FOOD CHECK: IMAGE-BASED FOOD RECOGNITION FOR CALORIE AND NUTRIENT ESTIMATION

A Capstone Project
Presented to the Faculty of the
Information and Communications Technology Program
STI College Calamba

In Partial Fulfilment
of the Requirements for the Degree
Bachelor of Science in Information Technology

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April 2025

ENDORSEMENT FORM FOR ORAL DEFENSE

TITLE OF RESEARCH: **Food Check: Image-Based Food Recognition for Calorie and Nutrients Estimation**

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In Partial Fulfilment of the Requirements
for the degree Bachelor of Science in Information Technology
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ABSTRACT

Title of research**:** FOOD CHECK: IMAGE-BASED FOOD RECOGNITION FOR CALORIE AND NUTRIENT ESTIMATION

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Keywords: Mobile Application for Calorie and Nutrients regarding image-based recognition.

This mobile application was developed for food recognition using an image recognition method and to estimate calories and nutrients from food packaging. This system aims to gain knowledge and awareness in food regarding the substance of Calories and nutrients. Tracking nutritional values helps everyone to enhance their capability regarding their Health Consciousness, mostly for those who may not have the condition to consult nutritionist or dietician regularly. Imaging solutions for food item recognition and nutritional content estimation could fill the gap in promoting healthy dietary habits. These systems allow users to take photos of meals and estimate nutrients and calories instantly, promoting better food choices and healthier dietary habits. Advances in image processing and machine learning can help in nutrition, empowering individuals to make healthier food choices without expensive professional services.

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INTRODUCTION

Project Context

Today, nutritional awareness has consumed most minds. As a result, people have started to do more food calculations about their food intake towards maintaining good fitness and balance of meals. This study employed the Internet of Things for mobile application use with Filipino meal recognition and wove this into a weighing scale so that recognition and food calculation processes could never be made easier without having to do individually scale and measure the macronutrients of each food (Demition, A. D et al., 2024).

Balanced diets are important to prevent the development of diseases: obesity, diabetes, and heart diseases. Tracking nutritional values of the food that goes into the mouths of people is a task that may feel difficult for many. While qualified nutritionists may give insights into personalized diets and calculate required food intake, they are often found to be expensive for each scope of people to provide in useful application. This is how a big portion of the population remains unaware of calorie and nutrient contents of their food, which can give rise to long-term considerations for health problems (Żarnowski et al., 2022).

Through the time, imaging solution for food item recognition and nutritional content estimation would serve as an apt course solution to fill this gap. These systems allow users to take photos of meals and significantly estimate nutrients and calories instantaneously. Such a system could promote better food choices, encourage more healthy dietary habits for health-conscious people. The increase in the demand for accessible and low-cost ways to monitor dietary behavior has, therefore, opened the discussion to exploring how modern technology can help in health management at the individual level. With advances in image processing and machine learning, there is now an opening for the application of these technologies in nutrition. This project is situated right where technological feasibility meets public health utility-in this space employing common devices like smartphones for a more feasible estimation of calorie and nutrient intake. Situating this innovation against the backdrop of everyday life will address the broader challenge of empowering individuals to make healthy food choices without having to rely on expensive professional services (Dalakleidi et al., 2022).

Purpose and Description

The purpose of this project is to design a mobile application for food recognition using image recognition methods and to estimate calories and nutrients from food packaging. The application employs machine-learning techniques combined with a structured nutritional database that seeks to provide accurate information regarding food types, serving sizes, and relevant nutritional values.

The project aims at supporting the health-conscious consumer who may not have conditions to consult nutritionists or dietitians regularly. By simplifying food content information through technology, the application nudges these users to make more informed food choices. Ultimately, the application fosters healthier eating patterns while proposing a more accessible regime of keeping up a balanced diet and a healthy lifestyle.

Background of the Problem

Individuals struggle to accurately monitor their calorie intake and nutrients on the food they eat due to lack of convenient, affordable and accessible tools for analyzing food content. This leads to difficulties in understanding the nutritional value of consumed foods that contributes to unhealthy eating habits, which can lead to health issues like diabetes, obesity and heart disease.

Enhanced user-friendly, mobile-based solution that utilizes image recognition to automatically identify food items and provide calorie and nutrient information.

Many health applications require users to manually input data, such as food intake and physical activity, which can be time-consuming and inconvenient. This discourages frequent use, as users may find the process tedious or difficult to maintain over time. Additionally, existing dietary measurement systems present a trade-off: highly accurate systems often require complex and slow data entry, reducing usability, whereas faster systems may sacrifice precision, leading to unreliable assessments. As a result, the healthcare industry faces a pressing need for dietary assessment tools that combine efficiency with accuracy. The ideal solution would streamline the tracking process without compromising the reliability of the data, making it more user-friendly and encouraging sustained engagement. By integrating innovative technology, such as automated tracking methods or AI-powered analysis, health applications could offer a more seamless and effective experience for users (Nadeem et al., 2023).

Existing food recognition models lack integration with comprehensive nutrient databases.

Inadequate integration of food recognition systems with an extensive nutrient database is the reason for the current systems failing to provide accurate nutritional information. Thus, when the image analysis recognizes a food item correctly, the system often fails to present the correct nutrient values. Nutritional data are therefore subjected to misinterpretation, rendering the nutritional monitoring process less trustworthy. The absence of a direct link connecting visual food recognition with validated database entries means that users are sometimes receiving confused or erroneous information. Low confidence on the part of users and consequent ineffectiveness of food tracking applications are the consequences. Thus, there is a need for a system that reliably identifies food from images and automatically retrieves nutritional information from a credible, trusted database. Only with this setup can reliable, consistent results be ensured. (Konstantakopoulos et al., 2024).

Applications offer image-based food recognition, but advanced features are often paywalled, restricting access for financially limited users.

With artificial intelligence integration and image recognition, individuals may now track food intake to make lifestyle choices that are healthier. Because of this, those technologies are being utilized for better nutrition awareness and building sustainable healthy habits. However, because of all the features related to advanced aspects like personalized diet tips, nutritional breakdowns, and remote health monitoring, it has been found that more people with low incomes cannot access them because they are paid. This lack of access means that really many who could benefit from these particular tools cannot use them, while more affluent users enjoy them. As a result, health technologies meant for public well-being tend to be privately funded (Kirubakaran et al., 2023).

Objectives

General Objectives

This mobile application was designed to serve as a tool for analyzing the nutritional content of food, providing a reliable platform for understanding calorie and nutrient consumption. By offering users clear and accurate information about what they eat, the application promoted informed food choices and encouraged the development of healthy eating habits. Ultimately, it aimed to minimize the risk of various health issues such as diabetes, obesity, and heart disease.

Specific Objectives

1. **To develop a mobile application that has the following module:**

    - **A scanning module that was user-friendly, capable of identifying each food item, and providing calorie and nutrient information to**

the user.

This module offered users a convenient way to identify foods by capturing images of their packaging. Upon identification, it furnished accurate data on caloric and nutrient composition, thereby enhancing user awareness of nutrition in relation to their food choices. It supported health-conscious individuals in objectively tracking their dietary habits and empowered them to make better dietary decisions through real-time nutrient information. By combining image recognition with nutritional data, it addressed a major limitation of existing food analysis tools.

- **A nutrient database module that was comprehensive and integrated with image recognition to accurately display nutritional information.**

  This module retrieved and displayed validated nutritional data from a trusted database once a food item was recognized. It aimed to reduce misinterpretation by ensuring that the displayed data corresponded precisely to the identified food. This feature significantly improved the reliability of nutritional monitoring and increased user confidence in calorie and nutrient estimations.

