



Automated Storage & Retrieval System (AS/RS)

Revolutionizing Warehousing with AS/RS - Precision, Efficiency, and AI Innovation

Introducing the Automated Storage and Retrieval System (AS/RS), a cutting-edge pallet storage solution that transforms warehouse operations. Built on Lenovo's innovative robotics platform and intelligent AI algorithms, the AS/RS delivers unmatched performance in **high-density storage, flexibility, and scalability**. Designed to elevate efficiency and reliability, the system ensures seamless pallet movement, enabled by advanced **4-way** robotic shuttles that navigate with precision and agility.

Uninterrupted Operation through Distributed Control Architecture

AS/RS employs a distributed control architecture that mitigates single-point failures — ensuring system **redundancy** and **continuous** operation even in the event of shuttle malfunction. Experience unparalleled **reliability** in every warehouse function.

AI-Driven Precision for Smarter Warehousing

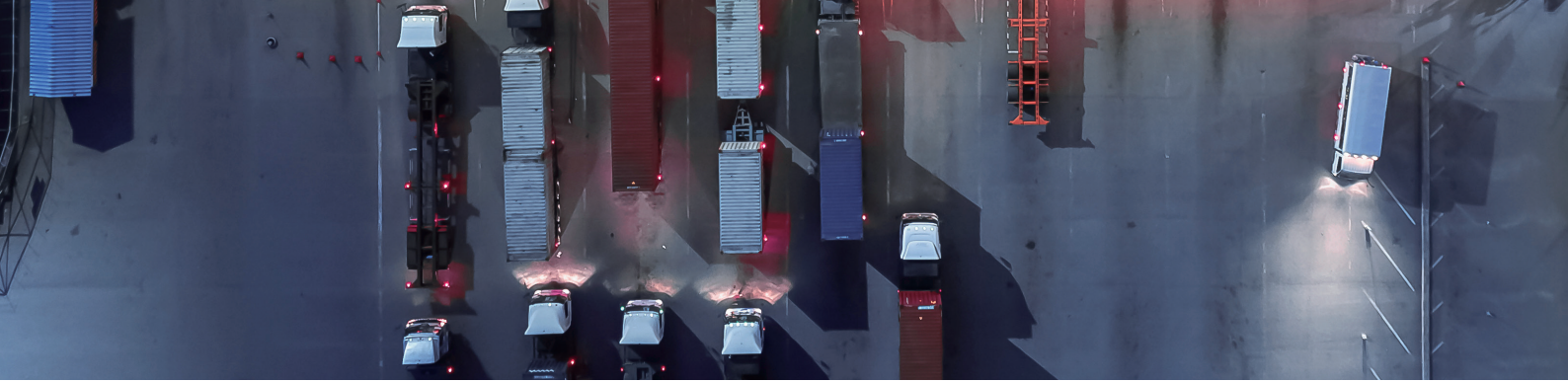
Powered by advanced machine learning algorithms, the AS/RS dynamically optimizes storage and retrieval paths in real-time, based on SKU turnover rates, demand fluctuations, and inventory levels. This intelligent system cuts retrieval time by up to **40%** while eliminating redundant movements, delivering pinpoint accuracy in high-density storage, rapid order fulfillment, and streamlined operations — all automated for **maximum efficiency**.

