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An E-Commerce System Using MERN Stack And Machine Learning

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Abstract

In the digital age, online shopping has emerged as a fundamental pillar of the global economy, transforming traditional commerce models and enhancing accessibility for consumers. This study aims to establish a comprehensive theoretical framework for understanding the evolution, significance, and impact of e-commerce, with a particular focus on AI-driven negotiation techniques. Consumer behavior in online shopping is influenced by factors such as convenience, product variety, accessibility, and social interactions. However, several challenges persist, including security risks, fraudulent transactions, and inefficient dispute resolution. This research explores how artificial intelligence (AI)-driven negotiation algorithms can optimize pricing models, refine product recommendations, and enhance customer satisfaction by ensuring fair pricing and seamless transactions. AI-driven automation not only mitigates existing e-commerce challenges but also strengthens digital marketplaces by fostering trust and efficiency.

Keywords: e-commerce, AI negotiation, online shopping, digital marketplace, consumer behavior, dynamic pricing, dispute resolution

1. Introduction

This project presents a web-based shopping platform aimed at enhancing the experience of customers through an Android-based application. E-commerce allows users to purchase goods and services directly from vendors via the internet, eliminating the need for intermediaries. The proposed system integrates AI-driven negotiations to personalize pricing models, optimize consumer satisfaction, and drive competitive advantage for businesses. Customers benefit from a seamless shopping experience, where AI adapts to their purchasing behaviors and suggests the best deals, enhancing overall engagement. The rapid expansion of e-commerce has revolutionized the way consumers interact with businesses, enabling seamless transactions through digital platforms. This study presents a web-based shopping system integrated with an Android-based application designed to enhance the overall customer experience. By eliminating intermediaries, e-commerce enables direct transactions between buyers and sellers. The integration of AI-driven negotiation techniques further optimizes this process by personalizing pricing models, improving user satisfaction, and driving competitive advantages for businesses. These AI algorithms dynamically analyze consumer purchasing patterns, market trends, and competitor pricing to offer customized deals, thereby enhancing engagement and sales.

1.1 Input and Output Design

An efficient e-commerce platform thrives on well-optimized input and output design. Key inputs such as customer preferences, browsing history, and purchase patterns are essential for refining search results, enhancing product recommendations, and personalizing the user experience. Advanced AI-driven negotiation models leverage these inputs to dynamically adjust pricing strategies, offering real-time, tailored discounts and promotions that align with consumer demand.

On the output side, a seamless and intuitive user interface is paramount. Detailed product descriptions, high-quality visuals, and AI-enhanced decision-making tools empower customers to make informed purchasing choices. Features such as voice-assisted search, chatbots, and interactive comparison tools further enhance the shopping journey, ensuring convenience and engagement. By integrating AI-driven insights with user-centric design, e-commerce platforms can boost customer satisfaction, conversion rates, and long-term loyalty.

1.2 Data Filtering and AI Negotiation

Recommender systems leverage collaborative filtering (CF) to analyze customer behavior and predict preferences, enhancing personalization in e-commerce. AI-powered negotiation algorithms take this a step further by dynamically adjusting product prices and suggesting tailored alternatives based on real-time demand, purchase history, and browsing patterns. This intelligent approach ensures that buyers receive the most relevant deals while maximizing value, and sellers can optimize pricing strategies to boost sales and profitability. By integrating AI-driven recommendations with adaptive pricing models, e-commerce platforms create a more engaging, efficient, and competitive shopping environment.

2. E-Commerce in India

India's e-commerce landscape is witnessing unprecedented growth, driven by increasing consumer preference for online shopping due to wider product selections, competitive pricing, and enhanced convenience. Market research indicates that e-commerce penetration in India is projected to reach 12% within the next decade, fueled by digital transformation and evolving consumer habits.