- **An accessible image-based food recognition feature, along with additional functionalities designed to support users with limited financial resources.**

  The application provided essential food identification and nutritional analysis features free of charge, removing paywalls that typically restrict access to advanced health tools. These features enabled users to regulate their dietary intake and promoted equal access to resources necessary for maintaining a healthy eating pattern.

2. **To conduct an evaluation component that gathered user feedback and assessed the system's quality characteristics using the ISO 25010 standard.**

   Feedback was collected to evaluate user satisfaction with the system's functionality, usability, and overall effectiveness. The system was assessed using ISO 25010 to ensure compliance with internationally recognized software quality standards, resulting in a robust and user-centered solution.

Scope and Limitations

Scope

This research focused on developing *Food Check*, an image-based food recognition tool designed to estimate the calorie and nutrient content of meals. Users were able to take or upload a picture of food, which was then processed by computer vision and machine learning models integrated into the system to recognize identifiable food items. The system estimated nutritional contents—such as calories, carbohydrates, proteins, and fats—based on information retrieved from reputable food composition databases.

Limitation

The researchers were restricted to a predetermined set of common food items to ensure recognition and estimation accuracy. Although the system was designed to offer real-time feedback for individual dietary tracking, it did not accommodate complex or composite dishes with multiple components, nor culturally unique or exotic food items.

Users were able to view, save, and monitor their diet through a streamlined, easy-to-use interface, which made it easier to maintain their dietary goals. However, the system was primarily intended for individuals who are health-conscious or follow specific dietary plans, and may not fully support broader dietary diversity or specialized nutritional needs.

Review of Related Literature/Studies/Systems

Review of Related Literature

This chapter presents a review of related literature and studies, both local and international, that informed the development of *FOOD CHECK: Image-Based Food Recognition for Calorie and Nutrient Estimation*. It covers key technologies such as deep learning, Convolutional Neural Networks (CNNs), and nutrient estimation methods, which formed the foundation of the system.

Image Processing Identification

Image-based food recognition has become a key area in dietary tracking and nutrition monitoring, offering a faster and more accurate alternative to manual food logging. In the study "Food Item Calorie Estimation Using YOLOv4 and Image Processing", the authors utilized the YOLOv4 object detection algorithm to identify food items within an image and estimate their caloric content. The system integrated computer vision with a nutritional database to map detected food items to calorie values. Image preprocessing techniques such as segmentation and background removal were applied to improve recognition accuracy. This approach demonstrated the effectiveness of deep learning in enhancing food recognition and supported its use in real-time dietary monitoring applications (Patil et al., 2021).

The study "Nutrient and Food Group Prediction as Orchestrated by an Automated Image Recognition System in a Smartphone App (CALO mama)" (2022) introduced a smartphone application aimed at real-time food recognition and nutrient estimation. The app used automated image recognition to predict nutrient content and categorize food groups directly from meal images. It leveraged deep learning techniques to classify food types and estimate macronutrients such as calories, proteins, and carbohydrates—aligning with the goals of the Food Check system. One key insight from the study was the importance of manual corrections after automated identification to improve accuracy. The study validated the system's effectiveness in a mobile environment, highlighting the practicality of integrating real-time image recognition for food and nutrient analysis (Sasaki et al., 2022).

Nutritional Information

A comprehensive survey on image-based food recognition and volume estimation emphasized the increasing role of deep learning techniques, particularly CNNs, in dietary assessment applications. The study highlighted how computer vision systems were developed to recognize various food types and estimate their portions from 2D images, allowing for more accurate calorie and nutrient analysis. These systems typically used a combination of food detection, segmentation, and volume estimation to deliver nutritional information with reduced manual input. The findings supported the feasibility and growing accuracy of automated nutrition tracking systems, especially those deployed on smartphones—directly aligning with the objectives of the Food Check system (Tahir, 2021).

A systematic review on the efficacy of image-based food recognition systems (IBFRS) in dietary assessment outlined several key phases: segmentation of food items, classification into categories, and estimation of volume, calories, or nutrients. Notably, 58% of the 78 studies reviewed employed deep learning methods, particularly CNNs, in at least one phase of the IBFRS. The authors emphasized that CNNs outperformed other approaches when trained on large, publicly available food datasets, enhancing the accuracy of food recognition and nutrient estimation. This analysis underscored the potential of integrating CNN-based IBFRS into mobile applications, facilitating real-time, user-friendly dietary monitoring—well aligned with the goals of Food Check (Dalakleidi, 2022).

The study "Foodopedia: A Convolutional Neural Network-Based Food Calorie Estimation" presented a system that utilized CNNs to identify food items from images and estimate their calorie content. The model was designed to improve the accuracy of dietary tracking by automating food recognition and nutrient calculation. This approach supported real-time analysis, making it suitable for health-focused applications like Food Check.

Similarly, "CalorieWise: Deep Learning for Food Image Analysis and Calorie Estimation" explored the use of CNNs to analyze scanned food images and estimate their calorie content. The system accurately identified food items and mapped them to a dataset containing calorie information per gram. This demonstrated the potential of deep learning in automating dietary assessment and calorie estimation, further supporting the objectives of the Food Check application (Neeraja, 2023).

Database

As mobile health technologies evolved, a growing number of applications began using computer vision techniques to estimate the caloric and nutritional content of food through image input. A systematic review highlighted the use of depth maps and segmentation algorithms to improve portion size estimation. It also emphasized the critical role of structured food databases in translating visual data into meaningful nutritional information. Additionally, the study explored user interface features that enhanced the experience, such as the ability to retain and review previous scans. This historical tracking allowed users to visualize dietary patterns, making it a functional component of long-term nutritional monitoring (Amugongo et al., 2022).

The integration of computer vision into dietary assessment was further explored in a comprehensive survey by Min et al. (2020), which examined methodologies involving CNNs and transfer learning models like Inception-v3 for food classification. These models enabled food identification and volume estimation, which are essential for accurate nutritional analysis. The study also emphasized the importance of large-scale food databases, such as Food-101 and UECFOOD, to enhance recognition accuracy. Challenges such as varying lighting conditions, mixed dishes, and occlusions were also discussed. Applications like SnapCal, which integrated CNNs for food recognition and volume estimation, demonstrated the value of combining deep learning with structured databases and history features to support long-term dietary monitoring (Tahir & Loo, 2021).

History of Scanned Food Items

Recent developments in image-based food recognition systems have greatly enhanced dietary assessment by providing accurate estimates of calorie content and nutritional values from food images. These systems utilize convolutional neural networks (CNNs) and deep learning techniques to analyze food items based on their visual features. One of the key advancements is the incorporation of a feature that records the history of scanned food items. This feature allows users to track their dietary intake over time, making it easier to identify patterns and make informed nutritional decisions. Historical data of food scans has been shown to improve user adherence to healthy eating habits by enabling self-reflection and providing personalized feedback based on previous meals. Moreover, this historical tracking feature mitigates issues related to traditional methods like food diaries, which are often subject to inaccuracies and biases due to reliance on memory (Dalakleidi et al., 2022).

