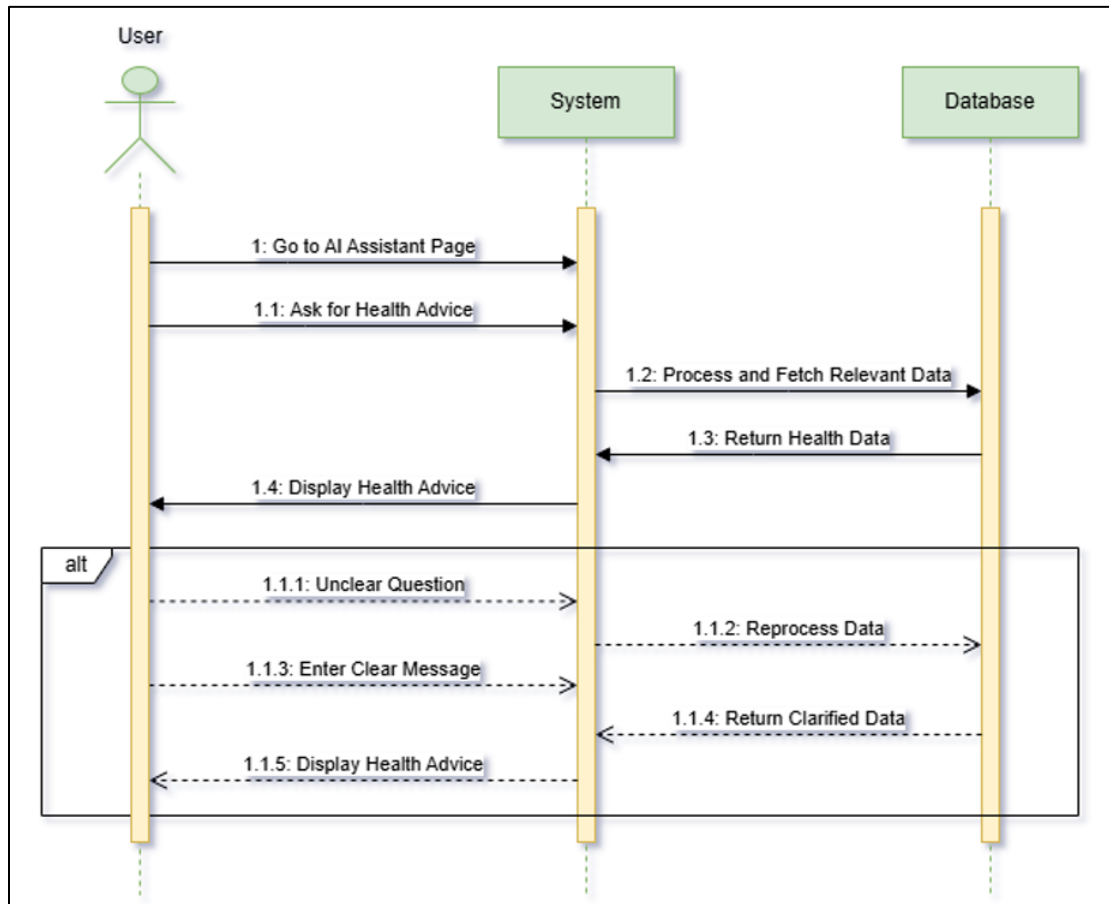


Figure 3.36: Sequence Diagram of AI Chatbot Module

Main Flow:

1. The user navigates to the AI Assistant page.
2. The user types a health-related question for health advice.
3. The system processes the query.
4. The system fetches relevant data from the questions bank.
5. The system then displays advice to the user.

Alternative Flow:

1. If the input from the user is unclear or incomplete, the system prompts the user to enter a clearer message.
2. Once the user provides a clearer message, the system reprocesses the data and fetches the relevant information again.
3. After reprocessing, the system displays clarified health advice to the user.

Statistic Module

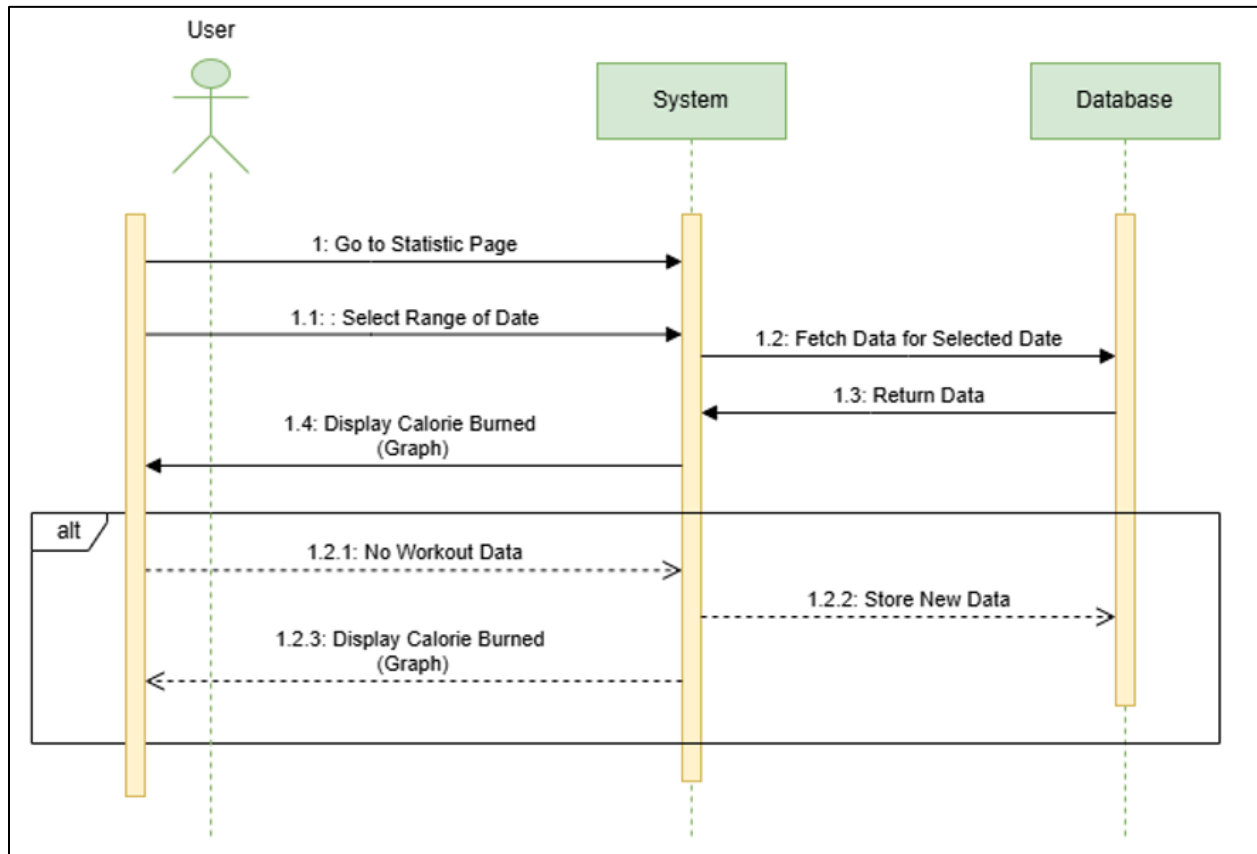


Figure 3.37: Sequence Diagram of Statistic Page

Main Flow:

1. The user navigates to the statistics page.
2. The user can select a range of dates to view the calorie-burned data.
3. The system sends a request to the database to fetch the data for the selected range of date.
4. Once the data is retrieved, the system displays the calorie-burned in the form of graph to the user.

Alternative Flow:

1. If the system detects no data for the selected date, it will show 0 until there is new data entered.

Notification page

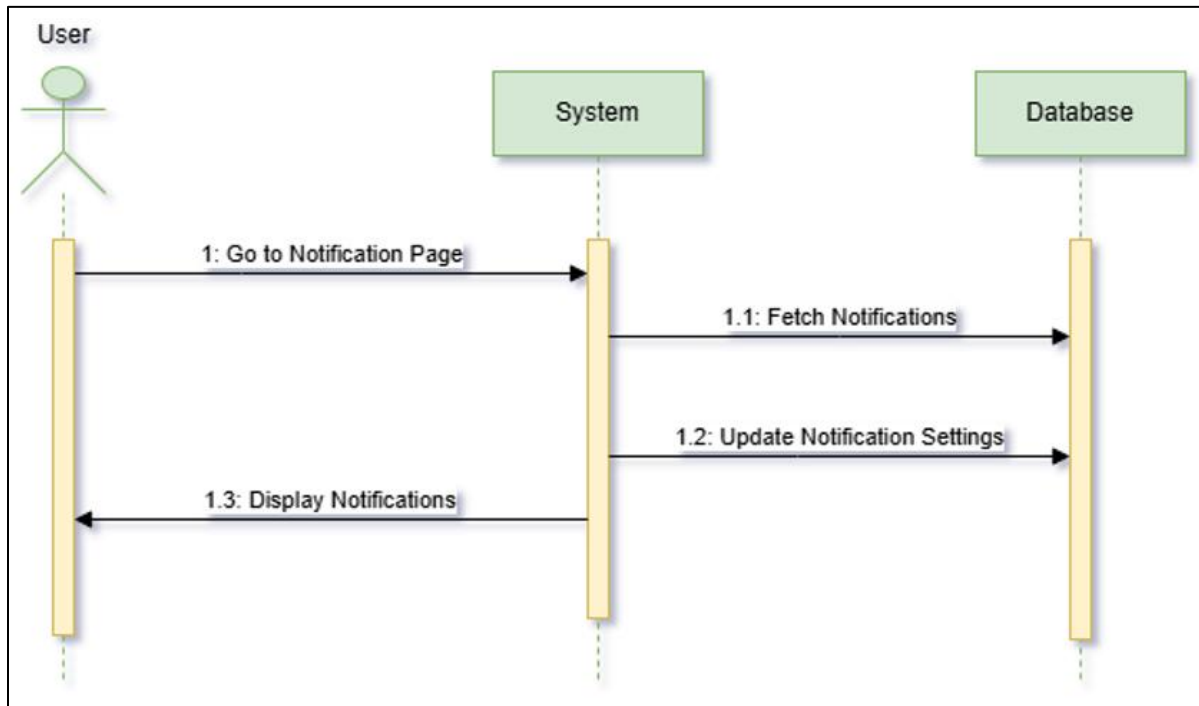


Figure 3.38: Sequence Diagram of Notification Page

Main Flow:

1. The user navigates to the notification page.
2. The system retrieves the current notifications by fetching them from the database and displays them to the user.
3. The user decides whether to turn notifications on or off based on their preference.
4. The system processes the user's preferences and updates the notification settings in the database.
5. Once the updates are successful, the system retrieves and displays the updated notification preferences to the user.

3.6 User Interface Design

This section focuses on the user interface (UI) design of the proposed mobile application. The goal of the UI design is to create an intuitive, user-friendly, and visually appealing interface that enhances user experience while ensuring seamless navigation. The design process includes creating wireframes, mockups, and prototypes to provide a clear understanding of the app's layout, functionality, and navigation flow.

3.6.1 Login Page

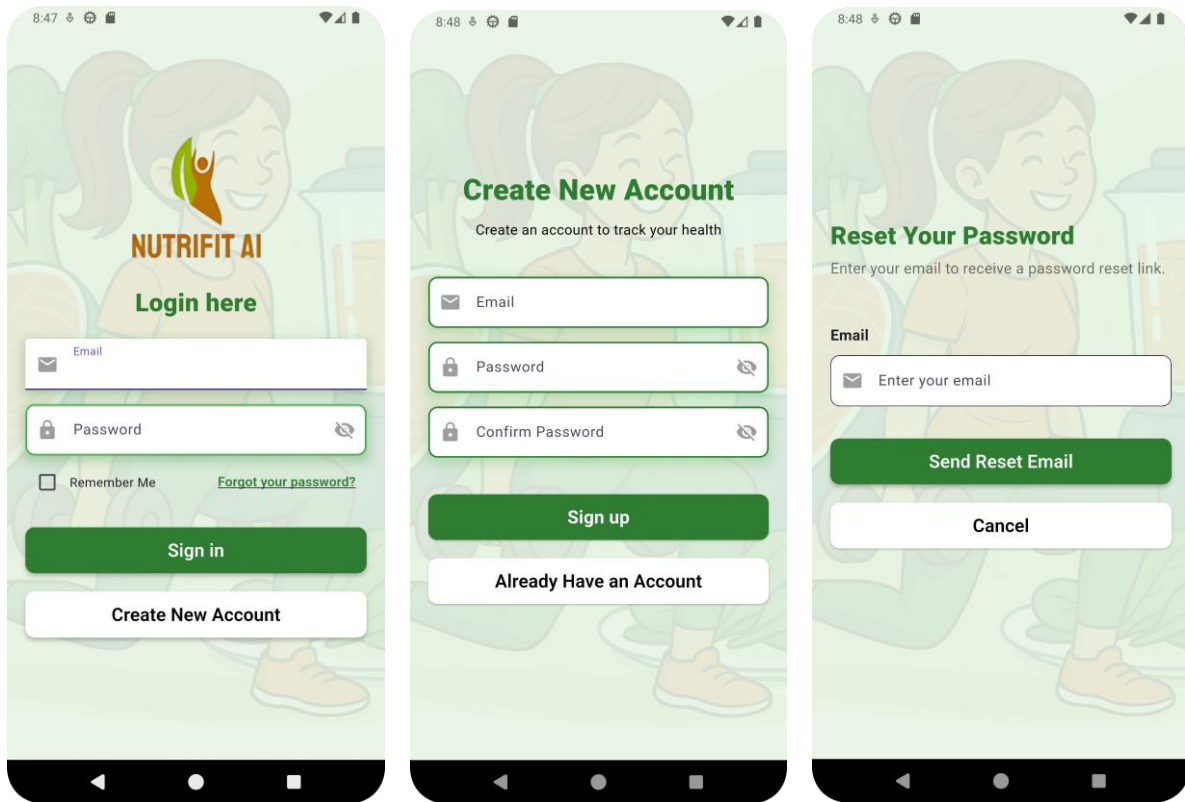


Figure 3.39: Screenshots of Login Page

Figure 3.39 shows the screenshots of the login page. Login Page will let users log in with an existing account or create a new one. If the users forgot the password, they click on the “Forgot Your Password” button to reset and create a new password.

3.6.2 Home Page

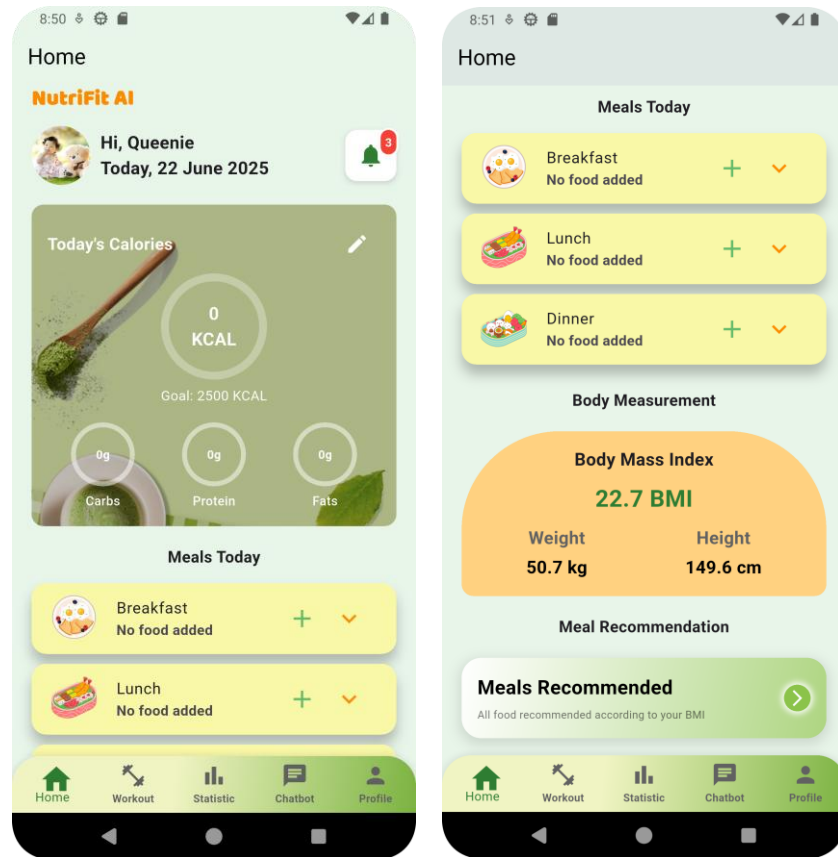


Figure 3.40: Screenshots of Home Page

Figure 3.40 shows the screenshots of home page. In the home page, there are four sections which are Macronutrients, Food Logger, Body Measurement and Meal Recommendation. In the Macronutrients section, the calories eaten today, carbs consumed, protein consumed, and fat consumed of user are updated every time the user does his or her food log. In the Food Logger section, users can do food log by clicking the “+” icon. In the Body Measurement section, the calculated Body Mass Index (BMI) is shown according to the weight and height of the users. For the Meal Recommendation section, users can view the recommended food by system (breakfast, lunch and dinner) by clicking the “>” icon.

3.6.3 Adding Food from Food Library Page

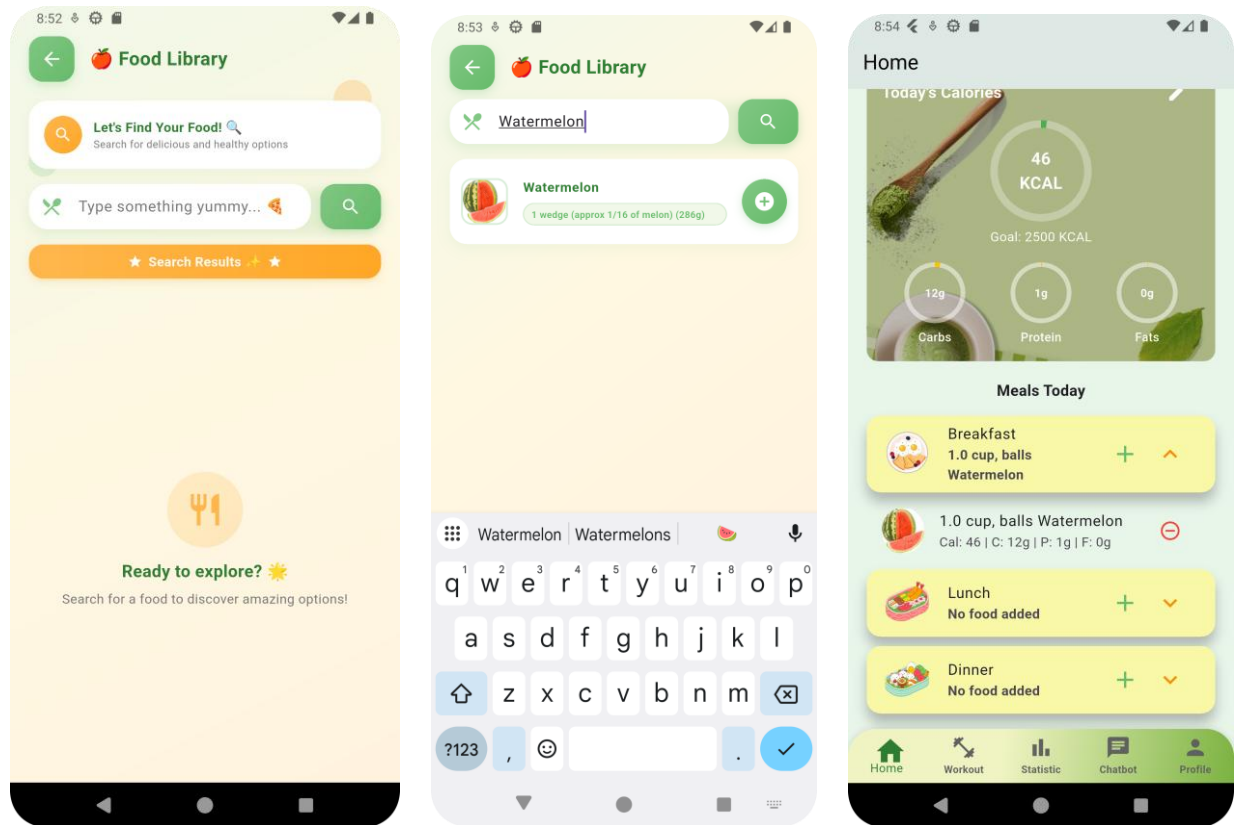


Figure 3.41: Screenshot of Adding Food from Food Library

Figure 3.41 shows the Food Library where users can add their daily food (breakfast, lunch and dinner). Users can select the food from the food list and scale the portion of food. After adding the food, the food are displayed in the Food Logger section and the calories consumed will also be displayed.

3.6.4 Meal Recommendation Page

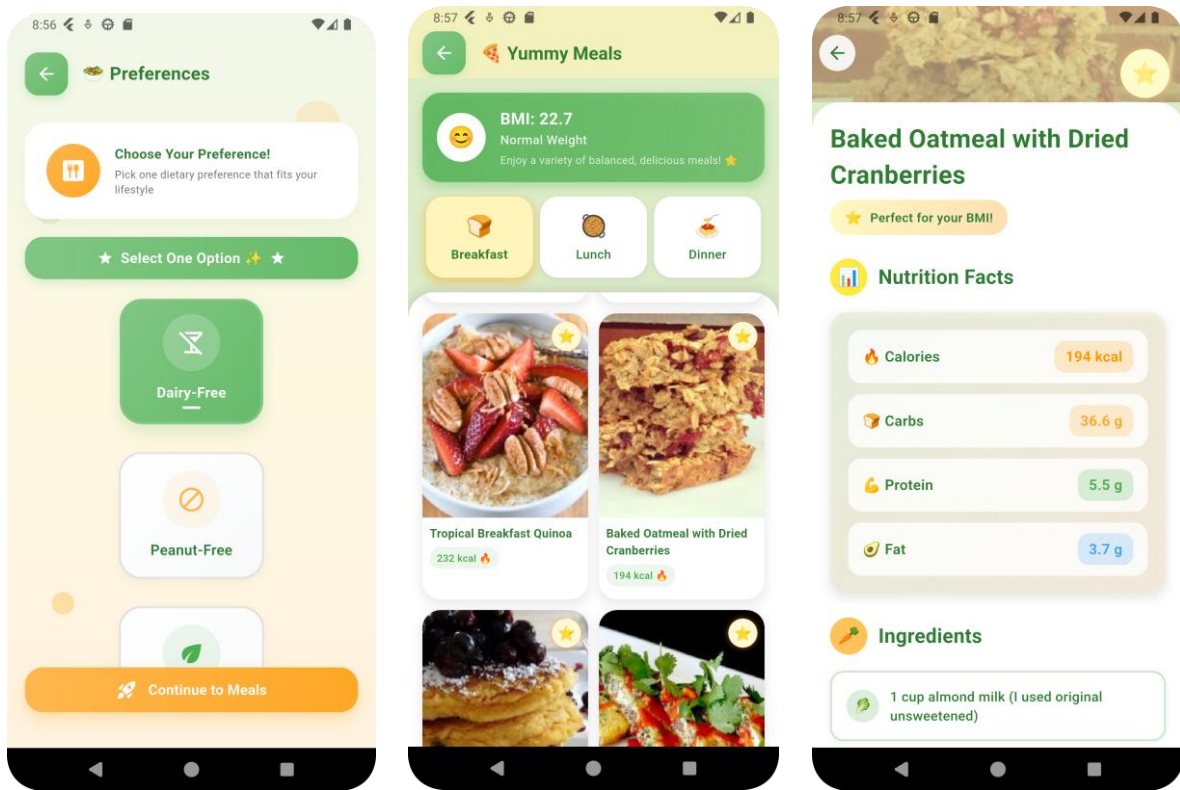


Figure 3.42: Screenshot of Meal Recommendation Page

Figure 3.42 shows the screenshots of meal recommendations Page. First, the user needs to choose their preferences for meals. Then, users able to see the recommended food by system for breakfast, lunch and dinner. All the recommended food will display the calories. If user select food to view the information, it will display the calories, carbohydrates, proteins, fats and ingredients.

3.6.5 Workouts Page

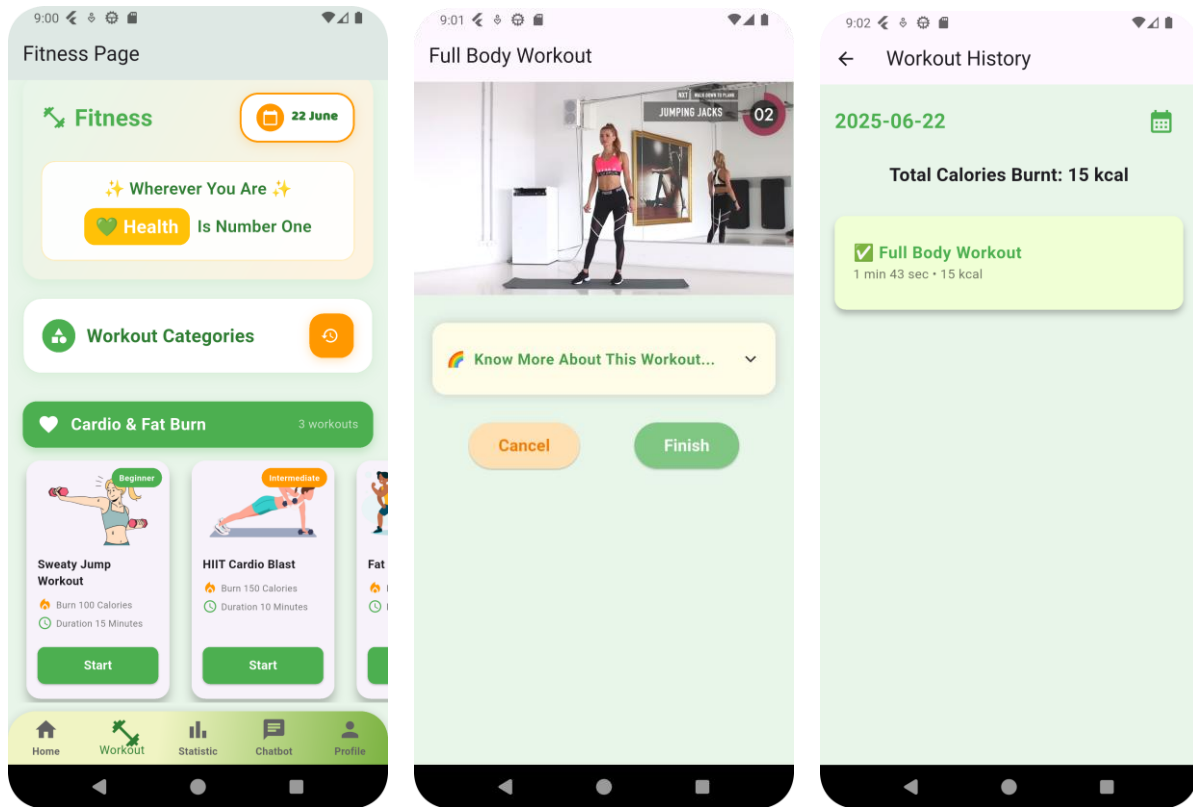


Figure 3.43: Screenshots of Workout Page

Figure 3.43 are the screenshots of the workout page. At the top of the workout page, there is a motivation quote section. Below the motivation quote section, there is a workout section. In the workout section, there are four types of workouts which users can choose to learn. Users can click either one workout to start in the workout section. After start, the video automatically be played. Users can click “Cancel” button if user would like to stop watching the workout. If the user completes the workout, user can click “Finish” button to complete the workout. The calories burned are calculated according to the intensity and timer of the workout. Then, the type of workout, duration and calories burnt are displayed in the workout history page.

