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Smart Bargain Bot: A Text and Voice-Based Price Negotiation System for E-Commerce Platforms

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Abstract:
In recent years, online shopping has witnessed tremendous growth, transforming the retail landscape. While numerous features have been incorporated into e-commerce platforms, traditional negotiation a key aspect of offline shopping remains largely absent. To address this gap, we propose an intelligent Price Negotiating Chatbot with Text and Voice capabilities for e-commerce websites. This chatbot enables users to negotiate product prices dynamically, simulating the real-life bargaining experience found in physical stores. The system interacts with users using natural language (via text and speech) and leverages historical pricing data to suggest acceptable discounts while maintaining business profitability. One of the core challenges in price prediction systems is the trade-off between accuracy and reliability, especially when irrelevant features are used or when certain algorithms are mismatched with the dataset characteristics. Incorrect price predictions can lead to significant business losses. Our proposed system integrates a rule-based and data-driven algorithm that adapts to variations in data and mitigates issues such as feature unavailability or model degradation over time. By carefully managing these challenges, our chatbot aims to provide a more accurate, efficient, and customer-friendly negotiation process in online retail environments.

Keywords: Price Negotiation, Chatbot, E-Commerce, Voice Interaction, Text-based Bot, Price Prediction, AI Negotiation System.

1. Introduction:

In the current digital era, e-commerce platforms leverage various artificial intelligence (AI) techniques to enhance user experience by recommending popular or frequently purchased products. These intelligent systems help streamline the customer's shopping journey through personalized suggestions and efficient search capabilities. However, a key aspect of offline shopping price negotiation remains largely unexplored in the online retail space. Often, highly rated or best-selling products are priced beyond the customer's budget, compelling them to compromise on their choice or abandon the purchase altogether. Similarly, lower-cost products may raise concerns regarding quality or value. To address this limitation, the concept of price negotiation through AI-powered chatbots presents an innovative solution. Negotiation is a complex process that combines linguistic interaction with logical reasoning, aiming to arrive at a mutually agreeable price between the buyer and the seller. In the proposed system, the seller sets a

predefined minimum acceptable price alongside the original product price. These two points serve as bounds for the negotiation algorithm, which determines an optimal offer through interactive dialogue with the customer. By enabling real-time negotiation on e-commerce platforms, this system aims to enhance customer satisfaction, reduce product abandonment, and improve overall sales conversion rates.

2. Literature Survey:

The integration of negotiation capabilities into e-commerce chatbots has gained significant attention in recent years due to its potential to enhance user satisfaction and simulate real-world bargaining experiences. Multiple studies have explored the use of artificial intelligence, natural language processing (NLP), and machine learning techniques to build intelligent negotiation systems for online retail platforms.

1. Bindu et al. (2023) presented a price negotiating chatbot designed specifically for e-commerce using NLP techniques. Their system focused on improving buyer–seller interactions by providing a more natural negotiation process, emphasizing language understanding and affordability-based offers. Similarly, Fu et al. (2023) introduced a self-play mechanism and AI feedback system for improving language model performance in negotiation scenarios. Their research highlighted the importance of reinforcement through self-generated dialogues to fine-tune negotiation behavior in large language models.
2. Ahmad et al. (2023) developed INA, a reward-based dialogue system that incorporates strategic negotiation through reinforcement learning. Their integrative framework optimizes agent responses based on rewards, making the negotiation process more adaptive and goal-driven. Ramachandran et al. (2023), in their study on contract price negotiation, utilized an AI-based chatbot that demonstrated efficient dialogue management and optimized contract deals using logical frameworks.
3. Liu et al. (2023) explored the compatibility between conversational recommender systems and large language models in pre-sales e-commerce dialogues. Their research demonstrated how recommendation engines can complement price negotiation by better understanding customer intent and preferences. Cheng et al. (2024) examined user responses to text-based chatbots, finding that task complexity and chatbot transparency significantly impact user trust and decision-making in e-commerce settings.
4. Bekal (2024) introduced EMORA, an AI-powered negotiation chatbot, and demonstrated its utility in enhancing user engagement and satisfaction during price negotiations. Challagundla et al. (2024) proposed an ensemble machine learning-based chatbot using text and voice modalities to integrate intellectual consciousness in negotiation, paving the way for more human-like conversational agents. Zhao et al. (2024) analyzed lexical alignment in bargain-based chatbot systems, emphasizing the role of linguistic mimicry in achieving successful negotiations.
5. These studies collectively establish a strong foundation for developing intelligent, responsive, and efficient negotiation systems for e-commerce platforms. However, challenges remain in maintaining accuracy, personalization, and contextual relevance during real-time negotiations, which our proposed system aims to address through hybrid techniques and domain-specific design.