A large-scale food image dataset, Nutrition5k, contains over 5,000 images of real-world food dishes, each annotated with detailed nutritional information, including calories, macronutrients, and micronutrients. This dataset has been widely used to improve deep learning models for food recognition and nutritional estimation. By leveraging such comprehensive annotations, these models can accurately identify food items and predict their nutritional content, which is critical for systems aimed at estimating calories and nutrients from images. Furthermore, the ability to track the history of scanned food items is enhanced by such datasets, as it allows for the development of systems that can store and recall previous food scans. This feature enables users to monitor their dietary intake over time, helping them make informed decisions about their nutrition and eating habits. The study utilized MobileNetV3 with transfer learning and data augmentation to classify Indian food images with high accuracy. This approach, which integrates deep learning and data augmentation, is relevant to systems that focus on image-based food recognition and nutrient estimation. The system can leverage a robust database to store food information and nutritional data, facilitating the tracking of food items over time. By maintaining a history of scanned food items, users can effectively monitor their dietary habits and make informed decisions about their nutrition (Thames et al., 2021)

Benchmarking

Features	CalorieWise: Deep Learning for Food Image Analysis and Calorie Estimation	Food Item: Calorie Estimation Yolov4 Image Processing	SnapCal: A Mobile App for Food Recognition and Nutritional Tracking	Indian Food Image Classification and Recognition with Transfer Learning Technique Using MobileNetV3 and Data Augmentation	Food Check: Image-Based Food Recognition for Calorie and Nutrients Estimation
Image Processing Identification	✔	✔	✔	✔	✔
Nutritional Information	✔	✔	✔		✔
Database	✔	✔	✔	✔	✔
History of Scanned Food Items	✔			✔	✔

Table 1. Benchmarking

Synthesis

Recent advancements in image-based food recognition systems have laid a strong foundation for the development of dietary tracking tools like FOOD CHECK. Across multiple studies, deep learning—particularly Convolutional Neural Networks (CNNs)—has emerged as a central technology for food identification and nutrient estimation. Patil et al. (2021) and Neeraja (2023) both demonstrated the effectiveness of CNN-based models such as YOLOv4 and CalorieWise in accurately detecting food items and estimating caloric content from images. These systems employed preprocessing techniques like segmentation and background removal to enhance recognition accuracy, which directly supports FOOD CHECK's goal of reliable image-based food analysis.

Similarly, Sasaki et al. (2022) and Dalakleidi (2022) emphasized the importance of real-time food recognition and nutrient estimation in mobile applications. Their studies highlighted the value of automated image classification and macronutrient prediction, while also noting the need for manual corrections to improve accuracy. This aligns with FOOD CHECK's design, which integrates automated recognition with a structured database to minimize errors and improve user trust.

A recurring theme across literature is the integration of large-scale food databases. Studies by Tahir (2021), Min et al. (2020), and Thames et al. (2021) underscored the role of datasets like Food-101, UECFOOD, and Nutrition5k in enhancing recognition accuracy and providing detailed nutritional information. These databases enable systems to map visual data to validate nutritional values, which is a core feature of FOOD CHECK. The use of transfer learning and data augmentation, as seen in Thames et al.'s work, further supports the robustness of image classification models in diverse food contexts.

The concept of historical tracking also emerged as a valuable feature in dietary monitoring. Dalakleidi (2022), Amugongo et al. (2022), and Tahir & Loo (2021) discussed how storing past food scans allows users to reflect on their eating habits and make informed decisions. This feature not only improves user engagement but also addresses limitations of traditional food diaries, which are prone to memory bias. FOOD CHECK incorporates this functionality to support long-term dietary monitoring and behavior analysis.

While most studies support the feasibility and effectiveness of image-based food recognition, some also highlight limitations. For example, Sasaki et al. (2022) noted that automated systems may struggle with complex or culturally unique dishes, requiring manual input for improved accuracy. This insight is reflected in FOOD CHECK's current scope, which focuses on common food items and plans future expansion to accommodate more diverse meals.

In summary, the reviewed literature collectively supports the technological and functional components of FOOD CHECK. By synthesizing deep learning models, structured nutritional databases, and historical tracking features, the system aims to provide a comprehensive, accessible, and user-friendly solution for calorie and nutrient estimation. The integration of these elements positions FOOD CHECK as a practical tool for promoting healthier eating habits and supporting personalized nutrition management.

METHODOLOGY

This chapter presents the sequence of development and the methodology used to complete the capstone project, FOOD CHECK: Image-Based Food Recognition for Calorie and Nutrient Estimation. The project followed the Agile methodology, which emphasizes iterative development, continuous feedback, and adaptability. The methodology encompassed the following phases: requirement analysis, requirements documentation, system design, development and testing, implementation planning, and implementation results.

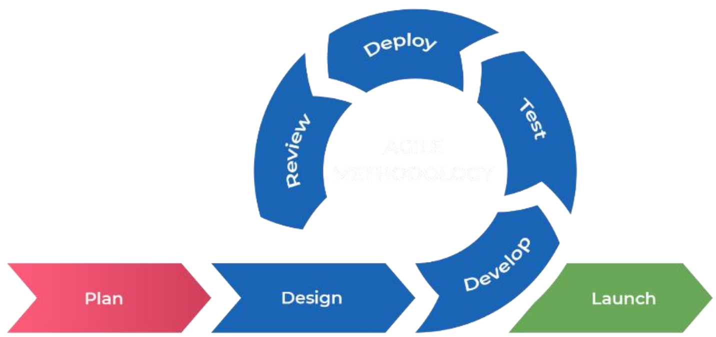

Figure 1. Agile Methodology

Plan

In this stage, the research team focused on gathering and analyzing data from online resources, as well as collecting feedback from students, researchers, and nutritionists. Using these insights, the team conceptualized the system's design, defined its core structure, identified its main features, and outlined the user flow. The goal was to ensure that the system addressed user expectations while providing a clear and user-friendly experience for individuals aiming to monitor their calorie intake and nutrient consumption.

Design

This phase involved the creation of the system's user interface. The team mapped out the layout, navigation flow, and visual components to deliver a cohesive and engaging user experience. Special attention was given to how users would interact with each feature, ensuring that the interface was both intuitive and supportive of the users’ goals related to diet tracking and nutritional awareness.

Development

With the design finalized, the team proceeded to the development phase, where the system was transformed into a functional platform. This involved coding the system architecture, integrating key features, and ensuring that each component functioned smoothly. The development process ensured that all planned functionalities—such as food logging, nutrient analysis, and calorie estimation—were implemented effectively.

Testing

In this critical phase, the team conducted thorough testing to identify bugs, inconsistencies, and performance issues. Each feature was evaluated to confirm that it functioned properly and aligned with user expectations. By resolving issues early, the team enhanced the platform’s reliability and ensured that it delivered a seamless and efficient experience for users.

Deployment

After successful testing, the system was deployed in a live environment. This step included transferring the system to the production server, configuring it for accessibility, and monitoring its initial performance. The deployment phase ensured that the system was fully functional and ready for real-world use, while allowing the team to quickly address any emerging issues.

Review

Following deployment, the team gathered feedback from users to evaluate the system’s usability and performance. Feedback was collected regarding ease of use, feature effectiveness, and suggested improvements. This input helped the team refine the platform and make informed updates to better serve users' needs in tracking their diet and nutrition.

Launch

In the final phase, the application was officially launched and made accessible to all users interested in calorie and nutrient tracking. The launch marked the transition from development to active use, allowing individuals to benefit from the system's tools and insights. This milestone promoted a more informed and health-conscious lifestyle among its users.

Technical Background

Technologies were deliberately selected during the development phase of FOOD CHECK—a mobile application designed for image recognition of food items, coupled with automatic estimation of calories and nutrients. The selection was guided by key factors such as accuracy, efficiency, scalability, and user-friendliness. Each technology contributed to the overarching goal of delivering a seamless and reliable user experience.

