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Restaurant Management System with KDS System Using Full stack

Shakthi Priyan T
Department of Information Technology
Panimalar Institue Of Technology
Chennai,India
shakthithiru04@gmail.com

Muthuraj M
Department of Information Technology
Panimalar Institue Of Technology
Chennai,India
rajm97911@gmail.com

Nilesh A
Department of Information Technology
Panimalar Institue Of Technology
Chennai,India
Nilvish3000@gmail.com

MS.S .Sandhiya ,M.E
Assistant Professor
Department of Information Technology
Panimalar Institute of Technology
Sandhiyasamuel97@gmail.com

Dr. G. Dhanalakshmi, M.E, Ph.D,
Head of the Department
Department of Information Technology
Panimalar Institute of Technology
dhanalakshmi4481@gmail.com

***Abstract*— The Restaurant Order Management System is a complete solution that streamlines food ordering and management through four interconnected modules: User, Chef, Manager, and Admin. Users can register, log in, browse menu items, place orders, and track preparation and completion statuses in real time. Chefs can manage their menu items, view and accept incoming orders, update cooking times, and mark orders as completed. Managers oversee chef activities, track order statuses, and allocate tasks to ensure smooth operations. The admin module allows administrators to register, log in, manage grocery and home essentials inventory, monitor food status updates, and perform daily and weekly income analysis. By enhancing communication between users, chefs, managers, and admins, the system improves workflow efficiency, speeds up order processing, optimizes resource management, and delivers a better dining experience within the restaurant environment.**

Keywords—JSP, Servlets, Realtime order tracking, Food Ordering Solution

I. Introduction

The Restaurant Order Management System is designed to simplify and enhance the entire food ordering and management process within a restaurant by integrating four key modules: User, Chef, Manager, and Admin. Users can easily register, log in, explore the menu, place orders, and track their order status in real time. Chefs manage menu items, accept and update orders, and mark them as completed. Managers oversee the workflow, manage chefs, and allocate orders to ensure timely service. The admin module further strengthens the system by managing grocery inventories, monitoring food preparation statuses, and analyzing income reports daily and weekly. This system promotes better communication, improves operational efficiency, and ensures a seamless and satisfying experience for both customers and restaurant staff.

The proposed Restaurant Order Management System connects Users, Chefs, Managers, and Admins to streamline food ordering, preparation, and management. It allows real-time order tracking, chef task management, grocery inventory monitoring, and income analysis. The system enhances communication, optimizes workflow, and improves the overall dining experience.

A. JAVA Server Pages(JSP)

JSP is server-side technology used for creating dynamic web content. It allows developers to embed java code within HTML pages, making it easier to generate dynamic and interactive web pages help separate presentation logic (HTML) from the business logic(Java code),making it easier to maintain and manage web applications offers security features that help protect against common web vulnerabilities.

B. Servlets

Servlets are java classes which handle client requests and generate dynamic web content. JavaScript is client-side scripting language which can be used to interact with servlets to create dynamic web applications. Servlets are the backbone for many server-side Java applications due to their efficiency and scalability.

II. Literature Review

Service robotics[1] has recently been a growing field as well in research as in industrial contexts. It offers adaptive robotic systems that allow direct human-robot interaction and cooperation which are often only used inside research labs. In this paper we present the BratWurst Bot, a service robotic system that demonstrates the combination of many different robotic skills to create a powerful application. With ROS as a software framework and standard robotic components this system also shows the short ramp-up time modern service robotics can provide. The BratWurst Bot offers an intuitive tablet interface and was extensively tested “in the field” on public events where it proved its reliability and effectiveness.

It has been[2] well-documented that Americans have shifted towards eating out more and cooking at home less. The objective of this study is to examine how patterns of home cooking and home food consumption have changed from 1965 to 2008 by socio-demographic groups. This is a cross-sectional analysis of data from 6 nationally representative US dietary surveys and 6 US time-use studies conducted between 1965 and 2008. The subjects are adults aged 19 to 60 years (n= 38,565 for dietary surveys and n=55,424 for time-use surveys). Weighted means of daily energy intake by food source, proportion who cooked, and time spent cooking were analyzed for trends from 1965–1966 to 2007–2008 by gender and income. T-tests were conducted to determine statistical differences over time.

Nutrition policy makers[3] often express concern about a loss of cooking skills in societies where more and more food is prepared and eaten away from home. There are several reasons for this concern. They include the loss of basic

domestic skills that give people control over individual and household food supply, a loss of knowledge of ingredients and their use, as well as an ignorance regarding cooking methods making healthy home cooking less likely. This leaves the field open for less healthy ready-to-eat alternatives. Policy makers are also aware of changes in the social role of food, which has its own health connotations.