3. EXISTING SYSTEM

Consumer behavior analysis is a vital aspect of understanding how individuals select, purchase, use, and dispose of products or services. Businesses invest heavily in this area to ensure profitability and customer satisfaction. However, current e-commerce systems lack one important aspect found in offline shopping price negotiation. In 2017, Facebook's FAIR (Facebook Artificial Intelligence Research) group, in collaboration with the Georgia Institute of Technology, experimented with over 5,000 negotiation datasets to train bots. When trained to respond based on human-like tendencies, the bots often became overly agreeable. However, when trained using models based on human belief systems, the bots frequently produced false responses. Among traditional machine learning techniques used for

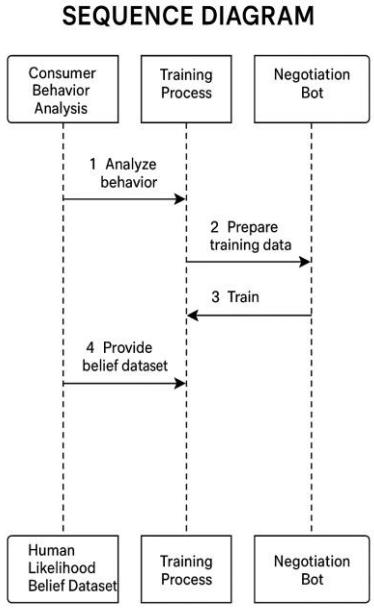


Fig: Sequence Diagram

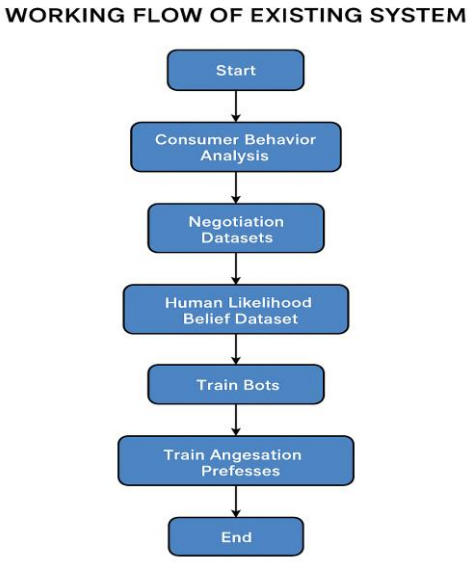
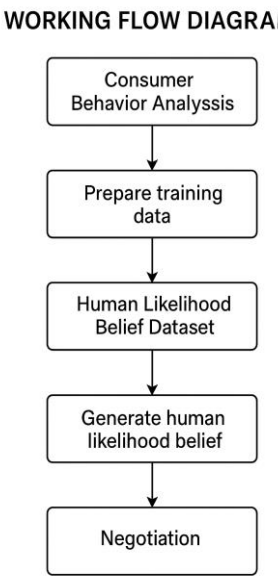


Fig: Workflow Diagram

negotiation, Support Vector Machines (SVMs) have been widely adopted due to their ability to handle non-linearity in datasets. Despite these advancements, existing systems still suffer from major drawbacks: **Disadvantages of Existing Systems:** Low accuracy in predicting optimal negotiation responses**,** Inefficient decision-making models in dynamic customer interactions

4. PROPOSED SYSTEM

To address these limitations, the proposed system introduces a smart chatbot integrated into an e-commerce platform capable of handling price negotiations through both text and voice inputs. The chatbot leverages a dataset containing product prices and predefined minimum acceptable prices for each item. Customers can initiate negotiation via a "Negotiate" button integrated into the product display page.



