

SOFTWARE AND AI ENABLE AUTOMATION SUCCESS



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Universities, Businesses Collaborate for Warehouse Robotics Innovation

Academic researchers are working to help solve business problems with safer, more easily controlled, and more dexterous robots.

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EDITOR'S NOTE

Welcome to *Robotics 24/7's* first Special Focus Issue of our second year! We've

heard a lot about how robot hardware will be commoditized and how software will make the difference between successful deployments and failures.

While that may be an overstatement, there's no doubt that robotics software, artificial intelligence, the Internet of Things, and big data are transforming businesses.

In this Special Focus Issue, we look at fleet management offerings for mobile robots, AI for picking systems, and improving robotic perception and dexterity. There's a lot of hype around AI, so it's important to learn what robots are actually capable of doing right now.

I've spoken with leading robotics users, suppliers, and associations, and they agree that AI and software will be crucial to successful deployments in 2022. Other trends continuing from the past year include increasing focus on interoperability among robots from multiple vendors, concern about AI regulations, and new tools for developers and users.

As robots get smarter, so too should the companies that sell, integrate, and ultimately use them! I look forward to following new and expanded applications and to sharing them with you.

Eugene Demaitre, Editorial Director

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Fleet Management Software Evolves, Can Improve Mobile Robot Interoperability

From integrating with warehouse and enterprise software to complying with emerging standards, software for mobile robots is evolving.

BY PHIL BRITT

Fleet management software continues to evolve, enabling not only better and more efficient operations of the robots themselves, but also the interoperability of robots from different manufacturers. It can also be integrated with enterprise resource planning, warehouse management systems, and other software, though much of this integration is still at an early stage.

“The main differentiator for MiR is the amount of sensors we use on our robot to feed data into a planning algorithm,” said Ed Mullen, vice president of sales for the Americas at Mobile Industrial Robots ApS (MiR).

“We collect five different types of sensor data. When we’re trying to navigate around facilities, we can see everything from the floor up to 3 ft. We can see small objects, big objects, and we can see front, left, right and rear of the robot,” he said. “So that gives a very detailed look into what’s happening around us.”

The Odense, Denmark-based company’s proprietary Fleet Manager sits on a company network, instructing the robots what tasks or programs to execute, Mullen told *Robotics 24/7*.

“It also has a 30,000-ft. view of the facility from a map standpoint and can see all the robots where they are positioned on the map, and it can do some path

FLEET MANAGEMENT

planning and collision avoidance,” he added.

MiR uses open application programming uses an open interface (API) to integrate with SAP or other enterprise resource planning (ERP) systems to pull data from or push commands commands to the MiR fleet management system, explained Mullen.

Florisa uses MiR software for management data

Though MiR doesn't sell a warehouse management system (WMS), its fleet controller can connect to one. “We've got many, many customers using our fleet tied into their management system, whether it's a warehouse or some type of industrial factory,” said Mullen.

For example, Brazil-based textile firm Florisa has five MiR1000 autonomous mobile robots (AMRs) with a load capacity of 1 ton each operating in a five-story warehouse integrated with four elevators and radio frequency identification (RFID) cages. They are connected to the company's ERP and WMS systems, and there are 450 receiving positions and 3,000 tissue storage positions.

The MiR1000 robots and MiR Fleet Manager have helped Florisa get more data for anal-

ysis, increase productivity and market responsiveness, reduce errors, and ultimately grow profits, said Mullen.

“We're not developing software specifically for the semiconductor market or the pharmaceutical market,” Mullen said. “We're developing software that can be configured to connect into and be used in many different verticals. That's what makes our robots appealing especially to companies that have different infrastructures.”

The more such systems are integrated, the greater the possibility of movement to “lights-out” facilities, he noted.

Open systems needed for growth

Too much fleet management software is closed, offering only limited interoperability, according to Christian Fritz, founder of Transitive Robotics, which builds full-stack robotic capabilities as a service on an open platform.

“They want to be the one-stop shop that provides you with everything that you might need for your

robotics operation,” he said. “These solutions essentially make robotics companies choose between their offerings and building their own in house. There's no mid-

dle ground between them.”

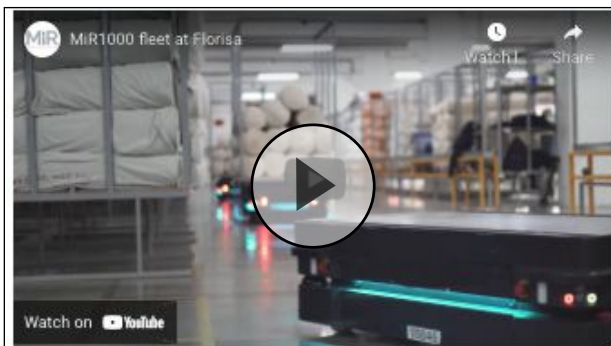
But when Fritz was at Savioke, the service robot company chose to use third-party vendors for fleet management software rather than investing the resources that would be needed to develop a proprietary system. A closed third-party product can be a problem if the user outgrows it, he said.

“What's different about Transitive Robotics is it's open-source, so you can do whatever you want with it,” said Fritz. “Secondly, it provides all of its capabilities as independent [solutions] that you can embed in your own solution.”

Fritz called integration with ERP, warehouse execution systems (WES), and other software “the prime challenge with fleet management systems today.”

“Everyone wants to integrate with so many different systems,” he said. “It's not only ERP and warehouse management systems; it's also things like Pager Duty for operational concerns or analytics solutions.”

“All of those integrations can be built into our platform, but we don't have those integrations at this point,” Fritz added. “I know people who are working on that, and the trend is definitely toward integration.”



FLEET MANAGEMENT

Fleet management moves into the cloud

Another trend is moving fleet management into the cloud, said Florian Pestoni, co-founder and CEO of Mountain View, Calif.-based InOrbit Inc.

“We help maximize the value of every robot, both working with the robot developers to help them improve the robot and focus on their differentiation, as well as with the end users who are trying to improve their processes, sometimes using different types of robots, sometimes from different vendors,” he said.

Whereas most AMR vendors have some type of fleet management software, most of those systems are “pretty basic,” according to Pestoni. “What we’re starting to see is the need for a robot-agnostic way of managing this complexity—especially when you see deployments where you might have different robots carrying out different tasks.”

Initiatives address interoperability standards

Emerging interoperability standards efforts are working to help robotics manufacturers and software providers to work together

so that end customers can choose from different types of robots.

Examples include the Advanced Robotics for Manufacturing (ARM) Institute’s working group and Europe’s VDA 5050 standard for autonomous guided vehicles (AGVs).

InOrbit’s cloud platform supports the MassRobotics AMR-Sender protocol, which is designed to help connect robots from different vendors for basic functionality. It was first demonstrated at FedEx’s DART center during the Association for Advancing Automation’s (A3) AMR & Logistics Conference in October.

“This allows companies that are developing robots to rely on a platform like InOrbit rather than building their own software stack,” said Pestoni. “That saves years of development work.”

He cited Saviok as one company pursuing this strategy and added that deeper integrations between robotic and non-robotic systems such as ERP and WMS will continue to evolve.

Another development that Pestoni expects to start taking hold in 2022 is the concept of robot operations, or RobOps. He is co-founder of the Robot Oper-

AWS IoT RoboRunner Offers Central Repository

Amazon Web Services recently announced AWS IoT RoboRunner, which collects and combines data from each type of robot in a fleet and standardizes data types like facility, location, and robotic tasks in a central repository.

Developers can use AWS IoT RoboRunner’s APIs and software libraries to build applications on top of the centralized repository for use cases such as task orchestration, space management, and robot collaboration.

“With AWS IoT RoboRunner, enterprises can improve efficiency of robotics fleets and reduce costs of running robotic operations,” said AWS.

ations Group (ROG), which is promoting a set of processes, tools, and best practices to guide robot manufacturers, operators, and customers in the design and use of robots.