AI-Powered Off-Peak Optimization

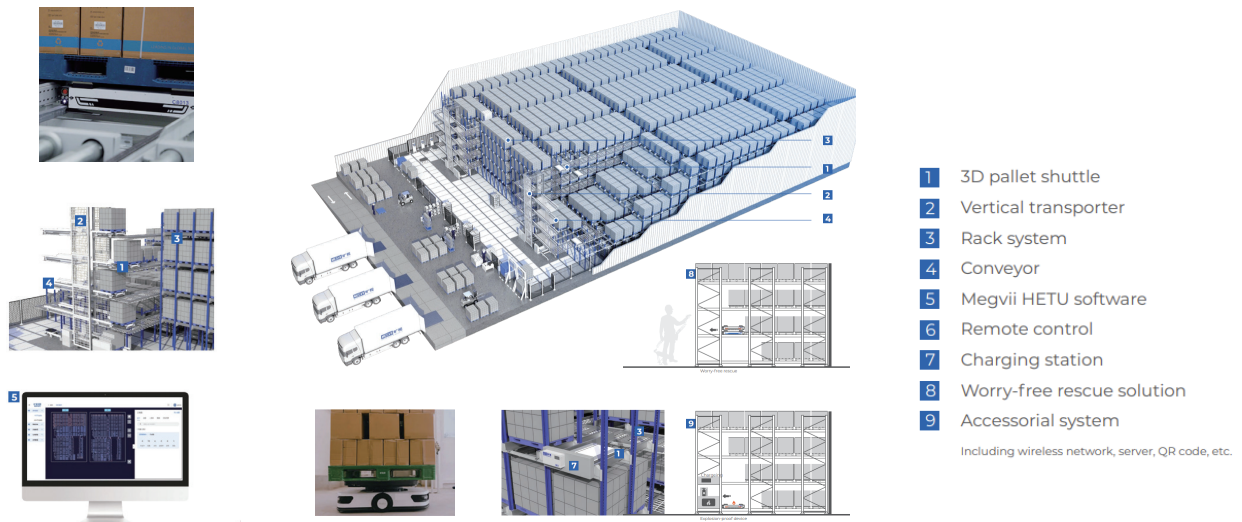
Unlock operational efficiency during slower periods with **AI-driven** off-peak inventory replenishment. Intelligent software analyzes stock status, outbound data, and order trends to rearrange inventory, prioritize access paths, and position fast-moving items near outbound stations. This revolutionary approach boosts **space utilization**, reduces idle time, and transforms downtime into value.

Inbound Management Redefined

AS/RS revolutionizes inbound operations with an AI-enabled “**small concentration, large dispersion**” slotting strategy. By assigning identical materials to a single aisle while dispersing their storage across zones, the system eliminates pallet blockages, balances workloads, and creates seamless flow between inbound and outbound processes — enhancing warehouse efficiency.



System Configuration



Core Advantages for Future-Ready Warehousing



Adaptability

Customizable for any warehouse layout, temperature conditions, and industry-specific demands.



Scalability

Modular hardware and software allow effortless expansion; add shuttles as required to match throughput needs.



Reliability

Distributed control architecture ensures continuous operation, even in the face of individual shuttle malfunctions.



Flexibility

Switch between high-density and high-selectivity configurations with ease, scaling investments based on immediate business needs.



Key features that Set AS/RS Apart

- **AI-Optimized Storage Planning:**

Dynamic slotting and mixed-SKU strategies increase storage density by up to **45%**, maximizing space utilization.

- **High-Speed 4-Way Mobility:**

Ultra-thin shuttles achieve speeds of **1.5m/s** and acceleration of **2m/s²**, with **±2mm** positioning precision for fast, multi-directional movement.

- **Intelligent Cluster Scheduling:**

AI-powered coordination of shuttles, lifts, and AMRs minimizes idle time and optimizes cross-layer capacity.

- **Dual-Buffer Efficiency Boost:**

Buffer zones reduce handling distances and operation time by **25%**, doubling throughput compared to non-buffer systems.

- **Multi-Environment Adaptability:**

Reliable performance across normal, refrigerated, and frozen conditions, supporting diverse industries like pharmaceuticals, food, and manufacturing.

- **Comprehensive Safety Protections:**

Incorporates anti-collision, obstacle avoidance, path pre-monitoring, and fire-safe charging for maximum equipment and personnel safety.

- **Seamless System Integration:**

Open APIs enable real-time data sync with WMS/WCS systems, ensuring unified automation and fleet management.

- **Modular Scalability:**

Easily expand capacity by adding pallet shuttles without overhauling the entire system.

- **Visual O&M Platform:**

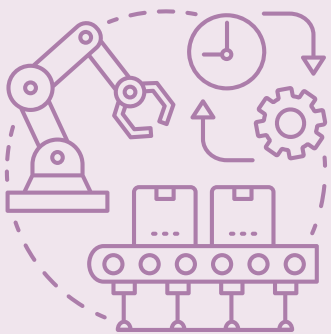
Intuitive dashboards provide device monitoring, task tracking, and analytics for simplified management and troubleshooting.

