

# SmartServe: An AI-Powered Smart Bulk Food Ordering System with Bidding and QR-Based Feedback Integration

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**Abstract :** In the food service industry, bulk ordering from restaurants often lacks a structured and competitive pricing mechanism, leading to inefficiencies for both customers and restaurant owners. Existing systems primarily offer fixed-price models, limiting flexibility and failing to ensure the best price-to-quality ratio. To address these limitations, this paper proposes SmartServe, a dynamic restaurant bulk ordering system that integrates an AI-driven bidding process where restaurants compete based on price and quality. Additionally, a recommendation engine and chatbot enhance user experience by leveraging order history and customer preferences. The system incorporates a QR-based feedback mechanism, ensuring real-time quality assessment that further refines recommendations and bidding outcomes. Implementation results indicate that SmartServe optimizes order fulfillment efficiency while providing cost-effective solutions for customers and higher engagement opportunities for restaurants.

**Keywords:** Bulk Food Ordering, AI-Based Bidding System, Restaurant Recommendation Engine, Chatbot Integration, QR Code Feedback, Customer Sentiment Analysis, Intelligent Restaurant Management, Order Optimization, Automated Food Service, Smart Engagement Solutions

## I. INTRODUCTION

In the rapidly evolving landscape of the food industry, the global food market, valued at \$56 billion in 2021, is projected to grow at a compound annual growth rate (CAGR) of 9% through 2025 [1]. This growth has been accompanied by rising customer expectations, especially in areas of personalization, convenience, and speed. With digital transformation reshaping operational models, several platforms like Zomato, Swiggy, and Uber Eats have emerged, focusing primarily on individual food orders and delivery logistics [2]. However, when it comes to bulk ordering for events, institutions, or group needs, most existing systems rely heavily on manual communication and

negotiation with restaurants, lacking intelligent automation [3]. Platforms such as CaterNinja, which specialize in bulk food orders for corporate events or parties, offer basic menu selection and fixed pricing, but often miss out on dynamic features like real-time restaurant bidding, personalized recommendations, or intelligent feedback integration [4]. Users often express frustration due to non-transparent pricing, lack of comparative options, and limited personalization. Current QR-based systems in the market are primarily used for contactless payments or menu viewing, offering little to no value in terms of real-time service feedback or automated system learning [5].

Given the existing inefficiencies in the bulk ordering domain, there is an increasing demand for intelligent systems that ensure competitive pricing, transparency, and personalization. SmartServe addresses these gaps by introducing a dynamic and transformative approach to restaurant-customer interaction. It implements a real-time bidding mechanism wherein restaurants compete based on price and service quality, thus fostering healthy competition and providing customers with optimal choices [6]. To further enhance decision-making, SmartServe integrates an AI-powered recommendation engine that leverages historical order data and user feedback to suggest the most suitable options [7]. The platform also incorporates an interactive chatbot, offering real-time assistance, order-related guidance, and personalized recommendations, thereby improving overall user engagement [8]. Moreover, the use of a QR-based feedback system allows customers to share immediate responses post-order, which in turn feeds into SmartServe's analytics engine to refine future bidding outcomes and recommendation accuracy [9]. By synergizing these intelligent features, SmartServe positions itself as a next-generation platform for restaurant management and bulk order processing, offering a data-driven, user-centric, and automated solution to a traditionally underserved segment of the food service industry [10].

This paper is organized as section II provides a Literature Survey on existing bulk ordering systems and their limitations. Section III introduces the Proposed System,

SmartServe, and discusses its key features and AI-driven mechanisms. The Methodology for system development is outlined next, followed by the Implementation and Results of the proposed system. The paper concludes with a summary of findings and recommendations.

## II. LITERATURE SURVEY

The digital transformation of the food industry is rapidly reshaping how restaurants operate and engage with customers. As consumer expectations grow for faster, smarter, and more personalized experiences, businesses are turning to advanced technologies to stay competitive. From QR code systems and AI chatbots to intelligent recommendation engines, these innovations are streamlining operations and enhancing service quality.