“RobOps are a vital part of robotics development and integration at scale across industries,” said the organization. “RobOps comprises an executional layer to the larger evolving picture of autonomous robotic integration in our world.” ■

Phil Britt owns S&P Enterprises and is a technology writer who lives in the greater Chicago area. In addition to Robotics 24/7, he has written for financial services and business publications, including magazines, newsletters, conference dailies, and Web sites.



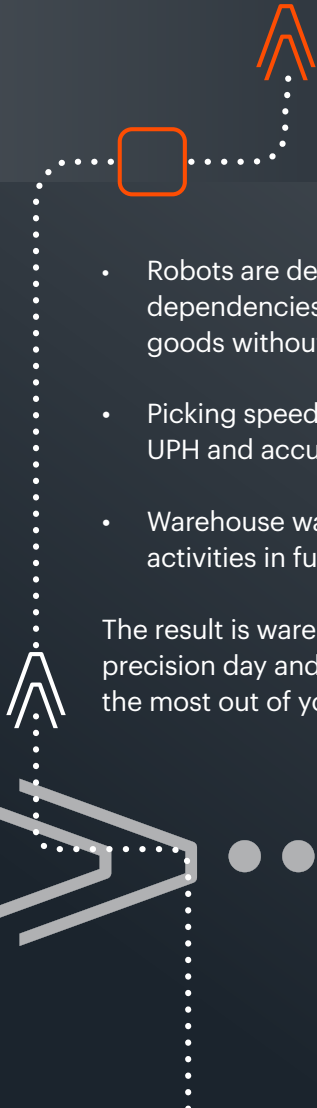
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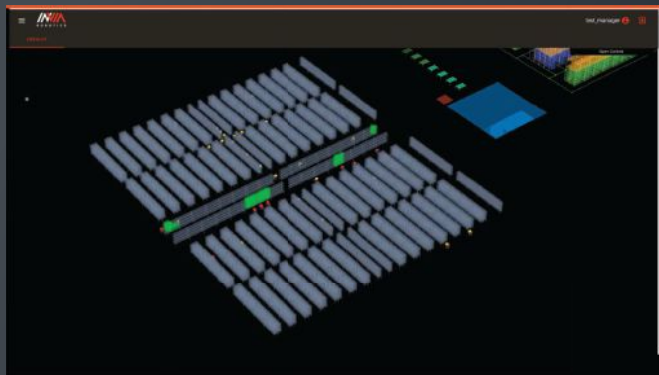
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Robotics Leaders Look Ahead to Technology, Business Developments in 2022

BY EUGENE DEMAITRE

What needs to improve in the coming year for robotics users? Six experts give their predictions for next year.

As 2021 drew to a close, it was a good time to reflect on recent robotics trends, in terms of growing global demand in the face of worker shortages and supply chain challenges. It's also a time to gaze into the proverbial crystal ball to see how automation will continue to develop to serve industry needs.

Robotics 24/7 asked the following thought leaders among robotics associations, end users, and suppliers about their thoughts:

- **Susanne Bieller**, general secretary of the International Federation of Robotics (IFR), the top organization reporting on global industrial usage
 - improving U.S. competitiveness through automation and workforce development
- **Tom Ryden**, executive director of Mass-Robotics, an organization dedicated to growing the Massachusetts robotics ecosystem
- **Aaron Prather**, senior technical advisor at FedEx Express, a noted user of robotics and industry advocate
- **Fergal Glynn**, vice president of marketing at 6 River Systems, which provides collaborative autonomous mobile robots (AMRs)
- **Suzy Teele**, vice president of strategic initiatives and outreach at the Advanced Robotics for Manufacturing (ARM) Institute, a public-private partnership focused on
 - improving U.S. competitiveness through automation and workforce development
- **Lior Elazary**, founder and CEO of inVia Robotics, which supplies software and robotics as a service (RaaS)

We recently looked at some of the biggest trends of 2021. *Robotics 24/7* also discussed some predictions for 2022.

Ease of use, sensing to improve

What robotics capabilities do you expect to improve in the coming year?



Susanne Bieler,
IFR

Bieller: Two trends are expected: more ease of use and improvements in sense and respond. We will see the large robot suppliers tackle both these topics, as well as some dedicated companies developing solutions as add-ons.

There is a clear market need for easy-to-program and easy-to-teach robots. The potential of this capability to open up a variety of new applications and customers is huge. The trend will be in 2022 and far beyond.

We also see more and more use of machine learning in robotics to enable interactions with their environments. 2022 will show machine learning in commercial pick-and-place applications, for example. This will bring us gradually closer to the goal of responsive collaboration—true responsive collaboration will remain a dream in 2022.

Ryden: I believe we will see significant improvements in the ease of use and simplification of programming of robots. This will allow for greater flexibility in applications.

I am also looking forward to seeing some of the new sensors that are being developed, which will allow robots to gain a better understanding of the environments they are operating in.

Teele: We expect to see more advances in collaborative robots, more re-programming ease, and increasing use of AI.

Prather: I think we are going to see some big breakthroughs in vision and AI, which are going



Suzy Teele,
ARM Institute

to lead to not only better and faster pick-and-place applications, but also opening up new use cases for mobile robots, like moving from indoor environments to outdoor environments.

Glynn: AMRs are going to continue to evolve, expanding the ability to collaborate with their operators.

The ability for warehouse managers to monitor what's happening on the ground at multiple sites and be able to adjust operations remotely from a cloud-based software system will also continue to grow.

Mobile robots will continue to see improvements across the board, with hardware, processing, and software enhancements. These combined updates will ultimately provide companies with the best possible fulfillment solutions.

Elazary: All mobile robot capabilities will improve! Our industry has commercialized truly life-changing technology, and it's only in its beginning stages.

There's still so much we can improve in existing applications like picking. We can make order batching more efficient. We can make pick paths faster.

For us, we're constantly looking for every improvement we can make to what we're already doing. For example, we've made our robots picking speeds 35% faster this year.

With a RaaS model, our customers get all of those improvements automatically through system upgrades that are part of their subscription price. They are never threatened by obsolescence, which is really important when adopting new technologies.

Capabilities to evolve

As software and AI continue to evolve for robots and fleets, do you expect more specialization or more generalization?

Bieller: We at the IFR expect this to be somewhat balanced. Today, we see some companies are focusing on general robot systems, like a base robot, that theoretically can do everything and lacks specialized application—for example, Boston Dynamics' Spot robot dog.

On the other hand, we will see an increasing number of software- or application-focused companies that offer dedicated functionalities to certain

ROBOTICS LEADERS LOOK AHEAD

target markets. For example, German startup Energy Robotics focuses on the inspection of assets or plants.



Tom Ryden spoke at MassRobotics' recent partner appreciation event in Boston.

Ryden: In some sense, more specialization. As the software improves, robots can be put to use for more demanding and difficult challenges. These applications will need specific features, such as unique end effectors on robot arms.

Teele: We hope to see both, since both are needed. More generalization, with easy re-programming, is especially needed for smaller operations and contract manufacturers who normally can't devote a robotic system to only one task.

But specialization is also needed to more fully complete a task, freeing humans from dull, dirty, and dangerous work.



Aaron Prather,
FedEx

Prather: There is going to be both. In my opinion, the already established robotics and automation providers are going to move more towards generalization so they can tap into more industries that are automating due to the previously mentioned issues.

However, this is going to open the door for startups to go after the specialization that will be needed in some of these niche use cases in some of these industries. This in turn could heat up the funding and acquisition space as well.

Glynn: Specialization is likely to continue as the fulfillment industry grows and evolves in 2022. Hardware will become even more customizable, allowing companies to meet their unique needs and configurations.

Over time, we also expect robotic fleets and other warehouse automation solutions to be further customized to the exact shape and size companies require to pick specific items or perform other specialized tasks.

