A

Mini Project Report

on

EatFit: AI Based Smart Product Health Compatibility Checker

Submitted in partial fulfillment of the requirements for the

degree

Third Year Engineering – Computer Science Engineering (Data Science)

by

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CERTIFICATE

This to certify that the Mini Project report on EatFit: AI Based Smart Food Health Compatibility Checker has been submitted by Sakshi Kadam (22107032), Priyanka Barman (22107004), Tejas Deshmukh (22107015) and KisanKumar Jena (22107049) who are bonafide students of A. P. Shah Institute of Technology, Thane as a partial fulfillment of the requirement for the degree in **Computer Science Engineering (Data Science)**, during the academic year **2024-2025** in the satisfactory manner as per the curriculum laid down by University of Mumbai.

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ABSTRACT

EatFit is an AI-based smart food health compatibility checker designed for individuals managing health conditions such as high blood pressure, diabetes, obesity, and cholesterol issues. The system enables users to upload a food product image and instantly receive a compatibility assessment based on their health profile. Using a rule-based system, EatFit evaluates whether the product is safe for consumption by cross-referencing the ingredients with the user's specific health conditions. It also provides a detailed nutrition score based on standard Indian nutritional parameters defined by FSSAI (Food Safety and Standards Authority of India), helping users make informed dietary choices. In addition to compatibility and nutritional scoring, EatFit identifies potential allergen risks by analyzing the product's ingredient list. If any ingredient is flagged as a known allergen for the user, the system issues a warning, enhancing safety for individuals with food sensitivities. To support healthier choices, the platform offers alternative product recommendations using a Random Forest classifier, suggesting healthier substitutes with better nutritional profiles. EatFit also includes diet recommendations based on the user's BMI, activity level, and dietary preferences, making it a comprehensive health companion.

Chapter 1

Introduction

In today's fast-paced world, making healthier food choices is often challenging, especially when it comes to packaged food products with complex ingredient labels. Many consumers struggle to identify harmful additives, allergens, and other dietary concerns, leading to unintentional consumption of unhealthy or unsafe products. EatFit is an advanced AI-powered solution designed to simplify this process by providing instant food analysis through a simple image upload.

EatFit leverages artificial intelligence and image recognition to extract nutrition values from packaged food labels. EatFit evaluates age restrictions and specific health-related warnings, making it a valuable tool for individuals with dietary sensitivities, medical conditions, or personalized nutrition goals. What sets EatFit apart is its ability to recommend healthier alternatives. If a scanned product contains unsafe or unsuitable ingredients, the system instantly suggests better options, enabling users to switch to more nutritious and safer choices without the need for manual research. This feature empowers consumers to make informed decisions effortlessly, eliminating the confusion surrounding food labels. Designed to be intuitive and user-friendly, EatFit acts as a personalized nutrition assistant, integrating seamlessly into everyday shopping habits. Whether used in stores or at home, it ensures that users have access to reliable, AI-driven nutritional insights at their fingertips. By promoting smart, health-conscious purchasing decisions, EatFit encourages a simpler, safer, and healthier lifestyle, revolutionizing the way people choose and consume packaged food.

With its seamless integration of AI and real-time food analysis, EatFit goes beyond traditional nutrition tracking. It empowers users with instant, science-backed insights, enabling them to make well-informed choices without the hassle of decoding ingredient lists. Whether for individuals with dietary restrictions, health-conscious consumers, or parents ensuring safe food for their families, EatFit serves as a trustworthy companion in maintaining a balanced and safe diet. By combining convenience, accuracy, and health awareness, EatFit is reshaping the way people interact with packaged food, making healthier living easier than ever.

1.1 Purpose :

The primary purpose of EatFit is to simplify and enhance healthy food choices by leveraging artificial intelligence for real-time ingredient analysis. In today's world, where packaged food is widely consumed, understanding complex ingredient labels and identifying hidden additives can be challenging. Many consumers unknowingly purchase products containing harmful chemicals, allergens, and unhealthy preservatives, leading to potential health risks. EatFit aims to bridge this gap by providing users with instant, accurate insights through a simple image upload of packaged food labels.

EatFit serves as a smart food assistant, ensuring that users are aware of any potential risks before consuming a product. It not only identifies harmful ingredients, allergens, and dietary concerns but also considers age restrictions and health warnings, making it especially useful for parents, individuals with medical conditions, and health-conscious consumers. By delivering personalized recommendations, EatFit enables users to easily switch to healthier alternatives, removing the guesswork from making nutritious choices.

Beyond personal benefits, EatFit contributes to greater food awareness and public health consciousness by encouraging individuals to be more mindful of what they consume. It empowers users to take control of their diet, make informed purchasing decisions, and develop healthier eating habits effortlessly. With its AI-driven efficiency and user-friendly approach, EatFit transforms food selection into a simpler, smarter, and safer experience, ultimately promoting a healthier lifestyle for all.

1.2 Problem Statement :

Consumers today face significant challenges when it comes to understanding and analyzing food ingredients, especially in packaged products. Food labels are often complex, technical, and misleading, making it difficult for individuals to identify harmful additives, allergens, preservatives, and artificial chemicals. As a result, many people unknowingly consume ingredients that could negatively impact their health.

For individuals with specific dietary restrictions, medical conditions, or personal health goals, finding suitable food options becomes even more difficult. Without proper guidance, they may struggle to recognize products that meet their needs, leading to uninformed and

potentially harmful purchasing decisions. Furthermore, age restrictions and specific health concerns associated with certain food ingredients are not always clearly stated, increasing the risk of accidental consumption.The traditional method of manually checking ingredient lists is both time-consuming and inefficient, especially in fast-paced environments like grocery stores. Consumers often have limited time to research every product, forcing them to make quick but uninformed decisions based on branding or misleading packaging claims rather than verified nutritional information.

Given these challenges, there is a strong need for an AI-driven solution that can instantly analyze food ingredients, detect harmful components, and recommend healthier alternatives. Such a solution would empower users with accurate, real-time insights, ensuring that they can make safe, smart, and health-conscious food choices effortlessly.

1.3 Objectives :

The objectives of EatFit include leveraging AI and advanced data analysis to simplify food selection, enhance health awareness, and promote better eating habits. The platform focuses on ingredient analysis, health risk assessment, personalized recommendations, and seamless shopping integration.

- **Ingredient Analysis Using OCR and NLP**: EatFit employs Optical Character Recognition (OCR) to extract text from images of packaged food products. Using Natural Language Processing (NLP), it analyzes ingredient lists and nutrients values to detect harmful additives, allergens, preservatives, artificial chemicals and pvide a nutri-score. This automated approach eliminates the need for manual decoding, making food selection faster, easier, and more reliable.

- **Health Risk Assessment of Ingredients:** The system evaluates the health risks associated with specific ingredients, providing users with insights into their potential effects on different body parts and overall well-being. For instance, high sugar levels may be flagged as a risk for diabetics, while excessive sodium content could be a concern for those with high blood pressure. By highlighting these risks, EatFit helps users avoid harmful ingredients and make better dietary choices.

- **Alternative Food Recommendations:** If a product is deemed unsuitable, EatFit suggests healthier and safer alternatives based on individual dietary needs, BMI, and

personal health preferences. The system analyzes ingredient compositions and nutritional values to recommend options that align with the user's health goals, helping them make informed decisions without the hassle of searching for better alternatives.

- **Diet Recommendation System:** EatFit extends beyond food analysis by providing personalized diet recommendations tailored to specific health conditions, dietary restrictions, and nutrition goal uses random forest classifier. Whether a user is managing a medical condition like diabetes or following a weight-loss plan, the system offers guidance on suitable foods to help them stay on track.

- **Packed Food Product Review and Shopping Assistance:** The platform acts as a smart food reviewer, offering detailed reviews and safety scores of packaged food items. Users can also add recommended alternatives directly to their cart, ensuring a seamless shopping experience. By integrating real-time analysis with easy purchasing options, EatFit enhances convenience while promoting a healthier lifestyle.

These objectives work together to empower consumers with AI-driven insights, ensuring they can make healthier choices effortlessly while shopping for packaged food.

1.4 Scope:

Some of the key areas covered by EatFit include ingredient analysis, health risk detection, personalized recommendations, and seamless shopping assistance. The platform is designed to enhance food awareness and simplify decision-making for consumers.

- Automated Ingredient Analysis: Uses OCR and NLP to extract and analyze nutrients details from uploaded images of packaged food products.

- Harmful Component Detection: Identifies harmful additives, allergens, preservatives, and chemicals, alerting users about potential health risks.

- Health Risk Assessment: Evaluates the effects of ingredients on different body parts and overall well-being, ensuring informed food choices.

- Personalized Food Recommendations: Suggests healthier alternatives based on individual dietary needs, BMI, and health preferences.

- Dietary Guidance System: Provides personalized diet recommendations tailored to user's medical conditions, lifestyle goals, and nutritional needs using random forest classifier.
- Age and Health Restriction Alerts: Identifies ingredients that may be unsuitable for children, elderly individuals, or people with specific medical conditions.
- Food Product Review System: Offers detailed reviews and safety scores for packaged food products, ensuring transparency in food selection.
- Seamless Shopping Integration: Enables users to add recommended products to their cart for a smooth and convenient shopping experience.
- User-Friendly Interface: Provides an intuitive, simple, and efficient platform for quick decision-making while shopping.
- Scalability and Expansion: Can be expanded to support multiple languages, regional food databases, and additional dietary preferences for a wider audience.

