Warehouse and inventory management robots

Introduction

In recent decades, the leather goods industry has undergone rapid transformation, driven primarily by growing demand for leather goods such as backpacks, bags, wallets, belts, etc. E-commerce has been quickly adopted in this sector, with online stores increasingly replacing brick-and-mortar ones.

The challenges posed by globalisation and increased competition have prompted companies to find increasingly efficient ways to optimise the supply chain and value chain by reducing labour costs and improving inventory accuracy. Thus, as a trend in the transformation of these industries, automated warehouse and inventory management technologies have been adopted.

Warehouse robots

These types of machines were designed to replace humans in traditional manual operations such as material handling, picking, sorting, and transport within warehouses and production workshops.

The main categories of robotic systems used in leather goods logistics are autonomous mobile robots (AMRs), autonomous guided vehicles (AGVs), automated storage and retrieval systems (AS/RS), visually guided picking robots, and drones and inventory scanning sensors.
Autonomous mobile robots (AMRs)

Autonomous mobile robots (AMRs) are the "brains" that enable autonomous navigation in modern leather goods warehouses, using simultaneous localisation and mapping (SLAM), cameras, and sensors to move freely without fixed rails or cables.
These robots perform tasks such as:

- Transporting materials and finished products to and from warehouses and production areas. These robots move smoothly and without vibration to prevent damage to surfaces.

Figure 1 AMR

OTTO Lifter | Autonomous Forklift | OTTO by Rockwell Automation

- Automatic inventory management is a task that high-mast robots, such as those from Dexory, perform with 99.9% accuracy and at a speed of up to 10,000 pallets per hour.

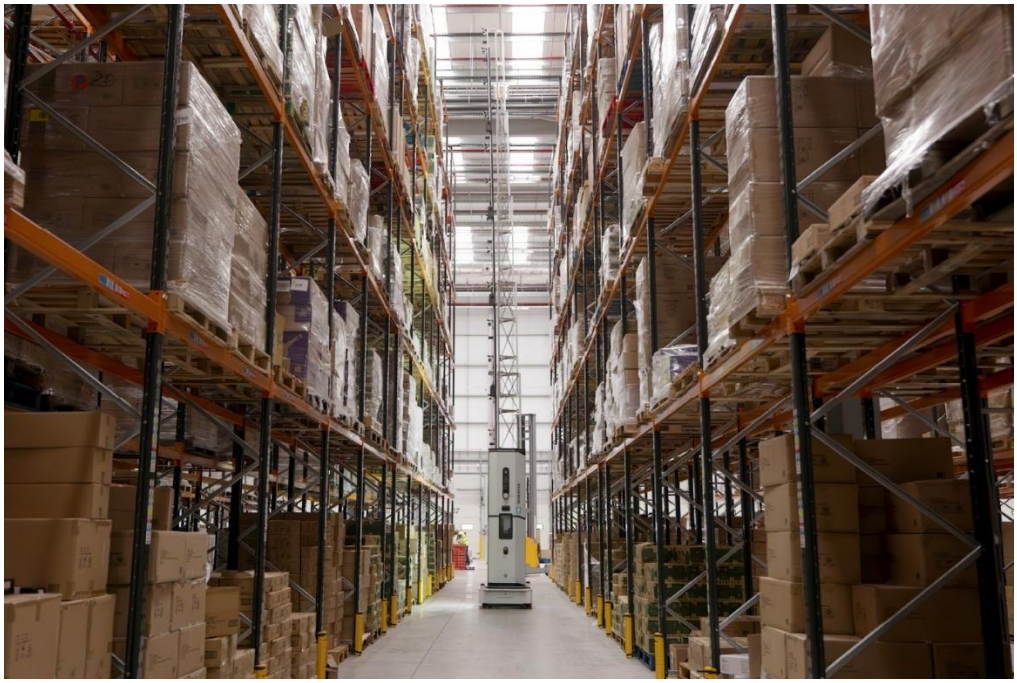

Figure 2 Dexory AI | Intelligent Automation for Warehouse Operations

Through barcodes, RFID tags, scanners, and WMS, real-time inventory tracking is possible, reducing human error. This allows discrepancies and shortages to be detected more quickly and corrective measures to be taken in a timely manner. Data analysis is performed by AI in real time, providing demand forecasts and suggestions for improving operations.