Software solutions will also see continued enhancement and updates, allowing for warehouse operations to adapt in real time, ensuring ultimate efficiency.

Elazary: I actually believe it will be both robots becoming more adaptive and better performance. We're just scratching the surface of the types of tasks that can be automated.

At inVia, we started with picking—that was the perfect use case for robots. It's repetitive and much more practical for robots to do than people. Then we added cycle counting, replenishment, putbacks, etc.

So, there will be more and more tasks that make sense to automate as the technology becomes even more precise.

There will also be more specialized intelligence created to accommodate changes in warehouse infrastructure.

For example, systems will need to specialize beyond traditional warehouses to adapt to micro-fulfillment centers that might be located in office buildings or back-of-store. That's the specialization piece.

But I think the specialized applications will be combined in a general platform. So instead of having hundreds of companies that address each specialization, we'll have a few companies that combine specialized applications into a cohesive automation solution.



Lior Elazary,
inVia Robotics

Looking forward to in-person events

What are you looking forward to most in 2022?

Bieller: Definitely in-person events. The past two years have proven that the development and introduction of new products and technologies is maintained—if not improved—in difficult times like the pandemic.

We can be confident 2022 will bring exciting news in in our space. We will continuously see new use cases for robotics. Creativity has been spurred by the crisis.

Things we learned not to take for granted are personal contacts, chances for networking, and face-to-face exchanges. We will appreciate them all much more after such a long time of digital events and meetings.

Ryden: New use cases. In 2022, I anticipate the continued developments in robotics and AI will lead to expanded applications for robotics.

Teele: As the largest national consortium working to advance to state of robotics in manufacturing, and the skills needed to operate them, we at the ARM Institute are most looking forward to continuing to work with our 330+ member organizations to solve some of the biggest challenges preventing manufacturers from using robots, and ultimately, growing manufacturing in the U.S.

Prather: The return of in-person events is going to be huge for 2022 on so many fronts. Not only will it allow for all of these needed conversations around things like interoperability to happen, but it will get many end users back out there to trade shows like Automate to see these technologies and talk to providers about the tasks they are looking to automate.

Personally, I am looking forward to seeing all of my Robot Safety colleagues at R15 Week, which will be hosted by the FedEx Institute of Technology on the campus of the University of Memphis, in March and then



*Fergal Glynn,
6 River Systems*

again in Columbus, Ohio, later in the year.

As more robots enter the public sphere and start to interact with the general public, be it at their local restaurant or grocery store or a delivery robot on the sidewalk, robot safety is going to enter a new phase in 2022.

Glynn: At 6 River Systems, we're looking forward to continuing to help our customers experience better fulfillment everywhere by increasing efficiency and meeting increased demand.

We're expanding our solutions allowing for greater customization like the recently announced use of our Chucks on multiple warehouse floor levels at a 3PL [third-party logistics provider] site in the U.K. Adjusting to unique challenges like this and adapting to site layouts are efforts that will continue into 2022 to meet the demands for our customers with high-volume needs.

Elazary: I'm looking forward to seeing the further maturation of e-commerce unfold. We've created such an amazing process where you can press a button and have a package delivered to your doorstep, and we're only in the beginning stages.

It's going to get further refined every year as we apply technology to make it better. I'm excited for us to get to the point where we have the Star Trek replicator! That won't be next year, but we'll get one step closer to it in 2022. ■



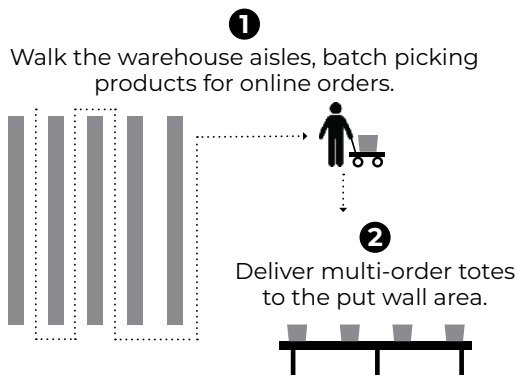
Speed Up Your eCommerce Fulfillment Operations by 3X with Robotic Automation

Consumer buying habits have shifted radically toward eCommerce, putting pressure on fulfillment centers to process more orders, more quickly with existing resources.

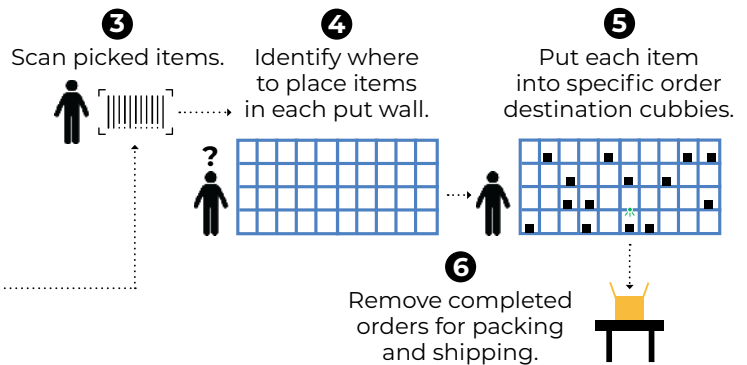


Typical eCommerce Fulfillment Operations

TO PROCESS ORDERS, WORKERS:



AT THE MANUAL PUT WALLS, ADDITIONAL WORKERS:

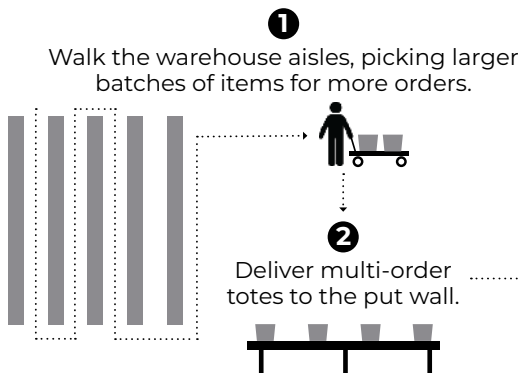


Manual put wall challenges include:

- Typically, put walls have a maximum of 80 order cubbies.
- Onerous physical and time-consuming sorting process for employees.
- Many employees required for picking, sorting, and packing.
- Bottlenecks between picking and sorting processes.

Learn how Berkshire Grey's Robotic Put Wall can increase order fulfillment throughput by up to 3X and handle nearly 100% of typical SKU assortments.

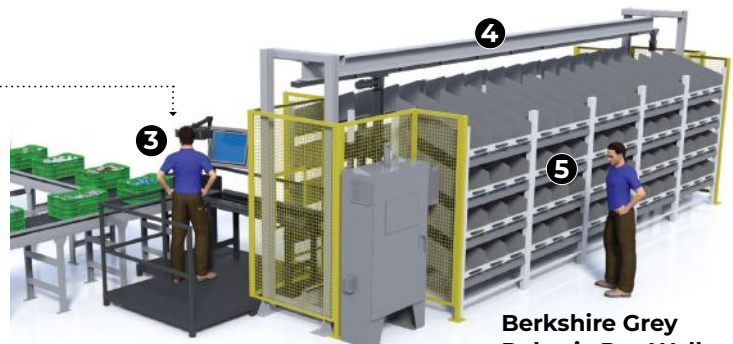
TO PROCESS ORDERS, 1/3 FEWER WORKERS:



Boost batch pick rates by up to 33% and order sortation rates by up to 300%.

AT THE AUTOMATED PUT WALL, 2/3 FEWER WORKERS:

- 3** Scan and place items onto the induction conveyor.
- 4** The Robotic Put Wall automatically puts the items into the appropriate order cubbies (up to 240).
- 5** Remove completed orders for packing and shipping.



Berkshire Grey Robotic Put Wall

AI BECOMING AN ESSENTIAL FEATURE FOR PICKING ROBOTS



BY EUGENE DEMAITRE

Honeywell, Mujin, and RightHand Robotics have applied machine learning to make picking more precise and efficient.

