Mobile Robots Grow Up
MOBILE ROBOTS GROW UP

Novelties no longer, mobile robots are being deployed at scale by companies looking to address labor shortages, meet e-commerce customer demand, and improve operational efficiency.

By Phil Britt

Driven by market needs, particularly in warehousing and logistics, the market for mobile robots will be strong in 2019 and for several years thereafter, according to researchers.

“2018 was a year with a lot of pilot programs,” said John Santagate, IDC research director, commercial robots at International Data Corporation (IDC). “By the end of the year, we were talking to many of the major players and they were having new programs go live every week. The gravity of that situation can’t be overlooked.”

The novelty factor of mobile robots has worn off, agreed Matthew Cherewka, business development and solutions design manager at Vecna Robotics. “We’re starting to scale with companies rather than just running pilot programs. Some winners among users are starting to emerge.”

There are several reasons warehousing, logistics and other companies are turning to mobile robots:

➤ **Lack of human workers:** Unemployment is running at historical lows. Even if unemployment rates were higher, some of the warehouse locations are too far from population centers to draw enough workers.

➤ **Ability to work 24x7:** Similar to the point above, the mobile robots can work around the clock. Although they need to be maintained, and there is the occasional need to take one offline for a repair, the robots don’t suffer from repetitive stress injuries, chat with co-workers, or take long lunch breaks.

➤ **Short-term ROI:** Depending on factors such as type of mobile robot, type of deployment, hours of operation, the robots pay for themselves in anywhere from six to 24 months, according to users and analysts.

➤ **Flexibility:** Mobile robots can be added or subtracted from a process relatively easily, whereas in traditional automation, if a component of a conveyor system or an automated storage and retrieval system (AS/RS) goes down, it stops the whole operation, Cherewka said. Even with automated guided vehicles (AGVs), if a vehicle goes down, the
whole system backs up, since they are limited to fixed paths. If a mobile robot gets stuck or goes down, the rest of the system continues to operate and they can reroute around the problem area until the issue is resolved.

With Vecna’s solutions specifically, even if a robot goes through a dead zone or loses connection, that individual robot will continue to operate until the connection is re-established since it is both autonomous and safe enough to complete its current mission on its own, Cherewka said. In addition, if a robot cannot complete its task for some reason, the pivot.al software will dynamically respond and reallocate tasks to account for this, making the robots themselves and the intelligence system that manages them significantly more robust than a system with a single point of failure.

Even in worst-case scenarios, mobile robot workflows have been designed specifically to be able to be supplemented with manual labor - such as flipping one of Vecna’s robots from autonomous to manual control. This provides companies with another layer of robustness that makes these automation solutions highly attractive over traditional automation.

TYPES OF MOBILE ROBOTS

As mentioned earlier, AGVs were once the only ways that companies could deploy mobile robots, and relied heavily on barcodes and markers on the ground for localization and navigation. AGVs typically can only be deployed in specially designed and highly structured environments with no human interference.

Advances in machine vision and navigation technology has given rise to autonomous mobile robots (AMRs), which rely on a slew of sensors including radar, infrared, lidar, and cameras for localization and mobility. This allows robots to be deployed in unstructured environments, including manufacturing and retail, where many human interactions are required. The ability of AMRs to work alongside humans appears to be the future of mobile robots, allowing them to take on repetitive tasks in hazardous environments or work longer hours.

While many robotics companies offer specialized mobile robots, additional vendors are involved in retrofitting or installing mobility solutions onto existing mobile vehicles, such as trucks, forklifts, and even cleaning systems. Vendors in this space include:
➤ Caterpillar and Komatsu (mining trucks)
➤ BlueBotics, Seegrid, and Balyo (forklifts)
➤ Brain Corp (commercial floor cleaning vehicles)

Though warehousing and fulfillment, particularly with rapidly growing e-commerce and customer demands for ever faster delivery, combined with historical low unemployment, are certainly the sweet spot for mobile robots, they are also working their ways into hospitality, retail and a host of other industries.

