

Real-Time Inventory and Stock Management for Grocery Stores

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Abstract: The Real-Time Stock and Inventory Management System for supermarkets is a modern, web-based system for improving stock monitoring, sales analysis, and supplier coordination. Developed with a secure and scalable platform using Spring Boot and MSSQL, the system has the features of real-time inventory tracking, automatic replenishment, product categorization, sales analysis, and supplier monitoring. With an emphasis on operational effectiveness and data correctness, the platform uses role-based access control (RBAC) to enable secure user interaction. The system effectively minimizes incidences of stock out and overstock, eliminates human errors, enhances customer satisfaction, and supports more accurate decision-making through rich analytics and reporting.

Keywords: Inventory Management, Stock Tracking, Grocery Store Automation, Real-Time Monitoring, Role-Based Access Control (RBAC).

I. INTRODUCTION

The grocery retail industry, like all other sectors, is now compelled to have strong and effective digital infrastructure that supports best-in-class inventory management and improves store performance. Manual tracking or traditional inventory management systems based on legacy software are plagued by issues like inaccurate inventory counts, frequent instances of stockout or excess inventory, long restocking cycles, and lack of visibility into sales patterns. As the pace of retail technology and data-driven management practices accelerates, the need for a secure, real-time inventory management platform becomes ever more critical to drive greater operational efficiency and customer satisfaction. The Real-Time Inventory and Stock Management System can overcome these issues by bringing together seminal features like real-time tracking of stock levels, automated reordering processes, product categorization, supplier management, and sales analysis. Built with Spring Boot and MSSQL, additionally includes role-based access control (RBAC) to allow for secure operations and data integrity throughout the platform.



Fig. 1 Our Website Design.

II. LITERATURE SURVEY

Computerization of inventory control processes has come to be one of the prime areas of research interest in academic and industry circles over the past decade. In the retail environment, significant advancements have been achieved towards

balancing inventory control systems with automated, real-time platforms. Wilson and Clark (2020) noted that manual stock tracking systems are prone to cause inventory errors and stockouts, thereby necessitating automated real-time inventory control solutions [1]. Harris and Nguyen (2021) noted that integrating supplier management with stock tracking increases the efficiency of restocking and reduces operational lags [2]. Morgan and Patel (2022) described the role of real-time inventory visibility in facilitating decision-making and enabling better stock forecasting in dynamic retail environments [3]. Singh and Thomas (2021) noted the role of sales data analysis in optimizing inventory levels and improving profit margins [4]. Subsequently, Roberts and Kim (2022) demonstrated that automated restocking systems have significant potential to reduce human errors and decrease shortages in supermarkets [5]. Sharma and Iyer (2023) noted that cloud-based inventory platforms facilitate scalability and offer improved disaster recovery facilities for retail businesses [6]. Lopez and Das (2020) observed that mobile-optimized, user-friendly dashboards and reporting modules improve store managers' engagement and efficiency in handling stock [7]. Banerjee and Mehta (2023) opined that incorporating AI-based demand forecasting models has the potential to further optimize the replenishment strategies of stock and reduce wastage [8]. Subsequently, Green and Ali (2022) emphasized the application of IoT-based sensors in real-time monitoring of inventory status, particularly in the case of perishable items [9]. Lastly, Ahmed and Bose (2023) described the application of block chain technology in improving transparency and traceability in supply chain and inventory management processes [10].

III. MODULE-WISE DESCRIPTION

The Real-Time Inventory and Stock Management System is designed using a modular approach to streamline product cataloging, stock tracking, supplier coordination, sales operations, and reporting functions. Each module interacts with a secure backend system to ensure real-time, accurate data handling and efficient grocery store

management. The major modules are described below:

1. CATLOG INVENTORY INFORMATION

The CatLog Inventory Information module is instrumental in maintaining an organized and updated record of all products sold within the grocery store. It manages a vast list of product metadata, including product names, unique SKUs, barcodes, price data, brands, categories, and shelf locations. Products are organized systematically into hierarchical category and subcategory groupings to enable efficient search, filtering, and updating operations. Dynamic addition, modification, and deletion of products are supported by the system to manage new stock additions or product phase-outs. Advanced search capabilities allow users to locate products using keywords, particular categories, or barcode scanning mechanisms. In addition, integration with barcode readers and point-of-sale systems ensures maximum effectiveness of inventory updates and sales transactions.



Fig. 2 Cat-log Inventory Information.

2. STOCK AND INVENTORY TRACKING

The Stock and Inventory Tracking module is one of the core modules of the inventory management

system and provides real-time monitoring of product quantities, movement, and status. Every sale transaction, restocking transaction, or adjustment transaction invokes the immediate update of stock quantities in the central database, thereby providing accurate visibility into the inventory at any moment. Low stock alerts are automatically created when product quantities fall below certain levels, thereby invoking timely restocking activity. The system provides tracking and monitoring of expiry dates in batches, which is very helpful in the case of perishable items. Complete inventory logs continuously log stock in/out transactions, returns, and damaged stock for auditing purposes. It provides rich information to managers about fast movers, slow movers, or obsolete products and enables them to make more strategic purchasing and merchandising decisions. The module efficiently reduces stockouts, avoids holding costs, and maintains an optimal inventory turnover ratio, which is critical to the operations of the grocery stores.