AI-driven negotiation systems are playing a pivotal role in this expansion by automating bargaining mechanisms, optimizing vendor pricing strategies, and fostering greater transparency in digital marketplaces. These intelligent systems enhance customer trust by offering personalized deals, dynamic price adjustments, and data-driven recommendations, ultimately improving the overall shopping experience while maximizing business profitability.

3. AI-Driven Social Emotion Analysis in E-Commerce

Social sentiment analysis is becoming a game-changer in shaping market trends and business decision-making. AI-powered systems process vast amounts of user feedback, product reviews, and social media discussions to assess consumer sentiment toward brands, products, and services in real time. By leveraging these insights, businesses can refine their marketing strategies, optimize customer engagement, and proactively address consumer concerns. Additionally, sentiment-driven analytics enable companies to predict purchasing trends, enhance brand perception, and personalize offerings, ultimately driving customer satisfaction and competitive advantage in the digital marketplace. By leveraging these insights, businesses can refine their marketing strategies, optimize customer engagement, and proactively address consumer concerns. Additionally, sentiment-driven analytics enable companies to predict purchasing trends, enhance brand perception, and personalize offerings. This data-driven approach helps businesses improve product

development, fine-tune advertising campaigns, and even anticipate market shifts, ultimately driving customer satisfaction, brand loyalty, and a strong competitive edge in the digital marketplace.

4. Online Shopping and the Economy

While some argue that online shopping negatively impacts local economies, research suggests that it actively fosters business growth by expanding market reach, supporting small and medium enterprises (SMEs), and generating digital employment opportunities. E-commerce platforms enable businesses to tap into broader customer bases beyond geographical limitations, driving sales and economic activity. Additionally, AI-driven price negotiations promote fair market competition by dynamically adjusting prices based on demand, supply chain efficiency, and consumer behavior. This ensures that both consumers and businesses benefit from optimized pricing structures, leading to sustainable economic growth.

4.1 The Role of AI in Online Taxation and Pricing

AI-powered pricing and taxation models play a critical role in maintaining financial transparency and regulatory compliance in the e-commerce sector. These intelligent systems ensure adherence to regional taxation laws by automating tax calculations, preventing tax evasion, and mitigating revenue losses from cross-border transactions. By seamlessly integrating with e-commerce platforms, AI-driven tax management tools streamline complex tax structures, ensuring accurate application of GST, VAT, and other levies based on location and product categories.

Moreover, AI enhances tax fraud detection by identifying anomalies in transaction patterns, reducing tax evasion risks, and strengthening governmental revenue collection. This contributes to fair contributions to both state and national economies while maintaining trust and compliance within the digital marketplace. As online trade continues to grow, AI-driven tax solutions will be instrumental in balancing innovation with regulatory accountability, fostering a more sustainable and equitable digital economy.

5. EXISTING SYSTEM

Modern e-commerce models face significant challenges, including data security risks, fraudulent transactions, and inefficient dispute resolution mechanisms. The rise in cybersecurity threats—such as data breaches, phishing attacks, and identity theft—puts sensitive customer information at risk, leading to financial losses, reputational damage, and diminished trust in online platforms. As digital transactions grow, fraudulent activities, including chargeback fraud, counterfeit sales, and payment scams, continue to create complications, resulting in revenue losses for businesses and frustration for consumers.

Additionally, dispute resolution remains a critical issue in e-commerce, as conflicts related to product quality, refunds, and delayed deliveries often require manual intervention. This leads to slow response times, inconsistent resolutions, and a lack of transparency in customer service processes.

To address these challenges, AI-driven negotiation techniques and fraud prevention systems are transforming online security and transaction management. Real-time transaction monitoring powered by AI detects suspicious activities and prevents unauthorized access by analyzing behavioral patterns and device authentication. Advanced fraud detection systems, utilizing machine learning algorithms, assess transaction histories, flagging potential fraud before it occurs. These intelligent systems can differentiate between legitimate and fraudulent transactions with high accuracy, minimizing false positives while ensuring security. Moreover, AI-driven customer support enhances dispute resolution by automating refund processes, streamlining inquiries, and ensuring fair, data-backed resolutions. AI chatbots and virtual assistants facilitate quicker response times, reducing the need for human intervention while maintaining customer satisfaction. Predictive analytics further help businesses anticipate fraud trends and adapt their security measures proactively.

