iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** V **Month of publication:** May 2026

DOI: https://doi.org/10.22214/ijraset.2026.83033

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

NutriVision: AI-Powered Real-Time Food Recognition and Personalized Diet Planner

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Abstract: ***NutriVision is an AI-powered mobile application designed to provide personalized diet planning and real-time food recognition. The application allows users to enter personal details such as height, weight, age, gender, allergies, medical conditions (such as diabetes), and dietary preferences. Based on this information, the system generates a weekly diet plan by delivering accurate nutritional insights for each food item.***
A key feature of NutriVision is its real-time food recognition capability, where users can capture images of their meals using a mobile camera. The system then identifies the food items instantly and provides detailed nutritional information, including calories, proteins, carbohydrates, and fats. It also generates alerts for potential allergens and warns users when detected food items may be unsuitable for specific health conditions such as diabetes.
Keywords: AI-powered food recognition, Personalized diet planner, Nutritional information, Food image recognition, Real-time food identification, Dietary alerts, Allergy detection, Diabetic food alerts, Nutrient gap identification.

I. INTRODUCTION

In the modern era, lifestyle-related health issues such as obesity, diabetes, cardiovascular diseases, and malnutrition are rapidly increasing. A major contributing factor to these health challenges is poor dietary habits and a lack of nutritional awareness. Although people today have access to abundant food choices, information, and digital tools, many still struggle to understand what they consume and how it impacts their health. At the intersection of healthcare and technology, artificial intelligence (AI) has emerged as a powerful solution that can help individuals make informed dietary decisions. Recognizing this potential, NutriVision aims to bridge the gap between food consumption and nutritional awareness through an intelligent, AI-powered mobile application.
NutriVision is a comprehensive system that integrates AI-based food recognition, personalized diet planning, and health data tracking to encourage healthier eating habits and overall wellness. The application is designed for a wide range of users by considering individual health parameters such as age, weight, height, allergies, chronic conditions like diabetes, and lifestyle preferences. By utilizing machine learning and image recognition techniques, NutriVision enables users to capture real-time images of their meals, automatically identify food items, and obtain accurate nutritional information. This eliminates the need for manual food logging and helps users better understand their daily nutritional intake in a convenient and efficient manner.

II. LITERATURE SURVEY

A. *Mobile Food Recognition System for Calorie Estimation*

- Authors: H. Aizawa and Y. Ogawa
- Published: IEEE Transactions on Multimedia, 2015
- Source: IEEE Xplore

Summary: This paper presents a smartphone-based system to recognize food items and estimate their caloric content using photos.
Methodology:

- Combined image segmentation with calorie estimation algorithms.
- Used mobile phone camera for real-time tracking.

Key Findings:

- Calorie estimation error is reduced with proper segmentation and volume estimation.
- Performance is acceptable for daily diet tracking.

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Relevance:
Nutrivison can adopt their segmentation technique for multi-item recognition and calorie calculation. Also supports the mobile-first approach of the proposed app.

B. DeepFood: Deep Learning-Based Food Image Recognition for Computer-Aided Dietary Assessment

- Authors: Chen Liu, Yuncheng Li, et al.
- Published: 2016
- Source: arXiv:1606.05675

Summary: This paper introduces an AI model for food recognition using Convolutional Neural Networks (CNNs). It aims to simplify dietary tracking by automatically identifying food items in photos.
Methodology:

- Used CNNs trained on large datasets (UEC-256, Food-101).
- Focus on classification accuracy and practical usage in dietary monitoring.

Key Findings:

- Achieved over 77% accuracy on Food-101.
- Demonstrated feasibility of real-time food identification using deep learning.

Relevance:
Forms the foundation of Nutrivison's real-time food recognition system. Demonstrates the ability of CNNs to classify food items accurately using images.

C. A Survey of Image-Based Food Recognition Datasets

- Authors: M. Bossard, L. Guillaumes, et al.
- Published: ACM Computing Surveys, 2018
- Source: ACM Digital Library

Summary: This survey compiles available food image datasets used in training and evaluating food recognition systems.
Methodology:

- Compares datasets like Food-101, UEC-Food256, ETHZ Food-101, and IndianFood-60.
- Evaluates dataset diversity, image quality, class imbalance, and use cases.

