Machine Learning Based Nutrition and Diet Planning Web Application

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Abstract- This project introduces a web-based application that provides personalized nutrition and diet planning using machine learning. Developed with Python and Streamlit, the system ensures a user-friendly interface supported by secure authentication. Users create detailed health profiles that enable accurate BMI, BMR, and calorie requirement analysis. Machine learning models built with TensorFlow and scikit-learn generate customized meal plans tailored to goals such as weight loss or muscle gain. The system improves its recommendations over time by learning from user feedback and dietary habits. Additional features like weight tracking, yoga suggestions, and lifestyle tips enhance long-term wellness. A comprehensive nutrition guide educates users about macro and micronutrients. The food diary helps users monitor daily intake for better consistency. A curated directory of health professionals supports expert guidance when required. Overall, the project demonstrates how machine learning can deliver practical and personalized diet planning to diverse users.

Keywords: Machine learning, python, streamlit tensor flow scikit-learn.

I. INTRODUCTION

The Nutrition & Diet Planning application is an AI-powered health management system built using Stream lit that combines modern technology with personalized nutrition guidance. The application provides a comprehensive suite of features including BMR (Body Metabolic Rate) calculations, personalized meal planning, and AI-driven diet recommendations. It utilizes machine learning algorithms to analyze user profiles, including factors such as age, weight, height, activity level, dietary preferences, and health conditions to generate customized meal plans.

The system also includes advanced features like food diary tracking, weight goal monitoring, and specialized diet recommendations for various health conditions. The system is designed with user experience as a priority, featuring an intuitive interface that makes advanced nutritional guidance accessible to everyone regardless of their technical background. Through secure user authentication and comprehensive profile management, users can safely store their health information and track their progress over time.

This paper presents a web-based nutrition and diet planning system powered by machine learning. It outlines how user health data is analyzed to generate personalized meal plans and adaptive wellness support.

The paper demonstrates the effectiveness of integrating ML, health assessment tools, and user-friendly design for improved dietary management.

Our key contributions are:

[1] Development of a Machine Learning–Driven Diet Planning System - Implemented ML models using TensorFlow and scikit-learn to analyze user health data and generate tailored diet recommendations.

[2] Integration of Comprehensive Health Assessment Tools - Included BMI, BMR, calorie calculators, and nutrition analysis within a unified platform to support informed decision-making.

[3] Secure and Personalized User Experience -
Used password hashing and profile-based customization to ensure privacy and personalized interactions.

[4] User-Friendly Streamlit Interface -
Developed a clean, interactive, and accessible UI to promote long-term engagement.

II. LITERATURE SURVEY

[1] "An Advanced Deep Learning Approach for Dietary Recommend actions using ROBERA"
Authors: Bajjuri Usha Rani,Terli Joshna Valli, Betha Srikanth Reddy, Atluri Sreelaasya.
Published in: IEEE Preprint , Year: 2024
This paper presents an advanced deep learning approach for dietary recommendations using the RoBERTa model to analyze user-specific textual data. It demonstrates how RoBERTa can interpret dietary preferences, health metrics, and lifestyle information to generate highly personalized nutritional suggestions.
The paper also discusses the model's limitations, particularly its challenges in understanding complex dietary contexts such as medical conditions or unique lifestyle factors.

[2] "CHARLIE: A Chatbot That Recommends Daily Fitness and Diet Plans"
Authors: Deepanjali Chowdhury, Ahana Roy, Nirmalya Roy.
Published in: IEEE Preprint , Year: 2023
This paper presents CHARLIE, an intelligent chatbot designed to recommend daily diet and fitness plans by analyzing a user's schedule and personal data.
It utilizes datasets such as food.csv and nutrition_distribution.csv to generate customized nutritional and activity suggestions aligned with user routines.
The paper also highlights limitations, noting that CHARLIE may struggle with complex or nuanced inputs like emotional eating habits or culturally specific food practices.

[3] "An AI Based Approach for Personalized Nutrition and Food Menu Planning."
Authors: Khalid Azzimani, Hayat Bihra, Asma Dahmi
Published in: IEEE Preprint , Year: 2022
This paper presents an AI-based framework for determining individual nutritional needs and generating personalized food menu plans using processed dietary datasets. It introduces a method that leverages artificial intelligence to tailor meals for patients based on specific nutritional requirements drawn from datasets like Cleaned_Data_Final.csv and All_Diets.csv.
The paper also discusses challenges such as incomplete or inaccurate datasets and the lack of universal applicability and equity in personalized nutrition models.

