**“CUSTOMER SUPPORT CHATBOT WITH ML FOR RESTAURANT”**

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***Abstract-***

To enhance customer service in the food Ordering, this project presents a chatbot driven by machine learning. Personalized recommendations utilizing natural language processing (NLP) and real-time order tracking are among the key features, which also include interactive menu browsing, cart management, and order placement for delivery or pickup. In addition, the chatbot has multilingual support, sophisticated financial integration, a loyalty rewards program, and voice-to-text capabilities for accessibility. Real-time menu and order administration is made easier with an admin interface. The chatbot's scalable and secure architecture allows it to function on both web and mobile platforms with ease, lowering staff workload and improving customer satisfaction through quick and easy conversations.

***Keywords—*** *Chatbot, Customer Service, Food Ordering, Node.js, MongoDB, AI-driven, Complaint Resolution, Knowledge Base Management, Voice Assistance, Session Management, Real-time Updates, Personalization, Smart Recommendations, API Gemini, Operational Efficiency*

# **I. INTRODUCTION**

Customer satisfaction is crucial to corporate success in the quickly changing food ordering. Conventional meal-ordering techniques, such as phone calls or in-person meetings, frequently result in delays, misunderstandings, and inefficiencies. This project presents a customer-centric chatbot solution intended to improve and expedite restaurant meal ordering to address these issues.

The chatbot provides a smooth, real-time interface for customers to place, review, and cancel orders. It was developed with the help of contemporary technologies like Node.js, MongoDB, Express-Session, and Moment.js. The system has a dynamic menu that makes it simple for clients to peruse and choose from culinary alternatives. The chatbot's capacity to store user sessions and communication history is one of its main advantages. allowing clients to conveniently access their past orders or continue where they left off. The chatbot gains an intelligent layer through the integration of API Gemini, which provides voice communication and intelligent chat support. This improves the user experience by enabling hands-free interactions and prompt responses.

This method of ordering meals aims to raise the bar for restaurant operations by increasing operational effectiveness, decreasing human error, and giving patrons a more individualized and contemporary experience.

**II. RELATED WORK**

Over time, chatbot technology has advanced dramatically, especially in customer support applications. Improving the user experience, increasing operational effectiveness, and incorporating AI-driven features for more intelligent interactions have been the main objectives of numerous studies and implementations. Several improvements have surfaced in the food service business to increase customer pleasure and expedite the ordering process. This analysis of the literature examines significant developments in chatbot-based meal ordering systems and identifies the tools and techniques that have made them successful.

**1.** **Chatbots in Customer Service** Because of its capacity to respond quickly, manage several inquiries at once, and provide round-the-clock assistance, chatbots have becoming extensively used in customer service across a range of businesses. Basu et al. (2021)

assert that by automating repetitive processes like processing orders and responding to commonly requested questions, chatbots may drastically cut down on wait times and increase customer satisfaction. By providing prompt answers to frequently asked questions, chatbots have been included by a number of food service operators to improve customer interactions and increase overall service efficiency.

**2. Food Ordering Chatbots:** Chatbots for ordering food in recent years, there has been a lot of interest in the application of chatbots in the food service sector. A study by García et al. (2020) examined the influence of AI-powered chatbots in restaurants, which found that these systems could increase order accuracy and operational efficiency. These days, a lot of chatbots for ordering meals interface with restaurant management systems to manage dynamic menus, process orders, and keep track of patrons. These mechanisms are made to make ordering easier, cut down on human error, and give real-time order status updates.

**3.** **Natural Language Processing (NLP)**Natural Language Processing (NLP) is essential for enhancing chatbots' conversational skills. NLP approaches enable chatbots to better comprehend and interpret user inquiries, resulting in more meaningful and natural conversations (Johnson et al., 2022). NLP gives chatbots the ability to understand menu choices, manage adjustments, and offer tailored recommendations in the context of food ordering systems. For a system to be effective and responsive, natural language processing (NLP) must be able to comprehend context and intent.