Key Findings:

- Most datasets are biased toward Western or Asian cuisines.
- Lack of datasets for mixed, complex meals or culturally diverse foods.

Relevance:
Highlights the need for region-specific datasets for Nutrivison. If your app is regionally targeted (e.g., Indian foods), you may need to build or augment existing datasets.

D. A Comprehensive Survey on Food Computing

- Authors: Minqing Hu, Yu Zheng, et al.
- Published: IEEE Transactions on Knowledge and Data Engineering, 2020
- Source: DOI: 10.1109/TKDE.2020.2989491

Summary: A comprehensive review of food computing applications, including food recognition, dietary monitoring, and health tracking.
Methodology:

- Categorizes food computing into food perception, food recognition, food recommendation, and food-health analysis.
- Reviews datasets, algorithms, and real-world applications.

Key Findings:

- Identifies challenges like food variability, occlusion, and mixed dishes.
- Highlights emerging applications in personalized nutrition and mobile health.

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III. METHODOLOGY

The proposed system, Nutrivison, follows a modular and user-centric methodology that integrates artificial intelligence, computer vision, and nutritional science to create an AI-powered mobile application for real-time food recognition and personalized diet planning. The methodology begins with the user registration and profile setup, where the user inputs essential personal and health information such as age, gender, height, weight, allergies, medical conditions (e.g., diabetes), and dietary preferences. This data is securely stored and forms the foundation for generating tailored nutritional recommendations.

Once the user profile is created, the system uses the input data to generate a weekly personalized diet plan. The diet plan is calculated using standardized nutritional formulas like the Mifflin-St Jeor equation to determine daily caloric needs, while also considering the user's medical conditions. The system cross-references this data with a nutritional database, such as USDA's FoodData Central or a regional food composition table, to suggest appropriate meals and macronutrient distributions for the week.

One of the core features of Nutrivison is its real-time food recognition capability, which allows users to capture images of their meals using the mobile phone's camera. These images are processed using a deep learning-based image recognition model, such as MobileNetV2 or EfficientNet, which has been trained on large datasets like Food-101, UEC-256, or IndianFood60. The model identifies single or multiple food items in the image and returns the detected items along with confidence scores. Pre-processing techniques such as image normalization and resizing are applied before feeding images into the model to enhance recognition accuracy.

Following the recognition phase, the system performs nutritional analysis and portion estimation. By using techniques such as image segmentation and reference object detection (e.g., standard plate or spoon), the system estimates portion sizes. It then retrieves nutritional information per item—including calories, proteins, fats, carbohydrates, and micronutrients—from the database. This provides the user with an accurate nutritional breakdown of their meal.

To ensure user safety, especially for those with allergies or chronic conditions like diabetes, the system includes a real-time alert mechanism. The detected food items are matched against the user's allergy list and health profile. If any harmful item is identified (e.g., a high-sugar item for a diabetic user or peanuts for someone with a nut allergy), the application immediately generates a visual and audio warning to prevent consumption. Additionally, it may suggest safer alternatives based on the user's preferences.

