RAW MATERIAL USAGE TRACKER AND PREDICTION

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Abstract

The Raw Material Usage Tracker and Prediction system is designed to monitor, analyze, and predict the consumption of raw materials in an organization. The system maintains detailed records of material purchases, available stock, daily usage, production requirements, and remaining inventory. It helps organizations track raw material usage efficiently and identify consumption patterns over time. Historical usage data is analyzed using data analytics and machine learning techniques to predict future raw material requirements. The prediction feature helps estimate upcoming demand and supports timely material procurement. The system can also identify materials with high consumption rates and provide useful insights for inventory management. By continuously tracking stock levels, it can help reduce the chances of material shortages and unnecessary overstocking. Data visualization through charts and dashboards makes it easier for users to understand consumption trends and inventory status. The system improves planning by providing data-driven estimates instead of relying only on manual calculations. It can support better purchasing decisions, reduce material wastage, and improve production efficiency. Overall, the proposed system provides a centralized and intelligent solution for raw material tracking, consumption analysis, inventory monitoring, and future usage prediction.

I. Introduction

Raw materials are an essential part of every manufacturing and production process, and their proper management is important for maintaining smooth operations. Organizations need to continuously monitor the quantity of raw materials purchased, consumed, and available in stock. Traditional methods of tracking raw material usage often depend on manual records, spreadsheets, and basic inventory systems, which can lead to data-entry errors, inaccurate stock information, and difficulties in identifying consumption patterns. The Raw Material Usage Tracker and Prediction system is developed to overcome these challenges by providing an automated platform for monitoring and analyzing raw material consumption. The system stores information such as material name, quantity received, quantity used, remaining stock, usage date, and production requirements. It analyzes historical consumption data to identify trends and patterns in material usage. Machine learning and data analytics techniques can then be used to predict the amount of raw material required in the future. These predictions help organizations plan their purchases and maintain appropriate inventory levels. The system can also provide dashboards, reports, and graphical representations to make inventory information easier to understand. By reducing dependence on manual calculations, the system improves accuracy and saves time for inventory managers. It also helps minimize material shortages, overstocking, and unnecessary wastage. Overall, the system supports efficient inventory planning and enables organizations to make better data-driven decisions regarding raw material procurement and usage.

II. Literature Survey

The management of raw materials has become an important research area because inaccurate inventory decisions can lead to stock shortages, overstocking, increased storage costs, and production delays. Recent research shows a growing shift from traditional statistical forecasting toward machine learning and artificial intelligence for inventory and demand prediction.

1. **Aburto and Weber (2007)** studied inventory forecasting using statistical and time-series techniques. Their work demonstrated that traditional forecasting methods can provide transparent and understandable predictions, particularly when historical demand patterns are relatively stable. However, such methods can face limitations when demand becomes highly variable.
2. **Tliche and Taghipour (2020)** investigated weighted moving-average forecasting combined with optimization techniques for inventory-related prediction. The study showed that historical consumption data can be effectively used to estimate future requirements, although selecting suitable weights can be challenging.
3. **Seyedan and Mafakheri (2020)** examined machine-learning applications in supply-chain demand forecasting. Their work highlighted the ability of ML models to identify relationships among multiple variables and discover patterns that may not be easily captured by conventional statistical models.
4. **Salinas et al. (2020)** explored deep-learning approaches based on recurrent neural networks for probabilistic forecasting of sequential demand data. Such approaches demonstrate the potential of deep learning for handling time-dependent consumption patterns, although model complexity and data requirements remain important considerations.
5. **Li et al. (2023)** compared several time-series forecasting methods for predicting demand patterns. The research indicates that different forecasting techniques perform differently depending on the characteristics of the data, emphasizing the importance of selecting an appropriate model for a particular inventory problem.
6. **Atwani, Hlyal, and El Alami (2024)** reviewed AI-based demand forecasting models and reported the increasing use of artificial intelligence to improve forecasting accuracy, production planning, and inventory management in dynamic manufacturing environments.
7. **A systematic review of AI applications in supply-chain demand planning** found that demand forecasting is closely connected with inventory management for raw materials and finished products. Machine-learning methods can support decisions concerning when, where, and how much inventory should be maintained, helping reduce both stockouts and excess inventory.
8. **Royani et al. (2026)** conducted a systematic literature review of statistical and AI methods for manufacturing inventory management. The review found a major increase in AI-based approaches, while statistical methods remain useful for stable demand patterns. It also identified supervised learning, deep learning, and hybrid approaches as important directions for inventory prediction.
9. **Gomaa (2026)** reviewed AI-based demand forecasting in manufacturing supply chains and identified a progression from conventional machine

