ACROPOLIS INSTITUTE OF TECHNOLOGY

AND

RESEARCH

Department of Information Technology

Synopsis

on

Predictive Modelling Using Historical Sales Data to Forecast Future Product Demands

1. INTRODUCTION:

1.1. Overview:

- In today's competitive market, effective inventory management is crucial for businesses to meet customer demands while minimizing costs. This project focuses on utilizing **historical sales data** to forecast future product demands, reducing the risk of **stockouts** and **overstocking**.

- By analyzing **past sales trends, seasonal variations, and consumer behavior**, businesses can make **data-driven** inventory decisions. Poor inventory management leads to **lost sales, high storage costs, and inefficient supply chains**, making demand forecasting a critical requirement.

- This project explores various forecasting techniques to optimize inventory levels, contributing to improved **supply chain efficiency** and **customer satisfaction**.

1.2. Objective & Purpose of the Project/Innovativeness and usefulness:

Objective: The primary objective of this project is to design and implement a smart, scalable sales forecasting system that leverages historical sales data to predict future demand trends using advanced machine learning techniques. The system should assist businesses in making data-driven inventory decisions by analyzing seasonal trends, promotional effects, and past consumer behavior.

Develop a predictive model using Facebook Prophet
To capture complex patterns like seasonality, holidays, and growth trends in historical sales data.

Outcome:
An accurate forecasting model was developed using Prophet that can:

- Predict future sales (e.g., for the next month or quarter),
- Handle weekly cycles, holidays, and long-term growth trends,
- Support data-driven decisions for procurement and promotions.

Create an interactive web application using Streamlit
To provide real-time forecasting and visualization to end users.

Outcome:
A functional web application with:

- A user-friendly interface accepting CSV input,
- Automated forecast generation,
- Interactive plots and prediction charts,
- Output of performance metrics like MAE and RMSE.

Minimize inventory inefficiencies such as overstocking and stockouts
By using predictive insights from historical data.

Outcome:
Improved inventory planning through:

- Reduced risks of stockouts and overstocking,
- Better warehouse optimization,
- Enhanced synchronization across the supply chain.

2. LITERATURE SURVEY:

2.1. Existing Problem:

1. inFlow Inventory

Overview:
inFlow is an inventory and order management system tailored for small businesses. It handles stock, invoicing, and shipping.

Advantages:

- User-friendly desktop and mobile interfaces.
- Barcode scanning support.

Disadvantages:

- Limited forecasting capabilities.
- Less suitable for large-scale enterprises.

Comparison with Your Solution:

- Your system adds **ML-based dynamic forecasting** rather than relying on static reorder points.
- Better suited for **seasonal or rapidly changing demand environments**.

2. NetSuite ERP (by Oracle)

Overview:
NetSuite is a comprehensive ERP solution with strong inventory, accounting, CRM, and supply chain modules.

Advantages:

- Full ERP integration for large enterprises.
- Advanced reporting and demand planning tools.

Disadvantages:

- Very high cost; overkill for small businesses.
- Complex setup and learning curve.

Comparison with Your Solution:

- Your system is **lightweight, cost-effective**, and easier to deploy for **SMEs** (small and medium enterprises).
- Offers **focused forecasting without the overhead of ERP** complexity.

3. TradeGecko (Now QuickBooks Commerce)

Overview:
An inventory and order management platform designed for modern retail and e-commerce.

Advantages:

- Integration with Shopify, WooCommerce, and Amazon.
- Real-time inventory sync across channels.

Disadvantages:

- Basic forecasting features.
- Dependency on QuickBooks ecosystem.

Comparison with Your Solution:

- Your app adds **AI-driven adaptability** for new trends or sudden demand shifts, not just historical averages.

4. Fishbowl Inventory

Overview:
Fishbowl is a popular manufacturing and warehouse inventory system that integrates with QuickBooks.

Advantages:

- Strong manufacturing features (BOM, work orders).
- Barcode and asset tracking included.

Disadvantages:

- Outdated UI in places.
- Expensive for small teams.

Comparison with Your Solution:

- Fishbowl is **manufacturing-oriented**, while your solution is more **data science-driven**, offering **scalable predictive analytics** for diverse domains.

5. Zoho Inventory

Overview:
Zoho Inventory is a cloud-based inventory management solution used by small to medium-sized businesses. It helps track inventory, manage orders, generate reports, and integrate with platforms like Amazon, eBay, and Shopify.

Advantages:

- **Real-time inventory tracking** – Reduces errors in stock levels and prevents overselling.
- **Multi-channel selling integration** – Syncs inventory across different platforms automatically.

  Disadvantages:

- **Lacks advanced predictive analytics** – While it reports current trends, it does not deeply forecast future sales using ML models like Prophet.
- **High cost for premium features** – Small businesses may find full functionality costly.

2.2. Proposed Solution:

- **Real-Time Visibility and Reporting**

  Mobile Accessibility: Provide mobile-friendly dashboards and apps for on-the-go inventory management and decision-making.

  Customizable Alerts: Configure automated alerts for low stock levels, expiring items, or unusual activity in the supply chain.

  Performance Analytics: Generate detailed reports on key metrics like inventory turnover, carrying costs, and stockout rates to identify areas for improvement.

- **Centralized and Scalable Systems**

  Cloud-Based Platform: Implement a cloud-based inventory management system for centralized data storage, scalability, and remote access.

