

SMART MOBILITY

Mobile robotics the unsung heroes of Smart Factory automation evolution

By Jim McMahon

Smart Factories are no longer visions. While different model factories represent the feasible, many plants exemplify how the Smart Factory functions.

Automation providers are taking *Industry 4.0* to a new threshold. Leveraging interconnected automation with the latest controls technologies, they enable a more seamless production flow to be engineered and implemented, attaining the highest levels of operational predictability and production efficiency.

The exchange of data between production processes is facilitated by the Ethernet and the Cloud-based *Industrial Internet of Things (IIoT)*.

These systems also communicate and cooperate in synchrony with humans. This cyber-machine/human integration enables a much more efficient connection of processes and better organization within the production environment.

Robotics are a key operation of intralogistics and Smart Factory integration, delivering flexibility, speed and accuracy—making them ideal for productivity enhancements in a wide range of manufacturing and distribution applications.

From a safety perspective, robotics minimize the risk of fatigue and injury that human labor is subjected to in repetitive and hazardous applications.

Accordingly, manufacturing and distribution executives increasingly turn to robotics, and specifically automated guided vehicles (AGVs), as a



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AMRs transport common load carriers like tables, carts, racks and shelves to specified locations throughout manufacturing and distribution facilities.

solution for transporting materials and parts between assembly, production, distribution and fulfillment operations.

The use of AGVs has played a pivotal role in facilitating process and throughput efficiency and supporting the integration to *Industry 4.0*.

Interfacing with multiple systems, AGVs provide reliable raw material and product handling, with near zero potential for product damage.

Utilizing a combination of logic software and wireless navigation, AGVs can perform tasks that are not possible with other transport systems.

This includes the uniform movement and positioning of loads to within a fraction of an inch of their designated targets, with minimal noise, and with a high degree of safety for workers and their operational environment.

One of the more recent developments of AGVs has been the rise of automated mobile robots (AMRs) to support goods-to-person picking.

The AMRs transport common load carriers like tables, carts, racks and shelves to specified locations throughout manufacturing and distribution facilities.

Their focus is to significantly reduce time and effort required for order picking, whether that be for raw materials, kitting parts for assembly, or parts and finished products for shipping.

Order fulfillment for assembly line kitting and shipping spare



AMRs support assembly line kitting and shipping spare parts and finished products.

parts and finished products is a critical and labor-intensive process in manufacturing and distribution.

Most facilities utilize a person-to-goods model for order fulfillment. Workers walk or move a lift truck to where the inventory is located and manually pick items.

This is highly labor-intensive and leads to slow process flows where time is mainly spent locating and retrieving items to fill orders.

Manufacturing and distribution executives, looking for more efficient order picking solutions, have embraced automated goods-to-person systems where inventory is brought to the picker who is comparatively stationary.

Since the picker does not have to walk, up to a 60-percent reduction in travel time is realized.

Because operators are presented with only the goods needed for orders, goods-to-person systems reduce the chances that workers will pick the wrong items—improving accuracy and productivity, and reducing the high cost and disruption of customer returns.

One of the latest generation mobile robots, the model **OL1200S** AGV from Grenzbach Group (www.grenzenbach.com) performs tasks that are not possible with other transport systems.

This includes the uniform movement and positioning of loads to within a fraction of an inch of their designated targets with 360°



Grenzbach's model OL1200S AMR positions loads to within a fraction of an inch of their designated targets with 360° autonomous mobility.

autonomous mobility.

The robot accomplishes this with minimal noise, with a high degree of safety for workers and the operational environment, while fully supporting *Industry 4.0* interconnectivity.

Grenzbach is a global leader in the design and manufacturing of robotic handling applications, control technology, and complete fabrication lines for manufacturing, processing and automation in a multitude of industries.

With 650 specialized engineers, the company is capable of building customized AGVs for unconventional, difficult or hazardous production environments; heavy-duty AGVs for loads such as engines, drive trains or aircraft modules; long-load AGVs for transport of oversized goods and production parts; and AGVs for handling of sensitive IT infrastructure.

