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Personalized Diet Recommendation System Using AI/ML

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Abstract-*Lifestyle-related diseases such as obesity, diabetes, hypertension, and heart disorders are increasing rapidly due to unhealthy eating habits and lack of personalized nutritional planning. Traditional diet charts often follow generalized recommendations that do not consider individual health metrics, medical conditions, or nutritional needs. To overcome these limitations, this paper presents a Personalized Diet Recommendation System using Artificial Intelligence (AI) and Machine Learning (ML) to generate customized diet plans based on user-specific parameters. The system analyzes inputs such as age, gender, weight, height, BMI, activity level, and medical conditions to estimate caloric requirements and recommend balanced meal plans. Multiple ML models such as Decision Tree, Random Forest, K-Nearest Neighbors (KNN), Logistic Regression, and Support Vector Machine (SVM) were trained to predict nutrient needs. The model with the highest accuracy was integrated into a web-based application for real-time diet recommendation. Experimental evaluation shows that the system provides highly accurate and personalized dietary suggestions, helping users achieve fitness goals such as weight loss, weight gain, or weight maintenance. The proposed solution demonstrates the potential of AI-driven nutrition planning to improve public health and simplify diet management.*

Keywords-Personalized Diet, Artificial Intelligence, Machine Learning, Nutrition Prediction, BMI, Health Informatics, Meal Recommendation, Web Application.

I. INTRODUCTION

Healthy dietary habits play a vital role in maintaining physical well-being and reducing the risk of chronic diseases. Many individuals struggle with selecting appropriate food choices due to the lack of knowledge about nutritional values, calorie intake, and balanced diet structures. Standard diet charts provided by fitness trainers or websites often follow a broad structure that does not account for individual differences.

Artificial Intelligence (AI) and Machine Learning (ML) have emerged as powerful tools in healthcare and nutrition analysis. ML-based diet systems can analyze large datasets, learn patterns regarding nutritional requirements, and generate tailored recommendations. These systems are capable of automating complex calculations such as calorie estimation, nutrient requirements, and BMI classification.

A **Personalized Diet Recommendation System** uses ML algorithms to predict the ideal diet plan based on user profile attributes. By analyzing personal health data, the system can recommend meals that align with nutritional needs and fitness goals such as weight gain, weight loss, or maintenance.

The primary objectives of this system are:

- To predict daily calorie requirements using ML models.
- To classify users into categories such as underweight, healthy, overweight, and obese.
- To generate personalized diet plans based on BMI, activity level, and health conditions.
- To provide a user-friendly web application for easy interaction.

This research focuses on building an intelligent nutritional system capable of improving lifestyle and health using AI techniques.

II. LITERATURE REVIEW

Many researchers have contributed to AI-based dietary recommendation systems and nutrition prediction models.

Sharma et al. [1] developed a machine learning-based calorie prediction model using Decision Trees and achieved high accuracy in daily calorie estimation. Their model demonstrated the importance of anthropometric data in nutrition planning. P. Kumar et al. [1] AI-powered dietary recommendation using socio-economic indicators‖ in 2023: Focuses on the integration of socio-economic variables like income and occupation into predictive models. The work demonstrates how combining health attributes with lifestyle and social indicators improves diet recommendation systems. Kumar et al. [3] implemented an SVM-based diet suggestion system to classify user health categories such as underweight, normal, or obese, providing basic meal charts accordingly. Li et al. [4] created an AI-based nutrition advisor using neural networks to recommend micronutrient-balanced diets. Their work highlights the significance of data-driven nutritional planning. Reddy et al. [5] designed a smartphone-based food detection and

calorie estimation system using CNN. Their solution showed that automated caloric detection is possible with image processing. Ahmed and Das [6] developed a hybrid AI model combining ML algorithms and rule-based systems for diabetes-friendly diet recommendations.

These studies show that AI-driven dietary systems significantly improve personalized nutrition management. The proposed system integrates ML models with rule-based diet recommendations to enhance accuracy and usability.