  Integration with ERP and CRM Systems: Ensure seamless data flow between inventory management, Enterprise Resource Planning (ERP), and Customer Relationship Management (CRM) systems.

  Multi-Channel Inventory Management: Synchronize inventory across online and offline sales channels to prevent overselling and improve customer satisfaction.

- **Training and Change Management**

  Employee Training: Provide training programs to help staff adapt to new technologies and processes.

  Change Management Strategies: Develop strategies to ensure smooth adoption of new systems and minimize resistance to change.
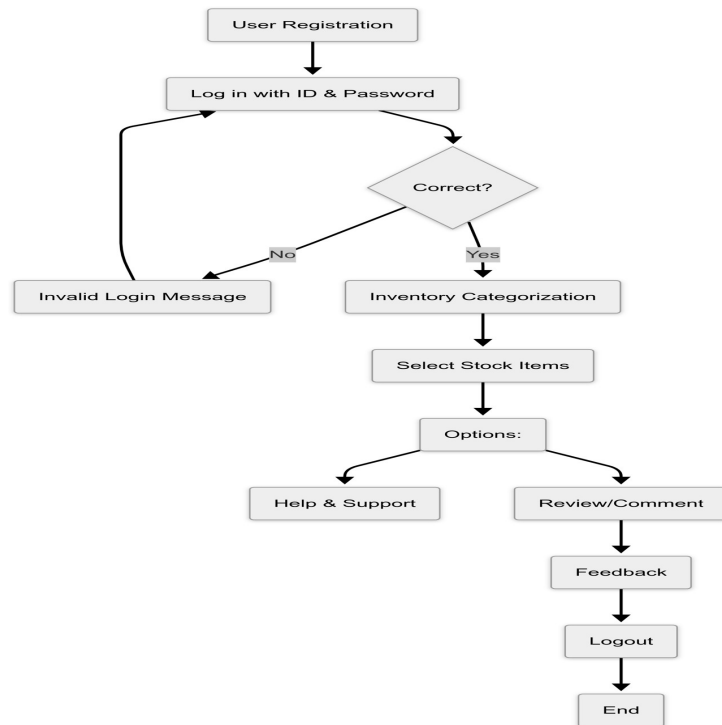
3. THEORITICAL ANALYSIS

3.1. Diagram:

Fig.1 Block Diagram of Smart Inventory Management.

3.2. Required Resources:

Category	Component	Purpose
Hardware	Server / Cloud Hosting	To store, process, and deploy inventory data and ML models
	Storage Devices (HDD / Cloud DB)	To store historical sales and forecasting data
	Computing Devices (PCs / Mobile Devices)	For accessing the web app and inventory dashboard

Category	Component	Purpose
Software	Programming Languages**:** Python, R	Core development, data processing, and model building
	Forecasting Tools: Facebook Prophet, Statsmodels	Time-series forecasting and trend analysis
	Machine Learning Frameworks: Scikit-learn, TensorFlow	For training and evaluating predictive models
	Database Management: MySQL, MongoDB	To manage structured and unstructured inventory and sales data
	Visualization Tools: Streamlit, Power BI, Tableau	For interactive dashboards, visual analytics, and forecasting outputs
	Web Deployment: Streamlit Cloud / Heroku	Hosting the web interface for real-time use

5. **Applications:**

   1. **Retail Industry:** Enhancing inventory management and customer satisfaction by ensuring product availability.

   2. **E-commerce:** Optimizing stock levels based on predictive analytics to improve order fulfillment rates.

   3. **Manufacturing:** Streamlining production schedules and raw material procurement based on demand forecasts.

   4. **Supply Chain Management**: Improving overall efficiency by aligning inventory levels with predicted sales.

   5. **Seasonal Products**: Assisting businesses in preparing for peak seasons by accurately forecasting demand.

   6. **Pharmaceutical Industry:** Managing medicine stocks is critical due to expiration dates and regulatory requirements.

7. **Food & Beverage Industry**: Perishable goods require accurate inventory tracking to reduce spoilage and optimize delivery schedules. This system supports:

8. **Automotive & Spare Parts Industry:** Managing spare parts inventory is challenging due to varying demand for different components.

9. **Fashion & Apparel Industry:** The fashion industry experiences fast-changing trends and seasonal demand shifts.

10. **Aviation & Aerospace Industry:** Airlines and aerospace manufacturers need critical component tracking to maintain safety and compliance standards.

5. REFERENCES:

[1]. https://www.researchgate.net/publication/383560175_AI-driven_demand_forecasting_Enhancing_inventory_management_nd_customer_satisfaction

[2]. https://disk.com/resources/inventory-forecasting-methods-to-reduce-stockouts-overstock/#:~:text=Seasonality%20Analysis,-Retailers%20often%20face&text=This%20method%20relies%20on%20historical,by%20managing%20their%20inventory%20carefully

[3]. https://www.pecan.ai/blog/predictive-inventory-management/

[4]. https://thousense.ai/blog/accurate-demand-forecasting-for-effective-inventory-management/

[5]. https://codup.co/blog/how-to-avoid-overstocking-and-stockouts-in-retail-best-practices-for-inventory-planning/

[6]. https://www.netstock.com/blog/demand-forecasting-for-supply-chains-how-to-predict-plan/

[7]. https://ijrpr.com/uploads/V5ISSUE10/IJRPR34021.

Submitted To:

Prof. Pawan Kumar Gupta

Submitted By:

Khushi Agrawal (0827IT221076)