From path planning to object recognition, artificial intelligence is essential to improving robotic piece picking, particularly in manufacturing and e-commerce.

“The number of AI applications and providers using AI in robotic picking solutions continues to increase,” said Thomas Evans, chief technology officer at Honeywell Robotics. “In the past year, we’ve seen an increase in the demand for automation, particularly around robots that use machine learning [ML] and artificial intelligence.”

“Quantifying the impact and improvements can most easily be estimated by the efficiencies and increased scope of robotics in autonomous pick-and-place tasks,” he added. “The improvements most readily tied to increasing the number of products and SKU variations a robot system can visualize and handle in warehouse and DC [distribution center] operations.”

In addition, Thomas explained, “improvements are made when AI solutions are exposed to more operational data and the developers can efficiently repurpose that data back into the AI and ML models.”

The following systems demonstrate recent innovations for picking robots using AI:

Honeywell SmartFlex Depalletizer

Pittsburgh-based Honeywell Robotics has a strong focus on machine learning innovation and implementation, according to Evans. “This isn’t just in the perspective to enhance robot performance and increase operational efficiencies, but also how we continue to quickly integrate automation solutions while on a customer site,” he said.

“Having a strong understanding to generalize ML and AI models for multiple applications as the starting point for customer deployments and quickly refine the system to meet operational requirement is where we have focused our AI development,” Evans noted. “It is an advantage to have a strong understanding of how to deploy AI solutions in order to provide end-to-end automation.”

The company has several products that use AI and articulated robot arms to pick and place packages and products. Honeywell’s Smart Flexible Depalletizer is an autonomous system that uses machine learning to identify items on a pallet, then reach and pick up individual or multiple packages (the mode can be changed) to place on a conveyor belt.

The latest computer vision technology identifies the exact location of every case on the pallet, while perception software automatically recognizes a wide variety of packaging. This technology allows for seamless handling of a continuous flow of pallets in any sequence without requiring any pre-programming or operator intervention, according to Thomas.

With AI and machine learning, the depalletizer is designed to optimize the movements of the robotic arm for maximum picking speed and efficiency. The control logic senses the weight of each item as the robot lifts it and automatically updates its gripping response to securely transfer each product.

The depalletizer, which was introduced in September, is in pilot at one production facility and is commercially available. “There is a lot of interest from our customer base,” according to Thomas.

Some installations could come in early 2022 with even more advanced AI and machine learning capabilities, he said.

Mujin robot doesn’t use a neural net

Other companies using AI with picking robots rely heavily on neural networks, but they are very dif-



icult to train, asserted Brandon Coats, director of system innovation at Mujin Inc.

“No matter what you do, it will never be 100% accurate,” he said. “So we’re going in and using a model-based definition approach.”

That approach relies on a combination of sensing the environment and then using it for measurements, path planning, and execution. This enables a picking robot to have a target and a plan to reach the target before execute mode, Coats said. “We never give the robot a target that it can’t reach,” he explained.

Rather than a neural net, Tokyo-based Mujin’s robot relies on a database of items to be picked, enabling the task to be completed without any training.

While picking robots have been used in assembly-line operations for years, 3D vision systems have only recently advanced to the point where the robots have the necessary intelligence for warehouse and logistics applications, according to Coats.

A Japan-based company is already using 20 of the robots to perform 100,000 picks daily per unit. The success of the technology there could be the basis for quick adoption around the world, Coats said.

“With everything we’re seeing, a lot of Fortune 500 companies are going to want to make their supply chains more redundant and capable,” he said. “By this time next year, you’re going to see some major names deploying these types of robotic systems.”

Coats said he doesn’t expect any major changes in the underlying AI technology. Instead, there will be continued evolution and realization of the cost benefits of such systems, he said.

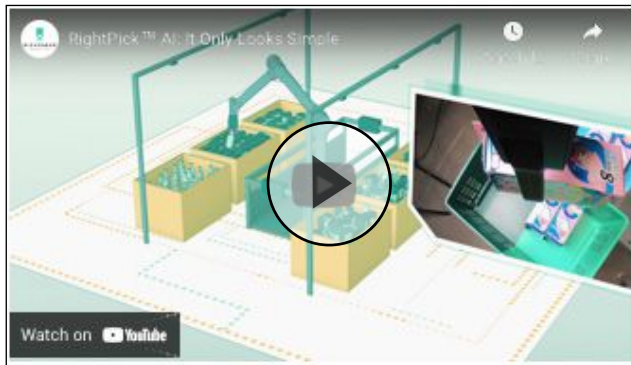
“The same way that we saw robots getting into automotive manufacturing 20 and 30 years ago,

AI AND PICKING

you're going to see the same thing over the next five to 10 years in warehousing and logistics," said Coats.

AI advances benefit robotics users

"When it comes to AI and picking robots, the companies commercializing these systems are benefiting from broader technology trends," said Vince Martinelli, head of product and marketing at RightHand Robotics Inc. "It's now possible to hail a ride in an autonomous vehicle in some cities, for example, and we already take for granted that we can order lunch via a virtual assistant using AI-augmented speech and voice recognition based on natural language processing."



This progress seems to be accelerating, pushing the state of the art in underlying tools, methods, and sensors that are also critical for the machine vision and motion planning systems that are at the heart of autonomous picking systems, Martinelli added.

"Robotic arm costs have come down significantly over time, making the systems more attractive, and pressure on retailers from on-demand e-commerce, labor challenges, and the global pandemic have piqued demand for warehouse automation," he said.

AI software and processors, cloud and data-centric technologies, and autonomous mobile robots (AMRs) are each attracting billions of dollars of investment globally, according to Martinelli.

"When we look at the commercial impact, we see the number of production sites with picking robots increasing since they were introduced by

RightHand Robotics in 2017," he added. "These robots are working across retail verticals including general e-commerce, pharma and online drug-stores, grocery, and others."

This growing experience base has helped drive technology improvements in the past year, as has the demand for meaningful data from the people who operate fulfillment centers, Martinelli said. As the software has improved, so too has the reliability and performance of AMRs to execute warehouse tasks such as picking and materials handling.

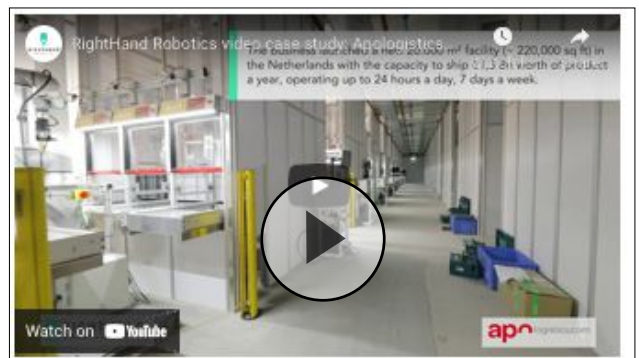
RightPick 3 learns without models

RightHand Robotics incorporated AI into its RightPick 3 system, which comes equipped with all components to integrate with fulfillment systems. It also includes the RightPick MCP application programming interface (API) for easy and safe integration.

The RightPick 3 uses the RightPickAI software, which the company said does not rely on models but instead learns over time.

Apologistics GmbH is one user of RightHand's technology. The company, which claimed to be Europe's most advanced online pharmacy, with 100,000 products, recently opened a 220,200-sq.-ft. (20,438 sq. m) warehouse in the Netherlands.

With a fleet of RightPick-enabled picking robots and an automated storage and retrieval system (ASRS) from AutoStore, Apologistics handles more than 25,000 parcels per day with 20 or fewer employees, according to founder Michael H. Fritsch. ■





Robotics' Second Wave Relies on Software and Integration

BY ROBERTO MICHEL

As robotics become more widely deployed and warehouses begin to use fleets from multiple vendors, the focus is shifting from hardware to software and interoperability.