III. PROBLEM STATEMENT

Individuals lack knowledge of their exact daily calorie requirements and nutritional needs. Traditional diet charts fail to consider personal differences such as age, activity level, BMI, and medical conditions. Manual nutrition planning is time-consuming and requires expertise.

Thus, there is a need for an AI-based personalized diet recommendation system that automatically analyzes user data, predicts nutritional requirements, and generates diet plans tailored to individual health profiles.

IV. METHODOLOGY

The proposed diet recommendation system is developed using a structured methodology involving data collection, preprocessing, model training, and deployment.

A. Data Collection

The dataset consists of user attributes such as:

- Age
- Gender
- Weight
- Height
- BMI
- Activity Level
- Health Goal (weight gain/loss/maintenance)

B. Data Preprocessing

- Handling missing values
- Normalizing numerical attributes
- Encoding categorical attributes
- Splitting dataset into training and testing sets

C. Machine Learning Models

Multiple models were trained and evaluated:

- Decision Tree
- Random Forest
- K-Nearest Neighbors (KNN)
- Logistic Regression
- Support Vector Machine (SVM)

The model with the highest accuracy **Random Forest** was selected for the final system.

D. Prediction Parameters

The system predicts:

- BMI Class (Underweight, Normal, Overweight, Obese)
- Daily Calorie Requirement
- Macronutrient Distribution (Proteins, Carbohydrates, Fats)

E. Diet Recommendation Module

Based on the prediction:

- **Weight Loss Plan** → Low-calorie, high-fiber foods
- **Weight Gain Plan** → High-calorie, protein-rich foods
- **Maintenance** → Balanced macronutrients

F. Web Application

Built using **Flask**, providing:

- User login
- Profile submission
- Personalized diet results
- Downloadable diet report

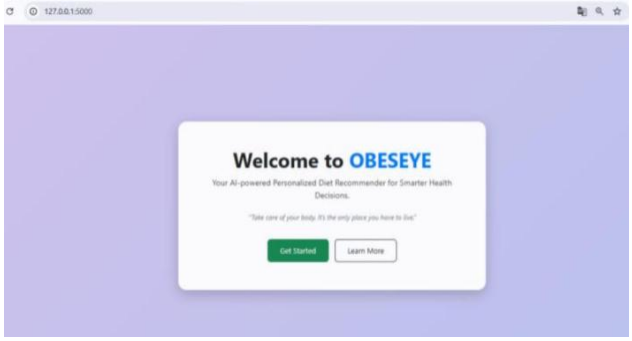

Fig - 3.1: **User Sign-Up Page**

The Home page serves as the welcome screen for the application. It introduces the system as OBESEYE - AI-powered Personalized Diet Recommender and emphasizes its goal of smarter health decision-making. The interface provides two options." Get Started," Which redirects new users to registration or login, and "Learn More," which provides extra information about the system. A motivational quote reinforces the health focus

of the platform. The clean and modern design makes it inviting for users to begin their journey

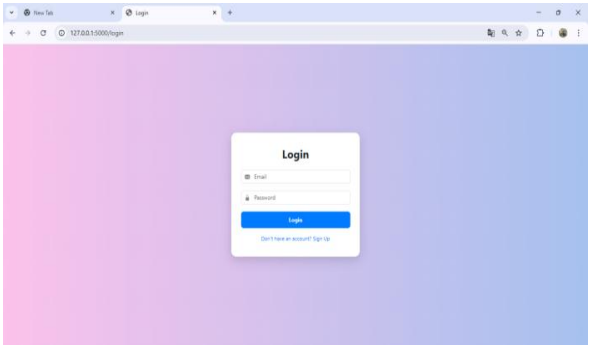

Fig - 3.2: Login Page

The Login page allows existing users to sign in using their registered email and password. On successful authentication, the system establishes a secure session, enabling personalized access to the diet prediction services. If credentials are invalid, the user is prompted to re- enter correct details. This page acts as a gatekeeper, ensuring that sensitive data and prediction results are accessible only to authorized users. The design is kept simple with a direct focus on login functionality.