These advancements align with broader industry trends. Thomas and Patel [1] projected a 9% compound annual growth rate in the digital food services sector from 2021 to 2025, driven by demand for automation, convenience, and high-quality service. One notable innovation is the use of QR code-based systems, which have improved both customer engagement and data collection. Čović et al. [10] highlighted their effectiveness in electronic market research, enabling faster and more accurate feedback. Khan [2] extended this utility by developing a cloud-based expiry tracking system to enhance food safety and inventory control. Similarly, Wahsheh and Al-Zahrani [3] explored QR code security in healthcare, offering insights adaptable to secure restaurant feedback. Alkhayyat et al. [4] demonstrated real-time feedback collection through an online QR scanning platform, improving customer interaction and service response. Processing this feedback efficiently is key to personalization. Wu et al. [9] employed QR decomposition to summarize textual reviews, aiding recommendation systems in delivering tailored suggestions. This complements the rise of AI-driven customer support tools. Among these, AI-powered chatbots play a central role. Dutt et al. [5] introduced a chatbot for dynamic information retrieval, offering fast, personalized responses. Gupta et al. [6] applied AI chatbots to simplify restaurant ordering, while Garg et al. [8] developed an NLP-based chatbot capable of handling multiple orders with greater accuracy and satisfaction. These systems, built on Natural Language Processing and intent recognition, are redefining digital customer service.

At the operational level, systems like the real-time food booking platform developed by Ardiansyah et al. [7] have minimized wait times and streamlined service. These solutions reflect the shift toward real-time responsiveness that Thomas and Patel [1] identified as a key market driver. Beyond front-end systems, digital tools are transforming strategic operations. Wei and Guo [11] proposed a bid evaluation model to improve cost-efficiency and fairness in vendor selection—principles that apply directly to the competitive nature of the food service sector.

Unifying these innovations, V.N.A. et al. [12] introduced a prompt-based recommendation system that combines chatbot features with feedback summarization, exemplifying

the industry's move toward intelligent, customer-centric automation.

Despite advancements, current systems have limitations that hinder optimal restaurant operations. Feedback mechanisms are often consumer-focused and lack actionable insights for restaurants. Additionally, personalized recommendations based on order history are missing, and there is no automated bidding or dynamic pricing for bulk orders. This prevents cost optimization and a win-win situation for both consumers and restaurants. These gaps highlight the need for an integrated system that addresses these challenges.

## III. PROPOSED SYSTEM

SmartServe is an AI-powered platform designed to streamline bulk restaurant orders. It features an automated bidding system that promotes competitive pricing among restaurants, ensuring customers get the best value. Additional modules, including a recommendation engine based on past orders, an interactive chatbot for order guidance, and a QR-based feedback system for real-time reviews, enhance customer satisfaction and operational efficiency. Fig. 1 shows the Architecture Diagram of SmartServe.

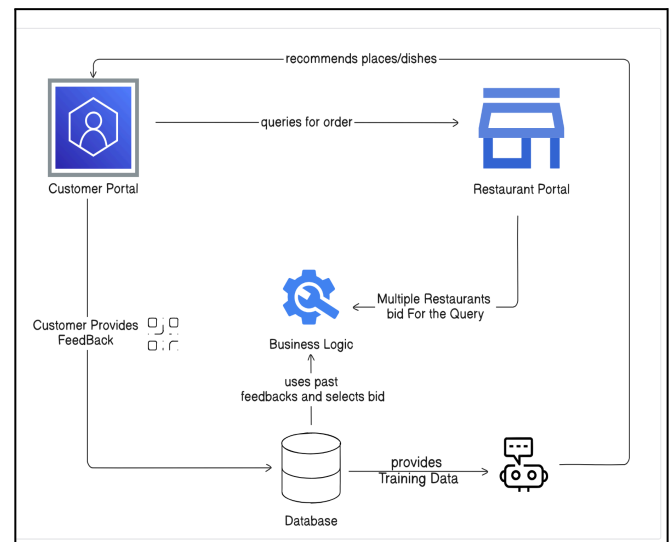


fig. 1 : Architecture Diagram of Smartserve

The process begins with Order Placement, where customers input their order details. The Bidding Process follows, allowing restaurants to submit bids based on price, quality, and delivery time. Bid Evaluation & Selection uses AI to rank bids and select the best option. After confirmation, Order Processing begins, with real-time tracking and Chatbot Assistance for customer updates and modifications.