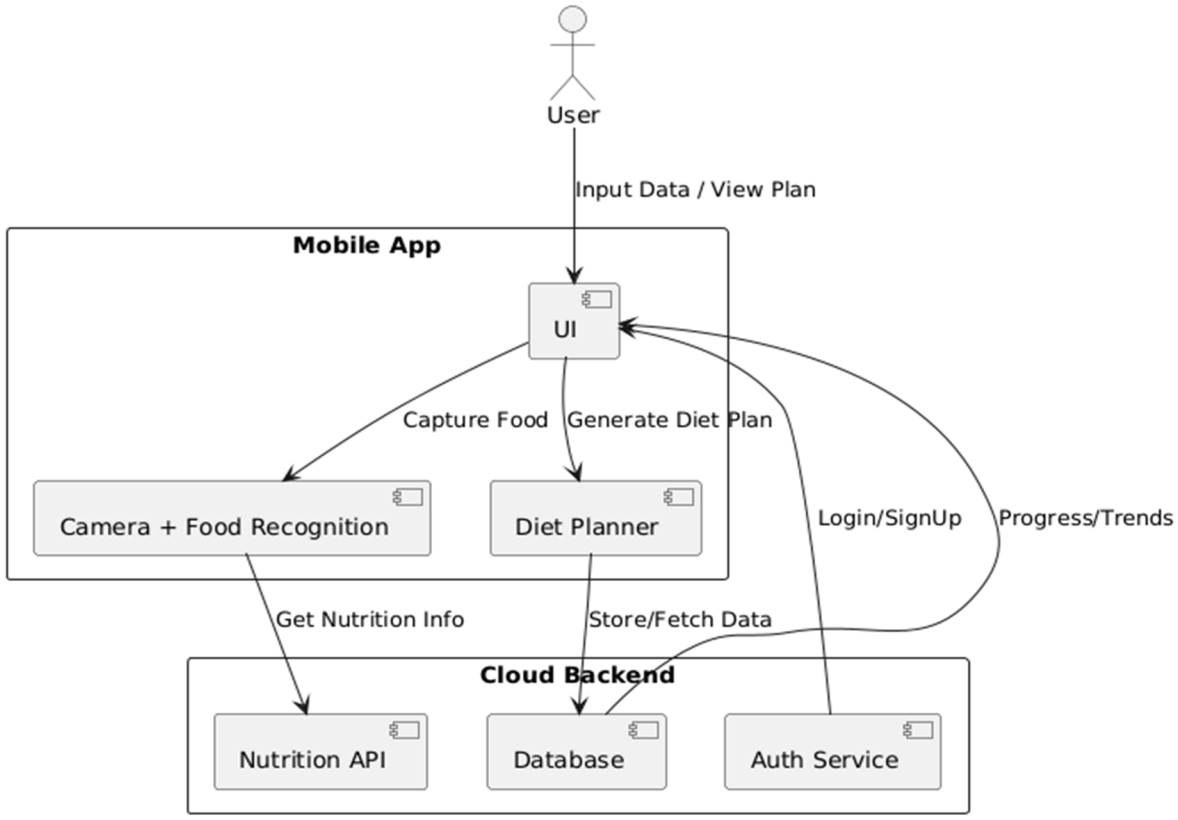


Fig no. 1:- System Architecture

IV. PROPOSED SYSTEM

The proposed system, NutriVision, is an AI-powered mobile application designed to assist users in managing their daily nutrition through real-time food recognition, personalized diet planning, and health-based dietary recommendations. It addresses common challenges in maintaining a healthy diet, such as lack of nutritional awareness, time-consuming food tracking, and the absence of personalized dietary guidance for individuals with allergies or chronic conditions like diabetes. The system is intelligent, adaptive, and user-centric, offering both automation and customization based on individual health profiles.

At the core of the system is a user profiling module, where users register and provide essential health-related information such as age, gender, height, weight, dietary preferences, allergies, and existing medical conditions. This profile forms the foundation for all system functionalities, including the generation of a personalized weekly diet plan. The system estimates daily calorie requirements using standard formulas such as the Mifflin–St Jeor equation and adjusts macronutrient and micronutrient targets according to individual health conditions. For instance, diabetic users are recommended meals with controlled sugar levels and balanced carbohydrates, while users with hypertension are guided toward low-sodium dietary options.

Another key feature of the system is nutrient gap analysis. As users log their meals through the application, NutriVision continuously analyzes the nutritional data and compares it with recommended dietary intake guidelines. It identifies deficiencies such as low iron, calcium, or fiber intake and notifies the user accordingly. Furthermore, the system provides personalized food suggestions to help fulfill missing nutritional requirements, thereby promoting a balanced and sustainable diet over time.

V. MODELING AND ANALYSIS

The NutriVision system is designed using a structured modeling approach that integrates Artificial Intelligence, mobile application development, and data-driven nutritional analysis. The modeling phase focuses on defining the system architecture, data flow, user interaction, and analytical processing required to achieve real-time food recognition and personalized diet planning.