3.6.6 Statistic Page

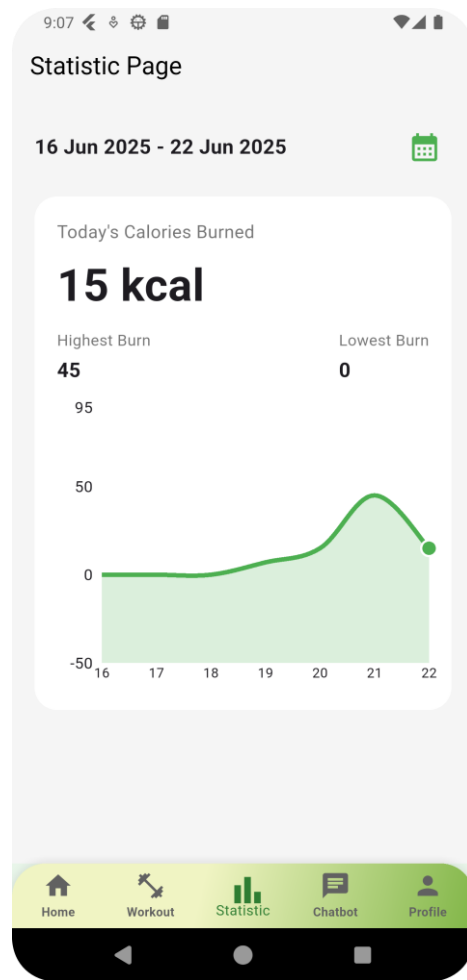


Figure 3.44: Screenshots of Statistic Page

Figure 3.44 are the screenshots of statistic page. There is Calories Burned graph is displayed. It will display the upward and downward changes on the graph based on the selected date.

3.6.7 AI Chatbot Page

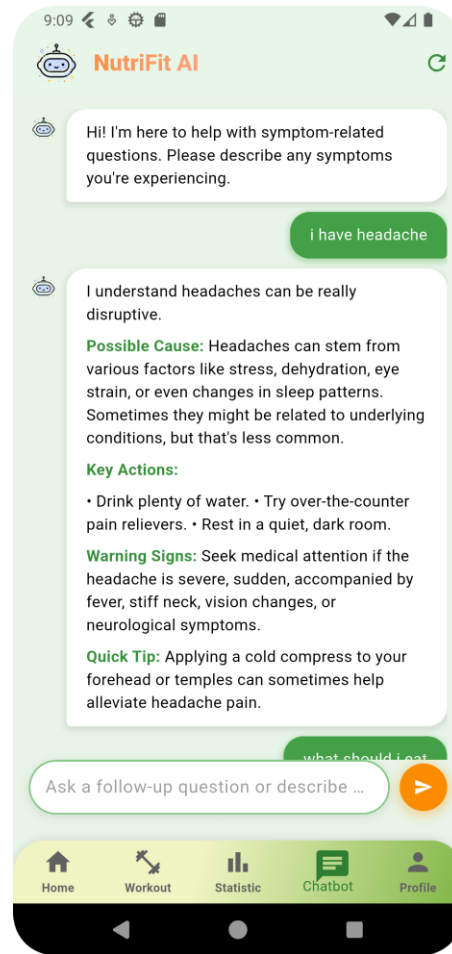


Figure 3.45: Screenshot of AI Chatbot Page

Figure 3.45 shows the screenshot of AI Chatbot Page of NutriFit AI. The user can type in the message box and click on the “Send” button to send the message for asking about the symptoms of health problems. The AI assistant will provide the advice to the users.

3.6.8 Profile Page

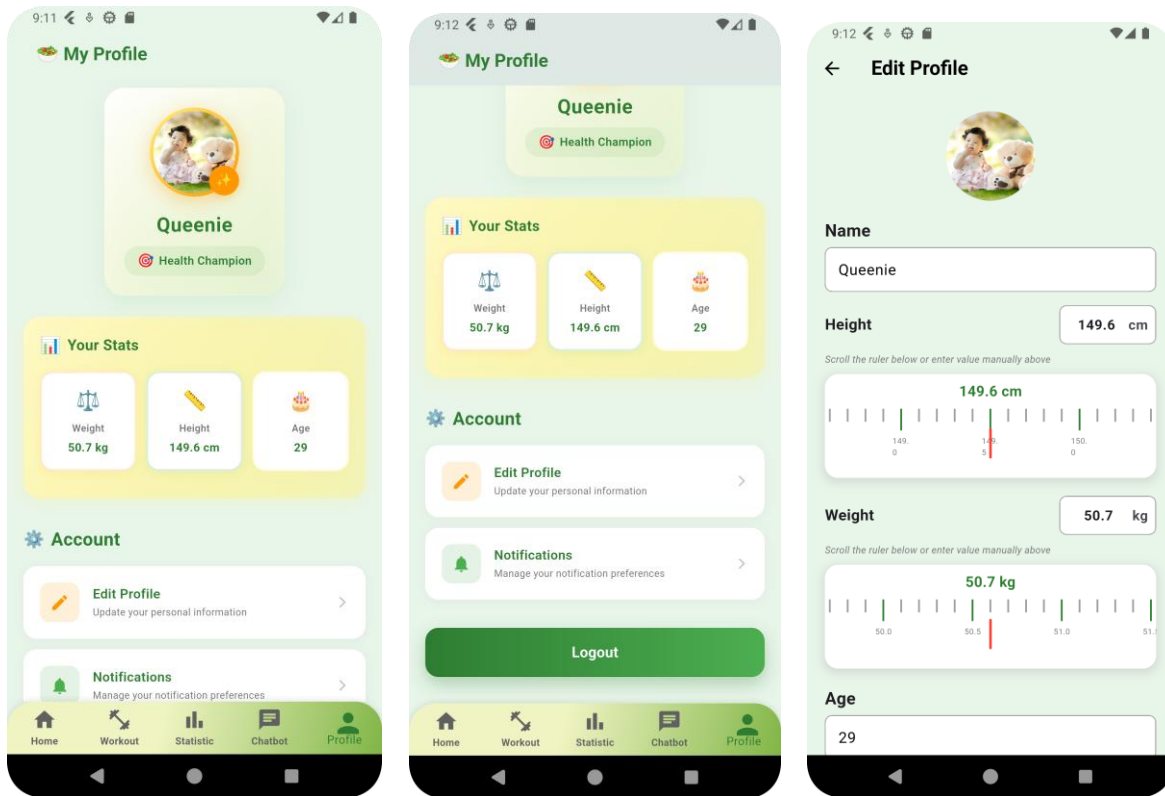


Figure 3.46: Screenshots of Profile Page

Figure 3.46 are the screenshots of profile page. The name, age, height and weight are displayed on the profile page. Users can click “Edit Profile” button to edit the personal information. Users can edit their height, weight, age, gender and their goal. The changes of information will update the data of Body Measurement on the home page.

3.6.9 Notification Page

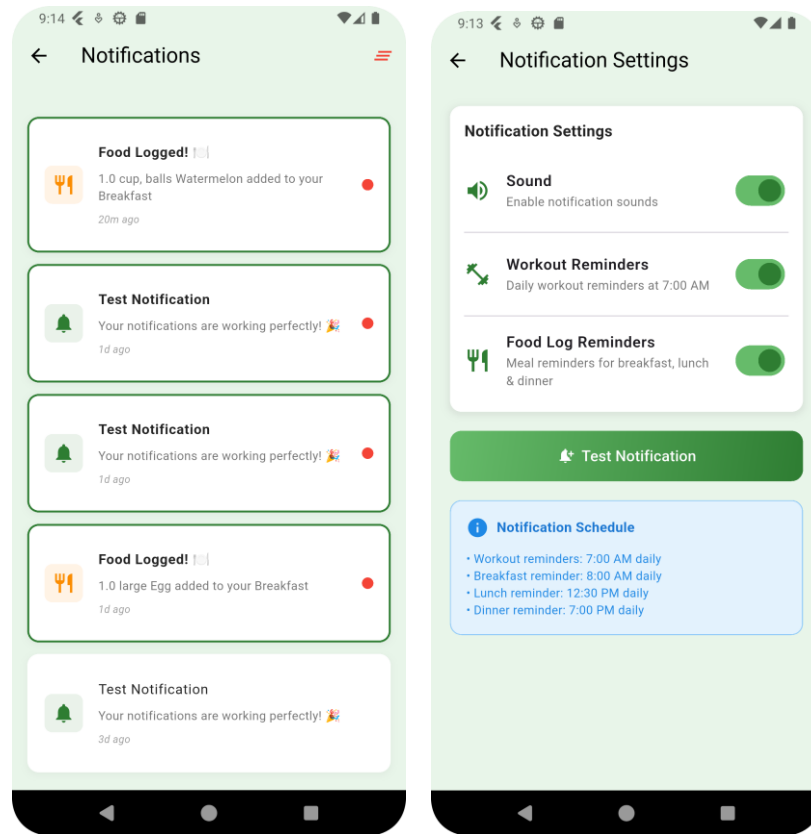


Figure 3.47: Screenshot of Notification Page

Figure 3.47 shows the Notification Page of NutriFit AI. Users can choose to switch on or off the sound of notification. Additionally, users can also choose to switch on or off the notification pop out of this mobile application.

Chapter 4: System Implementation

4.1 Introduction

This chapter discussed how NutriFit AI is developed, including the software and hardware used to develop this mobile app. The installation process of Android Studio, Flutter and Firebase are discussed. The purpose of this chapter is to provide an overview of the implementation process and a detailed record of the actions taken to ensure the successful deployment of NutriFit AI.

4.2 Hardware And Software Development Tools Requirements

This section lists the necessary software and hardware tools required to construct the NutriFit AI application. A laptop with sufficient processing power, RAM, and storage for coding and testing is part of the gear, along with mobile devices for testing apps on various operating systems. Android Studio is used for coding and debugging, Firebase is used for backend services, Flutter is used for cross-platform development, and Dart is the main programming language. Additionally, Figma is used for UI/UX design. These resources were chosen in order to guarantee effective development, seamless testing, and peak app performance.

4.2.1 Hardware Setup

Table 4.1: Hardware Requirements to Develop NutriFit AI

Components	Requirements
Processor	13th Gen Intel(R) Core(TM) i5-13420H 2.10 GHz
Graphic (GPU)	Nvidia GeForce RTX
RAM	8.00 GB
ROM	512 GB SSD

Device	An Android Smartphone (Huawei Nova 9)
--------	---------------------------------------

This table shows the hardware requirements for the development of the NutriFit AI application. 13th Gen Intel Core i5-13420H processor running at 2.10 GHz provides fast processing power for coding and testing. An Nvidia GeForce RTX graphics card is used to ensure smooth rendering of graphics and support for resource-intensive tasks. The system is equipped with 8 GB of RAM, allowing for smooth multitasking and efficient operation of development tools and the app. For storage, the system uses a 512 GB SSD, which provides fast read and write speeds, ensuring quick access to files and data. Additionally, an Android smartphone which is Huawei Nova 9 is used for testing the application. This ensures that it performs well on real mobile device. These components were chosen to ensure efficient development and thorough testing of the app, offering seamless experience during both coding and performance evaluation.

4.2.2 Software Setup

Table 4.2: Software Requirements to Develop NutriFit AI

Components	Requirements
Operating System	Window 11
System Type	64-bit operating system, x64-based processor
Software	Android Studio, Flutter
Programming Language	Dart
Database	Firebase

This table shows the software requirements for developing the NutriFit AI application. The operating system required is Windows 11, which provides a modern and efficient platform for

development. The system type is 64-bit, specifically designed for x64-based processors, ensuring compatibility and optimal performance for the tools being used. For software, Android Studio is used as the main development environment, while Flutter is utilized for cross-platform app development. The programming language used is Dart, which works seamlessly with Flutter for building high-performance, responsive applications. Finally, the app's database is managed through Firebase, a powerful backend-as-a-service platform that handles user data, authentication, and real-time data synchronization. These software components were chosen to ensure smooth development, high performance, and a robust backend for NutriFit AI.

4.3 Implementation Of Integrated Development Environment (Ide)

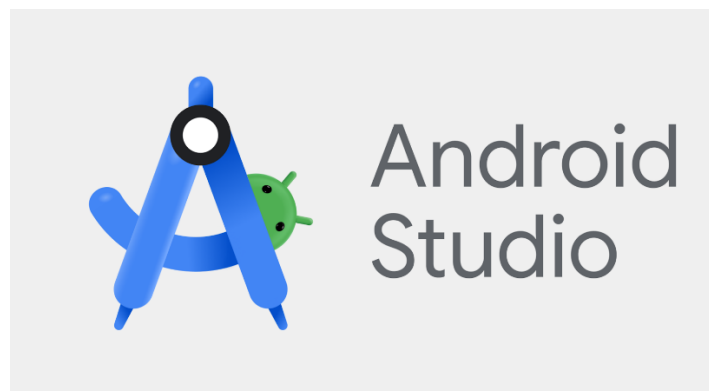


Figure 4.1: Android Studio (Google Developers, 2024)

The Integrated Development Environment (IDE) used for NutriFit AI development is Android Studio. Android Studio is the official development tool for creating apps on Google's Android operating system. It's built on IntelliJ IDEA, a popular software by JetBrains, and is specifically designed to make Android app development easier and more efficient. To ensure a smooth development process, the latest version of Android Studio is installed and configured on the development machine. The newest version typically includes performance improvements, bug fixes, and new features that enhance the development experience. By using the latest version, we

also ensure compatibility with the most recent Android SDK (Software Development Kit) and platform updates, allowing developers to access the latest APIs and features provided by Android.

The following are the steps to install Android Studio for NutriFit AI development:

1. Go to the official Android Studio website at developer.android.com/studio and click the "Download Android Studio" button for Windows operating system.
2. Once the file is downloaded, open the installer. For Windows, this is a .exe file. Double-click the file to begin the installation process.
3. The installation wizard will guide you through the setup.
4. On Windows, just click "Next" and choose where you want Android Studio to be installed.
5. During installation, you'll be asked to choose components. By default, the necessary components are selected, so just proceed with the default settings unless you want to customize.
6. Click the "Install" button, and the installer will copy the necessary files.
7. Once installed, open Android Studio. You'll see a setup wizard that will help you set it up.
8. The wizard will guide you to install the Android SDK (Software Development Kit). This is essential for creating and testing Android apps. Just click "Next" to download and install it.
9. After the SDK installation is complete, Android Studio will configure the environment and you'll be ready to start developing.
10. Once everything is installed and configured, Android Studio will launch, and you're ready to start building Android apps.

4.4 Implementation Of Framework (Flutter)



Figure 4.2: Flutter (Flutter, 2024)

Flutter is the framework chosen to develop NutriFit AI because it allows for building high-performance, cross-platform mobile apps using a single codebase. Flutter uses Dart as its programming language, which is fast and easy to learn. The framework offers a rich set of pre-designed widgets that make building the user interface both simple and customizable, ensuring a visually appealing experience. For NutriFit AI, Flutter enables quick development and smooth animations, helping create a responsive and interactive app that adapts well to various screen sizes. Additionally, it integrates easily with other services like Firebase, which is used for authentication and data storage, allowing the app to sync user information and provide real-time updates. With its hot reload feature, Flutter also speeds up development by instantly reflecting code changes, making the development process more efficient. To implement Flutter for the NutriFit AI project, here is the step-by-step instructions:

1. Visit the official Flutter website at <https://docs.flutter.dev/get-started/install/windows/mobile> and follow the installation instructions for Windows operating system.
2. Install the Flutter through Visual Studio Code.
3. Launch VS Code.
4. To open the Command Palette, press Control + Shift + P.
5. In the Command Palette, type flutter.
6. Select Flutter: New Project.
7. VS Code prompts you to locate the Flutter SDK on your computer. If you have the Flutter SDK installed, click Locate SDK. If you do not have the Flutter SDK installed, click Download SDK.
8. After the SDK download is successful, the Select Folder for Flutter SDK dialog will display, choose where you want to install Flutter.
9. Click Clone Flutter. Then, wait for it to finish installing the dependencies and tools needed for flutter.
10. After all the components successfully been install, a notification showing “The Flutter SDK was added to your PATH” is displayed.
11. Open Android Studio and select "Configure" -> "Settings". In the left-hand sidebar, choose "Languages & Frameworks" -> "Flutter" and set the Flutter SDK path to the location where the Flutter SDK was extracted.
12. Create a New Flutter Project. Go to "File" -> "New" -> "New Flutter Project". Choose the "Flutter Application" template, provide a project name (e.g., nutrifitai), and select a suitable location to save the project.

13. After the project is created, open the main.dart file and click on the green play button (or use the "flutter run" command in the terminal) to launch the app on the emulator or connected device. Ensure that the emulator/device is properly set up and recognized by Flutter.
14. Open the lib/main.dart file and start editing the code to build the NutriFit AI application according to the project requirements. Modify the UI, add functionalities, and integrate with external services like Firebase for database operations.
15. Continuously evaluate the app during development by running it on emulators or physical devices. Use Flutter's hot-reload feature to quickly see the changes without restarting the app.

4.5 Implementation Of Database Tool (Firebase)



Figure 4.3: Firebase (Google, 2024)

For the NutriFit AI app, Firebase is used as the database tool to handle user data, authentication, and real-time synchronization. Firebase is a powerful and easy-to-use backend platform that offers a range of services, making it a perfect choice for building a mobile app. First, Firebase Authentication is used to manage user sign-ups, logins, and password resets securely. This ensures that users can access their personal profiles and data safely.

Firebase Firestore, which is a NoSQL cloud database, is used to store user information, including their health details like weight, height, fitness goals, and meal logs. This allows the app

to securely store data and sync it across devices in real time. Users can add, update, or delete their health information, and these changes are reflected immediately. Firebase also helps in managing push notifications. It allows us to send reminders to users for workouts, meals, or other health-related activities, ensuring they stay on track with their goals. Here are step-by-step instructions for implementing Firebase in the NutriFit AI project:

1. Go to the Firebase Console at <https://console.firebase.google.com> and click on “Add Project.” Follow the prompts to set up a new Firebase project for NutriFit AI app.
2. In the Firebase Console, once your project is created, click on "Add App" and choose Android. You'll need to follow the instructions to download the google-services.json (for Android) and add it to NutriFit AI app's project.
3. In your Flutter project, open the pubspec.yaml file and add the necessary Firebase dependencies. You can find the most recent version of Firebase plugins for Flutter at <https://pub.dev/packages>. For example, you'll need `firebase_core`, `firebase_auth`, and `cloud_firestore` for user authentication and data storage.
4. Then, running `flutter pub get` to install these dependencies.
5. In your main Flutter app file (usually `main.dart`), import Firebase and initialize it in the `main()` function.
6. To allow users to sign up, log in, and reset passwords, you'll need to set up Firebase Authentication. Add the `firebase_auth` package to your project and configure the sign-up, login, and password reset methods.
7. Firestore will store user data such as meal logs, workout progress, and health details. Add the `cloud_firestore` package and create methods to store and retrieve user data.

8. In the Firebase Console, go to the Firestore Database section and set up security rules to ensure that only authenticated users can read and write their data.
9. Finally, test your app to ensure Firebase is working properly. Test user sign-up, login, data storage, and synchronization across devices.

4.6 System Architecture

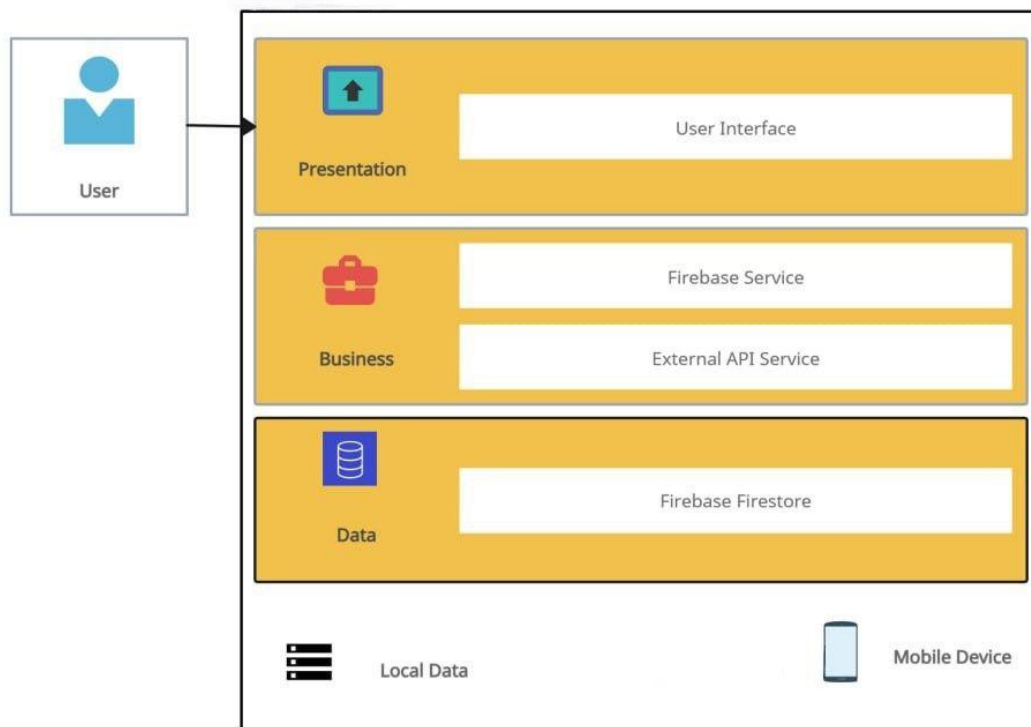


Figure 4.4: Architecture Diagram of NutriFit AI Application

The diagram illustrates the system architecture of the NutriFit AI app, organized into three key layers which are Presentation, Business, and Data. The Presentation Layer is the part that users interact with directly, displaying meal recommendations, workout details, and progress. It communicates with the Business Layer, which handles the logic behind the app's features, like managing user authentication through Firebase Service and pulling data from external sources via

API Services. Finally, the Data Layer stores everything, with Firebase Firestore syncing and saving user data in the cloud so that it's always up to date across devices. The app runs on a Mobile Device, where users input their data, and it's processed and stored efficiently. This setup ensures that the app functions smoothly by keeping each layer focused on its role, allowing for a seamless and scalable experience.

4.6.1 Presentation Layer

The Presentation Layer is part of the NutriFit AI app that users directly interact with. It includes all the visual elements and screens of the app, such as the home page, food logger page, meal recommendation page, workout tracker, and profile settings. This layer is responsible for creating an intuitive and engaging user experience, making sure the app is not only functional but also user-friendly. For example, when a user enters their health data (like weight, height, and fitness goals), the Presentation Layer displays personalized meal plans based on that information. It also handles notifications and reminders for workouts or meals, ensuring the user stays on track with their fitness journey. Additionally, it maintains visual consistency, such as using easy-to-read fonts, intuitive icons, and color schemes that match the app's branding.