[4]"Virtual Dietitian: A Nutrition Knowledge Based System Using Forward Chaining Algorithm"
Authors: Manuel B. Garcia, JoelB. Mangaba, Celeste C. Tanchoco
Published in: IEEE Preprint , Year: 2021
This IEEE paper presents Virtual Dietitian, a nutrition knowledge-based system that uses a forward-chaining algorithm to provide dietary guidance based on validated sources such as USDA nutrient databases and clinical nutrition guidelines. It evaluates the system through beta testing, where users achieved an 85% task completion rate with efficient interaction times, supported by expert feedback. The paper also identifies limitations, noting that rule-based forward chaining may fail to adapt to complex or unforeseen dietary scenarios beyond predefined rules.

III. BLOCK DIAGRAM

The hardware architecture of the proposed nutrition and wellness recommendation system is designed to support efficient computation, seamless data processing, and smooth user interaction. At the core, the system relies on a central processing unit (CPU) that executes calculations such as BMR, calorie estimation, and AI-driven diet plan generation. The system memory (RAM) provides temporary storage for user inputs, health profile data, and machine learning operations, ensuring fast retrieval and processing. A local storage unit or database server is used to store user profiles, nutrition datasets, diet types, yoga information, and doctor contacts. The system also utilizes network hardware, including Wi-Fi or Ethernet modules, to connect the front-end interface with the back-end server and enable features like messaging, email functions, and cloud synchronization. Input devices such as keyboards, touchscreens, or smartphones allow users to enter their health data and navigate the interface, while output devices like monitors or mobile displays present meal plans, nutrition analysis, and yoga recommendations. If deployed on a server-based environment, a cloud infrastructure (e.g., AWS, Azure, or Google Cloud) handles large-scale computation for AI diet generation and ensures high availability.

Fig : Block diagram of Diet planning web application

A. Hardware Requirements:

1) Server-Side Requirements:
Processor: Multi-core CPU (Intel Core i5/i7 or equivalent AMD processor)
RAM: Minimum 8GB, recommended 16GB for optimal performance
Storage: At least 50GB SSD storage for application files, database, and user data
Network: Stable internet connection with minimum 10Mbps upload/download speeds

2) Development Environment:
Processor: Intel Core i5/i7 or equivalent (2.5GHz or higher)
RAM: 8GB minimum, 16GB recommended for machine learning model training Software Requirements.
Storage : 256GB SSD for development tools and codebase.

Graphics: Integrated graphics sufficient; dedicated GPU beneficial for ML training.
Display: 1920x1080 resolution or higher.

3)End-User Requirements
Any device with a modern web browser (desktop, laptop, tablet, or smartphone)
Minimum4GB RAM recommended for smooth experience Stable internet connection

B. Software Requirements:

1) Web Framework:
Streamlit - Frontend framework for creating interactive web applications with Python.

2) Machine Learning Libraries:
TensorFlow - Deep learning framework for neural network implementation.
scikit-learn - Machine learning library for classification and regression algorithms.
NumPy - Numerical computing library for array operations.
Pandas - Data manipulation and analysis library.

3) Data Visualization:
Plotly - Interactive plotting library for nutritional charts and graphs.
Matplotlib - Static plotting for data visualization.
Seaborn - Statistical data visualization enhancement.

4) Authentication and Security:
Hashlib - Built-in Python library for password hashing.
uuid - Unique identifier generation for user sessions.
JSON - Data storage and configuration management

5) Development Tools:
Git - Version control system for code management.

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6) Server Configuration:

Streamlit Configuration – Custom server settings for deployment.

Environment Variables - Secure configuration management.

7) Database Management:

JSON-based storage-Lightweight data persistence for use profiles.