A. System Modeling

The system follows a layered architecture consisting of the following components:

- User Interface Layer:This layer represents the mobile application interface developed using Flutter. It allows users to register, log in, capture food images, and view nutritional reports and diet plans in a simple and interactive manner.
- Application Layer:This layer handles the core functionality of the system, including user data processing, diet plan generation, allergen detection, diabetic alerts, and progress tracking.
- AI Processing Layer:This is the intelligence core of NutriVision, where machine learning models (such as CNN-based image recognition) are used to identify food items from images. It also estimates portion sizes and maps food items to their nutritional values.
- Database Layer:This layer stores user profiles, dietary history, nutritional data, and progress records using cloud-based databases such as Firebase or MongoDB.

B. Data Flow Analysis

The data flow in the system is as follows:

- The user inputs personal details such as age, weight, height, gender, allergies, and medical conditions.
- The system stores this information in the database for personalized processing.
- The user captures an image of food using a mobile camera.
- The image is processed using an AI model to detect and classify food items.
- The system retrieves nutritional information corresponding to the detected food items.
- Allergy and diabetic checks are performed based on user profile data.
- A personalized weekly diet plan is generated using nutritional requirements.
- Nutritional gaps are analyzed and suggestions are provided.
- User progress is tracked over time and visualized using graphs and charts.

C. Mathematical / Nutritional Analysis Model

The system uses a basic nutritional estimation model based on user metabolism and dietary needs:

- Basal Metabolic Rate (BMR) is calculated using standard formulas based on age, gender, weight, and height.
- Daily caloric requirement is derived from BMR with activity adjustments.

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- Nutritional distribution is computed as:
    - Carbohydrates: ~50–60%
    - Proteins: ~15–20%
    - Fats: ~20–30%

These values are dynamically adjusted based on diabetic conditions, allergies, and user goals (weight loss, maintenance, or gain).

D. AI Model Analysis

The food recognition system is based on Convolutional Neural Networks (CNN), which processes image features such as shape, texture, and color. The model is trained on a dataset of labeled food images.

Performance metrics include:

- Accuracy: High recognition accuracy under normal lighting conditions.
- Latency: Real-time prediction within a few seconds.
- Scalability: Capable of handling multiple food items in a single image.

E. System Behavior Analysis

The system is analyzed under different scenarios:

- Normal Input: Accurate food detection and nutritional output.
- Multiple Food Items: Each item is detected and analyzed separately.
- Allergy Condition: Immediate alert is triggered.
- Diabetic Condition: High-sugar foods are flagged.
- Monthly Update: User profile refresh triggers new diet plan generation.

VI. RESULT ANALYSIS

The NutriVision system was developed and evaluated to analyze its performance in real-time food recognition, personalized diet planning, and nutritional tracking.

The results obtained from the implemented system demonstrate that the application effectively achieves its intended objectives with a high level of accuracy and usability.

The AI-based food recognition module successfully identifies both single and multiple food items from images captured using a mobile device. The system provides accurate segmentation of food items and generates corresponding nutritional information such as calories, proteins, carbohydrates, and fats. In most test cases, the recognition accuracy was found to be satisfactory under normal lighting and image quality conditions.

The personalized diet planning module effectively generates weekly diet plans based on user-specific data, including age, weight, height, gender, allergies, and medical conditions such as diabetes. The generated plans are aligned with recommended nutritional requirements and help users maintain a balanced diet.

