Choosing the right Autonomous Mobile Robot (AMR)

Five things for material handling automation

White paper | December 2020

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Introduction

The challenges in material handling and logistics are growing rapidly across all industries. Customers want smaller volumes of a wider variety of products on a demanding timeline. This ever-increasing demand is creating stress in manual material handling situations, which leads to worker fatigue and eventually to quality and throughput issues. For decades, companies have been trying to find ways to optimize operations by introducing lean methodologies. However, in many occasions, manual processes lie in the way of achieving this goal.

Technological advancements are finally providing a solution to this problem in the form of autonomous mobile robots (AMRs), which can transport materials throughout dynamic and peopled environments on a 24/7 timetable. No longer burdened by constant trips throughout the facility, workers can focus on tasks that directly add value. However, not all AMRs are created equal. It's important to carefully choose a solution provider, and there are several key features that a mobile robot must have in order to offer the greatest value for an application.

Things to look for include the following:

- Easy installation and quick adaptation to new requirements
- Safe operation alongside people in dynamic environments
- Ability to work collaboratively in a fleet
- Easy customization to suit specific requirements
- Global support for reliable operation in any region

This white paper will discuss these requirements in detail and provide some background on the importance of each consideration.

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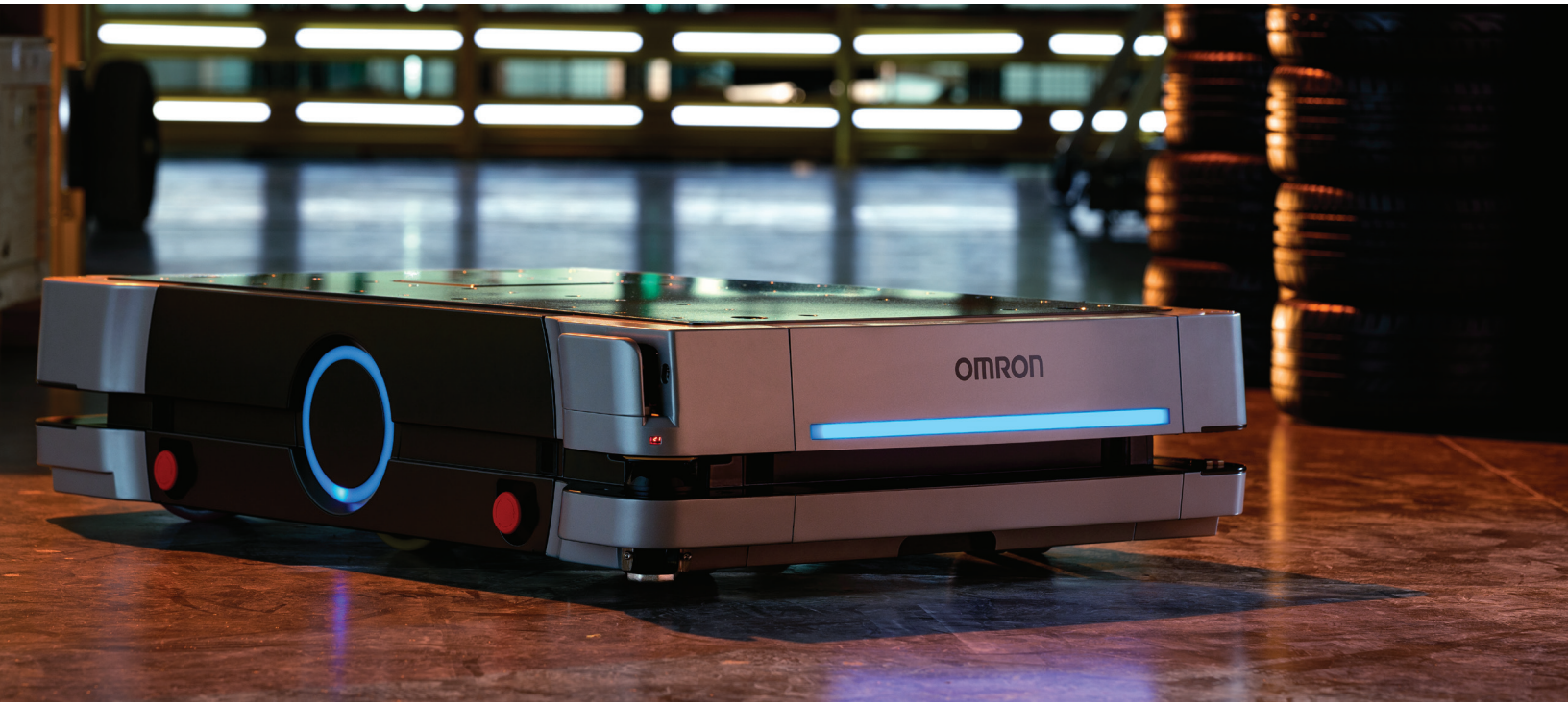
Contents

