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A Context-Aware Smart Food Court Recommendation and Ordering System

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Abstract: ***The growing adoption of artificial intelligence in service applications has led to the development of intelligent systems that significantly enhance user experience and operational efficiency. At college dining halls and food courts, conventional ordering methods depend on fixed menus and manual choices, resulting in prolonged decision-making and restricted personalization. This paper presents a Smart Food Recommendation System that provides tailored food suggestions considering user preferences, mood, budget, and past orders to tackle these challenges. The platform utilizes a rule-based recommendation engine in a web-based canteen management system developed with HTML, CSS, JavaScript, Python (Flask), and SQLite. Food products are categorized by mood labels, price categories, and preference features to offer context-sensitive suggestions. Its modular design features user authentication, menu management, recommendation processing, order handling, payment verification, and feedback collection, providing convenience for users and oversight for administrators. By incorporating personalized filtering and budget-conscious suggestions, the system minimizes food selection time, enhances recommendation accuracy, and boosts overall user satisfaction. Experimental implementation in a college dining area shows better efficiency than conventional menu-driven ordering.***

Keywords: Intelligent Meal Suggestion System, Customized Meal Recommendations, Cost-Conscious Suggestions, Rule-Oriented Recommendation Engine, Flask Framework, SQLite Database

I. INTRODUCTION

Food is an important part of daily living, but choosing the right meals from a variety of menu selections may be difficult for consumers. Recommendation systems have become useful tools to help people make efficient and customized food choices as intelligent technologies continue to progress. However, in institutional settings like college food courts, creating a scalable, context-aware meal recommendation system that takes user preferences and operational efficiency into account continues to be a realistic difficulty [1]. The system seeks to improve user experience and the efficiency of meal selection in institutional settings by organizing food products into relevant categories and using methodical filtering algorithms [2]. Lightweight, explainable, and context-aware food recommendation systems designed for regulated situations such as college food courts have received little attention despite advances in recommendation technology. To improve decision-making, operational effectiveness, and overall user happiness, an effective system that combines structured filtering mechanisms with user-centric inputs is therefore required [3]. Recommendation systems employ a variety of strategies, including collaborative filtering, content-based filtering, knowledge-based systems, and hybrid models, to evaluate user preferences and forecast appropriate alternatives [4].A Prescription-based meal recommendation system that combines dietary recommendations, medical prescriptions, and user preferences [5]. The goal is to provide consumers tailored meal suggestions based on their past eating habits [6]. One of the goals of the study is to develop and validate a model for menu recommendations based on food intake [7]. Biological, social, environmental, and contextual variables all affect food choices, making dietary behavior complicated and challenging to forecast. To help consumers make more individualized meal choices, modern food recommender systems use user preferences and digital nudging techniques [8]. Since collaborative filtering was first introduced in the mid-1990s, recommender systems have seen substantial evolution and are now frequently utilized to handle information overload [9]. While collaborative filtering (CF) uses order history and customer ratings to suggest things based on user similarities, content-based filtering (CBF) examines the features of food items (such as ingredients and cuisine type) [10]. A smooth, frictionless, and intelligent eating experience that satisfies the demands of both patrons and food court operators is produced by the Smart Food Court Ordering System [11].

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Customers' expectations are changing along with the fast-food industry, calling for higher levels of service and satisfaction [12]. Online shopping is a rapidly developing business, by which customers are able to reach the products on internet as well as sellers can reach to customers in the same way [13].

II. LITERATURE REVIEW

Using user ratings, browsing history, recipe preferences, and collaborative filtering approaches, a number of meal recommendation systems have been created to produce customized recommendations Rehman et al. [1] However, this study focuses on recent developments in food recommendation systems considering domain-specific characteristics, as discussed by Bianchini et al. [5].Users' preferences can be discovered through behavioral data, allowing for more tailored suggestions. Such information is used by intelligent food recommender systems to forecast user preferences and effectively recommend suitable foods Salma et al.[7] , Conventional recommendation systems used collaborative and content-based filtering methods to offer customers tailored meal recommendations. In order to increase accuracy and get around constraints like the cold-start issue, hybrid recommendation schemes integrate many methods S. Jha et al.[10] , These definitions state that customers' perceptions of the security of online commerce are based on trust. In summary, this study discusses consumers' confidence in the dependability and quality of customer support provided by online retailers S. M. Alagöz and H. Hekimoğlu [13].