EatFit aims to revolutionize the way consumers make food choices by leveraging AI-powered ingredient analysis, health risk assessment, and personalized recommendations. By simplifying food selection and promoting healthier alternatives, EatFit empowers users to make informed decisions, ensuring a smarter and healthier lifestyle.

Chapter 2

Literature Review

The "Leveraging AI in Food Safety, Quality, and Security" [1] by Sambandh Bhusan Dhal and Debashish Kar, published in January 2025. The research explores how artificial intelligence (AI) can improve food systems. The authors argue that AI contributes to better food safety, quality (including packaged goods), and security by detecting contamination, enhancing consistency in production, and optimizing supply chains. Their methodology involved a literature review of AI applications in food systems spanning from 1990 to 2024. They analyzed various AI techniques, including machine learning, computer vision, deep learning, and emerging technologies like the Internet of Things (IoT) and blockchain. The study concluded by identifying AI's critical role in modern food systems, demonstrating its potential to provide solutions for food safety, quality, and security challenges. However, the authors also acknowledged existing limitations, such as data limitations and ethical concerns, and suggested directions for future research in this area.

The "Nutritional Intelligence in the Food System: Combining Food and Health" [2] by Danielle I. McCarthy, published on November 27, 2024, delves into the role of artificial intelligence in improving decision-making within the food system, specifically focusing on the crucial intersection of nutrition and health. This study explores how AI can contribute to better nutritional choices and overall well-being through data-driven approaches. The methodology employed by McCarthy involves the collection of extensive food consumption data, which is then integrated with individual health records. By applying AI models to this combined dataset, the research aims to predict nutritional outcomes. The results of the study demonstrate that AI-powered "nutritional intelligence" significantly enhances dietary decision-making, ultimately leading to improved health outcomes. Beyond individual benefits, the research also highlights the potential of AI to influence the development of future food policies and healthcare interventions, suggesting broader implications for public health. This research complements the previously discussed study on AI in food safety, quality, and security by focusing specifically on the nutritional and health aspects of food systems, showcasing the diverse applications of AI in addressing critical challenges related to diet and well-being.

The "NLP and Machine Learning for Food Categorization and Nutrition Prediction," [3] authored by Guanlan Mavra Ahmed and Mary R. L'Abbé, published in March 2023, explores the application of Natural Language Processing (NLP) and Machine Learning (ML) to automate food categorization and nutrition prediction. This study aims to enhance the

accuracy of these processes while simultaneously reducing the manual effort typically required. The methodology employed involves a BERT-based NLP model for text processing, coupled with various ML algorithms, including XGBoost, k-Nearest Neighbors (k-NN), and Elastic Net, for both food classification and nutrition estimation. The research achieved high accuracy, with a score of 0.98 for major food categories and 0.96 for subcategories. Additionally, the model demonstrated a strong performance in nutrition prediction, achieving an R-squared value of 0.87. This study highlights the potential of combining NLP and ML techniques to streamline and improve the accuracy of food categorization and nutrition prediction, offering a significant advancement in automated dietary analysis.

Chapter 3

Proposed System

The proposed system, EatFit: AI-Based Smart Food Health Compatibility Checker, offers food compatibility analysis by evaluating whether a product is safe for individuals with specific health conditions, such as BP, diabetes, obesity, and cholesterol issues. It provides a nutrition score based on standard parameters and alerts users about potential allergen risks from the product's ingredients. The system also offers alternative product recommendations and generates personalized diet plans based on the user's health profile.

3.1 Features:

- AI-Powered Ingredient Analysis: Uses OCR and NLP to scan and interpret ingredient lists from food package images.
- Harmful Additive and Allergen Detection: Identifies harmful preservatives, artificial additives, allergens, and unhealthy ingredients.
- Health Risk Assessment: Analyzes ingredients' effects on different body parts and overall health conditions.
- Alternative Product Recommendations: Suggests healthier, safer alternatives based on nutritional value and dietary needs.
- Personalized Diet Suggestions: Provides dietary recommendations based on BMI, medical conditions, and lifestyle goals.
- Food Product Review System: Displays safety ratings and ingredient transparency for packaged food items.
- User-Friendly Shopping Integration: Allows users to add recommended products to their cart for easy purchase.
- Multi-Language Support: Expands usability with regional food databases and ingredient translation features.

3.2 Functionalities:

EatFit enables users to upload images of packaged food products, where OCR (Optical Character Recognition) extracts the ingredient list. The system then analyzes the extracted text using NLP (Natural Language Processing) to identify harmful additives, allergens, and unsafe ingredients. It cross-references the data with a health risk database to evaluate the impact on various health conditions. If a product contains unhealthy or restricted ingredients, EatFit provides alternative food recommendations that align with the user's dietary preferences and health goals. Additionally, the system offers personalized diet plans based on BMI, medical conditions, and lifestyle choices using random forest classifier.

EatFit also integrates real-time alerts to notify users about food recalls, banned substances, and ingredient-related health risks. The system supports multiple languages, allowing a diverse range of users to access its features. Users can also add recommended products to their cart, making healthier shopping decisions more convenient.

Chapter 4

Requirement Analysis

Establishing a foundation for precision, security, and efficiency, this system defines key components, functionalities, and constraints. It empowers users with real-time nutrition analysis, allergen detection, and personalized diet recommendations, ensuring informed dietary choices tailored to individual health needs. The system integrates a variety of advanced technologies to offer a seamless experience, enhancing the efficiency of nutrition tracking and dietary planning.

1. Front-End Development:

- **HTML** provides the core structure of the web pages, defining key elements such as input forms for user details (age, height, weight, disease conditions), BMI result displays, and meal recommendations.
- **CSS** is used to enhance the aesthetics of the interface, incorporating modern design elements such as interactive layouts, color schemes, font styles, and smooth transitions for an engaging user experience.
- **JavaScript** powers the interactivity of the application, enabling dynamic updates, form validations, and real-time BMI calculations. Embedded JavaScript functions facilitate user interactions by dynamically displaying meal recommendations and dietary insights.

2. Back-End Development:

- **Flask** handles all server-side operations, managing HTTP requests, session handling, and seamless interaction between the front-end and back-end via RESTful APIs.
- The application ensures smooth JSON communication, ensuring that user input data (age, weight, height, diseases) is processed efficiently to generate meal recommendations.

3. Database Management

- Stores user profiles, past diet recommendations, and health records for personalized suggestions.

4. Dataset:

- A structured collection of diverse nutritional data, including food ingredients, allergen details, and health impact analysis, is essential for accurate meal recommendations. Data preprocessing ensures consistency and reliability.

5. Accuracy:

- The system should ensure high accuracy in meal recommendations, dietary analysis, and allergen detection, minimizing incorrect suggestions.

6. Scalability:

- The platform should support a growing food database, multiple dietary preferences, and various health conditions while maintaining optimal performance.

7. Real-time Response:

- The system must generate instant nutritional insights and recommendations within seconds for a seamless user experience.

8. Security Measures:

- Secure authentication, data encryption, and strict access control must be implemented to protect user health data and prevent unauthorized access.

9. Interactive & Visually Enhanced UI:

- Stunning design with high-quality images, sleek animations, and smooth transitions

10. AI-Powered Enhancements:

- The Random Forest model recommends meals and products based on nutritional values and user health profiles.
- Dynamically adjusts suggested food intake based on real-time disease-based dietary restrictions.

Chapter 5

Project Design

5.1 Use Case Diagram

It is a visual representation that models the interactions between users (or other systems) and a system, describing its functionality and behavior from the user's perspective.