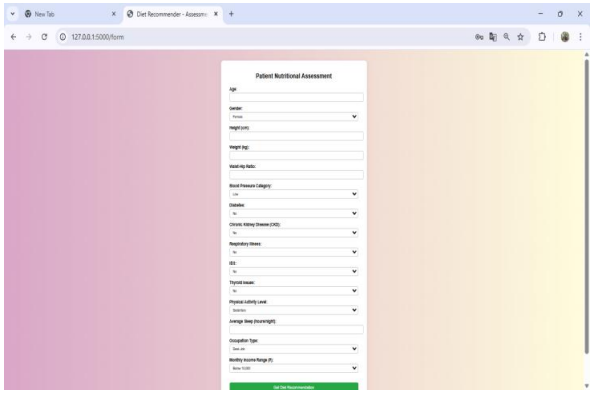

Fig - 3.3: Patient Nutritional Assessment Page

This form is the core input interface where users provide personal and health-related details. It collects information such as height, weight, gender, age, waist-hip ratio, blood pressure level, and medical conditions such as diabetes, chronic kidney disease, or thyroid disorders. Lifestyle inputs such as physical activity level, average hours of sleep, occupation type, and income level are also taken into consideration. These detailed inputs act as features for the machine learning models, which output personalized diet plans. The structured design ensures completeness and accuracy of user data collection.

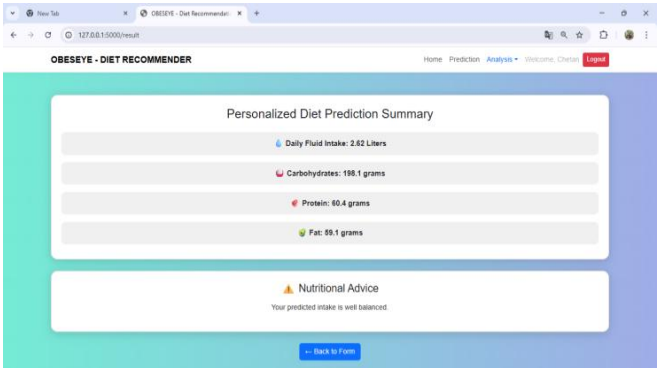

Fig - 4: - Prediction Result Page

After form submission, the user is presented with a personalized diet prediction summary. This includes calculated values for daily fluid intake, carbohydrate requirements, protein intake, and fat intake. Alongside these numerical results, the system also provides a nutritional advice message indicating whether the predicted diet is balanced or requires adjustments. The page also features a navigation bar with options to explore further analysis or to log out. This summary acts as the immediate feedback layer, giving users clear insights into their dietary needs.

V. RESULTS AND DISCUSSION

The ML models were evaluated using accuracy, precision, recall, and F1-score.

Model Performance

Model	**Accuracy**
Decision Tree	87%
Logistic Regression	83%
KNN	85%
SVM	88%
Random Forest	**92%**

Random Forest achieved the highest performance and was integrated into the diet recommendation system.

System Output

The system displays:

- User BMI status
- Recommended calorie intake
- Customized diet plan
- Breakfast, lunch, and dinner suggestions

The web interface is clean and user-friendly, allowing users to instantly view diet recommendations based on their input attributes.

VI. CONCLUSION AND FUTURE WORK

This research presents a Personalized Diet Recommendation System using AI/ML techniques. The system effectively predicts calorie requirements and generates personalized meal plans. The Random Forest model achieved the highest accuracy among all tested algorithms.

FUTURE WORK

- Integration with wearable health devices
- Real-time calorie estimation using food images
- Deep learning models for more accurate nutrition prediction
- Mobile app deployment

The system serves as a powerful AI tool for promoting healthy, personalized lifestyle management.

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