It is problematic to try to reinstall the lost opportunities to cook and it may not even be possible. In the case of the aged, there may be less access to food to cook and to facilities for cooking, or a loss of the ability or inclination to cook. Loss of appetite is also of concern in older adults. For these reasons and combined with increasing frailty and loss of independence, Meals on Wheels and other home delivery services have become important nutritional support systems for this age group. There is certainly strong evidence to support the importance of nutritious food throughout the life cycle. There has been little evidence, however, about whether food preparation and cooking might affect health and even survival. This issue of Public Health Nutrition provides some of the evidence required.

The paper focuses[4] on the development of smart restaurant ordering management system that enhances customer experience by integrating AI-driven mood-based food recommendations ,real-time order management and inventory tracking. The study leverages MERN stack for scalability and ease of use. By addressing the gaps of previous studies, the project integrates AI and sentiment analysis with practical restaurant workflows to create an innovative, scalable solution that enhances the dining experiences and operational management.

The research paper titled "Constructing a Study Buddy using MERN(MongoDB,Express.js,React,Node.js)Stack Technologies"[5] presents a dynamic web application aimed at enhancing student collaboration and support. The study leverages modern technologies to optimize student interactions, accelerate learning processes, and address various academic and non-academic needs. The study utilizes MERN stack technologies ,authentication, and authorization of security with real-time interactions with chatbots.

III. PROPOSED METHODOLOGY

The proposed methodology for the Restaurant Management system (RMS) encompasses a structured approach to the design, development, and implementation of the system. The methodology is divided into several key phases(Refer fig 2):

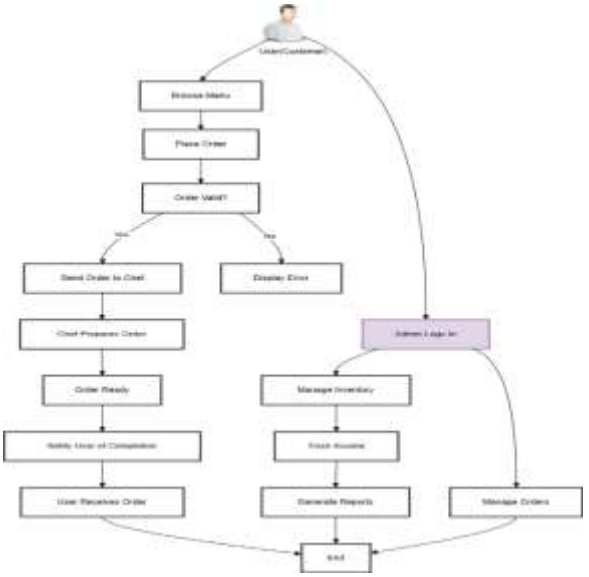

Fig 2:Proposed Framework of RMS

A. *Requirement Gathering and Analysis*

The phase involves collecting and analyzing the requirements from various stakeholders, including users, chefs, hall managers, and administrators. This phase includes:

- *Interviews and Surveys*: Conducting interviews and surveys with potential users to understand their needs, preferences in the current ordering process.
- *Use case identification:* Identifying and documenting use cases for each actor in the system which will guide the development of functionalities.

B. *System Design*

This phase includes:

- *Use case diagram*: The use case diagram is used to visualize the interactions between the actors(User,Chef,Admin,Hall Manager) and the system functionalities which serve as a blueprint for understanding user interactions.
  Class diagram: The class diagram portrays the core entities(User,Chef,HallManager,Order,Menuitem, Inventory) and their relationships which help in structuring the data model and understanding how different components interact.(refer Fig 2)
- *State diagram*: To illustrate the lifecycle of an order, detailing the various states(WaitingForOrder,OrderPlaced,PreparingOrder,OrderReady,OrderCompleted,Cancelled) and the transitions between them.(refer Fig 3)
- *Activity diagram*: To outline the flow of activities for Users and Admins which captures the sequential flow of actions ensuring clarity in the order management cycle.(Refer Fig 4)
- *Sequence diagram*: To illustrate the interactions between the User,Chef,Admin,Hall and the System which highlights the step-by-step processes

involved in order placement ,preparation and administrative tasks.(Refer Fig 5)

C. System Architecture

The system architecture outlines the high-level components and their interactions:

- *User Interface(UI):*Designing an intuitive UI that allows customers to easily browse menus, place orders and receive notifications. The UI should be user-friendly and responsive to enhance customer experience.
- *Backend Server*: Implementing a robust backend server that manages business logic, including order validation, status updates, communication between user, chefs, and admins.
- *Database Management and Module integration*: Establishing a secure and efficient database to store crucial information about user profiles, order details, menu details and inventory. Ensuring the Chef Module, Hall manager module and admin module are well integrated with the backend.

D. Implementation

It involves the actual development of the system based on the design illustrated in the previous phases.

- *Coding*:Writing code for the frontend and backend components, ensuring the adherence to coding practices and best practices.
- *Testing:* Conducting thorough testing including unit testing, integration testing and user acceptance testing to identify any issues before deployment.
- *Deployment*: Deploying the system in a live environment, ensuring that all components are functioning correctly.