The primary development environment for the application was Microsoft Windows, with Visual Studio Code serving as the main code editor to facilitate efficient development and debugging. For backend operations, Firebase was utilized due to its real-time database capabilities, secure user authentication, and cloud storage features, enabling synchronized and secure data management.

Android Studio was employed to streamline Android-specific development tasks and device emulation, ensuring smooth development and thorough testing across Android devices. For designing an engaging and user-friendly interface, the design team collaborated using Figma, a powerful UI/UX design tool. Figma enabled real-time collaboration between designers and developers, ensuring that the interface remained aesthetically pleasing, functional, and accessible.

Together, these technologies formed the backbone of FOOD CHECK, supporting accurate food recognition and nutrient estimation. This technological synergy advanced the application's mission to promote healthy eating practices through intelligent, image-based food tracking.

- **Calendar of Activities**

In February, this was the selection of members per group. The group then began searching for an adviser for their capstone project. After securing an adviser, the researchers began brainstorming and creating titles from the first to the third week of March, alongside the ongoing title-checking process. This stage was crucial for ensuring that the research topics were relevant and aligned with the project's objectives. Once the selected title was approved by the adviser, the data gathering process officially began. The researchers meticulously collected the necessary data, ensuring its accuracy and relevance to their chosen topic. The researchers worked on drafting chapters one and two of their documentation, which began in the third week of March and continued until April. During this time, they focused on the introduction, background of the study, and literature review, laying the foundation for the entire project. This period also involved refining the research methodology and establishing the framework for the study. As they progressed, the researchers remained in STI College in close communication with their adviser to ensure their work met the required academic standards.

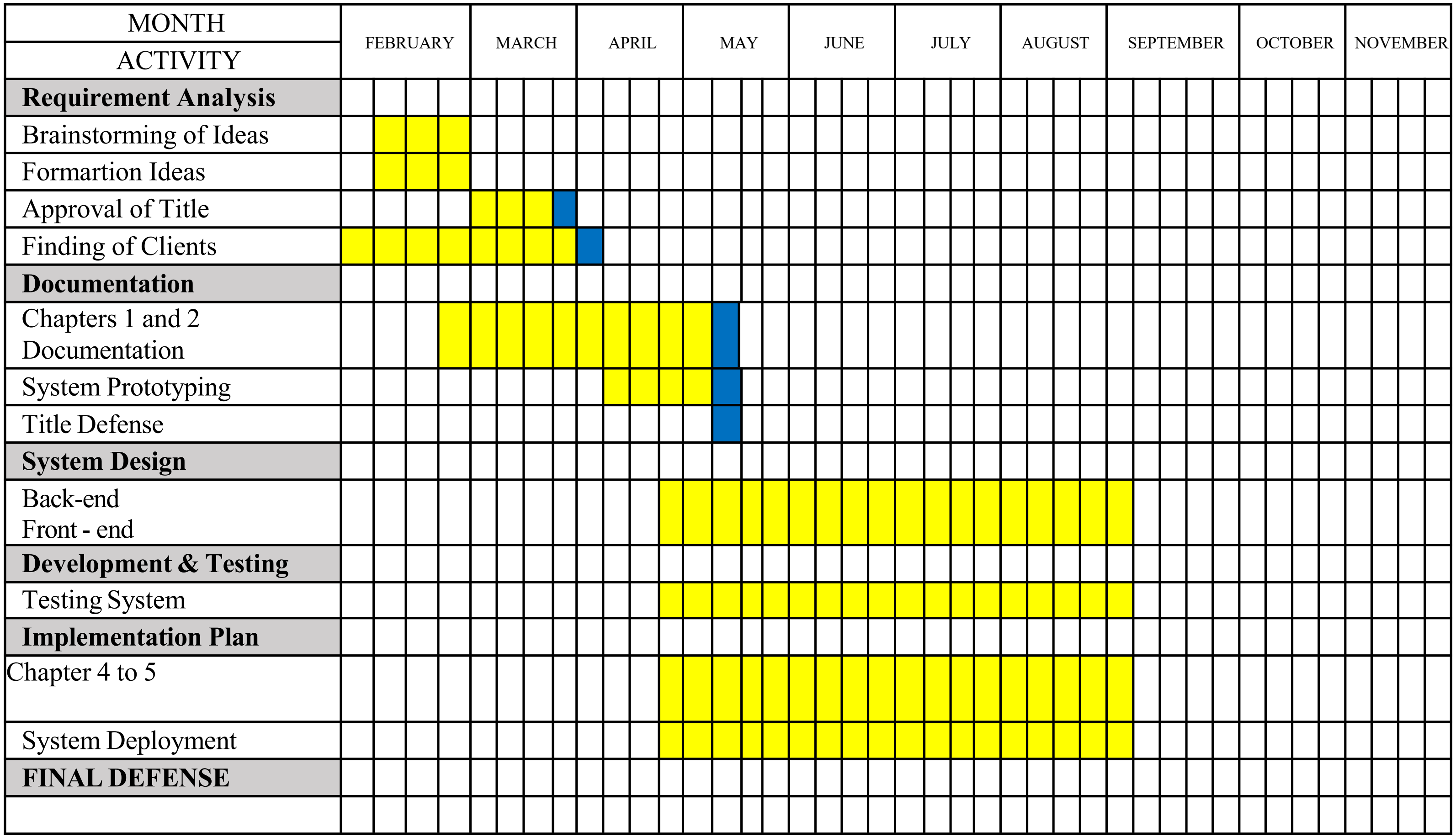

Table 2. Gantt Chart

Legend - **Ongoing**
- **Complete**

Resources

The specifications for the required hardware and software used in the development of FOOD CHECK are described in the sections that follow. These resources played a crucial role in configuring the system and supporting the technical requirements of the project.

The development environment was set up using the researchers' personal computers and internet access. Both hardware and software requirements were based on the available resources and the practical needs of the system. The setup provided a competent working environment for experimentation and implementation, ensuring that the development process was efficient and aligned with the project's objectives.

Hardware

Hardware	Hardware Requirements
Processor	Intel core i5 2.40 GHz/Ryzen 5 4600G 3700 MHz
Motherboard	Asus/Gigabyte B250M/H110M
Internal Memory (RAM)	8GB
Storage Capacity	500 GB free disk space
Monitor	14" FHD IPS Display
Keyboard	General Keyboard
Mouse	General Mouse
Smartphone Devices	**Android 14 and iOS 17**

Table 3. Hardware Specification

Processor

Processors are the most important component of a computer system. A Processor is a hardware that performs data input/output, processing, and storage functions for a computer system. In this article, we are going to discuss processors. (geeksforgeeks, 2024).

Figure 2. Processor

Motherboard

A motherboard (also called mainboard, main circuit board, MB, mobo, base board, system board, or, in Apple computers, logic board) is the main printed circuit board (PCB) in general-purpose computers and other expandable systems. It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals (Wikipedia, 2025).

Figure 3. Motherboard

Internal Memory (RAM)

Internal memory RAM is the physical hardware inside a computer that temporarily stores data, serving as the computer's "working" memory. RAM is volatile, which means the data is lost when the device is switched off (Tim Fisher, lifewire, 2020).

Figure 4. Internal Memory

Storage Capacity (Hard Disk Drive or Solid-State Drive)

SSD stands for Solid-State Drive. It is a type of computer storage device that uses integrated circuit assemblies to store data persistently. Unlike traditional hard disk drives (HDDs), which use spinning disks and movable read/write heads, SSDs have no moving parts. This fundamental difference in design leads to several key advantages in performance, reliability, and energy efficiency. (Dwight Pavlovic, HP, 2024).