CHANGES DURING PEAK SEASON
Additional evidence that mobile robots are moving beyond pilot programs is their deployment during peak season. Santagate said the last few months of the year is peak season for warehousing companies that are filling holiday orders, so it’s rare for companies to make changes to their processes since they don’t want to risk disruption.

Yet at the end of 2018, many companies were going live with mobile robot deployments from companies such as Fetch Robotics, Locus Robotics, and 6 River Systems. Other robotics companies with major deployments in 2018 included Aethon, Omron, and Vecna.

“In warehousing and fulfillment, mobile robots are a must have to remain competitive,” Santagate said

EXAMPLES OF MOBILE ROBOT PROVIDERS
Below is a brief look at some of the major mobile robots providers, and the tasks the robots are performing. In addition to these companies, startups continue to enter the market on a regular basis.

AETHON
Whereas most mobile robot providers tout their robots primarily in the warehousing, logistics, or e-commerce space, Pittsburgh-based Aethon cites the usage of its TUG robots in hospitality, healthcare and materials handling: “Over 5,000,000 times a year, TUG delivers for manufacturing,
healthcare, and hospitality organizations worldwide.”

With a variety of carts that can be attached to its universal base, TUG safely hauls up to 1,400 pounds of almost anything. Best of all, with digital mapping and navigation, TUG requires no additional fixed infrastructure such as beacons, magnets or wire guides.

Integration to ERP/MES systems allows automatic dispatch and real-time material movement updates. TUG can respond to real-time requests from the production line through integration with PLC controllers.

TUG automatically picks up and drops off carts in various applications. Videos on the company’s website show use in hospitals and hospitality environments. The robot also communicates with a company’s IT system to automate the dispatching of the robot fleet and update the inventory system when materials are moved.

**FETCH ROBOTICS**

While only a couple of years ago companies using mobile robots looked at the deployments as experiments, they’ve now become mainstream, particularly at logistics companies like DHL and Ryder, said Joe Lau, Fetch director of product management. “Third party logistics are a key market for us. They, in turn are pursuing manufacturers and retailers.”

It’s not just the largest third-party logistics (3PL) companies either, Lau said. Smaller companies have found that they can scale up or down with mobile robots easier than they can with human workers, he added.

San Jose, Calif.-based Fetch uses a “platform-based approach” for controlling the robots, so a company can manage robots across several
different plants – even those with different configurations and workflows – with a single interface.

Beyond the speed, flexibility and other advantages cited by many, Fetch’s robots also feature RFID antennas, enabling companies to keep track of products while in a Fetch-enabled facility. This traceability is particularly important to warehousing and logistics customers, Lau said.

Ryder announced earlier this year that it was deploying Fetch robots as part of its smart warehouses in Chicago, Dallas and Miami. According to the company, the implementation of robotics throughout a Ryder-managed warehouse produced a 25% increase in productivity and 20% operating savings, simply by reducing travel time in the warehouse, which can account for 30% of an employee’s shift.

Fetch’s robots use lidar and 3D cameras to deliver what Lau called “a level of safety our competitors can’t provide.”

**LOCUS ROBOTICS**

In January, the Boston-based company announced upgrades and enhancements to the company’s robot hardware, navigation software, user experience (UX), and management dashboards, aimed at improving worker productivity, operational performance and efficiency for retail/e-tail, 3PL, distribution and industrial specialty customers.

“It is an exciting time for innovation in retail,” said Rick Faulk, Locus Robotics’ CEO, in a statement announcing the upgrade. “Major brands and third-party logistics companies are turning to technology to maximize productivity in an increasingly competitive labor market. This new suite of
software and hardware includes the most advanced and innovative suite of robotics capabilities on the market to date.”