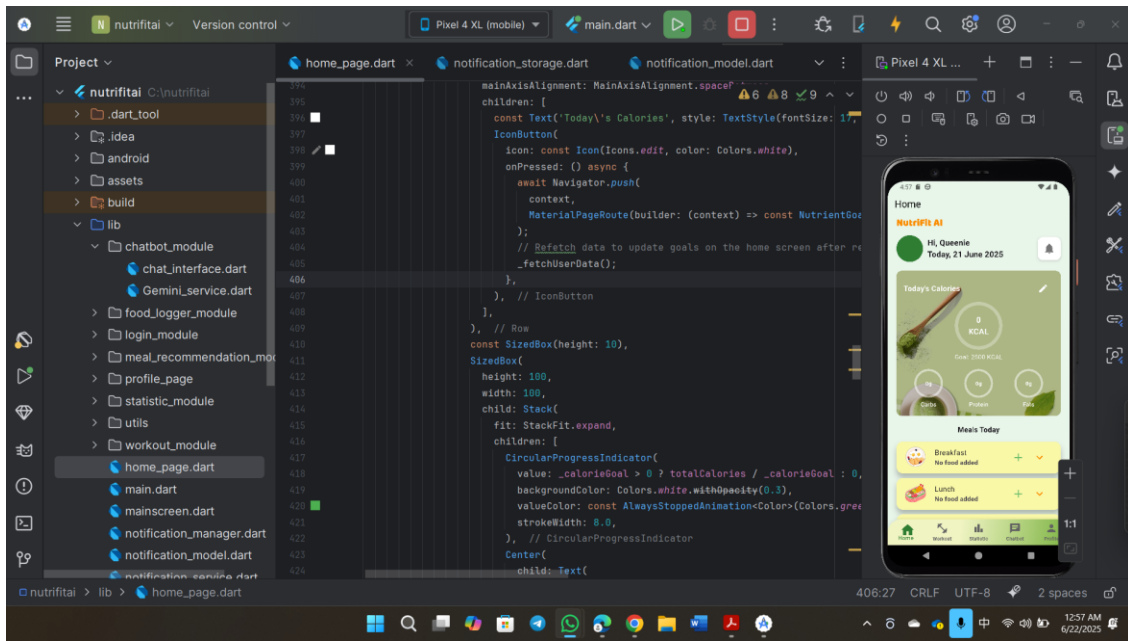


Figure 4.5: The Home Page Coding of NutriFit AI Application

Each file in the NutriFit AI app contains specific code and functions that are related to particular features or tasks. The code is organized into separate files based on its purpose, making it easier to manage and update. During the development process, the code is written and thoroughly tested to ensure it meets the app's requirements and works as intended. This ensures that each part of the app functions smoothly and delivers the expected experience to the user. The table below shows the file structures of the system:

Table 4.3: File Structure of NutriFit AI

Folder	Description
nutrifitai/android	This folder contains all the files and configurations specific to the Android version of the app. It includes things like settings, Android-specific libraries, and permissions needed for the app to run on Android devices.

nutrifitai/build	This folder stores temporary files created during the app's build process. It includes compiled code and other files generated as part of the app's setup and packaging for distribution.
nutrifitai/lib	This is the core folder where all the main code for the app lives. It contains Dart files that define the app's functionality, user interface, and logic. It's where the majority of the development work happens.
nutrifitai/assets	This folder holds non-code files like images, icons, fonts, and other resources that the app uses. These files are essential for the app's appearance and user experience.

4.6.2 Business Logic Layer

The Business Logic Layer is where all the behind-the-scenes work happens in the NutriFit AI app. It handles the core functions and processes that make the app work, such as user authentication, data management, and decision-making. When a user enters their details, like weight and height or meals preferences, this layer processes that information and determines the appropriate meal plans. It also manages how the app interacts with external services, like fetching food data from an API or syncing data with the Firebase database. Essentially, this layer makes sure everything runs smoothly, and that the app behaves as expected, ensuring users get personalized, real-time information. Without the Business Logic Layer, the app would not be able to deliver the tailored experience that NutriFit AI promises.

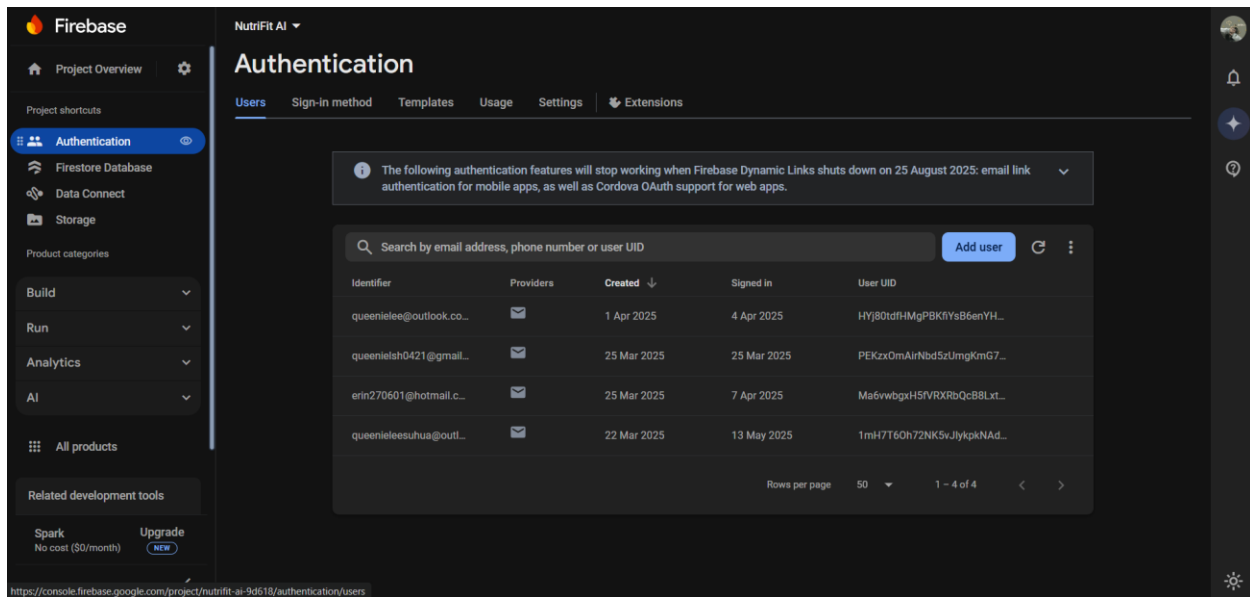


Figure 4.6: Firebase User Authentication of NutriFit AI

4.6.3 Data Storage Layer

The Data Storage Layer is where all the important information in the NutriFit AI app is stored and managed. This includes user data such as their profile details (like weight, height, and fitness goals), meal logs, workout progress, and even the recommendations made by the app. All of this information is securely stored in the cloud using Firebase Firestore, which makes it accessible from any device the user logs into. It ensures that data is synced in real-time, so if a user logs their meals or completes a workout on one device, it instantly reflects across all their devices. This layer also handles data retrieval, ensuring the app can fetch and display the right information quickly. In short, the Data Storage Layer is responsible for safely storing user data and ensuring it's always up-to-date and accessible, making the app reliable and efficient.

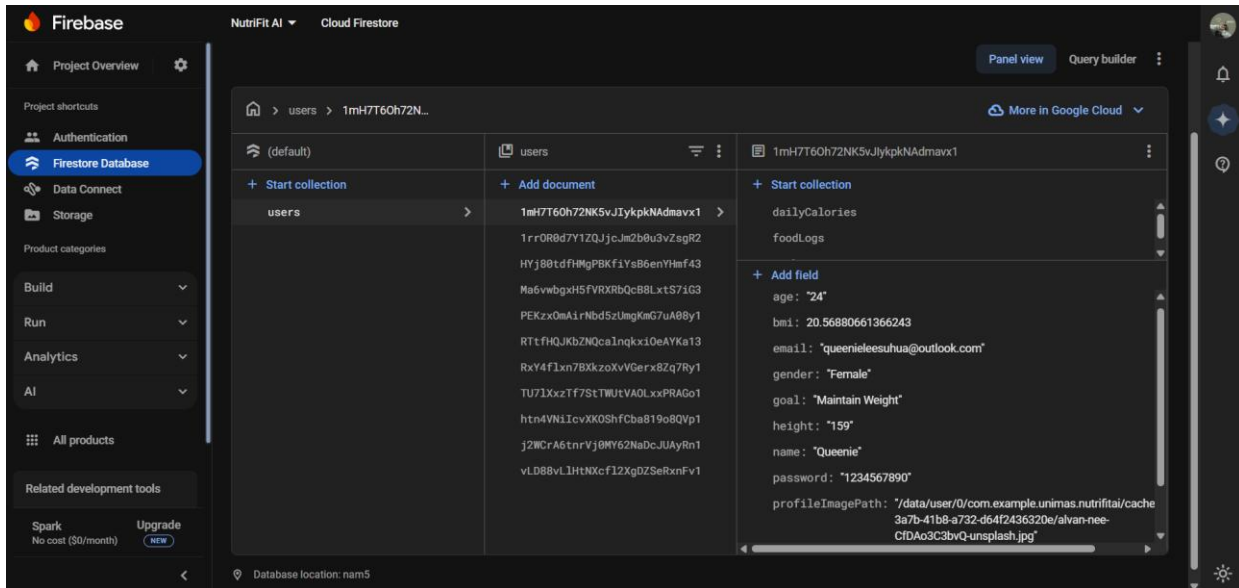


Figure 4.7: Firebase Firestore Database of NutriFit AI

4.7 Nutrifit AI Module Implementation

1. User Profile Management

NutriFit AI allows users to create and manage their profiles. Users input personal details such as their name, age, weight, height, and fitness goals. Based on this information, the system calculates the user's Body Mass Index (BMI) and uses it to personalize meal and workout suggestions. This module ensures that each user receives tailored recommendations that align with their unique health and fitness objectives.

2. Food Logger Module

Users allow to log their meals, track their calorie intake, and monitor important nutrients like carbs, protein, and fat. The app integrates with an external database (Nutritionix API) to fetch nutritional information for various food items. Users can add meals throughout the day, and the system will update their total intake.

3. Meal Recommendation Module

This module provides personalized meal plans based on the user's profile, including their BMI, and dietary preferences. By analyzing the BMI data from the user's and dietary preferences, the app suggests meal options that align with their needs whether the user is underweight, normal weight or overweight.

4. Workout Tracking

NutriFit AI also includes a workout tracking module that allows users to log their exercise routines. Whether it's a run, weightlifting session, or yoga class, users can track the type of workout, duration, and calories burned. The app then saves the data and presents a history of all past workouts. This helps users see their progress, adjust routines, and stay motivated.

5. AI Chatbot Module

The chatbot module, powered by Gemini, is a key feature of NutriFit AI. It interacts with users to answer symptoms-based health questions. This module adds an interactive layer to the app, making it more engaging.

6. Statistics Module

To help users stay motivated and see how far they've come, the statistics module provides detailed reports on calories burned. Users can view the statistics through interactive chart.

7. Notification Module

The system includes a notification and alerts feature that helps users stay consistent with their health goals. It sends timely reminders to encourage users to log their meals and workouts regularly.

Notifications are scheduled to appear at specific times to prompt users to stay on track with their daily routines and targets.

8. Profile Module

The profile management feature allows users to edit and update their personal information, including name, gender, height, weight, age, and fitness goals. As users update key data such as height and weight, the system recalculates recommendations to ensure they remain accurate and personalized based on the latest information.

4.8 Interfaces Of Nutrifit AI

The screenshots of NutriFit AI are shown in this section. Each screenshot highlight how the app serves specific user needs, from managing profiles and tracking meals to logging workouts and interacting with the AI chatbot.

4.9.1 Login Page

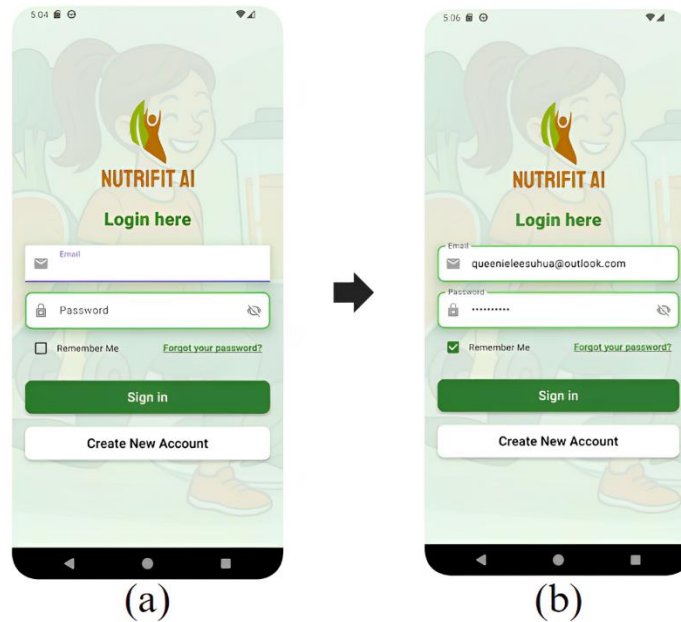


Figure 4.8: NutriFit AI Login Page

Figure 4.5 showcases the login page of the NutriFit AI mobile app, which serves as the first step for users to access their personalized health and fitness features. In the initial step (shown in a), users are prompted to enter their email and password to log in. The page offers the "Remember Me" option, allowing users to stay logged in for convenience, eliminating the need to input their credentials every time they access the app. Additionally, there is a "Forgot your password?" hyperlink for users who need to reset their password, and a "Create New Account" button for new users to sign up. Once the login credentials are entered, the screen transitions to the next view (b), where the email and password fields are populated, and the "Remember Me" box is checked. The password is hidden for security purposes. The "Sign In" button is now active, enabling the user to complete the login process.

4.9.2 Register Page

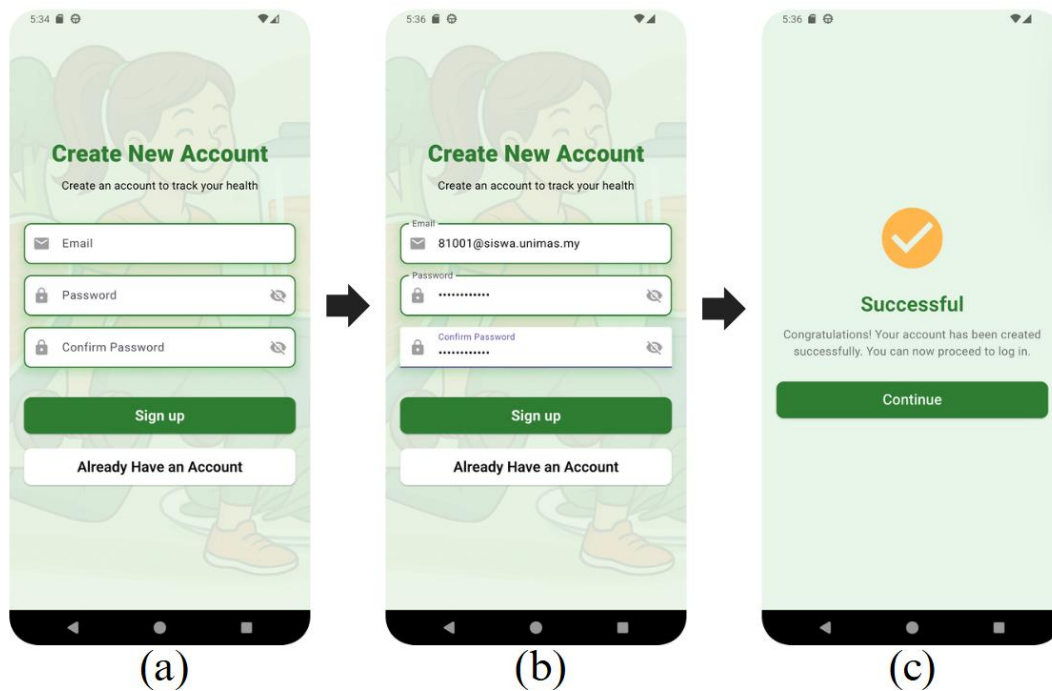


Figure 4.9: Register Page for NutriFit AI

Figure 4.6 shows the register page of the NutriFit AI app, which allows new users to create an account. In (a), the user is prompted to fill in their email, password, and confirm password. The password fields are hidden for privacy, displaying dots for security. There's a "Sign up" button for submitting the registration details, and a button below that display "Already Have an Account", which takes users back to the login page if they already have an account. In (b), after the user fills in the required information, their email and password are shown, while the confirm password field is also populated. The user is now ready to click the "Sign up" button to proceed. Finally, in (c), once the account is successfully created, the screen shows a confirmation message with a green checkmark and the text "Successful". The message below confirms that the account has been created, and the user can now proceed to log in by pressing the "Continue" button.

4.9.3 Forgot Password Page

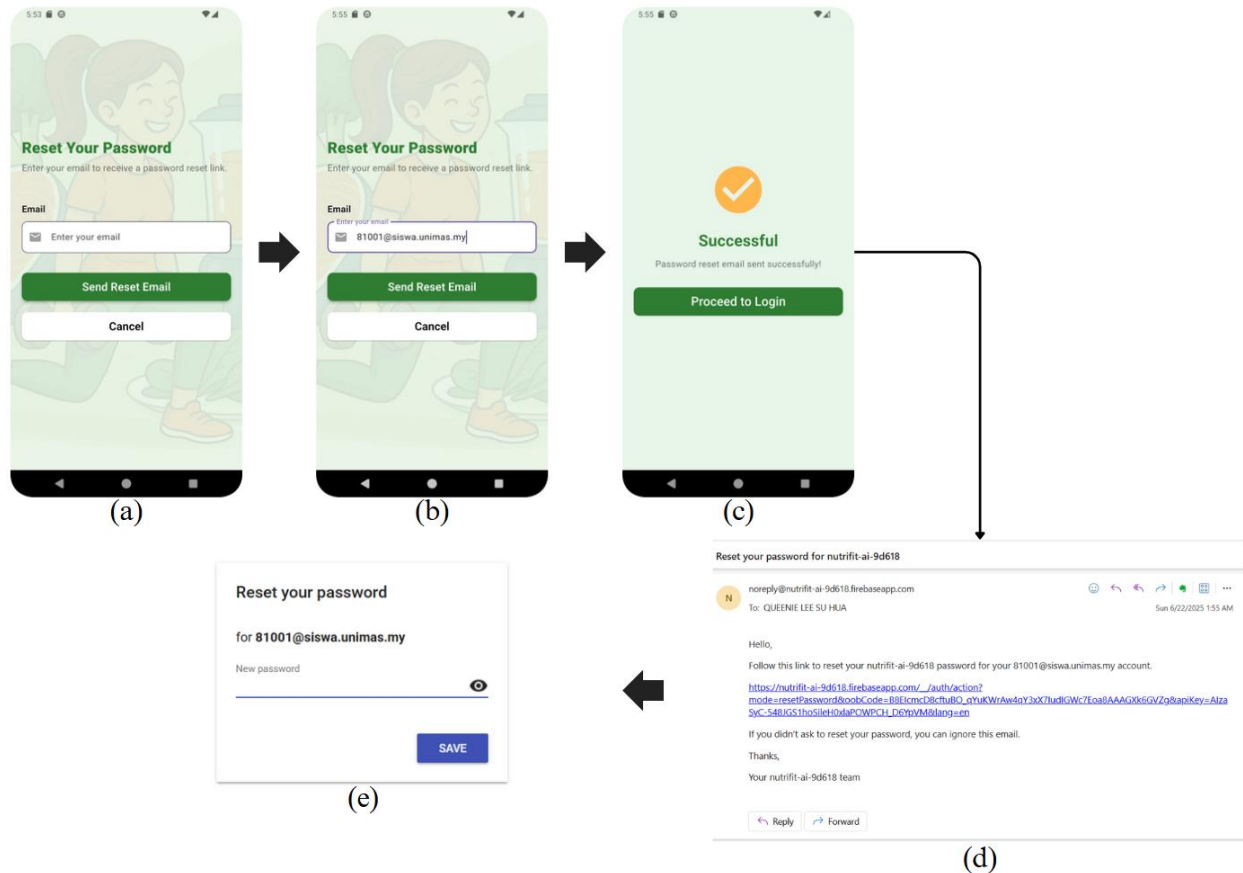


Figure 4.10: Forgot Password Page for NutriFit AI

Figure 4.7 demonstrates the Forgot Password feature of the NutriFit AI app, which helps users recover access to their account if they've forgotten their password. In the first step (a), users are prompted to enter their email address in the provided field to receive a password reset link. Once the email is entered, they can click the "Send Reset Email" button to initiate the process, with a "Cancel" option available to abort the action if necessary. After entering the email, the next screen (b) confirms the email address and proceeds to send the reset email. Upon successful submission, the app displays a confirmation message (c) that the password reset email has been sent, along with a "Proceed to Login" button to allow users to return to the login screen and try logging in again after resetting their password. The user will then receive an email (d) containing

a unique link to reset their password. This email assures the user that they can ignore it if they didn't request a reset. Finally, when the user clicks the link, they are taken to a page (e) where they can enter a new password. After typing the new password, they can click "Save" to confirm the change.

4.9.4 Home Page

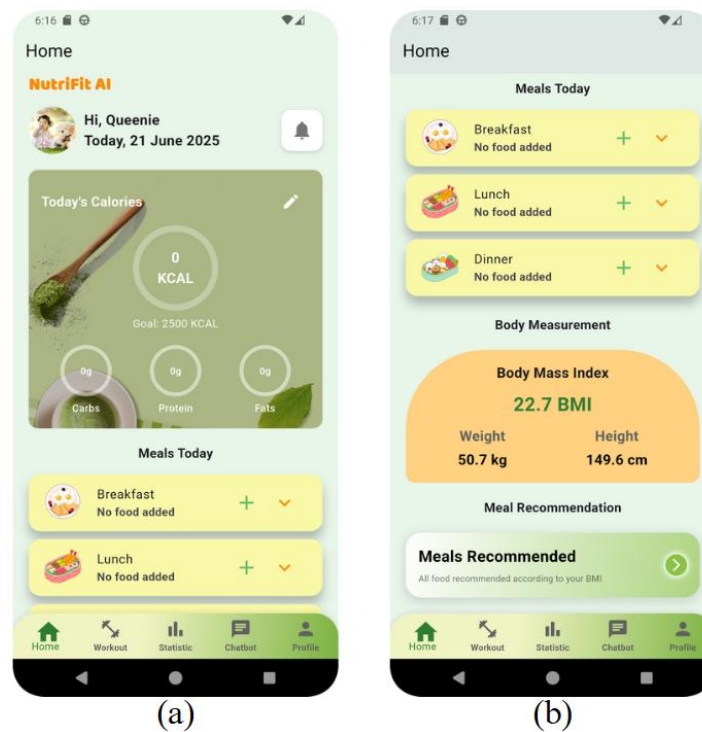


Figure 4.11: Home Page for Nutrifit AI

Figure 4.8 shows the Home Page of the NutriFit AI app after a user has logged in. In (a), the app displays a welcome message with the user's name and the date. The "Today's Calories" section shows the user's current calorie intake, which is 0 KCAL, as no meals have been logged yet. The goal for the day is set to 2500 KCAL, and the nutritional values for carbs, protein, and fats are displayed as 0g. Below that, the app shows the Meals Today section, with Breakfast, Lunch, and Dinner listed, but none of the meals have been added yet. The app also provides quick access to the Workout, Statistics, Chatbot, and Profile sections through the bottom navigation bar. In (b),

after some meals have been added, the page updates to show Breakfast, Lunch, and Dinner with icons and the option to expand each meal to view more details. The Body Measurement section is now visible, showing the user's BMI, weight, and height. Additionally, the Meal Recommendation section encourages the user to view meal suggestions based on their BMI, with the option to click on a button to explore recommended meals tailored to their needs.

4.9.5 Food Logger Page

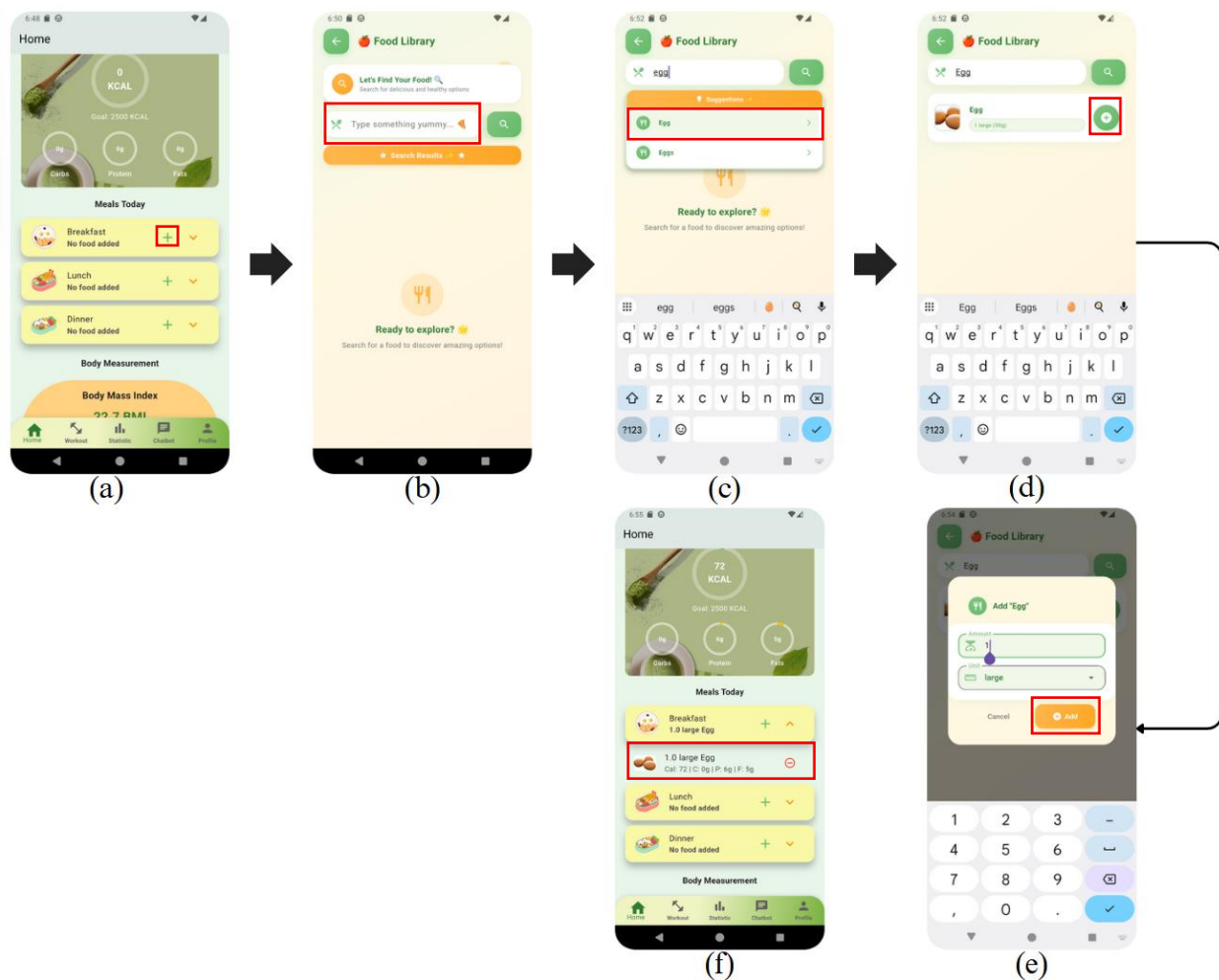


Figure 4.12: Food Log for NutriFit AI

Figure 4.9 illustrate the Food Log Module of the NutriFit AI app, designed to help users track their meals and monitor their daily calorie intake. On the Home Page (a), users can see the

“Meals Today” section, where meals for Breakfast, Lunch, and Dinner are displayed. Initially, Breakfast shows "No food added" along with a add button to add food. Once the user taps the add button, they are redirected to the Food Library page (b), where they can search for a food item by typing it into the search bar. For example, the user types "egg" into the search bar, and the app suggests matching items like "Egg" and "Eggs" (c). The user can select the desired food item, and key in the amount and unit of the food. To log the food, the user clicks the "Add" button (d), and the app updates the Breakfast section on the Home Page to show 1 large egg with its corresponding nutritional information (e). The updated “Meals Today” section now reflects the added food, providing users with an easy and efficient way to track their daily intake and progress (f).

