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Design of an AI-Driven Smart Restaurant Menu System for Personalized Calorie Optimization Using Health Profiles

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Abstract: ***The growing consumption of unhealthy food and lack of dietary awareness have led to increased health issues such as obesity, diabetes, and cardiovascular diseases. Traditional restaurant menus provide static information and do not consider individual health conditions or nutritional requirements. This paper proposes an AI-driven smart restaurant menu system that delivers personalized food recommendations based on user health profiles. The system collects user inputs such as age, weight, health conditions, and dietary goals, and processes this data using machine learning algorithms to suggest optimal food choices. It integrates a nutritional database, real-time calorie tracking, and intelligent recommendation mechanisms to provide healthier alternatives and alerts. Additionally, the system utilizes smart digital displays or QR-based interfaces for seamless user interaction. The proposed system aims to promote healthier eating habits, enhance user awareness, and support balanced dietary decisions in real-time restaurant environments.***

Index Terms: ***Artificial Intelligence, Smart Menu System, Calorie Optimization, Health Recommendation, Machine Learning, IoT, Personalized Nutrition, Digital Restaurant Systems***

I. INTRODUCTION

The rapid growth of the food industry and increased dependency on restaurant-based dining have significantly influenced modern lifestyle habits. While convenience and variety have improved, unhealthy eating patterns have also increased, leading to serious health conditions such as obesity, diabetes, and heart diseases. Most restaurant menus today are static and provide limited nutritional information, making it difficult for individuals to make informed dietary decisions.

With advancements in artificial intelligence and digital systems, there is an opportunity to transform traditional menu systems into intelligent platforms that can assist users in selecting healthier food options. Personalized recommendation systems have already shown success in domains such as e-commerce and entertainment, but their application in restaurant environments remains limited.

This paper proposes an AI-driven smart restaurant menu system that provides personalized food recommendations based on user health profiles. The system leverages machine learning techniques, nutritional databases, and real-time interaction interfaces to guide users toward balanced dietary choices. By integrating health awareness into the food ordering process, the proposed system aims to improve public health outcomes and enhance user experience.

II. LITERATURE REVIEW

Several research studies have explored the use of artificial intelligence and recommendation systems in healthcare and food domains. Traditional calorie tracking applications provide users with dietary insights but require manual input and are not integrated into real-time food selection environments. Existing food delivery platforms offer recommendations based on user preferences but do not consider health conditions or nutritional requirements. Some studies have proposed nutrition-aware systems that provide dietary suggestions; however, these systems often lack real-time adaptability and personalization within restaurant settings. Machine learning models have been successfully used for health prediction and dietary analysis, but their integration with live menu systems is still limited.

Furthermore, IoT-based smart systems have been introduced in restaurants for automation and digital ordering, yet they do not incorporate health-based decision-making. This highlights a gap in combining AI, health data, and smart restaurant systems. The proposed system addresses this gap by integrating personalized health analysis with dynamic menu recommendations.

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III. SYSTEM ARCHITECTURE

The proposed system architecture consists of four major layers: the user interaction layer, the application processing layer, the AI recommendation engine, and the data storage layer. The user interaction layer includes smart digital screens or QR-based mobile interfaces through which users input their health details such as age, weight, dietary goals, and medical conditions. This layer ensures a seamless and user-friendly experience. The application processing layer handles data validation, session management, and communication between different modules. It processes user input and forwards it to the AI recommendation engine. The AI recommendation engine is the core component of the system. It analyzes user health profiles along with nutritional data and applies machine learning algorithms to generate personalized food suggestions. It also identifies unhealthy options and recommends better alternatives. The data storage layer consists of a NoSQL database that stores food nutritional values, user preferences, and historical data. This layer ensures scalability and efficient data retrieval. Additionally, an optional IoT integration layer connects smart displays and restaurant systems to provide real-time updates and personalized menu rendering.