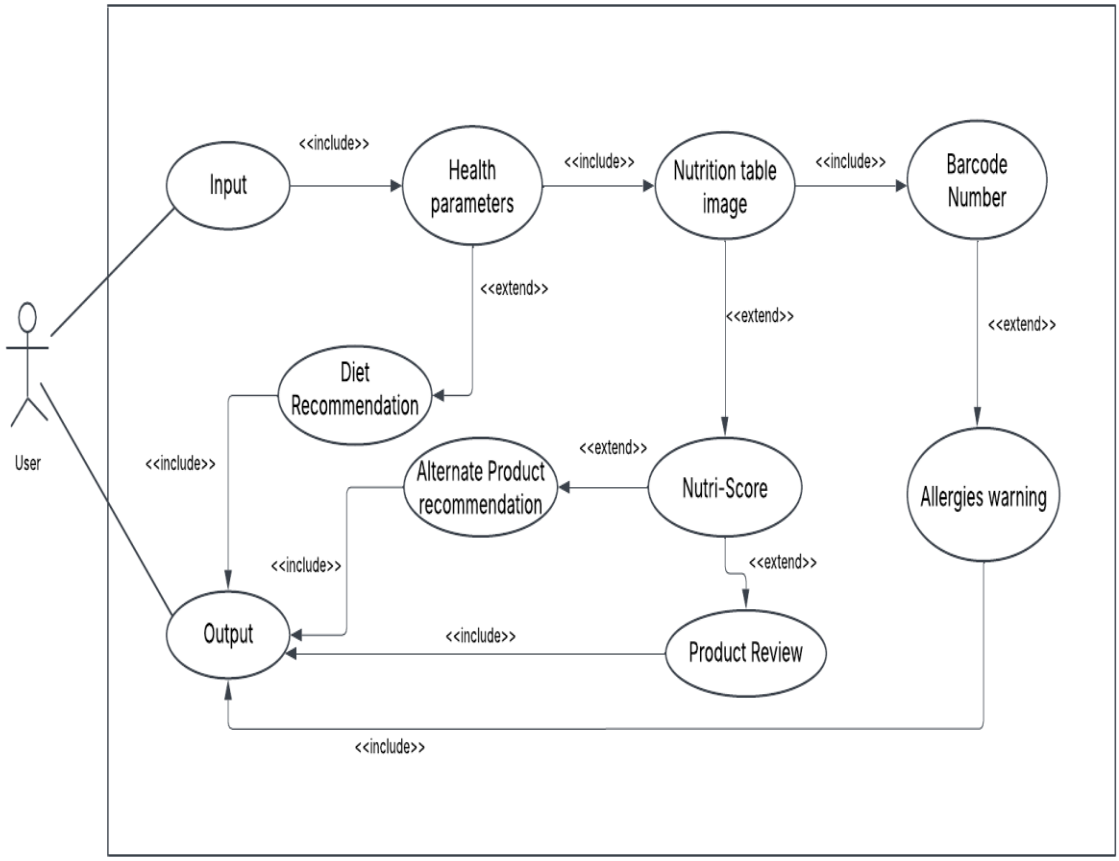

Figure 5.1: Use Case Diagram

Actor (User):

- The User is the primary actor interacting with the system. This can be any individual concerned about their health, such as people with chronic conditions (diabetes, hypertension, cholesterol issues) or those who are health-conscious.

- The user inputs information into the system by either uploading a nutrition label image or scanning a barcode to check the food product's compatibility with their health parameters.

Input Module:

- The system accepts two types of input:
- Nutrition Table Image: The user uploads a photo of the nutrition label, which the system processes using OCR (Optical Character Recognition) to extract nutrient details.
- Barcode Number: The user scans or enters the product's barcode, allowing the system to retrieve nutrition data from a food database (such as Open Food Facts).

Processing Module:

- Health Parameters: The system evaluates the nutritional information against the user's health conditions. It detects harmful ingredients, excess nutrients, or allergens.
- Nutri-Score Calculation: Based on the FSSAI (Food Safety and Standards Authority of India) guidelines, the system calculates the nutri-score by analyzing the nutritional content (e.g., fats, sugars, sodium).
- Allergies Warning: The system checks the product's ingredients. If any allergens are detected, the system triggers a warning, recommending the user to avoid the product.
- Alternate Product Recommendation: If the scanned or uploaded product is deemed unhealthy, the system suggests alternative products that are safer and healthier, based on a Random Forest recommendation model.
- Diet Recommendation: Based on the user's health profile, the system offers personalized diet suggestions to promote better eating habits.

Output Module:

- The Output Module displays the final result of the analysis in an easy-to-understand format. It provides the following information:
- Nutri-Score: Displays the nutritional rating of the product.
- Product Review: A summary of the product's health impact, indicating whether it is safe or harmful for the user.

- Allergies Warning: Displays a clear warning if allergens are detected.
- Alternate Product Recommendations: Shows healthier product suggestions if the scanned product is unsuitable.
- Diet Recommendation: Provides personalized diet tips based on the user's health profile, guiding them toward better dietary choices.
- The results are shown in a user-friendly interface, making it easy for the user to make informed food choices.

5.2 DFD (Data Flow Diagram)

A Data Flow Diagram (DFD) is a graphical representation of the flow of data within a system, illustrating how data moves between processes, external entities, and data stores. It is widely used in system analysis and design to model the logical flow of information through a system.

Figure 5.2.1: Data Flow Diagram Level 0

The Data Flow Diagram (Level 0) illustrates the basic interaction between the user and the system. The user provides a product image as input, which is processed by the image-to-text converter. This module extracts the nutritional information from the image using OCR technology. The system then generates a health-based product review.

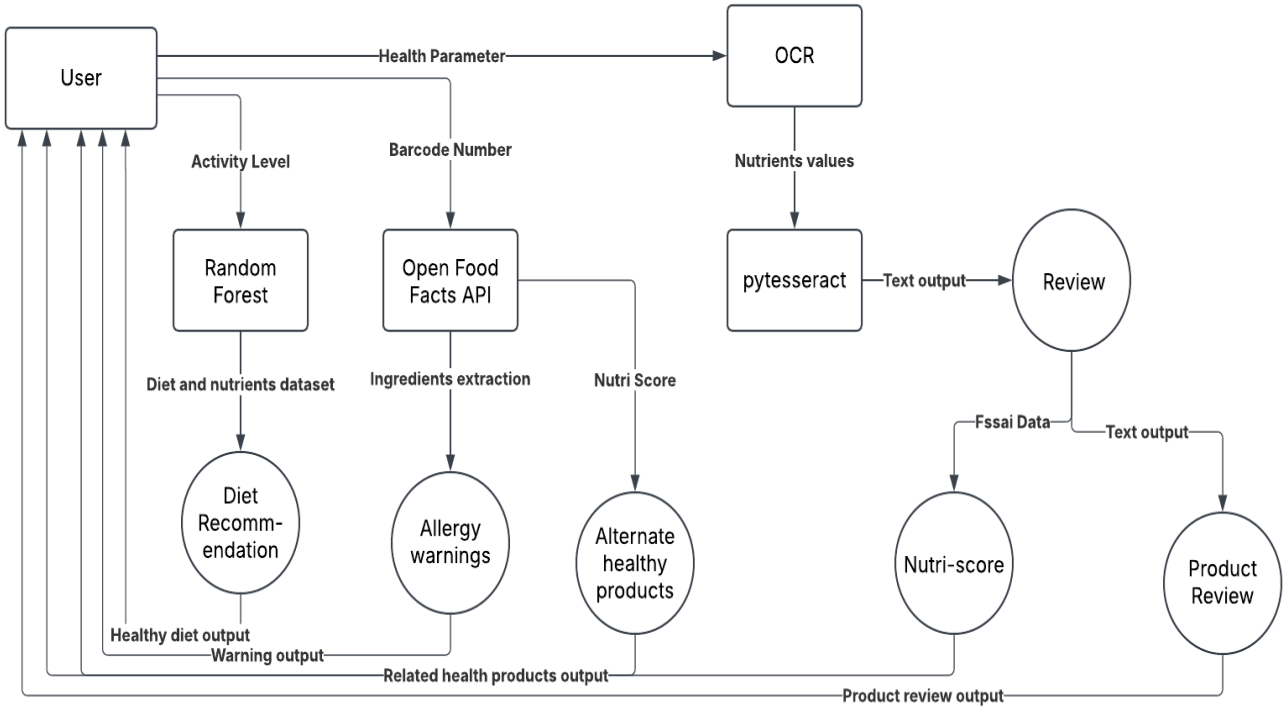

Figure 5.2.2: Data Flow Diagram Level 1

The Level 1 Data Flow Diagram (DFD) represents the detailed workflow of the EatFit system, starting with the user input. The user provides health parameters, activity level, and product barcode. The system utilizes OCR (Optical Character Recognition) to extract nutritional values from the product image. The extracted data is processed using pytesseract, converting it into readable text. This text is then passed to the Review module, which generates a comprehensive product review. The review data is further enriched with FSSAI standards to ensure compliance and accuracy in the final product review output.

The system also integrates machine learning and external APIs to enhance its functionality. The Random Forest model analyzes the user's activity level and health parameters to provide personalized diet recommendations. The Open Food Facts API is used to extract ingredient details from the barcode, enabling the system to generate allergy warnings and Nutri-scores. The system also suggests alternate healthier products for better dietary choices. Finally, the output includes health-based diet recommendations, product reviews, allergy warnings, and alternative product suggestions, all tailored to the user’s health profile.