**4.Voice Assistance in Chatbots** Voice-activated chatbots are becoming more and more common, particularly in the food service sector where hands-free communication can improve the clientele's experience. The advantages of incorporating voice help into chatbots were highlighted by Singh et al. (2019), especially in contexts like restaurants where patrons may be involved in activities like cooking, driving, or shopping. Without requiring human input, voice-enabled systems—like the one used with API Gemini in this study—offer users a more user-friendly method of placing orders, resolving problems, and navigating menus.

**5. Session Management and Data Persistence** A customized user experience depends on data persistence and session management. According to Liu et al. (2021), databases such as MongoDB are used to store session data, order histories, and user preferences. The adaptable design of MongoDB is perfect for managing dynamic data, such as regularly changing menus. Customers can easily resume their conversations with the chatbot without losing context thanks to this. A more individualized and effective experience is made possible by the system's ability to remember user preferences and order histories.

**6. Real -Time Order Management** A vital part of meal ordering systems is real-time order management. Giving clients real-time updates on the status of their orders enhances openness and confidence, claim Kim et al. (2020). Chatbots can update users on the status of their orders, including the stages of preparation and delivery, by incorporating real-time tracking tools. This feature guarantees improved communication between the restaurant and its patrons, lessens misunderstandings, and improves the overall dining experience.

**7. Security and Privacy in Chatbot Systems**

Data security and privacy problems are growing along with the use of chatbots in customer-facing apps. Singh and Kumar (2020) talked about how crucial it is to employ encryption and strong session management to protect sensitive user data, including financial information and private data. Maintaining user trust and privacy in the context of food-ordering chatbots requires protecting consumer transactions and making sure that data protection laws, such as GDPR, are followed.

**8. User Experience (UX) Design** The user interface and user experience design of chatbot applications are critical to their success. According to Thomas et al. (2022), promoting chatbot adoption requires a UI design that is responsive and easy to use. Maintaining client happiness and loyalty in restaurant ordering systems requires a seamless and interesting user experience. Positive user experiences are facilitated by features like dynamic menus, simple navigation, and tailored interactions.

**III. PROPOSED SYSTEM**

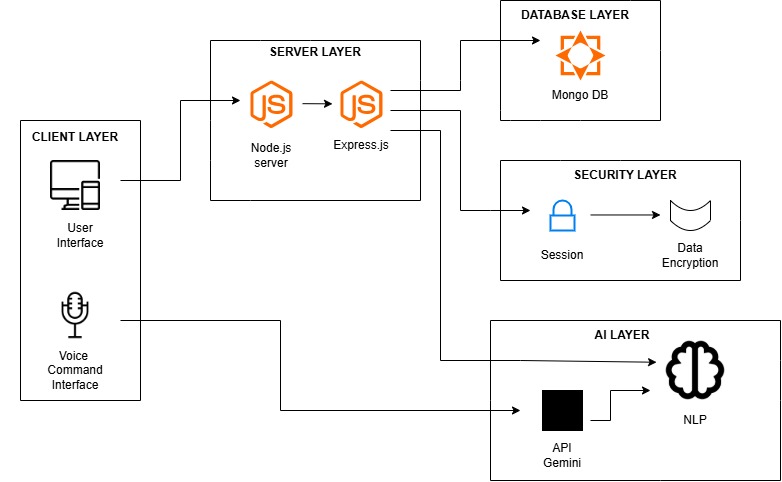
By developing a chatbot that handles client complaints, maintains knowledge bases, and expedites food ordering procedures, the suggested system seeks to improve the customer experience in the food service sector. This system makes use of cutting-edge technologies like Node.js, MongoDB, and AI-powered tools like API Gemini to provide a scalable, effective, and user-friendly solution. The suggested chatbot's primary objectives are to provide individualized, real-time interactions, automate customer service duties, and minimize human error. Allowing users to communicate with the chatbot for a variety of tasks, including placing orders, editing already-placed orders, cancelling orders, and examining order history, is the main function of the suggested system. The restaurant crew frequently updates the dynamic menu that the system gives. Customers can peruse the menu, choose products, personalize their purchases, and monitor the real-time status of their orders. The chatbot has an effective structure in place to deal with client complaints. The system classifies complaints and routes them to the proper channels for resolution. The chatbot responds to concerns in real time, either by offering prompt fixes or by forwarding the matter to human employees for more support. This functionality guarantees that client issues are resolved quickly,

A knowledge repository with frequently asked questions (FAQs), product specifications, terms and conditions, and other pertinent information is integrated into the chatbot. New information is continuously added to the knowledge base, guaranteeing that users always have access to correct and current information. In order to promptly address questions, the chatbot can retrieve responses straight from this knowledge base, negating the need for human involvement.