Figure 5. Storage Capacity

Monitor

On a desktop computer, the monitor connects via a cable to a port on the computer's video card or motherboard. Even though the monitor sits outside the main computer housing, it's an essential part of the system (Tim Fisher, Lifewire, 2023).

Figure 6. Monitor

Keyboard

The keyboard is the piece of computer hardware used to input text, characters, and other commands into a computer or similar device. It's an external peripheral device in a desktop system (it sits outside the computer case) or is "virtual" in a tablet PC (Tim Fisher, Lifewire, 2023).

Figure 7. Keyboard

Mouse

The mouse, sometimes called a pointer, is a hand-operated input device used to manipulate objects on a computer screen. Whether it uses a laser or ball, or the mouse is wired or wireless, a movement detected from the mouse sends instructions to the computer to move the cursor on the screen to interact with files, windows, and other software elements (Tim Fisher, Lifewire, 2023).

Figure 8. Mouse

Smartphone Device

A mobile device is a small, portable computing device used for communication, entertainment, productivity, and internet access. Common examples include smartphones, tablets, laptops, wearable devices, e-readers, and portable media players. These devices have wireless connectivity options like Wi-Fi, Bluetooth, and cellular networks, allowing users to stay connected and access information from anywhere. They play a crucial role in the era of mobile computing, offering flexibility and convenience in various aspects of daily life (TechTarget, n.d.).

Figure 9. Smartphone

Software

Software	Requirements
Windows Operating System	Windows 11
Visual Studio Code	version 1.99.
Firebase	Version 11.6.0
Android Studio	Meerkat | 2024.3.1
MySQL	9.2.2
Browers	Chrome
Figma	Version 124.4.7

Table 4. Software

Windows Operating System

The Windows Operating System (Windows OS) is a widely used family of graphical operating systems developed by Microsoft. It is designed to run on personal computers (PCs), laptops, tablets, and other devices. Windows is known for its user-friendly interface,

Figure 10. Windows Operating System

Visual Studio Code

A free, open-source, and lightweight code editor developed by Microsoft. It is designed for building and debugging modern web and cloud applications, offering support for many programming languages and a rich set of features for developers. It is highly customizable and has a vast ecosystem of extensions that enhance its functionality (Microsoft, n.d.).

Figure 11. Visual Studio Code

Firebase

A platform developed by Google that provides a suite of tools and services to help developers build and manage mobile and web applications. It simplifies the backend development process by offering a variety of services like real-time databases, authentication, hosting, analytics, and more. Firebase aims to enable developers to focus more on building user-facing features rather than managing infrastructure (Firebase, n.d.).

Figure 12. Firebase

Android Studio

An official Integrated Development Environment (IDE) for Android application development, built on JetBrains' IntelliJ IDEA. It is designed specifically for creating Android apps and provides a rich set of features that help developers write, test, and debug Android applications more efficiently. Android Studio is the primary IDE used in Android development and supports multiple programming languages, including Java, Kotlin, and C++ (Google, 2023).

Figure 13. Android Studio

MySQL

Most widely used open-source relational database management systems (RDBMS). It is based on the Structured Query Language (SQL), which is used to manage and manipulate databases. MySQL is known for its reliability, speed, and ease of use, and it powers many large-scale applications, including websites, data warehouses, and enterprise systems (MySQL, n.d.).

Figure 14. MySQL

Browser

A popular, fast, and secure web browser developed by Google. It is one of the most widely used browsers in the world, known for its speed, simplicity, and integration with Google services. Chrome is available on multiple platforms, including Windows, macOS, Linux, iOS, and Android (Google, n.d.).

Figure 15.GoogleChrome

Figma

A popular cloud-based design and prototyping tool used for user interface (UI) and user experience (UX) design. It allows teams to collaborate in real-time on design projects, making it particularly well-suited for designing websites, apps, and other digital products. Figma has gained widespread use among designers and development teams because of its intuitive interface, collaborative features, and versatility (Microsoft Corporation, 2021).

Figure 16. Figma

Requirements Analysis

The system is expected to perform effectively across various usage scenarios, including mobile and web platforms, allowing users to access the program wherever they are—at home, in restaurants, or even in gyms. In addition to the fast and convenient availability of information, the design of the plan should align with the intended use of the product, which may occur during meal times or discussions about dietary plans. Furthermore, traditional methods such as manually inputting nutritional values or searching for them online are often inefficient and prone to errors. The proposed solution incorporates image processing and interconnected databases, providing users with a simplified and automated approach that enhances accuracy while reducing user effort.

Requirements Documentation

This phase outlines the system's design, functionality, and workflow. The researchers carefully considered the requirements gathered during the Requirements Analysis phase.

Homepage

The figure illustrates the product categories and includes a search button for finding specific items. It also displays five navigation options: Home, History, Scan/Upload Image, and Profile. These features provide users with flexible access to nutritional information for various products or food items.

Figure 17: FoodCheck Homepage

Product Details

This figure shows the name and Nutri facts of the food when you click any product on the Homepage.

searched.

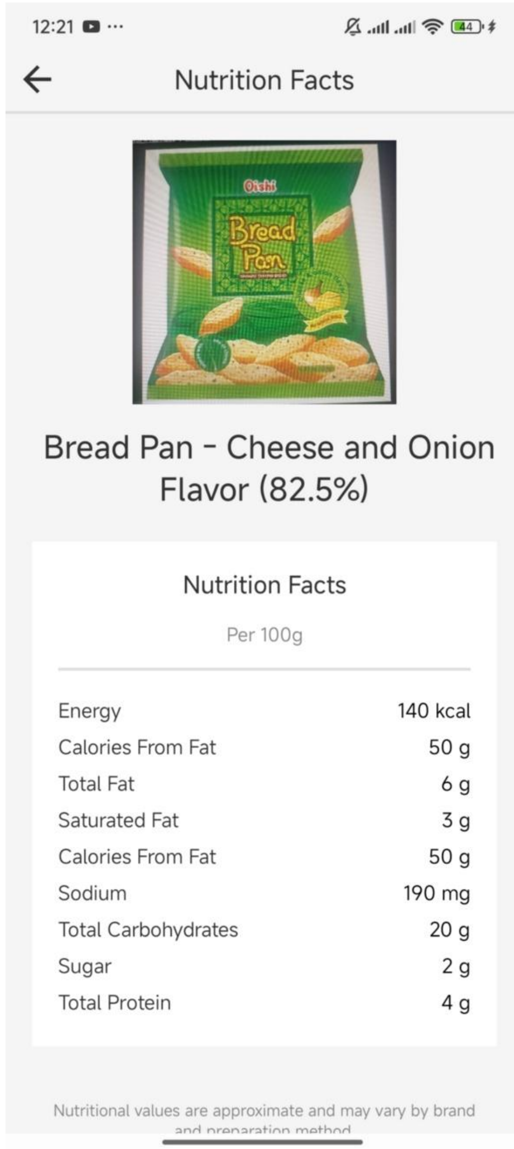

Figure 18: Product Details

Search Bar

This figure shows the other items that isn't included on the homepage and could be searched.