Requirement #1: Easy installation and quick adaptation to new requirements



Conveyors have been a staple of factories and warehouses for more than a hundred years. They were quite useful for manufacturers who were producing large amounts of a single product every day for long periods of time. Unfortunately, in today's faster-paced markets, conveyors are proving to be too expensive to implement due to rapidly changing production needs. This is because they are exceedingly difficult – and in some cases impossible – to modify when products or processes change.

About a decade ago, automated guided vehicles (AGVs) appeared on the scene as an alternative to conveyors in material handling. Although they free up manufacturers from the need to reconfigure multiple unwieldy conveyors, AGVs are still not an ideal solution for flexible materials transport. This is because they require predefined pathways to be set up via factory modifications, such as magnetic strips on the floor or beacons on the walls. The need to retrofit a facility for an AGV system leads to added costs and downtime not just upon installation, but also whenever production changes occur.

Autonomous mobile robots, on the other hand, can safely navigate without the use of floor magnets and wall-mounted beacons. An AMR will first create a base-line map of the facility using its sensor. Once in operation, it will constantly detect its surroundings and compare what it "sees" with the original map. This allows it to avoid obstacles – whether stationary or moving – by automatically rerouting itself. Without the requirement to pre-designate a path, an AMR solution is more flexible overall and has a lower total cost of ownership (TCO) relative to an AGV system.

To get the most value out of an AMR fleet's ability to dynamically avoid obstacles, it's necessary to choose mobile robots that feature easy-to-use mapping software and an interface that makes installation and integration easy. These capabilities will ensure that the system can adapt to changing requirements as quickly as possible.

Requirement #2: Safe operation alongside people in dynamic environments

It's impractical – and in many cases impossible – to automate everything. There are many tasks inside factories and warehouses that robots are unable to perform. According to the Material Handling & Logistics U.S. Roadmap 2.0, the material handling and logistics workforce of 2030 will involve humans working directly with automation technologies. This means that safety is an essential consideration for mobile robots, even if industrial robots have traditionally been fenced off from manufacturing workers.

Manufacturers need to choose AMRs with the most advanced environment detection technology, such as lasers and sensors, so that they can ensure that the robots can move around safely in places where people are present. Most AMRs are equipped with sensors to detect objects between floor level and the average height of a person's knee, so they have little trouble detecting shelves set on the ground or people walking around. However, things can get tricky when there are pieces of equipment hanging from the ceiling or drawers sticking out unexpectedly from cabinetry. Depending on the environment – and especially if the AMR is going to be transporting objects of a certain height – it may be necessary to select a robot that includes side lasers to help it avoid hitting any hanging or protruding obstacles.