- Collaborative selection involves easy communication between robot and human by displaying on a screen the components/products/materials to be collected and their characteristics (Locus Origin: Collaborative Robots Warehouse).
- Real-time inventory monitoring by reading RFID tags is achieved with robots such as TagSurveyor from Zebra/Fetch, which patrol warehouse shelves and scan tags.

Figure 3 Fetch Robotics: TagSurveyor RFID Solution - Material Handling 24/7

The implementation of these robots in warehouses and storage facilities is proving to be a faster return on investment than in the production area.

Figure 4 Autonomous mobile robots (AMRs) | Linde Material Handling

Autonomous mobile robots (AMRs) provide flexibility in internal transport between different workshops and between workshops and warehouses. Flexibility is ensured by equipping robots with intelligent navigation systems using visual sensors and LIDAR to create real-time maps and be able to bypass and avoid obstacles that accidentally appear in their path, such as human workers or other equipment. When an obstacle blocks the route, the AMR automatically reconfigures its route.

Loading options can range from a few kilograms for accessories to hundreds of kilograms for moving pallets of leather. The operational impact on production consists in reducing the time needed to move raw materials and main and auxiliary materials from the warehouse to the operator's workstation, which translates into 2-5 times increase in workplace productivity. Unified fleet control, using specialised software such as that provided by AMR Studio® Fleet Manager | ABB, allows for the simultaneous coordination of dozens of robots, assigning them tasks and prioritising them in real time.

Robots can be integrated with resource planning and inventory management systems to ensure the traceability of every product entering and leaving the warehouse and the status of inventories at any time with 99% accuracy.

Autonomous guided vehicles (AGVs)

AGVs operate in warehouses to move and lift heavy loads, following fixed routes, but they can also be used to move heavy loads between the central warehouse and day warehouses. Compared to AMRs, AGVs are less flexible in that settings must be made manually, and movement is restricted to fixed routes that must be free of obstructions.

Figure 5 Warehouse Automation AGVs | Automated Systems - JBT

Automatic storage and retrieval systems (ASD/RS)

These systems are ideal for compact, dense, vertically organised warehouses. AS/RS technologies can be of the VLM (Vertical Lift Module) type, which consist of a storage "cabinet" with compartmentalised drawers, organised vertically and accessed through a window next to which the requested box is delivered. The boxes are moved inside using an internal lift. These systems are ideal for storing die-cutting knives or accessories organised by model.

Figure 6 Vertical Storage System | SSI SCHAEFER

Figure 7 Horizontal cabinet for cutting-dies and components - ABC

These systems provide protection against accidental damage and environmental factors (humidity, light, dust) by providing a closed storage space. Security is guaranteed by authenticating the person accessing the boxes. This way, it is always known who accessed a particular box and when. The use of VLM systems increases work efficiency by reducing search, access, and movement time by 70%.

Another AS/AR technology involves the use of rail-mounted cranes that move vertically up to 20 m for storing smaller boxes (Mini-Load AS/AR) or larger boxes (Unit-Load AS/AR).