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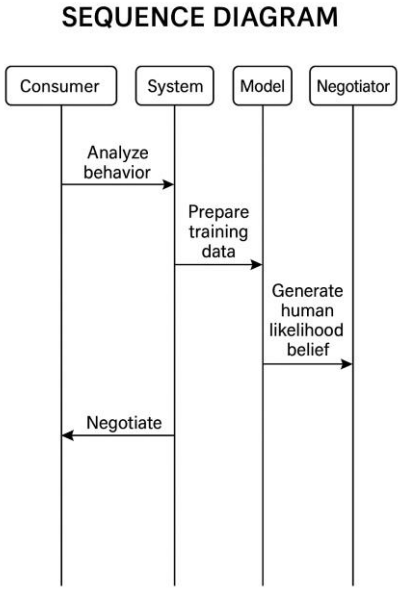


Fig: Sequence Diagram

Users can add products to their cart, negotiate, and choose to either proceed with the purchase or continue browsing. The system is designed to simulate the offline shopping experience while enhancing customer engagement through negotiation flexibility.

Advantages of the Proposed System: Higher accuracy in negotiation decisions, Improved efficiency and responsiveness, Increased user satisfaction and trust

5. IMPLEMENTATION

The implementation of the proposed system is divided into several functional modules, each contributing to the overall user experience:

Browse Products: The Browse Products module serves as the foundational component of the e-commerce platform, enabling users to conveniently explore and evaluate a wide range of products tailored to their preferences and needs. This module is designed with user experience at its core, offering an intuitive and responsive interface that allows customers to search and filter products by type, price, brand, and other relevant criteria. The goal is to facilitate a smooth and efficient browsing experience that closely mimics the in-store shopping process but with the added advantages of digital interaction.

Each product in the catalog is displayed with comprehensive details to help users make informed purchasing decisions. These details typically include the product name, high-quality image, current price, and a brief yet informative description highlighting key features, specifications, or usage. This ensures transparency and reduces the chances of customer confusion or dissatisfaction post-purchase. Moreover, the system architecture is optimized to load products quickly and adapt to different screen sizes, ensuring a seamless experience across devices such as smartphones, tablets, and desktops.

One of the standout and innovative features of this module is the “Negotiate” button prominently displayed alongside each product listing. Unlike traditional e-commerce platforms where prices are fixed, this feature allows users to engage in real-time price negotiation using an AI-powered chatbot. This interaction can be carried out via text or voice, depending on user preference. By clicking the “Negotiate” button, users initiate a conversational interface where they can propose a price or inquire about possible

discounts, promotions, or bundle offers. This adds a layer of personalization and interactivity to the shopping experience, making it not only more engaging but also more dynamic.

The chatbot embedded in the negotiation process is driven by natural language processing (NLP) and machine learning algorithms, enabling it to understand user queries, analyze product pricing policies, and respond intelligently within a defined negotiation range. The chatbot may consider factors such as ongoing deals, user purchase history, and stock availability while negotiating. The objective is to simulate a human-like bargaining process commonly seen in physical retail environments, thereby bridging the gap between online and offline shopping experiences.

This combination of product discovery and interactive negotiation makes the shopping process more user-centric. Users are no longer passive recipients of price tags but active participants in the purchasing journey. It fosters a sense of empowerment and satisfaction as customers feel they have a say in determining the final purchase price. Additionally, it can boost customer retention and loyalty, as shoppers are more likely to return to a platform where they feel valued and heard.