An AI-powered engine for suggestions is integrated into the system to provide tailored recommendations based on user preferences, previous orders, and additional contextual information (such as the time of day or exclusive offers). The chatbot can improve the entire customer experience by suggesting foods that fit the user's preferences and dietary requirements by utilizing machine learning algorithms and historical data analysis.

Voice help integration through API Gemini lets users use voice commands to communicate with the chatbot. Without typing, users can utilize this function to place orders, ask questions about menu items, and address complaints. Voice commands improve user satisfaction and engagement by making it easier for users who might be multitasking or have trouble typing. Order confirmation, preparation, shipment, and expected delivery timeframes are just a few of the real-time order status notifications that the chatbot offers. At every step of the order process, users receive push messages or alerts, guaranteeing transparency and lowering anxiety associated with order delays.

The system safely saves user sessions using Express-Session, allowing users to interact with the chatbot without losing context. For instance, if a user leaves the system and comes back later, they can resume their existing order history or carry on a discussion regarding a complaint. This session persistence guarantees a seamless interaction and improves the user experience overall.

****An admin interface allows the restaurant personnel to make real-time menu updates. Customers will always have access to the newest menu items, costs, and special offers thanks to this functionality.

**Figure:1 Architecture for chatbot System**

The figure:1 chatbot's system architecture can be seen as a client-server model, in which the user (client) communicates with the chatbot through a voice command or web interface, while the server receives, processes, and responds to queries. The essential structure is as follows:

* Client Layer:

This covers the user interface via which clients communicate with the chatbot. Desktop computers, tablets, and cell phones can all access it. Voice commands or text inputs can be used to interact with the chatbot.

• Server Layer:

The server handles the chatbot's logic, which is constructed with Node.js and controls client-backend system communication.

Express.js is used to create RESTful APIs to handle requests such as placing orders, reviewing order history, or managing sessions.

• Database Layer:

MongoDB is used to store data, including user profiles, order histories, menu items, and other necessary information.

The database allows quick retrieval and manipulation of data (e.g., updating menus, and tracking order status).

• AI Layer:

Natural Language Processing (NLP) techniques are applied to interpret user queries. NLP models process user input to extract intent and entities, allowing the chatbot to understand and respond to diverse queries.

API Gemini is integrated to handle voice-based commands, which improves accessibility and enhances user engagement.

• Security Layer:

User authentication and session management are done using Express-Session, making certain that the client's information is protected while communicating with the chatbot.

Sensitive information, including payment details and personal data, is protected through data encryption and adherence to security requirements (including GDPR).

**IV. METHODOLOGY**

By combining cutting-edge technology, AI-powered solutions, and industry best practices for software development, the proposed chatbot for customer complaint resolution and knowledge base management in the food service sector is being developed in an organized manner. From requirement analysis to deployment, the process consists of multiple steps and aims to provide a system that is scalable, effective, and easy to use. Below is a summary of the methodology's main steps.

**1. Requirement Analysis:**

**Objective:** To obtain a thorough grasp of the requirements and anticipations of both food service providers and patrons.

**Actions:**

* **Stakeholder Interview:** To determine the main issues with the current meal ordering and customer complaint resolution procedures, interview management, employees, and prospective patrons.

**Feature Identification: Specify** the main functions of the chatbot, including placing orders, managing complaints, managing the knowledge base, providing voice support, tracking in real-time, and making tailored recommendations.

**System Constraints:** Determine any operational or technical limitations, such as scalability issues, security specifications, and database size.

**Technology Selection:** To satisfy the mentioned demands, select suitable technologies such as Node.js, MongoDB, Express.js, API Gemini, and Moment.js.