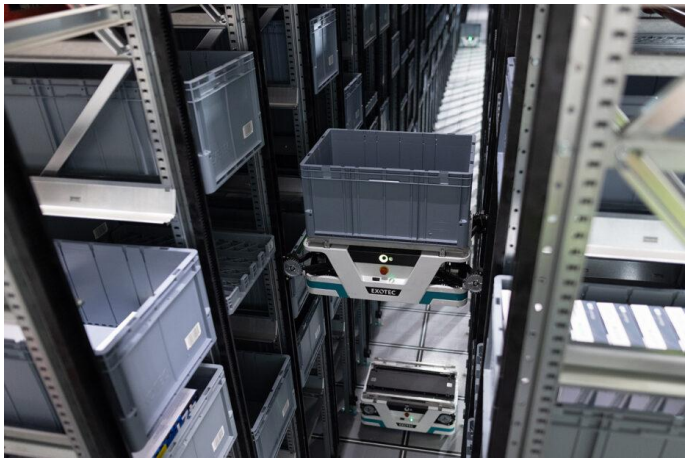

Figure 8 Intro to AS/RS: Automated Storage & Retrieval Systems | Exotec

Robotic arms and pickers

These are called robotic manipulators and perform handling operations associated with picking from warehouses and production lines. Boxes can be handled by robots such as TORU from Magazino (Mobile robots for smart intralogistics automation) used in a warehouse belonging to Gabor Shoes.

Figure 9 Shoe logistics robot TORU automates Gabor warehouse

Fixed-position robotic arms are used for sorting and handling small items. The challenge lies in handling soft and deformable materials. To solve this problem, robotic arms are equipped with either high-pressure suction cups/vacuum for gripping flat surfaces without damaging them, or soft grippers.

Collaborative robots (Cobots) can also be used in warehouses for selecting, sorting, packing, and moving various materials, components, or finished products. They work alongside human employees, reducing the physical effort required by staff.

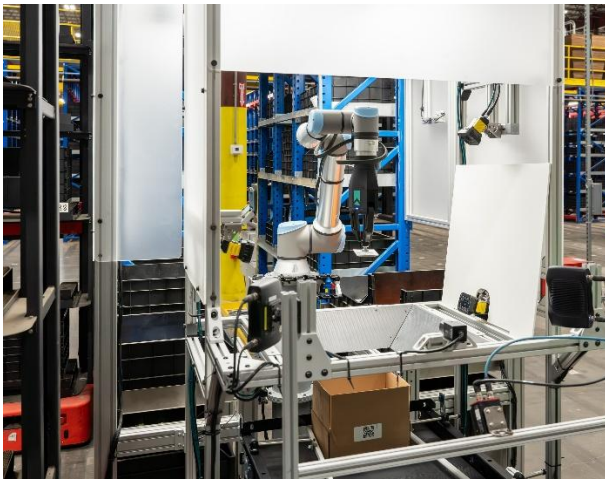

Figure 10 RightHand Robotics™ | Products

Figure 11 Cobot Automation for Packaging | Schubert Group

Inventory Management Robots

These robots are designed to monitor stocks and provide an accurate picture of inventories in real time. Monitoring can be achieved using key technologies such as:

- RFID (radio frequency identification) embedded in product labels to enable automatic scanning and tracking
- Computer vision systems: using cameras and artificial intelligence recognition.
- Autonomous drones and scanners to scan inventory in large warehouses or on high shelves, reducing manual inventory audits.

Benefits*	Challenges*
Efficiency & Speed Robots accelerate handling and picking operations, reducing cycle times by up to 50%.	**High Initial Investment** Robotic systems require significant capital expenditure.
Accuracy Automated inventory tracking prevents stock discrepancies and overstocking.	**Leather Material Sensitivity** Robots must handle materials delicately to avoid scratches or deformation.
Labour Optimisation Reduces reliance on repetitive manual labour; workers can focus on skilled tasks like quality assessment.	**Integration Complexity** Requires alignment between ERP, WMS, and robotic control software
Traceability RFID and vision systems maintain full material tracking across the value chain.	**Skills Gap** Need for technically skilled staff to operate, maintain, and program the systems.
Safety Minimises workplace accidents involving heavy or awkward leather products.	**Customisation Needs** Leather goods warehouses are often bespoke; one-size-fits-all robot solutions are rare.

Scalability

Systems can be expanded as the business grows without major infrastructure changes.

* Generated with AI

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