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Smart Inventory Management System

Aswathy K R , Computer Science, Nehru College of Engineering and Research Centre
Akhila M Shaji, Computer Science, Nehru College of Engineering and Research Centre
Athul M , Computer Science *,Nehru College of Engineering and Research Centre*
Bhavya K, Computer Science ,Nehru College of Engineering and Research Centre
Asst.Prof . Anjana Ashokan ,Computer Science ,Nehru College of Engineering and Research Centre

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1.Abstract

The Smart Inventory Management System is a comprehensive solution designed to simplify inventory tracking, order management, and restocking for businesses of all sizes. It ensures businesses maintain the right stock levels, prevent shortages, and avoid overstocking through automation and real-time monitoring. Effective inventory management and sales analysis play a crucial role in improving retail efficiency and profitability. This project presents a data-driven framework that integrates association analysis to identify product relationships and enhance cross-selling opportunities. The study focuses on analyzing sales trends, categorizing inventory based on turnover rates, and implementing predictive analytics for demand forecasting. By optimizing stock levels, the approach helps prevent overstocking and stockouts, ensuring smooth operations. Additionally, advanced visualization techniques are used to extract actionable insights, aiding in strategic decision-making. By combining inventory optimization, association analysis, and predictive modeling, this framework offers a scalable solution to modern retail challenges, promoting sustainable growth and efficiency. Other essential features include automated stock alerts that notify users when inventory levels drop below preset thresholds, ensuring timely restocking. The system also offers supplier management tools, enabling businesses to track supplier performance, store important supplier details, and automate purchase orders—ensuring stock is replenished efficiently. By integrating automation, hybrid data storage, and real-time insights, the Smart Inventory Management System enhances efficiency, minimizes waste, and improves profitability—helping businesses stay agile and meet customer demands seamlessly

1.INTRODUCTION

In today's competitive retail landscape, efficient inventory management and data-driven decision-making are crucial for sustained success. Traditional methods often struggle to keep up with fluctuating demand, dynamic market trends, and evolving customer preferences. Without precise forecasting and strategic stock control, businesses risk overstocking, stockouts, and revenue losses.To address these challenges, this project introduces a retail analytics and inventory management system that leverages advanced data analytics, association analysis, and predictive modeling. By integrating market basket analysis, the system uncovers product

relationships, enabling retailers to enhance cross-selling opportunities and optimize inventory placement. Additionally, the project incorporates demand forecasting techniques to ensure businesses maintain optimal stock levels, reducing waste and improving supply chain efficiency. Inventory categorization based on turnover rates and demand patterns further refines stock management, helping businesses allocate resources effectively. Moreover, interactive data visualization tools transform complex sales data into actionable insights, enabling retailers to make informed strategic decisions. By merging inventory optimization, sales trend analysis, and predictive analytics, this system offers a scalable and efficient solution to modern retail challenges, driving growth, profitability, and operational efficiency.

2. Smart Inventory Management System

2.1 Introduction

Inventory management plays a critical role in the success of modern businesses. Inefficiencies such as overstocking, stockouts, and delays in restocking can

significantly impact profitability. The Smart Inventory Management System (SIMS) is developed to address these challenges by automating key inventory processes and providing real-time analytics to improve operational efficiency and decision-making.

2.2 Objectives

The main objectives of SIMS are as follows:

1. Automate inventory tracking and restocking processes.
2. Predict future demand using data-driven forecasting.
3. Identify product relationships using association rule mining.
4. Generate real-time alerts for inventory levels.
5. Provide strategic insights through advanced data visualization

2.3 Related Work

Previous research in inventory systems has focused on Enterprise Resource Planning (ERP), Radio-Frequency Identification (RFID), and traditional statistical forecasting. However, these approaches often fall short in real-time adaptability and integration. SIMS advances existing models by incorporating predictive analytics and intelligent automation for dynamic inventory control.

2.4 System Methodology

2.4.1 Data Collection

Sales and inventory data are collected from Point-of-Sale (POS) systems and cloud-based sources. The system supports integration through Application Programming Interfaces (APIs).

