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AI-Powered Multi-Vendor Online Marketplace System

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Abstract: *Corporate marketplaces face challenges in managing multiple vendors, large product inventories, and personalized customer interactions due to increasing system scale and operational complexity. Traditional online marketplace systems often lack centralized coordination, intelligent assistance, and real-time interaction capabilities. This paper presents an AI-Powered Multi-Vendor Online Marketplace System, developed using React, Node.js, Express, and MongoDB.*
The system provides vendor management, product listing, inventory tracking, secure order processing, and an AI-powered product interaction module, along with role-based authentication for efficient system control. The backend utilizes RESTful APIs with JWT authentication, and system functionalities are tested using Postman.
Results show improved operational efficiency, enhanced customer engagement, and streamlined vendor coordination, making the system a scalable and intelligent solution for modern online marketplaces..

Keywords: AI-Powered Multi-Vendor Online Marketplace, Artificial Intelligence, MERN Stack, Product Interaction, MongoDB, React

I. INTRODUCTION

With the rapid growth of digital commerce and online marketplaces, businesses are increasingly moving towards multi-vendor systems to expand product availability and reach a larger customer base. Modern consumers expect fast services, personalized recommendations, and real-time order tracking, which requires intelligent and scalable system architecture.

In modern digital marketplaces, managing multiple vendors, large product inventories, and customer interactions is challenging due to increasing system scale and operational complexity. Traditional online marketplace systems rely on basic functionalities, leading to inefficient vendor coordination, lack of intelligent assistance, and limited user engagement, which reduces overall system effectiveness.

This paper presents an AI-Powered Multi-Vendor Online Marketplace System, a web-based system that simplifies marketplace operations and enhances user experience. Customers can browse products, add items to cart, and place orders, while vendors manage product listings, inventory, and order processing, and an admin workflow ensures centralized control.

The system provides real-time management, secure transactions, and AI-based product interaction for better decision-making. It enhances operational efficiency, reduces manual effort, and improves user satisfaction, making it a scalable and intelligent marketplace solution.

The AI-Powered Multi-Vendor Online Marketplace System was developed to address these challenges. The project was completed during the 2025–26 academic year at Sant Gajanan Maharaj College of Engineering (SGMCOE), Mahagaon, under the guidance of Asst. Prof. M. G. Rane, with contributions from MCA final-year student Mr. Sudesh Rajendra Sawant.

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II. RELATED WORK

Previous research in online marketplace systems highlights the importance of automation and real-time interaction in improving system efficiency. Many existing systems provide basic product management functionality but lack proper backend architecture and scalability.

Modern online marketplace applications demonstrate the benefits of digital transformation, including improved user engagement and better vendor coordination. However, simpler systems still face challenges such as inefficient database management, lack of automation, and limited real-time features.

The AI-Powered Multi-Vendor Online Marketplace System addresses these limitations by integrating a robust backend using Node.js and Express, along with a responsive frontend using React, ensuring better performance and scalability.

III. PROBLEM STATEMENT

In modern digital marketplaces, managing multiple vendors, product inventories, and customer interactions has become a challenging task due to increasing system scale and complexity. Many existing online marketplace systems still rely on basic or partially automated processes, which are inefficient and lack intelligent interaction. Handling vendor coordination, product updates, and order management becomes difficult without proper integration and automation.

Inefficient management often leads to inconsistent product information, delayed order processing, and poor inventory control. The absence of real-time interaction and intelligent support reduces user engagement and affects decision-making.

Moreover, coordination between vendors, customers, and administrators becomes complicated without a centralized system. This results in inefficiencies and reduced user satisfaction. Therefore, there is a need for an efficient, scalable, and AI-enabled marketplace system to improve coordination, enhance user experience, and ensure overall system efficiency.