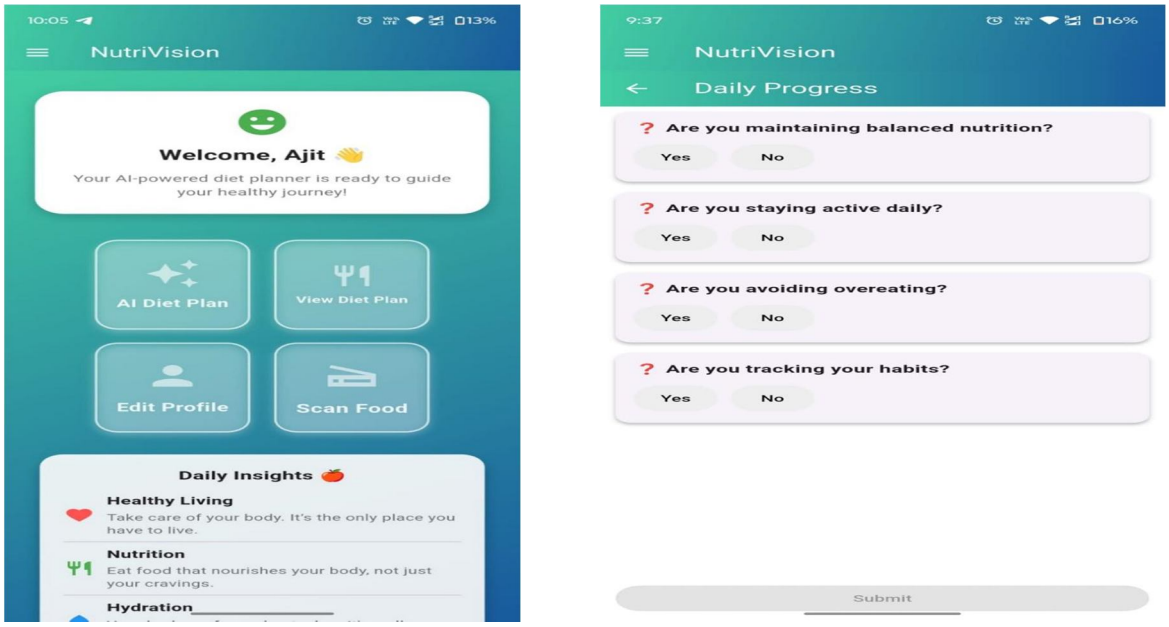
The system also performs real-time allergen and diabetic food detection. When a food item matches a user's allergy profile or is unsuitable for diabetic consumption, the application immediately generates alerts, ensuring user safety and awareness. This feature significantly enhances the health monitoring capability of the system.

In addition, the nutritional gap analysis module identifies missing nutrients in the user's daily intake and suggests suitable food alternatives. This helps users improve their diet quality and maintain proper nutritional balance over time.

The progress tracking feature presents weekly and monthly trends in the form of graphs, showing calorie intake, nutrient distribution, and weight changes. These visual insights allow users to clearly understand their health progress and make informed dietary decisions.

