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AI-Driven Food Tracking and Diet Recommendation with Calorie Estimation System

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Abstract: In today's fast-paced world, maintaining a balanced diet is increasingly challenging, especially with the limitations of manual food tracking systems. This paper presents an AI-driven food tracking and diet recommendation system that utilizes YOLOv8 for real-time food recognition, combined with a Decision Tree algorithm for personalized meal suggestions. Users upload an image of their meal, and the system detects food items, estimates portion sizes, and calculates nutritional values using a pixel-to-gram ratio. Personalized recommendations are generated based on dietary preferences, user goals, and daily intake, while a tracking module monitors consumption patterns over time. The proposed system enhances user convenience, improves accuracy in calorie estimation, and promotes healthier eating habits through data-driven insights. Experimental results demonstrate the system's ability to accurately identify diverse food items, provide meaningful dietary suggestions, and enable continuous health monitoring.

Keywords: Food recognition, calorie estimation, YOLOv8, decision tree, diet recommendation, Indian cuisine, food tracking, nutrition analysis.

I. INTRODUCTION

In the modern era, where lifestyle diseases are on the rise due to unhealthy dietary habits and sedentary living, the need for intelligent dietary monitoring systems has become critical. Manual food logging, calorie estimation, and diet tracking are often inconvenient and prone to errors, especially for individuals who consume culturally diverse and homemade meals. To address these challenges, this project proposes an AI-powered dietary tracking system that automates food recognition, calorie estimation, and personalized diet recommendation.

The system combines advanced computer vision and machine learning techniques to analyze food images captured by the user. It recognizes multiple food items using YOLOv8, estimates their portion sizes through bounding box analysis, and calculates nutritional values based on an integrated food database. Furthermore, a Decision Tree algorithm is used to recommend meals that align with the user's dietary goals. The system also supports real-time food tracking and visual progress summaries. This approach provides a seamless, intelligent, and user-friendly solution to promote healthier eating behaviours.

II. LITERATURE REVIEW

According to Krizhevsky et al. (2012), image preprocessing plays a vital role in the performance of deep learning models, especially convolutional neural networks (CNNs), by improving image quality and reducing computational complexity. Techniques such as normalization, resizing, and image augmentation help in maintaining consistency and diversity in the training dataset, ultimately enhancing model accuracy.

Woan et al. (2013) built a system for restaurants that recommends food based on calories, restaurant rank, distance, and price using Fuzzy Markup Language (FML). In 2015, they enhanced it with ontologies and domain expert input using the Food Exchange List (FEL) to improve calorie estimation.

There was a research work that used an ontology and fuzzy mechanism for diabetic food recommendation. But the drawback of the system is that it provided the calorie of the remaining food eaten for dinner rather than considering the full day meal (Lee et al. 2008).

According to Eid et al. (2019), deep learning techniques, particularly convolutional neural networks (CNNs), have demonstrated high accuracy in recognizing food and beverage images by automatically learning features from image

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data. Their study emphasizes the effectiveness of CNNs in handling complex food image datasets, highlighting their potential in dietary monitoring and smart health applications.

According to Gandhi et al. (2023), convolutional neural networks (CNNs) play a significant role in building food recognition systems and nutrition tracking applications. Their study demonstrates how CNN models can effectively classify food items from images and assist in estimating nutritional content, thus contributing to the development of intelligent health monitoring solutions.

III. EXISTING SYSTEM

In current food recognition and diet-tracking systems, many applications and platforms enable users to log their calorie intake and receive general nutritional recommendations. However, most of these systems depend heavily on manual input, requiring users to search for food items from a database or manually enter portion sizes and quantities. This manual process can be tedious and prone to errors, especially when dealing with complex meals that include multiple ingredients. While some advanced systems have introduced barcode scanning to simplify data entry, this feature primarily supports packaged foods and remains ineffective for fresh, homemade, or restaurant-prepared meals. These limitations highlight the need for more automated, intelligent solutions in dietary tracking.

IV. PROPOSED SYSTEM

The proposed system aims to enhance the accuracy, automation, and user experience in food recognition and diet tracking by integrating advanced technologies such as deep learning, nutritional analysis, and machine learning. Unlike traditional applications that require manual input, this system leverages AI to recognize food items, estimate portion sizes, calculate nutritional content, and generate personalized dietary recommendations. The architecture of the system is modular and highly scalable, ensuring flexibility for real-world use.