After delivery, the QR-Based Feedback system allows customers to rate their experience, refining restaurant services and influencing future recommendation.

## Comparison of Results with Existing System

Feature	Swiggy & Zomato	CaterNinja	SmartServe
Ordering Process	Single-restaurant ordering, delivery logistics	Bulk ordering for events, manual negotiation	Automated bidding process for bulk orders
Pricing Model	Fixed pricing, dynamic pricing during promotions	Fixed pricing, negotiation with restaurants	Dynamic pricing through competitive bidding
Recommendation System	Basic recommendations based on user preferences	Basic recommendations based on menu options	AI-powered recommendation engine based on order history and preferences
Feedback Mechanism	Ratings and reviews after order delivery	No real-time feedback mechanism	QR-based feedback integrated for continuous improvement
Customer Interaction	Limited, via app or customer service	Limited, manual communication with restaurants	AI-driven chatbots for personalized interactions
Efficiency in Order Fulfillment	Standard delivery times, manual intervention	Time-consuming manual order handling	Optimized order fulfillment with automated system
Transparency	Transparent menu and pricing	Limited transparency in bulk pricing and options	Transparent bidding process with clear pricing options

### A. Bidding-Based Bulk Ordering

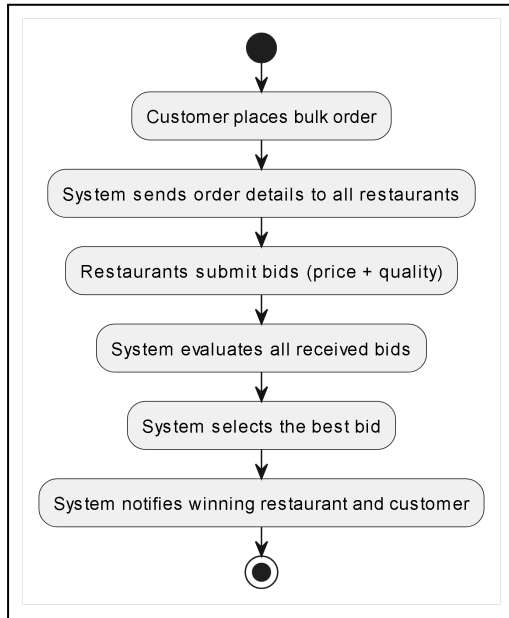


fig. 1 : Architecture Diagram of Smartserve

Traditional restaurant ordering systems are often limited by fixed pricing and a narrow vendor selection, leading to inefficiencies in cost, quality, and delivery. SmartServe addresses these challenges through a dynamic, AI-powered bidding mechanism for bulk orders. When a customer

submits an order with specific details such as cuisine, quantity, budget, and delivery timeline the request is broadcast to all registered restaurants on the platform. Restaurants evaluate the request and respond with competitive bids based on pricing, delivery time, and available resources.