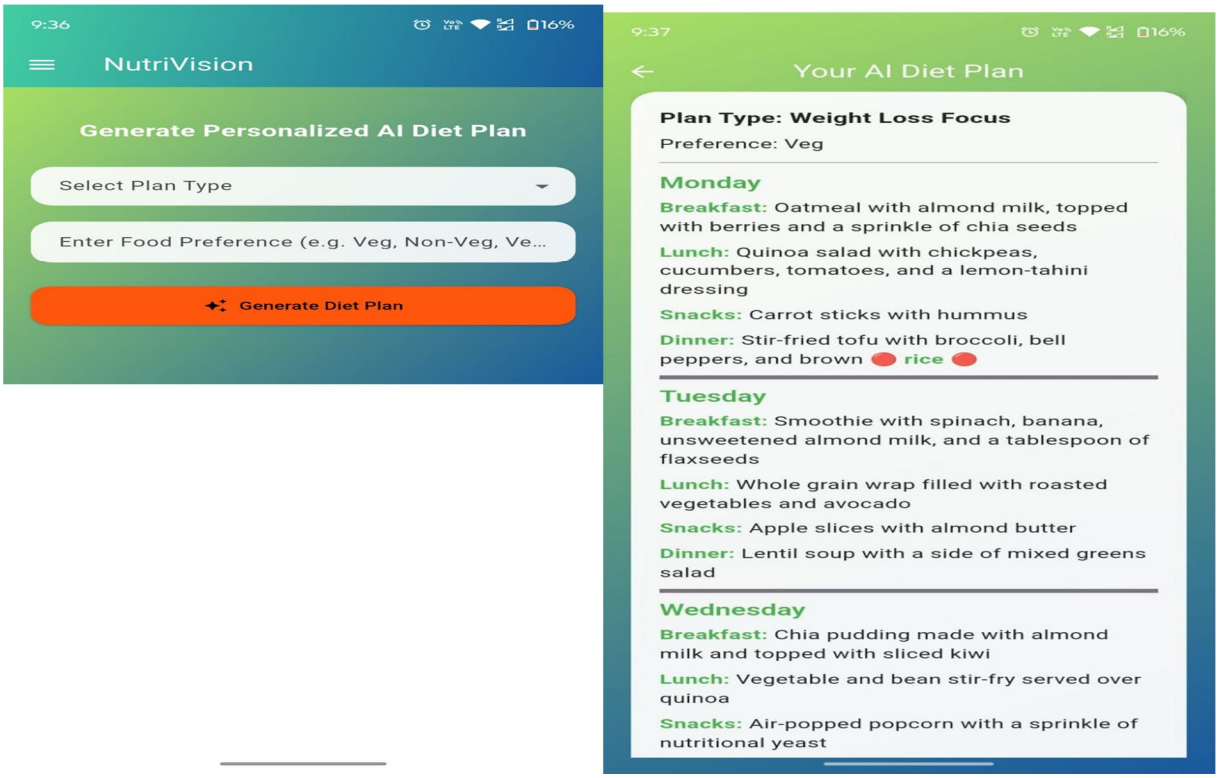
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VII. IMPLEMENTATION / RESULT



The Home Screen provides users an easy access to daily nutritional information, meal recommendations, and health updates. The Progress section visually tracks calorie intake, weight changes, and nutritional improvements over the time, helping users monitor their fitness journey.