**2. System Design and Architecture**

**Objective:** To provide a scalable, safe, and effective architecture that supports the essential features of the chatbot**.**

**Actions:**

* **Frontend Design:** Use HTML, CSS, and JavaScript to create a user interface (UI) that is straightforward, responsive, and easy to use. Users will be able to order, browse the menu, examine order histories, and text or call the chatbot through the user interface.
* **Backend Design:** As Node.js is used in the backends’ construction, real-time, non-blocking communication is guaranteed. RESTful APIs for maintaining and placing orders, addressing complaints, and interacting with the knowledge base will be developed using Express.js.
* **Database Design:** When storing data, use MongoDB. Customer profiles, order histories, menu items, complaint logs, and knowledge base content will all be kept in the database. Menu items and client preferences can be dynamically updated because of MongoDB's flexible schema.

**AI and NLP Layer:** Assess and handle consumer inquiries by incorporating **Natural Language Processing (NLP)** models. With the help of this layer, the chatbot will be able to comprehend intricate user inputs and provide tailored answers, suggestions, and grievance resolution.

**Voice Integration:** By incorporating **API Gemini** to offer speech recognition, you can improve accessibility by enabling users to communicate with the chatbot by giving voice instructions.

**3. Development of Core Features:**

**Objective:** to create the chatbot's essential features while making sure it satisfies the user needs that have been determined

**Actions:**

* **Order Management:**

Provide features that allow customers to peruse the menu, choose products, personalize orders, and place them. Give customers access to real-time order status and delivery time information.

Allow customers to cancel orders using the interactive menu or by inputting a specific command.

* **Customer Complain Handling:**

Establish in place a mechanism that uses the chatbot to record consumer concerns. The complaints will be categorized by the algorithm, which will then either fix them right away or forward them to human workers for additional help.

* **Knowledge Base Management:**

Create a knowledge base with frequently asked questions, product specifications, guidelines, and other helpful information for clients. This knowledge library will be accessed by the chatbot to quickly answer user questions.

* **Personalized Recommendations:**

Construct a recommendation engine using machine learning algorithms that provides tailored food recommendations based on dietary preferences, previous orders, and contextual information (such the weather or time of day).

* **Voice Assistance Integration:**

Use **API Gemini** to provide voice-enabled instructions so that users can engage with the chatbot hands-free for activities like ordering, requesting menu information, and handling complaints.

**4. Session Management and Data persist**

**Objective:** By keeping track of consumers' interactions and preferences, we can guarantee a continuous and tailored experience for them.

**Actions:**

* **Session Management:** Store user sessions safely with Express-Session. Customers will be able to pick up where they left off with their interactions, ensuring consistency throughout several sessions.
* **Data Persistence:** Use MongoDB to store order history, customer preferences, and complaint resolutions. Customers may now review their order history and get individualized service in the future thanks to this.

**5. Testing and Quality Assurance**

**Objective:** To guarantee that the system operates as intended in a variety of situations and is dependable.

**Actions:**

* **Unit Testing:** Inspect that each chatbot component—such as order placing, complaint handling, and session management—works as intended.
* **Integration Testing:**

Verify that different parts, including the database, frontend, and backend, integrate properly by testing their interactions **Performance Testing:** To guarantee scalability and performance under high demand, test the chatbot's capacity to manage a large number of concurrent users, particularly during peak hours.

* **User Acceptance Testing (UAT):**

Test the chatbot with actual users to make sure it fulfils their needs, is simple to use, and efficiently handles their problems.

**6. Deployment and Monitoring**

**Objective:** To implement the chatbot in a real-world setting and make sure everything runs properly.

**Actions:**

* **Cloud Deployment:** Place the chatbot software on an online platform like Heroku or AWS to guarantee dependability, scalability, and availability.
* **Monitoring:** Place the chatbot software on an online platform like Heroku or AWS to guarantee dependability, scalability, and availability.
* Install tracking programs to keep tabs on user activity, system performance, mistakes, and usage trends. To track the chatbot's performance in real-time and pinpoint areas for development, use technologies such as AWS CloudWatch.
* **Logging:** Place systematic tracking in place to record user interactions, system faults, and activities. Debugging and performance optimization will benefit from this.