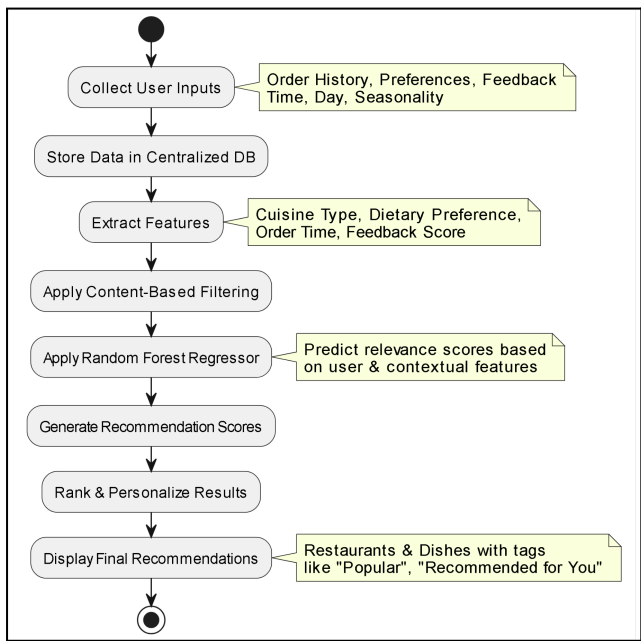
An AI-driven ranking algorithm then assesses these bids using a weighted scoring system that considers factors like cost-effectiveness, restaurant ratings, reliability, and customer feedback. The highest-ranked bid, offering the best balance of quality and value, is presented to the customer for confirmation or adjustment. This intelligent bidding process ensures competitive pricing, enhances service quality, and creates a fair, transparent marketplace where restaurants are incentivized to deliver their best. These bids are evaluated through a structured weighted scoring algorithm, designed to optimize for both quality and cost. Specifically, each bid  $B_i$  is assigned a score  $S_i$  based on the formula:

$$S_i = w_1 \cdot \left(1 - \frac{P_i}{B}\right) + w_2 \cdot R_i + w_3 \cdot \left(1 - \frac{T_i}{T}\right) + w_4 \cdot F_i$$

In this formula,  $P_i$  denotes the price quoted by the restaurant, while  $B$  represents the customer's maximum budget.  $T_i$  is the estimated delivery time provided by the restaurant, and  $T$  is the customer-defined delivery deadline.  $R_i$  reflects the restaurant's average rating (on a scale of 1 to 5), and  $F_i$  is the normalized feedback score derived from previous customer reviews. The weights  $w_1, w_2, w_3, w_4$  are tunable

constants that determine the relative importance of price, delivery time, rating, and feedback respectively, with the constraint that  $w_1+w_2+w_3+w_4 = 1$ . This weighted scoring mechanism enables SmartServe to balance cost-effectiveness with service quality and reliability. Once all bids are scored, they are ranked in descending order, and the restaurant with the highest score is selected to fulfill the bulk order. This ensures that customers receive optimal service while promoting healthy competition among restaurants on the platform.

## B . AI-Powered Recommendation Engine

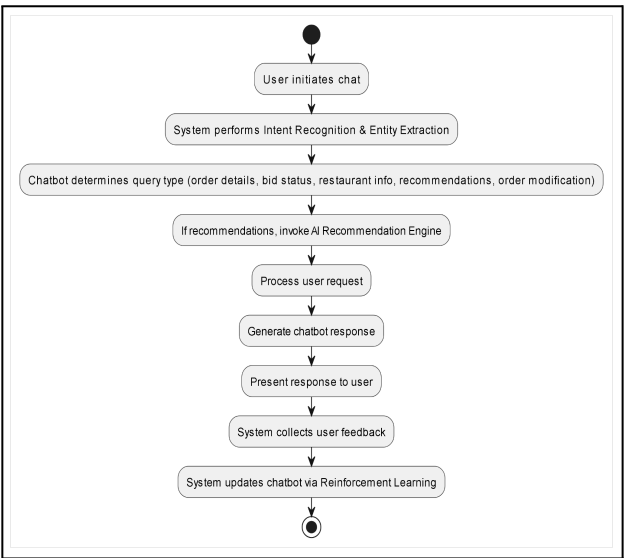


To elevate user experience, SmartServe integrates a performance-based recommendation engine that prioritizes reliability and quality over speculative predictions. It analyzes historical reviews, order history, restaurant ratings, and satisfaction scores to suggest consistently high-performing vendors. The system highlights attributes like “best-rated for hygiene” or “frequent successful bidder,” helping users confidently choose trusted restaurants. The engine also factors in bid success rates, favoring restaurants with a track record of competitive pricing and service quality. By using weighted scoring and rule-based filtering, SmartServe ensures recommendations are grounded in real performance