III. PERSONALIZATION AND THE TRANSFORMATION OF TRADITIONAL FOOD ORDERING SYSTEM

Conventional canteen and restaurant ordering systems function within a restricted range of features, mainly concentrating on displaying menus and handling transactions. These systems address all users equally, providing fixed food menus without contextual variation. As a result, the full responsibility for decision-making falls on the user, often leading to confusion, extended selection periods, and less than ideal choices. The absence of personalization results in a fixed, binary interaction framework in traditional systems: users either browse the menu manually or choose items unpredictably. No adaptive system exists to understand or react to personal preferences, emotional conditions, or financial limitations. The Smart Food Recommendation System transforms this fixed model by prioritizing personalization as a key element. Instead of showing food items as a static list, the system organizes them based on characteristics like food category, mood association, and price bracket. This categorization allows for real-time filtering of recommendations according to user inputs. By considering factors such as emotional conditions (joy, anxiety, fatigue), food choices (vegetarian or meat-eater), and financial limits, the system changes meal selection from a simple browsing activity into a smart, guided process. In contrast to conventional menu-driven platforms that focus solely on transactional efficiency, the proposed system highlights contextual engagement. Its suggestion system utilizes rule-based filtering, applying established logical criteria to align user inputs with suitable food characteristics. This method guarantees clarity, computational efficacy, and preserves significant relevance in the recommendations offered. The emphasis on contextual alignment distinguishes the suggested model from solely static or handpicked menu systems. Moreover, incorporating user authentication and order history enables the system to enhance its recommendations as time progresses. The system enhances personalization accuracy over time by keeping prior selections and feedback ratings in the database. This transition from a standard menu presentation to personalized recommendations signifies a major change in institutional food service management. The system progresses from a basic ordering interface to a decision-support tool that alleviates cognitive burden and improves user satisfaction. By utilizing a personalization-focused architecture, the Smart Food Recommendation System transforms the connection between users and menus. It demonstrates how smart filtering systems can substitute fixed, inflexible selection frameworks with adaptable, user-focused engagements. By transcending the constraints of conventional ordering binaries—manual searching versus arbitrary selection—the system creates a more intelligent, adaptive framework designed for campus dining service settings.

IV. RECOMMENDATION LOGIC, USER BEHAVIOR, AND DATA-DRIVEN FILTERING

Recommendation systems operate at the convergence of user tastes, behavioral trends, and situational limitations. In conventional canteen environments, meal selections are frequently influenced by visible menu items, social pressures from peers, or impulsive choices. Nonetheless, these methods are devoid of organized personalization and fail to consider the contextual elements affecting personal choices. The suggested Smart Food Recommendation System addresses this constraint by integrating rule-based intelligence into the ordering process, allowing for dynamic filtering and context-sensitive recommendation creation. The system is fundamentally built around a systematic classification of food items according to attributes like category, price bracket, type of food (vegetarian/non-vegetarian), and mood tags. These characteristics act as metadata labels that allow the backend system to align user inputs with appropriate menu selections.

When a user indicates factors such as mood (e.g., happy, stressed, tired), budget limits, and dietary choices, the system analyzes these inputs through conditional filtering rules. The generated recommendation list represents the overlap of these criteria, offering a customized option to fixed or general menu presentations. The logic of rule-based filtering provides clarity and efficiency in computation. In contrast to intricate collaborative filtering or deep learning methods that require extensive datasets and heavy training, this strategy highlights simplicity, scalability, and appropriateness for small-scale institutional use. Recommendations are produced using deterministic logic: mood-driven filtering reduces the dataset, financial limitations eliminate unsuitable options, and preference alignment sharpens the final choice. This tiered filtering minimizes unrelated recommendations and improves user contentment. User actions enhance system reactivity. The SQLite database retains order history and feedback ratings, enabling the platform to recognize commonly chosen items and trending categories. Even though the system doesn't utilize predictive machine learning models, past data enables improved recommendations and focused promotional emphasis. Trending menu items can be effectively marketed, whereas underperforming dishes can be examined by managers for possible modifications.