Another crucial aspect of this module is the back-end integration with the inventory and pricing management systems. When a user negotiates a price and reaches a mutual agreement with the chatbot, the system automatically validates the agreed price, updates the shopping cart, and reflects changes in stock levels. This real-time synchronization ensures that business logic is enforced while maintaining operational accuracy. Security and user privacy are also prioritized in this module. All interactions, including voice negotiations, are processed securely, and user data is protected according to standard data protection policies. Furthermore, the system maintains logs of negotiation sessions for quality monitoring, training improvements, and potential customer support needs.

View Order: The View Order module plays a crucial role in providing users with visibility and control over their purchase history. It serves as a centralized hub where users can conveniently monitor, manage, and review their current and past orders. Designed with simplicity and usability in mind, this module ensures that users have full transparency regarding the status and details of every transaction they have made on the platform. Upon accessing the View Order section, users are presented with a neatly organized list of their orders, categorized as “Ongoing Orders” and “Order History.” Each entry displays comprehensive information including the Order ID, product name, quantity purchased, individual and total price, date of purchase, and the current delivery status. This detailed breakdown ensures that customers have all necessary information at their fingertips, making it easier to verify purchases, track shipments, or raise concerns if needed.

A major feature of this module is the real-time tracking of order status. Users can see whether their order is being processed, packed, shipped, or delivered. This tracking is dynamically updated based on backend logistics data, offering a seamless and informed shopping experience. Such transparency builds trust and reduces the need for customer support intervention, as users can independently monitor their order progress. In addition to tracking, the module provides options for order-related actions. For example, users may be able to reorder a previously purchased item with a single click, which is particularly useful for frequently bought products. The module may also support order cancellation, subject to the platform’s return and cancellation policies. If an order is still in a cancellable state—typically before it is shipped—the user can select the item and initiate the cancellation process directly from the interface. The View Order module is designed to be responsive and accessible across devices, allowing users to manage their orders from mobile phones, tablets, or desktops. The clean layout, search/filter functionality, and action buttons all contribute to an intuitive experience.

Chatbot: The Chatbot module represents the core innovation and intelligence behind the price negotiation system in the e-commerce platform. It is designed to provide a seamless, engaging, and human-like interaction through both text and voice communication, significantly enhancing user experience and redefining how customers engage with online shopping platforms. By simulating natural conversations, the chatbot bridges the gap between conventional online shopping and the interactive bargaining culture found in physical marketplaces. At its foundation, the chatbot is capable of understanding user inputs using Natural Language Processing (NLP). Whether a customer types or speaks their queries, the system parses the message, interprets intent, and responds accordingly. This multimodal communication makes the platform more inclusive and user-friendly, catering to a broader range of users including those who prefer speaking over typing.

The most unique feature of the chatbot is its negotiation capability. When a user chooses to negotiate a product's price by clicking the "Negotiate" button, the chatbot initiates a conversation. It allows the user to propose a new price for the selected item. The chatbot then evaluates this proposal against the product's internal minimum acceptable threshold, which is predefined by the seller or dynamically set by pricing algorithms. Depending on the offered price, the chatbot may respond in one of three ways: acceptance, rejection, or a counteroffer. The decision-making process of the chatbot can be governed by either rule-based logic or machine learning models. In a rule-based system, predefined conditions determine how the chatbot reacts to different price inputs. In a more advanced machine learning-based approach, the chatbot can learn from historical negotiation patterns, user behavior, and market trends to offer more dynamic and personalized responses. This adds a layer of adaptability and intelligence, ensuring the negotiation feels realistic and tailored to the individual user.

Once a mutual agreement is reached between the user and the chatbot, the final negotiated price is automatically updated on the product and reflected in the user's checkout cart. This seamless transition from conversation to action ensures a smooth and satisfying shopping journey.

In essence, the Chatbot module not only enables cost negotiation but also enhances user engagement, builds customer trust, and adds a competitive edge to the platform by making the online shopping experience more interactive and personalized.