learning toward deep learning, reinforcement learning, hybrid intelligence, and transformer-based approaches. The study also highlighted implementation challenges such as data quality, model complexity, and integration with existing systems.

III. System Analysis

The **Raw Material Usage Tracker and Prediction** system is designed to analyze and manage the usage of raw materials in a production environment. The system collects information about raw material names, quantities, purchase dates, usage quantities, and available stock. It maintains historical records that can be used to understand material consumption patterns. The system analyzes daily, weekly, and monthly usage to identify changes in consumption. It also monitors the current inventory level of each raw material. Based on historical usage data, the system predicts future raw material requirements. These predictions help organizations plan material purchases in advance. The system provides useful reports and visual dashboards for better understanding of inventory conditions. It can identify materials that are frequently consumed or approaching low-stock levels. The analysis reduces dependency on manual calculations and improves data accuracy. Overall, the system supports efficient inventory management and better production planning.

Existing System

In the existing system, raw material usage is commonly recorded using manual registers, spreadsheets, or basic inventory management software. Employees enter details such as purchased quantity, consumed quantity, and remaining stock manually. Stock information is generally updated after materials are received or used in production. Historical records may be stored separately, making it difficult to analyze long-term consumption patterns. Many existing systems focus mainly on recording inventory rather than predicting future requirements. Managers often estimate future material needs based on previous experience or simple calculations. Manual tracking can result in incorrect entries, duplicate records, and outdated stock information. Identifying materials with unusual consumption rates can also be difficult. Generating detailed reports may require additional manual processing. There is limited use of machine learning for predicting future raw material consumption. As a result, organizations may face stock shortages, excess inventory, and unnecessary material costs. Therefore, a more automated and predictive solution is required.

Disadvantages of Existing System

- Heavy dependence on manual data entry.
- Higher possibility of human errors.
- Difficult to identify consumption trends.
- No accurate future usage prediction.
- Time-consuming report generation.
- Risk of stock shortages.
- Possibility of unnecessary overstocking.
- Difficult to monitor multiple materials efficiently.
- Limited data visualization and analytics.
- Procurement decisions may depend on manual estimates.

Proposed System

The proposed **Raw Material Usage Tracker and Prediction** system provides an automated solution for monitoring and predicting raw material consumption. The system stores all raw material information in a centralized database for easy access and management. Users can record material purchases, production usage, stock levels, and other relevant details through the system. The application automatically calculates the available quantity based on received and consumed materials. Historical consumption data is analyzed to identify usage patterns and trends. Machine learning or suitable forecasting techniques are applied to predict future raw material requirements. The system can provide alerts when the available stock reaches a predefined minimum level. Interactive dashboards and charts help users understand material consumption and inventory status. Prediction results can assist managers in planning future purchases and production activities. The system reduces manual calculations and improves the accuracy of inventory records. It also helps minimize material wastage, stockouts, and unnecessary inventory costs. Overall, the proposed system provides an intelligent and user-friendly approach to raw material management.

Advantages of Proposed System

- Automated raw material usage tracking.
- Accurate calculation of available stock.
- Predicts future material requirements.
- Identifies consumption trends and patterns.
- Reduces manual data-entry errors.
- Helps prevent stock shortages.
- Reduces unnecessary overstocking.
- Provides real-time inventory information.
- Supports data-driven procurement decisions.
- Provides charts, dashboards, and reports.
- Saves time and improves operational efficiency.
- Helps reduce raw material wastage.