5.3 System Architecture

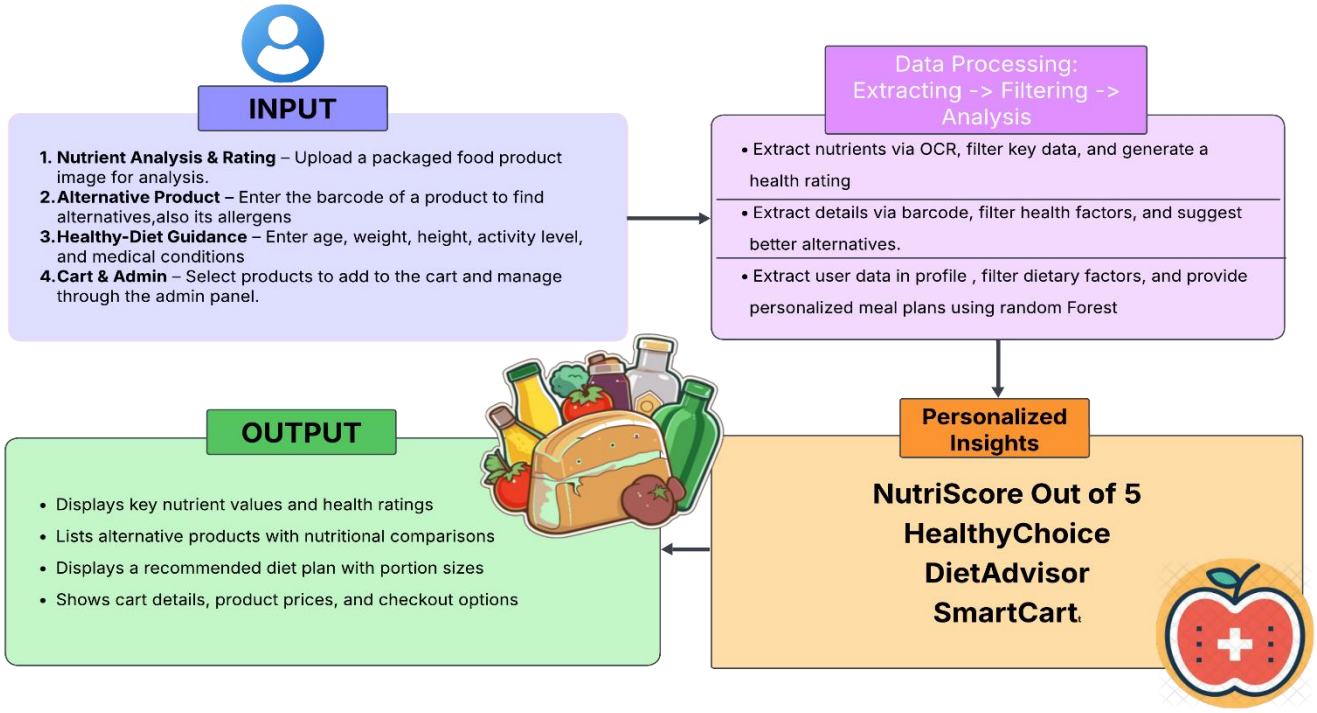

Figure 5.3: System Architecture

In this Fig. 5.3, The given system is designed to analyze food products based on their nutritional content, provide personalized dietary recommendations, and suggest healthier alternatives. Users can interact with the system by either uploading an image of a packaged food product or entering its barcode to retrieve relevant nutritional details. Additionally, they can input personal health information, such as age, weight, height, activity level, and medical conditions, to receive tailored dietary guidance.

Once the data is provided, the system processes it by extracting key nutritional values using Optical Character Recognition (OCR) and filtering important health-related factors. It evaluates the product's nutritional composition, generates a health rating, and determines whether the product aligns with the user's dietary needs. If the scanned product contains allergens or exceeds recommended nutrient limits, the system suggests better alternatives by leveraging a Random Forest-based recommendation model. Furthermore, it analyzes the user's health profile and recommends a suitable meal plan to promote better eating habits. Based on the processed data, the system provides meaningful insights in an easy-to-understand format. It assigns a NutriScore, a numerical rating that reflects the overall health impact of the product. Additionally,

it categorizes food items under "HealthyChoice" and "DietAdvisor" to help users make informed decisions. For a more convenient shopping experience, the system integrates a "SmartCart" feature, allowing users to manage selected products and compare them based on health benefits.

Finally, the output is displayed in a structured and visually appealing manner. Users receive a detailed breakdown of the product's key nutrient values, alternative product suggestions with nutritional comparisons, and personalized diet recommendations. The system ensures that users can make well-informed dietary choices by offering real-time food analysis, health-based product recommendations, and an interactive shopping experience tailored to their unique health conditions.

5.4 Implementation

The workflow of a website involves interaction between the front-end (client-side), back-end (serverside), and the database, with continuous communication and data processing. This system is built to provide an efficient, interactive, and dynamic experience for the user while maintaining security and performance standards.

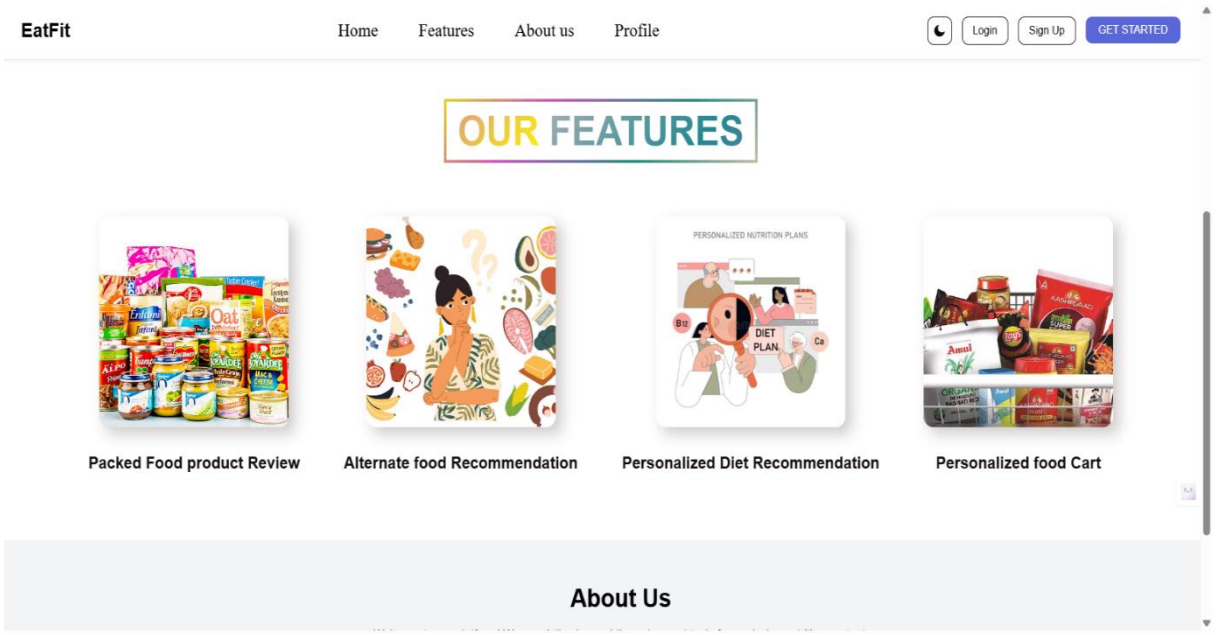

Figure 5.4.1: Home Page

In the figure 5.4.1,The web interface is designed with a clean layout and an intuitive navigation system. At the top, a navigation bar allows users to move between different sections, including Home, Features, About Us, and Profile. Additionally, there are login and signup

options, along with a “Get Started” button, which likely encourages new users to explore the platform. A dark mode toggle is also present, allowing users to switch themes for better accessibility.

The central focus of the page is the "OUR FEATURES" section, which highlights the platform’s core functionalities. Each feature is represented by an engaging image and a short description, ensuring clarity. The first feature, "Packed Food Product Review," enables users to analyze nutritional values from packaged food. The second feature, "Alternate Food Recommendation," suggests healthier alternatives based on nutritional content. The third feature, "Personalized Diet Recommendation," tailors diet plans according to the user's health conditions and dietary preferences. The fourth feature, "Personalized Food Cart," allows users to manage selected food products based on their nutritional suitability. The interface is designed with a modern aesthetic, utilizing high-quality images, a structured grid layout, and visually appealing typography. The combination of structured navigation, feature highlights, and interactive elements makes the platform highly engaging and user-friendly.

Figure 5.4.2: Upload product image and barcode

In the figure 5.4.2, This allows users to upload a product image or manually enter its barcode for nutrition analysis. It offers two input methods (image upload or barcode entry) for convenience. The "Upload" button sends the data for processing, aiming to extract and display the product's nutritional information. The design is simple and user-friendly, ensuring easy navigation and understanding.