Some new features are:
➤ Directed picking, featuring intuitive on-screen graphics that direct the warehouse worker to the next nearest pick location, helping to minimize unproductive walking time and improve picking speeds.
➤ Worker performance indicators that allow each worker to graphically visualize their productivity level while working, in real time, both in the absolute, and relative to performance goals. This is especially valuable when “pay-for-performance” incentives are being used, the company said.
➤ Management reporting via a new portal that features detailed reporting systems to optimize and manage operations.
➤ Dynamic software that actively tracks and adjusts the robots’ travel paths through the warehouse to minimize traffic congestion, allowing for higher productivity and picking.
➤ “Top-off” charging via software that automatically recognizes slow order times, directing robots to charge or “top off.”

MiR
Odense, Denmark-based Mobile Industrial Robots (MiR) has seen its growth doubling since 2014, with no slowdown expected any time soon, said Ed Mullen, vice president of sales.

MiR offers robots for 100 kg, 200 kg and 500 kg loads, with the Mir500 becoming the most popular, according to Mullen, who added that the company is developing a robot to handle a still heavier payload.

The MiRHook is a robot that can grab and lift products, much like a forklift, Mullen said, adding that several customers are replacing pallets with the MiR mobile robots. “There’s interest in all kinds of verticals. Automotive and every other types of business have forklifts moving pallets around.”

Mullen added that an intuitive interface makes it easy for users to get the robots into their warehouse and other processes. “We’re looking to make our products easier to use, more intuitive and smarter.”
The MiR robots use safety laser scanners, safety PLCs and safety relays to feed data into the planning algorithm, so that robots can recognize obstacles out up to 50 feet and plan to go around them or make a safe stop to not bump into or hurt someone. Mullen said the robots can stop in less than a foot.

MiRFleet provides users centralized control of robots throughout the facility from a single, web-based interface. MiR’s website also offers an ROI calculator, using type of robot and plant input (hourly cost of labor, material handlers per shift and operation hours), to provide prospective users with expected ROI.

OMRON

Darrell Paul, Omron’s market manager of robotics and motion says: “Customers benefit from proven and best performing navigation in the market with just the floor level laser scanner. Adding our patented mapping technology of light sources makes a top choice. Fleet management is a key advantage for Omron as customers grow to larger, more dynamic and high demanding fleets.”

The company’s LD Mobile Robot uses proprietary software and controls, which can be programmed to navigate around people or unplanned obstacles, using a digital map, so no floor magnets or navigational beacons are needed, which saves users up to 15% in deployment costs. Onboard sensors, including a safety rated main laser, lower laser and patented side lasers detect obstacles.

The robots include an onboard power supply offers runtime of up to 19
hours per day. On level surfaces, the Omron LD Mobile Robot can handle payloads up to 286 pounds (130 kg).

**6 RIVER SYSTEMS**
“Customers are crying out for new ways to automate, many of their older systems have been run into the ground and they can’t be altered,” said Fergal Glynn, vice president of marketing. Older systems are stagnant and often have older software that can’t be updated to today’s standards.

Mobile robots, on the other hand, offer better service levels for warehouses, logistics companies, retailers and other users. With retailers, the mobile robots provide a cost-efficient way of handling fulfillment themselves without outsourcing it to a third-party logistics firm.

Glynn added that the mobile robots enable companies to double or triple capacity without adding people. Also, many companies have added the mobile robots for peak seasons, in part because they can be brought online immediately, while a human worker takes time to train.

Even if used in conjunction with a human worker, a mobile picking robot can halve the time for the process, Glynn added.

**VECNA ROBOTICS**
“There is a good spread of capabilities in the robots that we offer,” said Matthew Cherewka, business development and solutions design manager at Vecna Robotics. Logistics, e-commerce, retail, manufacturing and
automotive are the most popular deployments.

“Our biggest advantages are our scalability and flexibility,” Cherewka said. “The real power our robots offer is that they can respond to changes in real time. A company can use the same robot in multiple different ways, even in the same building. That’s much better than traditional automation.”