E. Training and Support

Once the system is deployed, it is essential to provide training and support to the users.

- *User Training*:Conducnting training sessions for the users to familiarize themselves with the system's functionality and features.
- *Documentation and Ongoing support:* It involves providing user and technical manuals to assist the users in navigating the system and troubleshooting the common problems.

F. Evaluation and feedback

It involves evaluating the system's performance to identify the areas for improvement and gathering feedback from the user.

- *Performance Monitoring*: Continuously monitoring the system's performance to identify areas for improvement and ensure optimal condition.
- *User Feedback-Feedback Collection*: Implementing mechanisms for users to provide feedback on their experience with the system, including surveys and suggestions forms.

IV. Problem Statement

The main objective of the Restaurant Order Management System is to streamline and automate the restaurant's ordering and management processes by enabling smooth interaction between Users, Chefs, Managers, and Admins. It aims to provide customers with real-time order tracking, assist chefs in efficiently handling food preparation, help managers allocate and monitor tasks, and support admins in managing grocery inventories and analyzing daily and weekly incomes. Overall, the system focuses on improving service speed, operational efficiency, resource management, and enhancing the overall dining experience.

The scope of the Restaurant Order Management System covers the complete workflow of a restaurant, from customer order placement to food preparation, management oversight, and administrative analysis. It allows users to conveniently place, and track orders, enables chefs to manage and update food preparation statuses, supports managers in monitoring operations and assigning tasks, and provides admins with tools to manage grocery inventories and analyze income trends. The system is designed to enhance communication, ensure faster service delivery, optimize resource usage, and provide valuable business insights, making it suitable for restaurants of all sizes aiming to modernize and improve their operations.

V. Results and Discussions

The validation checks for user registration were implemented. Users can register with a unique email address,enchancing security and preventing duplicate email address. Users can place orders with real-time updates on status. The system provides seamless experience, allowing users to customize orders and receive notifications on the progress. Chefs can add, update, and delete menu items efficiently. This feature allows for dynamic menu changes based on availability and customer preferences to improve customer satisfaction.

Real-time tracking of order status is functional. Users appreciate the transparency in the order process leading to increased trust and satisfaction with service.Admins can manage inventory and analyze income reports effectively. The dashboard provides valuable insights into operational efficiency. The system can handle up to 100 concurrent users without significant lag. Comprehensive error handling was implemented with all the modules. User data is encrypted, and role-based access control is implemented.

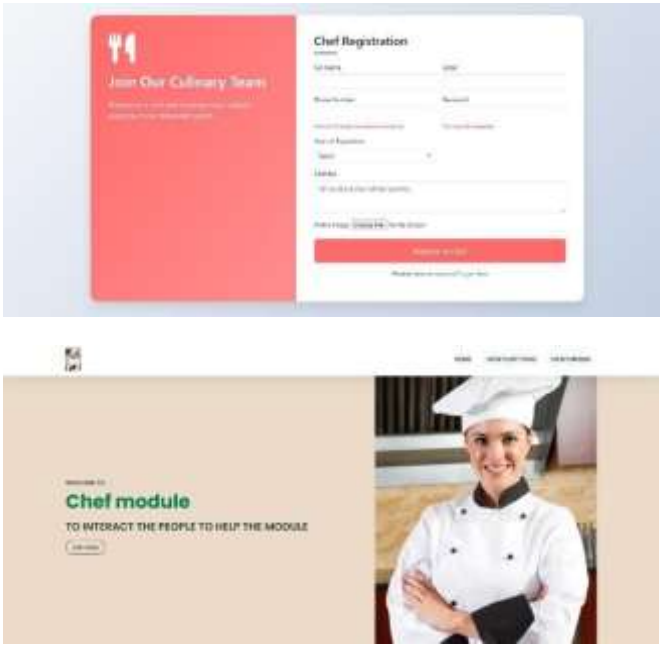

Fig 3:The Restaurant Management System

VI. Conclusion

In conclusion, the Restaurant Order Management System provides a comprehensive solution to streamline the food ordering process, improving efficiency and communication between users, chefs, and administrators. By offering a seamless interface for browsing menus, placing orders, managing inventory, and tracking income, the system enhances both customer experience and operational management. The integration of real-time updates, efficient order tracking, and robust administrative controls ensures timely service and smooth workflow within the restaurant.

With future enhancements, the Restaurant Order Management System could include the integration of machine learning algorithms to predict customer preferences and optimize the menu based on sales trends and customer behavior. Additionally, incorporating a real-time delivery tracking feature for users, enabling notifications of order progress from kitchen to delivery, could improve customer experience. Implementing contactless payment options, such as QR code scanning, and integrating with popular food delivery platforms would expand accessibility. The system could also include advanced analytics for admins, such as detailed insights into customer satisfaction, inventory management, and financial performance, aiding decision-making and operational efficiency. Furthermore, the use of AI-powered chatbots for automated customer support could enhance user interaction and reduce operational overhead

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