IV. Methodology

The methodology of the system begins with collecting raw material and historical consumption data from production and inventory records. The collected data includes material name, quantity received, quantity consumed, date, production details, and remaining stock. The data is then cleaned to remove duplicate, missing, or inconsistent values. After preprocessing, the relevant features are selected for analysis and prediction. Exploratory data analysis is performed to identify consumption patterns, trends, and variations in raw material usage. The processed historical data is divided into suitable training and testing datasets. A machine learning or time-series forecasting model is trained using the historical consumption information. The trained model predicts the expected usage of raw materials for future periods. Prediction results are evaluated using appropriate performance metrics to determine model accuracy. The prediction output is integrated with the inventory tracking module to provide useful recommendations. Dashboards and visualizations present stock levels,

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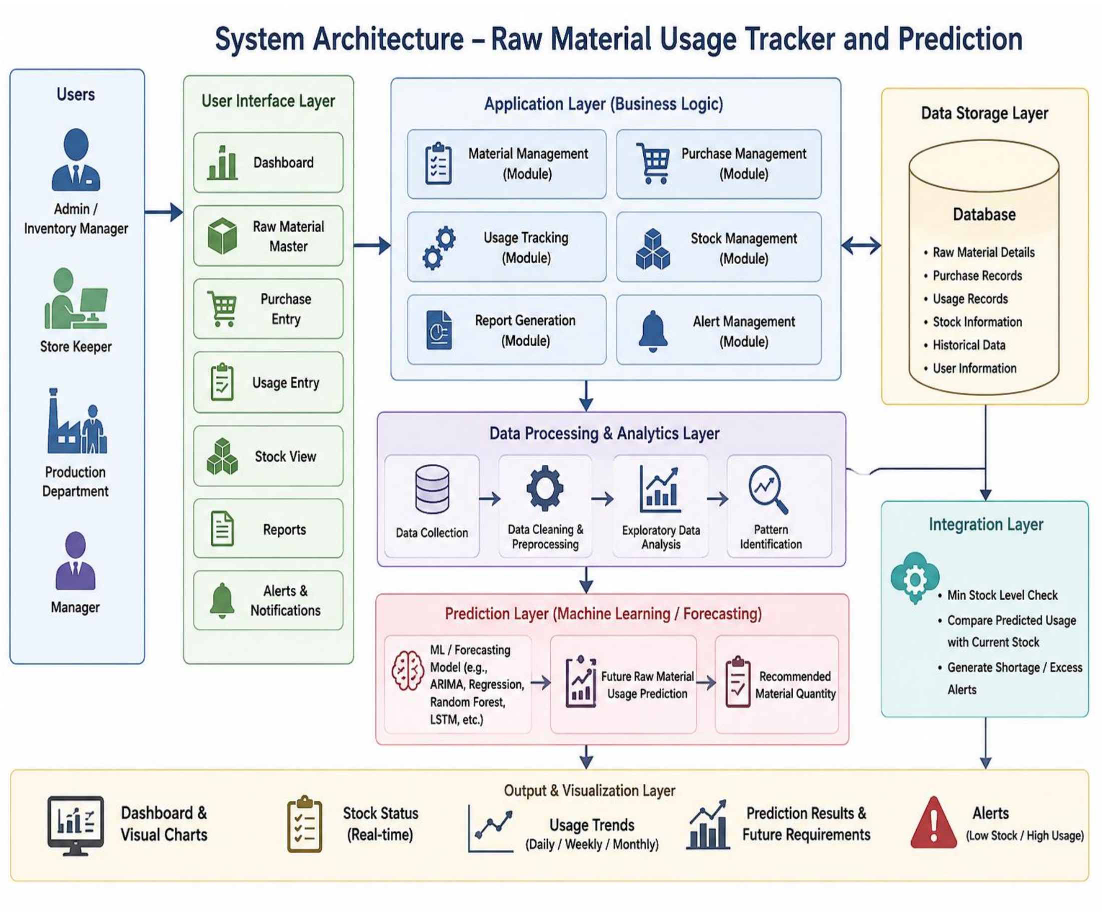
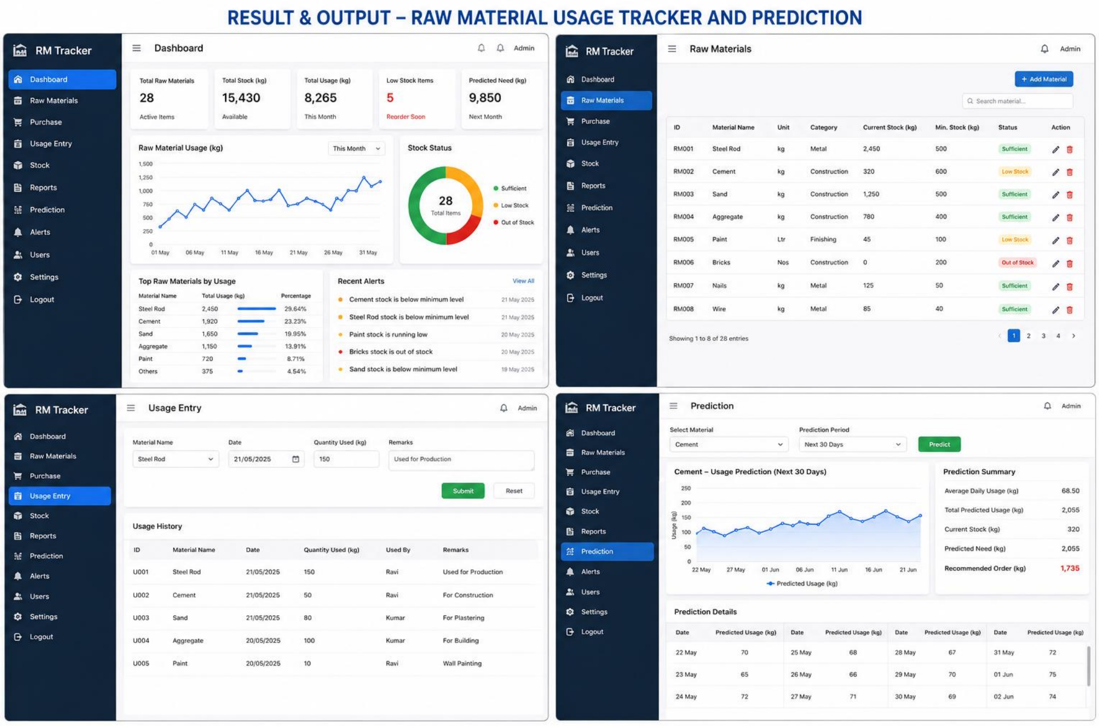
usage trends, and predicted requirements to users. Finally, the system supports inventory and procurement decisions based on the generated analysis and predictions.