By leveraging AI-powered solutions, e-commerce platforms can significantly strengthen security, mitigate fraud risks, and enhance customer trust. As digital commerce continues to evolve, integrating AI-driven

security measures will be essential in ensuring a safer, more transparent, and seamless online shopping experience

6. PROPOSED SYSTEM

Revolutionizing E-Commerce with AI-Driven Negotiation Techniques

AI-driven negotiation techniques are transforming the e-commerce landscape by enhancing customer satisfaction, optimizing business operations, and fostering a more competitive marketplace. A core component of this innovation is dynamic pricing strategies, where AI algorithms analyze real-time market trends, consumer purchasing behavior, and competitor pricing. By leveraging this data, AI can generate personalized discounts, flash sales, and targeted promotions that align with customer preferences while ensuring businesses maintain profitability and a competitive edge. This adaptive pricing model not only maximizes revenue but also enhances the overall shopping experience by offering consumers the best possible deals.

Another essential element is real-time sentiment analysis, which enables e-commerce platforms to gauge consumer emotions through product reviews, social media discussions, and direct feedback. By integrating natural language processing (NLP) and machine learning, AI can detect shifts in consumer sentiment and adjust pricing, product recommendations, or promotional strategies accordingly. For example, if widespread negative feedback emerges regarding a product's price point, AI can automatically implement strategic discounts, introduce bundled offers, or optimize marketing campaigns to improve customer perception and drive conversions.

Additionally, AI-powered automated dispute resolution is revolutionizing conflict management in e-commerce. Traditional dispute resolution methods often involve lengthy processes and human intervention, leading to customer dissatisfaction and operational inefficiencies. AI-driven systems, on the other hand, utilize historical transaction data, behavioral analytics, and predefined business policies to facilitate quick and fair dispute resolution. Whether handling refund requests, addressing delivery issues, or resolving product dissatisfaction claims, AI-powered mediation ensures transparent and efficient outcomes that benefit both consumers and sellers.

By integrating these AI negotiation techniques, e-commerce platforms can create a highly dynamic, efficient, and customer-centric shopping experience. The ability to adapt pricing in real time, respond proactively to consumer sentiment, and automate dispute resolution strengthens consumer trust, boosts sales, and fosters long-term business growth in the ever-evolving digital marketplace.

7. CONCLUSIONS

The debate over whether online shopping is more environmentally friendly than traditional retail is complex, as numerous factors come into play. While e-commerce offers unparalleled convenience, its environmental impact raises significant concerns. Factors such as packaging waste, increased carbon emissions from last-mile deliveries, and high energy consumption in massive fulfillment centers suggest that online shopping may contribute to environmental degradation. Additionally, modern consumer behaviors, including frequent impulse purchases, excessive reliance on expedited shipping, and liberal use of free returns, further amplify its ecological footprint. These practices lead to increased transportation emissions and material waste, compounding existing environmental challenges such as global warming, pollution, and resource depletion. However, e-commerce also presents opportunities for sustainability. Centralized distribution networks can, in some cases, reduce emissions compared to individual shopping trips. AI-driven logistics optimize delivery routes, cutting down on fuel consumption, while sustainable packaging and carbon-neutral shipping initiatives are being developed to offset environmental harm. To make online shopping more eco-friendly, both consumers and businesses must adopt a more responsible and conscious approach. Consumers can reduce their impact by opting for consolidated deliveries, choosing slower shipping options, and minimizing unnecessary returns. On the other hand, businesses should invest in sustainable packaging, implement green logistics, and promote circular economy practices that encourage responsible

consumption Ultimately, balancing convenience with sustainability is key to reducing e-commerce's environmental footprint. By fostering mindful shopping habits and implementing eco-friendly business strategies, we can ensure that the growth of online retail aligns with environmental responsibility rather than exacerbating ecological harm.

