Vivekanand Education Society's
Institute of Technology
(Autonomous Institute Affiliated to University of Mumbai, Approved by AICTE & Recognised by Govt. of Maharashtra)
NAAC accredited with 'A' grade

Semester: VI AIDS Review:1

Title of the Project:
Inventory Management and Demand Forecasting System

Domain:

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Introduction to Project

We Know,Managing inventory properly helps businesses keep the right amount of stock, avoiding shortages or excess. Poor inventory control can lead to lost sales, higher costs, and supply chain problems.Traditional forecasting methods are often inaccurate and can’t adjust to changing demand.

This project uses Machine Learning to predict future demand more accurately by analyzing past sales and market trends.
The system will automate stock tracking, reduce waste, and help businesses make better decisions.
With AI-driven insights, companies can save money, improve efficiency, and ensure products are always available when needed.

Problem Statement

- Inefficient inventory management leads to financial losses.
- Overstocks increase holding costs, while stockouts cause lost sales.
- Traditional forecasting methods are inaccurate and lack adaptability.
- Manual inventory tracking is time-consuming and prone to errors.
- Need for an intelligent system that adapts to changing demand patterns.

Objectives of the project

- Develop a system to monitor and manage inventory levels efficiently.
- Implement demand forecasting using Machine Learning algorithms.
- Reduce costs associated with overstocking and stockouts.
- Enhance supply chain efficiency by automating inventory tracking.
- Improve decision-making using real-time data analytics.

Requirements of the system (Hardware, software)

Hardware Requirements	Software Requirements
Server with sufficient storage capacity	Programming Language: Python
Computers/Workstations	Database: MySQL/PostgreSQL
Barcode Scanners (if applicable)	Framework: Flask/Django
IoT-enabled devices for real-time stock tracking	AI/ML Libraries: TensorFlow, Scikit-learn, Keras
	Cloud Integration: AWS/Azure for data storage and processing

Literature Survey

Sr. No.	Title	Author	Summary	Year of Publication
1	AI-enhanced inventory and demand forecasting: Using AI to optimize inventory management and predict customer demand	P. Kumar	Discusses how AI improves demand forecasting and inventory optimization by analyzing sales patterns and real-time market data. It highlights the role of machine learning in reducing stockouts and overstocking.	2024

Literature Survey

Sr. No.	Title	Author	Summary	Year of Publication
2	Demand forecasting for improved inventory management in small and medium-sized businesses	A. Sharma	Examines demand forecasting techniques tailored for SMEs, emphasizing the use of AI-driven models to predict customer demand accurately. It also explores how predictive analytics enhances inventory control and supply chain efficiency.	2023

Description Dataset

Dataset Name: Retail Sales Dataset

The Retail Sales Dataset provides transaction-level data on customer purchases, including details about product categories, pricing, and customer demographics. It consists of 1,000 records and 9 features, capturing key aspects such as transaction date, customer ID, age, gender, quantity purchased, and the total amount spent. The dataset helps in understanding purchasing patterns, customer preferences, and sales trends. By analyzing this data, businesses can optimize inventory levels, forecast demand, and improve sales strategies.

Key Features:
Product ID: Unique identifier for each product
Product Name: Name of the product
Category: Type of product (e.g., Electronics, Clothing)
Stock Quantity: Number of items available
Price per Unit: Cost per item
Sales Volume: Number of units sold
Supplier Info: Vendor or supplier details
Restock Date: Date of last inventory refill

Implementation

Pricing Strategy Optimization with Algorithms

Optimize product pricing based on demand and sales trends using **XGBoost** or **Random Forest Regression**:

1. **Demand-Based Pricing Prediction** – Uses **Random Forest Regression** and **Linear Regression** to analyze historical sales data and predict optimal pricing for revenue maximization.

2. **Price Elasticity Analysis** – Applies **XGBoost Regression** to measure how price changes impact demand and adjust pricing accordingly.

3. **Competitive Pricing Strategy** – Uses **XGBoost** with external pricing data to recommend dynamic price adjustments based on competitors' pricing.

4. **Seasonal Pricing Trends** – Uses **Time Series Forecasting (XGBoost/Random Forest)** to identify peak and off-peak sales periods and optimize seasonal pricing.

5. **Profit Maximization** – Uses **Random Forest Regression** to balance price adjustments with inventory levels to prevent stockouts while maximizing revenue.

Conclusion

The proposed Inventory Management and Demand Forecasting System leverages Machine Learning to enhance inventory control, reduce costs, and improve business efficiency through data-driven insights.

The system provides real-time forecasting, ensuring better supply chain decisions and minimizing financial losses.

References

Research Papers:
[2] P. Kumar, "AI-enhanced inventory and demand forecasting: Using AI to optimize inventory management and predict customer demand," *ResearchGate*, 2024. [Online]. Available: https://www.researchgate.net/profile/Praveen-Kumar-611/publication/386381884_AI-enhanced_inventory_and_demand_forecasting_Using_AI_to_optimize_inventory_management_and_predict_customer_demand/links/674fa8a4a7fbc259f1aafffe/AI-enhanced-inventory-and-demand-forecasting-Using-AI-to-optimize-inventory-management-and-predict-customer-demand.pdf.
[4] A. Sharma, "Demand forecasting for improved inventory management in small and medium-sized businesses," *ResearchGate*, 2023. [Online]. Available: https://www.researchgate.net/publication/372086184_Demand_Forecasting_for_Improved_Inventory_Management_in_Small_and_Medium-Sized_Businesses/fulltext/64a41a468de7ed28ba745fd4/Demand-Forecasting-for-Improved-Inventory-Management-in-Small-and-Medium-Sized-Businesses.pdf.
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