IV. PROPOSED SYSTEM OVERVIEW

The AI-Powered Multi-Vendor Online Marketplace System provides a structured workflow for managing online marketplace operations:

Step 1: User Registration and Authentication Step 2: Product Browsing and Availability Check

Step 3: Add to Cart with Product Details Step 4: Order Placement and Payment Processing

Step 5: Vendor Order Management Step 6: AI-Based Product Interaction Step 7: Real-Time Order Tracking and Completion

The system ensures smooth coordination between customers, vendors, and administrators and eliminates manual intervention.

V. SYSTEM ARCHITECTURE

The AI-Powered Multi-Vendor Online Marketplace System is structured into three layers:

Tier	Layer	Technology
1	Presentation	React, HTML5, CSS3, TypeScript
2	Application	Node.js, Express.js
3	Database	MongoDB

Table I. Three-Tier Architecture

This architecture enables efficient communication between the frontend and backend while ensuring scalability and security. The presentation layer manages the user interface, the application layer handles business logic, and the database layer stores user, product, and order data. This layered structure improves system performance.

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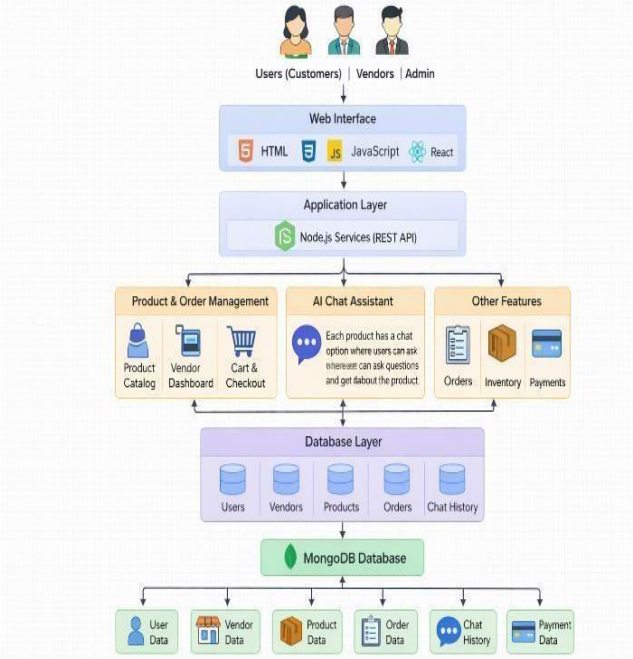

Fig No: 1.1 System Architecture

VI. MODULES DESCRIPTION

1. User Registration & Authentication

This module manages the registration and login process for customers, vendors, and administrators. Users can create accounts by providing their details, which are securely stored in the system. The system verifies user credentials during login and provides access based on roles. Customers can browse and purchase products, vendors can manage their stores, and administrators can monitor system activities. This module ensures secure authentication and maintains user information in a centralized database.

2. Product and Vendor Management

This module allows vendors to add, update, and manage product information within the system. Vendors can maintain product details such as name, description, category, price, and stock availability. The system stores product data in an organized manner, enabling efficient inventory tracking. Administrators can monitor vendor activities and manage product categories to ensure smooth marketplace operations.

3. Cart and Order Management

This module enables customers to browse products, add items to the cart, and place orders. Users can review selected items and proceed with order placement. The system records order details and updates order status accordingly. This module ensures smooth handling of the complete order lifecycle from selection to confirmation.

4. Admin Management and Monitoring

This module allows administrators to oversee and manage the overall functioning of the system. Administrators can monitor users, vendors, and products, as well as review orders and maintain system operations. It helps ensure proper coordination and smooth execution of marketplace activities.

5. Payment Management Module

This module handles payment processing and transaction management. It ensures secure payment processing and order confirmation after successful payment. The system records transaction details and maintains payment history for users and administrators. This module ensures secure and reliable financial transactions within the system.

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6. AI-Based Product Interaction Module

This module integrates artificial intelligence to enhance user interaction and provide smart assistance within the system. The AI chatbot allows customers to ask product-related queries and receive instant responses. This module improves customer engagement, and supports better decision-making, making the system more intelligent and user-friendly.