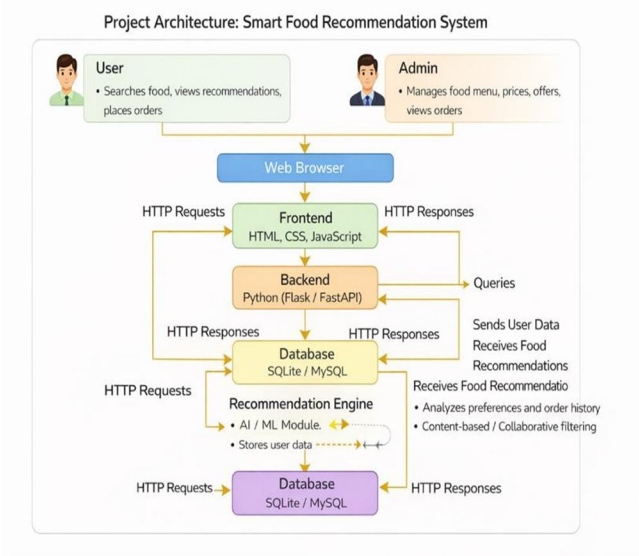

Fig :1.1 System Architecture of the Intelligent Food Suggestion System

Through the arrangement of food metadata and user contributions into a structured filtering framework, the system converts food selection into a directed, decision-aiding process. The emphasis goes beyond automation to contextual awareness—making sure suggestions match user intent, emotional condition, and financial limits. This methodological framework demonstrates how simple AI approaches can significantly improve institutional food service settings without the intricacies of extensive recommendation systems.

V. ADMINISTRATIVE CONTROL, SYSTEM GOVERNANCE, AND OPERATIONAL AUTOMATION

In typical canteen settings, administrative duties like updating menus, monitoring orders, and managing promotions are usually manual and reactive, resulting in operational inefficiencies and sluggish responses. The absence of centralized digital governance hinders data-informed decision-making and limits administrators' capacity to enhance food service management. The Smart Food Recommendation System addresses these issues by combining organized administrative controls within a cohesive, online framework. Upon deployment, the system transitions control from unstructured manual methods to organized digital management. The admin module provides role-specific access control, enabling authorized users to handle food items, adjust prices, track order history, and confirm payments via a centralized dashboard. In contrast to conventional paper-based or disjointed digital methods, this unified strategy guarantees transparency, accountability, and immediate monitoring. Administrative tasks—such as introducing new dishes, changing mood tags, modifying budget categories, or eliminating unavailable items—are immediately updated in the recommendation engine, ensuring system coherence. Automation enhances operational effectiveness even more. Order clustering methods combine several food choices into one transaction, while payment authentication guarantees secure monetary processing. Storing transaction data in the SQLite database creates a structured digital log of user behavior, allowing administrators to examine popular products, high ordering times, and overal l sales patterns.

This change transitions canteen management from a solely transactional method to a data-driven operational framework. Crucially, administrative control in the suggested system does not hinder user personalization but rather enhances it. As users engage with mood-based and preference-oriented suggestions, administrators retain backend control over food classification, promotional focus, and pricing arrangements. This two-layer structure harmonizes user-focused intelligence with management supervision, guaranteeing that automation improves rather than hinders service coordination. System monitoring persists post-order completion by collecting feedback and maintaining historical records. Feedback scores enable administrators to assess the quality of food and the precision of recommendations, whereas order history aids in the ongoing improvement of menu strategies. Consequently, the system does not end with processing transactions; rather, it creates an ongoing loop of input, observation, and enhancement.

The Smart Food Recommendation System illustrates how combining administrative governance with intelligent recommendation logic can update and enhance institutional food service settings through structured automation. The design guarantees effectiveness, responsibility, and growth while maintaining personalization as its primary operational goal.