The first phase of warehouse robotics may be coming to close. That's because vendors today are talking more about fulfillment processes, integration, and software rather than the robots.

The types of robotic systems available has matured and diversified. Autonomous mobile robots (AMRs) can assist warehouse associates with picking efficiency. There are also AMRs that move larger loads, autonomous lift trucks, goods-to-person automation, and mobile manipulators. In the past couple of years, rapid progress has been made with pick-and-place systems that use artificial intelligence and articulating robotic arms.

This proliferation of warehouse robotics has come pretty fast and already has brought operational benefits for distribution centers (DCs), but what comes next? While new robots are sure to come, one big change is that more vendors are talking about software capabilities and the imperatives that go with that, like integration and reliable yet flexible process performance.

“We are a fulfillment solution provider, not a robotics vendor,” said Fergal Glynn, vice president of marketing at 6 River Systems, whose Chuck robots work collaboratively with warehouse associates. “The reason being that the robot is a means to an end. What’s important to our customers is the performance of the fulfillment process enabled by the robots.”

Meanwhile, fulfillment centers aren’t just deploying one type of robot. Some are starting to deploy robotics from different vendors, elevating the importance of easy interoperability, said Dwight Klappich, research vice president at analyst firm Gartner Inc.

Application programming interfaces (APIs) from robotics vendors and from warehouse management system (WMS) providers can help. However, things get more complicated when multiple types of robots, fixed automation, and other systems like manifesting or cubing and weighing, need to work in concert.

“The problem is when opera-

tions get to the point of deploying heterogeneous fleets of robots, then that API approach becomes increasingly difficult to do,” explained Klappich. “You can end up with all these one-off integrations between multiple systems and a WMS, knowing that every time I want to introduce a new WMS or have a major upgrade, there is this integration effort again. And it’s not just the integration work itself; it’s also about wanting the ability to



Source: 6 River Systems

orchestrate work between robots of different types and with other types of automation.”

Integration and orchestration

The trend toward robots from multiple providers has given rise to a new software niche that Klappich and Gartner called “multirobot orchestration.” These platforms sit between business applications, heterogeneous fleets of robots, and other forms of automation.

The vendors in this emerging category come from different backgrounds, from providers that specialize in integration, to WMS or warehouse execution system (WES) vendors, to robotics suppliers who claim their software is

capable of orchestration. This category also involves universal fleet managers such as Amazon Web Services (AWS), which offers its RoboMaker product.

The goal of orchestration, explained Klappich, is to more easily establish unified workflows using different robots. For instance, a larger AMR or an autonomous lift truck can bring pallets to replenish a pick area supported by another type of robot. There

generally is less need for such a solution if a company is new to robotics, advised Klappich.

“The need depends on the complexity of the environment,” he said. “If you are an operation just getting started with robotics and want to integrate one

AMR solution with one WMS, you probably aren’t going to go out and get a multirobot orchestration platform. The need is driven more so by those companies with increasingly heterogeneous fleets.”

6 River Systems has worked with both APIs and integration platforms for deployments, said Glynn. Overall, operations managers want higher-level software that can help them orchestrate processes.

“We will work with partners to integrate disparate technologies together, but we believe that operators are looking for a single unified user experience and control center for their operations,” he said. “We’re already doing this

today at some of our customer facilities.”

SVT Robotics SOFTBOT simplifies connections

One vendor that specializes in robotics integration is SVT Robotics. The company offers software to simplify the connections between different systems and how they work together on common processes.

SVT’s SOFTBOT platform contains connectors between different robotic systems and enterprise systems like a WMS, and also to other forms of automation such as high-density storage and picking systems, or conveyor systems.

SOFTBOT offers both its own connectors and a drag-and-drop studio function for visually designing integrated process flows. Once designed, which can be done in minutes, the connectors automatically integrate the systems around the designed process without programming, said SVT Robotics.

In addition, the platform offers small apps called SOFTBOT Features to orchestrate how different systems can work in unison, noted A.K. Schultz, co-founder and CEO of SVT Robotics.

But rather than being a full-blown WES, features are “microservices” that do one specific thing. Tasks include parsing incoming orders to determine which system has needed inventory, whether the system is available, and how busy that system is. Using these small apps, the platform can coordinate systems, said Schultz.

“There is integration, and there is orchestration, but what

our customers ultimately want is the orchestration,” he said. “They want multiple different systems to be able to work together in concert, to create a new outcome that one system can’t really achieve on its own. But in order to do that, the first step is integration.”

Users look to save time and effort managing AMRs

Consulting firm MacGregor Partners used SOFTBOT to rapidly deploy mobile robots to automate the transport of supplies at a pharmaceutical client’s factory. The manufacturing facility needed to maintain a sterile environment, so MacGregor Partners chose AMRs as the transport method. SVT’s platform sped up the integration, and the project also included creation of screens for employees to use to communicate with the AMRs.

An integration platform can help companies cut the time and effort that would otherwise be spent on API-based integration, Schultz said. Rather than need point-to-point integrations to a WMS, SOFTBOT is a common point of integration between

automation and a WMS or an enterprise resource planning (ERP) system.

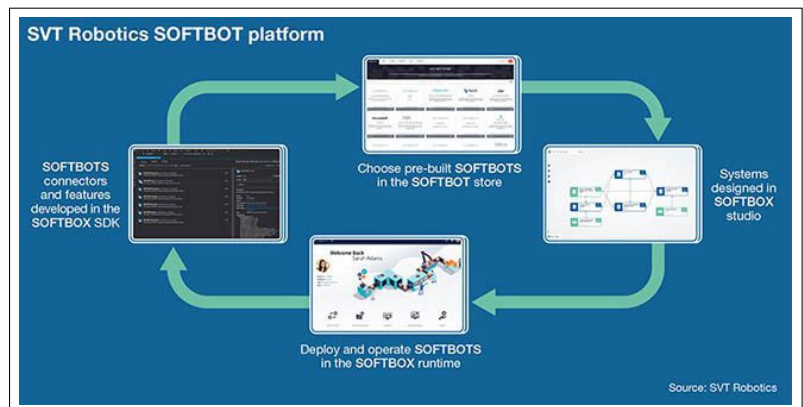
SVT’s platform and the connectors are able to “abstract” data integration details into logical information flows, said Schultz. The information includes the location for the next task, what goods need to be transported, and where to drop off goods.

This separates data exchange details from information flows, Schultz said, while letting different systems do what they do best, like fleet management or pick path optimization.

“By creating that abstraction, everybody is free to innovate on the part that they’re focused on, without having to deal with all of this complex, direct coupling of technologies,” said Schultz.

Blue Yonder offers Robotics Hub SaaS

Other vendors are also addressing the need for integration. Supply chain software vendor Blue Yonder’s Robotics Hub is aimed at simplifying the integration of multiple types of robots with its WMS.



SVT Robotics’ integration platform separates data interface details from the information flows needed for orchestration.

The software-as-a service (SaaS) offering is intended to streamline integration, not just with the company's WMS, but also with any upstream system that manages warehouse inventory and orders, said Adam Shawish, product management director for Robotics Hub at Blue Yonder.

"Automation solutions tend to have slightly different ways of communicating [with WMS] so we wanted to standardize those flows with Robotics Hub to reduce the time and effort it takes to roll out and integrate different automation vendors across a warehouse," he said. "It started out with a focus on [integrating] robotics, but it has since expanded into the onboarding of other types of automation, like goods-to-person systems."

GreyOrange agents anticipate orders

Multi-agent orchestration is a "core capability" of GreyOrange's GreyMatter software, said Akash Gupta, co-founder and chief technology officer at the robotics vendor. He said GreyMatter's "agents" can coordinate spans, not only its own robots, but also other robots, people, and systems such as automated packaging.