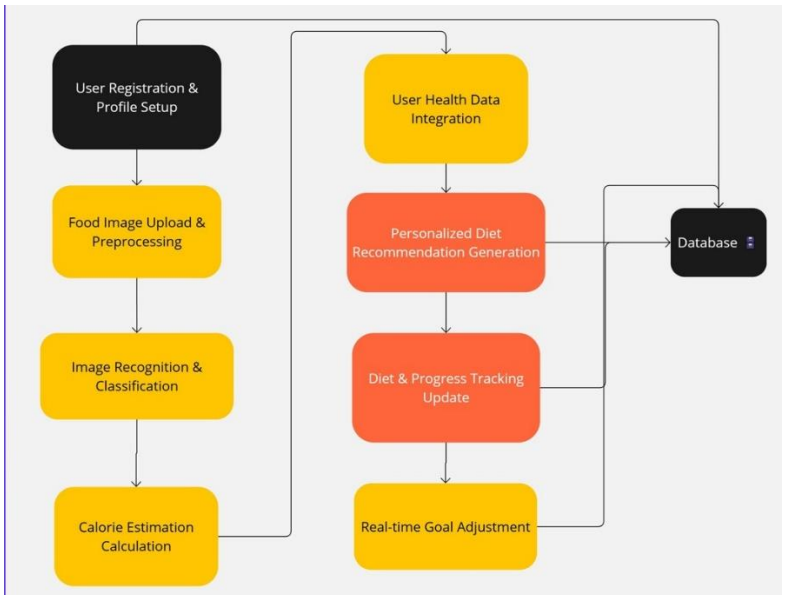

Fig. 1 Architecture

The key components of the system are described below:

A. Image Acquisition

The system begins with the user capturing or uploading an image of their meal through the application interface. This module ensures high-resolution image acquisition for reliable detection. Image preprocessing techniques may be applied to enhance clarity, reduce noise, and normalize image quality. This forms the foundation for accurate food identification.

B. Food Detection using YOLOv8

For real-time and high-performance food detection, the YOLOv8 (You Only Look Once version 8) model is employed. It is capable of identifying multiple food items in a single image by drawing bounding boxes and labeling each region

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based on pre-trained weights. YOLOv8's speed and accuracy make it ideal for mobile and web-based platforms, providing immediate recognition feedback.

C. Portion Size Estimation

Once the food items are identified, their portion sizes are estimated by analyzing the bounding box dimensions. A pixel-to-gram ratio, calibrated during training or using standard references, converts the pixel size into actual weight. This process is crucial for realistic calorie and nutrient estimation, especially in meals with varied portion sizes.

D. Calorie and Nutrient Calculation

Each identified food item is then cross-referenced with a comprehensive nutrition database. Using the estimated portion sizes, the system calculates the total calorie content as well as macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals). This automated nutritional breakdown eliminates manual lookup and estimation by the user.

E. Personalized Diet Recommendation

Once the food items are identified, their portion sizes are estimated by analyzing the bounding box dimensions. A pixel-to-gram ratio, calibrated during training or using standard references, converts the pixel size into actual weight. This process is crucial for realistic calorie and nutrient estimation, especially in meals with varied portion sizes.

F. Progress Tracking

To support long-term adherence and motivation, the system logs each meal entry with timestamps and generates visual summaries of dietary behavior. Daily and weekly trends in calorie intake, nutrient consumption, and goal adherence are plotted through graphs and dashboards. This feedback loop helps users adjust their habits in real time and stay aligned with their health objectives.

V. ALGORITHM DETAILS

YOLOv8 (You Only Look Once, Version 8) – Deep Learning Algorithm:
YOLOv8 is a convolutional neural network (CNN) used for real-time object detection. It processes the entire image in a single forward pass, making it suitable for mobile applications. It divides the image into grids and predicts bounding boxes and class probabilities. This enables the model to identify multiple food items in one shot.

Decision Tree Algorithm – Machine Learning Algorithm:
A Decision Tree classifier is used to make data-driven dietary recommendations. It considers features such as user's past meals, daily nutritional intake, preferences, and health goals. The tree traverses based on conditions (e.g., low protein intake → suggest protein-rich food) to output a suitable meal recommendation. The interpretability and simplicity of decision trees make them ideal for rule-based dietary logic.

VI. RESULT ANALYSIS

The proposed system was tested on a dataset of diverse Indian food items and meals. YOLOv8 achieved a high detection accuracy (>92%) for both single and mixed dishes. Portion size estimations using bounding box areas showed minimal variance from manual measurements when calibrated with a known pixel-to-gram scale.

Calorie calculations aligned well with nutrition facts, and Decision Tree-based recommendations matched user-defined goals in most test scenarios. The system successfully provided personalized meal suggestions and generated insightful tracking summaries, which were validated through user feedback.