In January, Vecna unveiled its artificial intelligence (AI) multi-agent AI Robotics engine, Pivot.al, which harmonizes the work of fleets of autonomous vehicles with workers and other automation.

The company prioritized workflows over robots by designing AI-driven software that enables humans and robots to react on-demand to the current state of operation and shift the workflow accordingly. Pivot.al evaluates all the work that needs to be done, along with all available agents (diverse types of robots, human workers, or other equipment), and dynamically optimizes task allocation among them.

Vecna’s self-driving vehicles collect data, analyze surroundings, and dynamically react to obstacles or any unforeseen events. Pivot.al provides data-driven insights at a fleet and workflow level, creating a continuous improvement cycle over time. Pivot.al uses this real-time data to dynamically optimize workflows in distribution centers and other industrial settings. Pivot.al integrates with existing legacy automation, piece-picking robots, user interfaces, WMS, and MES systems.

Vecna’s robots all share a single “brain” via the company’s autonomy stack, which means that software upgrades go to all units at once. Beacon
is the engine that software updates, data analytics, neural networks and Vecna’s 24/7 remote operations center. It analyzes data collected by Vecna robots as they work and feeds it back to them to improve performance, driving a cycle of continuous learning.

The company offers three types of self-driving robots:

- **Conveyor**: Offering a capacity of up to 500 kg, and a speed of up to 2 meters per second
- **Pallet Jack**: Offering a capacity of up to 3500 kg, and a speed of up to 2 meters per second
- **Tugger**: Offering a capacity of up to 4500 kg and a speed of up to 2 meters per second

**CHALLENGES FOR MOBILE ROBOTS**

Although robot manufacturers and analysts tout the advantages of mobile robots, from the reliability to the versatility to the functionality to the relatively quick ROI, they admit that there can be some challenges for companies adding mobile robots to current processes.

The top reason that a mobile robot implementation will fail, according to IDC’s Santagate, is when they aren’t a valid solution for a particular business, or a particular process.

Lack of understanding the systems is another issue that others have struggled with. Another reason for failure is the lack of involvement of top corporate leadership, Santagate added.

High expectations can also be troublesome for mobile robot deployments, said Lian Jye Su, principal analyst at ABI Research.

“The expectations for mobile robots vary from task to task,” Su said. “AGVs can be deployed in a quicker fashion, as long as the robots work in a highly structured environment. AMRs that are required to work alongside human workers and in a highly unstructured environment require a preprogrammed map or self-generation of a map to successfully navigate the environment. At the same time, robotics technology is still not advanced enough to perform multi-tasks at present. Research is still being conducted to add manipulation and voice command into mobile robots for better human robot interaction.”

Before adding mobile robots, Omron’s Paul recommends that a prospective customer examine how proven and robust is the navigation, and how intelligent is fleet management. “The key is to evaluate
performance not on one robot, but your expected fleet size in the future,” Paul explained.

The success of any mobile robot implementation will depend on the warehouse setup, said Fetch Robotics’ Lau. “People need to identify the right processes.” Look for the processes where mobile robots can provide the largest and quickest payback.”

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WILL MANIPULATION BE ADDED TO MOBILE ROBOTS?

In 2018, software and vision systems continued to improve to the point that they are no longer a constraint to adoption, according to Lian Jye Su, principal analyst for ABI Research’s industrial, collaborative and commercial robotics research service.

The big challenge for 2019, according to Su, is using manipulation combined with the mobility of the robots. Currently, different companies are using individual solutions. For example, IAM Robotics and InVia Robotics use vacuum grippers, while Magazino relies on a rectangular-shaped holder. Others use multiple-access arms.

“General manipulation is crucial, particularly in multi-task environments, where robots are required to pick up various objects,” Su said.

But others are still searching for the optimal solution. “The most common solutions on the market are finger grippers and vacuum grippers, each with its own pros and cons.”