The company's primary objective in the development of the **OL1200S** mobile robot AGV was to design nothing less than a new generation of autonomous goods transport vehicle.

Specifically, one that delivers a higher level of goods-to-person functionality supporting both manufacturing and warehousing applications of goods receipt, production, storage, order fulfillment and dispatching, with complete intralogistics integration of Smart Factory *Industry 4.0* connectivity.

The **OL1200S** mobile robot transports goods carriers (carts, shelves and racks) to destinations in production and warehousing autonomously and accurately for subsequent manual order ful-

fillment.

The robot frees workers from performing heavy-load and ergonomically-straining tasks, while providing a safe operating environment for workers.

The entire process is coordinated by a software ecosystem that not only controls the transport vehicles, but also ensures a maximally efficient workflow.

Here are the 12 key functionalities that make the *OL1200S* exceptionally robust, highly maneuverable, and quick mobile transport system for both production and warehousing applications:

- **Lithium Power.** Equipped with a 48 VDC lithium iron phosphate battery, providing up to 80 amperes charging current, the *OL1200S* delivers a top speed of 3.7-mph (one meter per second) when loaded, with a maximum uptime of six hours.
- **360° Mobility.** The *OL1200S* is omnidirectional, with positioning accuracy ± 0.6 inches (15-mm). It can move freely in any direction and rotate on its axis while stationary, with maximum performance in the smallest of spaces. Narrow pathways, 90° curves, turning maneuvers and cross-docking with goods carriers are all easily accomplished tasks.
- **Flexibility with Changing Tasks.** With smart sensors and **SLAM (Simultaneous Localization and Mapping)** navigation enabling the vehicles to map out unknown environments, the *OL1200S* reduces static peripheral requirements to a minimum. It does not require permanently installed stations for the pick-up and delivery of goods carriers, thus creating ideal conditions for highly flexible production environments.
- **Low Height.** Due to its low construction height, the *OL1200S* can tunnel under a variety of different load carriers, including tables, carts, racks and shelves.
- **360° Travel Area Monitoring.** A 360° 3D vision system detects disruptive factors with a minimum size of approximately two inches (50.8-mm). This prevents transportation damage caused by collisions with obstacles in the operating area, such as protruding components, partially open roller doors or forklift tines.
- **Autonomous Load Carrier Detection.** The *OL1200S* detects the position of inaccurately placed load carriers with a variance range of ± 9.8 inches (250-mm). The vehicle locates the goods carrier placed in the transfer zone and automatically compensates for manual positioning errors.
- **Long and Heavy Payloads.** The maneuvering ability of the *OL1200S* makes it particularly suitable for long loads. The AGV can transport up to 1.3 tons (2,645 pounds) lengthwise or crosswise.
- **360° People Safety.** Equipped with two LiDAR (light detection and range) laser scanners (front and back), the *OL1200S* provides safe operation for nearby workers.
- **Scalable for Production Volume Changes.** The *OL1200S* fleets are immediately and easily scalable to changing throughput requirements.
- **Adaptability to varied environments.** The mobile robot fleet is designed to integrate into existing environments, such as elevators, robotic cells, conveyors and packaging systems within a temperature range of 50° – 104° F (10° – 40° C). Due to the system's **SLAM** naviga-



The OL1200S, equipped with a 48 VDC Li-ion battery, provides up to six hours uptime.

tion, there is no need to set up protected areas.

- **Space Consolidation.** The omnidirectional maneuverability of the *OL1200S* permits storage units to be located more compactly within tighter spaces.
- **VDA 5050 Compatible.** Designed to allow for maximum freedom for plant planning, the *OL1200S* can be combined with automated guided vehicles from other manufacturers under a single software control center via the **VDA 5050** interface.

Grenzbach's *OL1200S* mobile robot AGV technology is dependent upon state-of-the-art software solutions for all intralogistics functions within manufacturing and distribution.