4.9.6 Meal Recommendation Page

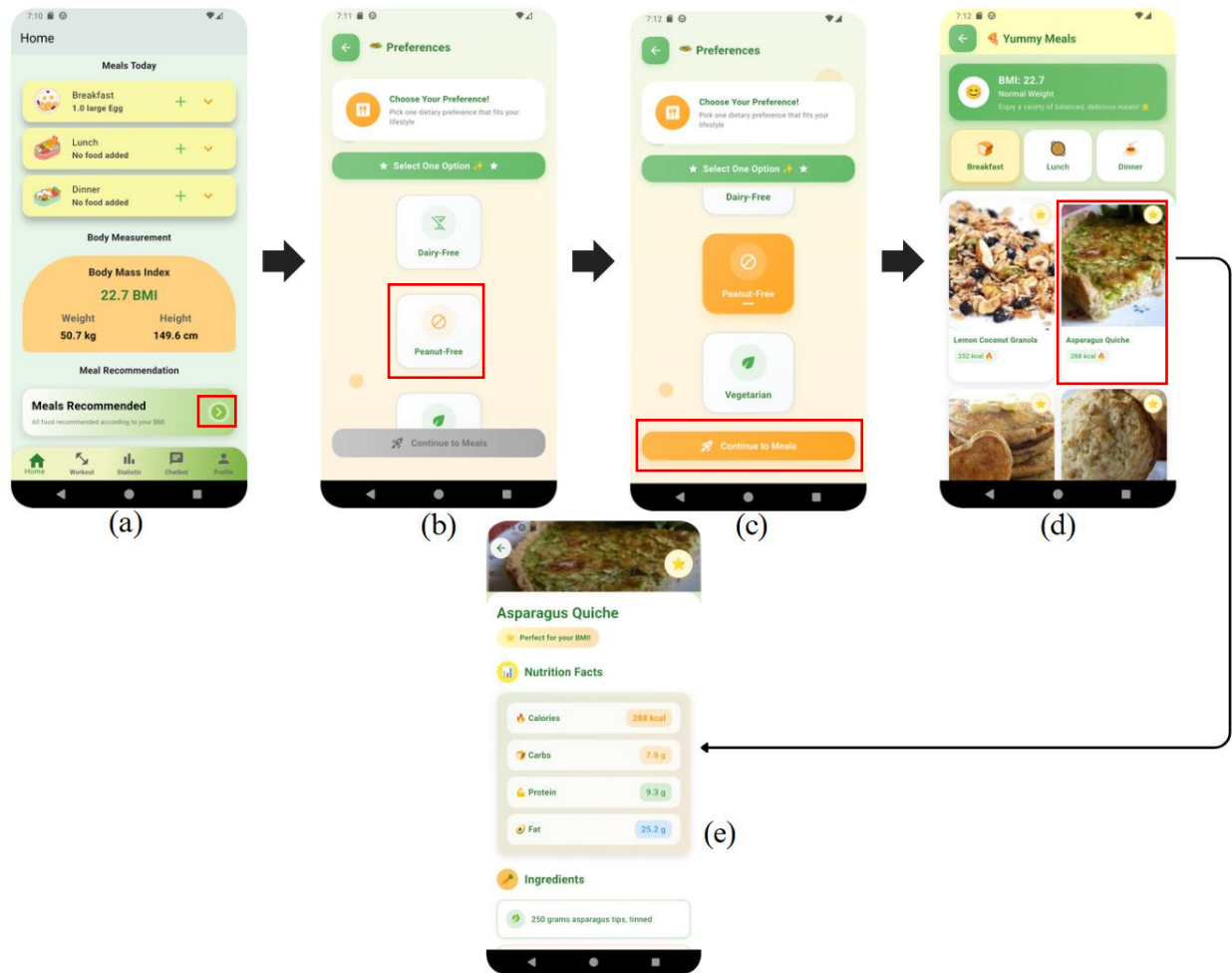


Figure 4.13: Meal Recommendation for NutriFit AI

Figure 4.10 illustrate the Meal Recommendation Module of the NutriFit AI app, designed to offer personalized meal suggestions based on the user's dietary preferences and BMI. In the first step (a), users can navigate to the Meals Recommended section on the Home Page and tap the approach icon to access personalized meal recommendations. This takes them to the Preferences Page (b), where they can select their dietary preferences, such as Peanut-Free, Dairy-Free, or Vegetarian, depending on their specific needs or allergies. After selecting their preferences, users can click on the "Continue to Meals" button, which directs them to a list of suggested meals that fit their criteria (c). In the next screen (d), the app displays a variety of meal options, such as Lemon

Coconut Granola and Asparagus Quiche, each accompanied by an image and calories. By selecting a meal, users can view detailed information about the dish (e), including its nutrition facts (calories, carbs, protein, fat) and a list of ingredients, allowing them to make more informed decisions based on their dietary goals.

4.9.7 Workout Page

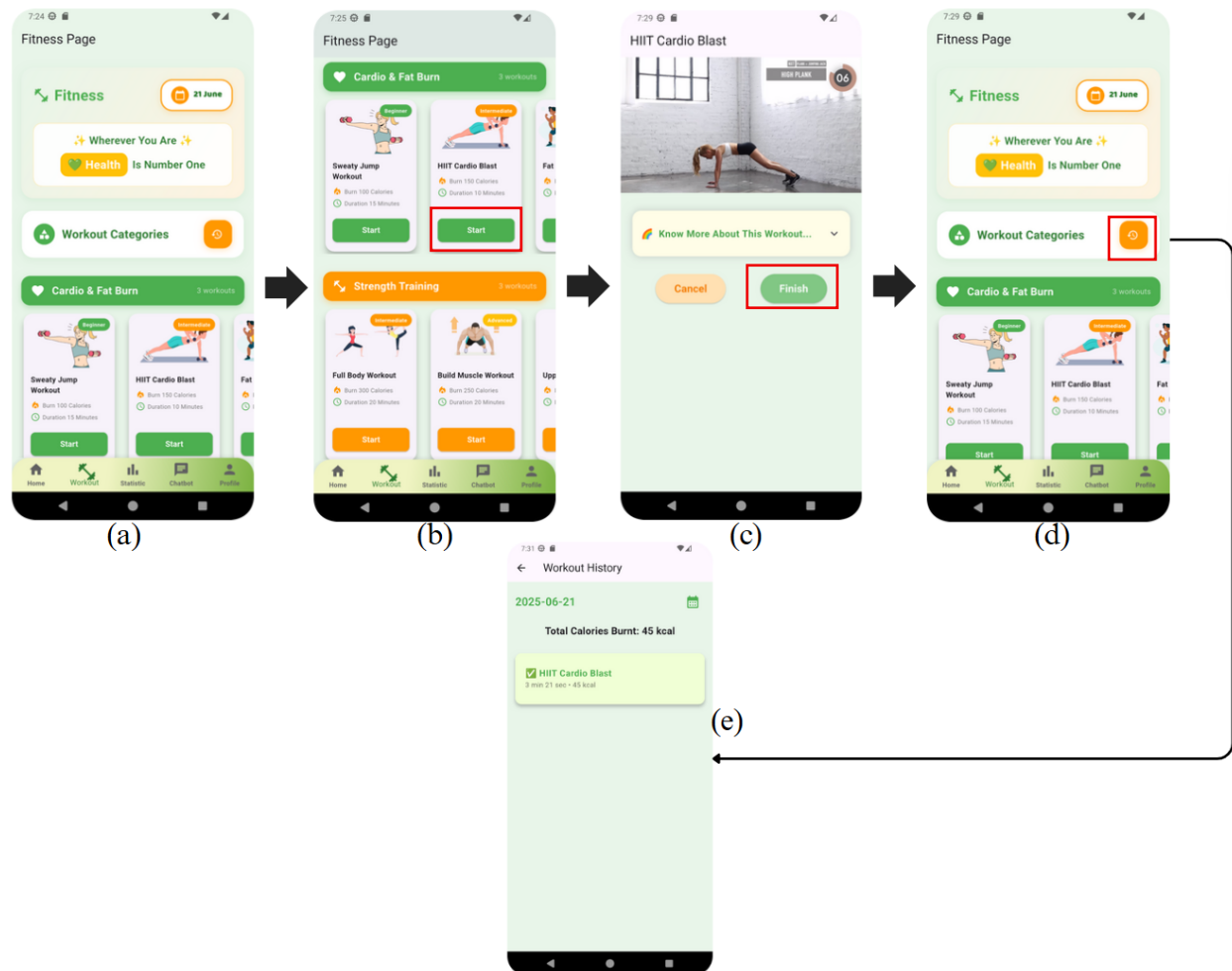


Figure 4.14: Workout for NutriFit AI

Figure 4.11 illustrate the Workout Module of the NutriFit AI app, which is designed to help users track and complete their fitness routines. In (a), the Fitness Page is displayed with different Workout Categories, including Cardio & Fat Burn and Strength Training. The user can choose a

workout and tap Start to begin their exercise session. For example, the user selects HIIT Cardio Blast from the Cardio & Fat Burn category. In (b), after selecting the workout, the video start. To view more information about the workout, open the drop down “Know More About This Workout” to get information. In (c), the workout session begins, and a timer counts down the duration of the session. Once completed, the user taps the Finish button to end the workout. In (d), after finishing the workout, the Fitness Page is updated to show the completed HIIT Cardio Blast workout. Finally, in (e), the Workout History is shown, displaying the total calories burned during the session. The user can track their progress over time and see the details of each completed workout. In this case, the HIIT Cardio Blast workout resulted in burning 45 kcal.

4.9.8 Statistic Page

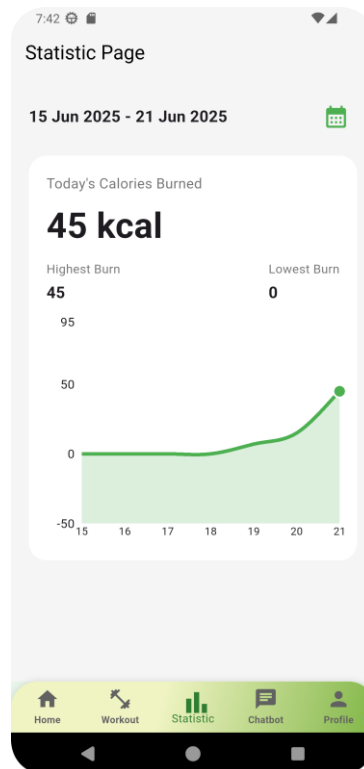


Figure 4.15: Statistics Page for NutriFit AI

Figure 4.12 showcases the Statistic Module of the NutriFit AI app, designed to track and visualize the user's progress in terms of calories burned over a period. At the top of the screen, the date range until current date is displayed, indicating the period for which the statistics are being tracked. User also can choose the date range by clicking the calendar icon. The app shows the total calories burned for the day, along with the highest burn for the day and the lowest burn. This information helps the user understand their calorie-burning progress throughout the day. Below this, a graph provides a visual representation of the calories burned, with the x-axis representing the days and the y-axis representing the calories burned.

4.9.9 AI Chatbot Page

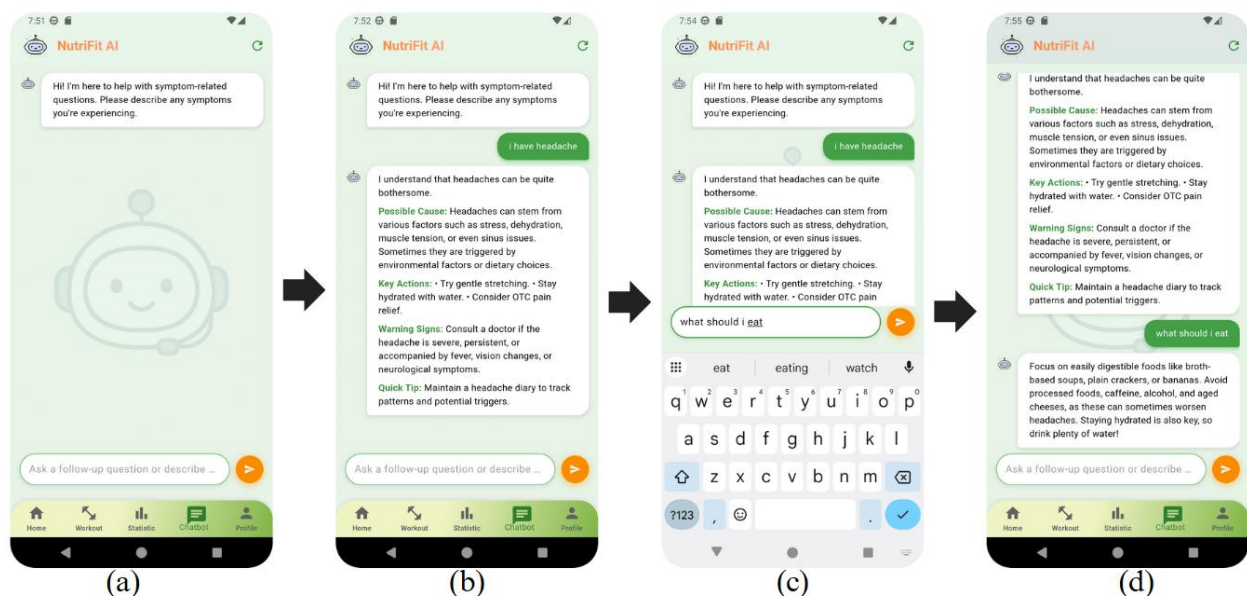


Figure 4.16: AI Nutrition Chatbot for NutriFit AI

Figure 4.13 illustrate the AI Nutrition Chatbot Module in the NutriFit AI app, which helps users with symptom-related questions and provides dietary advice. In (a), the user opens the chatbot and is greeted with a message asking them to describe any symptoms they are experiencing. For example, the user types "I have a headache", and the chatbot responds by acknowledging the issue. In (b), the chatbot provides a detailed response, including the possible causes of the headache. It

also suggests key actions to alleviate. Additionally, the chatbot provides warning signs that indicate when a doctor should be consulted. The chatbot also offers a quick tip to help track headache patterns and triggers. In (c), the user asks a follow-up question, typing "What should I eat" to get dietary advice. The chatbot responds with detail suggestions.

4.9.10 Profile Page

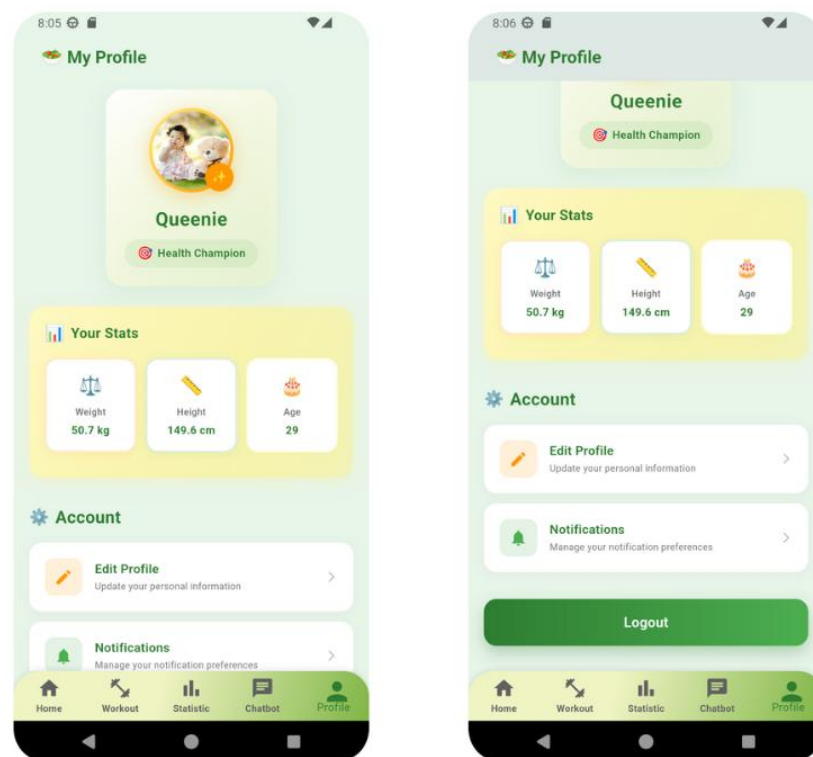


Figure 4.17: Profile Page for NutriFit AI

Figure 4.14 shows the “My Profile” page which is designed as the user's personal hub within the NutriFit AI application. Upon navigate to this page, the page greeting the user with their profile picture, name and a motivational badge to recognize their commitment. Below this, the "Your Stats" section offers a summary of key metrics like weight, height, and age, with each stat presented in its own card for easy readability. Furthermore, the “Account” section acts as a control center, offering clear options to “Edit Profile” to update personal information and manage “Notifications.” For security, a “Logout” button is easily accessible at the bottom of the screen.

4.9.11 Edit Profile Page

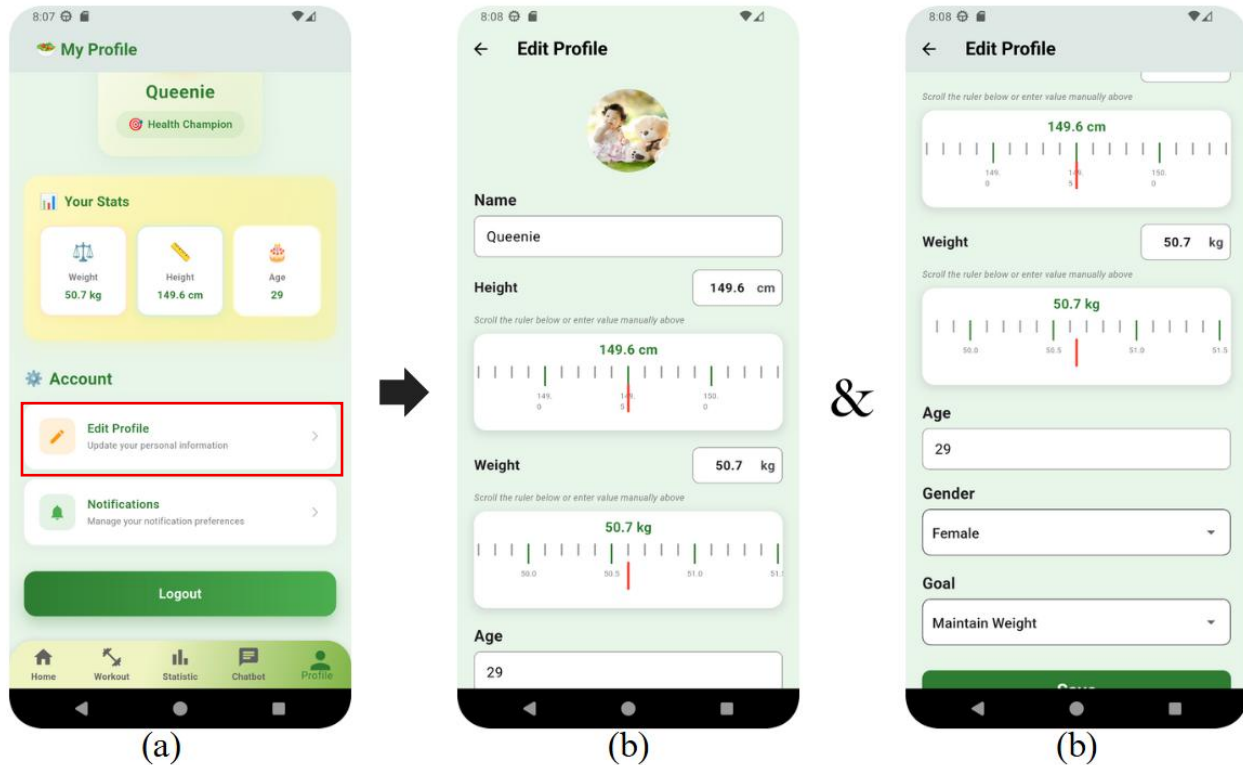


Figure 4.18: Edit Profile Page for NutriFit AI

Figure 4.15 shows the "Edit Profile" page which is implemented to give users complete and intuitive control over their personal data. The user can easily access this page by tapping the "Edit Profile" option from their main profile screen, as shown in figure (a). Upon navigate to the "Edit Profile" page (figure b), the user is presented with a well-organized form including name, height, weight, age, gender and health goal. At the top, their current profile picture is displayed, which they can tap to change. Once the user has finished making changes, they can save them, and the updated information are saved in the Firebase.

4.9.12 Notification Page

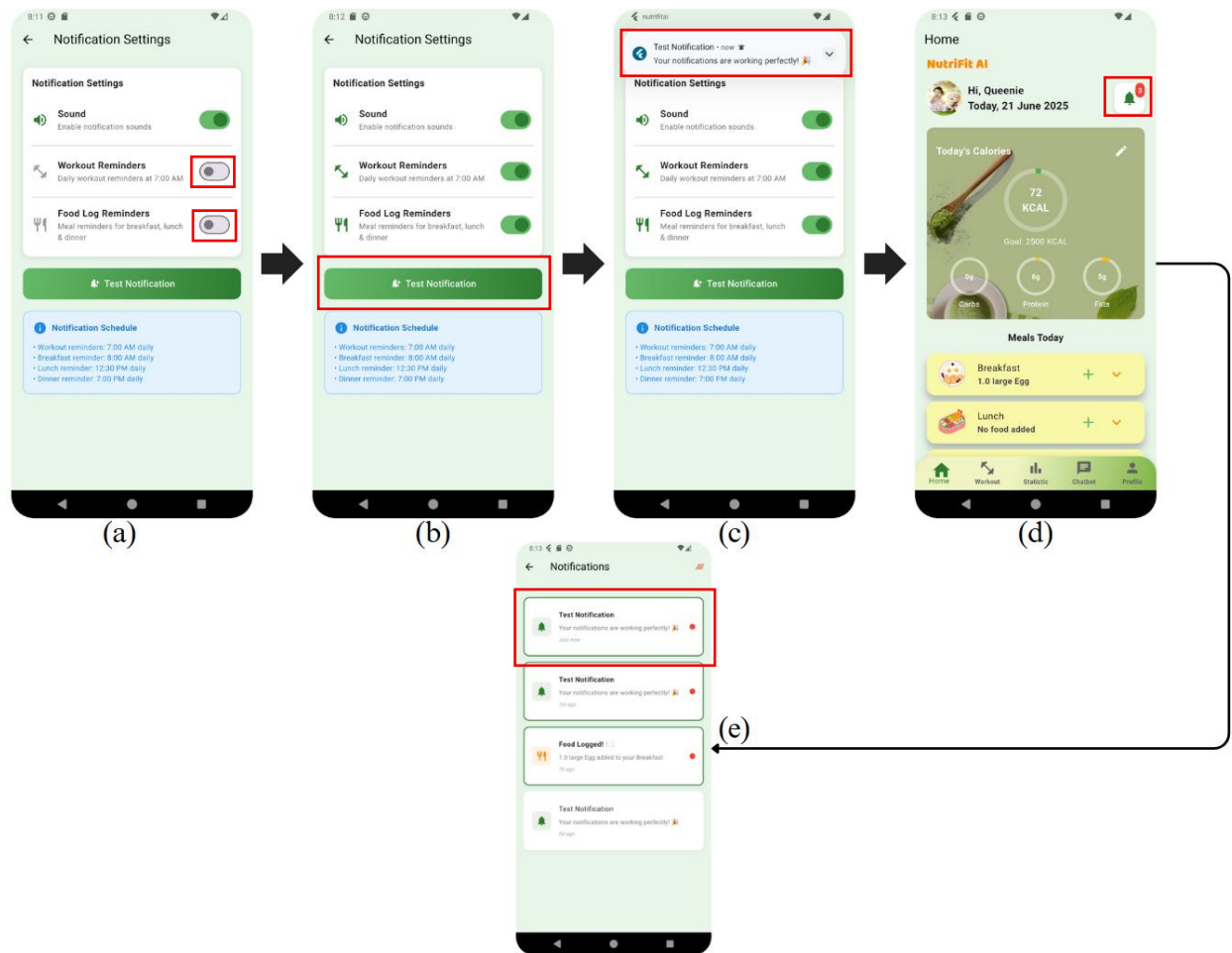


Figure 4.19: Notification Page for NutriFit AI

Figure 4.16 shows the notification system in this application which allows users to easily manage and control their reminders and alerts. In (a), users can enable or disable specific types of notifications using simple toggle switches. For example, they can turn on Workout Reminders (which send daily workout notifications at 7:00 AM) and Food Log Reminders (which remind users to log their meals for breakfast, lunch, and dinner). This gives users full control over which notifications they want to receive based on their personal preferences. For testing purpose, click the Test Notification button (c) to check if the notifications are functioning properly. This helps users verify that their preferences are saved and that the app is able to send notifications as

expected. When the test notification is triggered, a sample notification immediately appears at the top of the screen (c). On the home screen (d), a notification bell icon displays a red badge when there are new or unread notifications. This Tapping the bell icon takes users to the full Notifications page (e), where all recent notifications are listed accordingly.