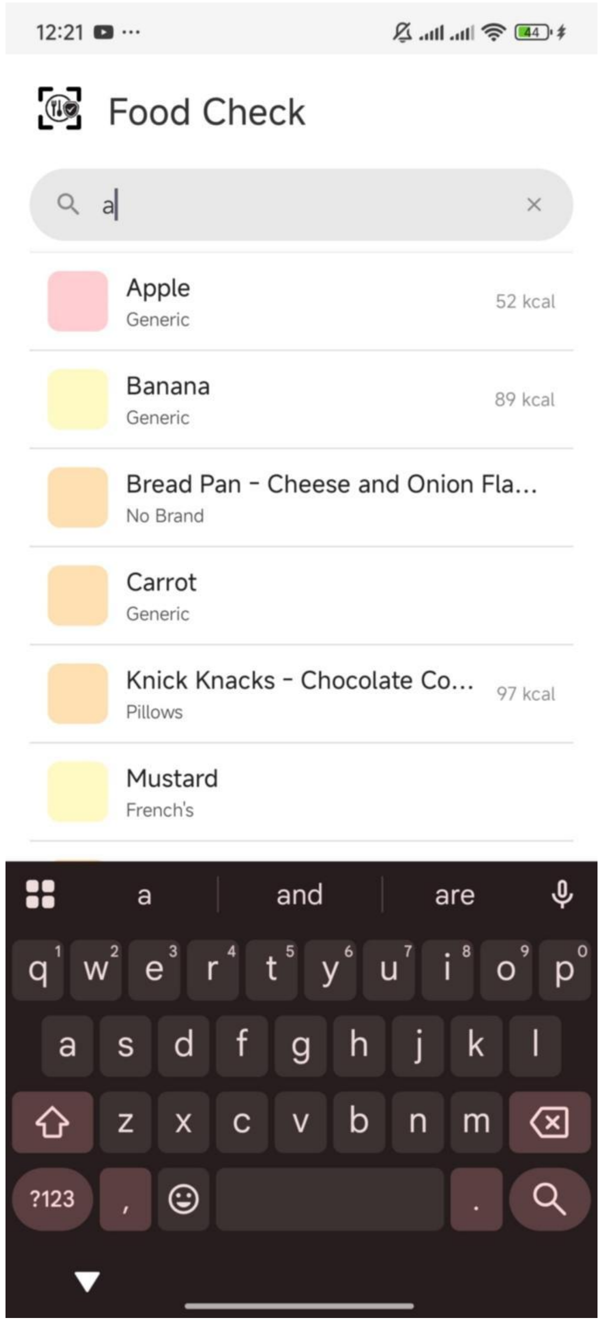

Figure 19: See more preview

Scan History

This figure shows the history of the product scanned or checked.

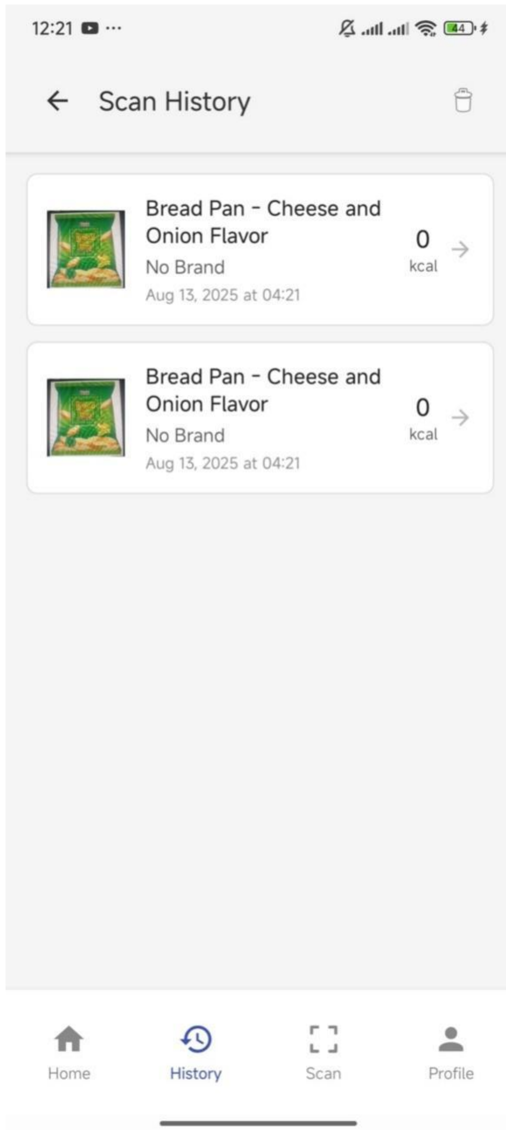

Figure 20: Scanned History

Scanner

This figure shows the camera where you can scan the product or food**.**

Figure 21: Scanner

Profile

This figure shows profile information. Edit your data and input your height and weight to get your BMI. And the settings of the application.