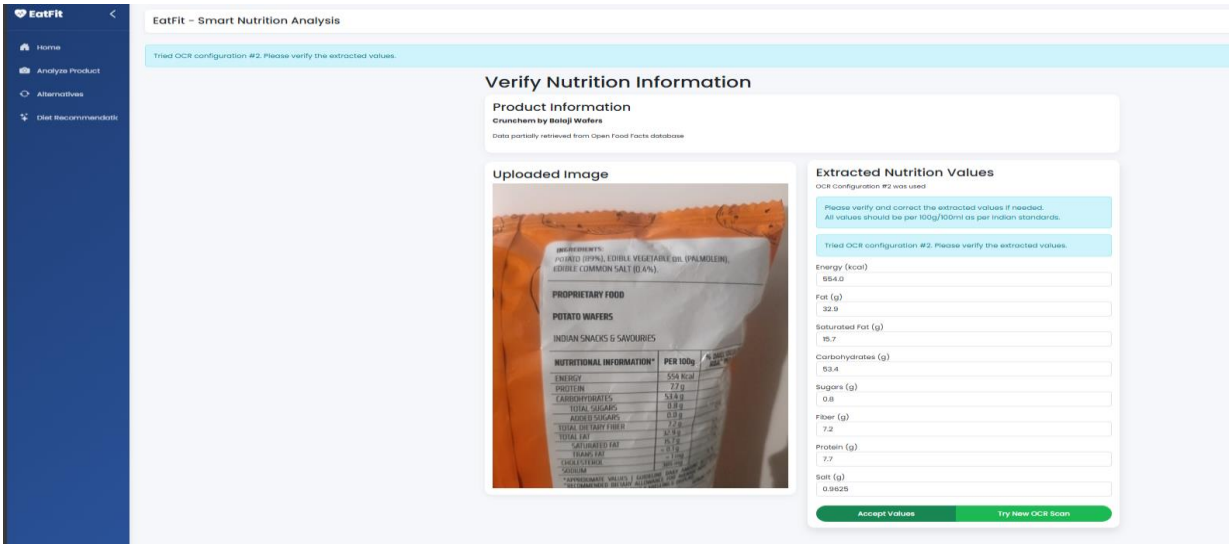

Figure 5.4.3: OCR nutrition extraction

In the figure 5.4.3, This interface allows users to verify and edit extracted nutrition information from a product image using OCR (Optical Character Recognition). The left section displays the uploaded nutrition label image, while the right section contains editable fields for key nutritional values such as energy, fat, carbohydrates, protein, and more. Users can modify incorrect values, upload a different image, or retry OCR scanning. Once verified, they can save and continue or attempt a new scan. This system ensures accurate data extraction before further analysis or recommendations

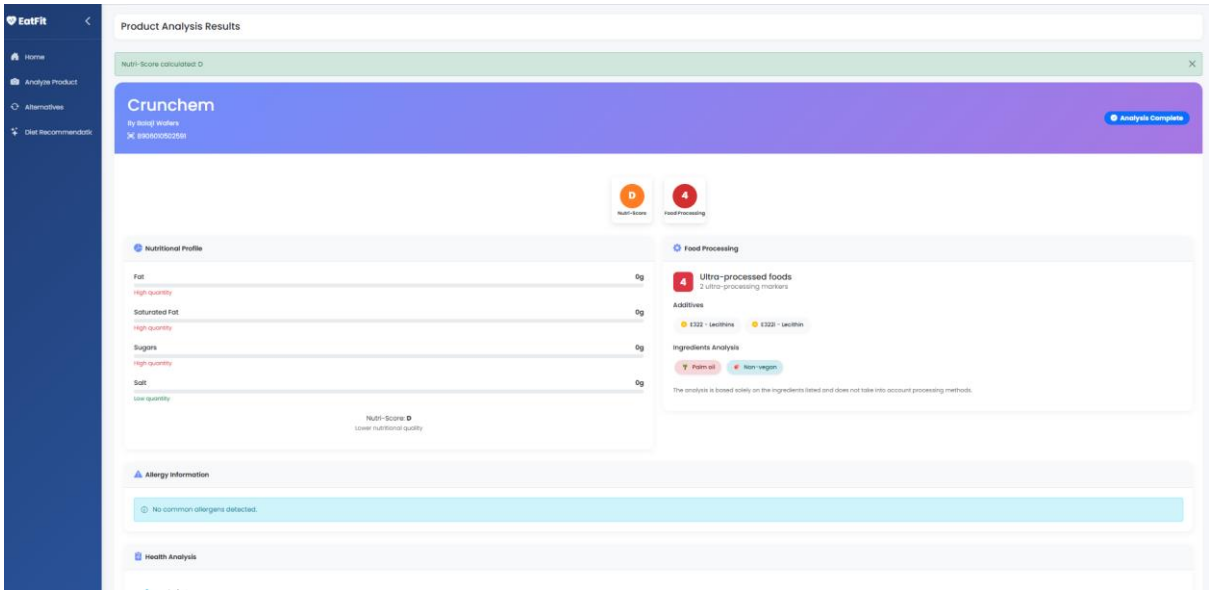

Figure 5.4.4a: Product Analysis

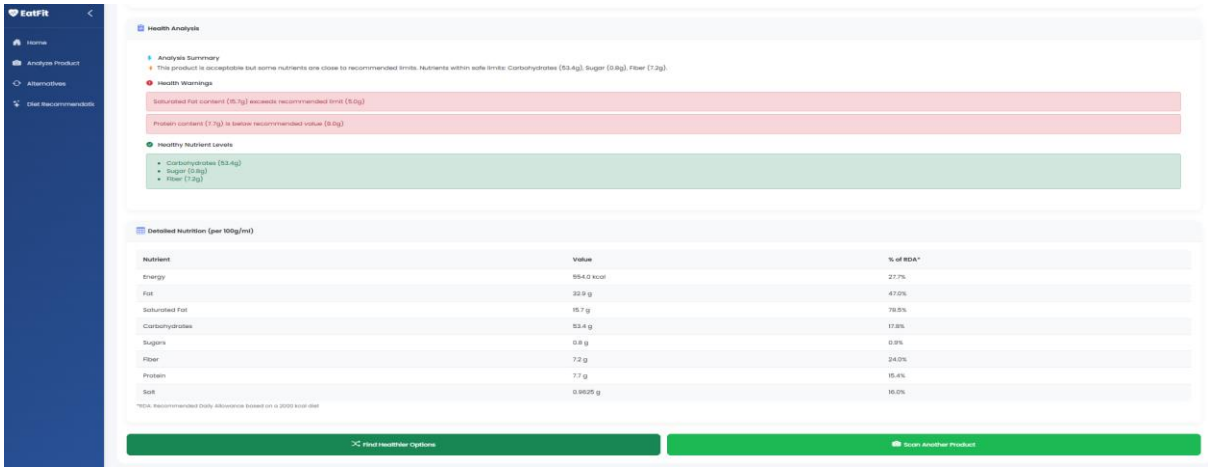

Figure 5.4.4b: Product Analysis

In the Figure 5.4.4a and 5.4.4b, When a product's information is uploaded, EatFit conducts a comprehensive nutritional analysis to provide a detailed understanding of its composition and impact on health. Firstly, a health score is assigned, offering a quick visual assessment of the product's overall nutritional quality. The analysis then meticulously breaks down macronutrients (fats, carbohydrates, proteins) and micronutrients (vitamins, minerals), comparing them to recommended daily allowances. Nutrients exceeding or falling below healthy ranges are flagged with warnings, highlighting potential dietary imbalances. The product's processing level is assessed, indicating how much it has been altered from its natural state, and highlighting potential health risks associated with highly processed foods. An allergen scan is performed, ensuring safety for individuals with food sensitivities

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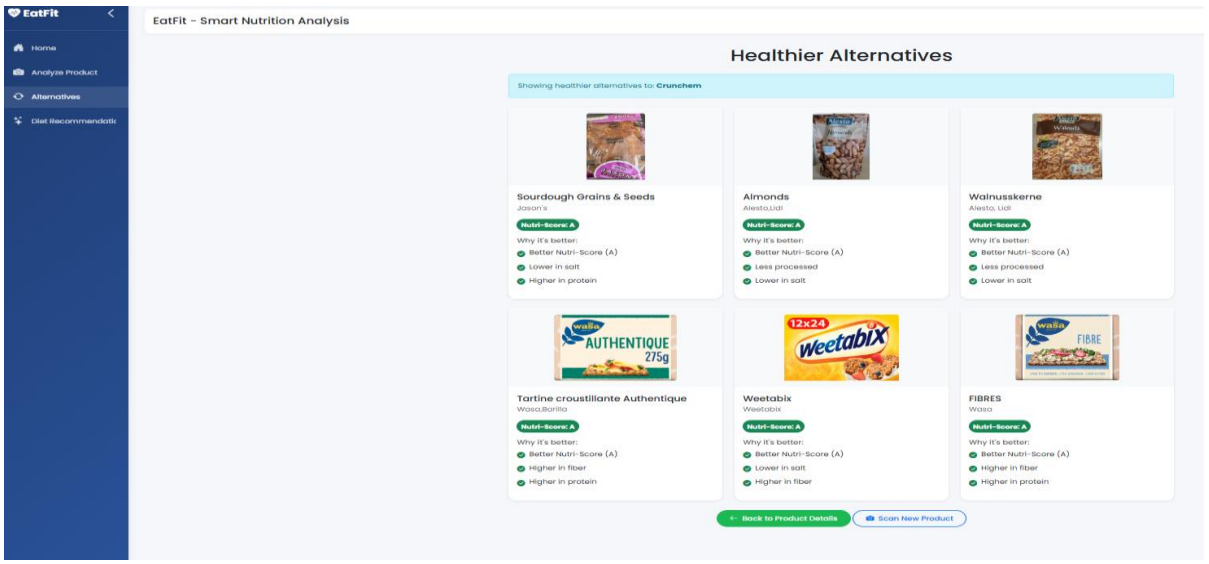


Figure 5.4.5: Healthier Alternatives

In this figure 5.4.5, It displays six healthier alternatives to a previously analyzed product. Each suggested alternative is presented with an image, its name, brand, and Nutri-Score, which indicates its nutritional quality. Crucially, each alternative also includes a "Why it's better" section, highlighting specific nutritional advantages such as a better Nutri-Score, lower salt content, higher protein or fiber, or being less processed. This allows users to quickly understand the benefits of each suggested replacement. Navigation is made easy with buttons to return to the original product's details or to scan a new product for analysis.