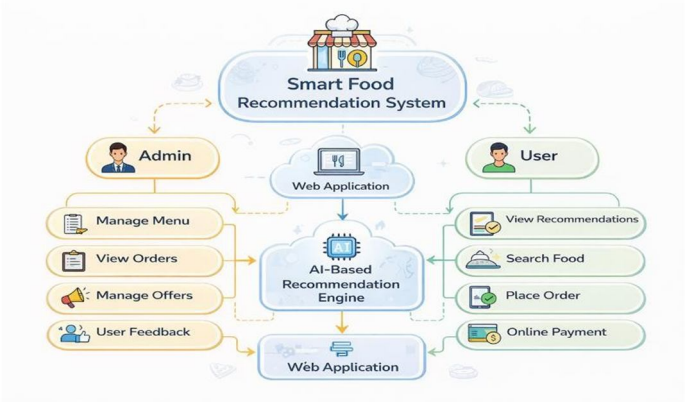

Fig. 1.2 "The Smart Food Recommendation System's Functional Architecture"

VI. OUTCOMES AND ASSESSMENT OF PERFORMANCE

The Smart Food Recommendation System was tested in a simulated college food court setting to assess its impact on enhancing user experience and operational efficiency. The assessment centered on three main performance metrics: decision-making duration, relevance of recommendations, and efficiency in administration. To evaluate usability, a group of users engaged with both a conventional static menu interface and the suggested recommendation-based system. Observational analysis showed that the typical food selection time was considerably decreased when users received recommendations based on mood and budget. System reduced cognitive strain and made decision-making easier by limiting choices based on contextual information. Users expressed higher satisfaction because of the clear and tailored nature of the recommendations. The relevance of recommendations was assessed qualitatively based on user feedback ratings. Because the system utilizes rule-based filtering instead of predictive machine learning models, the accuracy of the output relies on the accuracy of predefined attribute matching. Results from feedback showed that alignment of mood tags and budget filtering generated contextually suitable recommendations in the majority of test scenarios. The deterministic filtering process guaranteed clarity and prevented unexpected outcomes, which is especially advantageous in small-scale institutional environments. From an organizational viewpoint, centralized order handling and digital record keeping enhanced operational clarity. Administrators could observe sales patterns, keep tabs on regularly ordered products, and efficiently refresh menu information. The incorporation of payment validation and order consolidation enhanced workflow efficiency compared to manual processing methods. Even though the system lacks extensive collaborative filtering or deep learning techniques, its streamlined design guarantees minimal computational burden, scalability, and simple maintenance. In summary, performance assessment indicates that incorporating contextual filtering into an online canteen system considerably boosts user interaction, decreases selection duration, and enhances service coordination.

VII. FUTURE SCOPE WITH AI/ML ENHANCEMENTS

Although the existing implementation depends on rule-based recommendation mechanisms, the system offers a solid base for future development utilizing sophisticated artificial intelligence and machine learning methods. A possible improvement includes the incorporation of collaborative filtering algorithms to produce suggestions by analyzing similarities among users with alike preferences.

This would allow for predictive personalization that goes beyond clear mood and budget parameters. Furthermore, content-based filtering methods might examine past order trends to suggest items automatically, eliminating the need for continuous manual parameter adjustments.

A further encouraging extension involves the use of machine learning classification models to automatically identify user mood via sentiment analysis of text entries. Incorporating natural language processing (NLP) frameworks might enable users to express their cravings in a conversational manner, turning the platform into a conversational intelligent assistant. Real-time analytics and data visualization dashboards could additionally assist administrators by recognizing demand trends, seasonal choices, and inventory enhancement methods. Nutritional analysis features could also be implemented to suggest food according to calorie consumption, dietary limitations, or health objectives. Cloud deployment and scalable database integration would enable the system to grow beyond a single institutional setting,

VIII. CONCLUSION

This document showcased the development and execution of an Intelligent Food Suggestion System designed specifically for institutional food court settings. The proposed system enhances traditional menu browsing into an intelligent, personalized experience by combining rule-based contextual filtering with a web-based canteen management platform. The system efficiently merges user preferences, mood factors, budget limits, and order history to produce pertinent food recommendations while ensuring computational ease and scalability. By utilizing modular architecture and centralized administrative oversight, the platform improves operational efficiency and simplifies order processing. Performance assessment shows that contextual recommendation notably shortens decision-making time, enhances user satisfaction, and facilitates effective data-driven management. In contrast to elaborate large-scale recommender systems, the suggested lightweight method provides an efficient and affordable option appropriate for small to medium-sized institutions. Ultimately, the Smart Food Recommendation System connects traditional food ordering systems with AI-enhanced customization. Incorporating contextual intelligence into daily campus dining services demonstrates the real-world effectiveness of artificial intelligence in improving user convenience, operational clarity, and service excellence. The incorporation of advanced machine learning methods in the future could enhance personalization features and develop the system into a scalable intelligent dining ecosystem.