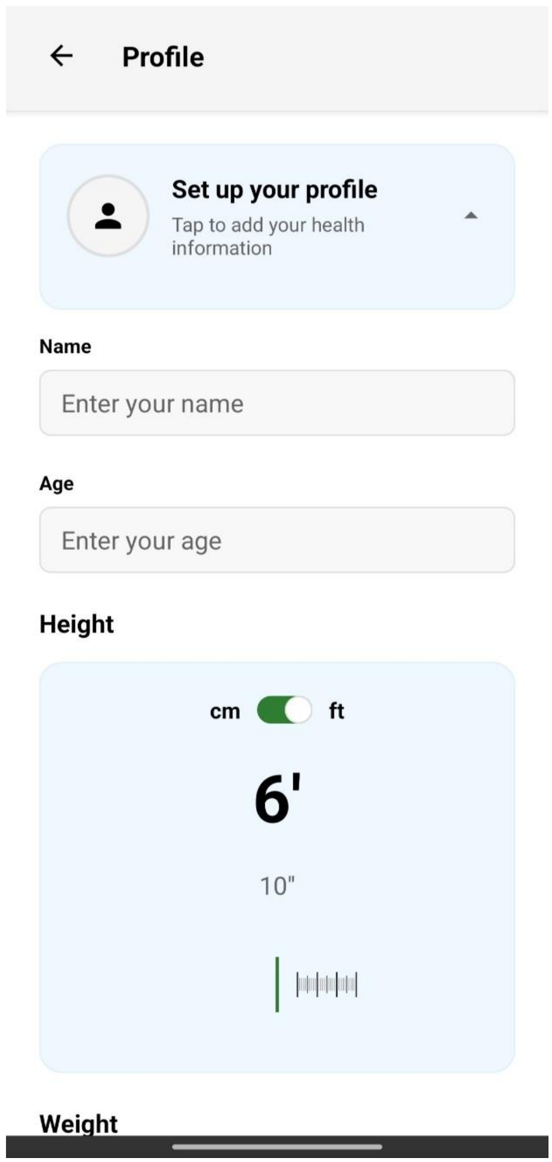

FIGURE 22: Profile

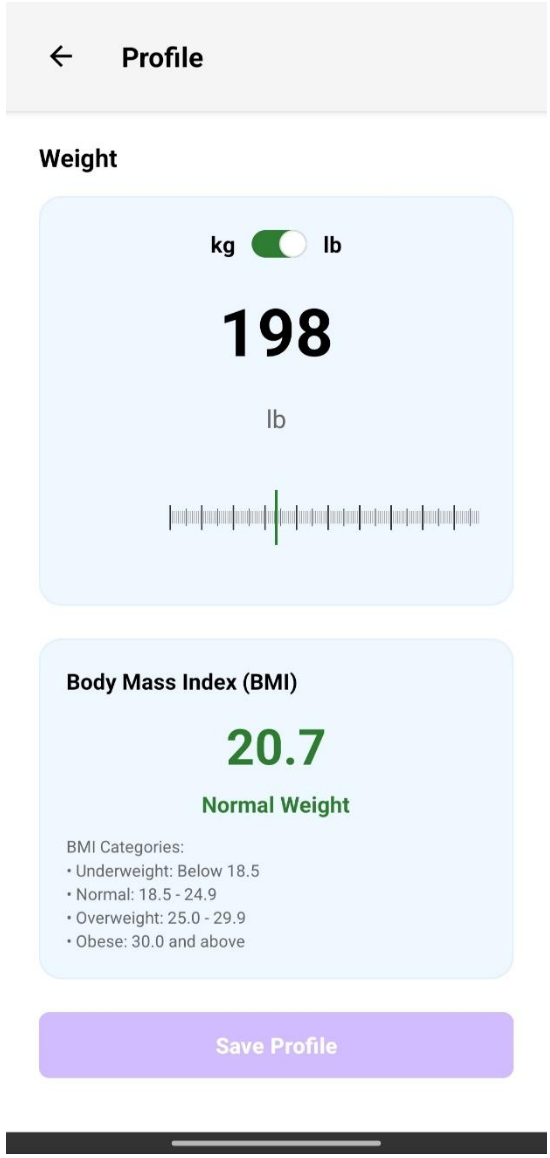

Figure 24: BMI

Design of Software, System, Product, and/or Processes

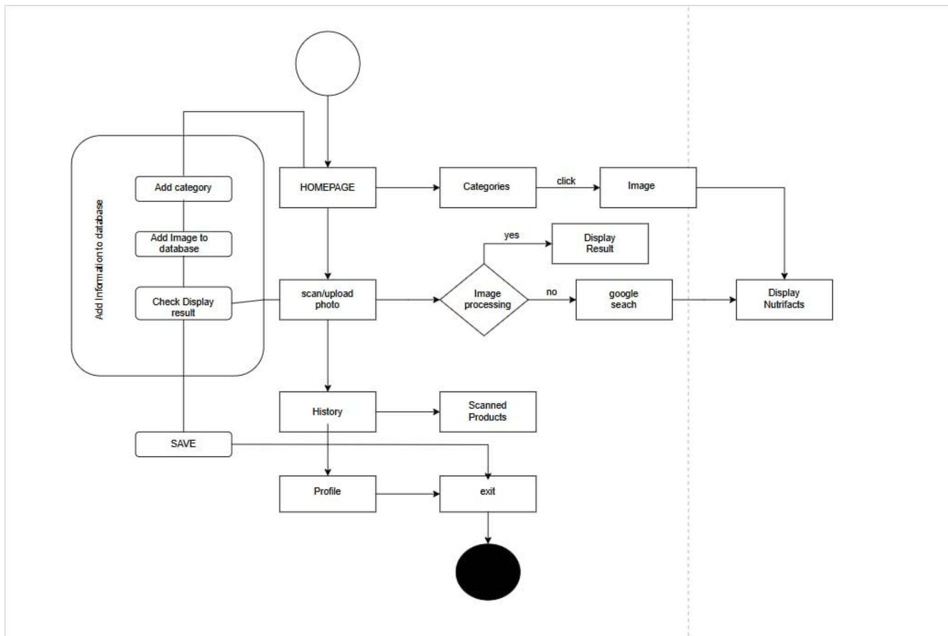

Figure 25. Admin Side Flowchart

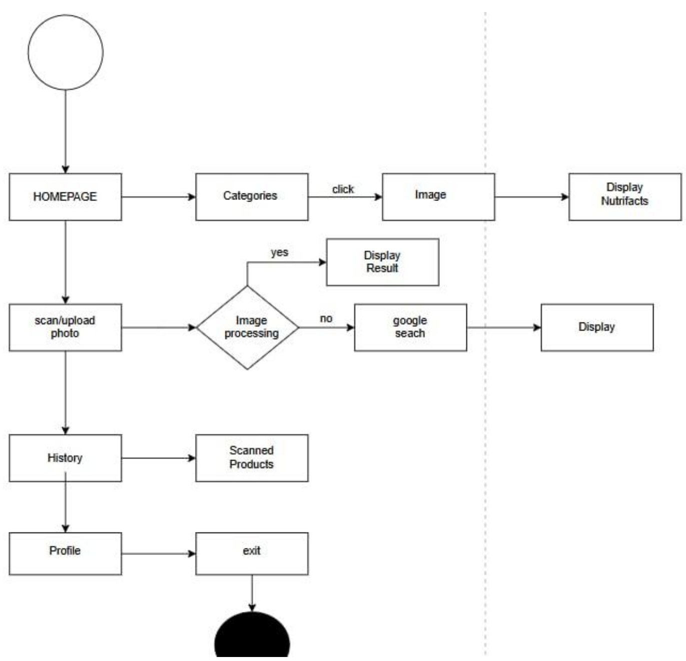

Figure 26. User Side Flowchart

Development

In this part, the developers shall describe in detail how they developed the system in accordance with standards.

RESULTS AND DISCUSSION

Testing

In this part, the proponents shall discuss and test the software development standards.

Description of Prototype

This part includes the system requirements, the preliminary design, and how the system is being evaluated and tested.

Implementation Plan

The Implementation Plan describes how the information system will be deployed, installed, and transitioned into an operational system. The plan contains an overview of the system, a brief description of the major tasks involved in the implementation, the overall resources needed to support the implementation effort (such as hardware, software, facilities, materials, and personnel), and any site-specific implementation requirements.

Implementation Results

This part consists of the outputs during the implementation phase. These may include the generated outcomes as the ground for improving the project/system. This part is optional.

CONCLUSION AND RECOMMENDATIONS

Summary of Findings

A mobile app was created to recognize food and estimate its calories and nutrients from packaging. The goal is to help people learn about what's in their food. This tracking helps everyone become more aware of their health, especially those who can't see a nutritionist often. Food recognition apps can help promote healthy eating. Users can take a photo of a meal and instantly see its calories and nutrients. This encourages better food choices. With improvements in image processing and machine learning, these apps empower people to eat healthier without needing expensive professional advice.

The Food Check: Image-Based Food Recognition for Calorie and Nutrient Estimation provided the user the following module.

- The Mobile App allows the user to scan the Food and then the system scans and identifies the type of food using image processing and AI.

- The Mobile App Uses visual analysis size, volume, and shape to estimate serving size.

- The Mobile App Automatically calculates calories, proteins, fats, carbohydrates, and vitamins.

- The Mobile App allows you to edit your data and input your height and weight to get your BMI. In the settings of the application.

It is recommended that the mobile app should have a picture scanner to quickly retrieve precise nutritional information for packaged food items. The system should enable the user to see the history of the product scanned or checked.

Conclusion

Recommendation

The first part of this section is your summary, followed by the conclusion/s, and the last part is/are your recommendation/s.

This section summarizes the results based on the results and discussion chapter. There should be no presentation of tables or figures. A good summary should be comprehensive. A summary must be concise. Your summary should be considerably shorter than the source. Avoid repetitive details. A summary must be coherent and independent. You are expected to maintain your own voice throughout the summary. Don't simply quote other researcher's works; instead use your own words to express your understanding of what you have read. After all, your summary is based on your interpretation of the findings, points, or ideas. However, you should be careful not to create any misinterpretation or distortion by introducing comments or criticisms of your own.

Conclusions should unite with the findings and accomplishments of the study. If there are three summaries, there should also be three conclusions. Conclusions are arranged as they appear in the findings. Moreover, rejection and acceptance of the hypotheses, if applicable, are explained under conclusion. Only conclusions which are based definitely on the findings or results should be made. Mere opinions which have no basis in facts and findings have no place in the conclusions of the study.