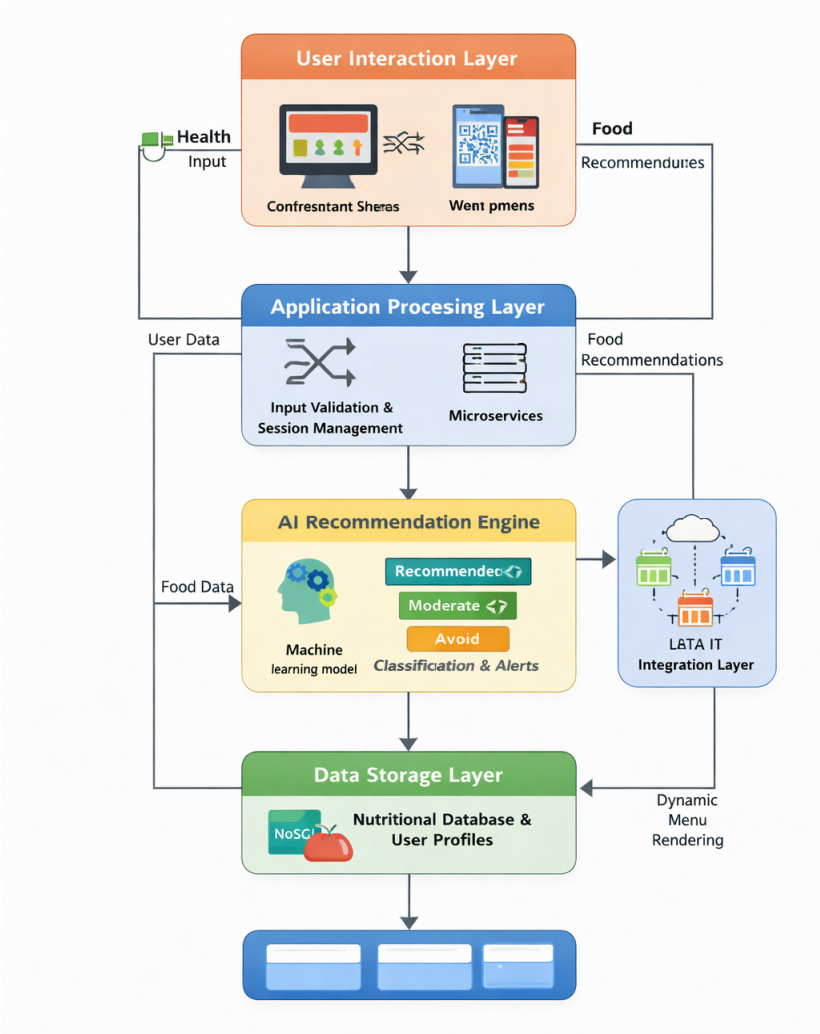

Fig. 1. Proposed System Architecture

IV. PROPOSED METHODOLOGY

The proposed methodology follows a structured workflow to deliver personalized food recommendations. Initially, the user provides health-related inputs such as age, weight, height, dietary goals (weight loss, maintenance, or gain), and medical conditions like diabetes or hypertension. This information is processed and used to calculate daily calorie requirements. The system then retrieves food data from the nutritional database, including calories, carbohydrates, proteins, fats, and sugar levels. Based on the user profile, the AI model evaluates each food item and categorizes it as recommended, moderate, or to be avoided.

A recommendation algorithm generates personalized meal suggestions that align with the user's health goals. If a selected food item exceeds the user's nutritional limits, the system provides alerts and suggests healthier alternatives. The system also maintains a real-time calorie tracker that updates based on user selections, helping users stay within their dietary limits. Finally, the selected items are processed for ordering, completing the interaction cycle.