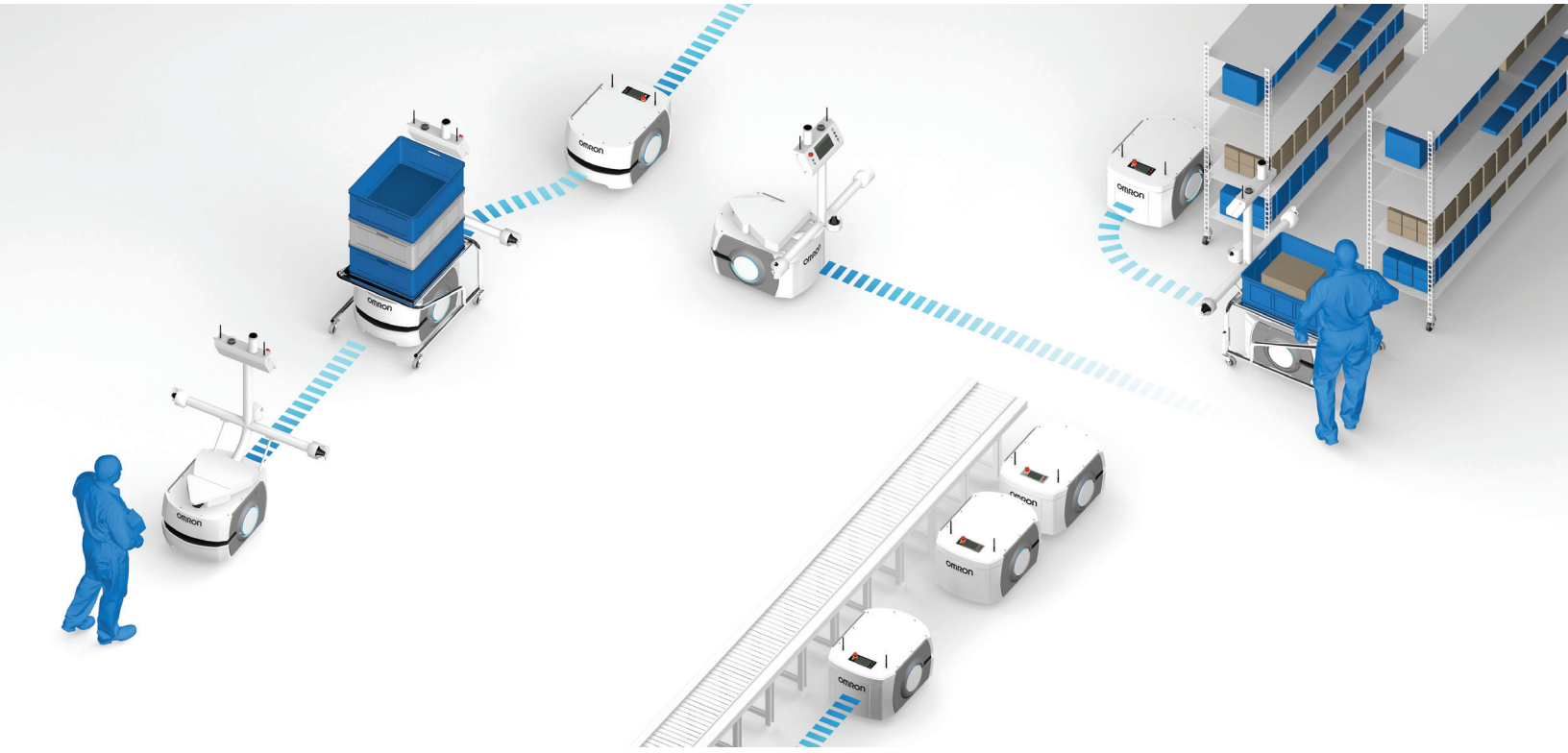
Another safety-related point to keep in mind when choosing a mobile robot vendor is to find out whether the vendor's products comply with the domestic and international safety regulations. These include EN 1525 ("Safety of Industrial Trucks, Driverless Trucks and Their Systems), ANSI 56.5:2012 ("Safety Standard for Driverless, Automatic Guided Industrial Vehicles and Automated Functions of Manned Industrial Vehicles") and JIS D 6802:1997 ("Automated Guided Vehicle Systems - General Rules on Safety"). For companies with facilities around the world, it's important to check with the mobile robot maker to ensure standards compliance in each region of operation.

What safety standards apply to AMRs?

Mobile robot-related safety standards include but are not limited to the following:

- EN 1525: "Safety of Industrial Trucks, Driverless Trucks and Their Systems)
- ANSI 56.5:2012: "Safety Standard for Driverless, Automatic Guided Industrial Vehicles and Automated Functions of Manned Industrial Vehicles"
- JIS D 6802:1997 "Automated Guided Vehicle Systems - General Rules on Safety"

Requirement #3: Ability to work collaboratively in a fleet



The noticeable advantage that comes from implementing a mobile robot often leads to an interest in developing an AMR fleet to cover the entire operation. This means that these AMRs need to come with a so-called fleet management system that will automatically allocate the work to a number of robots in the most efficient way. Since a good fleet management system coordinates AMRs to share jobs in such a way that the fewest possible robots are allocated to a certain task, it enables manufacturers to maximize their investment.