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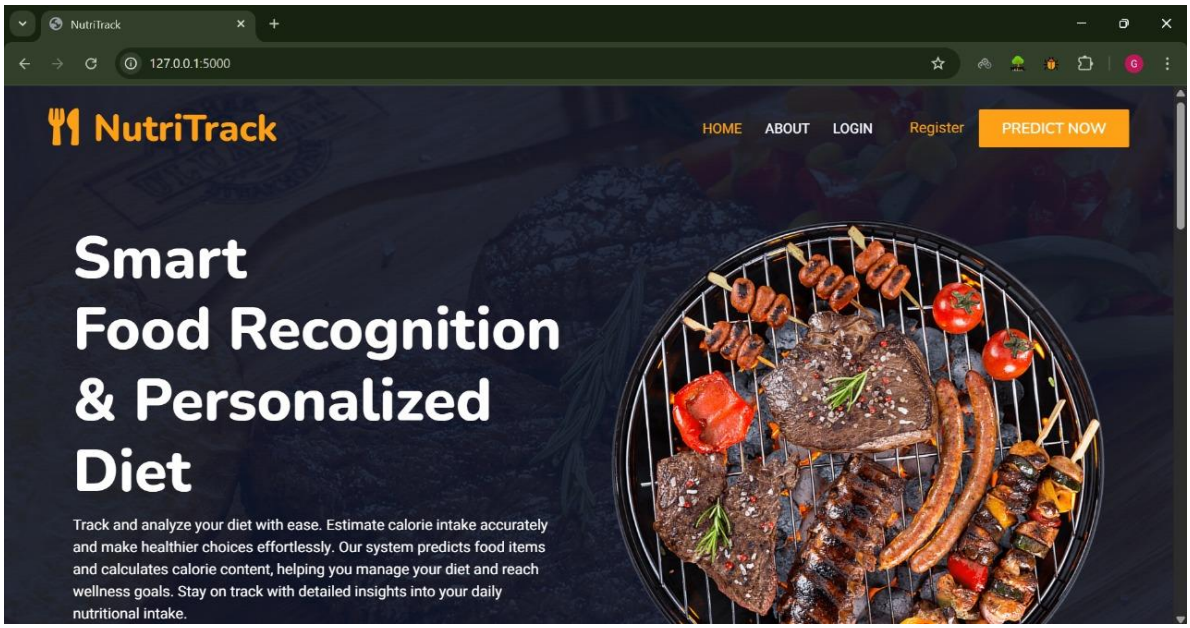