Chapter 5: System Testing

5.1 Introduction

System testing is a vital step which checks the entire application to make sure everything works as expected. This chapter covers the different tests performed on the NutriFit AI app to ensure it runs smoothly, able to do food log every day, track the workouts, provides accurate meal recommendations, and delivers great user experience.

5.2 Functional Testing

Functional testing is all about making sure that every feature of the NutriFit AI app works the way it's supposed to. During this phase, we tested all the main functions such as user registration and login, meal preference selection, meal recommendations, workout tracking, and the AI chatbot interaction. The goal was to check if the app responds correctly to users' actions and inputs. This testing includes verifying the expected behaviour of each function, validating input data, handling errors effectively, and evaluating user interaction.

5.2.1 Test Cases For Register Functionality

Table 5.1: Test Case For User Registration in NutriFit AI

Test Scenario ID	TS_SignUp_01			Test Case ID	TC_SignUp_01	
Test Title	Successful Register			Test Module	Register Page	
Test Case Description	Verify successful register for new credentials			Test Priority	High	
Pre-Requisite	User must have the NutriFit AI app			Post-Requisite	User is register and able to log in using email and password	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open NutriFit AI application	NutriFit AI app icon	Launch NutriFit AI Login Page	Launch NutriFit AI Login Page	Pass	Launch successful
2	Tap on “Create New Account” button	"Create New Account" button	Go to “Registration” Page	Go to “Registration” Page	Pass	Redirect successful
3	Enter valid email and password	Email: queenielesuhua@outlook.com Password: 1234567890Lee@	Email and Password is entered successfully	Email and Password is entered successfully	Pass	Email and Password is entered successfully
4	Tap on “Sign Up” button	“Sign Up" button	Go to “Login” Page	Go to ‘Login” Page	Pass	Redirect successful
5	Verify that the user is redirected to the home page	N/A	Redirected to the “Home Page”	Redirected to the “Home Page”	Pass	Redirect successful

5.2.2 Test Cases For Registration Functionality

Table 5.2: Test Case for Validation of Missing Required Information During User Registration in NutriFit AI

Test Scenario ID	TS SignUp 02			Test Case ID	TC SignUp 02	
Test Title	Missing Required Information			Test Module	User Registration Page	
Test Case Description	Verify that the user cannot register if any required information is leaving empty			Test Priority	High	
Pre-Requisite	User must have the NutriFit AI app			Post-Requisite	User remains on the user registration page	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Enter user details without providing any required information	Email: N/A Password: N/A Confirm Password: N/A	The alert of validation appears.	The alert of validation appears.	Pass	The alert of validation appears when required information is leaving empty
2	Enter user details with some required information missing	Email: queenieelesuhua@outlook.com Password: N/A Confirm Password: N/A	The alert of validation appears for the password and confirm password field	The alert of validation appears for the password and confirm password field	Pass	The alert of validation appears when password and confirm password field leaving empty
3	Enter all required information	Email: queenieelesuhua@outlook.com Password: 1234567890Lee@	Go to the “Register Success Page”	Go to the “Register Success Page”	Pass	Redirect successful

		Confirm Password: 1234567890Lee @				
--	--	--	--	--	--	--

5.2.3 Test Cases For Login Functionality

Table 5.3: Test Case for User Login in NutriFit AI

Test Scenario ID	TS_Login_01		Test Case ID		TC_Login_01	
Test Title	Successful Login		Test Module		Login Page	
Test Case Description	Verify successful login with valid credentials		Test Priority		High	
Pre-Requisite	User must have a registered account		Post-Requisite		User is logged in and redirected to the home page	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open NutriFit AI application	NutriFit AI app icon	Launch NutriFit AI Login Page	Launch NutriFit AI Login Page	Pass	Launch successful
2	Enter valid email and password	Email: queenieleesuhua@outlook.com Password: 1234567890Lee@	Go to Home Page	Go to Home Page	Pass	Login successful and go to home page.
3	Verify that the user is redirected to the home page	N/A	Redirected to the “Home Page”	Redirected to the “Home Page”	Pass	Redirect successful

5.2.4 Test Cases For Login Functionality

Table 5.4: Test Case for Validation of Invalid User Account During User Login in NutriFit AI

Test Scenario ID		TS Login 02		Test Case ID		TS Login 02	
Test Title		Invalid user account		Test Module		Login Page	
Test Case Description		Verify that an error message is displayed when a user enters invalid account		Test Priority		Medium	
Pre-Requisite		User must have a registered account		Post-Requisite		User remains on the login page	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open NutriFit AI application	NutriFit AI app icon	Launch NutriFit AI Login Page	Launch NutriFit AI Login Page	Pass	Launch successful	
2	Enter valid email and password	Email: queenielesuhua@outlook.com Password: 1234567890Lee@	Login successfully	Login successfully	Pass	Log in successful and go to home page	
3	Tap on “Login” button	“Login” button	Go to “Home” Page	Go to “Home” Page	Pass	Redirect successful	
4	Verify that an error message is displayed indicating invalid account	-	Error message is displayed indicating invalid credentials	Error message is displayed indicating invalid credentials	Pass	Display successful and remain on this page	

5.2.5 Test Cases For Login Functionality

Table 5.5: Test Case for Validation of Incorrect Password During User Login in NutriFit AI

Test Scenario ID		TS Login 03		Test Case ID		TC Login 03	
Test Title		Incorrect Password		Test Module		Login Page	
Test Case Description		Verify that an error message is displayed when a user enters wrong password		Test Priority		Medium	
Pre-Requisite		User must have a registered account		Post-Requisite		User remains on the login page	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open NutriFit AI application	NutriFit AI app icon	Launch NutriFit AI Login Page	Launch NutriFit AI Login Page	Pass	Launch successful	
2	Enter registered email	Email: queenielesuhua@outlook.com	Email entered successfully	Email entered successfully	Pass	Input accepted	
3	Enter incorrect password	Password: WrongPass123!	Error message “Login Failed. Incorrect Email or Password” successfully displayed	Error message “Login Failed. Incorrect Email or Password” successfully displayed	Pass	Display successful and remain on this page	

5.2.6 Test Cases For Reset Password Functionality

Table 5.6: Test Case for Validation of Password Reset Email Sent During Reset Password in NutriFit AI

Test Scenario ID		TS ResetPassword 01		Test Case ID		TC ResetPassword 01	
Test Title		Successful Password Reset Email Sent		Test Module		Reset Password Page	
Test Case Description		Verify that the user receives a password reset email after entering a registered email address		Test Priority		Medium	
Pre-Requisite		User must have a registered account		Post-Requisite		Password reset email is sent successfully	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Reset Password page	Forgot Password hyperlink	Launch NutriFit AI Reset Password Page	Launch NutriFit AI Reset Password Page	Pass	Launch successful	
2	Enter registered email	Email: queenielesuhua@outlook.com	Email is accepted	Email accepted	Pass	Input accepted	
3	Tap "Send Reset Email" button	Send Reset Email button	Go to the page displaying the success of sending email.	Go to the page displaying the success of sending email.	Pass	Email sent successfully	
4	Check email inbox	Checks registered email inbox	Password reset email is received	Email received	Pass	Email delivery confirmed	

5.2.7 Test Cases For Reset Password Functionality

Table 5.7: Test Case for Reset Password in NutriFit AI

Test Scenario ID	TS ResetPassword 02		Test Case ID		TC ResetPassword 02	
Test Title	Successful Reset Password		Test Module		Reset Password Page	
Test Case Description	Verify that the user can login using the password that has already been reset		Test Priority		Medium	
Pre-Requisite	User must have a registered account		Post-Requisite		Login successfully by using password that has been reset	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open Reset Password page	Forgot Password hyperlink	Launch NutriFit AI Reset Password Page	Launch NutriFit AI Reset Password Page	Pass	Launch successful
2	Enter registered email	Email: queenielesuhua@outlook.com	Email is accepted	Email accepted	Pass	Input accepted
3	Tap "Send Reset Email" button	Send Reset Email button	Go to the page displaying the success of sending email.	Go to the page displaying the success of sending email.	Pass	Email sent successfully
4	Check email inbox	Checks registered email inbox	Password reset email is received	Email received	Pass	Email delivery confirmed
5	Click on the link of reset password in the email	Link of reset password	Go to Reset Password Page from Firebase	Go to Reset Password Page from Firebase	Pass	Go to Reset Password Page from Firebase successfully
6	Key in the new password	New password: Newpassword123!	Reset password successful	Reset password successful	Pass	Password reset successful

7	Proceed to login using new password	New password: Newpassword123!	Login successful	Login successful	Pass	Login successful using new password
---	-------------------------------------	-------------------------------	------------------	------------------	------	-------------------------------------

5.2.8 Test Cases For Food Log Functionality

Table 5.8: Test Case for Food Search and Food Log to Meal Section in Home Page of Nutrofit AI

Test Scenario ID	TS FoodLog 01		Test Case ID	TC FoodLog 01		
Test Title	Successful Food Search and Log to Meal		Test Module	Food Log Module		
Test Case Description	Verify that the user can Verify that the user can search for a food item in the Food Library API and successfully log it into a specific meal (Breakfast, Lunch, Dinner).		Test Priority	High		
Pre-Requisite	User must be logged in, and the Food Library API integration should be functioning correctly.		Post-Requisite	The selected food item should be logged under the correct meal category.		
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Login to the user’s account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful
2	Scroll to the Food Log section in the home page.	-	Go to Food Log section	Go to Food Log section	Pass	-

3	Select meal type (e.g., Breakfast) and click on the “+” button in the meal type bar.	“+” button	Go to Food Library Page	Go to Food Library Page	Pass	Go to Food Library page successfully
4	Enter food name to search food in food library.	Food name: ‘Apple’	Food name accepted and displayed food result.	Food name accepted and displayed food result.	Pass	Food result successfully matched on the food search.
5	Click “+” button to log food into the meal (eg. Breakfast)	“+” button	Add food to the selected meal category (e.g., Breakfast).	Food added to Breakfast meal	Pass	Food added to meal successfully.
6	Navigate to the Meal Log	View Breakfast meal	'Apple' appears in the logged meals list	'Apple' in Breakfast	Pass	Food logged under correct meal category.

5.2.9 Test Cases For Food Log Functionality

Table 5.9: Test Case for Validation of Invalid Search Query when Log Food in NutriFit AI

Test Scenario ID	TS_FoodLog_02	Test Case ID	TC_FoodLog_02
Test Title	Food Log with Invalid Search Query	Test Module	Food Log Module
Test Case Description	Verify that the system shows an appropriate message “No Food Result Found” when a user searches for a food item that doesn't exist in the Food Library API.	Test Priority	Medium
Pre-Requisite	User must be logged in, and the Food Library API integration should be functioning correctly.	Post-Requisite	An message “No Food Result Found” is displayed, and no food item is logged.

Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Login to the user's account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful
2	Scroll to the Food Log section in the home page.	-	Go to Food Log section	Go to Food Log section	Pass	-
3	Select meal type (e.g., Breakfast) and click on the "+" button in the meal type bar.	"+" button	Go to Food Library Page	Go to Food Library Page	Pass	Go to Food Library page successfully
4	Search for a non-existent food item in food library.	Search query: 'xyzfood'	Error message: 'No food results found'	'No food results found'	Pass	Correct message displayed for invalid search

5.2.10 Test Cases For Food Log Functionality

Table 5.10: Test Case for Validation of Food Log for Multiple Meals in NutriFit AI

Test Scenario ID	TS FoodLog_03	Test Case ID	TC FoodLog_03
Test Title	Validate Food Log for Multiple Meals	Test Module	Food Log Module
Test Case Description	Verify that the user can successfully log different food items for different meal categories (Breakfast, Lunch,	Test Priority	Medium

		Dinner) by selecting them from the Food Library API.				
Pre-Requisite		User must be logged in, and the Food Library API integration should be functioning correctly.	Post-Requisite			Different food items should be logged under the appropriate meal categories (e.g., Breakfast, Lunch, Dinner).
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Login to the user's account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful
2	Scroll to the Food Log section in the home page.	-	Go to Food Log section	Go to Food Log section	Pass	-
3	Click "+" button for Breakfast	"+" button	Go to Food Library Page	Go to Food Library Page	Pass	Go to Food Library page successfully
4	Search for a food item	Search query: 'Egg'	Display search results for 'Egg'	'Egg' results shown	Pass	Food search works correctly
5	Click "+" button for 'Egg'	"+" button for 'Egg'	Add 'Egg' to the Breakfast meal category	'Egg' added to the Breakfast	Pass	Food added to Breakfast meal
6	Click "+" button for Lunch	"+" button	Go to Food Library Page	Go to Food Library Page	Pass	Go to Food Library page successfully
7	Search for another food item	Search query: 'Chicken'	Display search results for 'Chicken'	'Chicken' results shown	Pass	Food search works correctly.

8	Click “+” button for ‘Chicken’	“+” button for ‘Chicken’	Add ‘Chicken’ to the Lunch meal category	‘Chicken’ added to the Lunch meal	Pass	Food added to Lunch meal
9	Click "+" button for Dinner	“+” button	Go to Food Library Page	Go to Food Library Page	Pass	Go to Food Library page successfully
10	Search for a different food item	Search query: ‘Salad’	Display search results for ‘Salad’	‘Salad’ results shown	Pass	Food search works correctly
11	View Food Log	Check Food Log List	‘Egg’ under Breakfast, ‘Chicken’ under Lunch, ‘Salad’ under Dinner	All food logged correctly	Pass	Food logged under correct meals

5.2.11 Test Cases For Meal Recommendation Functionality

Table 5.11: Test Case for Meal Recommendation by System in NutriFit AI

Test Scenario ID	TS_MealRecommendation_01	Test Case ID	TC_MealRecommendation_01
Test Title	Successful Meal Recommendation for Vegetarian Preferences	Test Module	Meal Recommendation Module
Test Case Description	Verify that the system recommends vegetarian meals when the user selects the preference.	Test Priority	High
Pre-Requisite	User must be logged in and the Meal Recommendation API integration (Spoonacular or Edamam) must be functioning correctly.	Post-Requisite	The system should display only chosen preference meals in the meal recommendations.
Test Execution Steps:			

S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Login to the user's account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful
2	Scroll to the Meal Recommendation section in the home page.	-	Go to Meal Recommendation section	Go to Meal Recommendation section	Pass	-
3	Click ">" button to select preferences.	">" button	Go to Preference Page	Go to Preference Page	Pass	Vegetarian meals filtered correctly
4	Select preference (eg. "Vegetarian") from preferences	Toggle "Vegetarian" preference	Filter meals by vegetarian preference	Vegetarian meals displayed	Pass	Food search works correctly
5	View recommended meals	View meals displayed after filtering	Display only vegetarian meals	Displayed vegetarian meals	Pass	Meals displayed correctly
6	Check meal details	Select a vegetarian meal	Show the meal details including ingredients, calories, etc.	Meal details displayed calories, etc.	Pass	Meal details are shown correctly

5.2.12 Test Cases For Meal Recommendation Functionality

Table 5.12: Test Case for Verification of Meal Recommended when no Specific References Selected in NutriFit AI

Test Scenario ID	TS_MealRecommendation_02	Test Case ID	TC_MealRecommendation_02
-------------------------	--------------------------	---------------------	--------------------------

Test Title		Meal Recommendation Without Any Preferences Selected		Test Module		Meal Recommendation Module	
Test Case Description		Verify that the system recommends meals when no specific preferences are selected.		Test Priority		Medium	
Pre-Requisite		User must be logged in and the Meal Recommendation API integration (Spoonacular or Edamam) must be functioning correctly.		Post-Requisite		The system should display a variety of meals with no dietary restrictions.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Login to the user's account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful	
2	Scroll to the Meal Recommendation section in the home page.	-	Go to Meal Recommendation section	Go to Meal Recommendation section	Pass	-	
3	Click ">" button to select preferences.	">" button	Go to Preference Page	Go to Preference Page	Pass	Vegetarian meals filtered correctly	
4	Select no preferences	Leave all preferences unselected	Display a variety of meals without dietary restrictions	Variety of meals displayed	Pass	Meals displayed correctly	
5	View recommended meals	View meals displayed	Display a variety of meals	Meals displayed	Pass	Meals displayed correctly	

6	Check meal details	Select a random meal	Show the meal details including ingredients, calories, etc.	Meal details displayed	Pass	Meal details are shown correctly
---	--------------------	----------------------	---	------------------------	------	----------------------------------

5.2.13 Test Cases For Meal Recommendation Functionality

Table 5.13: Test Case for Validation of Meal Recommended when High User's BMI in NutriFit AI

Test Scenario ID	TS_MealRecommendation_03			Test Case ID	TC_MealRecommendation_03	
Test Title	Successful Meal Recommendation Based on BMI and Preferences (High BMI - Low Calorie)			Test Module	Meal Recommendation Module	
Test Case Description	Verify that the system recommends low-calorie meals for a high BMI (greater than or equal to 25) based on the user's BMI.			Test Priority	High	
Pre-Requisite	- User must be logged in and the Meal Recommendation API integration (Spoonacular or Edamam) must be functioning correctly. - The user must have a BMI greater than or equal to 25.			Post-Requisite	The system should display only low-calorie meals based on the selected preferences.	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Login to the user's account.	Email: testing123@gmail.com	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful

		Password: Testing123@				
2	Set User BMI to 30 (High BMI) in profile page	BMI: 30	System filters meals to suggest low-calorie meals	Low-calorie meals displayed	Pass	System filters low-calorie meals based on high BMI
3	Select preferences: Vegetarian	Toggle “Vegetarian”	System filters meals by low-calorie, vegetarian	Low-calorie, vegetarian meals displayed	Pass	Meals filtered by preferences and BMI
4	Check recommended meals	View the list of recommended meals	Display low-calorie meals based on BMI and vegetarian preferences	Displayed meals as expected	Pass	Meals displayed correctly
5	Check meal details	Select a meal from the list	Show the meal details including ingredients, calories, etc.	Meal details displayed	Pass	Meal details are shown correctly

5.2.14 Test Cases For Meal Recommendation Functionality

Table 5.14: Test Case for Validation of Meal Recommended when Low User's BMI in NutriFit AI

Test Scenario ID	TS MealRecommendation 04	Test Case ID	TC MealRecommendation 04
Test Title	Successful Meal Recommendation Based on BMI and Preferences (Low BMI - High Calorie)	Test Module	Meal Recommendation Module
Test Case Description	Verify that the system recommends high-calorie meals for a low BMI (less than 18.5) based on the user's BMI.	Test Priority	High

Pre-Requisite		- User must be logged in and the Meal Recommendation API integration (Spoonacular or Edamam) must be functioning correctly. - The user must have a BMI less than 18.5.		Post-Requisite		The system should display only high-calorie meals based on the selected preferences.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Login to the user’s account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful	
2	Set User BMI to 17 (High BMI) in profile page	BMI: 17	System filters meals to suggest high-calorie meals	High-calorie meals displayed	Pass	System filters high-calorie meals based on low BMI	
3	Select preferences: Dairy-Free	Toggle “Dairy-Free”	System filters meals by high-calorie, Dairy-Free	High-calorie, Dairy-Free meals displayed	Pass	Meals filtered by preferences and BMI	
4	Check recommended meals	View the list of recommended meals	Display high-calorie meals based on BMI and Dairy-Free preferences	Displayed meals as expected	Pass	Meals displayed correctly	
5	Check meal details	Select a meal from the list	Show the meal details including ingredients, calories, etc.	Meal details displayed	Pass	Meal details are shown correctly	

5.2.15 Test Cases For Meal Recommendation Functionality

Table 5.15: Test Case for Validation of Meal Recommended when Normal User's BMI in NutriFit AI

Table 5.15: Test Case for Validation of Meal Recommendation when Normal User's BMI is Normal with						
Test Scenario ID	TS MealRecommendation 05			Test Case ID	TC MealRecommendation 05	
Test Title	Successful Meal Recommendation Based on BMI and Preferences (Normal BMI - Balanced Calories)			Test Module	Meal Recommendation Module	
Test Case Description	Verify that the system recommends balanced-calorie meals for a normal BMI (between 18.5 and 25) based on the user's BMI.			Test Priority	High	
Pre-Requisite	- User must be logged in and the Meal Recommendation API integration (Spoonacular or Edamam) must be functioning correctly. - The user must have a BMI between 18.5 and 25.			Post-Requisite	The system should display balanced-calorie meals based on the selected preferences.	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Login to the user's account.	Email: testing123@gmail.com Password: Testing123@	Launch NutriFit AI Home Page	Launch NutriFit AI Home Page	Pass	Launch successful
2	Set User BMI to 22 (Balanced BMI)	BMI: 22	System filters meals to suggest balanced-calorie meals	Balanced-calorie meals displayed	Pass	System filters balanced-calorie meals based on balanced BMI

3	Select preferences: Gluten-Free	Toggle “Gluten-Free”	System filters meals by balanced-calorie, gluten-free	Pass	Pass	Meals filtered by preferences and BMI
4	Check recommended meals	View the list of recommended meals	Display balanced-calorie meals based on BMI, gluten-free	Displayed meals as expected	Pass	Meals displayed correctly
5	Check meal details	Select a meal from the list	Show the meal details including ingredients, calories, etc.	Meal details displayed	Pass	Meal details are shown correctly

5.2.16 Test Cases For Workout Functionality

Table 5.16: Test Case for Playing Workout Type Chosen By Use in NutriFit AI

Test Scenario ID		TS_Workout_01		Test Case ID		TC_Workout_01	
Test Title		Workout Selection and Start		Test Module		Workout Module	
Test Case Description		Verify that the user can successfully select and start a workout.		Test Priority		Medium	
Pre-Requisite		The user is logged in and on the Workout Page.		Post-Requisite		The system should display a variety of meals with no dietary restrictions.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Workout page by clicking the bottom navigation bar workout icon.	Navigate to Workout page	Display a list of available workouts to choose	Workouts displayed	Pass	List of workouts shown correctly	

2	Select a workout and click “Start Workout” button	“Start Workout” button	Workout selected and ready to start	Workout selected	Pass	Workout selected correctly
3	Workout play automatically after click “Start button”	Workout start	Timer starts, and calories tracking begins	Timer started	Pass	Timer started as expected

5.2.17 Test Cases For Workout Functionality

Table 5.17: Test Case for Cancellation of Workout in NutriFit AI

Test Scenario ID	TS Workout 02		Test Case ID		TC Workout 02	
Test Title	Workout Cancellation		Test Module		Workout Module	
Test Case Description	Verify that the user can cancel a workout before completion.		Test Priority		Medium	
Pre-Requisite	- The user is logged in and on the Workout Page. - The workout has been started but not completed.		Post-Requisite		The workout is stopped, and calories are saved according to the timer for incomplete workouts.	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open Workout page by clicking the bottom navigation bar workout icon.	Navigate to Workout page	Display a list of available workouts to choose	Workouts displayed	Pass	List of workouts shown correctly
2	Select a workout and click “Start Workout” button	“Start Workout” button	Workout selected and ready to start	Workout selected	Pass	Workout selected correctly

3	Workout play automatically after click “Start button”	Workout start	Timer starts, and calories tracking begins	Timer started	Pass	Timer started as expected
4	Play video for 4 minutes	Play video	Video plays, timer begins tracking	Timer calculated	Pass	Timer calculated correctly
5	Click on “Cancel Workout”	Tap the “Cancel” button	Workout stops, calories burned tracked according to timer	Workout canceled	Pass	Workout canceled successfully
6	Verify that workout is canceled	Check if workout session is labelled as “Unfinished Workout” in workout history	The unfinished workout saved in history	Workout history saved	Pass	Workout history saved as expected

5.2.18 Test Cases For Workout Functionality

Table 5.18: Test Case for Tracking Calories Burned After Workout in NutriFit AI

Test Scenario ID	TS Workout 03	Test Case ID	TC Workout 03
Test Title	Track Calories Burned During Workout	Test Module	Workout Module
Test Case Description	Verify that calories burned are tracked during the workout session according to time and activity type.	Test Priority	High
Pre-Requisite	- The user is logged in and on the Workout Page. - The workout has been started.	Post-Requisite	Calories burned should be tracked and displayed correctly based on the play time and workout intensity.

Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open Workout page by clicking the bottom navigation bar workout icon.	Navigate to Workout page	Display a list of available workouts to choose	Workouts displayed	Pass	List of workouts shown correctly
2	Select a workout (eg. HIIT Workout) and click “Start Workout” button.	“Start Workout” button	HIIT Workout selected and ready to start	HIIT workout selected	Pass	Workout selected correctly
3	Complete the workout for 10 minutes and click “Finish” button.	Workout duration: 10 minutes	Calories burned based on workout intensity and time	Calories tracked	Pass	Calories tracked correctly
4	Verify calories burned	Check the calories burned after 10 minutes	Calories burned based on type and time	Calories burned displayed in workout history page	Pass	Calories displayed correctly

5.2.19 Test Cases For Workout Functionality

Table 5.19: Test Case for Verification of Complete Workouts Appear in Workout History Page in NutriFit AI

Test Scenario ID	TS_Workout_04	Test Case ID	TC_Workout_04
Test Title	Workout History Tracking	Test Module	Workout Module
Test Case Description	Verify that completed workouts appear in the workout history log according to the date.	Test Priority	High

Pre-Requisite		- User has completed one or more workouts.		Post-Requisite		Workouts are logged and accessible from the workout history page.
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Complete a workout	Workout completed successfully	The workout should be added to workout history	Workout logged	Pass	Workout history updated correctly
2	Navigate to workout history	Go to workout history page	History of all completed workouts should be displayed accroding to the choosen date	History displayed	Pass	History displayed correctly
3	Verify workout details	-	Display workout details including calories burned and time spent	Workout details displayed	Pass	Details displayed correctly

5.2.20 Test Cases For Statistics Functionality

Table 5.20: Test Case for Verification of Displaying Correct Workout Calories Burned in Workout History Page in NutriFit AI

Test Scenario ID	TS_Statistics_01	Test Case ID	TC_Statistics_01
Test Title	Verify Display of Workout Calories Burned	Test Module	Statistics Module
Test Case Description	Verify that the total calories burned from workouts are correctly calculated and displayed.	Test Priority	High

Pre-Requisite		- User has completed one or more workouts. - Calories burned are calculated based on the type and duration of the workout.		Post-Requisite		Workouts are logged and accessible from the workout history page.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Statistics page by clicking the bottom navigation bar statistic icon.	Navigate to Statistics Page	Display today's statistics, including calories burned from workouts	Calories burned displayed	Pass	Calories burned shown correctly	
2	Check workout statistics	View "Today’s Calories Burned" section	Total calories burned during the workout(s) for the day are displayed	Total calories burned shown correctly	Pass	Correct total calories burned from workouts	

5.2.21 Test Cases For Statistics Functionality

Table 5.21: Test Case for Verification of Displaying Correct Calories Burned in Graph in NutriFit AI

Test Scenario ID	TS_Statistics_02	Test Case ID	TC_Statistics_02
Test Title	Verify Weekly Progress Display	Test Module	Statistics Module
Test Case Description	Verify that the weekly progress for burning calories is displayed correctly.	Test Priority	Medium
Pre-Requisite	- User has workouts for multiple days.	Post-Requisite	Weekly progress for burned is displayed correctly.
Test Execution Steps:			

S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open Statistics page by clicking the bottom navigation bar statistic icon.	Navigate to Statistics Page	Display today's statistics, including calories burned from workouts	Calories burned displayed	Pass	Calories burned shown correctly
2	View calories burned over the week	Check total calories burned for each day	Total calories burned for the week are correctly displayed	Total calories displayed	Pass	Correct total calories burned
3	Check progress graph	Ensure that a graph for calories burned is available	Graph reflects weekly progress accurately	Graph displayed correctly	Pass	Graph displayed correctly

5.2.22 Test Cases For AI Nutrition Chatbot Functionality

Table 5.22: Test Case for Verification of Chatbot Response to Health Symptom-Related Questions in NutriFit AI

Test Scenario ID	TS_AIChatbot_01	Test Case ID	TC_AIChatbot_01
Test Title	Verify Chatbot Response to Health Symptom-Related Questions	Test Module	AI Nutrition Chatbot Module
Test Case Description	Verify that the chatbot correctly responds to health symptom-related questions.	Test Priority	High
Pre-Requisite	- The user is interacting with the AI Nutrition Chatbot.	Post-Requisite	The chatbot responds appropriately with health-related advice or information.

		- The bot is trained to recognize symptom-related keywords (e.g., pain, fever, headache).				
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open AI Nutrition Chatbot page by clicking the bottom navigation bar chatbot icon.	Navigate to AI Nutrition Chatbot Page	Message: "Hi, how can I assist you today?"	Greeting message displayed	Pass	Chatbot page shown correctly.
2	Send a symptom-related message	Message: "I have a headache and nausea"	Chatbot responds with information about headaches and nausea	Relevant response	Pass	Chatbot responds correctly
3	Send a symptom-related message	Message: "I have a sore throat and cough"	Chatbot provides information about sore throat and cough	Relevant response	Pass	Chatbot responds correctly
4	Send a valid symptom message	Message: "I feel dizzy and lightheaded"	Chatbot suggests possible causes and remedies	Relevant response	Pass	Chatbot responds correctly

5.2.23 Test Cases For AI Nutrition Chatbot Functionality

Table 5.23: Test Case for Verification of Chatbot Response to Non-Symptom-Based Questions in NutriFit AI

Test Scenario ID	TS_AIChatbot_02	Test Case ID	TC_AIChatbot_02
Test Title	Verify Chatbot Response to Non-Symptom-Related Questions	Test Module	AI Nutrition Chatbot Module

Test Case Description		Verify that the chatbot correctly responds to health symptom-related questions.		Test Priority		High	
Pre-Requisite		- The user interacts with the chatbot asking non-symptom-related questions.		Post-Requisite		The chatbot informs the user that it can only respond to symptom-related questions.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Send a non-symptom-related message	Message: "What is the capital of France?"	Chatbot responds: “Sorry, I can only answer health symptom-related questions. Please ask about symptoms or health concerns.”	Correct error message	Pass	Chatbot responds correctly	
2	Send a non-symptom-related message	Message: "How do I cook pasta?"	Chatbot responds: “Sorry, I can only answer health symptom-related questions. Please ask about symptoms or health concerns.”	Correct error message	Pass	Chatbot responds correctly	

5.2.24 Test Cases For AI Nutrition Chatbot Functionality

Table 5.24: Test Case for Verification of Chatbot's Ability to Provide Answers for Follow-Up Symptom Queries in NutriFit AI

Test Scenario ID	TS_AIChatbot_03	Test Case ID	TC_AIChatbot_03
-------------------------	-----------------	---------------------	-----------------

Test Title	Verify Chatbot's Ability to Provide Answers for Follow-Up Symptom Queries	Test Module	AI Nutrition Chatbot Module			
Test Case Description	Verify that the chatbot can provide an answer for follow-up symptom-related queries by using previous information.	Test Priority	Medium			
Pre-Requisite	- The user has already interacted with the chatbot and provided some symptom-related input (e.g., headache, fever, etc.). - The chatbot is capable of asking follow-up questions to narrow down or clarify symptoms.	Post-Requisite	The chatbot successfully provides a response to the follow-up question and guides the user accordingly.			
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Asks a symptom-related question	"I have a headache and a sore throat"	Chatbot responds: "How long have you been experiencing these symptoms?"	Relevant follow-up question displayed	Pass	Chatbot asks for clarification
2	User asks about the impact of symptoms on daily life	"Will this affect my ability to work or go to school?"	Chatbot provides advice or asks further questions for clarification.	Relevant response displayed	Pass	Chatbot gives additional info

5.2.25 Test Cases For Profile Module Functionality

Table 5.25: Test Case for Verification of Profile Page Displaying Correct User Information in NutriFit AI

Test Scenario ID		TS Profile 01		Test Case ID		TC Profile 01	
Test Title		Verify the Profile Page Displays Correct User Information		Test Module		Profile Module	
Test Case Description		Verify that the profile page displays the correct user details such as name, height, weight, age, profile picture and health goals.		Test Priority		High	
Pre-Requisite		- User must be logged in and have data stored in Firestore (name, height, weight, age, profile image, health goals).		Post-Requisite		User data is displayed correctly on the profile page.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Profile page by clicking the bottom navigation bar chatbot icon.	Navigate to Profile Page	Profile Page opens	Profile Page opened	Pass	Profile page is displayed	
2	Check user profile information	Data in Firestore	Profile displays user's name, height, weight, age, image, and health goal	User info displayed	Pass	Profile data is loaded from Firestore	
3	Check profile image	User's profile image exists	Profile image is displayed in the profile section	Image displayed	Pass	Profile image loaded correctly	

4	Verify name, height, weight, age display	Name: "Testing", Height: "170 cm", Weight: "70 kg", Age: "25"	Profile shows Name: Testing, Height: 170 cm, Weight: 70 kg, Age: 25	Info displayed correctly	Pass	All user data is displayed properly
---	--	---	---	--------------------------	------	-------------------------------------

5.2.26 Test Cases For Profile Module Functionality

Table 5.26: Test Case for Editing Profile Information in Profile Page in NutriFit AI

Test Scenario ID		TS Profile_02		Test Case ID		TC Profile_02	
Test Title		Verify User Can Edit Profile Information		Test Module		Profile Module	
Test Case Description		Verify that that the user can edit and update their profile information (e.g., name, height, weight, age, profile picture and health goals).		Test Priority		High	
Pre-Requisite		- User must be logged in and profile data must be available.		Post-Requisite		User profile information is successfully updated.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Profile page by clicking the bottom navigation bar chatbot icon.	Navigate to Profile Page	Profile Page opens	Profile Page opened	Pass	Profile page is displayed	
2	Click on “Edit Profile”	Click “Edit Profile” button	Edit Profile form opens	Edit Profile form opened	Pass	Edit Profile page opens	
3	Edit name, height, weight, age	Name: "Queenie", Height: "149	User edits the profile information	Data edited successfully	Pass	Profile information is edited	

		cm", Weight: "52 kg", Age: "24"				
4	Save changes	Click "Save"	Changes are saved and updated on the profile page	Changes saved	Pass	Changes saved and displayed
5	Check updated information	User profile info updated	Profile page shows updated name, height, weight, and age	Info updated	Pass	Profile information updated successfully

5.2.27 Test Cases For Profile Module Functionality

Table 5.27: Test Case for Updating Profile Picture in Profile Page in NutriFit AI

Test Scenario ID		TS Profile 03		Test Case ID		TC Profile 03	
Test Title		Verify Profile Picture Can Be Updated		Test Module		Profile Module	
Test Case Description		Verify that the user can update their profile picture by uploading a new image.		Test Priority		Medium	
Pre-Requisite		- User must be logged in and have a current profile image set.		Post-Requisite		The new profile image is successfully displayed on the profile page.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Profile page by clicking the bottom navigation bar chatbot icon.	Navigate to Profile Page	Profile Page opens	Profile Page opened	Pass	Profile page is displayed	

2	Click on “Edit Profile”	Click “Edit Profile” button	Edit Profile form opens	Edit Profile form opened	Pass	Edit Profile page opens
3	Change profile picture	Select a new image from gallery	Profile picture changes	Profile image updated	Pass	Image is updated correctly
4	Save changes	Click "Save"	Changes saved successfully and new image displayed on profile page	Changes saved	Pass	New image displayed successfully
5	Verify new profile picture	Go back to profile page	New profile image displayed	New image displayed	Pass	Profile image updated correctly

5.2.28 Test Cases For Profile Module Functionality

Table 5.28: Test Case for Logout Function in NutriFit AI

Test Scenario ID		TS Profile 04		Test Case ID		TC Profile 04	
Test Title		Verify User Can Logout from Profile Page		Test Module		Profile Module	
Test Case Description		Verify that the user can log out successfully from the profile page.		Test Priority		Medium	
Pre-Requisite		- User must be logged in.		Post-Requisite		User is logged out and redirected to the login page.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Open Profile page by clicking the bottom navigation bar chatbot icon.	Navigate to Profile Page	Profile Page opens	Profile Page opened	Pass	Profile page is displayed	

2	Click "Logout"	Click "Logout" button	User is logged out and redirected to the login page	Redirected to login	Pass	User is logged out successfully
3	Verify Logout	Try to access Profile Page again	Profile page does not open, login page is displayed instead	Login page displayed	Pass	Logout confirmed successfully

5.2.29 Test Cases For Profile Module Functionality

Table 5.29: Test Case for Validation of Empty Fields in Edit Profile in NutriFit AI

Test Scenario ID	TS Profile 04		Test Case ID		TC Profile 04	
Test Title	Verify Validation for Empty Fields in Edit Profile		Test Module		Profile Module	
Test Case Description	Verify that the user is prompted with a validation message if they try to save the profile with empty fields.		Test Priority		Medium	
Pre-Requisite	- User must be logged in and attempting to edit their profile.		Post-Requisite		Error message for empty field shown when attempting to save empty fields.	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Open Profile page by clicking the bottom navigation bar chatbot icon.	Navigate to Profile Page	Profile Page opens	Profile Page opened	Pass	Profile page is displayed
2	Click on “Edit Profile”	Click “Edit Profile” button	Edit Profile form opens	Edit Profile form opened	Pass	Edit Profile page opens

3	Leave name, height, or weight empty and click “Save” button.	Clear name, height, or weight field	Error message for name, height and weight appears, stating “Please enter your name”, “Please enter your height”, “Please enter your weight”.	Error displayed	Pass	Error displayed for empty fields
---	--	-------------------------------------	--	-----------------	------	----------------------------------

5.2.30 Test Cases For Notification Page Functionality

Table 5.30: Test Case for Notification Page in NutriFit AI

Test Scenario ID	TS Notification_01		Test Case ID		TC Notification_01	
Test Title	Verify Notifications Displayed on Notification Page		Test Module		Notification Page	
Test Case Description	Ensure that the notification page displays the correct notifications.		Test Priority		Medium	
Pre-Requisite	- The user has unread notifications in the app.		Post-Requisite		The user can interact with notifications (e.g., mark as read or delete).	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Navigate to the Notification Page from the Home Screen.	N/A	Notification Page opens	Notification Page opened	Pass	Notification page displayed.
2	Review the displayed notifications.	N/A	The notification page should show a list of all	The notification page successfully show a list of all	Pass	All notifications displayed correctly.

			notifications, including their titles, descriptions, and timestamps.	notifications, including their titles, descriptions, and timestamps.		
--	--	--	--	--	--	--

5.2.31 Test Cases For Notification Page Functionality

Table 5.31: Test Case for Notification Settings in NutriFit AI

Test Scenario ID	TS Notification 02		Test Case ID		TC Notification 02	
Test Title	Verify the user can on and off the notification.		Test Module		Notification Page	
Test Case Description	Ensure the user can manage their notification preferences.		Test Priority		Medium	
Pre-Requisite	The user is logged into the app.		Post-Requisite		The preferences are saved and applied across all devices and sessions.	
Test Execution Steps:						
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Navigate to the profile page and select notification setting.	N/A	User is directed to the notification settings page.	User successfully navigates to notification settings.	Pass	Profile page and notification settings accessed successfully.
2	Update the notification preferences (e.g., turn off certain types of notifications).	N/A	User can successfully update and save their preferences.	Preferences updated and saved.	Pass	Changes applied successfully.

5.3 Non-Functional Testing

Non-functional testing ensures that the software meets non-functional requirements, such as performance, usability, and reliability. This section focuses on testing the modules' behavior under various conditions that do not directly relate to the core functionality but are essential for a smooth user experience.

5.3.1 Performance Testing

Performance testing is about making sure that the all the page loads quickly and smoothly. It checks how well the page performs under normal and heavy usage, and whether it meets the user's expectations for speed.

Table 5.32: Test Case for Performance and Responsiveness of NutriFit AI System

Test Scenario ID	TS_Performance_01	Test Case ID	TC_Performance_01
Test Title	System Performance Under Load	Test Module	Overall System
Test Case Description	Testing the performance and responsiveness of the NutriFit AI system under different load conditions	Test Priority	High
Pre-Requisite	- System is fully set up with all modules (Profile Page, Meal Recommendation, Workout, Statistics, AI Nutrition Chatbot, etc.) implemented and integrated. - User accounts and data are populated across modules.	Post-Requisite	Performance test report generated with analysis of system responsiveness and behavior underload.
Test Execution Steps:			

S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments
1	Load Testing	Simulate 10 concurrent users performing tasks (login, browsing, meal selection, etc.)	All users should be able to log in, perform tasks without significant delays or timeouts.	System handles the load and responds within acceptable response times (< 3 seconds for most operations).	Pass	No performance issues observed during load testing.
2	Stress Testing	Apply maximum load with 10 concurrent users making requests.	The system should continue to perform well under normal load without any significant slowdowns	System remains stable with no major failures, handles stress effectively.	Pass	System maintained stability and responsiveness under stress conditions.
3	Endurance Testing	Continuously run the system for 12-24 hours with varying user load.	The system should not exhibit performance degradation, memory leaks, or slowdowns over time.	No memory leaks or performance degradation detected.	Pass	No memory leaks or performance issues observed during endurance testing.
4	Response Time Testing	Measure response time for common tasks (login, meal recommendation, AI chatbot response, food logging).	System should respond to these tasks within defined time limits (< 3 seconds for login, < 5 seconds for meal	Response times for all operations are under the acceptable threshold (e.g., login: 2.5 seconds, meal recommendation: 4 seconds).	Pass	Response times for all operations were within acceptable limits.

			recommendations).			
5	Scalability Testing	Simulate increased load from 10 to 20 concurrent users over time.	The system should scale accordingly, maintaining performance under increasing load.	System adapts to increased load without significant slowdowns.	Pass	System showed excellent scalability as user load increased.
6	Database Performance Testing	Execute multiple database queries (e.g., fetching user profiles, meal logs, workout stats).	Database should return results in less than 3 seconds.	Database queries completed within the expected time frame.	Pass	Database performance was optimal during query tests.
7	UI Responsiveness	Test UI responsiveness when switching between modules	UI should remain responsive with no lags or freezing.	UI transitions smoothly, with no delays or freezing.	Pass	UI responsiveness was optimal during module transitions.

5.3.2 Usability Testing

Table 5.33: Test Case for Usability Testing in NutriFit AI

Test Scenario ID	TS_Usablility_01	Test Case ID	TC_Usablility_01
Test Title	Usability Testing	Test Module	Overall System
Test Case Description	Evaluating the usability of the NutriFit AI application by testing the ease of use, navigation, task completion, and user satisfaction.	Test Priority	High

Pre-Requisite		- The testing environment should have the necessary devices, including mobile phones and tablets, with different screen sizes, operating systems, and user profiles.		Post-Requisite		Detailed usability testing report with recommendations and improvements based on findings.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	Ease of Navigation	Test navigation flow from one module to another	User should be able to easily navigate between different modules with clear visual cues and intuitive UI design.	Navigation was seamless between modules with no confusion.	Pass	The app’s navigation was intuitive and user-friendly.	
2	Consistency in Design	Test consistency of UI elements (buttons, font sizes, colors, icons) across different screens	UI elements should maintain consistency in terms of design, color schemes, and layout across all screens.	UI elements were consistent across screens.	Pass	The application maintained a consistent design throughout all screens.	
3	Data Input	Verify the ease and accuracy of data input across various modules	The user should be able to input data easily and without any confusion or errors	The user can input data accurately and without any difficulties	Pass	Data input fields were user-friendly and intuitive	
4	Error Handling Test	Verify the system's ability to handle errors effectively,	Ensuring that users receive appropriate and clear error	The user received clear error messages when entering invalid	Pass	Appropriate error messages were displayed when	

			messages when they provide invalid or incomplete information.	or incomplete information		invalid inputs were entered
--	--	--	---	---------------------------	--	-----------------------------

5.3.3 Reliability Testing

Table 5.34: Test Case for Reliability Testing in NutriFit AI

Test Scenario ID		TS_Reliability_01		Test Case ID		TC_Reliability_01	
Test Title		Reliability Testing		Test Module		Overall System	
Test Case Description		Verify that the system remains stable and reliable under normal and stressful conditions across various modules, ensuring consistent functionality over time.		Test Priority		High	
Pre-Requisite		All system modules should be fully integrated and functional.		Post-Requisite		A report detailing system stability, any downtime, and performance issues encountered during testing.	
Test Execution Steps:							
S.No	Action	Inputs	Expected Output	Actual Output	Test Result	Test Comments	
1	System Restart Test	Restart the system and check if all modules continue working seamlessly	All modules should load without issues post-restart	The system restarted successfully, and all features were operational.	Pass	The system restarted successfully, and all features were operational.	
2	API Response Time Check	Check the response time from external	Response times should remain	UI elements were consistent across screens.	Pass	API responses were timely, and there were no	

		APIs (e.g., Spoonacular, Edamam)	within acceptable limits			significant delays.
3	Network Interruption Test	Simulate network disconnection and then reconnect to see how the system handles it	The system should handle the interruption gracefully and reconnect automatically	The system handle the interruption gracefully and reconnect automatically	Pass	The system performed well when reconnecting after network interruptions.

5.4 User Acceptance Testing (UAT)

To evaluate the functionality, usability, and overall satisfaction of the NutriFit AI application, a User Acceptance Testing (UAT) was conducted involving 21 respondents. Refer to Appendix C to view the questionnaire questions. The purpose of this questionnaire is to identify areas that require improvement, ensure that the application aligns with user expectations, and validate that the system functions effectively before being fully deployed. The participants were asked to interact with the app and provide feedback based on their user experience, focusing on key aspects such as system features, interface design, navigation, responsiveness, and the effectiveness of the NutriFit AI application.

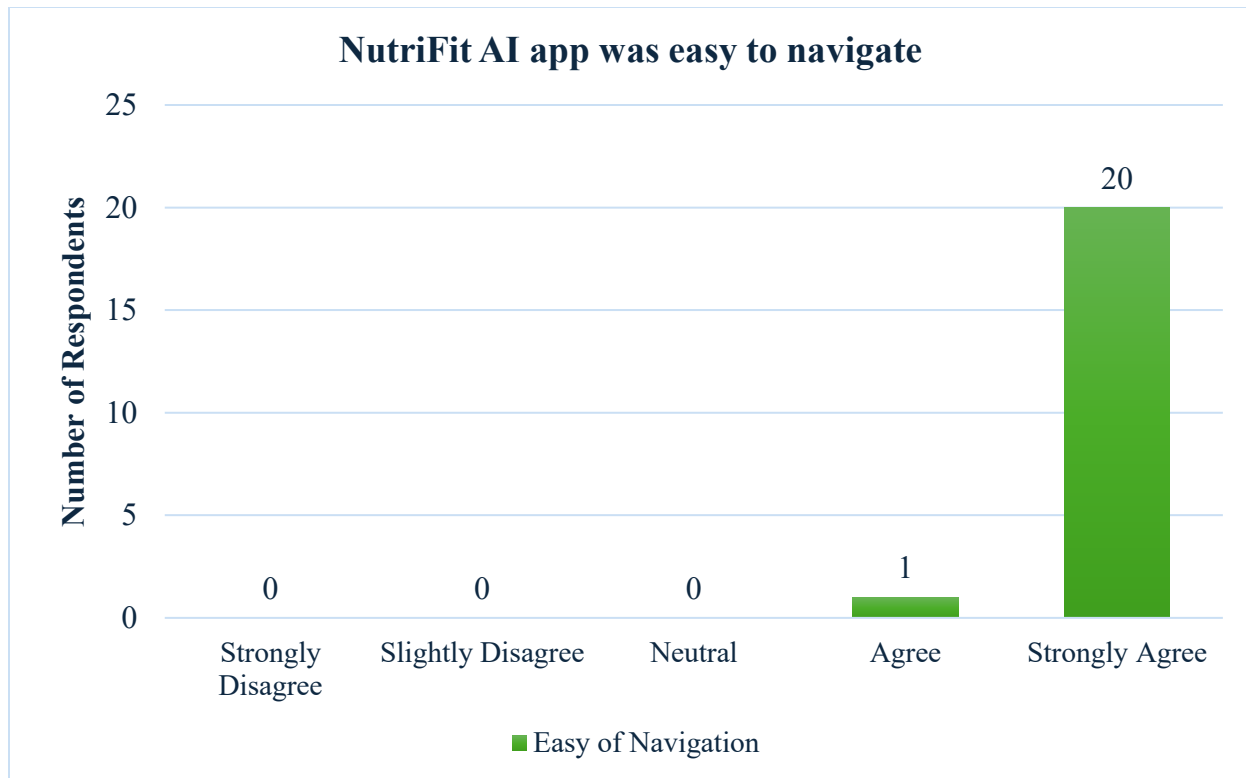


Figure 5.1: NutriFit AI app was Easy to Navigate

Figure 5.1 shows a total of 21 respondents provided their feedback. Out of these, 20 respondents strongly agreed that the application is easy to navigate, while 1 respondent agreed with the statement. This indicates that the majority of users found the app interface to be intuitive, user-friendly, and simple to use. The positive responses suggest that users were able to easily explore the app's features and functions without confusion or difficulty.

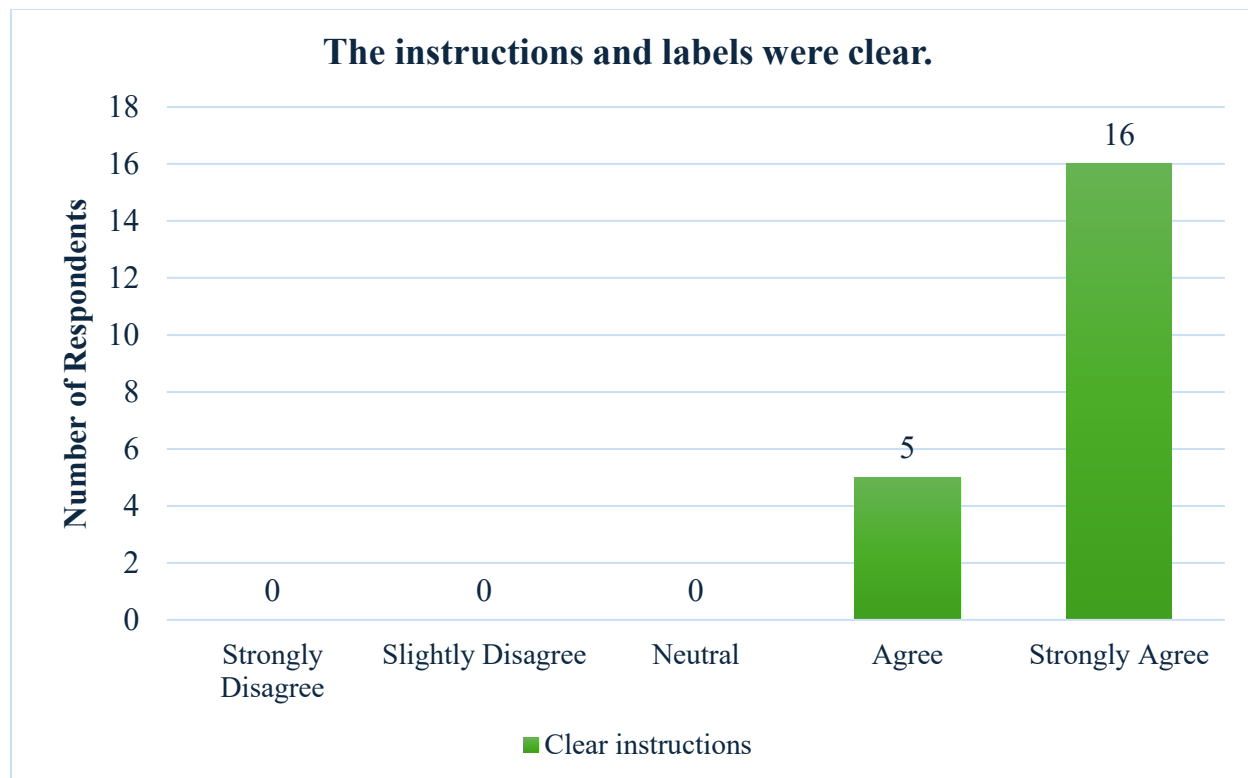


Figure 5.2: The Instructions and Labels were Clear

From the graph, the feedback of the question “The instructions and labels were clear” from respondents was highly positive. 16 respondents strongly agreed that the instructions and labels provided within the app were clear and easy to understand, while 5 respondents agreed with the statement. This shows that the majority of users were able to easily follow the instructions and interpret the labels throughout the app.

