



E-COMMERCE INVENTORY MANAGEMENT SYSTEM

A Phase 1 Report on Developing a E-Commerce Inventory Management System

¹Mr.CHETHAN GOWDA, ²Dr. Shashidhar Kini K

¹Student, ²Professor & Head

¹Department of Master of Computer Applications,

¹Srinivas Institute of Technology, Valchil Mangaluru, Karnataka, India

Abstract : The E-commerce Inventory Management System provides a user-friendly dashboard for efficient stock management. It allows administrators to update stock levels, track inventory shortages, generate reports, and categorize products for better organization. A dedicated module monitors order history, aiding stock analysis. The system minimizes stockouts and overstocking, enhances efficiency, and ensures consistent product availability, improving client satisfaction

IndexTerms - E-Commerce, Inventory Management, MERN Stack, Stock Tracking, Product Categorization, Order History, Real-Time Updates, Automation, MongoDB, React.js, Express.js, Node.js, API Integration, Data Analytics, Inventory Forecasting

I. INTRODUCTION

The E-Commerce Inventory Management System is a robust application built using the MERN stack—MongoDB, Express.js, React.js, and Node.js—to streamline and automate inventory management processes. It offers businesses a modern solution for managing product listings, tracking stock levels, and monitoring inventory movements in real time. The system includes a user-friendly interface that allows administrators to easily update product quantities, categorize items, and access vital statistics. Real-time notifications help businesses respond promptly to stock shortages or excess inventory. By automating stock updates and order tracking, the system reduces manual effort and minimizes errors. Historical order data is stored and analyzed to identify purchasing patterns, enabling better forecasting and stock control. The architecture is scalable, making it adaptable for businesses of all sizes. It also supports secure authentication and data protection to ensure sensitive information remains safe. React.js enhances the user experience with responsive design and real-time interactivity. Node.js and Express.js ensure fast server-side operations, while MongoDB handles flexible data storage. The use of Redux and React Router ensures smooth navigation and state management. The system also integrates with APIs for analytics and payment gateways. Its modular design supports customization based on specific business needs. This project addresses common challenges in inventory control and delivers a comprehensive, future-ready solution.

Ease of Use

The E-Commerce Inventory Management System is built with a strong focus on ease of use, ensuring that users can operate the platform without requiring technical expertise. The intuitive dashboard, developed using React.js, offers a seamless and responsive user experience across various devices. Its organized layout allows users to easily navigate between stock management, order tracking, and reporting features. Real-time stock updates and automated alerts help users take immediate action without manually checking every detail. The search and filter functionalities simplify the process of locating specific products or order histories. Users can add, edit, or delete items with minimal effort through well-labeled buttons and clear instructions. Automation of inventory adjustments significantly reduces manual work and lowers the risk of errors. The interface uses a clean design, avoiding unnecessary clutter and guiding users through their tasks with ease. Even complex operations like stock analysis or report generation are handled in a straightforward manner. The system supports accessibility standards, making it inclusive for users with disabilities. Tooltips and on-screen prompts offer additional support, ensuring smooth usage for beginners and professionals alike. The platform's performance remains consistent, enhancing user confidence and productivity. Navigation across the system is fast and reliable, saving valuable time for businesses. Visual feedback, such as confirmation messages, reassures users during actions like data updates. With minimal training, any user can manage inventory operations effectively. Overall, the system is designed to provide a hassle-free, efficient, and pleasant experience for all users

2. Abbreviations and Acronyms

In this paper, the following abbreviations and acronyms are used:

- MERN – MongoDB, Express.js, React.js, Node.js
- UI – User Interface
- UX – User Experience
- API – Application Programming Interface
- CRUD – Create, Read, Update, Delete
- JSON – JavaScript Object Notation
- JWT – JSON Web Token
- DBMS – Database Management System
- HTTP – Hypertext Transfer Protocol
- CSS – Cascading Style Sheets
- JS – JavaScript
- DB – Database
- SKU – Stock Keeping Unit
- ERP – Enterprise Resource Planning
- SaaS – Software as a Service
- RDBMS – Relational Database Management System
- SEO – Search Engine Optimization
- POS – Point of Sale
- OMS – Order Management System
- B2B – Business to Business
- B2C – Business to Consumer

RESEARCH METHODOLOGY

This section outlines the methodology adopted to develop a web-based **E-Commerce Inventory Management System**. The aim is to optimize inventory control, stock tracking, and order management for businesses in the e-commerce industry. The methodology involves defining the system scope, identifying data sources, outlining the application architecture, and discussing the tools and technologies used in the development process.

3.1 Population and Sample

The population for this study consists of e-commerce businesses that manage a wide range of products, including small and large online retailers. The sample data is curated from various hypothetical products across multiple categories such as electronics, fashion, home goods, and accessories. It includes simulated inventory levels, sales data, and customer orders to replicate real-world e-commerce environments. Products with detailed information like name, price, stock count, and order history are considered. Data on different sales volumes and stock management techniques are included to reflect diverse business models. The sample ensures comprehensive analysis of stock control issues like stockouts and overstocking. It aims to simulate how the E-Commerce Inventory Management System can optimize stock management for a variety of product types. The data used reflects e-commerce operations as of 2025, with a focus on efficiency and customer satisfaction. This data helps evaluate the system's impact on inventory optimization. The sample provides insights into the system's adaptability to varying business sizes and operational needs.