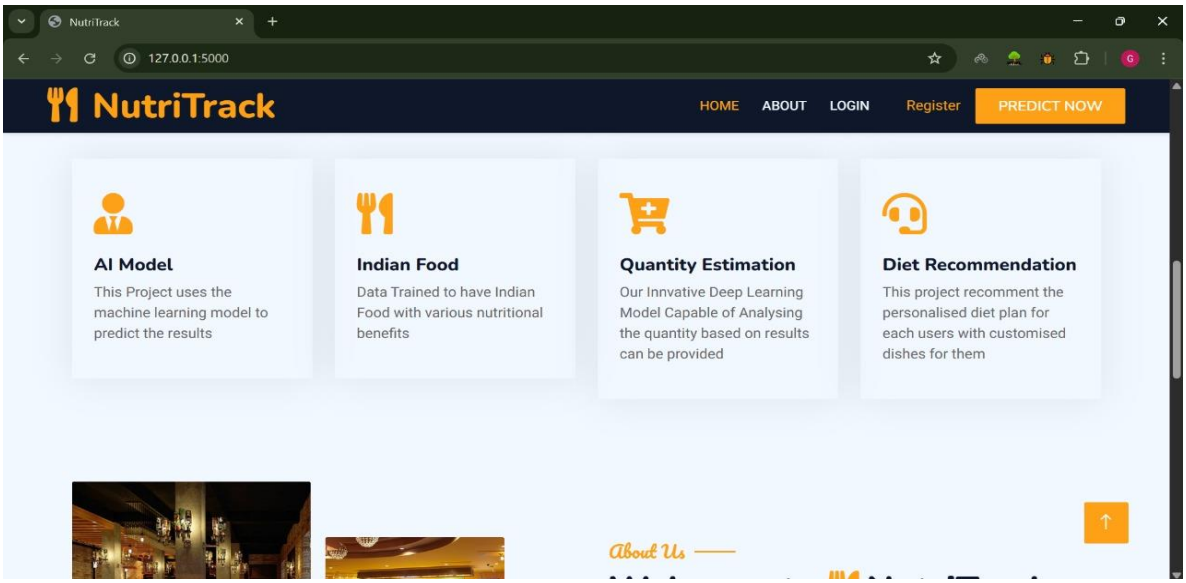

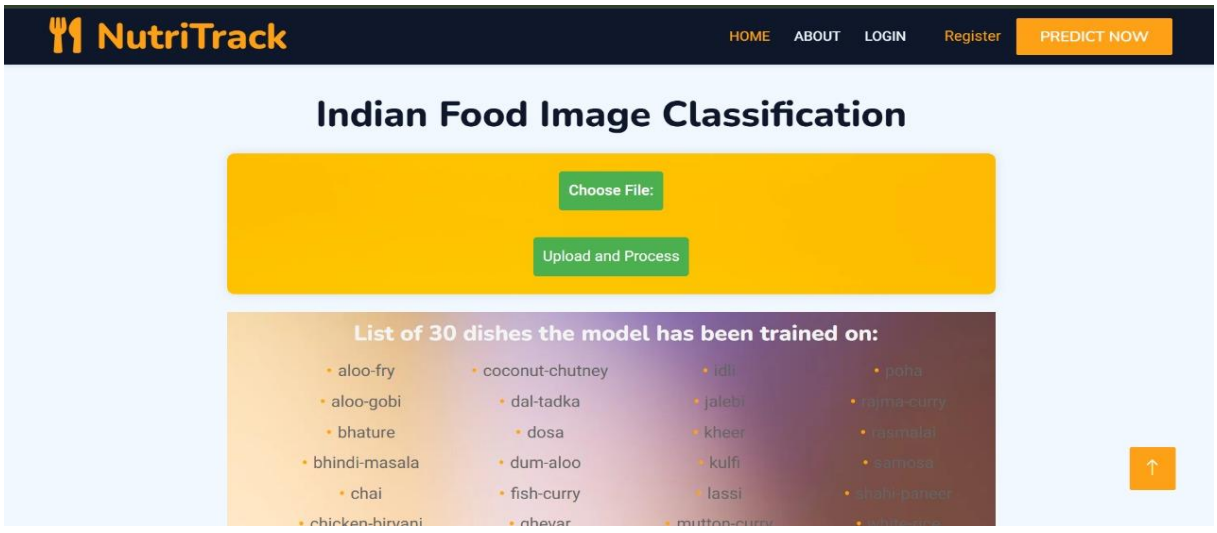