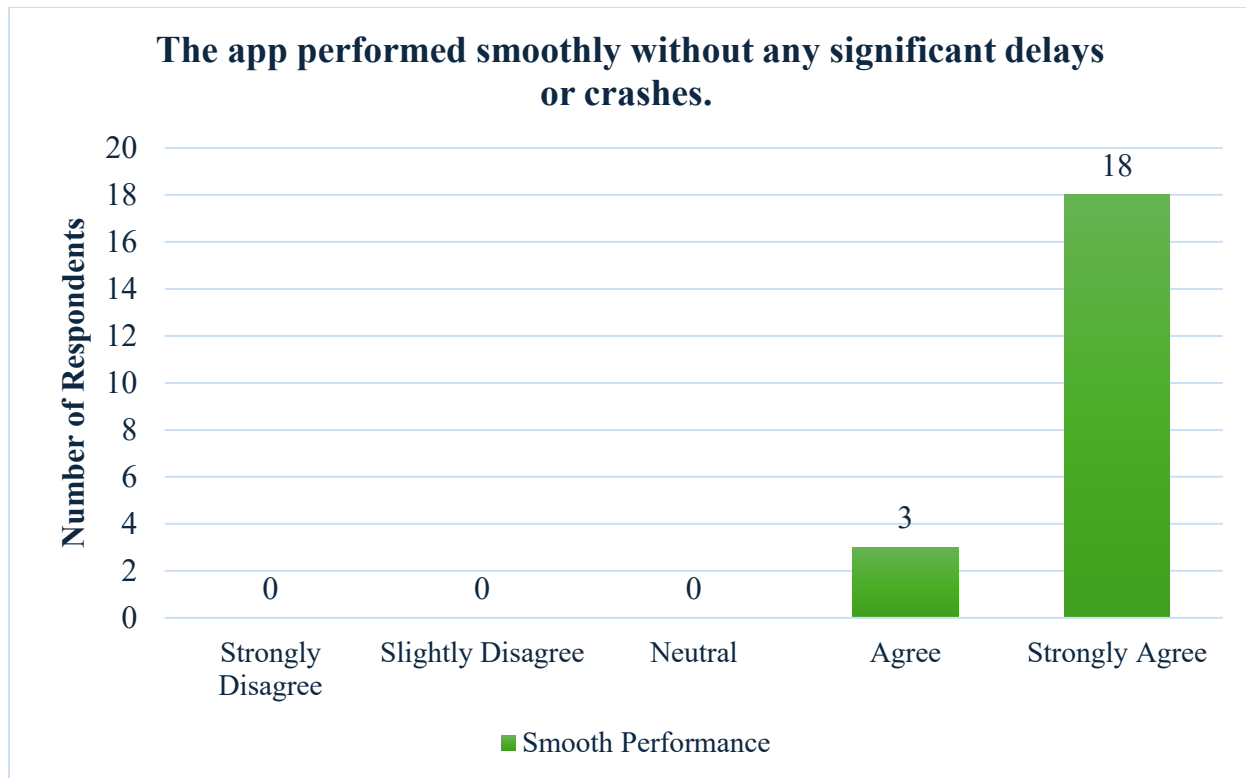


Figure 5.3: The App Performed Smoothly Without Any Significant Delays or Crashes

From the Figure 5.3, 18 respondents strongly agreed, and 3 respondents agreed that the app functioned well during their testing. This indicates that most users experienced stable performance, with minimal issues related to delays or app crashes. The smooth and reliable operation of the app likely enhanced users' overall satisfaction and confidence in using NutriFit AI.

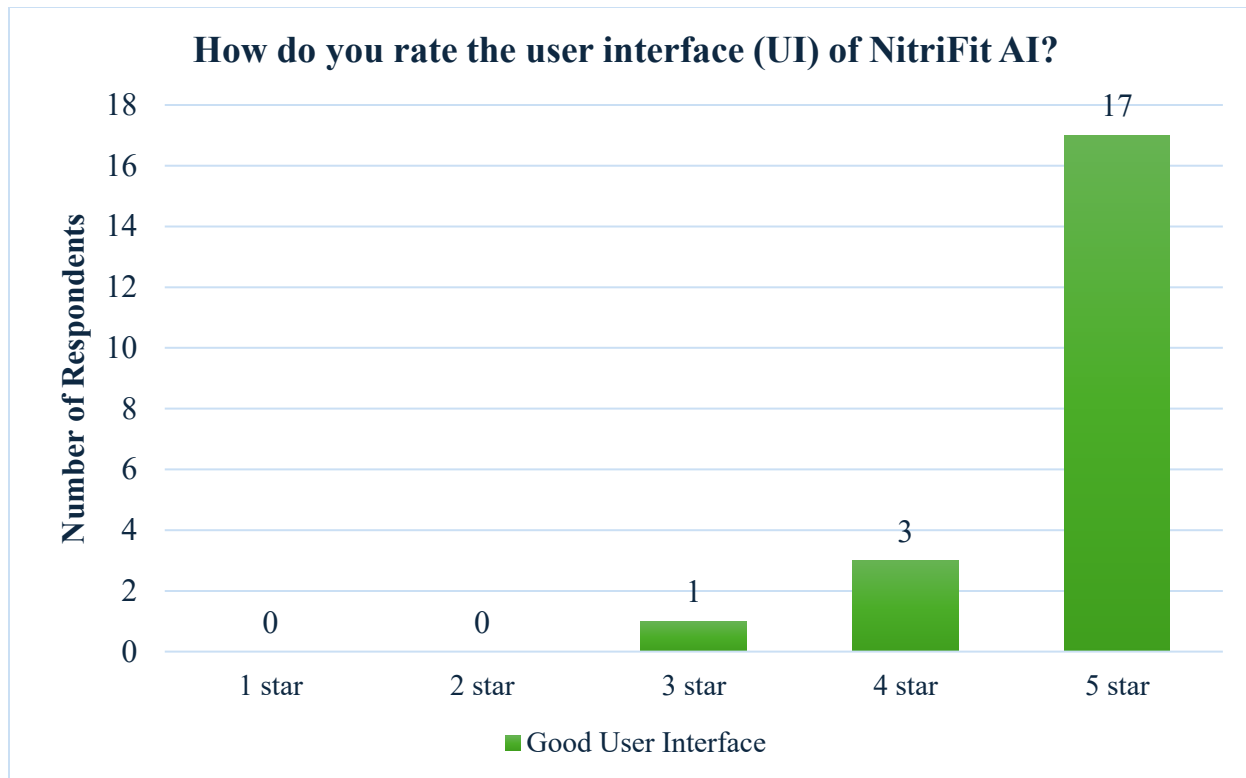


Figure 5.4:How Do You Rate the User Interface (UI) of Nutrifit AI?

The graph in Figure 5.4 illustrates the results of a survey asking respondents to rate the user interface (UI) of the NutriFit AI app. The majority of users, 17 respondents, gave the UI a 5-star rating, indicating a high level of satisfaction with the app's design and usability. 3 respondents rated it 4 stars, showing that while they were generally happy with the UI, there might have been a few areas for improvement. Only 1 respondent gave the UI a 3-star rating, suggesting it was acceptable but not exceptional. Notably, no respondents rated the UI with 1 star or 2 stars, meaning there were no strong negative reactions. Overall, the results highlight that the NutriFit AI app's user interface is largely well-received, with most users finding it user-friendly and visually appealing.

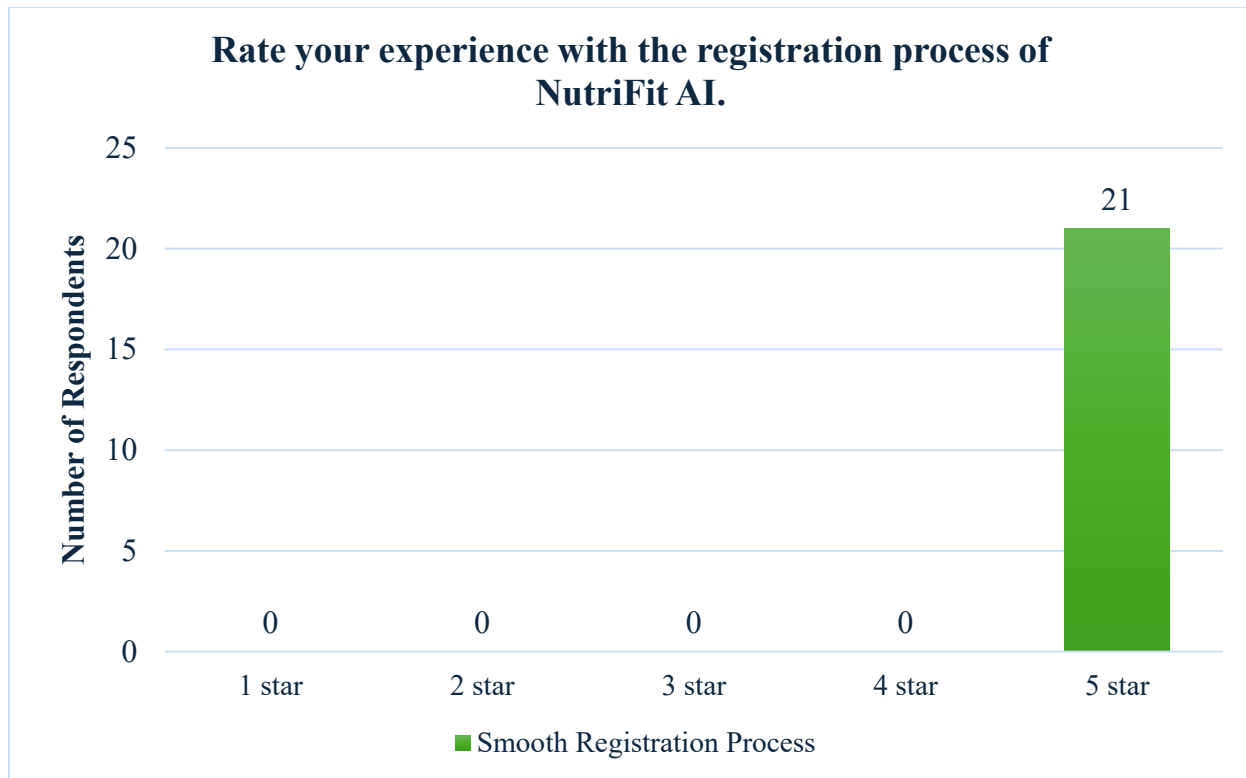


Figure 5.5: Rate Your Experience with the Registration Process of Nutrifit AI

The graph in Figure 5.5 represents respondents' ratings of their experience with the registration process of the NutriFit AI app. The majority of respondents, 21 in total, gave the registration process a 5-star rating, indicating that they found it to be smooth and efficient. No respondents rated the process with 1 star, 2 stars, 3 stars, or 4 stars, suggesting that everyone who participated had a positive experience. This indicates that users are highly satisfied with how easy and user-friendly the registration process is in the app.

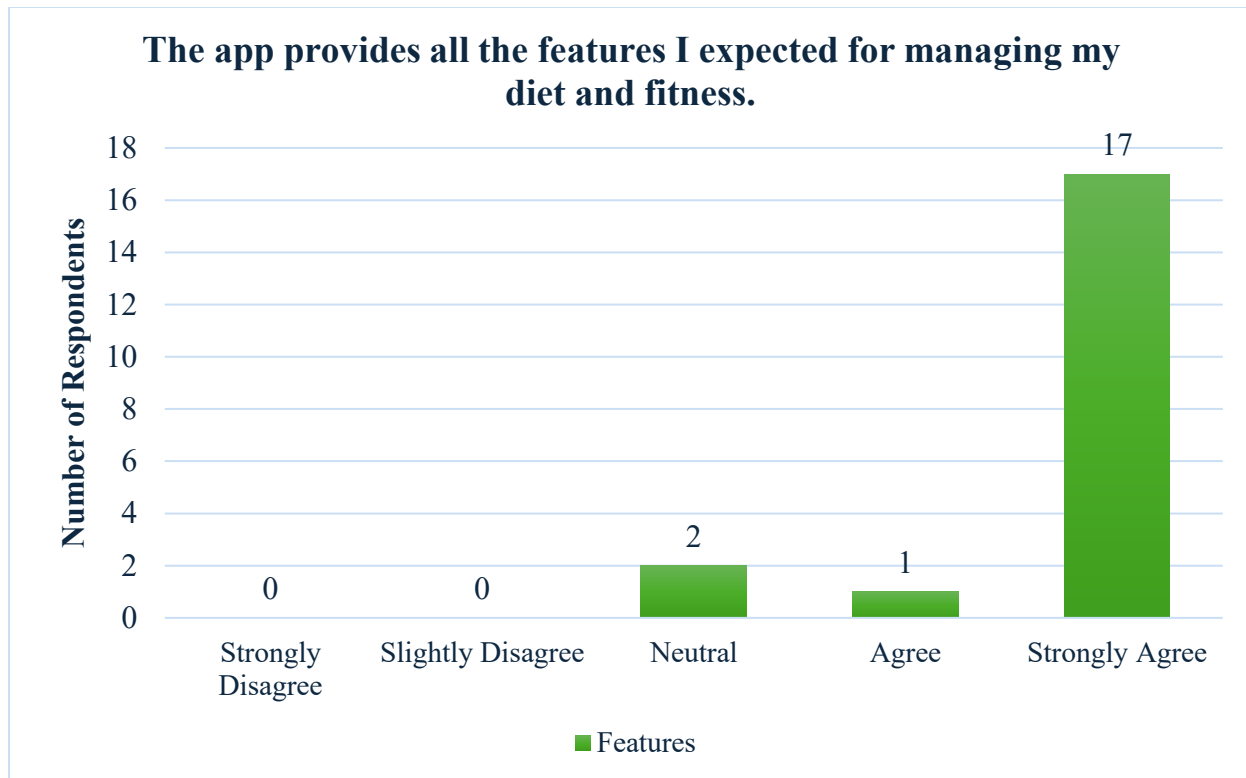


Figure 5.6: The App Provides all the Features I Expected for Managing My Diet And Fitness

From Figure 5.6, the majority of respondents, 17 people, strongly agreed that the app meets their expectations, as shown by the tall bar on the right side. Only 1 respondent agreed, while 2 respondents were neutral, meaning they neither agreed nor disagreed with the statement. Importantly, no respondents strongly disagreed or slightly disagreed, suggesting that overall, users are satisfied with the app's features for managing their health and fitness. This indicates that the app is seen as effective in providing the necessary tools and functionalities to support users' diet and fitness goals.

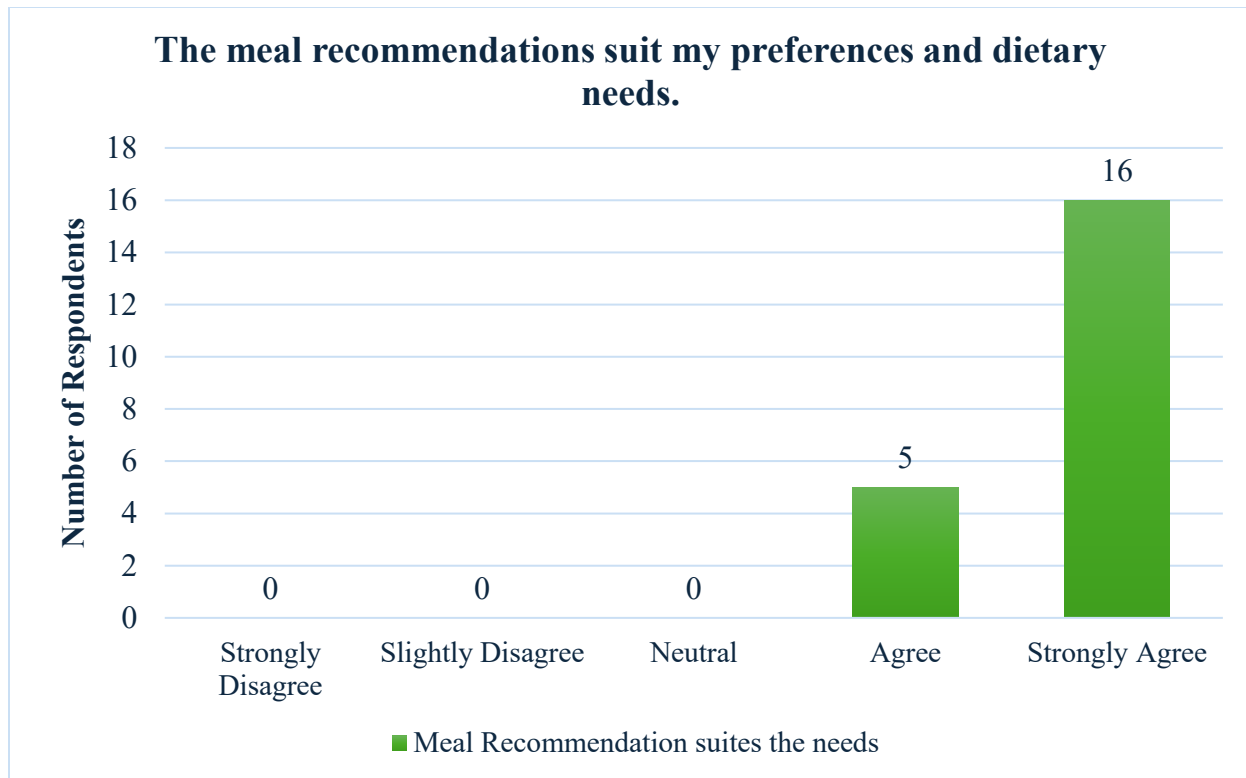


Figure 5.7: The Meal Recommendations Suit My Preferences and Dietary Needs

From Figure 5.7, 16 peoples strongly agreed that the meal recommendations met their expectations, as indicated by the tall bar on the right side of the graph. 5 respondents agreed, while there were no respondents who slightly disagreed or strongly disagreed with the statement. Only a few respondents were neutral, meaning they did not feel strongly one way or the other. This suggests that most users are satisfied with the meal recommendations, finding them appropriate for their dietary needs.

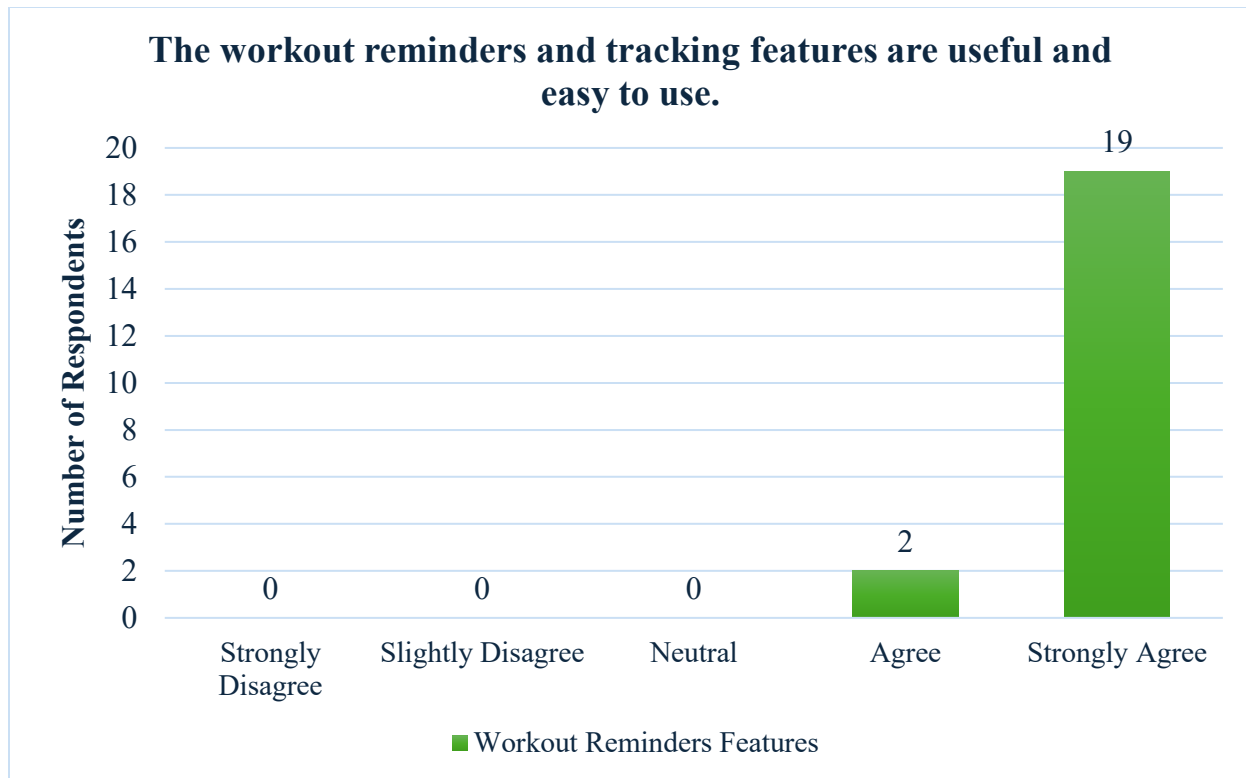


Figure 5.8: The Workout Reminders and Tracking Features are Useful And Easy to Use

From Figure 5.8, 19 out of 21 respondents strongly agreed that the features are both useful and easy to use. Only 2 respondents agreed, suggesting they found these features helpful but perhaps not as impactful as others. Importantly, no one disagreed or slightly disagreed with the statement, which indicates a generally positive response. A small number of respondents remained neutral, meaning they neither expressed strong approval nor disapproval. Overall, the results suggest that most users are highly satisfied with how the workout reminders and tracking features support their fitness routines.

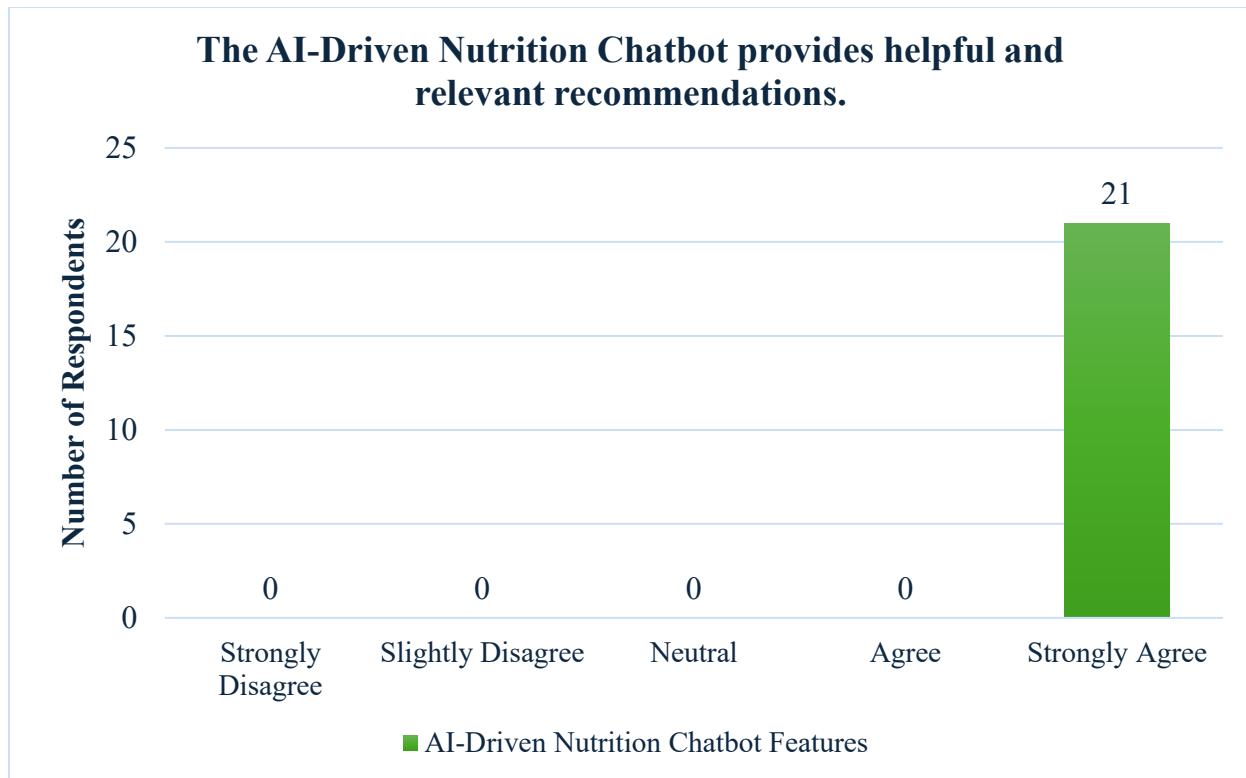


Figure 5.9: The AI-Driven Nutrition Chatbot Provides Helpful and Relevant Recommendations

From Figure 5.9, 21 out of 21 respondents strongly agreed that the chatbot offers valuable and appropriate suggestions. There were no respondents who strongly disagreed, slightly disagreed, or felt neutral about the chatbot's ability to deliver useful advice. Overall, the data shows that users are highly satisfied with the AI Nutrition Chatbot, finding its recommendations to be both beneficial and relevant to their needs.