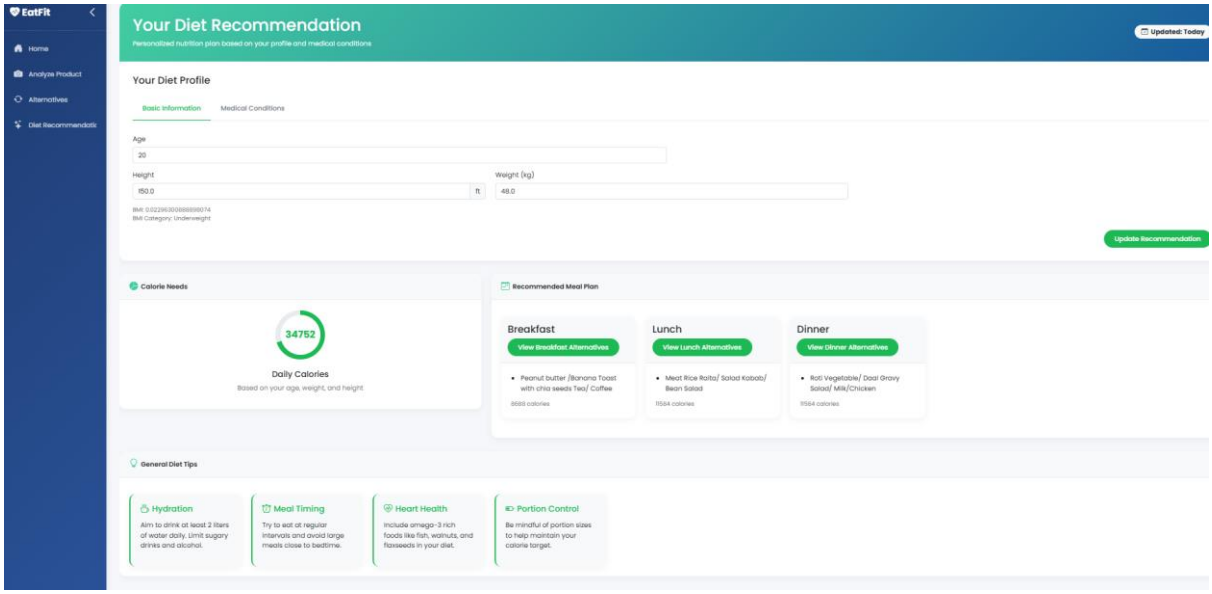


Figure 5.4.6: Diet recommendation Page

In the figure 5.4.6, The Nutrition-Based Meal Plan system personalizes dietary recommendations by analyzing user input such as age, weight, height, and medical conditions. It calculates BMI and categorizes it (e.g., underweight, normal, overweight), then generates a meal plan tailored to the user's health status. The system ensures balanced nutrition by suggesting appropriate food options for breakfast, lunch, and dinner, considering dietary restrictions and health conditions like hypertension, diabetes, and cholesterol. The interactive interface allows users to input details and receive instant meal recommendations, promoting healthier eating habits based on scientific guidelines.

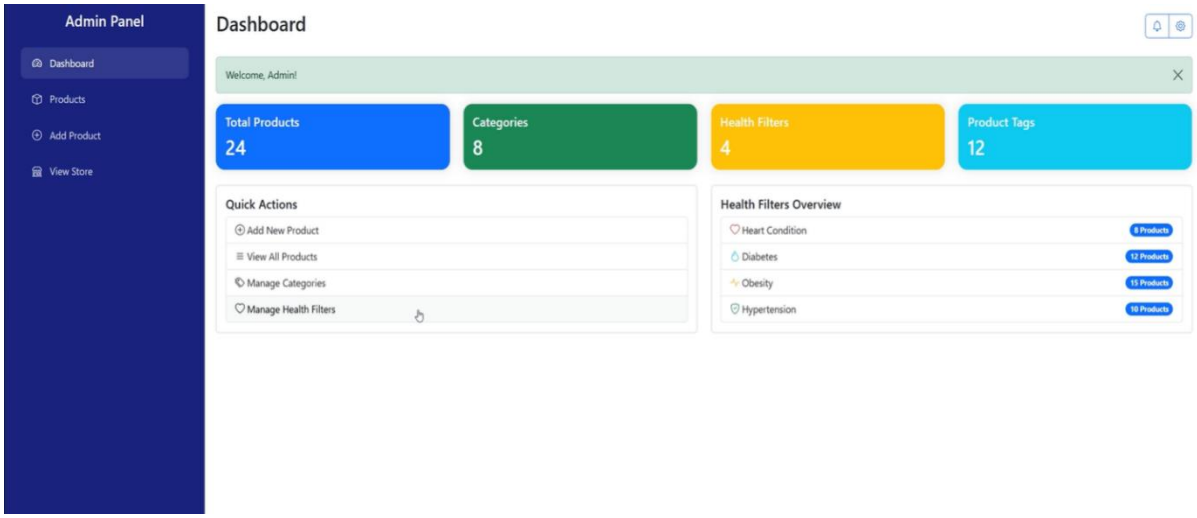


Figure 5.4.7: Admin Panel Page

In the figure 5.4.7, This Admin Panel Dashboard allows admins to add, edit, and manage products for users. Admins can add new products, view and modify existing products, and categorize them based on health filters like diabetes, hypertension, obesity, and heart conditions. They can also manage product tags to improve search and filtering. The panel provides a structured overview of available products and their classifications, ensuring users receive well-organized and health-conscious recommendations.

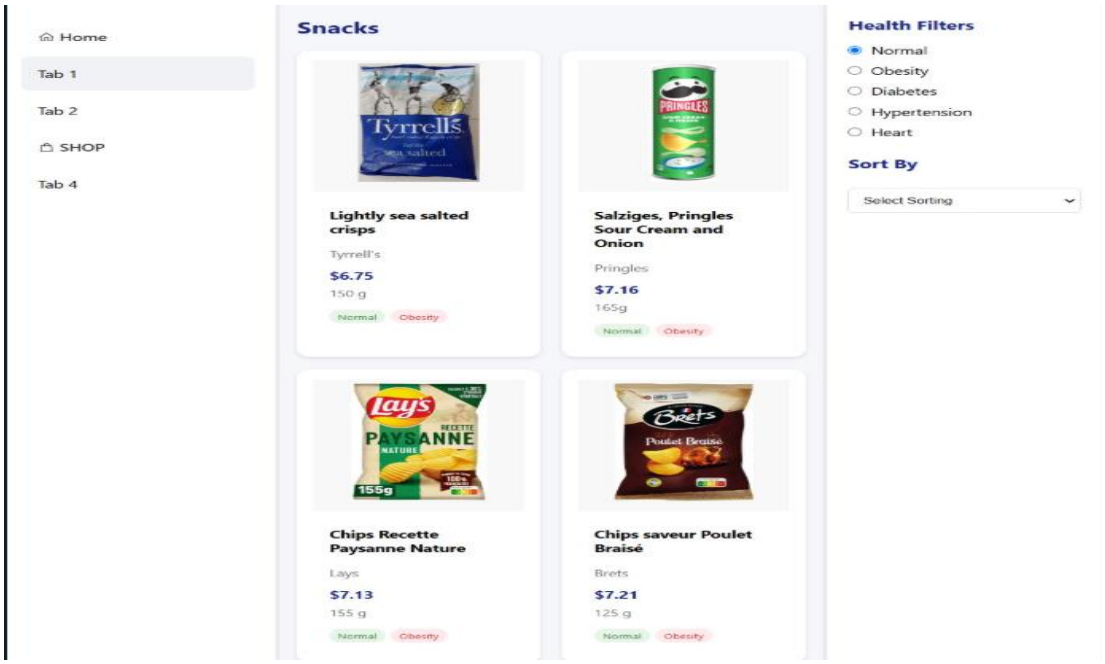


Figure 5.4.8: Category-wise product listing page

In the figure 5.4.8, This is a category-wise product listing page, where users can browse products under different categories. The sidebar contains multiple tabs for navigation, and the Health Filters on the right allow users to filter products based on health conditions such as Normal, Obesity, Diabetes, Hypertension, and Heart conditions. Each product card displays its name, brand, price, weight, and relevant health suitability tags. Additionally, users can sort products using the sorting dropdown for a better shopping experience**.**

Chapter 6

Technical Specification

In our project, these specifications encompass the selection of programming languages, libraries, and methodologies to ensure that the system is equipped with the appropriate resources for compatibility, scalability, and efficiency throughout its development and deployment phases.

Hardware Requirements:

- Image Upload: The system requires users to upload food product images (e.g., product packaging with nutrient labels) as the primary input.

Software Requirements:

- Operating System: Windows 10 and above (development environment).
- IDE: Visual Studio Code (VSCode).
- Programming Language: Python 3.12.1 (backend) and JavaScript (React.js frontend).
- Frontend Framework: HTML, CSS and JS for building a responsive, interactive user interface.
- Backend Framework: Flask for handling API requests, processing data, and providing real-time results.