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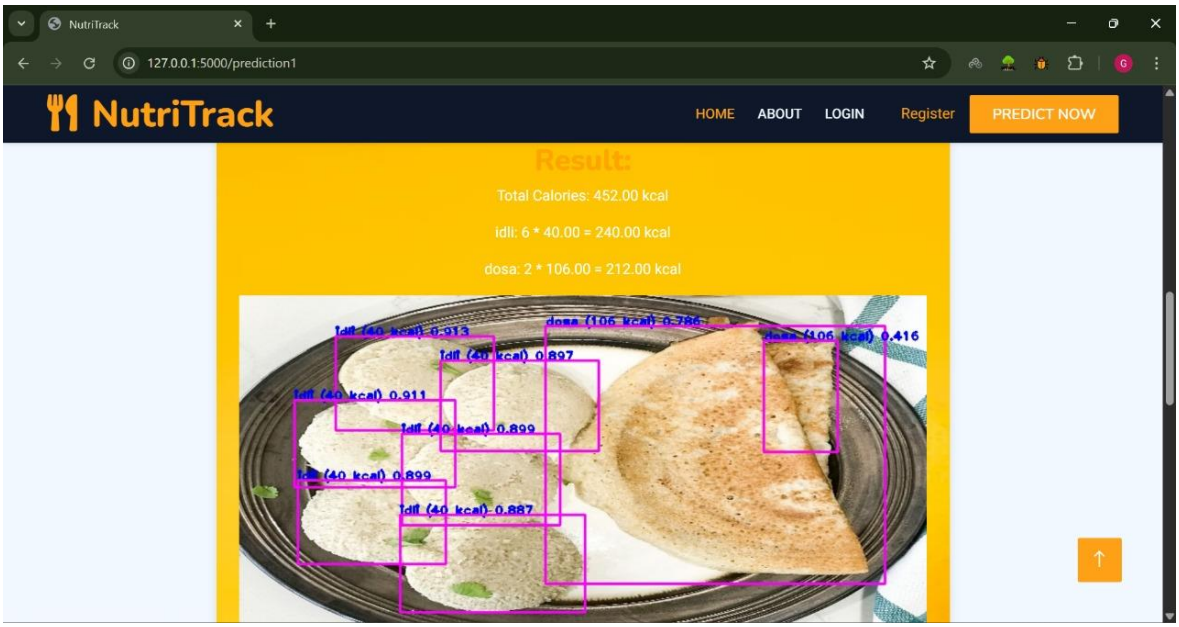