Built on a hybrid architecture, the SmartServe recommendation engine integrates content-based filtering with a supervised machine learning model Random Forest Regressor to deliver personalized and context-aware suggestions. The engine analyzes key user-specific inputs such as order history, cuisine preferences, and feedback, alongside contextual signals including time of day, day of the week, and seasonality. By learning from these multidimensional features, the Random Forest model predicts the relevance score of different restaurant options

and dishes. Over time, as more data is collected, the system continues to retrain and refine its decision trees, allowing it to dynamically adapt to individual user behavior and broader consumption trends. This approach ensures not only accuracy in recommendations but also robustness against noise and anomalies in user data, promoting a consistent and high-quality user experience.

## C. Chatbot for Customer Interaction



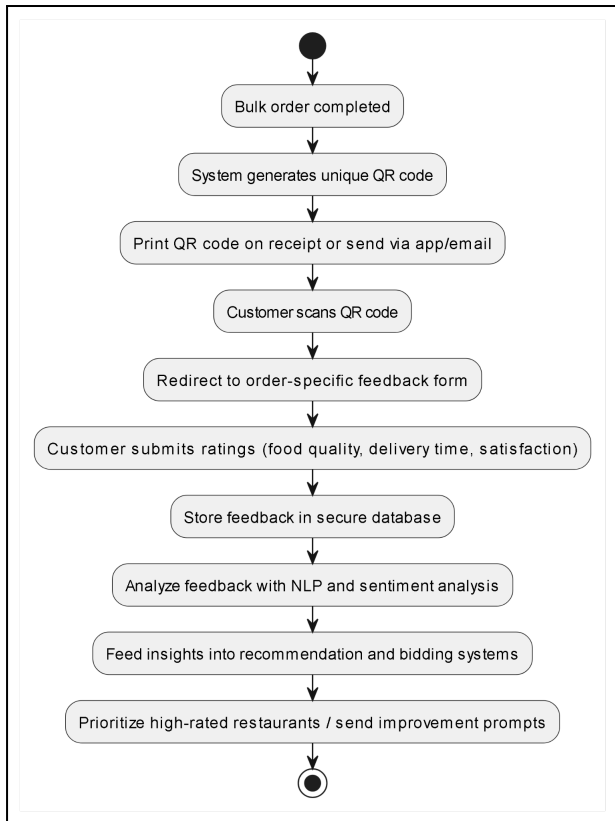
SmartServe’s AI-driven chatbot is embedded directly within the bulk-ordering workflow, employing spaCy for intent recognition and entity extraction alongside a fine-tuned BERT model for deep semantic understanding. As soon as a user asks about “order status,” “current bid,” “restaurant details,” or “modify my order,” the chatbot parses the query accurately, mapping extracted entities to SmartServe’s microservices endpoints.

This conversational agent is tightly coupled with the Recommendation Engine API, which blends collaborative filtering with content-based algorithms to generate personalized restaurant and menu suggestions. During the bid phase, the chatbot highlights each offer’s price, estimated delivery time, and historical performance metrics, presenting a clear comparison that guides the user toward the optimal choice without manual evaluation.

After each interaction, session logs and explicit user feedback are sent to a Q-learning reinforcement-learning module, which continually refines the chatbot’s dialogue policies and response accuracy. This iterative learning loop—driven by real usage data—ensures that SmartServe’s chatbot becomes progressively more intuitive, context-aware, and effective at streamlining the bulk-order experience.