IV. METHODOLOGY

The methodology of the machine-learning-based nutrition and diet planning web application involves collecting reliable nutritional datasets from sources like preprocessing them by cleaning, normalizing units, and engineering useful features. User inputs such as age, gender, height, weight, activity level, dietary preferences, and health goals are gathered through a Streamlit interface to calculate BMR, and daily calorie requirements. Machine learning models such as clustering, decision trees, or regression are developed using Python to classify foods, predict nutrient suitability, and optimize meal combinations. The recommendation engine then filters foods and generates personalized diet plans based on calorie targets and macro-nutrient balance. Python handles backend logic, model training, and data processing, while Streamlit provides an interactive UI for input collection and result visualization. Finally, system performance is evaluated, and user feedback is incorporated for continuous improvement and refinement of diet recommendations.

Additionally, the system employs model validation techniques and hyperparameter tuning to ensure high predictive accuracy and robustness. Visualization modules are integrated to display nutrient breakdowns, calorie distribution, and meal summaries in an intuitive manner. Modular code architecture is followed to separate data handling, machine learning, and interface components for easier maintenance.

V. FLOW CHART

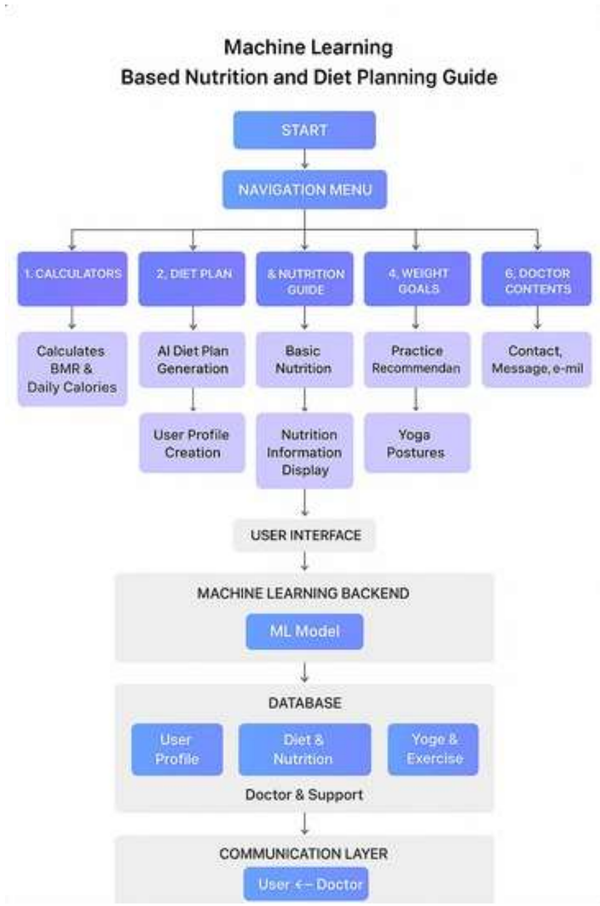


Fig : Flow chart of nutrition and diet planning web application

VI. IMPLEMENTATION

The implementation of the nutrition and diet planning system is carried out using Python for backend processing and Streamlit for building the interactive web interface. User inputs collected through Streamlit widgets are processed in real time to compute calorie requirements and generate personalized recommendations. The ML model predicts suitable food options, which are further refined by the rule-based recommendation logic.

Frontend

The frontend embraces a modern, health-focused aesthetic with a clean interface that prioritizes user experience. The design uses calming green tones associated with health and wellness.

1) Responsive Layout System:
Mobile-First Approach - Designed primarily for mobile users, then scaled up for larger screens.
Flexible Grid System - Adapts seamlessly across devices from smartphones to desktop computers.
Touch-Friendly Elements - Large buttons and interactive areas optimized for finger navigation.

2) Navigation Structure:
Sidebar Navigation - Persistent menu providing quick access to all 7 core modules. Quick Action Bar - Frequently used features readily accessible from any page.
Search Functionality - Global search across nutrition database and user content

3) Dashboard Interface:
Personalized Welcome Screen - Displays user name, current goals, and daily progress.
Widget-Based Layout - Modular components that users can customize and rearrange.
Progress Indicators - Visual representations of health goals and achievements.

4) Data Visualization:
Interactive Charts - Plotly-powered graphs showing nutrition trends and progress.
Pie Charts - Macronutrient distribution with hover details.
Progress Bars - Goal completion status with animated fill effects.
Comparison Views - Before/after visualizations and target vs. actual metrics.

5) Accessibility Implementation:
Screen Reader Support - Proper ARIA labels and semantic HTML structure.
Keyboard Navigation - Full functionality accessible via keyboard shorts.