Recommendations are based on the conclusions. It may include further research of the study and/ or enhancement of the developed system.

In the succeeding paragraphs, there should be no indentations, paragraphs are justified with left alignment. Delete this highlighted section and replace it with your content.

REFERENCES

Akmalbek Abdusalomov, Mukhriddin Mukhiddinov, Oybek Djuraev, Utkir Khamdamov, & Ulugbek Abdullaev. (2024). AI-Based Estimation from Images of Food Portion Size and Calories for Healthcare Systems. Lecture Notes in Computer Science, 9–19. https://doi.org/10.1007/978-3-031-53830-8_2

Amugongo, L. M., riebitz, A., Boch, A., & Lütge, C. (2022). Mobile Computer Vision-Based Applications for Food Recognition and Volume and Calorific Estimation: A Systematic Review. healthcare, 11(1), 59. https://doi.org/10.3390/healthcare11010059

Dalakleidi, K. V., Papadelli, M., Kapolos, I., & Papadimitriou, K. (2022). Applying Image-Based Food-Recognition Systems on Dietary Assessment: A Systematic Review. Advances in nutrition (Bethesda, Md.), 13(6), 2590–2619. https://doi.org/10.1093/advances/nmac078

Demition, A. D. R., Narciso, Z. A. L., & Paglinawan, C. C. (2024). Filipino Meal Recognition Scale with Food Nutrition Calculation and Smart Application. Engineering Proceedings, 74(1), 54. https://doi.org/10.3390/engproc2024074054

Haque, R. U., Khan, R. H., Shihavuddin, A. S. M., Syeed, M. M. M., & Uddin, M. F. (2022). Lightweight and Parameter-Optimized Real-Time Food Calorie Estimation from Images Using CNN-Based Approach. Applied Sciences, 12(19), 9733. https://doi.org/10.3390/app12199733

Kirubakaran, S. J., Gunasekaran, A., Dolly, D. R. J., Jagannath, D. J., & Peter, J. D. (2023). A feasible approach to smart remote health monitoring: Subscription-based model. Frontiers in Public Health, 11, Article 1150455

Konstantakopoulos, F. S., Georga, E. I., & Fotiadis, D. I. (2023). A Review of Image-based Food Recognition and Volume Estimation Artificial Intelligence Systems.IEEE Reviews in Biomedical Engineering, PP. https://doi.org/10.1109/RBME.2023.3283149

Li, X., Yin, A., Ha Young Choi, Chan, V., Allman-Farinelli, M., & Chen, J. (2024). Evaluating the Quality and Comparative Validity of Manual Food Logging and Artificial Intelligence-Enabled Food Image Recognition in Apps for Nutrition Care. Nutrients, 16(15), 2573–2573. https://doi.org/10.3390/nu16152573

Lo, F., Sun, Y., Qiu, J., Lo, B. (2023). Image-Based Food Classification and Volume Estimation for Dietary Assessment: A Review https://ieeexplore.ieee.org/abstract/document/9082900

Mao, S., Zhu, J., Cao, Q., & Xu, H. (2024). Deep Learning Applications and Challenges in Food Image Recognition and Nutrient Calculation. 384–392. https://doi.org/10.1109/icdacai65086.2024.00077

Mezgec, S., & Koroušić Seljak, B. (2017). NutriNet: A Deep Learning Food and Drink Image Recognition System for Dietary Assessment. Nutrients, 9(7), 657. https://doi.org/10.3390/nu9070657

Nadeem, M., Shen, H., Choy, L., & Barakat, J. M. H. (2023). Smart Diet Diary: Real-Time Mobile Application for Food Recognition. Applied System Innovation, 6(2), 53. https://doi.org/10.3390/asi6020053

Neeraja, K., & Meenakshi, B. (2022). CalorieWise: Deep Learning for Food Image Analysis and Calorie Estimation. International Journal of Engineering and Science Research, 12(1), 1–15. Retrieved from https://ijesr.org

Patil, S., Patil, S., Kale, V., & Bonde, M. (2021). Food item calorie estimation using YOLOv4 and image processing. International Journal of Computer Trends and Technology, 69(5), 69–76. https://doi.org/10.14445/22312803/IJCTT-V69I5P110

Rouhafzay, A., Rouhafzay, G., & Jbilou, J. (2025). Image-Based Food Monitoring and Dietary Management for Patients Living with Diabetes: A Scoping Review of Calorie Counting Applications. Frontiers in Nutrition, 12. https://doi.org/10.3389/fnut.2025.1501946

Samad, S., Ahmed, F., Naher, S., Kabir, M. A., Das, A., Amin, S., & Islam, S. M. S. (2022). Smartphone apps for tracking food consumption and recommendations: Evaluating artificial intelligence-based functionalities, features and quality of current apps. Intelligent Systems with Applications, 15, 200103. https://doi.org/10.1016/j.iswa.2022.200103

Sasaki, Y., Sato, K., Kobayashi, S., & Asakura, K. (2022). Nutrient and Food Group Prediction as Orchestrated by an Automated Image Recognition System in a Smartphone App (CALO mama): Validation Study. JMIR Formative Research, 6(1), e31875. https://formative.jmir.org/2022/1/e31875

Selvaraju, T., Dakshinamurthi, V., Badurudeen, G., Prabhakaran, N., Gopi, P., &Hussain, M. A. N. (2025). Food detection and estimation of calories and other macro-nutrients and features to support healthy lifestyle. AIP Conference Proceedings, 3279, 020129. https://doi.org/10.1063/5.0263063

Tahir, G. A., & Loo, C. K. (2021). A Comprehensive Survey of Image-Based Food Recognition and Volume Estimation Methods for Dietary Assessment. *Healthcare (Basel, Switzerland)*, *9*(12), 1676. https://doi.org/10.3390/healthcare9121676

Thames, Q., Karpur, A., Norris, W., Xia, F., Panait, L., Weyand, T., & Sim, J. (2021). Nutrition5k: Towards automatic nutritional understanding of generic food. arXiv. https://arxiv.org/abs/2103.03375

Żarnowski, A., Jankowski, M., & Gujski, M. (2022). Public Awareness of Diet-Related Diseases and Dietary Risk Factors: A 2022 Nationwide Cross-Sectional Survey among Adults in Poland. Nutrients, 14(16), 3285. https://doi.org/10.3390/nu14163285

APPENDICES

APPENDIX A. RESOURCE PERSONS

APPENDIX B. RELEVANT SOURCE CODE

APPENDIX C. EVALUATION TOOL/TEST DOCUMENTS

APPENDIX D. SAMPLE INPUT/OUTPUT/REPORTS

APPENDIX E. USER'S GUIDE

APPENDIX F. PERSONAL TECHNICAL VITAE

Curriculum Vitae of

<GIVEN NAME MI. FAMILY NAME>

<complete address>
<email address>
contact number either cellular phone or landline or both

EDUCATIONAL BACKGROUND

Level	Inclusive Dates	Name of school/ Institution
Tertiary	month year	
Vocational/Technical	month year	
High School	month year	
Elementary	month year	

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
month year		
month year		
month year		
month year		

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
month year		
month year		
month year		
month year		

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
		month year
		month year
		month year

TRAININGS, SEMINARS, OR WORKSHOPS ATTENDED

Inclusive Dates	Title of Training, Seminar, or Workshop
month year	
month year	
month year	
month year	

Listed in reverse chronological order (most recent first).