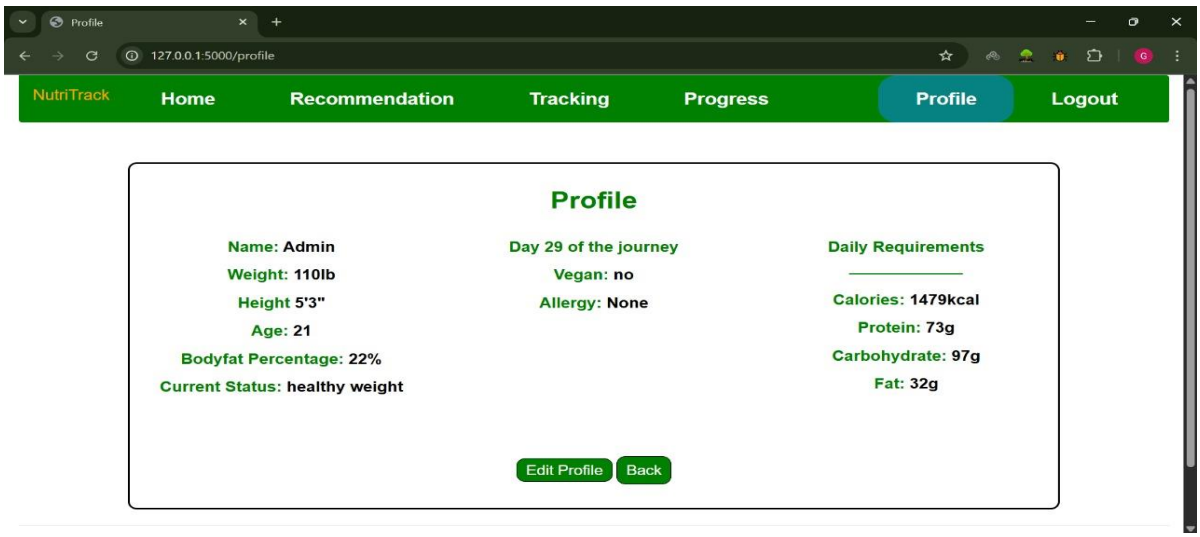

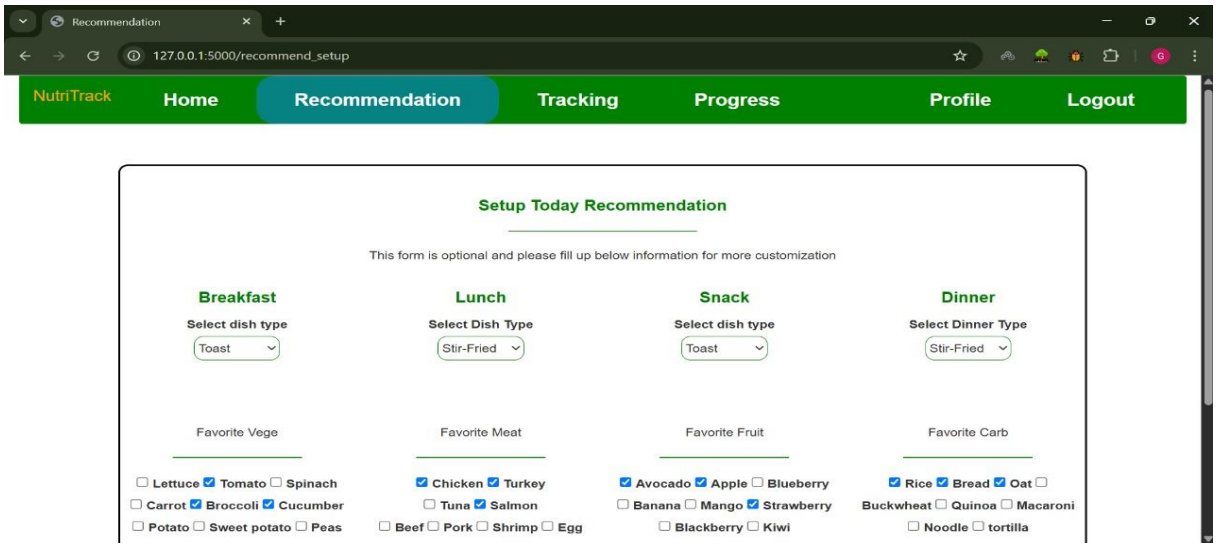

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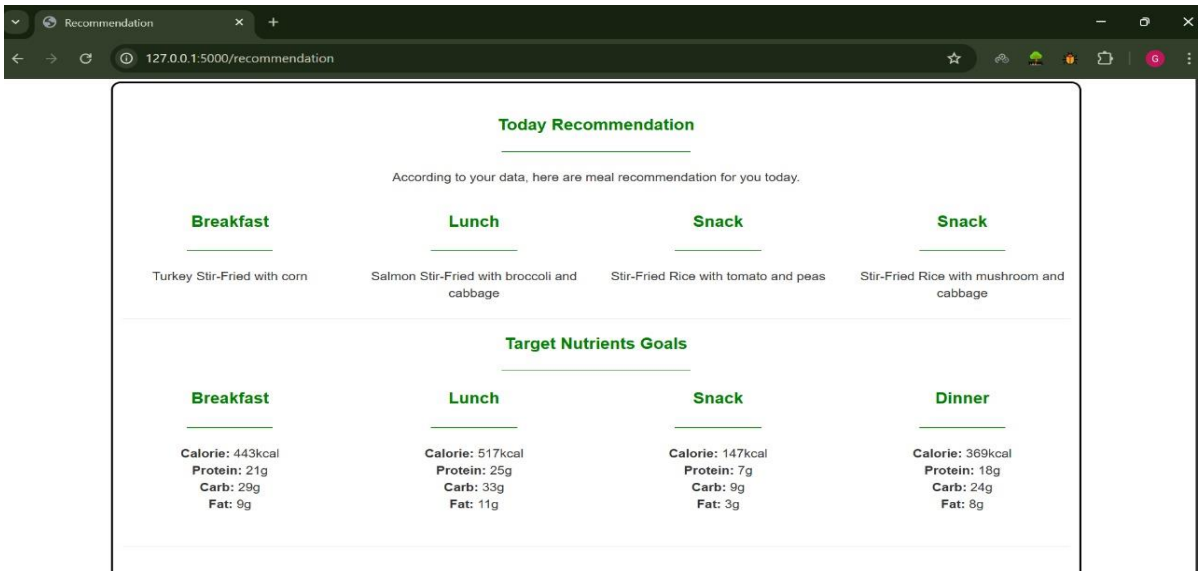