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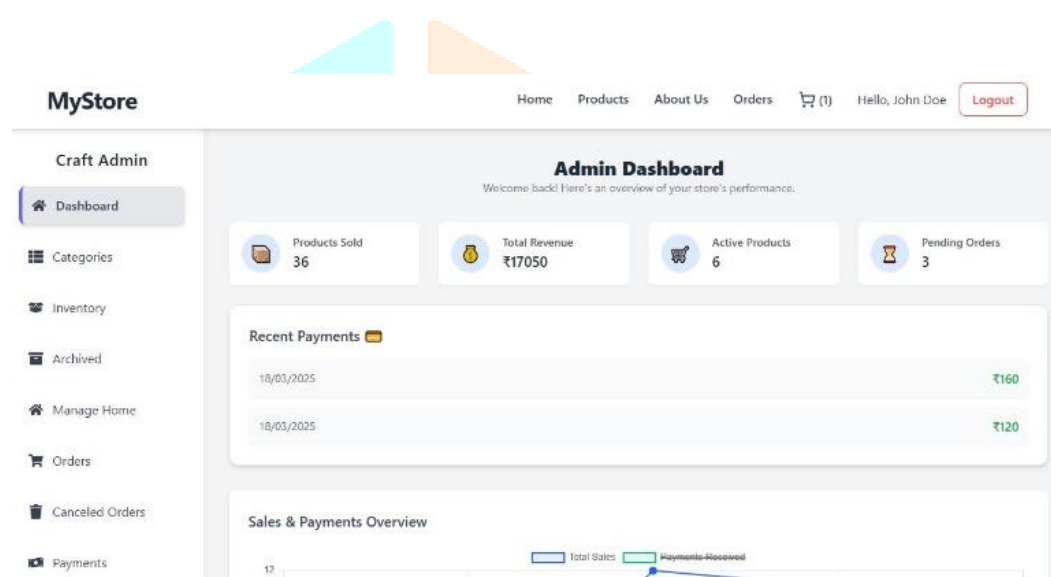


Fig 1: Admin dashboard The image depicts e-commerce admin dashboard ("MyStore") showing key store metrics. It includes sales data, recent payments, and a navigation menu for store management.



Fig 2 : The image presents a graph titled "Sales & Payments Overview." It shows Total Sales (blue line) and Payments Received (green line) over time. The graph indicates a significant jump in sales around January 2025, with payments tracking closely.