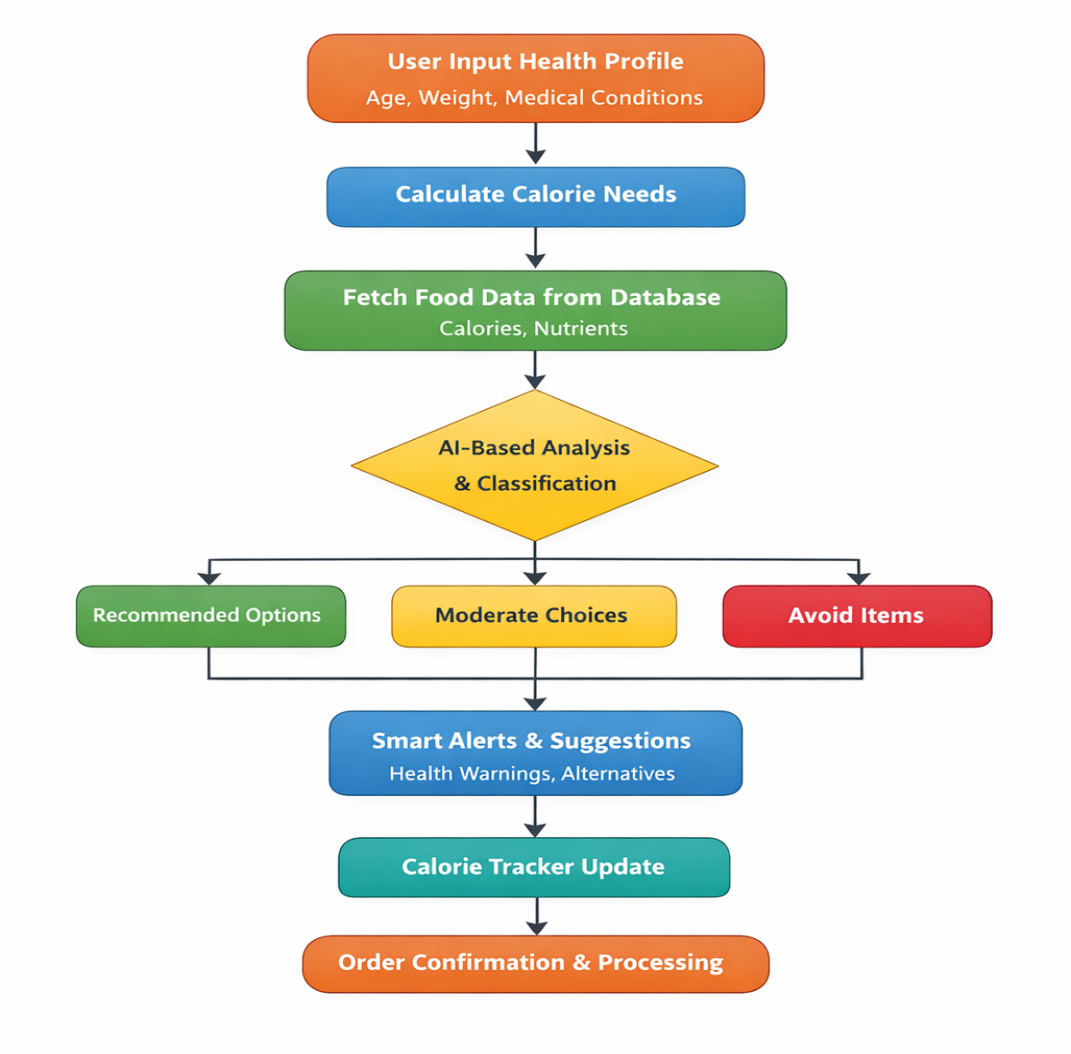

Fig. 2. Proposed Methodology Flow Diagram

V. CONCLUSION

This paper presented an AI-driven smart restaurant menu system that provides personalized calorie optimization based on user health profiles. The proposed system effectively combines artificial intelligence, nutritional data analysis, and smart interfaces to improve food selection decisions. By offering real-time recommendations and health-aware suggestions, the system enhances user awareness and promotes healthier lifestyles. The approach demonstrates strong potential for practical implementation in modern restaurant environments and contributes to the advancement of intelligent food systems.