3.2 Data and Sources of Data

This study relies on a combination of secondary data from e-commerce platforms and simulated primary data collected from product listings, sales reports, and inventory management APIs.

Key data points used in the system include:

- Product Information (e.g., Product name, description, price, and category)
- Inventory Levels (current stock count, minimum stock threshold)
- Sales Data (quantity sold, order history, and sales trends)
- Order Fulfillment Data (order ID, customer details, order status, and shipping information)
- Supplier Information (supplier names, delivery times, and product availability)
- User Preferences (product searches, filtering criteria, and wish list data)

Simulated datasets were used to test the system's performance, ensuring accurate stock tracking and real-time updates. These datasets replicate real-world e-commerce environments, with varied sales volumes, product types, and inventory conditions.

3.3 Theoretical framework

The objective of the E-Commerce Inventory Management System is to streamline inventory control and order fulfillment by providing a real-time view of stock levels, order history, and product availability. The platform is designed with an emphasis on UI/UX to ensure a user-friendly and efficient experience for both administrators and customers.

While this project does not currently incorporate advanced AI-based predictive analytics, it is structured with a scalable architecture that can accommodate future features like demand forecasting, automated restocking suggestions, and AI-driven inventory optimization.

Key variables used in the system include:

- Product ID and Category (categorical)
- Stock Levels (numerical)
- Sales Data (numerical)
- Order Status (Pending/Completed/Cancelled) (categorical)
- Inventory Alerts (Low Stock/Out of Stock) (categorical)
- User Queries (product searches, filter selections, order history)

3.4 Statistical tools and econometric models

This section outlines the technological ecosystem, software tools, and design methodologies used to build the E-Commerce Inventory Management System.

3.4.1 Descriptive Statistics

Preliminary data analysis was conducted to verify the consistency and usability of the inventory and transaction data collected for the E-Commerce Inventory Management System. Categorical data such as product categories, SKU numbers, and supplier names were standardized for accurate product filtering and reporting. Numerical variables like stock levels, order quantities, and prices were validated for consistency and alignment with known market conditions.

3.4.2 System Architecture and Technology Stack

The E-Commerce Inventory Management System is developed using the MERN stack—MongoDB, Express.js, React.js, and Node.js—for full-stack web development:

- a) **Frontend (React.js):** Used to build a dynamic and responsive user interface that allows administrators to view real-time stock levels, update product details, and manage orders. React's component-based architecture ensures a smooth user experience with real-time updates and efficient state management.
- b) **Backend (Node.js & Express.js):** Handles the server-side logic, including managing APIs for stock updates, product categorization, and order history tracking. Express.js manages HTTP requests and responses, while Node.js ensures non-blocking, event-driven processing for high performance and scalability.
- c) **Database (MongoDB):** Stores product details, inventory levels, order histories, and customer information in a flexible NoSQL format. MongoDB's dynamic schema design allows for efficient querying and easy scalability to accommodate growing business needs. Data is stored in JSON format, enabling fast retrieval and updates for real-time inventory.

3.4.3 Feature Implementation and Evaluation

The following key features were implemented and manually tested to ensure reliability and performance of the E-Commerce Inventory Management System:

- **Real-time Stock Updates:** Inventory levels are updated in real time, ensuring administrators and customers always have access to the latest stock information.
- **Product Categorization:** Admins can efficiently categorize products, making it easier to filter and search within the inventory.
- **Order History Tracking:** The system tracks past orders, allowing businesses to analyze sales patterns, product demand, and reorder stock accordingly.
- **Admin Dashboard:** A comprehensive dashboard allows administrators to manage stock levels, update product details, and monitor real-time inventory.

Performance and usability were evaluated based on:

- **Data Accuracy:** Ensuring real-time stock levels are correctly updated and reflect actual inventory.
- **Filter Efficiency:** Accurate categorization and filtering of products for smooth navigation and quick search results.
- **System Responsiveness:** Low latency during stock updates, product searches, and order history access.
- **User Interface Clarity:** Easy-to-navigate design across devices.

IV. RESULTS AND DISCUSSION

4.1 Results of Descriptive Statics of Study Variables

Table 4.1 Descriptive Statics

User ID	Product ID	Query	Time Stamp	Result Count	Action Taken
101	1001	Laptop	2025-04-28 09:22	3	Added to Cart
102	1503	Wireless Mouse	2025-04-14 09:10	2	Completed Purchase

Table 4.1 represents simulated user interaction data with the E-Commerce Inventory Management System. It illustrates how users engage with the platform by querying products, checking availability, and completing actions such as adding items to their cart or finalizing purchases. The data captures interactions by user ID, product ID, query type (e.g., product search), timestamp, and the number of results returned, providing insight into how products are searched and purchased. This data helps in understanding user behavior, product demand, and the overall user experience with the system.

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