System Architecture

The system architecture consists of several interconnected layers that work together to track and predict raw material usage. The user interface layer allows inventory managers or authorized users to enter and view raw material information. The application layer processes user requests and manages inventory-related operations. The data processing layer validates, cleans, and prepares historical raw material usage data for analysis. The database layer stores raw material details, transaction records, stock information, and historical usage data. The analytics module analyzes consumption patterns and generates useful inventory insights. The prediction module uses machine learning or forecasting algorithms to estimate future raw material requirements. The system compares predicted requirements with current stock levels to identify possible shortages or excess inventory. A reporting and visualization module displays consumption trends, stock status, and prediction results through charts and dashboards. Alerts can be generated when stock levels fall below predefined thresholds. Users can use these outputs to make better purchasing and production decisions. Thus, the architecture provides an integrated flow from **data collection → storage → processing → analysis → prediction → visualization → decision-making**.



V. Result and Output



VI. Conclusion

The Raw Material Usage Tracker and Prediction system provides an efficient and intelligent solution for managing raw material consumption in an organization. The system helps users record purchases, monitor stock levels, track daily material usage, and maintain historical records in a centralized database. By analyzing historical consumption data, the system identifies usage patterns and trends that support better inventory planning. The prediction module estimates future raw material requirements using suitable machine learning or forecasting techniques. This helps organizations plan procurement activities and avoid unexpected material shortages. The system also reduces the problems associated with manual data entry and calculations. Dashboards, reports, charts, and alerts make inventory information easier to understand and monitor. By maintaining appropriate stock levels, the system can help reduce overstocking, wastage, and storage costs. The predicted requirements provide valuable support for production and purchasing decisions. Overall, the proposed system improves inventory visibility, planning accuracy, and operational efficiency. It provides a scalable foundation that can be further enhanced with advanced machine learning models and real-time data integration in the future.

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