Fig : Log in page

Backend

Centralized Application Logic:
Collects and validates user inputs.
Processes health metrics (like BMI).
Loads and uses machine learning models for diet recommendation.
Handles user registration and login with security measures.
Stores user data and logs using JSON files.
Generates personalized charts and visual feedback.

1) Backend Architecture

User Management Module:
Handles registration, authentication (login/logout), and profile storage.
Stores details such as age, gender, height, weight, and activity level.

Machine Learning Module:
Uses trained ML models to predict calorie and nutrient requirements based on user input.
Provides personalized diet recommendations and daily intake goals.
Continuously improves accuracy as more user data is collected.

Data Storage and Management:
All user records, nutrition databases, and tracking history are stored in structured tables.
SQL queries (or ORM tools) are used to retrieve and update data efficiently.

API Integration Layer:
Facilitates interaction between the frontend (Streamlit UI) and backend logic.
Handles communication between user inputs, prediction functions, and database queries.

Analytics and Visualization Layer:
Generates visual dashboards to display progress trends.
Converts raw data into insights using Plotly and other visualization tools.

2) Key Backend Functionalities
User Data Processing: Collects and validates personal and dietary information. Nutrient Prediction: Uses machine learning models to calculate daily nutritional requirements.
Meal Recommendation: Suggests food items or diet plans that match calorie and macronutrient goals.
Data Storage: Saves user logs, progress, and preferences in the database.
Progress Tracking: Compares user's current data with past records and goals.
Search & Filter Functions: Allows users to explore nutrition databases quickly.

3)Performance & Security Features
Caching: Frequently accessed data (like food items) can be cached for faster access.
Data Validation: Ensures that user inputs are within safe and logical ranges.
Authentication: Uses hashed passwords or session tokens to secure user accounts.
Error Handling: Graceful handling of missing data or invalid inputs.
Scalability: Can easily integrate external APIs or cloud databases for larger user bases.

VII. RESULT AND FUTURE SCOPE

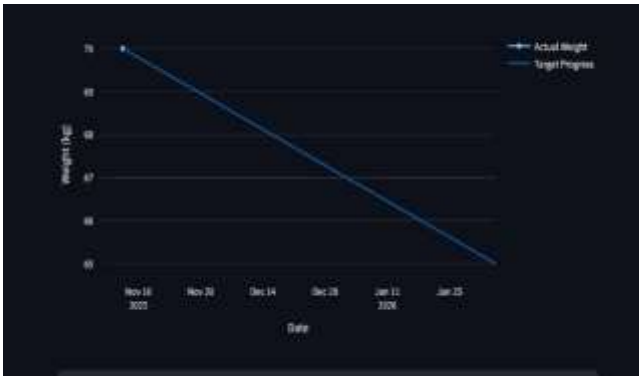
1) Nutrition Calculator

The Nutrition Calculator is a core component of the system designed to provide users with accurate and personalized insights into their daily energy requirements. By collecting essential personal data such as age, gender, weight, height, and activity level, the calculator computes the Basal Metabolic Rate (BMR)—the minimum number of calories the body needs to perform basic physiological functions such as breathing, circulation, and cell production. Building on this, the module also determines the Total Daily Calorie Needs by adjusting the BMR based on the user's physical activity level, thereby offering a realistic estimate of the calories needed to maintain current body weight.

2) Food Diary

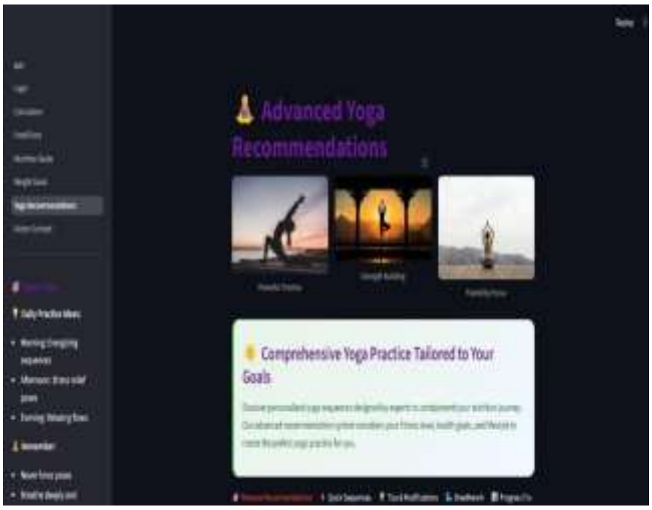
The Food Diary module serves as an essential component of the health management system by allowing users to systematically record and monitor their daily food intake. As users log each meal, the system automatically analyzes the nutritional content and computes the breakdown of key macronutrients, including carbohydrates, proteins, and fats, along with the total calorie count for the day. This module not only helps users stay aware of what they consume but also enables them to identify patterns in their eating habits, such as nutrient deficiencies or excessive calorie intake.