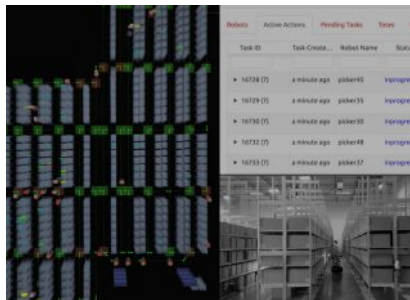
"Agents can work collaboratively or alone, depending on the work process and the task," Gupta said. "For example, a person might work with a goods-to-person robot, a robotic picking arm, and a mobile conveying robot to pick and pack an order and move it to shipping, or an unmanned intralogistics robot might work independently to move pallets from a dock door to a stock staging area."

"We believe most companies will prefer to have a mix of agents handling fulfillment, whether in one facility or across their nodes," he said.

inVia software deployed before hardware

inVia Robotics' software is sometimes deployed before its robots, said Lior Elazary, founder and CEO of inVia. This is done to make human-centered processes more efficient and then make further productivity gains once the robots are deployed, he said.

"More operations are needing this conductor capability to assign work, and decide what agent should do what, and when," he said. "Our software can perform this conductor role, and it can be for many types of agents, including people, robots, conveyor systems, other machines or something like an auto bagger."



Source: inVia Robotics

Seegrid manages stand-alone and interoperable systems

While robotics vendors should offer effective integration methods, some warehouse operations prefer a stand-alone system, noted Jeff Christensen, vice president of product at Seegrid.

"The ultimate goal is to optimize and improve material flow

overall, and integrations between various systems will be a part of this effort," he said. "Integrations support this effort, but they are not necessarily required to improve mobile automation today."

Seegrid has customers using integrations to dispatch its Palion AMRs from a WMS or inventory system and some doing it through a pull system or with manual dispatching.

"We also have customers creating integrations with other automation and other vendor's robots," Christensen added. "For example, our Palion Tow Tractors are picking and placing at conveyors. Our AMRs can pull alongside the conveyor and transfer an item back and forth between the conveyor and the tow tractor."

"We also have AMRs currently integrating with roll-up doors in facilities so our robot can open the door as it enters a new space and then close it after it passes through," he said.

Berkshire Grey works to ensure reliability

When it comes to pick-and-place applications, automation providers say system effectiveness comes as much from AI-based software as it does from the robot arm. Some vendors approach effectiveness and partnerships with integration in mind.

Berkshire Grey typically relies on APIs to integrate with WMS or other systems that govern inventory and orders, according to Kishore Boyalakuntla, vice president of products at the company, which recently released a robotic putwall system.

Not only does Berkshire Grey

ensure that its robots work with major WMSes, but it also focuses on the other direction, he said. This bi-directional flow lets a WMS or another system know if a SKU or label was damaged or any item was unable to be processed by the robot.

Even if AI capabilities can deal with variations, partners must consider it a part of integration, Boyalakuntla explained. “We make sure that when we turn on the lights and commission [a system], the pick rates and the throughput are exactly what we agreed upon with the customer or exceed it,” he said.

Honeywell invests in software for smart robots

Pick-and-place automation is very software-driven, using machine learning (ML) smarts to enable the solution to adjust to variations in SKUs or packaging. That means the efficacy of pick-and-place robots in the real world rests heavily on software expertise.

To support this, Honeywell Robotics has invested in software-related “building blocks” for robotics, said Thomas Evans, CTO of the unit of Honeywell Intelligrated.

For example, Honeywell’s Smart Flexible Depalletizer, launched in September, features a robotic arm and AMRs from partners to transport pallets. The robotics control software is from Honeywell, in addition to the company’s expertise in AI, ML, and vision.

Honeywell extensively tested the depalletizer system in pilots with customers to ensure that it

MassRobotics Interoperability Standard Helps ‘De-conflict’ AMRs

In May, regional industry group MassRobotics released its first version of a robotics interoperability standard. It is intended to help mobile robots from different vendors to work together at the same facility, said Jason Walker, CEO of Waypoint Robotics, which was recently acquired by Locus Robotics.

The standard addresses safe and efficient operation of AMRs from multiple vendors. Members of the working group and contributors to the newly introduced robotics interoperability standards include:

- Vecna Robotics
- 6 River Systems
- Waypoint Robotics
- Locus Robotics
- Seegrid
- Mobile Industrial Robots
- AutoGuide Mobile Robots
- Third Wave Automation
- InOrbit
- Open Robotics

A key focus of this standards effort is to allow AMRs of different types to share status information or “rules of the road.”

For example, the standard addresses data points such as common reference location, current location, a robot’s state (active versus idle), and future destination.

The standard also enables the creation of operational dashboards so managers can gain insights into fleet productivity and utilization. However, it is not meant as an orchestration platform or some type of overarching fleet controller, explained Walker, who is on the standards committee.

“The purpose is to be able to have multiple robots of different types and form factors, simultaneously deployed together in a single customer facility and have them work with each other in a productive and cooperative way, without having conflicts with each other,” he said.

For example, improved information sharing between robots can help avoid aisle congestion, or two robots showing up at the same dock door at the same time.

“What it does is provide a framework to allow vendors’ systems to ‘de-conflict’ with each other,” Walker said. “It allows vendors to create systems that can respond to the presence of other robots and cooperate with them.”

The standard does not say how one vendor’s system could control the movements of another vendor’s robots. Improved situational awareness between different robots is at its core, Walker said. “There’s a need for different types of mobile robots, and we need to be able to play well together,” he added.

Vecna, Waypoint, and WiBotic demonstrated MassRobotics’ interoperability standard at FedEx’s DART R&D center during A3’s AMR and Logistics Conference last fall in Memphis.

can perceive and adjust to variations. Evans explained why the company developed its own software controls.

“Our Honeywell Universal Robotic Controller was to be able to have full customization of what we’re providing our customers, which not only enables a quality solution; it also gives us full insight into how to deploy, commission, and maintain that software when it’s in the field,” he said. “And that is very important to us as a solution provider.”



Berkshire Grey Robotic Product Sortation system

While technologies like machine learning and robotic perception may seem removed from the day-to-day realities at DCs, these building blocks are key to handling the level of variation needed for applications such as depalletizing, especially when sequences of single-SKU pallets and mixed-SKU pallets are run through the system.

“That [flexibility to handle variation] is all within our software control and some of the things we work with the customer on to make sure we handle their pain points with this product,” said Evans.

Covariant aids AI-based robots

AI-based piece picking is still an advanced application for robots, making it difficult end-user organizations to compare them with established categories of materials handling automation, said Ted Stinson, chief operating officer at manipulation AI provider Covariant.

After all, how does one determine if an AI-driven arm and gripper can actually handle the rapidly changing SKU mixes seen in modern e-commerce? Flashy presentations from a dozen or more vendors can’t really answer that question, Stinson said.

It’s a crowded and confusing marketplace, where trying to understand the capabilities of one system versus another is highly challenging,” Stinson said. “It’s not like some more traditional materials handling system categories, where you can compare specification sheets and pretty well-established metrics around performance.”

One path forward is to run a performance benchmark test and invite vendors to participate.

Such tests should involve a mix of five to 25 SKUs and different scenarios for how they might be presented in bins to provide insights on what the systems can really handle.

Typically, such benchmarking gauges things like pick success rate, and the rate at which human intervention is needed. Ultimately, it’s not about comparing robots, but figuring out if AI can help deal with your product mix and fulfillment challenges, Stinson said.

“We encourage benchmarking, because it sets a foundation for an effective partnership by helping a company assess how well a robotics system and the AI that powers it is going to perform when it comes to adapting to its rapidly changing product mix,” said Stinson. ■

Roberto Michel is senior editor for Modern Materials Handling, a sibling site to Robotics 24/7. He has covered manufacturing and supply chain management trends since 1996.





READY Robotics, Futura Automation Partner to Aid Manufacturers in Western U.S.

Futura Automation will help manufacturers across 13 states design and deploy automation using READY Robotics' Forge/OS.