There are two main ways to identify a good fleet management system. The first is how well it manages traffic. It should control the traffic in such a way that AMRs don't end up blocking each other's paths or waiting too long for the other to pass. Secondly, the system needs to efficiently manage the jobs. It allocates the list of jobs – i.e. pick up A from location B and transport to location C – in the most productive way so that all tasks are completed in the least amount of time with the least distance travelled overall among all the robots in the fleet. These two features free up manufacturers to focus on the larger picture of task accomplishment rather than spending lots of time commanding individual robots.

A good fleet management system can even "look ahead" – meaning that it can predict which nearby robot will be available soon to work on the next job so that a robot that's immediately available but located far away won't be asked to traverse all the way to pick up the task. Managing the schedule according to which each robot can disengage to automatically recharge its battery is also important to maintain the flow. Furthermore, it's ideal if the system is based on dedicated hardware to eliminate any competition for IT resources within the organization. By having a dedicated piece of hardware that is ideally tweaked for running the software to keep the robot workforce performing, manufacturers don't need to worry about downtime originating from problems related to a shared server.

Requirement #4: Easy customization to suit specific requirements

Similar to the way people need different skills to accomplish different tasks, it's necessary to have different types of mobile robots to do different jobs. For example, a general transporter-robot would be able to move things from a pick-up location to a drop-off location. An AMR can be designed to attach to a movable cart and transfer that from one place to another, or it could be topped with a conveyor so that it can receive from and load onto a conveyor belt. It may be desirable to attach something to the robot so that it can meet specific process needs.

The most important thing is to have the option of reaching out to a skilled group of engineers that can offer a solution. The AMR needs to be easily customizable so that the manufacturer or system integrator will be able to take that robot and modify it as needed. Questions to ask include:

- Can the battery on the AMR also power the external equipment that needs to be attached to it?
- Does it provide the I/O points needed for the external equipment?

These technical features are extremely useful, but they're not easily available. Manufacturers should confirm with their AMR vendor about these capabilities. Moreover, all these different mobile robots need to be collectively and efficiently managed, which brings up the capabilities covered in the previous section.

Setting the stage for effortless customization

To ensure that a mobile robot solution can be readily customized, manufacturers should consider presenting the OEM with the following questions:

- Can the battery on the AMR also power the external equipment that needs to be attached to it?
- Does it provide the I/O points needed for the external equipment?

Requirement #5: Global support for reliable operation in any region

Once the AMR system proves successful in one facility, a manufacturer may want to duplicate the application in other locations around the world. If so, it must be possible to purchase the robots in each region of operation and get professional help in the implementation as well as technical support after the installation. For this reason, it's important to ask whether a mobile robot supplier an provide support on a worldwide basis. If it becomes necessary to find a different supplier for a new location and learn the new system, the return on investment will be much lower. This is something for companies to keep in mind, particularly if they have a global footprint.

Moreover, it would be extremely valuable if the AMR vendor could help with the process of combining the mobile robots with other automation equipment – such as arm robots, controllers and switches – in order to create an end-to-end solution. A mobile robot in itself is a tool and only part of the total automation solution. Manufacturers should find out whether an AMR vendor has any experience in solving problems specific to their industry, as the ideal automation partner will be a mobile robot maker that can share real examples of solutions that they have worked on in the past.

Summary

Thanks to the technological innovation leading to the development of AMRs, manufacturers no longer need to stock up on half-finished goods before moving them to the next process. AMRs can easily make multiple trips between pick-up and drop-off locations to ensure that the right amount of material is available at each end point at any given time. To get the most value from an automated materials transport solution, manufacturers should be sure to choose mobile robots that can guarantee safe operation alongside people in dynamic environments and that can work collaboratively in a fleet. Easy installation, quick adaptation to new requirements, and easy customization are also key considerations. Finally, choosing an OEM that can provide global support for reliable operation in any region is also something to keep in mind.

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