## D. QR-Based Feedback Collection



SmartServe features an advanced QR-based feedback system designed to collect real-time customer reviews seamlessly. After each bulk order is completed, a unique QR code is automatically generated, printed on the receipt or delivered digitally through the app or email. When scanned, this code directs customers to a feedback form linked specifically to their order, allowing them to rate aspects such as food quality, delivery time, and overall satisfaction. This structured approach ensures that feedback is directly tied to individual orders, enhancing relevance and ease of submission. The responses are then analyzed using Natural Language Processing (NLP) and sentiment analysis to extract actionable insights, such as customer satisfaction levels or service issues.

Collected data is securely stored and continuously fed into SmartServe's recommendation and bidding systems. High-performing restaurants are prioritized in future suggestions, while those receiving lower ratings receive targeted improvement prompts. By leveraging AI, data mining, and sentiment analysis, SmartServe fosters a transparent, data-driven ecosystem—empowering restaurants to refine services and strengthening customer loyalty through a responsive feedback loop.

Once the feedback is collected and analyzed, it is stored securely and integrated into the SmartServe system to influence both the recommendation engine and the bidding process. Restaurants that consistently receive high ratings are highlighted in future customer recommendations,

ensuring they remain competitive in the marketplace. Conversely, restaurants with lower ratings are flagged for review, and tailored suggestions for improvement are sent. These suggestions may include operational adjustments, such as improving food quality, enhancing customer service, or addressing specific pain points identified through customer reviews. This continuous feedback loop not only helps restaurants optimize their offerings but also encourages a culture of ongoing improvement, creating a more responsive and efficient dining experience for customers. As the system evolves, it increasingly fosters a collaborative environment where customer feedback directly informs restaurant decision-making, driving mutual growth and satisfaction.

## IV. IMPLEMENTATION AND RESULTS

### a. Home Page

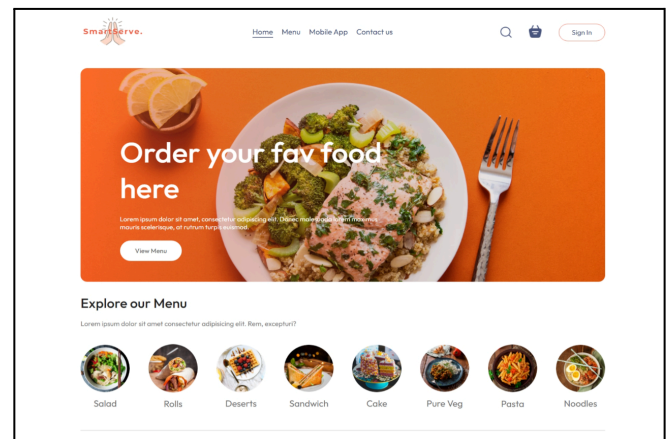
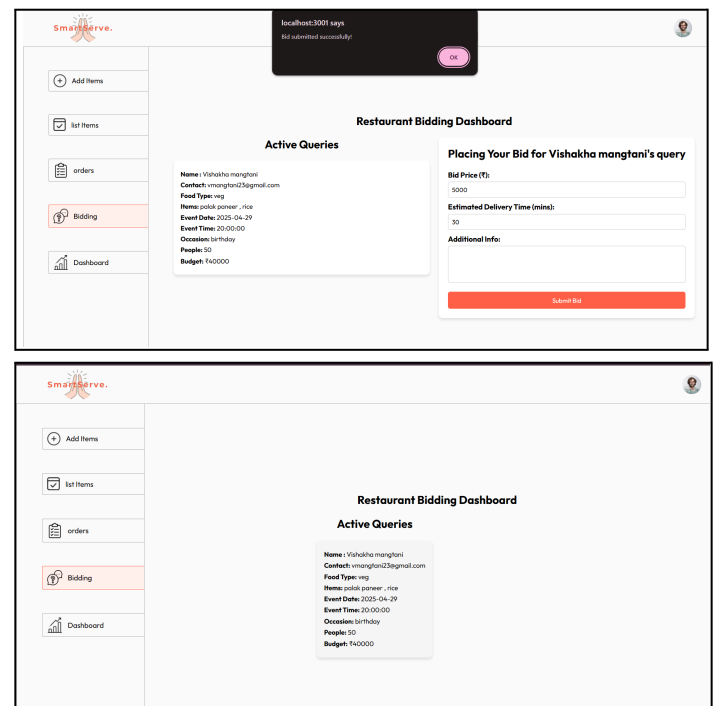