BY ROBOTICS 24/7 STAFF

Robotics suppliers and integrators have been partnering to help enterprises of all sizes adopt automation. READY Robotics Corp. recently announced a strategic partnership with Futura Automation to help distribute systems using its Forge/OS software in 13 states in the Western U.S. The companies said they will help manufacturers alleviate labor issues, solve production challenges, and boost output.

“Complexity prevents many manufacturers from utilizing automation to alleviate production challenges,” said Ben Gibbs, co-founder and CEO of READY Robotics. “Robots need to be easier to use, but that’s not enough. That’s why we’re so excited to partner with Futura Automation.

Their strong presence across the Western U.S. and extensive experience helping manufacturers automate a wide range of processes make them an ideal partner to represent Forge/OS-powered automation.”

Founded in 2016, READY Robotics said its software can

simplify robot programming. The Columbus, Ohio-based company’s core product is Forge/OS, which it described as “the first industrial operating system for controlling robots from top robot OEMs, as well as the peripherals needed to make those robots productive in a real-world environment.” It released Forge/OS 5 earlier this year.

In addition to its enterprise-grade software, the company offers its READY Market, a robot-agnostic marketplace, and the READY Academy, an online



CNC machine tending with VersaBuilt. Source: Futura Automation

learning platform. It said these offerings make it easier for manufacturers of all sizes and technical backgrounds to use robots to improve productivity and increase competitiveness.

Futura Automation joins READY Robotics network

READY Robotics has been building a network of distributors and integrators to lead the design and deployment of Forge/OS-powered systems. With Futura Automation as a cornerstone, READY said its network now covers the entire U.S., with over 30 regional partners.

Futura Automation, based since 2017 in Scottsdale, Ariz., said its team members have an average of more than 20 years of experience in industrial automation and robotic systems. The company focuses on material handling, automated assembly, and machine vision applications “that

augment human labor and fulfill the promise of Industry 4.0.” Futura Automation has offices and representatives across the U.S. and in Queretaro, Mexico.

Futura Automation will be READY’s stocking distributor for states including Arizona, California, Idaho, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Texas, and Washington.

“Futura Automation provides innovative solutions for tough manufacturing problems. Our team is focused on helping our customers compete in global markets and allow reshoring of production using automation tools such as robots, machine vision and artificial intelligence,” said Brian McMorris, president of Futura Automation.

“READY Robotics speeds up and simplifies the development and execution of robot manufac-

turing systems,” he said. “Our team will provide the required training and support to quickly and economically implement robotic solutions.”

Forge/OS to be embedded for several applications

Futura Automation plans to embed READY’s Forge/OS into several of its standard solutions, such as flexible feeding with its partners Flexfactory, Cognex, and FANUC. It also will use the software for machine tool robot tending with its VersaBuilt solution and gantry robotics with partners Macron Dynamics and Sanyo Denki.

The companies said they are considering several more systems that will be developed based on customer demand. By using Forge/OS, Futura Automation said it will be able to interchange robots from different brands to best meet the needs of the customer or the application.

With support for FANUC, Yaskawa, ABB, Staubli, Epson, Kawasaki, and Universal Robots, Forge/OS provides a single programming interface for hundreds of models of industrial and collaborative robots, said READY Robotics. It also supports the peripherals required for automation.

READY added that “Forge/OS’s intuitive, no-code programming interface enables Futura Automation to deploy solutions that their customers can manage – including programming for new parts or new tasks, touching up programs, or recovering systems on their own.” ■



Getty Images

Robotics Leaders Ask Policymakers to Reconsider EU AI Act

Robotics innovators and associations call on European policymakers to amend proposed AI and machinery regulations.

BY EUGENE DEMAITRE

Government can help or hinder new technologies and industries. According to four experts in robotics in automation, the European Commission's proposed AI Act and updated machinery regulations could cause severe damage to European small businesses and robotics companies of all sizes. They today called on European policymakers to review and amend the proposals.

The new regulations would require machinery using software that could be classified as arti-

ficial intelligence to be certified by third parties for safety, adding what the industry and technology experts said is an unacceptable burden on business.

The European Commission's proposed regulations may be intended to protect safety and create a harmonized framework for AI and robotics, but they could instead stifle innovation, said the International Federation of Robotics (IFR), the VDMA Robotics + Automation Association, EUnited Robotics and REInvest Robotics.

Good intentions gone awry

"The politicians have the right intentions—to avoid problems in society—but they don't see the impact on emerging technologies and startups," said Dr. Esben Hallundbæk Østergaard, founder of Universal Robots and CEO of REInvest Robotics. "It's not the future we want."

"GDPR [the EU Global Data Protection Regulation] did a good job in limiting what data can be collected and how big corporations can use that data," he

told *Robotics 24/7*. “However, governments didn’t foresee the impacts. In one catastrophic case in medical research, one large EU project collected data, but the next couldn’t access it and was even fined.”

“All the large data-driven companies—Facebook, Google, Amazon, and others—are based in the U.S. and China,” Østergaard noted. “The EU wants to compete, but the new combination of laws could make it impossible for European companies to do so. It’s like running a race with a 10 kg [22 lb.] backpack on.”

“Regulators don’t want AI to turn evil and take over, but there’s a fundamental difference between what’s actually possible with AI and previous safety rules that addressed sawmills cutting limbs off of people,” he said. “It’s better to say that machines should be safe without going into detail about how to achieve that goal. Existing machinery directives, which took a while for us to understand, have already matured quite well.”

“The AI Act could damage not only the AI and robotics industries, but also anybody who would benefit from robotics in healthcare, farming, and construction,” he said. “This comes just as European automation has reached a level where it can help new segments.”

“Locally, the legislation will negatively affect thousands of



Esben Østergaard.
Source: LinkedIn

small businesses, factories, and manufacturers that rely on robotics and AI to automate critical operations and overcome labor shortages,” said Østergaard. “The U.S. may have the lead in software, and China with big data, but robotics is one area where European knowledge of how to build machinery gives us an edge.”

Concerns about European regulations

The four organizations and their leaders cited the following concerns about the proposed regulations as they are currently worded:

- Requirements for mandatory third-party certification of any machinery using AI would slow technology innovation across Europe.
- The restrictions would hinder AI adoption and put European companies, especially small and midsize enterprises (SMEs) and startups, at a competitive disadvantage globally.
- The proposed rules risk further disruption to regional supply chain, manufacturing, and logistics operations if they are adopted as initially written.
- Compliance with the regulations worldwide will become more complex and burdensome.

