

The logo for RADemics, featuring the text "RADemics" in white on a blue arrow-shaped background pointing to the right. The arrow is part of a larger blue horizontal bar that is positioned over a dark blue vertical bar on the left side of the page.

RADemics

Autonomous Warehouse Inventory Management Using AI-Powered Drones and Cloud- Based Logistics Systems

A decorative graphic consisting of several thin, curved lines in shades of blue and grey, originating from the bottom left and extending upwards and to the right, resembling stylized grass or reeds.

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Autonomous Warehouse Inventory Management Using AI-Powered Drones and Cloud-Based Logistics Systems

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Abstract

The integration of AI-powered drones and cloud-based logistics systems has emerged as a transformative solution for modern warehouse management. This chapter explores the synergy between autonomous drone technology and cloud computing in enhancing inventory management, operational efficiency, and decision-making in large-scale warehouse environments. AI-powered drones, equipped with advanced sensors and machine learning algorithms, enable autonomous inventory tracking, stocktaking, and real-time data processing, while cloud logistics platforms facilitate seamless data synchronization, predictive analytics, and remote monitoring. By examining case studies and real-world applications, this chapter highlights the significant benefits of autonomous drone integration, including reduced operational costs, improved inventory accuracy, and optimized supply chain performance. Despite the promising advancements, several technical challenges, such as malfunctions, environmental interference, and software failures, remain critical for successful deployment. The chapter also delves into strategies for mitigating these challenges, including the implementation of real-time feedback loops, fail-safe mechanisms, and predictive maintenance systems. As the logistics industry increasingly adopts these technologies, further research is essential to address the remaining gaps and unlock the full potential of AI-driven warehouse automation.

Keywords: Autonomous drones, warehouse management, cloud logistics, real-time data processing, inventory tracking, predictive analytics.

Introduction

The logistics and warehousing industry have undergone substantial transformation in recent years, driven by the need for greater efficiency, accuracy, and scalability in inventory management [1]. Traditional methods of managing warehouse operations, which heavily rely on human labor and manual inventory tracking, have shown their limitations in coping with the increasing complexity and demands of modern supply chains [2]. In this context, the adoption of emerging technologies such as AI-powered drones and cloud-based logistics systems is paving the way for next-generation automation in warehouse management [3]. AI drones, equipped with advanced sensors, machine learning algorithms, and real-time data processing capabilities, are capable of

performing tasks autonomously, reducing human error and increasing operational efficiency [4]. This chapter explores the role of these technologies in revolutionizing warehouse management and highlights the numerous benefits they bring to the logistics sector [5].

The integration of AI-powered drones with cloud logistics platforms enables a seamless flow of data between drones, warehouse management systems (WMS), and enterprise resource planning (ERP) software [6]. Cloud computing allows for the storage, processing, and real-time analysis of vast amounts of data generated by drones as they perform tasks like inventory tracking, stocktaking, and monitoring of warehouse conditions [7]. This integration enhances decision-making by providing warehouse managers with access to real-time, actionable data, improving overall visibility and responsiveness [8]. As AI drones continuously collect data from their surroundings, the cloud system synchronizes and analyzes this information, providing up-to-date insights into inventory levels, stock movement, and warehouse performance [9]. This ability to monitor operations in real-time leads to significant improvements in operational efficiency and reduces the likelihood of stock discrepancies [10].

One of the most significant advantages of AI-powered drones is their ability to perform autonomous inventory management tasks with minimal human intervention [11]. These drones, which are equipped with advanced computer vision, can scan shelves, identify products, and track stock levels more quickly and accurately than manual methods [12]. In large-scale warehouses, where the sheer volume of inventory can overwhelm human workers, drones provide an efficient solution for managing inventory with greater accuracy [13]. Drones can perform tasks such as cycle counting and inventory audits autonomously, updating records in real time, thus reducing the time spent on manual checks and ensuring that inventory data is always accurate [14]. This autonomy also means that drones can operate around the clock, eliminating downtime and increasing productivity without compromising on accuracy [15].