Libraries:

- pandas – For data manipulation and analysis.
- numpy – For numerical computations.
- pytesseract – For OCR-based text extraction from food product images.
- sklearn – For implementing the Random Forest model used in alternative product recommendations.

Methodology

- OCR and Text Extraction: The system uses pytesseract for OCR (Optical Character Recognition) to extract nutritional information and ingredients from food product images.
- Rule-Based System: The extracted text is processed using a rule-based logic to check food compatibility against the user's health profile.The system flags products as safe, moderate, or unsafe based on FSSAI-compliant nutritional limits and allergen presence.
- Random Forest Classifier: The Random Forest model is used to provide alternative product recommendations and generate personalized diet plans.The classifier suggests healthier alternatives based on the nutritional values and user health conditions.
- API Integration: The system integrates with Open Food Facts API to fetch additional product details and nutritional information in real time, enhancing accuracy and coverage.

Datasets

- Nutrition Dataset: Contains nutritional values of food products mapped with health parameters and FSSAI-compliant limits.
- Diet Dataset: Used for training the Random Forest classifier to generate personalized diet plans.
- Allergens and Ingredients Dataset: Lists common allergens and ingredients that could cause adverse reactions, enabling the system to flag risky products.
- Nutrient Images Dataset: Used for training the OCR model, allowing it to accurately extract nutritional information from product images.
- Open Food Facts Dataset: The system uses this external dataset for real-time product information, including nutritional values and ingredient details.

Chapter 7
Project Scheduling

In project management, a schedule is a listing of a project's milestones, activities, and deliverables. Usually, dependencies and resources are defined for each task, then start and finish dates are estimated from the resource allocation, budget, task duration, and scheduled events. A schedule is commonly used in the project planning and project portfolio management parts of project management. The development and maintenance of the project schedule is the responsibility of a full-time scheduler or team of schedulers, depending on the size and the scope of the project. The project schedule is a calendar that links the tasks to be done with the resources that will do them. It is the core of the project plan used to show the organization how the work will be done, commit people to the project, determine resource needs, and used as a kind of checklist to make sure that every task necessary is performed.

A Gantt chart is a type of bar chart that illustrates a project schedule. Modern Gantt charts also show the dependency relationships between activities and the current schedule status. This chart lists the tasks to be performed on the vertical axis, and time intervals on the horizontal axis. The width of the horizontal bars in the graph shows the duration of each activity. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements constitute the work breakdown structure of the project. Modern Gantt charts also show the dependency (i.e., precedence network) relationships between activities. Gantt charts can be used to show current schedule status using percent-complete shadings.

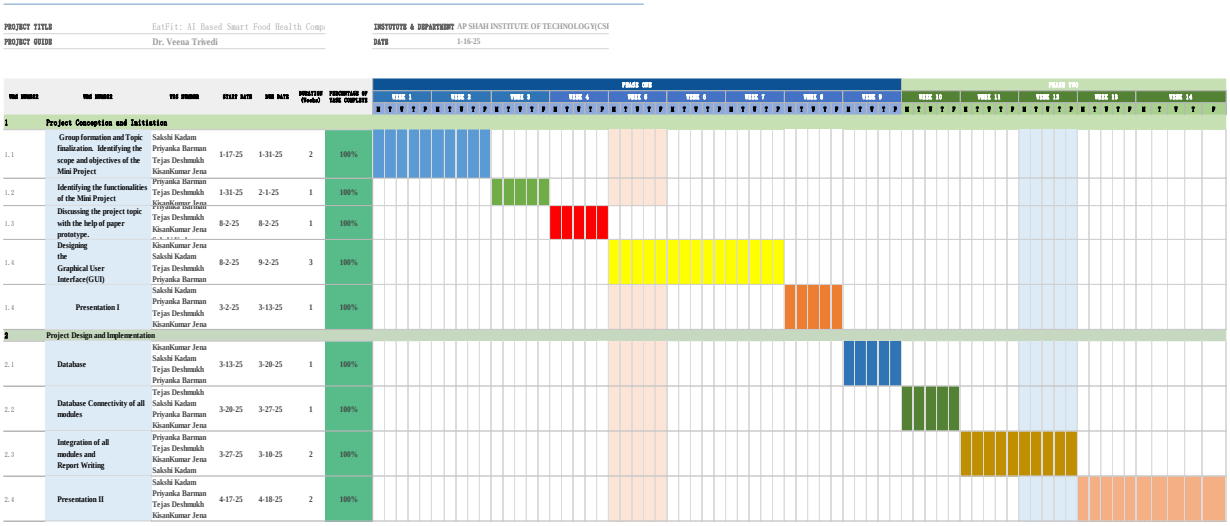


Figure 7.1. Gantt Chart

In this Fig. 7.1, The Gantt chart represents the project timeline for an AI-Based Smart Food Health system under the guidance of Dr. Veena Trivedi, spanning from January 6, 2025, to April 02, 2025. The project is divided into two main phases: Project Conception and Initiation, followed by Project Design and Implementation.

In the first phase, the team members—Sakshi Kadam, Priyanka Barman, Tejas Deshmukh, and Kisan Jena—began by forming the group and finalizing the project topic from January 17 to January 31. Once the scope and objectives were set, they worked together to identify the functionalities of the project by February 1. Following this, they discussed the project topic using a paper prototype on February 8. The graphical user interface (GUI) design started on the same day and continued for three weeks until February 9. To mark the completion of this phase, they conducted Presentation I between March 2 and March 13.

The second phase focused on project implementation. The database design was carried out between March 13 and March 20, with Kisan Jena, Sakshi Kadam, Tejas Deshmukh, and Priyanka Barman collaborating. After finalizing the database, Tejas Deshmukh, Sakshi Kadam, Priyanka Barman, and Kisan Jena worked on database connectivity across all modules from March 20 to March 27. The next step involved integrating all modules and preparing the final report, which took place between March 27 and April 10, led by Priyanka Barman, Tejas Deshmukh, Kisan Jena, and Sakshi Kadam. The project concluded with Presentation II, scheduled for April 17 and April 18. Throughout the timeline, color-coded bars indicate task progress, and all tasks have been marked as 100% completed.

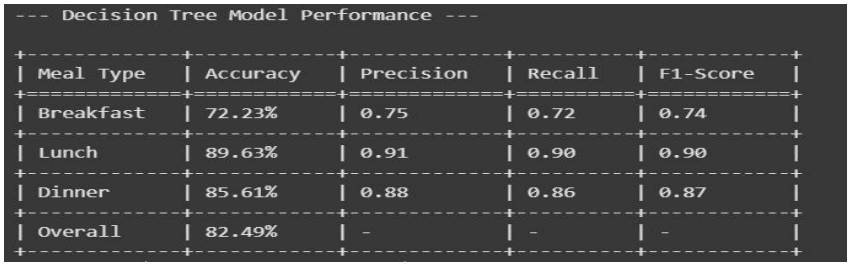
Chapter 8

Project Results

The proposed EATFIT System successfully integrates machine learning algorithms, user health profiling, and food data analysis to deliver an efficient meal recommendation and product analysis system. The results demonstrate the effectiveness of the implemented models, enhancing health-conscious decision-making and dietary planning for users.

Diet recommendation: The EatFit diet recommendation system is designed to provide personalized meal plans based on user inputs such as age, weight, height, BMI, and existing health conditions. The system ensures that each recommended meal aligns with the user's dietary needs while promoting a balanced and healthy lifestyle.

- To achieve this, two machine learning models Random Forest and Decision Tree were implemented to predict suitable meals for breakfast, lunch, and dinner.

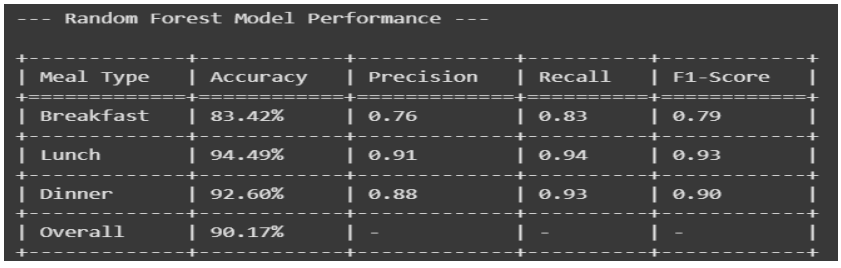


--- Decision Tree Model Performance ---

Meal Type	Accuracy	Precision	Recall	F1-Score
Breakfast	72.23%	0.75	0.72	0.74
Lunch	89.63%	0.91	0.90	0.90
Dinner	85.61%	0.88	0.86	0.87
Overall	82.49%	-	-	-

Figure 8.1 Diet recommendation model using the Decision Tree algorithm

In this Figure 8.1, The Decision Tree model performed well, achieving 79.85% accuracy for breakfast, 91.72% for lunch, 89.63% for dinner, and an overall accuracy of **87.73%.** However, it has a tendency to overfit, meaning it can become too specific to the training data and may not generalize well for new users. This limitation can lead to less accurate meal recommendations in real-world applications.