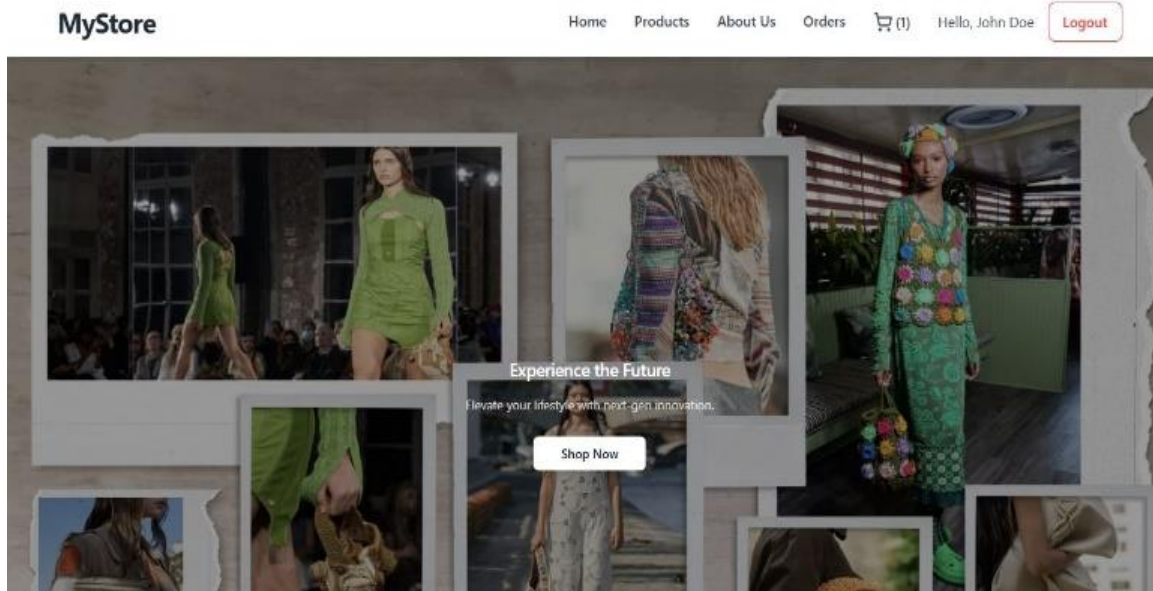


Fig 3: The image shows a product page for a "Crochet Hand Bag" on an e-commerce site. It displays the product image, price (₹800), and an option to "Negotiate Price." There's also a section for customer reviews, which is currently empty.

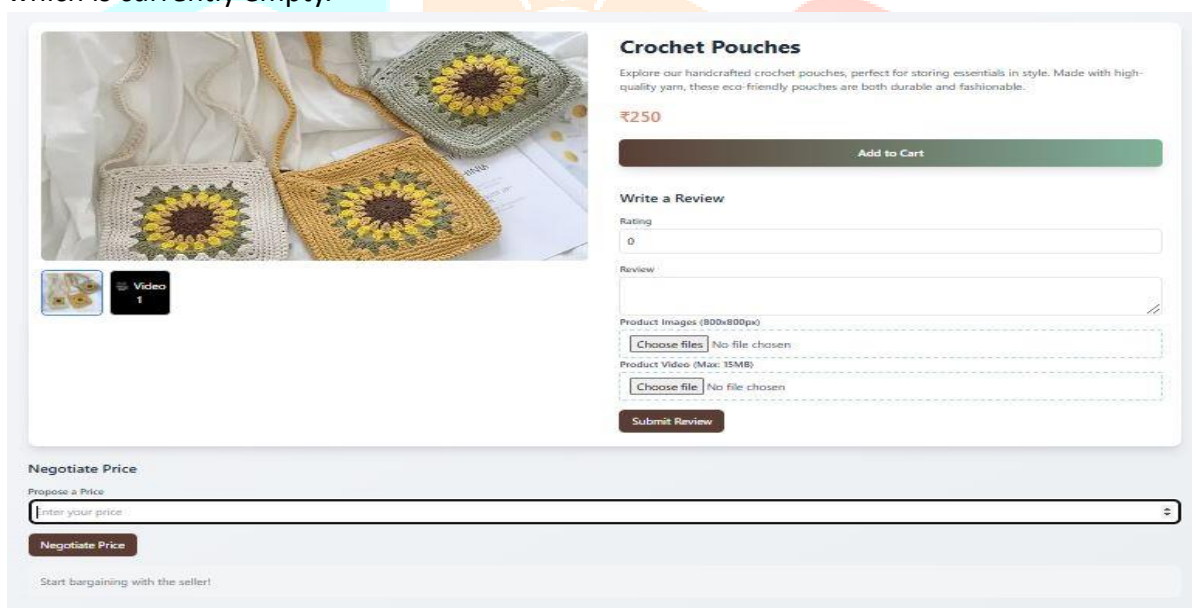


Fig 4: This is the customer-facing product detail page where shoppers view information about a specific item for sale.

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