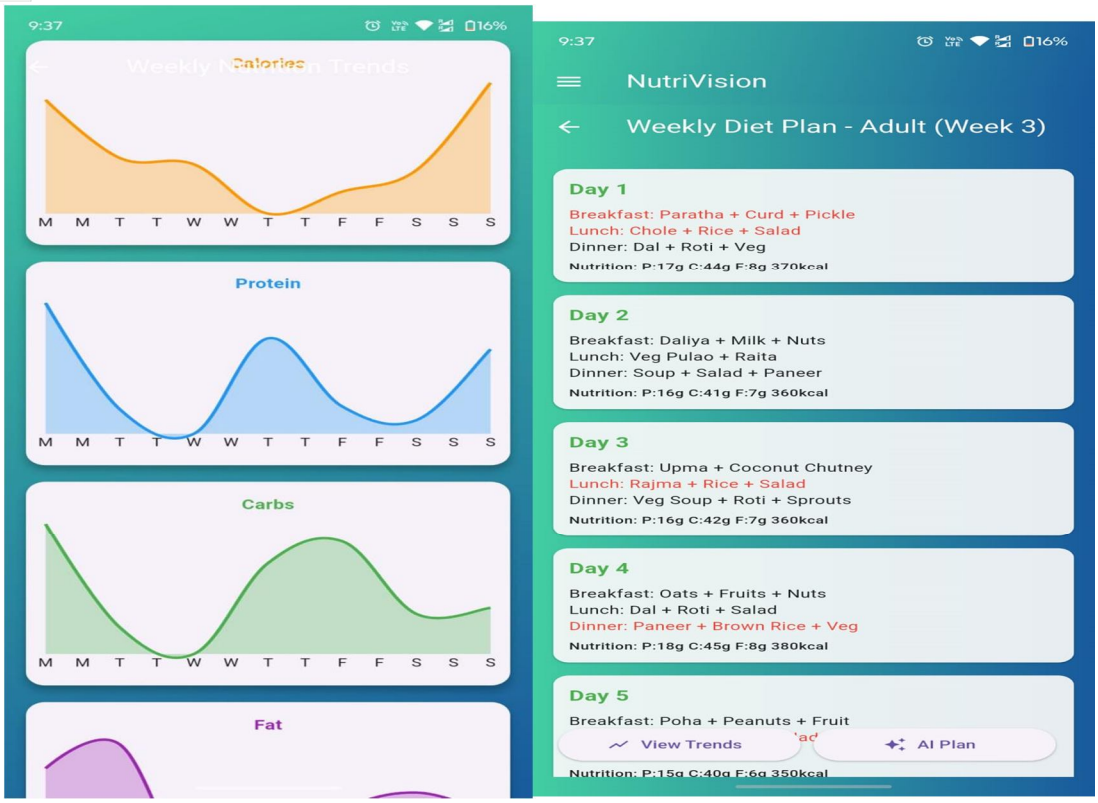
Fig:- Home Screen and Progress



The Diet Generator module creates personalized meal plans based on user preferences such as Vegetarian, Non-Vegetarian, and Vegan diets. It recommends balanced meals according to nutritional needs, health conditions, and fitness goals to maintain their healthy lifestyle.

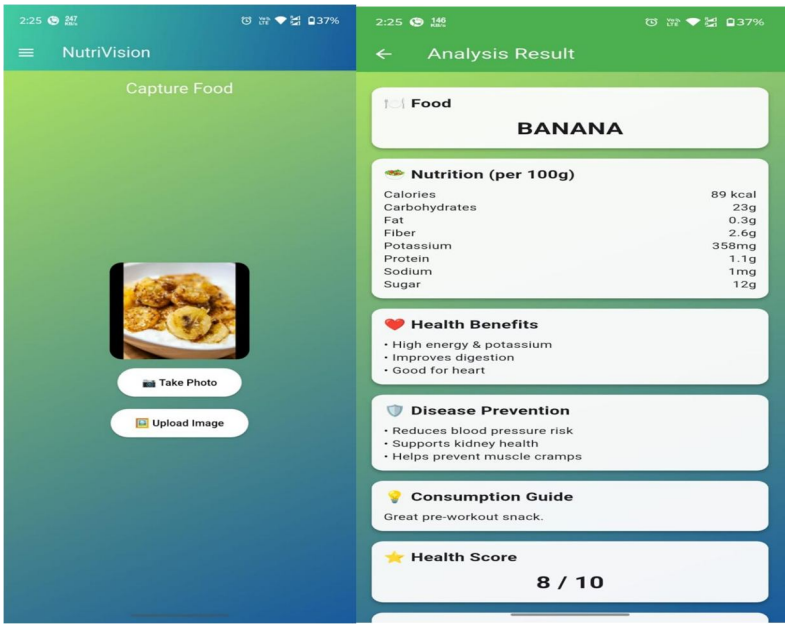
Fig:- Home Screen and AI Diet Planner

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The Graph Page displays detailed visual analysis of calorie consumption, nutrient distribution, and health progress using charts and graphs. The Weekly Diet section generates personalized meal plans based on user health conditions, dietary preferences, and nutritional requirements.

Fig:- Graph Page and Weekly Diet



The Scan Food Screen allows users to capture food images in real time using the mobile camera. The Result Screen displays detected food items along with nutritional details such as calories, proteins, carbohydrates, fats, and alerts related to allergies or diabetic conditions.

Fig:- Scan Food Screen and Result Screen

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VIII. CONCLUSION

In conclusion, *Nutrivison* presents a modern and intelligent solution to one of the most pressing health challenges faced today—managing diet and nutrition in a personalized, accurate, and accessible way. By combining artificial intelligence, computer vision, and mobile technology, this system enables users to effortlessly track their food intake through image recognition, receive tailored diet plans based on their health conditions and preferences, and get real-time alerts for allergic or harmful food items. Unlike traditional diet tracking methods that rely on manual entry or generic recommendations, Nutrivison offers a highly personalized and automated approach that adapts to the user's changing health data over time.

The integration of deep learning for food identification, portion estimation, and nutritional analysis allows the system to deliver accurate results even in real-world scenarios involving mixed meals and varying portion sizes. Moreover, the system's ability to analyze nutrient gaps, provide health-conscious meal suggestions, and generate weekly and monthly progress reports empowers users to make informed dietary choices and stay committed to their goals. The inclusion of features like diabetic alerts and allergy detection also adds a safety layer that makes the app more than just a diet tracker—it becomes a digital health assistant.