--- Random Forest Model Performance ---

Meal Type	Accuracy	Precision	Recall	F1-Score
Breakfast	83.42%	0.76	0.83	0.79
Lunch	94.49%	0.91	0.94	0.93
Dinner	92.60%	0.88	0.93	0.90
Overall	90.17%	-	-	-

Figure 8.2 Diet recommendation model using the Random Forest algorithm

In this Figure 8.2, On the other hand, the Random Forest model significantly outperformed the Decision Tree, with 83.42% accuracy for breakfast, 94.49% for lunch, 92.60% for dinner, and an overall accuracy of **90.17%.** The key advantage of Random Forest is that it combines multiple decision trees, reducing the risk of overfitting and improving prediction stability. By aggregating the results from multiple trees, it provides a more generalized and accurate recommendation system, ensuring that the suggested meals align better with a user's dietary needs.

Therefore, **Random Forest** was chosen as the final model for EatFit because of its higher accuracy, better generalization, and robustness in handling diverse user inputs. This ensures that users receive more reliable, data-driven diet recommendations tailored to their health profiles.

Ingredient Analysis Using OCR: The EatFit system incorporates OCR technology to extract ingredient and nutrition information from product labels, allowing users to analyze food content efficiently. This feature is particularly beneficial for identifying key nutrients and potential allergens.

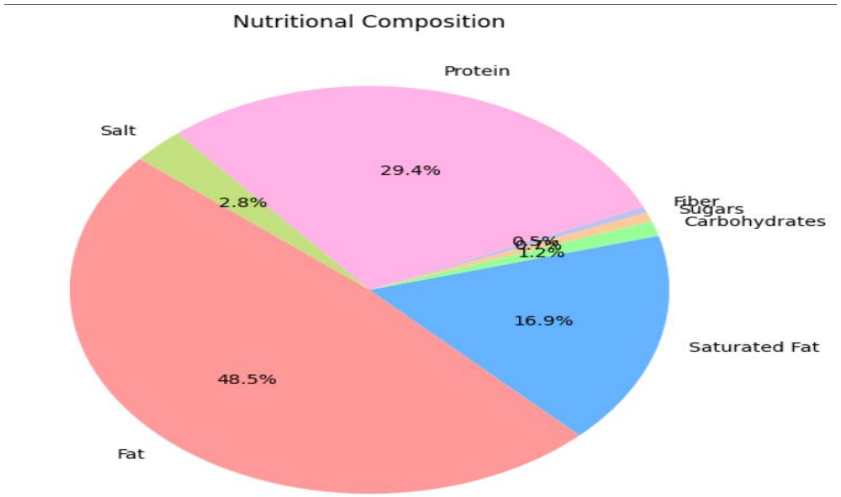


Figure 8.3 Nutritional Composition Analysis using OCR

In this fig.8.3, The extracted data is visualized using a pie chart, representing the nutritional composition of the product. By leveraging OCR for ingredient analysis, the system provides a quick and accurate breakdown of nutritional values, helping users make informed dietary choices. The use of graphical representation further enhances understanding, making it easier to assess food suitability at a glance.

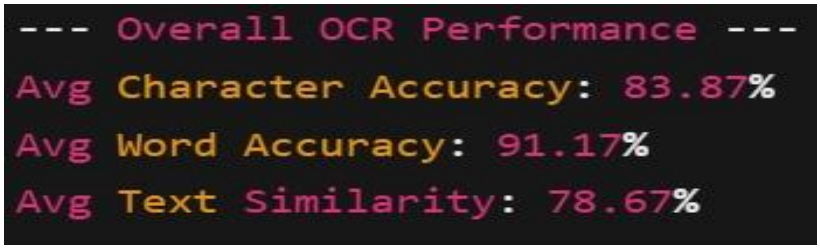


Figure 8.4 Accuracy of the Ingredient Analysis Using OCR

In this Fig.8.4, This image displays the performance of an OCR system. It achieved 83.87% character accuracy, meaning some letters were misread. Word accuracy was better at 91.17%, showing it often gets the words right despite character errors. However, the overall text similarity is only 78.67%, indicating significant differences between the original and recognized text.

Health Risk Assessment of Ingredients: The health risk assessment of ingredients helps evaluate the potential impact of various food components on an individual's health. By analyzing allergen levels in different products, the system identifies ingredients that may pose risks to people with dietary restrictions or allergies.

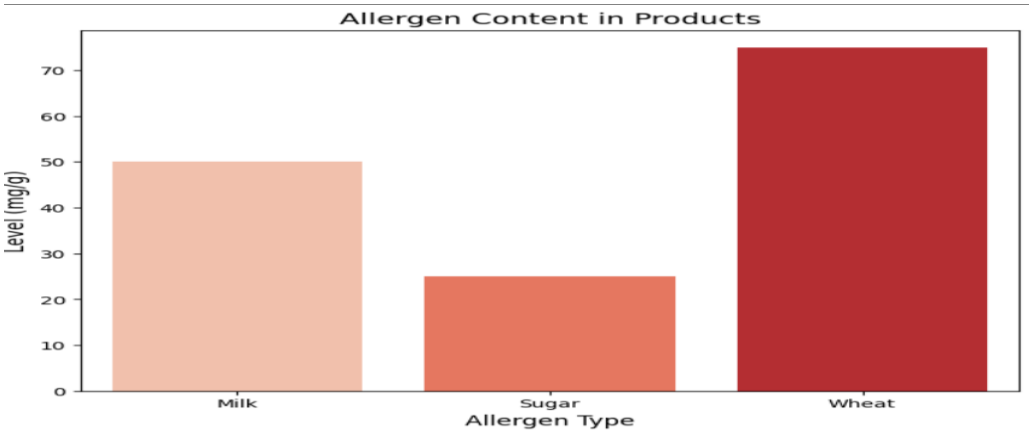


Figure 8.5. Health Risk Assessment of Ingredients

In this fig.8.5, Using data visualization techniques, such as bar charts, the system represents allergen content in a way that is easy to interpret. This enables users to quickly understand which ingredients might be harmful based on their concentrations. By leveraging this assessment, individuals can make informed food choices, reducing the risk of allergic reactions or health complications.

Chapter 9

Conclusion

The EatFit: AI-Based Smart Food Health Compatibility Checker effectively addresses the need for personalized dietary assessment by helping individuals with specific health conditions make informed food choices. By leveraging OCR-based text extraction, rule-based compatibility checks, and machine learning algorithms, the system provides a comprehensive evaluation of food products. It accurately identifies potential health risks, flags unsafe ingredients based on the user's health profile, and assigns a nutrition score according to FSSAI standards. This ensures that users can confidently assess whether a product is safe and suitable for their dietary needs.

The system's intuitive interface and efficient backend architecture ensure a smooth user experience. The React.js frontend offers a responsive and user-friendly platform, while the Flask backend handles complex processing tasks, such as extracting nutritional information and evaluating compatibility. The incorporation of Random Forest-based recommendation algorithms allows the system to suggest healthier product alternatives, while the rule-based checks accurately highlight allergy risks and ingredient-related concerns. This combination ensures reliable and precise food analysis, catering to the needs of health-conscious individuals.

Overall, EatFit demonstrates the power of AI and data-driven decision-making in promoting healthier dietary habits. By providing accurate, real-time food compatibility assessments, the system empowers users to make safer and smarter food choices. Its ability to analyze nutrition labels, detect allergens, and recommend healthier alternatives makes it a valuable tool for individuals managing chronic health conditions or simply aiming for better nutritional awareness.

Chapter 10

Future Scope

The EatFit: AI-Based Smart Food Health Compatibility Checker holds significant potential for future enhancements and widespread usability. One major improvement is the integration of real-time barcode scanning. By enabling users to scan product barcodes in stores, the system can instantly retrieve and display detailed nutritional information and compatibility results. This will make on-the-spot food assessment more convenient and practical, allowing users to make informed decisions while shopping. Making EatFit accessible in grocery stores, supermarkets, and pharmacies will significantly enhance its usability and impact, making it a reliable companion for health-conscious consumers.

Another key area of expansion is the inclusion of multilingual support. By adding language localization, EatFit can cater to a diverse and global audience. Users will be able to access the system in their native languages, making it easier for people from different regions to understand the food analysis and recommendations. This enhancement will ensure that language barriers do not prevent users from benefiting from the platform, promoting greater accessibility and inclusivity. To further improve the system, enhanced AI capabilities can be incorporated for more accurate and dynamic analysis. By refining the OCR model and using advanced NLP techniques, the system can better interpret complex ingredient labels and detect hidden allergens or additives. Additionally, implementing AI-driven recommendation engines can offer more precise and personalized diet suggestions by considering user preferences, activity levels, and real-time health metrics. This will make EatFit smarter and more efficient in delivering tailored health insights.

Lastly, expanding the system's accessibility and availability will significantly increase its impact. By integrating EatFit into mobile apps, smartwatches, and store kiosks, users can perform food compatibility checks anytime, anywhere. Partnering with retail chains and e-commerce platforms would allow users to assess products before purchasing them online or in-store. This broad availability would make EatFit a seamless and essential tool for daily dietary management, empowering individuals to make healthier food choices with ease.

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