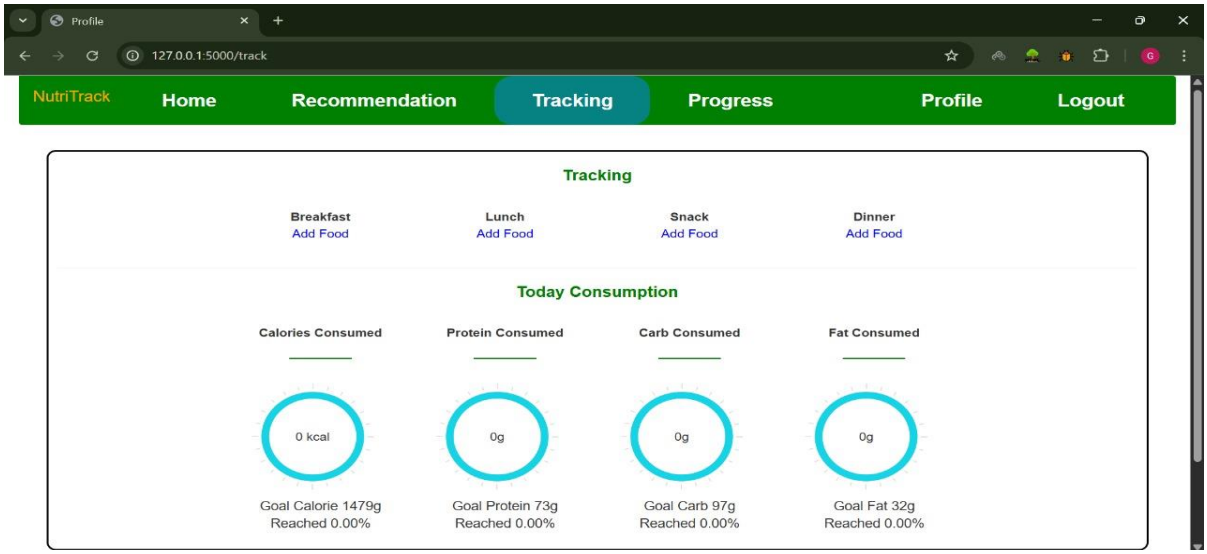

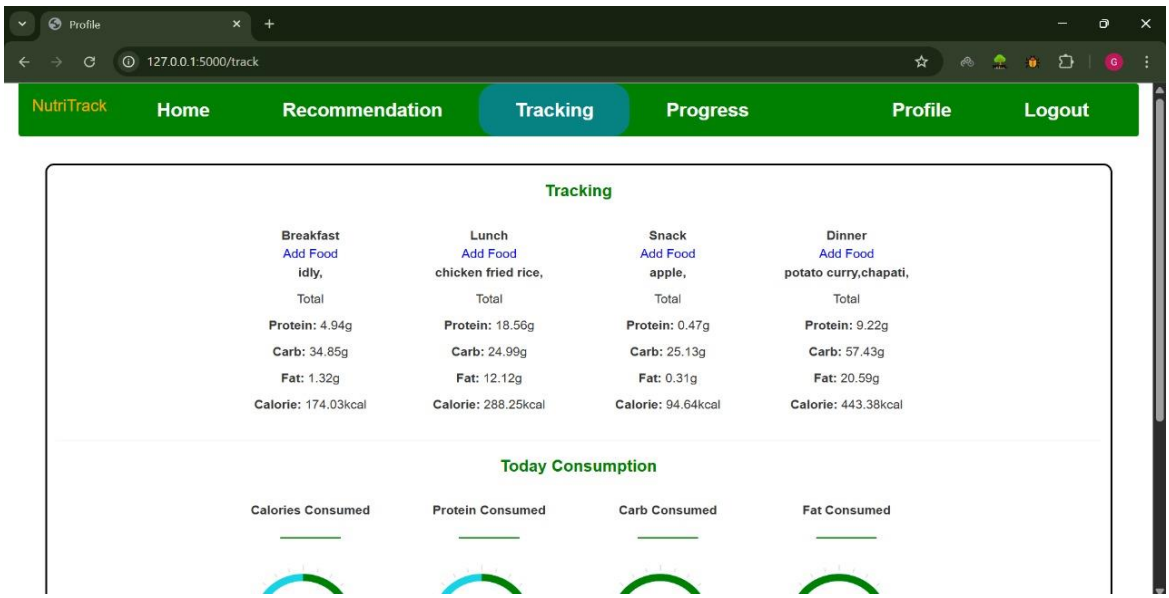

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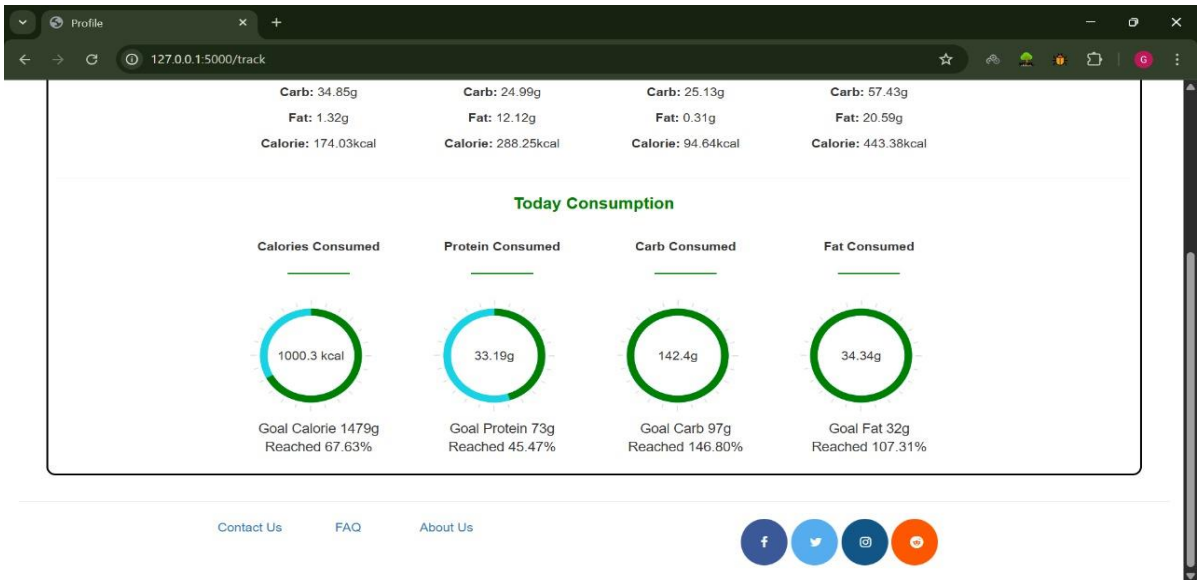