The management and control software provides critical intelligence capabilities to seamlessly manage inventory and perform goods transport operations within the integrated intralogistics environment. These software systems encompass the following:

- Lightweight warehouse execution system (**WES**);
- Warehouse control system (**WCS**), with an integrated fleet manager system (**FMS**);
- Cloud-based **IIoT** platform **SERICY**;
- Application server, functioning as a modular control center.

The **WES**'s intelligent prioritization system, optimizes order processing at workstations.

At the pick gates, the standard integrated pick-by-light and put-to-light system supports fast and process-reliable order picking, enabling the AGVs and employees to work together efficiently.

The **WES** manages requirements for same-day delivery, deadline dispatch, serial number tracking, and last-minute order changes, while providing process security for flow of goods, inventory and warehouse stock.

The Grenzbach **WCS** takes over warehouse management tasks in production and warehousing

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Low-profile AMRs can tunnel easily under tables, carts, racks and shelves.

environments for optimized control of logistical processes in the mobile robots' automated transport of goods.

The software also serves as the interface between the company's *ERP* (enterprise resource planning) and the Fleet Manager System.

Using the WCS, users manage goods carriers and items within the mobile robot AGV system and assign them to different storage locations.

In addition to the automatic creation of jobs, transport orders can be easily created via tablets at individual process stations.

More complex material flow sequences can be linked to conditions such as the selection of buffer and storage locations. The WCS also enables universal fleet management via *VDA 5050*.

Grenzbach's Fleet Manager System coordinates all transportation and handling tasks of the robotic AGVs.

Distances and cooperation of the fleet are continuously optimized, and the *FMS* provides for smooth integration into the plant's software ecosystem, such as the *ERP*.

The software coordinates all vehicle movements based on transport orders and feedback given by the *ERP*, using robust algorithms to ensure an intelligent selection of vehicles and optimized deadlock-free route finding based on CAD.

It also controls the following functions:

- **Energy management of the vehicles**—monitoring of battery conditions and smart charging management;



Coordination of all vehicle movements based on transport orders and feedback given by the *ERP*.

- **Alarm management**—sending information about faults in the system;
- **Management of rights**—integration of a role-rights-concept carried out by the Grenzbach security manager;
- **FMS interfacing** to external periphery, such as external hardware like robots, hall doors, elevators, etc.;
- Providing controlled shutdown of the equipment following a pre-defined scenario in the event of fire.

A web-based user interface provides a comprehensive overview and visibility of the system, such as travel paths, vehicles, and logistics processes (picking stations, put wall, pick-by-light and put-to-light systems, safety equipment, charging technology and transfer stations).

For both warehouse and manufacturing, the Grenzbach's *SERICY* platform controls, monitors and optimizes all processes with complete transparency.

The modular platform incorporates apps preconfigured for intralogistics that enable a holistic digitization.

In addition, *SERICY* brings the process data from all machines together for use in all departments within the company, including manufacturing, and distribution.

Linking the historical information system of the company by using standardized interfaces, *SERICY* can be used on-premises, or in a private *Cloud*, and it is arbitrarily scalable due to its architecture.



Web-based interface provides complete overview and visibility of the system.

The software digitally integrates data and solutions, resulting in optimized mobile robot transport activities that guarantee reliable and in-time delivery of components to workers and assembly robots in manufacturing, and parts and finished goods to fulfillment for shipping.

Functioning as a modular control center, the application server proactively controls and directs all logistics sequences in manufacturing and distribution processes, while integrating transport equipment and devices.

The collaboration of automated mobile robot AGVs for goods transport, combined with intelligent connectivity, has enabled outstanding control and a better assurance of reliable product assembly and distribution.

All in all, Grenzbach's *OLI200S* mobile robot technology gives manufacturers a truly holistic solution to intralogistics with a more 'lean,' efficient, productive and versatile process for goods transport in assembly and distribution operations.

Most importantly, this powerful technology firmly positions manufacturers to take advantage of the vast benefits available from Smart Factory *Industry 4.0* intralogistics.

www.grenzbach.com

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