Embrace the Future of Warehousing

AS/RS represents the pinnacle of efficiency, adaptability, and reliability. It combines Lenovo's expertise in robotics and AI to deliver a system that exceeds expectations and drives operational excellence. Transform your warehouse today — where AI-driven precision meets state-of-the-art innovation.

Optimizes warehouse operations with AI automation

A leading third-party logistics provider partnered with Lenovo to automate its warehouse operations, dramatically improving its operational efficiency—mitigating the risks of a tight labor market, gaining competitive advantages, and enhancing customer service.



The Results:

Faster Order Processing: Streamlined workflows powered by AI dramatically reduced order fulfillment time. **+40%**



Lower Energy Consumption: Optimized system efficiency led to significant energy savings. **-30%**



Higher Operational Efficiency: AI automation improved productivity and reduced reliance on manual labor. **+30%**



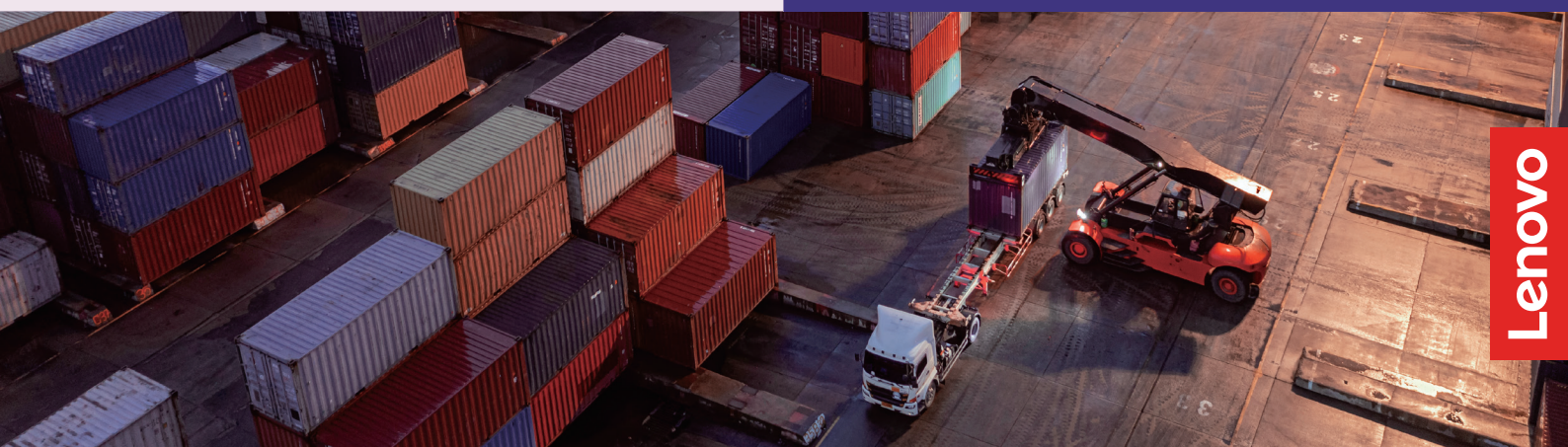
Reliable On-Time Deliveries Enhanced precision enabled consistent delivery performance.



This transformation aligns seamlessly with Singapore's 2030 economic vision, showcasing how Lenovo's AI automation empowers businesses to overcome labor shortages, reduce costs, and achieve sustainable growth.

Unify Your Warehouse Operations Today

Lenovo's AI automation is your key to building a sustainable, competitive supply chain. Take the first step toward smarter logistics and operational excellence—act now to future-proof your warehouse operations!



Lenovo's global strength

180

Markets

10M+

Order lines per year

1B+

Global customers

120M+

Shipments

30+

Global manufacturing sites

2000+

Suppliers

>\$160M

Digital transformation investment

18

R&D locations worldwide

69.5K

People



Global Supply Chain
Ranked 8th by Gartner



World Economic
Forum's Global
Lighthouse Network



TITAN Business Awards



BIG Awards for
Business - Product of
the Year

Maintain stability with
distributed intelligence —
Lenovo AS/RS enhances
end-to-end warehouse
efficiency through
concurrent operations.

Contact us today to discover how Lenovo Manufacturing Solutions can bring the future of manufacturing to you.

Learn more on:

<https://www.lenovo.com/us/en/solutions/industry/manufacturing/>