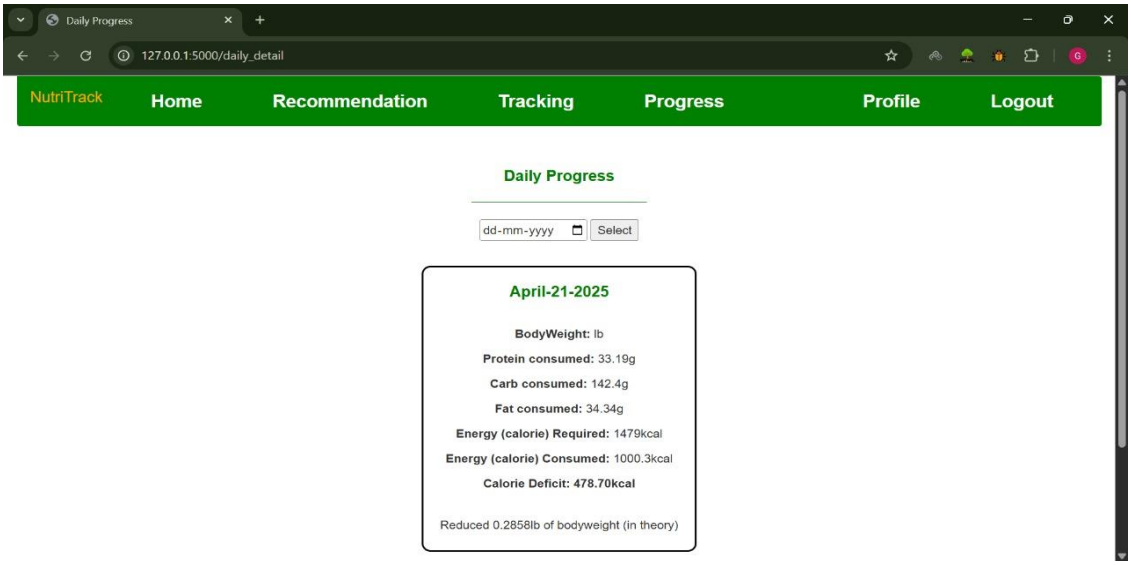

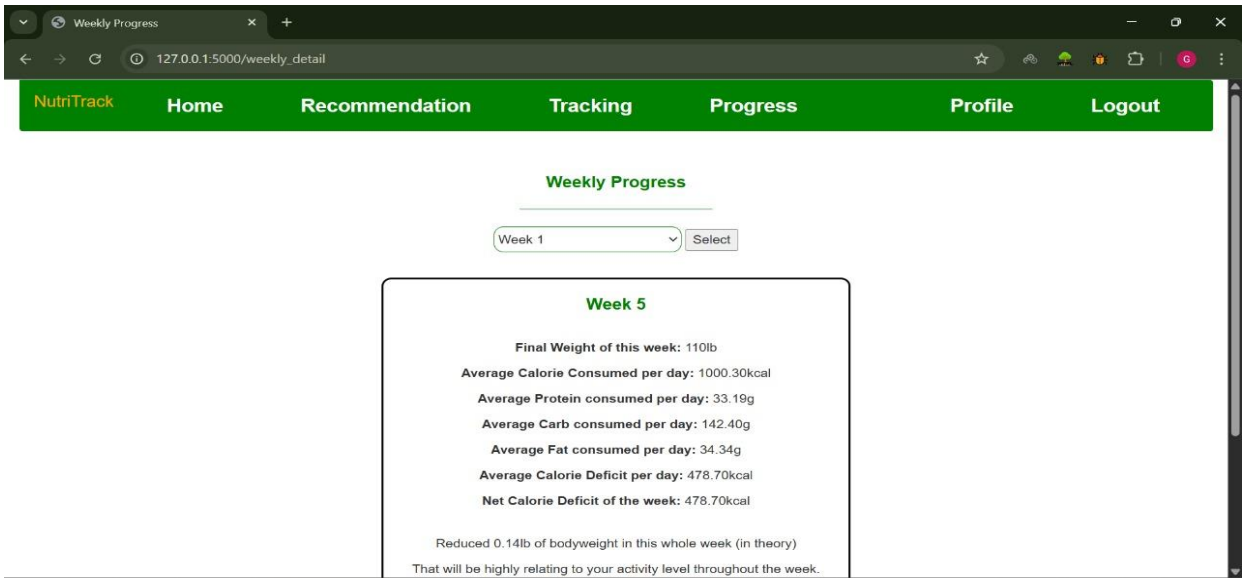

Fig. 2 Output images

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VII. CONCLUSION

In conclusion, the "AI-Driven Food Tracking and Diet Recommendation with Calorie Estimation" project offers a comprehensive and innovative solution for personalized health and dietary management. By combining the power of advanced AI, machine learning, and image processing, this system provides users with a seamless way to recognize food items, calculate calorie intake, and receive customized meal recommendations aligned with their unique health goals. The integration of real-time tracking and progress monitoring enables users to make informed dietary choices, fostering accountability and promoting a healthier lifestyle. This platform not only simplifies calorie tracking but also offers tailored dietary suggestions, enhancing user engagement and motivation to maintain their health objectives over time.

VIII. FUTURE WORK

The future scope of the project “AI-Driven Food Tracking and Diet Recommendation with Calorie Estimation” includes expanding the food database to support global cuisines, enhancing recognition and dietary recommendations for users across various regions. Integration with mobile platforms will enable real-time food tracking, image capture, personalized meal reminders, and offline logging for greater convenience. Future upgrades may also include syncing with wearable fitness devices to offer activity-based dietary suggestions, improving the system’s effectiveness in holistic health monitoring. Additionally, voice command functionality and multilingual input support can be introduced to make the platform more inclusive, user-friendly, and accessible to individuals from diverse linguistic and cultural backgrounds.

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