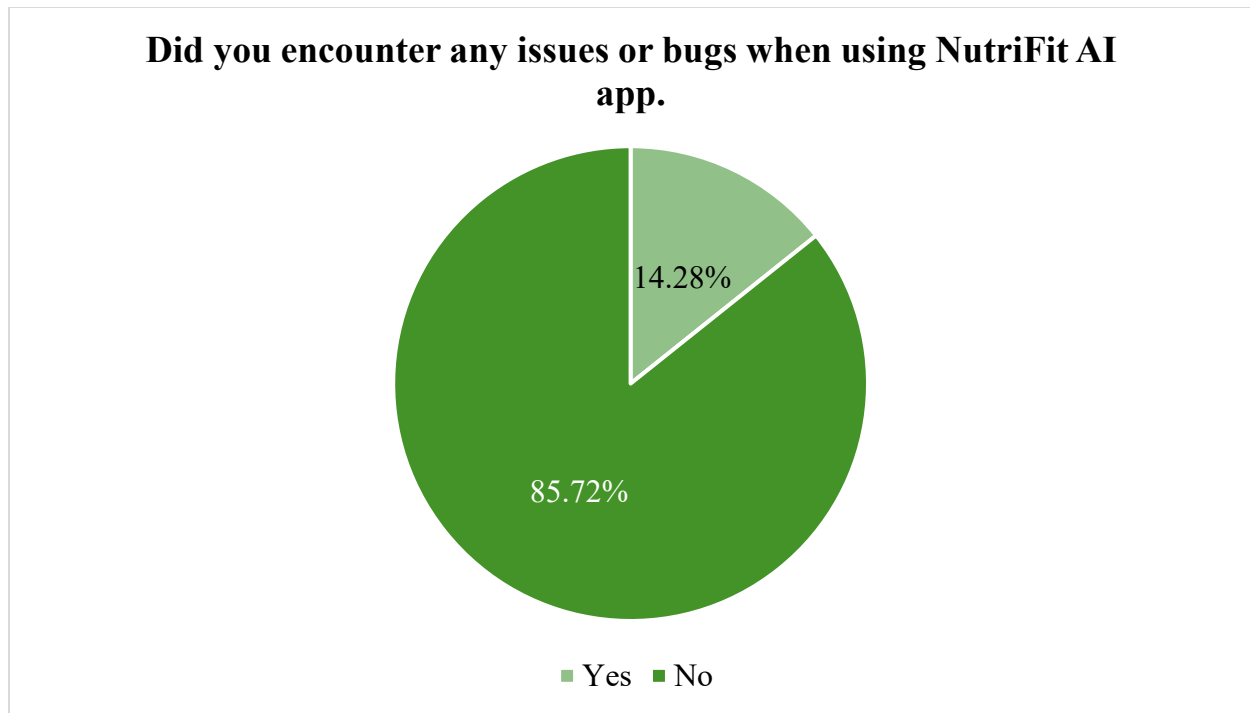


Figure 5.10: Did You Encounter Any Issues Orbugs when Using Nutrifit AI App

This pie chart represents the results of a survey question asking users if they encountered any issues or bugs while using the NutriFit AI app. The majority of respondents, 85.72%, reported that they did not experience any issues or bugs while using the app, as shown by the large green portion of the chart. On the other hand, 14.28% of users indicated that they did encounter some issues or bugs during their experience with the app, represented by the smaller portion of the chart. Overall, the data shows that most users found the app to be stable and reliable, with only a small fraction reporting any technical problems.

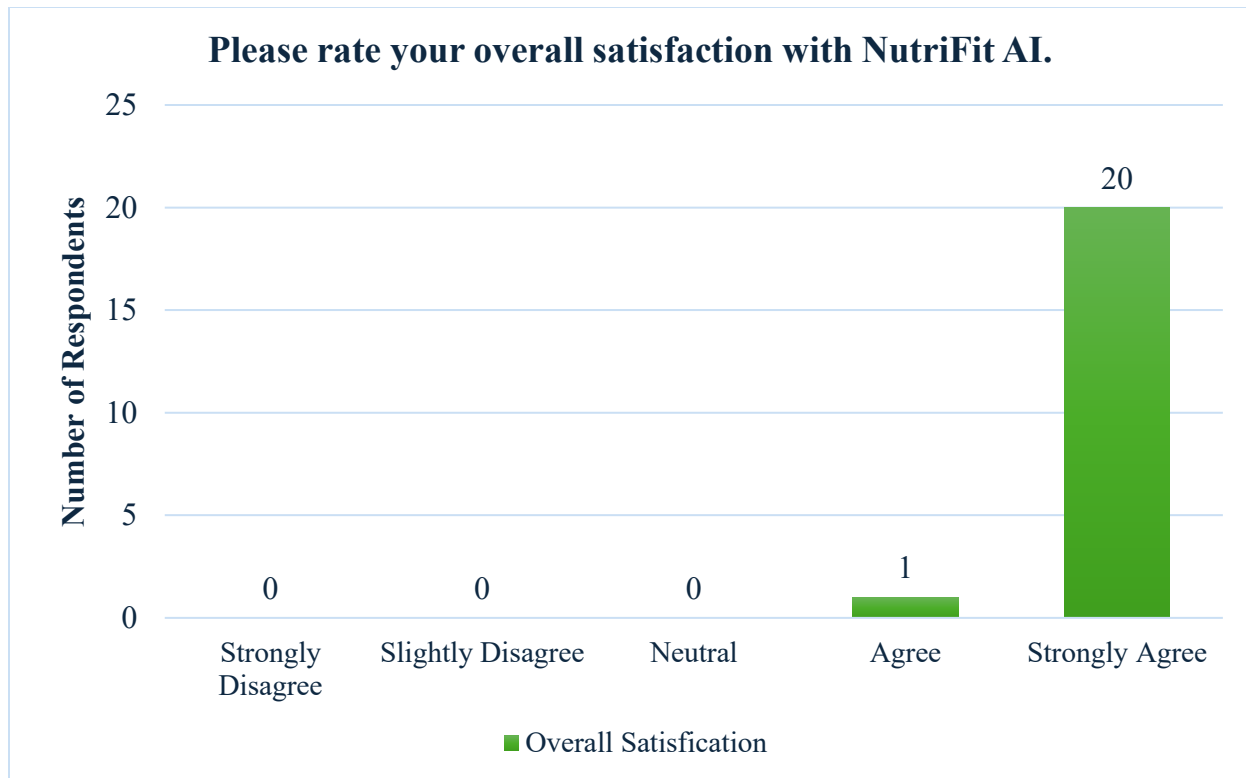


Figure 5.11: Please Rate your Overall Satisfaction with Nutrifit AI

This graph shows the results of a survey where users were asked to rate their overall satisfaction with the NutriFit AI app. The majority of respondents, 20 people, strongly agreed that they are highly satisfied with the app, as represented by the tall green bar on the far right. 1 respondent agreed with the statement, indicating they were generally satisfied but not as enthusiastic. There were no responses for slightly disagree, neutral, or strongly disagree, suggesting that most users are either satisfied or very satisfied with the app. Overall, the graph indicates that NutriFit AI has received a highly positive response from the majority of its users.

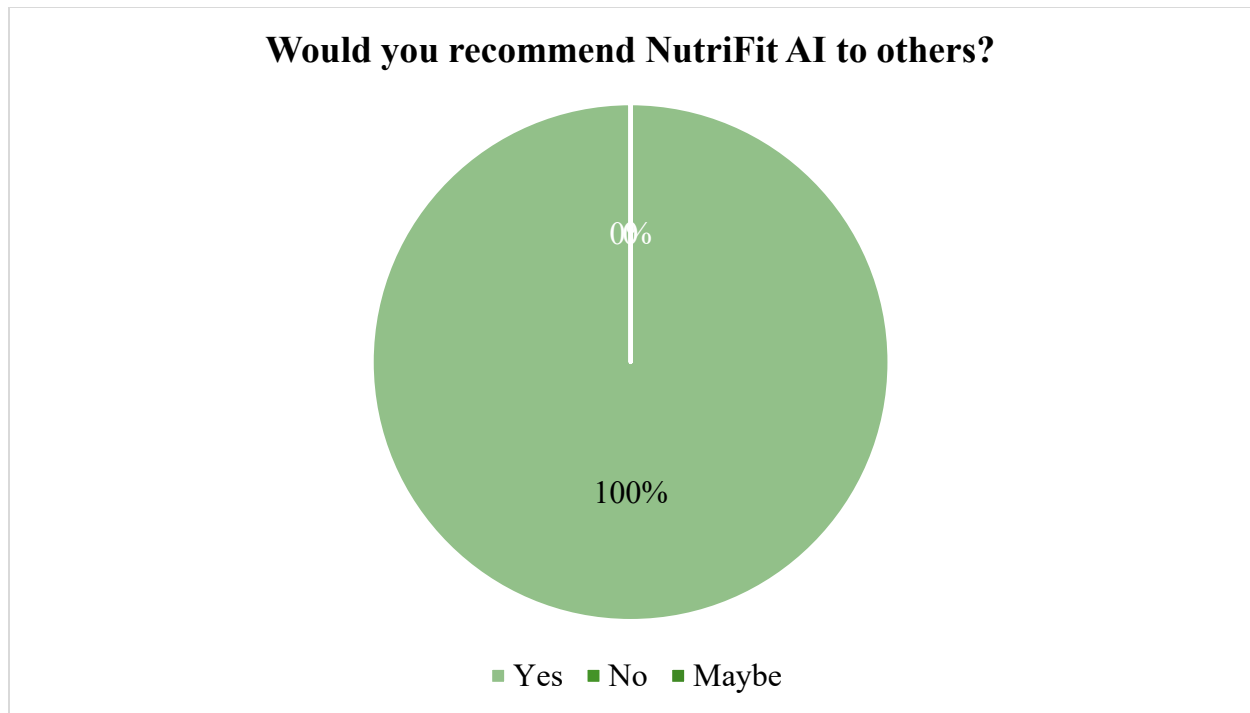


Figure 5.12: Would You Recommend Nutrifit AI to Others?

This pie chart illustrates the results of a survey asking respondents if they would recommend the NutriFit AI app to others. The entire chart, representing 100% of respondents, shows that all participants would recommend the app, as indicated by the large green section labeled “Yes”. There are no respondents who answered “No” and “Maybe”, as shown by the absence of any portion for that choice. This indicates that everyone who took part in the survey had a positive experience with the app and would recommend it to others, highlighting a strong level of satisfaction with the NutriFit AI app.

Chapter 6: Conclusion And Future Work

6.1 Conclusion

The development of NutriFit AI has successfully achieved its primary objectives of providing users with an integrated and efficient platform for managing their diet and fitness. The project aimed to address the common issue of fragmented health management tools by offering an all-in-one solution. Specifically, NutriFit AI successfully implemented features such as personalized meal recommendations based on user input, customized workout plans, and an AI-driven nutrition chatbot that provides real-time, symptom-based dietary advice. The system development and testing phases, guided by the prototyping model, have validated the app's functionality, performance, and usability. This ensures the application is a reliable and effective tool for users to track their progress, receive tailored guidance, and promote sustainable healthy habits. By consolidating essential diet and fitness management features with AI-powered support, NutriFit AI contributes to simplifying health management and tackling issues like obesity.

6.2 Achievement

The development of NutriFit AI has successfully achieved its core objectives and delivered a comprehensive health management solution as initially assumption.

Key achievements of this project include:

- **Integrated Diet and Fitness Management.** NutriFit AI successfully unified both diet and fitness tracking into a single mobile application. This addresses the core problem of users needing to rely on multiple, fragmented applications for a complete health plan.
- **Personalized Meal Recommendations.** The application provides personalized meal recommendations for breakfast, lunch, and dinner, based on user-input data such as BMI,

weight, height, and dietary preferences (e.g., dairy-free, peanut free, vegetarian, gluten-free).

- **Customized Workout Plans.** NutriFit AI offers personalized workout plans and exercise tutorials, enabling users to track their physical activity and calories burned.
- **AI-Driven Nutrition Chatbot:** An advanced AI-powered nutrition chatbot, utilizing Gemini API, was successfully integrated to deliver real-time, symptom-based dietary suggestions and health advice.
- **User-Friendly Design and Data Visualization.** The app features an intuitive user interface, allowing users to easily navigate and manage their health journey. It also includes a statistics module with visual charts to monitor weight changes and calorie trends, promoting user motivation.

6.3 Limitations And Constraints

While NutriFit AI successfully delivers on its core objectives, it's important to acknowledge certain limitations and constraints encountered during its development and in its current iteration. These factors have influenced aspects of the app's functionality, scope, and broader applicability:

- **API Usage Limitations.** The functionality of the AI-driven nutrition chatbot relies on external APIs, specifically Gemini API. While powerful, the usage of such APIs often comes with rate limits and potential costs, which could impact the responsiveness or scalability of the chatbot under very high user loads in a production environment. Similarly, the food library integration relies on an external database (e.g., Nutritionix API). Furthermore, the Spoonacular API and Edamam API for meal recommendation also had limitation on its requests to recommend food.

- **Initial Data Scope for Meal Recommendations.** While meal recommendations are personalized, the current system's initial recommendations are primarily based on user input data such as BMI, weight, height, and general preferences. More advanced personalization, involving deep learning from individual dietary habits over time, is a future enhancement rather than a current full implementation.
- **Offline Functionality.** The system currently requires internet connectivity for food log, meal recommendation, real-time AI chatbot responses and data synchronization. This means that some features might be limited or unavailable when a user is offline.
- **General Health Advice:** While the AI chatbot provides symptom-based dietary suggestions, it's crucial to note that this advice is for general nutritional guidance and not a substitute for professional medical consultation. The app serves as a supportive tool for health management rather than a diagnostic or treatment platform.

6.4 Future Work

The development of NutriFit AI has established a strong foundation for an all-in-one diet and fitness management application. To further enhance its capabilities, user experience, and impact, several key areas have been identified for future work and enhancements:

- **Advanced Personalization through Machine Learning.** Current recommendations are based on initial user input, future iterations could implement more advanced machine learning algorithms to learn from a user's ongoing food logging patterns, workout performance, and actual progress. This would allow the system to dynamically adjust meal plans and workout routines for even more precise and adaptive guidance, moving beyond static recommendations. For instance, if a user consistently struggles with a particular type of workout, the system could suggest alternatives or modifications.

- **Integration with Wearable Devices.** A significant enhancement would be to integrate NutriFit AI with popular wearable fitness devices (e.g., smartwatches, fitness trackers). This would allow for automatic collection of activity data, heart rate, sleep patterns, and potentially more accurate calorie burn estimates, reducing manual input and providing a more holistic view of a user's health.
- **Expansion of Food Database and Global Accessibility.** To address the limitation of localized food databases, future work should focus on expanding the food library to include a wider range of international and local Malaysian food items with comprehensive nutritional data. This would enhance the app's usability for a more diverse user base, particularly in Malaysia.
- **Enhanced AI Chatbot Capabilities.** While the current chatbot focuses on symptom-based nutrition, it could be expanded to offer a wider range of general health advice, incorporating information on hydration, sleep, stress management, and mental well-being, while maintaining clear disclaimers that it's not a substitute for medical professionals.

References

- Acer laptops, desktops, Chromebooks, monitors & projectors*. Acer Malaysia. (2025).
<https://www.acer.com/my-en>
- Agile Model - javatpoint*. www.javatpoint.com. (2024). <http://javatpoint.com/software-engineering-agile-model>
- AlSlaity, A., Suruliraj, B., Oyeboode, O., Fowles, J., steeves, darren, & Orji, R. (2022). Mobile applications for Health and Wellness: A Systematic Review. *Proceedings of the ACM on Human-Computer Interaction*, 6(EICS), 1–29. <https://doi.org/10.1145/3534525>
- AppAdvice (2024). Home workout - no equipments by Leap Health.
https://appadvice.com/app/home-workout-no-equipments/1313192037#google_vignette
- Build apps for any screen*. Flutter. (2024). <https://flutter.dev/>
- Craig, L., Laskowski, N., & Tucci, L. (2024, October 1). *What is AI? Artificial Intelligence explained*. Search Enterprise AI.
<https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence>
- Data Bridge Market Research. (2021). Asia-Pacific Diet and Nutrition Apps Market Report – Industry trends and forecast to 2028.
<https://www.databridgemarketresearch.com/reports/asia-pacific-diet-and-nutrition-apps-market>
- De Carli, S. (2023). Introduction to firebase. *Build Mobile Apps with SwiftUI and Firebase*, 17–42. https://doi.org/10.1007/978-1-4842-9452-9_2
- Fadhil, A. (2018). Can a chatbot system determine my diet?: Addressing challenges of chatbot application for meal recommendation.
https://www.researchgate.net/publication/316145190_Can_a_Chatbot_System_Determin

e My Diet Addressing Challenges of Chatbot Application for Meal Recommendation

Google. (2024). Google. <https://firebase.google.com/>

Google Developers. (2024). Android Studio Overview. Retrieved from <https://developer.android.com/studio>

Huawei Official Website. (2025). Huawei Nova 9 Specifications. Retrieved from <https://consumer.huawei.com>

Ibm. (2024, December 19). Artificial Intelligence. *What is artificial intelligence (AI)?* <https://www.ibm.com/think/topics/artificial-intelligence>

Josmantek (2024). Macros App - Calorie Counter. Macros. <https://macros.app/>

Kirvan, P., Lutkevich, B., & Lewis, S. (2024, November 15). What is a Waterfall model? Definition and guide. Search Software Quality. <https://www.techtarget.com/searchsoftwarequality/definition/waterfall-model>

Malve, M., Mahajan, P., Waghmare, S., Pagar, S., & Mali, M. (2024). AI based web application for diet planning and recipe generation. *International Journal for Multidisciplinary Research*, 6(6). <https://doi.org/10.36948/ijfmr.2024.v06i06.29919>

Nutritionix. (2024). Log everything you eat in as little as 60 seconds per day. <https://www.nutritionix.com/app>

Schoeppe, S., Alley, S., Van Lippevelde, W., Bray, N. A., Williams, S. L., Duncan, M. J., & Vandelanotte, C. (2016). Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1). <https://doi.org/10.1186/s12966-016-0454-y>

Sommerville, I. (2011). *Software Engineering* (9th ed.). Addison-Wesley.

<https://www.facom.ufu.br/~william/Disciplinas%202018-2/BSI-GSI030->

<EngenhariaSoftware/Livro/softwareEngineeringSomerville.pdf>

Tuama, D. Ó. (2023). *Software Development Methodologies: A guide*. Code Institute Global.

<https://codeinstitute.net/global/blog/software-development-methodologies-a-guide/>

World Obesity Federation. (2024). World Obesity Federation.

<https://worldobesity.org/about/about-obesity/prevalence-of-obesity>

Yang, Y., & Koenigstorfer, J. (2021). Determinants of fitness app usage and moderating impacts of education-, motivation-, and gamification-related app features on Physical Activity Intentions: Cross-sectional survey study. *Journal of Medical Internet Research*, 23(7).

<https://doi.org/10.2196/26063>

Appendix A: Questionnaires

Survey on Diet and Fitness Mobile App with AI-Driven Nutrition Chatbot

Hi everyone,

I am Queenie Lee Su Hua (81001), final year student from Bachelor Degree of Software Engineering in Universiti Malaysia Sarawak (UNIMAS). I am currently conducting this survey as part of my Final Year Project titled "Diet and Fitness Mobile App with AI-Driven Nutrition Chatbot."

The purpose of this survey is to gather insights and feedback to help define the requirements and features of the mobile app. Your responses will help me create a user-friendly and effective app that meets the needs of individuals aiming to improve the fitness and dietary habits.

There are 3 sections for this survey:

Section A: Demographic Information

Section B: Health & Fitness Goals

Section C: Preference for Fitness and Diet App with AI Nutrition Chatbot

The survey will take approximately 5–10 minutes to complete. Your participation is entirely voluntary, and your responses will remain confidential.

If you have any questions or require further information, feel free to contact me at 81001@siswa.unimas.my.

Thank you for your time and valuable input!

***Required**

Section A: Demographic Information

This section collects basic demographic details to better understand your background.

1. Gender: *

Mark only one oval.

☐ Male

☐ Female

2. What is your age group? *

Mark only one oval.

☐ Under 18

☐ 18-25

☐ 26-40

☐ 40 and above

3. What is your occupation? *

Mark only one oval.

- ☐ Student
- ☐ Employee
- ☐ Unemployed
- ☐ Retired
- ☐ Other:

Section B: Health & Fitness Goals

This section aims to gather information about your health and fitness goals to help tailor the app's features and recommendations to better support your journey towards improved health and wellness.

4. What is your primary health and fitness goal? *

Tick all that apply.

- ☐ Weight loss
- ☐ Weight gain
- ☐ Muscle building
- ☐ General fitness
- ☐ Improve diet
- ☐ Other: _____

5. What challenges have you faced in achieving your fitness or diet goals in the past? *

Tick all that apply.

- ☐ Lack of motivation
- ☐ Not enough time
- ☐ Lack of fitness or dietary knowledge
- ☐ Difficulty in meal preparation
- ☐ Physical limitations
- ☐ Other:

6. What kind of guidance would you like for improving your diet? *

Tick all that apply.

- ☐ Portion control tips
- ☐ Meal suggestions based on nutritional needs
- ☐ Calorie counting
- ☐ Balanced meal planning
- ☐ Other: _____

7. Would you like to receive notifications for meal reminders or workout suggestions *

throughout the day?

Mark only one oval.

☐ Yes

☐ No

☐ Maybe

Section C: Preference for Fitness and Diet App with AI Nutrition Chatbot

This section aims to understand your preferences for a fitness and diet app that incorporates an AI-powered nutrition chatbot.

8. How often do you use fitness or diet apps? *

Mark only one oval.

- ☐ Daily
- ☐ Weekly
- ☐ Occasionally
- ☐ Never

9. What is your level of experience with fitness or diet management? *

Mark only one oval.

- ☐ Beginner
- ☐ Intermediate
- ☐ Advanced
- ☐ None

10. What features do you think most helpful in your fitness or diet app? *

Tick all that apply.

- ☐ Meal Plans Recommendation according to BMI
- ☐ Workout tutorials and exercise routines
- ☐ Daily Calorie Tracking
- ☐ Calorie Burnt Report
- ☐ AI-driven chatbot for dietary advice
- ☐ Other:

11. What kind of exercise routines would you like the app to provide? *

Tick all that apply.

- ☐ Cardio
- ☐ Strength training
- ☐ Yoga
- ☐ Pilates
- ☐ Stretching
- ☐ High intensity interval training (HIIT)

12. Have you ever used an AI-powered chatbot for health-related advice? *

Mark only one oval.

- ☐ Yes
- ☐ No

13. Would you find it beneficial if a fitness and diet app included an AI chatbot that offers personalized nutrition advice based on your health symptoms (e.g., Headache, Stomachache)?

Mark only one oval.

Not beneficial ☐ ☐ ☐ ☐ ☐ Extremely beneficial

14. How important is it for the app to provide suggestions on how to modify meals based on personal preferences (e.g., vegetarian, gluten-free)?

Mark only one oval.

Not important ☐ ☐ ☐ ☐ ☐ Extremely important

15. How important is it for you to be able to track both fitness and diet in one app instead of using multiple apps?

Mark only one oval.

Not important ☐ ☐ ☐ ☐ ☐ Extremely important

Appendix B: User Acceptance Testing (UAT) Questionnaire for NutriFit AI



User Acceptance Testing (UAT) Questionnaire of NutriFit AI Mobile Application

Dear respondents,

I am Queenie Lee Su Hua (81001), final year student from Bachelor Degree of Software Engineering in Universiti Malaysia Sarawak (UNIMAS). I would like to invite you to participate in my final year project titled **"Diet and Fitness Mobile App with AI-Driven Nutrition Chatbot."**

Thank you for participating in the User Acceptance Testing (UAT) for NutriFit AI. Your feedback is extremely valuable and will help me improve the app to better meet the needs of future users.

The purpose of this questionnaire is to gather feedback from users regarding the functionality, usability, design, and overall experience of the NutriFit AI mobile application. Your responses will help evaluate how well the app meets user needs and identify areas for improvement before its final release.

If you are an android user, please download the NutriFit AI App using the following link:

Please note that the app is only available for Android devices at the moment.

Thank you once again for your time and support in helping me complete this project. Your contribution truly means a lot! If you have any questions or require further information, feel free to contact me at 81001@siswa.unimas.my.

Sincerely,

Queenie
UNIMAS

queenielsh0421@gmail.com [Switch accounts](#)

 Not shared

* Indicates required question

NutriFit AI app was easy to navigate. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

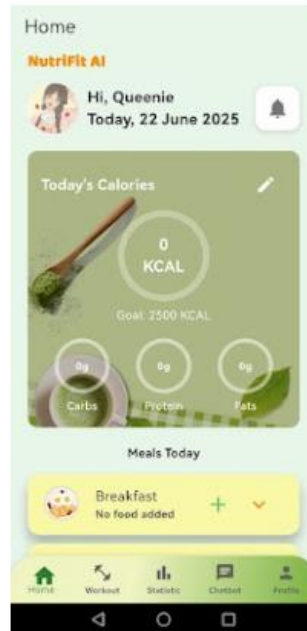
The instructions and labels were clear. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

The app performed smoothly without any significant delays or crashes.

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

How do you rate the user interface (UI) of NutriFit AI? *



1	2	3	4	5
☆	☆	☆	☆	☆

Rate your experience with the registration process of NutriFit AI. *

1	2	3	4	5
☆	☆	☆	☆	☆

The app provides all the features I expected for managing my diet and fitness. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

The meal recommendations suit my preferences and dietary needs. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

The workout reminders and tracking features are useful and easy to use. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

The AI-Driven Nutrition Chatbot provides helpful and relevant recommendations. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

The features in the app are easy to find and use. *

	1	2	3	4	5	
Strongly Disagree	☐	☐	☐	☐	☐	Strongly Agree

Did you encounter any issues or bugs when using NutriFit AI app. *

☐ Yes

☐ No

If yes, write down the issues and bugs that you encounter (if applicable).

Your answer _____

Please rate your overall satisfaction with NutriFit AI. *



Would you recommend NutriFit AI to others? *

☐ Yes

☐ No

☐ Maybe

Any additional comments or suggestions for NutriFit AI?

Your answer _____

Submit

Clear form

Never submit passwords through Google Forms.

This content is neither created nor endorsed by Google. - [Contact form owner](#) - [Terms of Service](#) - [Privacy Policy](#)

Does this form look suspicious? [Report](#)