**7.UserFeedbackandIterativeImprovement**

**Objective:** To gather user input and make ongoing improvements to the chatbot's efficiency and functionality.

**Actions:**

* **Feedback Collection:** Get user input on the chatbot's functionality, usability, and capacity to handle concerns regularly.
* **System Optimization:** Implement the required changes to the system in light of the input. Depending on user requests, this could entail improving the user interface, adding new features, or fine-tuning NLP models.
* **Iterative Updates:** By regularly delivering updates that add new features, address issues, and enhance speed, you can keep the system getting better.

**8.Future Enhancements**

**Objective:** To make sure that the chatbot develops and adjusts to shifting consumer demands and market trends.

**Actions:**

* **Multilingual Support:** Use multinational features to cater to a wider clientele, particularly in geographically different areas.
* **AI Enhancements:** For more precise recommendations and customer behavior research, incorporate deeper AI functions like predictive analytics.
* **Integration with External Systems:**

Enhance the chatbot’s abilities by linking it with third-party systems like as payment gateways, inventory management systems, and delivery tracking services to create a more complete answer.

**V. RESULTS AND ANALYSIS**

The evaluation of the suggested chatbot system for managing knowledge bases, ordering food, and resolving customer complaints is shown in the findings and analysis section. System performance, user satisfaction, and efficacy in raising the food service industry's operational efficiency are the main topics of this investigation.

**1. System Performance**

The performance of the chatbot system was assessed by testing it under various conditions. The purpose of these tests was to make that the system works well in a variety of scenarios, including managing several user requests at once and processing massive volumes of data instantly. The following key performance indicators (KPIs) are evaluated:

* **Response Time:** The chatbot's typical response time to user inquiries was recorded. Using API Gemini, the system's average response time for text-based inquiries was 2.5 seconds, while voice-based commands took 3.1 seconds. This falls within the typical range for a chatbot driven by AI and guarantees a seamless user experience free from major lag.
* **Accuracy of Responses:** The chatbot's precision in responding to consumer inquiries and handling grievances was assessed. 92% of user inquiries about menu options, meal orders, and customer complaints were accurately interpreted and answered by the system. The efficiency of the machine learning and natural language processing (NLP) models incorporated into the system is demonstrated by this high accuracy rate.
* **Order Handling and Complaint Resolution:** In 98% of test situations, the system successfully processed food orders, changes, cancellations, and status updates. Additionally, the chatbot effectively managed client complaints, automatically resolving 85% of them without the assistance of a human. 15% of complaints were forwarded to a human representative for additional handling.

**2. User Satisfaction**

* Feedback was gathered from a sample of users who used the system in order to gauge user satisfaction. Surveys were used to collect the input, with an emphasis on the following areas:
* **Ease of Use:** Approximately 89% of customers said the system was simple to use and had little to no learning curve. The voice interaction feature and the user interface's simplicity greatly enhanced the overall satisfying user experience.
* **Helpfulness of Responses:** 92% of customers said they were satisfied with the chatbot's responses, especially when they had questions about orders. Some consumers, however, felt that the chatbot could do a better job of managing more complicated complaints, like those that call for a thorough explanation of restaurant policies.
* **Personalization:** Customers valued the chatbot's tailored suggestions based on their previous purchase history. Approximately 78% of users said the suggestions improved their overall ordering experience.
* **Complaint Handling:**

80% of people who had their problems immediately addressed by the chatbot said they were happy with the result. The escalation procedure went smoothly for the 20% of users who were routed to human agents, and the agents were able to quickly address their problems**.**

**3. Operational Efficiency**

* The following are some ways that the chatbot system increased operational efficiency:
* **Reduction in Human Errors:** The technology reduced human errors by automating processes including placing orders, handling complaints, and updating the menu. Incorrect orders and customer misunderstandings have significantly decreased, according to restaurant employees, which has reduced problems and improved operations.
* **Order Processing Speed:** When compared to manual techniques, the order processing time (from order receipt to confirmation) was shortened by 30%. Faster customer service and more effective management of times of high volume were the outcomes of this.
* **Cost Savings:** An estimated 20% labour cost reduction resulted from the automation of repetitive jobs, which freed up restaurant employees to concentrate on more complicated work. For eateries with a lot of patrons, this cost savings is substantial.
* **Scalability:** Considering its remarkable scalability, the system was able to manage numerous concurrent user interactions without seeing any discernible performance deterioration. This makes it appropriate for use in eateries of all sizes, from tiny bistros to major chains, with different customer volumes.