Su pointed out that OnRobot, Robotiq and Schunk have unveiled adaptive grippers with wider strokes for tasks that need more precision than users can find in traditional grippers. But no single finger gripper is ideal for all tasks.
The vacuum grippers don’t work well with heavy or porous items, Su said. But some companies are attempting to tackle the above challenges, Su said, pointing to Soft Robotics’ use of deformable and soft grippers in order to target the food industry, because traditional grippers apply too much pressure to work well with foodstuffs. However, such customized solutions don’t work well for a company with several different types of products for which they want to use a gripper-enhanced mobile robot.

“This is where a combination of hardware and software elements can play a huge role,” Su said.

CASE STUDY: METRO PLASTICS IMPROVES QUALITY CONTROL, EFFICIENCY, AND SAFETY WITH MIR ROBOT

Metro Plastics, a manufacturer of molded plastics for locks, shovels, consumer electronics, agriculture, and other industries, has enjoyed strong growth since its founding in 1974. The company grew to the point where it needed to move into a newer, larger facility, said Kenneth Hahn, the company’s president.

With the larger facility, the company wanted to cut down the time on moving finished goods to quality assurance, which it was doing with forklifts in the older facility.

Boxes of finished products would stack up at each press until a quality
inspector could make her way around the floor to inspect parts and have them delivered to the warehouse. During busy periods, boxes and pallets were tripping hazards for workers, and the constant fork truck traffic added to the safety risks, he said.

“There was going to be a lot of movement back and forth,” Hahn said. “My father always wanted to look at an AGV, but there was no possibility to use it in the older building.”

Although it could be installed in the newer building, the price went as high as six figures once all of the costs were computed. So an intern working at the facility costed out various other solutions, eventually meeting with Neff Engineering, a distributor of MiR robots, presenting that and other possibilities to Metro Plastics executives. While not the least expensive, an autonomous robot looked like the best option, in part because it would have better versatility than an AGV, while also not requiring some type of tracking in the facility.

“It didn’t require any wires in the concrete; it didn’t need wires or anything else for guiding. It was about half of the cost of some of the other solutions,” Hahn said.

Neff worked closely with Metro Plastics to set up the robot, a MiR 200. Once the robot arrived, a worker drove it around the facility in order to map it, and integrated it into the company’s proprietary web-based software, Metro Connect, a very simple process, according to Hahn. The robot was initially programmed to operate on a continuous loop on the production floor, stopping at each designated location so operators could load finished boxes of products. Now operators can signal the robot to stop at a station only when necessary. Large production floor monitors enable operators to know when the robot will be nearby, and they can summon it via a laptop and wireless network. The robot takes boxes directly to quality inspection.
MANY BENEFITS OF THE AMR

The robot operates around the clock and paid for itself in under a year, Hahn said.

One of the biggest surprises, according to Hahn, has been the increases in quality. With products being inspected a box at a time rather than a pallet at a time as with the old system, fewer defects are missed and quality has improved substantially.

All of the propane trucks have been replaced, with Metro Plastics saving about $400 a month, according to Hahn.

There have been numerous soft benefits as well, according to Hahn. “The self-esteem of the folks working on the production line has improved, now they tell people they work with a robot. As millennials enter the workforce, they want to work with the newest technology.” Not only that, but, unlike the forklifts, the robot isn’t only extremely quiet, but it also is safe – it can stop quickly if a worker unexpectedly walks in its path. As a result, the workers can now use earphones to listen to music (or other choices), something that was never possible before.

“It’s a real wow factor for the customers who come in to see our plant.” Hahn adds. “They can’t believe that all of these new processes and technology is all integrated into making their product.”

Metro Plastics is continuing to automate its facility. The company is in the process of installing powered conveyor belts at each station, which will be able to load the robot, even if an operator isn’t present.

“We don’t want to invest in a solution that isn’t going to be part of the future,” Hahn said.

— Phil Britt