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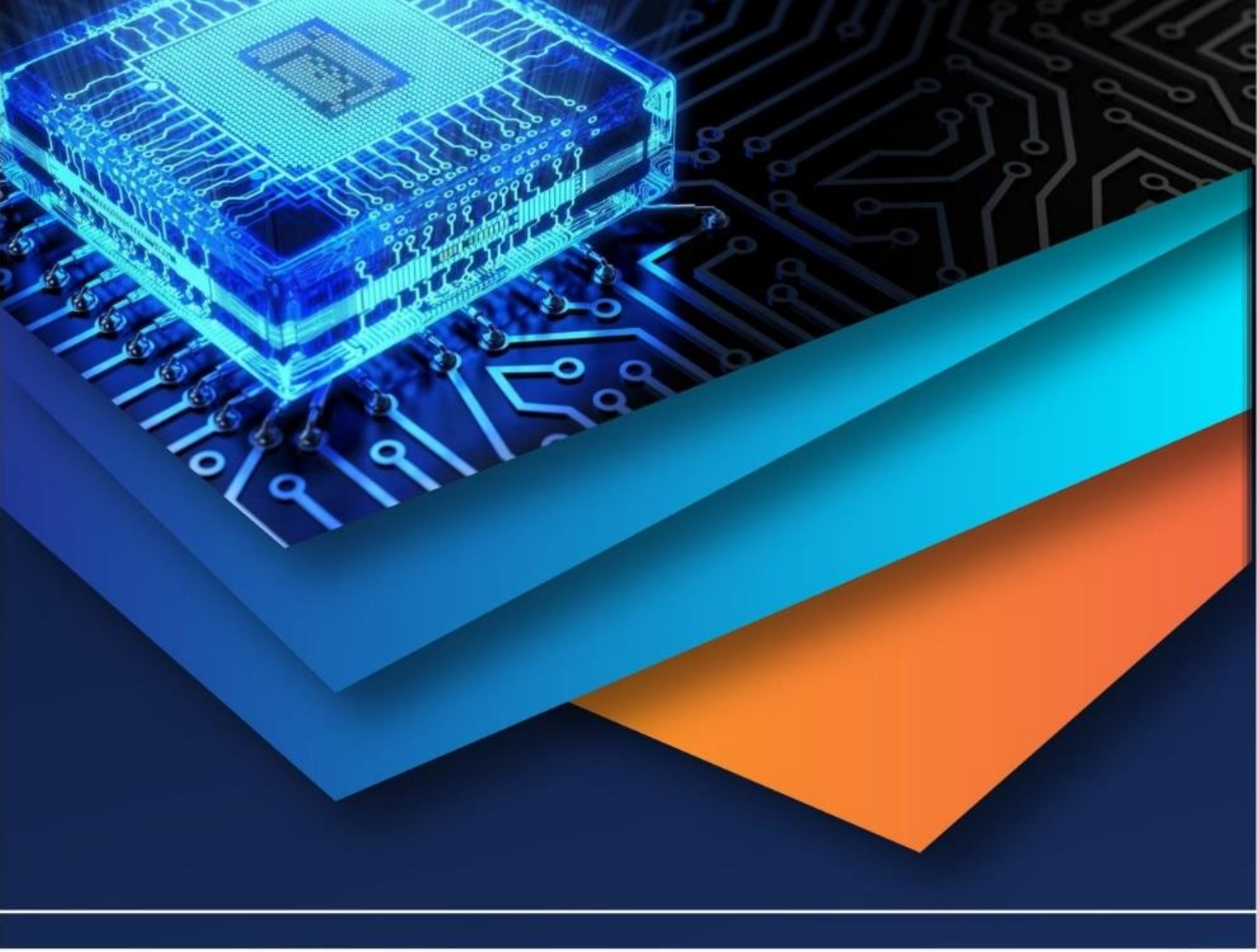

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