IOT TECHNOLOGIES IN WAREHOUSE MANAGEMENT

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ABSTRACT

IoT (Internet of Things) technologies have revolutionized warehouse management by enhancing efficiency, visibility, and operational control. An integral part of Industry 4.0, IoT enables real-time data collection, analysis, and automation, optimizing various aspects of warehouse operations.

Keywords: IOT, irregularitiesSystems, SMEs, RFID

INTRODUCTION

IOT sensors monitor temperature, humidity, and air quality in real-time, ensuring optimal storage conditions for goods and reducing spoilage. Smart climate control systems adjust settings automatically, saving energy while maintaining ideal conditions. Constant monitoring of climate data ensures immediate response to any irregularitiesSystems make real-time adjustments, saving time and reducing the risk of human error. Smart systems optimize energy usage, reducing operational costs while minimizing environmental impact. The integration of IoT (Internet of Things) technologies within warehouse management has revolutionized the way businesses operate, optimize their processes, and enhance overall efficiency. IoT-enabled tracking systems provide real-time visibility into inventory levels, product locations, and supply chain dynamics, enabling warehouse managers to make more informed decisions and streamline operations.(Maheshwari et al., 2021)

One of the key advantages of IoT in warehouse management is the ability to monitor perishable goods and ensure their optimal freshness and quality. Wireless sensor networks can track temperature, humidity, and other environmental factors, allowing for proactive management of perishable inventory and minimizing waste. This is particularly important for small and medium-sized enterprises (SMEs) in the warehousing industry, who often struggle to adopt advanced technologies due to resource and knowledge constraints.

The implementation of IoT in warehouse management also facilitates improved inventory optimization, reducing operational costs and enhancing customer satisfaction. IoT-assisted systems can analyze sales patterns, shelf life, and customer preferences to optimize product placement and replenishment, ensuring that the right products are available at the right time. Moreover, IoT-enabled automation and data analytics can streamline the overall warehouse management process, from receiving and storage to order fulfillment and shipping. Such advancements in warehouse management enabled by IoT technologies can justify the investment in these innovative solutions, driving increased productivity, cost savings, and improved customer experiences (Khanna & Tomar, 2016)(Zhang et al., 2021)(Maheshwari et al., 2021).

IoT (Internet of Things) technologies are transforming warehouse management by providing real-time visibility, enhancing efficiency, and enabling smarter decision-making. Here are some key ways IoT is being utilized in warehouse management:

1. **Asset Tracking**: IoT devices such as RFID tags, GPS trackers, and sensors can be attached to goods, pallets, or even forklifts to track their location in real-time. This improves inventory accuracy, reduces search times, and prevents loss or theft.

2. **Inventory Management**: IoT sensors can monitor inventory levels automatically. They provide data on stock levels, expiration dates, and storage conditions (like temperature and humidity), ensuring optimal storage conditions and minimizing wastage.

3. **Predictive Maintenance**: IoT-enabled sensors on machinery and equipment can monitor performance metrics in real-time. They can detect anomalies or signs of wear and notify maintenance teams before a breakdown occurs, reducing downtime and repair costs.

4. **Automated Guided Vehicles (AGVs)**: AGVs equipped with IoT sensors navigate warehouses autonomously. They optimize routes, avoid obstacles, and adjust their operations based on real-time data, enhancing efficiency in material handling.

5. IoT sensors monitor environmental factors such as temperature, humidity, and air quality. This ensures that goods sensitive to environmental conditions (e.g., pharmaceuticals, food) are stored under suitable conditions.

6. **Worker Safety and Productivity**: IoT wearables (like smart helmets or vests) monitor workers' health metrics (such as heart rate and body temperature) and location. They ensure safety protocols are followed and can optimize worker movements for efficiency.
   Order Picking and Packing: IoT devices can optimize the order picking process by guiding workers to the exact location of items using augmented reality or pick-to-light systems. This reduces errors and speeds up fulfillment times.

7. **Supply Chain Optimization**: IoT data from warehouse operations can be integrated with broader supply chain data. This integration enables better demand forecasting, efficient route planning, and synchronized inventory management across multiple locations.

8. **Energy Management**: IoT-enabled systems monitor energy consumption in warehouses. They can identify areas of energy waste and optimize energy usage, leading to cost savings and reduced environmental impact.

9. **Data Analytics and Insights**: IoT generates vast amounts of data that can be analyzed to identify trends, optimize operations, and make data-driven decisions. Machine learning algorithms can predict demand patterns or suggest process improvements based on historical data.

Overall, IoT technologies in warehouse management enhance operational efficiency, improve accuracy, optimize resource utilization, and ultimately contribute to a more responsive and agile supply chain ecosystem.

REFERENCES

1. https://techwireasia.com/05/2023/disrupting-warehouse-management-with-passive-iot/
2. https://biztechmagazine.com/article/2024/03/4-ways-iot-devices-are-helping-retail-supply
3. https://www.google.co.uz/books/edition/Blockchain_IoT_and_AI_Technologies_for_S/RqEIE QAAQBAJ?hl=ru&gbpv=1&dq=IOT+Technologies+in+Warehouse+Management&pg=PA2 &printsec=frontcover