3) Weight Goals



The Weight Goals module is designed as a comprehensive and motivational tool that assists users in setting realistic body weight targets and systematically tracking their progress over time. When users enter their current weight, goal weight, and periodic updates, the system records each entry and automatically generates a dynamic line chart that visualizes their weight trend. This graphical representation provides users with a clear, continuous overview of how their weight is changing, making it easier to identify patterns such as consistent improvement, stagnation, or fluctuations. In addition to visual tracking, the module encourages users to adopt a goal-oriented mindset by breaking down their fitness journey into measurable milestones.

4) Yoga Recommendations



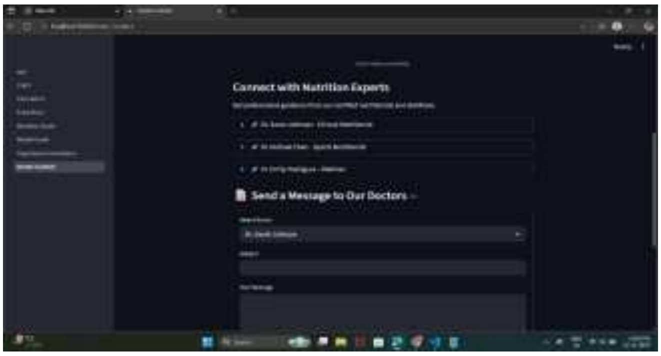
The Yoga Recommendations module provides users with customized yoga routines that are thoughtfully aligned with their nutritional profile, fitness goals, and overall wellness needs. By evaluating factors such as the user's daily activity level, health targets, preferred intensity, and personal comfort, the module intelligently suggests specific yoga practices tailored to individual requirements. These may include calming and restorative sessions for relaxation, strength-oriented flows for muscle development, or flexibility-focused routines that enhance mobility and posture. Each recommendation is designed to support both physical improvement and mental clarity.

The Doctor Contact module serves as a vital communication bridge between users and certified nutrition experts, ensuring access to reliable, professional guidance within the application. This module allows users to reach out to qualified dietitians or nutritionists by selecting a preferred doctor, specifying the subject of their concern, and composing a detailed query related to diet, health issues, or personalized nutritional needs. Users can also securely share their contact information to enable follow-up consultations or expert responses.

FUTURE SCOPE

The Nutrition-Based Diet Planning Guide can be further enhanced with several advanced features to improve user experience, personalization, and overall system intelligence. With AI-driven recommendation systems, the platform can learn from user habits, medical conditions, and progress patterns to deliver highly tailored meal plans and lifestyle suggestions. Connecting the system to wearable devices would enable real-time monitoring of heart rate, sleep, steps, and calories burned, allowing diet recommendations to adjust dynamically throughout the day. Enhanced visual analytics such as charts, dashboards, and weekly progress summaries would help users better understand their nutritional intake and stay motivated. Future upgrades may also incorporate automated nutrient detection using computer vision so users can simply upload food photos to get accurate nutritional estimates. Additionally, an NLP-based chatbot could provide instant guidance, address diet-related queries, and support users without requiring frequent expert consultations, making the system more interactive and user-friendly.

5) Doctor Contact



VIII. CONCLUSION

Overall, this project highlights the significant value of combining Python's flexibility, data- processing capabilities, and user-friendly interfaces to create a cohesive personal health management ecosystem. The integration of visual elements such as charts and graphs makes complex health data easy to understand, enhancing user engagement and decision-making. By uniting nutrition tracking, calorie monitoring, weight management, yoga guidance, and expert consultation into a single, seamless platform, the system demonstrates how technology can empower individuals to take a proactive role in their health.

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