Fig. : Home Page

### b. Bidding Process



[Home](#)
[Menu](#)
[Chatbot](#)
[Contact us](#)

### Restaurant Query Form

Type of Food Order:

Occasion:

Number of People:

Food Items (Comma Separated):

Budget (₹):

Event Date:

Event Time:

Additional Information:

Submit Query

### Restaurant ChatBot

reviews:

Suggest a place for Italianfood

Here are some restaurants you might like: - Beyond Flavours: This place has received great reviews!

I wish to have some pizza

Here are some restaurants you might like: - Flechazo: This place has received great reviews!

Type a message... Send

Try these prompts:

Recommend me a restaurant

I wish to have some pizza

Suggest a place for Indian food

Fig. : Chatbot Implementation

#### d. Dashboard for Restaurant Analysis

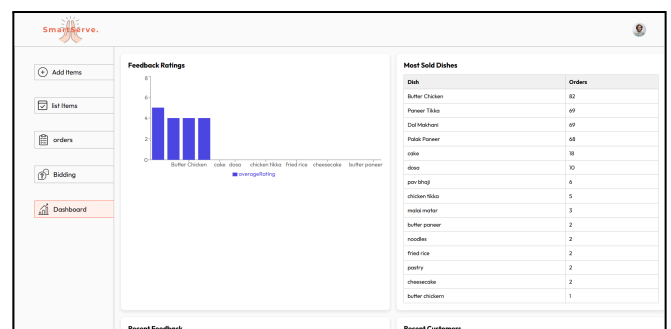


Fig. : Dashboard for Restaurant Analysis

#### e. Restaurant Orders

[Home](#)
[Menu](#)
[Chatbot](#)
[Contact us](#)

### Restaurant ChatBot

Recommend me a restaurant

Here are some restaurants you might like: - Beyond Flavours: This place has received great reviews!

I want to eat paasta

Type a message... Send

Try these prompts:

Recommend me a restaurant

I wish to have some pizza

Suggest a place for Indian food

SmartServe.

- Add Items
- list Items
- orders
- Bidding
- Dashboard

#### Order Page

User Details:

Name: Vubishka manghani

Email: manghani2@gmail.com

Phone: 0935697403

Order Date: 19/09/20

Total Amount: ₹800.00

Items Ordered:

- Butter Chicken - 1 x ₹350 = ₹350
- Panner Tikka - 1 x ₹250 = ₹250
- Dal Makhani - 1 x ₹200 = ₹200

Pending

User Details:

Name: Vubishka manghani

Email: manghani2@gmail.com

Phone: 0935697403

Order Date: 2/09/2025

Total Amount: ₹0.00

Items Ordered:

- Butter Chicken - 1 x ₹350 = ₹350

Pending

## V. CONCLUSION AND FUTURE WORK

SmartServe aims to redefine the food ordering experience by combining efficiency, personalization, and transparency. By integrating AI-driven features like the recommendation engine, chatbot, and real-time feedback collection, it provides users with a seamless and dynamic interface. The flexible quotation system empowers customers to make informed decisions, while the feedback system ensures continuous improvement and adaptability. These innovations not only enhance customer satisfaction but also support restaurant partners by optimizing their operations.

Despite the current success of SmartServe, there are areas that require further optimization. In the future, we aim to enhance the recommendation engine by incorporating deep learning models for better personalization and context awareness. Improving the accuracy of sentiment analysis and reducing response time for chatbot interactions will also be a focus. Additionally, expanding the platform's scalability to handle more complex datasets and supporting larger user bases will ensure that SmartServe continues to meet the demands of its growing customer base.

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