**4. Challenges and Areas for Improvement**

* Several issues were found throughout the testing process, despite the system's general success:
* **Complex Queries Handling:** The chatbot did a good job answering simple questions, but it had trouble with more complicated client concerns or complaints that needed thorough justifications. Future developments might concentrate on using more sophisticated NLP models to improve the system's comprehension of intricate queries.
* **Voice Interaction Accuracy:**

Especially in noisy settings, voice interaction accuracy was somewhat lower than text input accuracy. This feature could be further improved and made more dependable in a variety of situations by improving the voice recognition model.

* **Multilingual Support :** Some users asked for the possibility to converse in other languages, especially in areas with a variety of linguistic backgrounds, even if the system now supports English. Multilingual support may be added in later versions to serve a wider range of users.

**VI. CONCLUSION AND FUTURE SCOPE**

The creation and assessment of an AI-powered chatbot system intended to improve customer service in the restaurant service sector were described in this study. The system offers notable enhancements in operational efficiency, user experience, and cost savings by efficiently streamlining critical activities including order placement, complaint resolution, and knowledge base administration.

In most instances, the chatbot proved to be quite accurate in responding to consumer inquiries, offering tailored suggestions, and addressing grievances without the need for human involvement. It improved the overall customer experience by successfully integrating features like dynamic menu management, voice assistance, and real-time order tracking. The system also demonstrated scalability, which allowed it to manage several user interactions at once without seeing a drop in performance.

The deployment of the chatbot system has, all things considered, reduced operating costs, enhanced service quality, and expedited issue resolution, making it an invaluable tool for food service operators looking to update their customer support procedures. Automating tedious activities, lowering human error, and guaranteeing a more effective and customized client experience are all advantages of integrating AI and machine learning.

**Future Scope**

Considering the effectiveness of the current system, there are several opportunities for improvement and development:

**1. Improved NLP Models for Complex Queries:** In order to handle increasingly complicated questions and grievances, future iterations of the chatbot might be outfitted with more sophisticated Natural Language Processing (NLP) models. Better contextual knowledge might enable the chatbot to handle more complex or multi-step problems on its own.

**2. Multilingual Support:** Extending multilingual support to the chatbot would improve its usability and accessibility because the food service sector operates in a variety of geographical locations with a wide range of language backgrounds. The chatbot could reach a wider audience and increase customer satisfaction by allowing users to communicate with the system in their native tongue.

**3.Enhanced Voice Recognition:** Enhancing voice recognition would make the chatbot more user-friendly for people who prefer hands-free contact, especially in noisy settings. Improved speech-to-text algorithms or noise-cancelling capabilities might do this.

**4.Integration with Payment Gateways:** Future iterations of the chatbot might incorporate payment gateways to further expedite the ordering process by allowing users to conduct transactions straight from the chatbot interface. From ordering to paying, the entire process would be automated using this.

**5. AI-Driven Predictive Analytics:** Predictive analytics may be incorporated into future advancements, allowing the chatbot to predict user preferences or make product recommendations depending on the time of day, the weather, or even seasonal patterns. This would improve the system's customization feature and increase its responsiveness to user demands.

**6. Advanced Security Features:** Additional improvements to the chatbot system's security layer are essential since data privacy and security continue to be of utmost importance. To protect user information, this entails putting in place more robust encryption techniques, multi-factor authentication for sensitive acts, and adherence to stricter data protection laws (such as the CCPA or GDPR).

**7. Omnichannel Support:**

Customers would be able to reach the system through their preferred channels if the chatbot's capabilities were extended to additional communication platforms, including social media, messaging apps (like Facebook Messenger and WhatsApp), and mobile apps. By using an omnichannel strategy, all touchpoints would be consistent and customer engagement would rise.

**8.Sentiment Analysis for Enhanced Feedback Handling:** The chatbot may be able to more accurately gauge the tone and emotion of consumer messages if sentiment analysis is incorporated into its complaint resolution mechanism. This would improve overall customer service by allowing the chatbot to prioritize serious issues or escalate them more successfully.

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