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Smart Warehouse Fire Management

Prof. Asmita Boraste, Kaustubh Pachpande, Yash Sonawane, Tanmay Mane, Om Vazarde
Department of Computer Engineering
Loknete Gopinathji Munde Institute of Engineering Education & Research Polytechnic, Nashik, India

Abstract: *In the modern supply chain, warehouses play a pivotal role in linking various partners and have become a competitive factor. Efficient management and resource allocation in warehouses are crucial for maintaining operational efficiency. Traditional warehouse management systems are increasingly becoming inadequate due to the dynamic nature of the market. This paper proposes a Smart Warehouse system using Internet of Things (IOT) technology to monitor, track, and control warehouse operations. The system employs various sensors, including temperature, humidity, fire, and light sensors, integrated with Arduino microcontrollers. These sensors collect real-time data, which is then transmitted to a web application for monitoring and control. The system aims to reduce manual labor, minimize losses due to environmental changes, and enhance overall warehouse efficiency. By leveraging IOT, the proposed system offers a scalable, cost-effective, and automated solution for modern warehouse management.*

Keywords: Arduino, IOT, MQ-2 Sensor, DHT-11 Temperature Humidity Sensor, Flame Sensor, Buzzer, Relay, LDR Sensor, Warehouse Management

I. INTRODUCTION

The Internet of Things (IOT) has revolutionized the way devices interact and share data. Cframeworks enable the collection, processing, and analysis of data in real-time, making it an ideal technology for applications such as smart cities, agriculture, and industrial control. In the context of warehouse management, IOT offers the potential to automate monitoring and control processes, thereby reducing human error and improving efficiency.

Warehouses are critical components of the supply chain, responsible for storing goods and ensuring their availability when needed. Traditional warehouse management systems often rely on manual processes, which are prone to errors and inefficiencies. The proposed Smart Warehouse system leverages IOT to automate the monitoring of environmental parameters such as temperature, humidity, and fire hazards. By integrating sensors with a web application, the system provides real-time data to warehouse managers, enabling them to make informed decisions and take corrective actions promptly.

II. METHODOLOGY

Several studies have explored the use of IOT in warehouse management and related fields:

1.Nee (2009) investigated the impact of Warehouse Management Systems (WMS) on business performance, highlighting the benefits of reducing costs and improving efficiency through automation.

2. Sahuri and Utomo (2016) proposed a web-based system for small enterprises to manage warehouse inventory using SMS notifications, improving decision-making and accuracy.

3. Adiono et al. (2017) developed an RFID-based goods locator system, which enhanced real-time inventory tracking and reduced the time needed to locate items.

4. Oner et al. (2017) designed an RFID-based system for the wool yarn industry, demonstrating significant cost savings and improved operational efficiency.

5. Nikesh Gondchawar et al. (2016) proposed an IOT-based smart agriculture system, which included smart warehouse management for monitoring temperature, humidity, and theft detection.

6. Rajalakshmi et al. (2016) developed an IOT-based crop-field monitoring system, emphasizing the importance of real-time data collection and automation in reducing water wastage.

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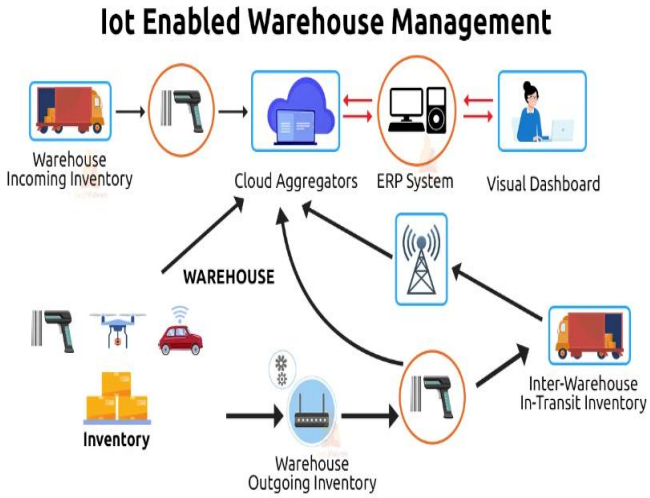
7. Mao et al. (2018) proposed an intelligent WMS based on cloud computing, RFID, and GPS, which provided real-time data for better decision-making.
8. Patil et al. (2018) introduced a cloud-based WMS that improved visibility and data accuracy, enabling better management of warehouse operations.
These studies underscore the potential of IOT in transforming traditional warehouse management systems into more efficient, automated, and data-driven solutions



III. SYSTEM ARCHITECTURE

3.1 Microservices Architecture

The Smart Warehouse system is built on an IOT architecture, consisting of the following components:

- Sensors: The system employs various sensors, including DHT-11 (temperature and humidity), MQ-2 (gas detection), Flame Sensor (fire detection), and LDR (light detection).
- Arduino Microcontroller: The Arduino acts as the central processing unit, collecting data from the sensors and transmitting it to the web application.
- Web Application: The web application provides a user-friendly interface for warehouse managers to monitor real-time data and receive alerts.
- Actuators: The system includes actuators such as relays, buzzers, and fans to control environmental conditions based on sensor data.

3.2 Implementation Steps

1. Sensor Integration: The sensors are connected to the Arduino microcontroller, which collects data on temperature, humidity, fire, and light conditions.
2. Data Transmission: The Arduino transmits the collected data to the web application via Wi-Fi.
3. Real-Time Monitoring: Warehouse managers can monitor the data in real-time through the web application, which displays the current status of the warehouse environment.
4. Automated Control: The system can automatically trigger actuators (e.g., turning on fans or sounding alarms) based on predefined thresholds for temperature, humidity, or fire detection.
5. Alert System: The system sends alerts to warehouse managers via the web application or SMS in case of abnormal conditions.

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IV. IMPLEMENTATION

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V. RESULTS AND DISCUSSION

The proposed Smart Warehouse system was successfully implemented and tested in a simulated warehouse environment. The system demonstrated the following capabilities:

- Real-Time Monitoring: The web application provided real-time updates on temperature, humidity, fire, and light conditions.
- Automated Control: The system automatically activated fans and alarms when environmental conditions exceeded predefined thresholds.
- Alert System: Warehouse managers received timely alerts via the web application, enabling them to take corrective actions promptly.

The system proved to be highly effective in reducing manual labor, minimizing losses due to environmental changes, and improving overall warehouse efficiency

VI. CONCLUSION

The Smart Warehouse system using IOT offers a robust, scalable, and cost-effective solution for modern warehouse management. By automating the monitoring and control of environmental conditions, the system reduces manual labor, minimizes losses, and improves overall efficiency. The system's real-time monitoring and alert capabilities enable warehouse managers to make informed decisions and take corrective actions promptly. With further enhancements, the system has the potential to revolutionize warehouse management in various industries.

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