Fig. 3 Stock & Inventory Tracking.

3.VENDOR AND SUPPLIER RELATIONSHIP



Fig. 4 Vendor & Supplier Relationship.

The Vendor and Supplier Relationship module manages supplier management and procurement processes efficiently, acting as an intermediary between the grocery business and its suppliers. It keeps detailed records of supplier profiles, company information, contact details, contractual information, payment history, and product inventory supplied.

The system facilitates the generation and maintenance of restock orders, monitoring order status, and tracking delivery schedules. Automatic generation of purchase orders from low-stock alerts is made possible, ensuring timely restocking without manual intervention. Supplier performance indicators like delivery reliability, product quality, and price consistency are monitored to assess and optimize vendor relationships over a period of time. The system also accommodates multiple supplier situations, enabling a product to be supplied by multiple vendors based on availability or price benefits. Automated notifications, reminders for delayed delivery, and integrated communication channels further facilitate coordination with suppliers.

4.SALES OPERATION PROCESSING

The Sales Operation Processing module controls the entire life cycle of sales transactions within the grocery store setup. It systematically records every sale through integrated point-of-sale (POS) systems, immediately updates inventory levels, and generates electronic receipts to customers. The

module facilitates various payment methods, such as cash, card, and wallets, thereby making the checkout process efficient. Discounts, loyalty rewards, taxes (including GST), and promotional discounts can be dynamically included during billing. Sales summaries on a daily, weekly, and monthly basis are automatically generated to provide business insights. Additionally, a sales trend analysis is carried out to detect high-demand items and peak shopping hours, thereby helping managers plan promotions and stock replenishment. Security features, such as role-based access, ensure that only authorized staff can process refunds, apply discounts, or make amendments to sales records. Real-time synchronization with the inventory module ensures correct records of stocks. Automation and securing of the sales process, through this module, optimizes operational efficiency, minimizes manual errors, and maximizes overall customer satisfaction.



Fig. 5 Sales Operation Processing.

5.REPORTING SYSTEM

The Reporting System module offers end-to-end business analytics and intelligence through the creation of customized reports that track all the important store operation

details. They include inventory stock levels, sales performance, supplier delivery rates, profit margin, low-stock warnings, and product movement trends. Managers use visual dashboards that include real-time visualizations like graphs, charts, and tables to enable faster analysis.

Advanced filtering capabilities enable users to create reports for specified date ranges, categories, product types, or vendor performance. Scheduled reporting enables key stakeholders to be informed at regular intervals by way of email or system notifications.

Export options enable users to download reports in PDF, Excel, or CSV formats for offline analysis or sharing with external stakeholders. Security features ensure that sensitive financial and inventory data are accessible only to authorized staff. Through the capability to deliver actionable information, the Reporting System enables the grocery store management team to make informed decisions, accurately predict demand, optimize stock, and drive business growth efficiently.



Fig. 6 Reporting System.

IV. ACCESS MANAGEMENT AND DATA PROTECTION

This subject covers the critical measures to protect sensitive sales, supplier, and inventory data and control user access to system functionality. A good access management system renders information and system processes available only to authorized users, such as administrators, store managers, and employees. Strict enforcement of Role-Based Access Control (RBAC) ensures that users are granted access strictly based on their job role and responsibility. For example, administrators have full rights to modify inventory and supplier information, while sales staff can only make transactions and view limited product information.

Multi-factor authentication (MFA) has been incorporated to provide an added layer of security, thus minimizing the risk of unauthorized access. All sensitive information, including supplier agreements, sales information, and stock valuations, are encrypted during transit and storage, according to industry-approved security standards. Continuous monitoring of user behaviour, along with real-time anomaly detection, assists in detecting and countering potential security threats. Data protection laws compliance ensures that operational integrity, confidentiality, and accountability are ensured throughout the entire system. In essence, Access Management and Data Protection are the pillars of a secure, reliable, and trusted inventory management system.

V.CONCLUSION

The Real-Time Inventory and Stock Management System offers a secure, efficient, and user-friendly platform to automate the operations of grocery stores, inventory management, monitoring of sales, and coordination with suppliers. By combining essential functionalities such as catalog inventory

management, real-time stock tracking, supplier relationship management, sales operation processing, and end-to-end reporting in a logical and modularized framework, the system enables effective communication between store managers, suppliers, and operational staff. Every module is carefully designed with a focus on scalability, security, and operational efficiency, thus allowing the system to easily scale up to accommodate different store sizes and changing retail dynamics.

A core strength of the system lies in its emphasis on data security and access control through the implementation of role-based access control (RBAC), encryption methods, and compliance with data privacy legislation to safeguard sensitive corporate data. Additionally, functionality such as real-time synchronization, low inventory alerts, and intelligent reporting significantly enhances operational efficiency and supports data-driven decision-making. With regard to future development, the system holds vast potential for enhancement through the incorporation of artificial intelligence-based demand forecasting, advanced sales analytics, and IoT integration for advanced inventory tracking, thereby providing a platform for an even more intelligent and completely automated retail management platform.

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