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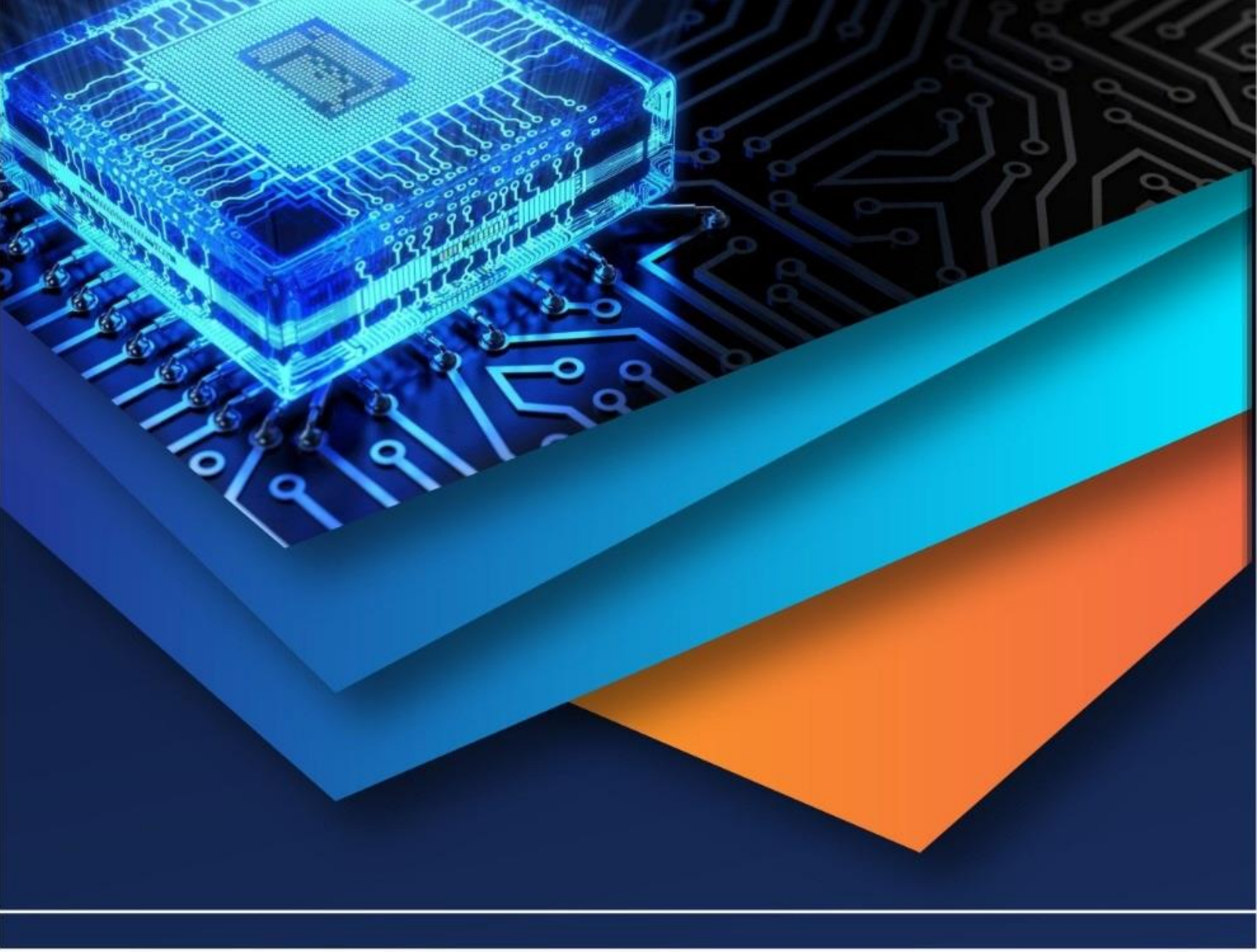

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