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A Data Driven IOT Framework for Real-Time Inventory Tracking and Predictive Management

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Abstract **— The increasing demand for efficient inventory management has made manual stock tracking difficult and time-consuming. This paper proposes a data-driven IoT framework for real-time inventory tracking and predictive management. The system monitors inventory data, detects stock abnormalities, and generates alerts when stock levels require attention. Machine Learning (ML) techniques are used to analyze historical inventory data and predict future stock requirements.**

Keypoints — Internet of Things, Inventory Management, Real-Time Tracking, Machine Learning, Predictive Analytics

I. INTRODUCTION

Inventory management plays a crucial role in maintaining stock availability and operational efficiency. Traditional inventory tracking methods are time-consuming and may lead to stock errors and shortages. With the advancement of the Internet of Things (IoT), automated systems are being developed to improve inventory management.

IoT enables real-time inventory monitoring, while Machine Learning (ML) helps predict future stock requirements using historical data. This paper presents a data-driven framework that improves inventory accuracy, reduces stock shortages, and supports efficient decision-making.

II. PROBLEM STATEMENT

In the current inventory management scenario, organizations often face difficulties in tracking stock levels accurately using manual methods. Traditional inventory systems may lead to stock shortages, excess inventory, and delayed updates. Additionally, the lack of predictive analysis makes it difficult to estimate future stock requirements. Therefore, there is a need for an automated IoT-based system that enables real-time inventory tracking, detects stock abnormalities, and predicts future inventory needs to improve accuracy and efficiency.



III. OBJECTIVES

The primary objective of this research is to develop a data-driven IoT framework for real-time inventory tracking and predictive management. The system aims to monitor stock levels, identify inventory abnormalities, and analyze historical data using Machine Learning techniques. It also aims to reduce manual effort, prevent stock shortages, and improve inventory management efficiency. Additionally, the framework supports better decision-making through automated alerts and predictive analysis.

1. To design and develop an IoT-based framework for real-time inventory tracking.



2. To monitor inventory data and maintain accurate stock records.
3. To apply Machine Learning techniques for predicting future stock requirements.
4. To detect stock abnormalities and generate automated alerts.
5. To reduce manual effort and minimize inventory errors.
6. To improve inventory efficiency and support better decision-making.

IV. LITERATURE REVIEW (SUMMARY)

Various research studies have explored the application of the Internet of Things (IoT) in inventory management systems. Early approaches relied on manual stock recording and barcode scanning, which often caused delays and inventory errors. With the advancement of IoT, real-time monitoring technologies have enabled more accurate stock tracking and automated data collection. Machine Learning techniques such as Decision Trees, Random Forest, and time-series forecasting have been used to predict stock requirements and improve inventory planning. Recent developments in cloud computing and data analytics have further enhanced inventory monitoring and decision-making. However, challenges such as data accuracy, system integration, and prediction errors still remain.

V. SYSTEM ARCHITECTURE

The proposed ystem architecture consists of interconnected modules that work together to enable real-time inventory tracking and predictive management. The process begins with inventory data collection and continues through data transmission, processing, prediction, and alert generation.
The system consists of the following modules:

1. Inventory Input Layer
- Collects inventory and stock details.
- Monitors stock levels and item conditions.
- Uses existing inventory records or sensor data.

2. Data Transmission Layer
- Transfers inventory data to the cloud or database.
- Supports real-time data communication.
- Ensures timely data updates.

3. Data Processing Layer
- Cleans and organizes inventory data.
- Removes duplicate or incorrect records.
- Stores processed data for analysis.

4. Machine Learning Layer
- Analyzes historical inventory data.
- Predicts future stock requirements.
- Detects abnormal stock variations.

5. Alert Generation Layer
- Generates alerts for low or abnormal stock levels.
- Notifies users about inventory issues.
- Supports timely stock replenishment.

6. Output Layer
- Displays inventory status through a dashboard.
- Provides stock reports and predictions.
- Supports efficient inventory decisions.

VI. METHODOLOGY / ALGORITHM

Methodology:

The proposed system follows these steps:
1. Collect inventory data from existing records or sensors.
2. Transfer inventory data to the database.
3. Preprocess and organize the collected data.
4. Analyze historical inventory information.
5. Apply Machine Learning techniques for stock prediction.
6. Detect stock abnormalities and low-stock conditions.
7. Generate alerts and display inventory status.
8. Evaluate system performance and prediction accuracy.

Algorithm:
Step 1: Input inventory data.
Step 2: Store data in the database.
Step 3: Preprocess inventory records.
Step 4: Analyze historical stock data.
Step 5: Apply the Machine Learning model.
Step 6: Predict future stock requirements.
Step 7: Detect abnormal or low stock levels.
Step 8: Generate alerts and display results.

VII. ADVANTAGES

Automates repetitive tasks.
Reduces hiring time.

Improves candidate matching accuracy.

Ensures consistency in evaluation.

Scalable for large recruitment processes.
Reduces human bias.



VIII . LIMITATIONS

Despite its advantages, the proposed system has certain limitations that need to be addressed.

The performance of the system depends on the accuracy and availability of inventory data.

Incorrect or incomplete data may affect stock predictions and inventory monitoring.

The system may also face challenges due to network connectivity issues and integration with existing inventory systems.

Additionally, implementing and maintaining IoT devices, cloud services, and Machine Learning models may require technical expertise and resources.

IX . RESULTS AND DISCUSSION

The proposed system improves inventory tracking and management efficiency.

It enables accurate monitoring of stock levels and inventory status.

The automated alert system helps identify low-stock conditions.

Machine Learning techniques support prediction of future inventory requirements.

System performance depends on the quality and availability of inventory data.

Network issues and inaccurate records may affect system performance.

Continuous data updates can improve prediction accuracy over time.

X. FUTURE SCOPE

Integration with advanced Machine Learning models for improved stock prediction.

Development of real-time inventory monitoring systems.

Integration with cloud platforms for remote inventory access.

Implementation of automated supplier notifications for stock replenishment.

Expansion to multiple warehouses and large-scale inventory systems.

XI. CONCLUSION

The proposed IoT-based inventory management framework provides an efficient solution for inventory tracking and predictive management.

The integration of IoT, data analytics, and Machine Learning supports accurate stock monitoring and demand prediction.

The system reduces manual effort, identifies stock abnormalities, and improves inventory efficiency.

It serves as a useful solution for organizations aiming to improve inventory management.

The proposed framework demonstrates how data-driven technologies can support better inventory decisions.

With further improvements, the system can become a valuable tool for modern inventory management.

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