VII. IMPLEMENTATION

A. Architecture and Stack

The AI-Powered Multi-Vendor Online Marketplace System follows a modern full-stack architecture:

Frontend: React for dynamic user interface Backend: Node.js with Express.js, Database: MongoDB

The system is developed using Visual Studio Code and tested using Postman.

The system is implemented using a modular architecture for communication between frontend and backend. Secure authentication and efficient database management ensure reliable performance and system scalability.

Hardware and Software Requirements

Category	Requirement Type	Details
Hardware	Processor	Intel i5 or higher
Hardware	RAM	8GB minimum (16GB recommend ed)
Hardware	Storage	256 GB SSDor higher
Hardware	Internet	Required
Software	Operating System	Windows / Linux / macOS
Software	Backend	Node.js with Express.js
Software	Language	JavaScript / TypeScript
Software	Frontend	React, HTML, CSS, JavaScript
Software	Database	MongoDB
Software	Tools	VS Code, MongoDB Compass, Postman

Table II. Hardware and Software Specifications

VIII. SYSTEM ANALYSIS

REAL TIME ORDER MANAGEMENT EFFICIENCY

The system enhances order management efficiency by enabling users to browse products and place orders instantly through a centralized system. Unlike conventional systems, it reduces processing delays and manual dependency. Real-time updates ensure quick order confirmation, status tracking, and better coordination between vendors and customers, improving overall performance.

Accurate Pricing Mechanism :

The system ensures accurate pricing by automatically calculating the total cost based on product price, quantity, and applicable rules. This minimizes calculation errors and maintains pricing transparency. Customers can review the final amount before placing orders, which improves trust and decision-making.

Secure System Access :

The system implements role-based authentication to provide secure access for customers, vendors, and administrators. Each user operates within defined permissions, preventing unauthorized access to sensitive data. This strengthens data security and ensures safe transaction handling.

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Scalability:

The system is built using a modular and scalable architecture, allowing it to handle increasing numbers of users, vendors, and products efficiently. New features and services can be integrated without affecting existing functionality, ensuring long-term adaptability and system growth.

IX. RESULTS AND DISCUSSION

Module	Metric	Result
User Interface	Usability	Interactive and user-friendly interface
Authentication Module	Access Control	Secure login with role-based authentication
Product Management	Efficiency	product handling and inventory control
Cart System	Functionality	Smooth add to cart and update operations
Order Management	Accuracy	Accurate order processing and tracking
Payment System	Reliability	Secure and successful transaction handling
AI Module	Interaction	Intelligent product- level response and assistance
System Performance	Speed	Fast processing and minimal delays

Table III. Performance and Evaluation Summary

The results clearly indicate that the system has significantly improved overall efficiency compared to traditional online marketplace systems. The ordering process is faster and more reliable, reducing delays for users. Automated pricing ensures transparency and eliminates errors, enhancing user trust.

Real-time order tracking improves monitoring and allows quick updates on order status. The system provides timely updates, improving communication between customers and vendors. Additionally, efficient product and order management helps in reducing operational complexity.

The system's user-friendly interface ensures ease of use for all users, while strong security mechanisms protect sensitive data. Overall, the system enhances performance, reliability, and user satisfaction, making it a scalable and intelligent solution for modern digital marketplaces.

X. PROJECT TIMELINE

Month	Activity
Dec 2025	Problem scoping, literature survey, topic finalization
Jan 2026	Requirements gathering, system analysis, architecture design
Feb 2026	Frontend and backend development across all modules
Mar 2026	Integration, end-to-end testing, debugging, model training
Apr 2026	Documentation, presentation preparation, formal submission

Table VI. Project Timeline — Academic Year 2025–26

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XI. CONCLUSION

The AI-Powered Multi-Vendor Online Marketplace System demonstrates that a well- designed web-based marketplace system can significantly improve online marketplace experiences. By integrating product management, order processing, and AI-based interaction into a single system, the system reduces manual effort and enhances user engagement. The system is scalable, efficient, and suitable for real-world deployment.

The system is scalable, efficient, and suitable for real-world deployment.

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