2.4.2 Inventory Categorization

Inventory is classified using ABC analysis based on turnover rates. Items with higher turnover are prioritized for monitoring and restocking.

2.4.3 Association Analysis

The Apriori algorithm is used to identify frequently co-purchased items, aiding in marketing strategies like product bundling and cross-selling (Sec. 2.6).

2.4.4 Predictive Modeling

Time series forecasting techniques are implemented to predict demand patterns. This helps avoid both stockouts and excess stock (Sec. 2.5).

2.4.5 System Architecture

The system includes the following components:

Data Ingestion Module: Collects and cleans data.

Analytics Engine: Performs forecasting and association rule mining.

2.5 Implementation and Results

The system was deployed in a medium-sized retail store. After three months:

Stockouts were reduced by 30%.

Overstocking incidents decreased by 25%.

Restocking decisions were made 40% faster than the manual process. The dashboard (see Fig. 1) provided clear insights into trends and stock movements.

2.6 Visualization and Decision Support

Advanced visualization tools were implemented to extract actionable insights. These included:

Heat maps of high-demand items.

Turnover rate graphs.

2.8 Conclusion

The Smart Inventory Management System provides an efficient, scalable solution for modern inventory challenges. By integrating machine learning, real-time tracking, and data visualization, the system enhances accuracy, reduces waste, and supports data-driven decision-making. Future work may involve incorporating Internet of Things (IoT) sensors and blockchain to improve traceability and automation.
Predictive trend lines for seasonal inventory planning. These tools support strategic planning by making patterns visible at a glance (Fig. 2).

2.7 Supplier Management Module

The system tracks supplier performance by recording delivery times, order accuracy, and pricing trends. This enables businesses to maintain strong supplier relationships and ensures timely replenishment (Sec. 2.4.5).

Table -1: sales table

Month	Units Sold	Revenue ($)	Average Price per Unit ($)
January	150	1,500	10
February	130	1,300	10
March	170	1,700	10
April	160	1,600	10
May	140	1,400	10
June	180	1,800	10
July	155	1,550	10
August	165	1,650	10

3. CONCLUSIONS

The Inventory Management System (IMS) enhances business efficiency by providing an organized and automated approach to stock tracking. By eliminating manual processes, the system reduces errors, optimizes stock levels, and ensures seamless supply chain operations. Its ability to record incoming and outgoing stock prevents overstocking and stockouts, improving overall inventory control.

Additionally, the system incorporates waste reduction strategies and eco-friendly practices, contributing to sustainable business operations. With improved inventory accuracy, businesses can offer better customer service, ensuring product availability and timely order fulfillment. Ultimately, this IMS serves as a comprehensive solution for modern inventory management, driving efficiency, sustainability, and customer satisfaction.

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5.REFERENCES

[1] H. Timinger, M. Schmidtner, and F. Reiche, ‘‘A framework for the construction and tailoring of engineering development process models,’’ IEEE Trans. Eng. Manag., vol. 2, no. 1, pp. 1–22, May 2022.

2• D. Incorvaja, Y. Celik, I. Petri, and O. Rana, ‘‘Circular economy and construction supply chains,’’ in Proc. IEEE/ACM Int. Conf. Big Data Comput., Appl. Technol. (BDCAT), Dec. 2022, pp. 92–99. 167008 V

3• M. Hadid, M. Gunduz, and Y. Hoon Kwak, ‘‘Assessing interorganizational relationships among key supply chain partners (KSCPs) in public construction projects,’’ IEEE Trans. Eng. Manag., vol. 71, pp. 8839–8856, May 2024.

4• N. S. M. Suferi, M. M. Rahman, and I. M. Yusof, ‘‘Industry 4.0 in construction: A conceptual framework,’’ in AIP Conf. Proc., vol. 2643, 2023, pp. 1–26.

5• S. A.-S. Salari, H. Mahmoudi, A. Aghsami, F. Jolai, S. and M. Yazdani, ‘‘Off-site construction three-echelon supply chain management with stochastic constraints: A modelling approach,’’ Buildings, vol. 12, no. 2, p. 119, Jan. 2022.