Post Review: The Post Review module plays a vital role in fostering transparency, trust, and community engagement within the e-commerce platform. It allows customers to share their experiences and opinions about the products they have purchased, helping both future buyers and sellers make informed decisions. As a key component of the feedback ecosystem, this module enhances overall user satisfaction and encourages accountability among sellers. After a successful purchase and delivery, users are invited to leave a product review through this module. The interface is user-friendly, featuring a rating system commonly represented by a 1 to 5-star scale alongside a text input box for optional written feedback. The rating provides a quick visual summary of customer satisfaction, while the written review allows users to elaborate on specific aspects such as product quality, value for money, delivery experience, or usage performance.

These reviews are publicly displayed on the product detail page, providing future buyers with valuable insights based on real experiences. Shoppers often rely on reviews to assess the authenticity, functionality, and reliability of a product before making a purchase decision. By showcasing genuine customer feedback, this module builds credibility and confidence in the e-commerce platform.

In addition to aiding other buyers, the Post Review module serves as a feedback channel for sellers and administrators. The input gathered helps vendors understand customer expectations, identify recurring

issues, and improve their products or services accordingly. For example, if multiple reviews mention packaging damage, the seller can take corrective measures in logistics. This ongoing feedback loop helps enhance product quality and service efficiency over time. The system includes moderation mechanisms to ensure that posted reviews are respectful, relevant, and free from offensive or spam content. Filters or manual review processes may be implemented to maintain the platform's integrity while respecting users' freedom of expression.

Logout: The Logout module is a critical component of the e-commerce platform, designed to ensure user security, privacy, and session integrity. While it may seem like a simple function, the logout mechanism plays an essential role in protecting user data and preventing unauthorized access, especially when the platform is accessed via public or shared devices. When a user chooses to log out, the system initiates a sequence of processes to securely terminate the current session. This involves invalidating the user's session token or authentication key on the server-side, ensuring that any further attempt to use the previous session credentials will be rejected. Simultaneously, all temporary data such as cookies, cache, local storage items, and session variables related to user activity is cleared to prevent any remnants of sensitive information from being accessible after logout.

This process is particularly important in scenarios where multiple users may access the same device. For example, in internet cafes, shared family computers, or workplace environments, failing to properly log out could lead to unauthorized actions, such as unauthorized purchases, changes to account settings, or exposure of personal and payment information. By terminating the session completely and removing any trace of stored data, the logout module safeguards against such risks. The user interface for logout is typically simple often a single button labeled "Logout" or "Sign Out" placed in the user profile or navigation menu. Upon clicking the button, the system prompts the logout function, provides a confirmation message or redirect, and returns the user to the home or login page. This offers visual assurance to users that their session has ended. On the backend, the logout function is implemented with best practices in mind, including measures such as session timeout, CSRF token revocation, and secure redirection. Some systems may also provide automatic logout after a period of inactivity to further enhance security.

6. SYSTEM TESTING:

System testing is a critical phase in the software development lifecycle that ensures the final product meets the specified requirements and works as intended. The main purpose of testing is to uncover defects, validate functionality, and verify that the software behaves reliably under various conditions. Testing involves subjecting the system to real-world inputs and validating outputs against expectations. A well-structured testing process provides confidence in system stability, performance, and accuracy.

TYPES OF TESTS

1. Unit Testing: it is focuses on verifying the smallest testable parts of the software, typically individual functions or modules. The goal is to ensure each unit performs as expected in isolation. Unit tests validate internal program logic, decision branches, and code flows. They are written and executed by developers during the coding phase. This is considered structural testing, requiring knowledge of the software's internal logic. Unit tests improve the maintainability and reliability of code and serve as a foundation for further testing.

2. Integration Testing: Integration testing evaluates how different modules or components interact with

each other. Even if units function correctly on their own, integration testing ensures that combining them results in consistent and expected behavior. This testing checks data flow between modules, interface correctness, and compatibility of integrated components. Problems like mismatched data formats or broken inter-module communication are identified here.