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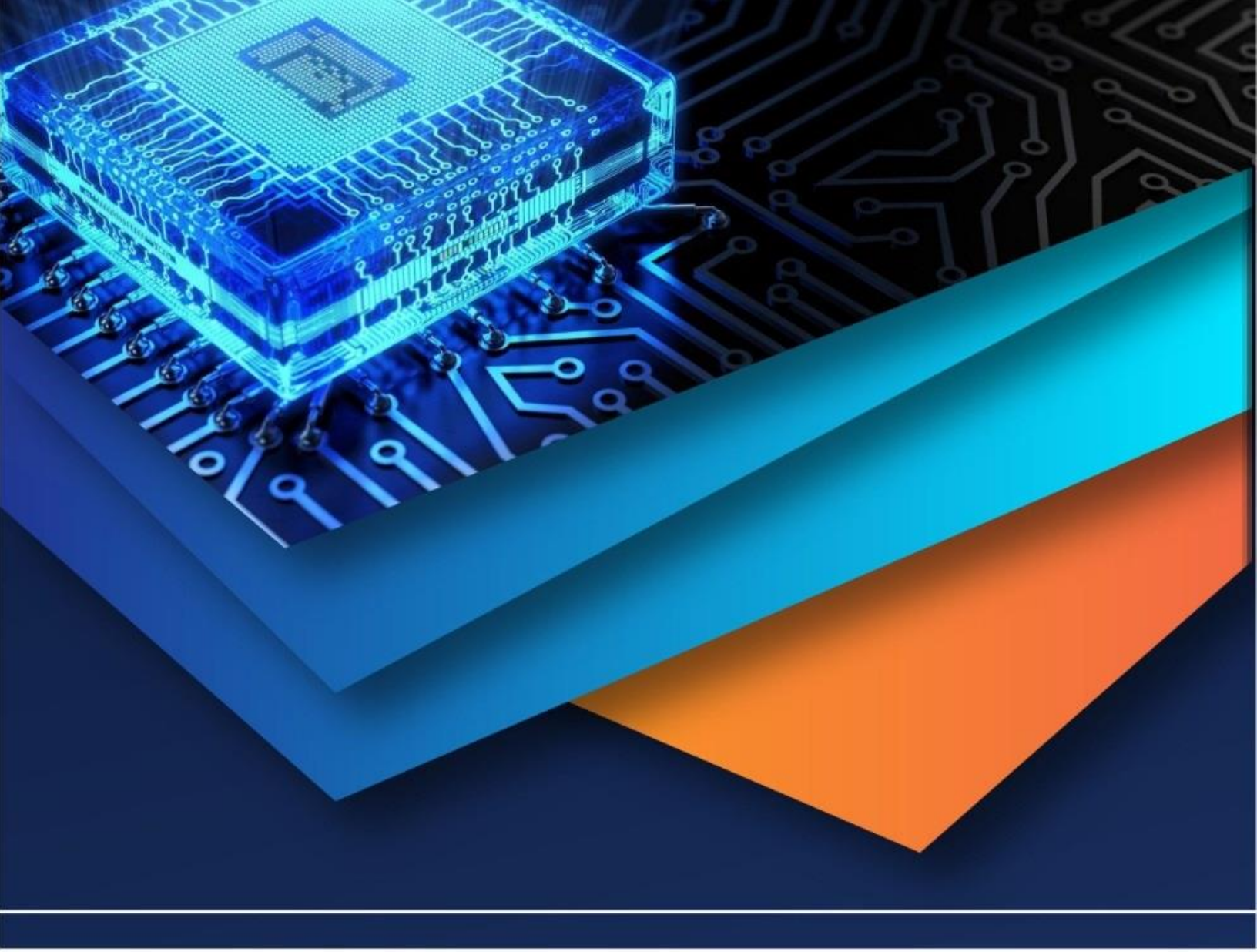
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