3. Functional Testing: Functional testing assesses whether the system meets the functional requirements as specified in the business documents. It examines inputs, outputs, user commands, and system actions to ensure everything behaves as expected. Key focuses include, **Valid Input** Accept only data of correct type and format. **Invalid Input** Reject incorrect data gracefully.**Functionality** Validate that defined features perform accurately. **Output** Ensure correct and expected results are displayed or saved **Process Flow** Check logical and sequential transitions between operations.

4. System Testing: System testing evaluates the complete and integrated application as a whole. It ensures that the software operates correctly in the target environment and aligns with customer expectations. System testing simulates real-world usage scenarios, combining functional, performance, and security tests. This phase is vital for identifying any last-minute inconsistencies, missing features, or system-level bugs before delivery.

5. White Box Testing: White box testing (or structural testing) involves a detailed inspection of the internal logic, code structures, loops, and conditions. The tester knows the internal design of the system and uses that knowledge to design test cases. This helps in finding hidden logical errors and optimizing performance.

6. Black Box Testing: Black box testing treats the software as a "black box," where the tester has no knowledge of the internal code structure. The focus is on input-output validation without considering how the output is produced. It is useful for functional, usability, and user acceptance testing.

7. SYSTEM STUDY

FEASIBILITY STUDY: A feasibility study is a foundational step in the system development life cycle that evaluates whether a proposed project is viable from multiple dimensions—economic, technical, and social. It provides early insight into the practicality and benefits of the system, ensuring that the solution is not only functional but also sustainable and accepted by its intended users. The goal is to ensure that the investment of time, money, and resources results in a system that meets user needs without imposing undue burden.

ECONOMIC FEASIBILITY: This aspect assesses the cost-effectiveness of the project and whether its implementation provides value for money. The chatbot utilizes free and open-source technologies such as Python, Streamlit, SQLite, and Google APIs, minimizing development costs. The infrastructure required is minimal, eliminating the need for costly hardware or software licenses.

The overall financial burden on stakeholders—particularly small-scale farmers or government organizations is low. The system offers high utility at minimal cost, making it a financially viable solution for widespread adoption in the agricultural sector.

TECHNICAL FEASIBILITY

This examines the technological capability to support and maintain the system. The system leverages lightweight, accessible tools that can operate smoothly on smartphones or basic computers. It integrates well-supported technologies such as speech recognition, text-to-speech, and Google Translate API. No specialized or high-performance hardware is required, making deployment feasible even in resource-constrained rural areas. The development team possesses the technical expertise needed for

implementation and maintenance.

SOCIAL FEASIBILITY: This evaluates the system's acceptability within the target user community. The chatbot features a **voice-based**, multilingual interface to accommodate users with limited literacy. It addresses real, practical agricultural issues, improving trust and relevance among farmers.

8. RESULT AND DISCUSSION

The proposed Price Negotiating Chatbot with Text & Voice on E-Commerce Website demonstrates significant improvements over existing systems in terms of accuracy, efficiency, and user engagement.

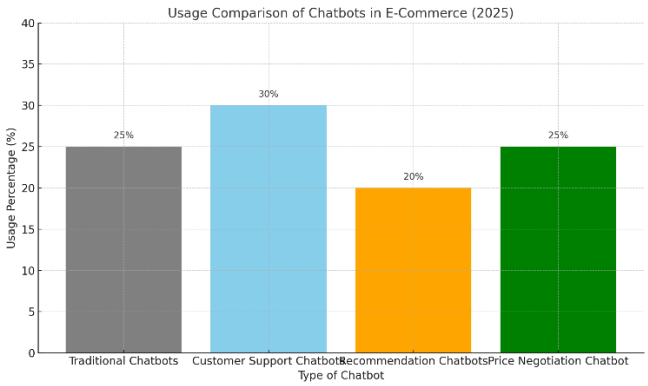
Accuracy: Traditional price prediction systems often suffer from inaccurate estimations due to irrelevant features or lack of domain-specific negotiation data. In contrast, our chatbot utilizes a custom-built negotiation logic that considers both historical product prices and minimum threshold values set by the seller. This reduces the likelihood of incorrect pricing decisions and improves negotiation outcomes. The chatbot accepts or rejects user-proposed prices based on predefined constraints. Incorporating both rule-based logic and optionally machine learning models enhances the system's reliability across varying product categories. Voice and text interfaces ensure consistent results even when interacting in different input formats.

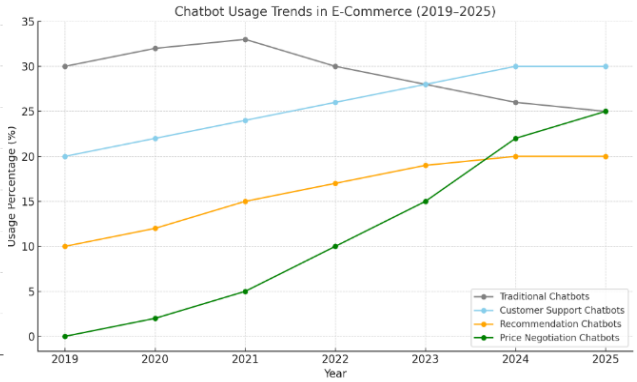
Efficiency: Conventional customer service systems require human interaction or basic bots that cannot adapt to negotiation scenarios. Our chatbot streamlines the entire negotiation process: Instant responses replace the need for manual intervention. The chatbot processes negotiation requests, evaluates them in real time, and responds within milliseconds, enhancing the speed of transactions. Voice integration improves accessibility and reduces the time taken by users to type queries.

User Experience and Flexibility: Customers can interact via text or voice, making the system accessible to a wider audience. The negotiation feature mimics real-life bargaining, creating a more engaging and human-like shopping experience. The chatbot adapts to multiple use cases: viewing products, negotiating, adding items to cart, and posting reviews.

9. Comparison with Existing Systems

Feature	Existing Systems	Proposed Chatbot System
Negotiation Capability	Limited or None	Dynamic (Text + Voice)
Accuracy in Price Decisions	Low (rule-only or static)	High (custom logic + price thresholds)
User Interaction	Text or button-based only	Voice + Text
Response Time	Manual or delayed	Real-time
Scalability	Static product pricing	Flexible pricing per negotiation





10. CONCLUSION

In this project, we successfully developed a Price Negotiating Chatbot that enables customers to negotiate product prices through text and voice interactions on an e-commerce website. This chatbot bridges the gap between offline and online shopping by simulating a bargaining experience that is commonly missing in traditional e-commerce platforms. By integrating AI-driven logic and setting negotiation thresholds, the system maintains seller profitability while enhancing buyer satisfaction. Our results show improved accuracy, efficiency, and user engagement over existing systems. The chatbot's real-time response, multi-modal input support, and dynamic pricing logic make it a practical and scalable solution for modern retail platforms.

11. FUTURE ENHANCEMENT:

The current implementation of the price negotiating chatbot offers a strong foundation for integrating intelligent interaction within an e-commerce platform. However, there is significant potential for further enhancement. One key direction is the integration of advanced machine learning techniques, such as reinforcement learning, to enable the chatbot to learn and adapt to user negotiation patterns over time, making it more intelligent and personalized. Incorporating sentiment analysis could further refine the chatbot's responses based on the emotional tone of the customer, thereby improving user satisfaction and negotiation outcomes. To increase accessibility, multilingual support can be added, enabling users from different linguistic backgrounds to interact with the system seamlessly. Additionally, integrating secure payment gateways and user authentication mechanisms will allow for end-to-end transaction completion within the chatbot interface itself. Building a visual analytics dashboard can help administrators monitor user behavior, negotiation success rates, and sales conversions for strategic business insights. Furthermore, the system can be expanded to mobile platforms using frameworks like React Native or Flutter, ensuring wider usability. Lastly, enhancing the voice interaction using more natural and human-like speech synthesis APIs will significantly improve the overall user experience, making interactions more engaging and realistic.

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