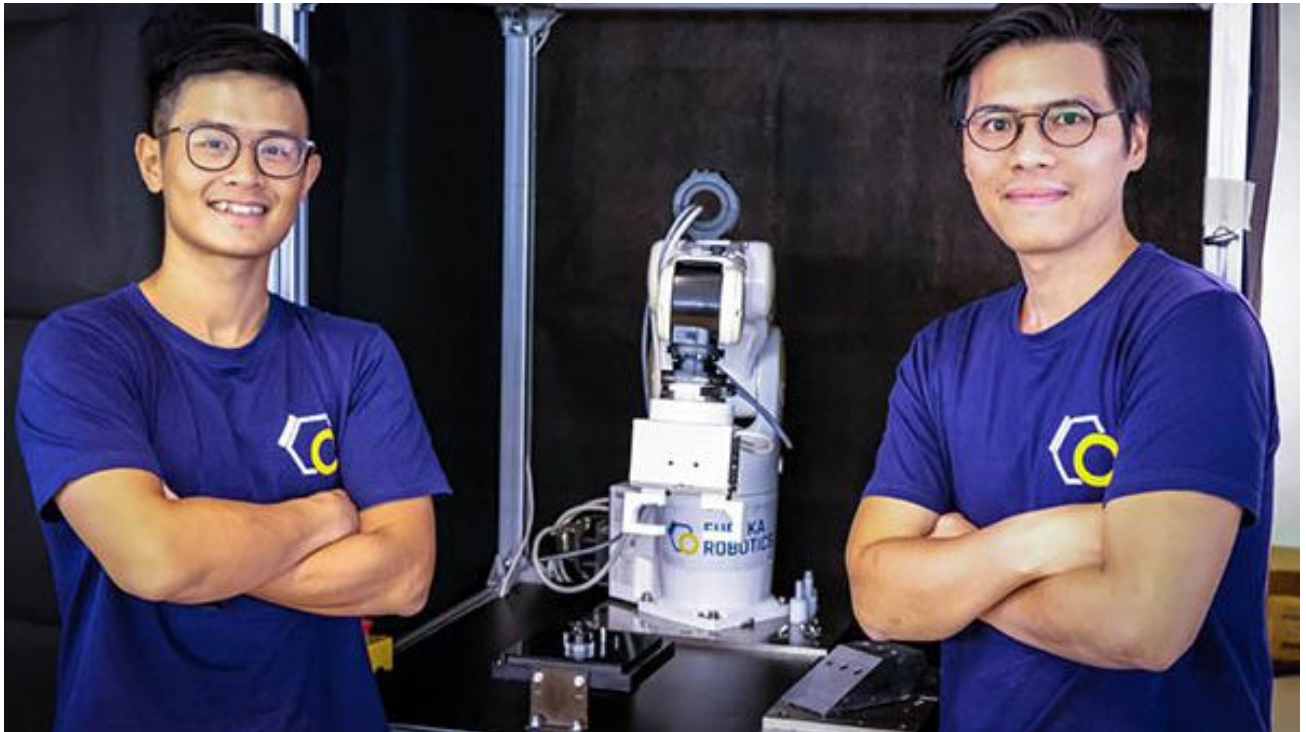
“The EU-Commission’s proposals include burdensome

regulations of so-called high-risk AI and high-risk machinery,” stated Patrick Schwarzkopf, managing director of the German VDMA Robotics + Automation Association and director of EUnited Robotics. “They include the introduction of extensive mandatory third-party certification requirements, which will discourage the use of AI and slow down innovation across Europe.”

“Another problem is that the definition of AI keeps evolving, from simply calculating faster than humans to symbolic reasoning and then to IBM Watson,” said Østergaard. “You need predictability or mean hours between failures for safety-rated systems, and you can’t do that with deep learning or neural networks.”

“For a collaborative robot, if the end customer can adjust it after it’s delivered, its questionable if you’d need someone to come out every time you need to make a minor change,” he added. “Today, a lot of devices are sold in Europe that don’t comply with current safety laws—that’s a much bigger risk than making it harder for those who already comply.”

“The International Federation of Robotics calls on European policymakers to amend both drafts to balance the protection of citizens with the market’s need to adopt new technologies and ensure a level-playing field for companies,” said Dr. Susanne Bieller, general secretary of the IFR. “This is not purely a European issue, as the proposed regulations will severely impact all companies bringing robots to the European market.” ■



Eureka Robotics Develops Software to Add Sensitivity, Dexterity to Industrial Robots

NTU Singapore spinoff Eureka Robotics' Dynamis technology promises to add precision and productivity.

BY ROBOTICS 24/7 STAFF

(above) NTU Singapore professors and Eureka Robotics co-founders Hung Pham (left) and Pham Quang Cong (right) with a DENSO WAVE robot equipped with the Dynamis force-feedback software.

Eureka Robotics recently announced that it has developed a proprietary force-feedback technology that can make industrial robots almost as nimble and sensitive as human hands. The company and its Dynamis software spun out of research at Nanyang Technological University (NTU) Singapore. Eureka Robotics said its technology enables robots to manipulate small and fragile objects that are millimeters in size without damaging them.

“Today, Dynamis has made it easy for anyone to program touch-sensitive tasks that are usually done by humans, such as assembly, fine manipulation, polishing, or sanding,” explained Pham Quang Cong, an associate professor at NTU Singapore and co-founder of Eureka Robotics. “These tasks all share a common characteristic: the ability to maintain consistent contact with a surface.”

“If our human hands are deprived of our touch sensitivity, such as when wearing a thick glove, we would find it very hard to put tiny Lego blocks together, much less assemble the tiny components of a car engine or of a camera used in our mobile phones,” said Pham, who is also the deputy director of the Robotics Research Centre at NTU's School of Mechanical and Aerospace Engineering.

NTU technology first seen in Ikea Bot

Mastering “touch sensitivity” and humanlike dexterity has been a holy grail for roboticists, said Pham. Programming force controllers is extremely complicated, requiring long hours to perfect the grip just for a specific task, he said.

Current robots in the market have either high accuracy but low agility, where robots perform the same movements repeatedly such as in a car factory, or low accuracy but high agility, such as robots handling packages of different sizes in logistics.

NTU scientists developed the force-feedback technology and demonstrated it with the “Ikea Bot,” which assembled an Ikea chair in just 20 minutes. The breakthrough was first published in the journal *Science* in 2018 and showed that a robot could match the dexterity of human hands in assembling furniture.

The Singapore university’s NTUitive innovation and commercialization company incubated Eureka Robotics and has helped to speed its path to market. It said it followed the NTU 2025 strategic plan, which seeks to tackle some of the world’s most pressing challenges with new technologies.

Eureka Robotics AI needs just one parameter

Known as “Force Sensor Robust Compliance Control,” the new software powered by Dynamis requires only a single parameter to be set – the stiffness of the contact, or whether it is soft, medium, or hard.

Pham developed the artificial intelligence algorithm with former Ph.D. student Dr. Hung Pham, now co-founder and chief technology officer of Eureka Robotics. This technology was further improved and was first deployed in Eureka’s custom-built robots, such as Archimedes. It can handle fragile optical lenses and mirrors with human-like dexterity and is now used by multiple companies worldwide.

Despite its simple setup, Dynamis can outperform conventional robotic controllers, which require an enormous amount of expertise and time to fine-tune, claimed Eureka Robotics.

Robotics engineers can use the technology to imbue robots with both high accuracy and high agility (HAHA) on a large scale, the company added. This could pave the way for industrial applications that were previously very difficult or impossible to

implement, such as handling and assembly of delicate objects such as glass optical lenses, electronics components, or engine gears.

DENSO to offer Dynamis with force controller

Since the Ikea Bot and Archimedes, Eureka Robotics’ founders said they have upgraded the software. It will be available for numerous industrial robots worldwide made by DENSO WAVE, which is part of the Toyota Group.

Clients purchasing the latest robots sold by DENSO will have an option to include Dynamis as part of the force controller, which reads the force detected by a force sensor on the robot’s wrist and applies force accordingly.

If too little force is applied, items may not be assembled correctly, while applying too much force could damage the items, noted Eureka Robotics.

“Due to its high basic performance and openness, DENSO robots are the preferred choice by companies and universities with advanced initiatives in the field of robotics,” said Hiroyasu Baba, FA/Robotics Business Unit Product Planning Department and manager of DENSO Wave. “NTU Singapore and Eureka Robotics have also been using DENSO robots for this reason.”

“Because of this relationship, joint development began naturally, and we were able to launch this product smoothly,” he said. “The technology, which will be installed in DENSO robots, is a technology for force feedback, which is becoming more and more important in the practical use of robotics. Thanks to the development capabilities of Eureka Robotics, the system is advanced, yet easy to use and light enough to be integrated into our standard robot controllers.”

To be equipped with the “Force Sensor Robust Compliance Control” capability, robots already running on DENSO WAVE’s RC8 controllers need only a simple software update from December 2021 onwards. Newly shipped RC8 controllers will come with the software available for activation. ■



Source: Eureka Robotics



Amazon Web Services Offers AWS IoT RoboRunner for Fleets, Teams with MassRobotics for Startup Accelerator

AWS IoT RoboRunner is intended to help developers build and deploy robot applications, and the Robotics Startup Accelerator with MassRobotics offers funding and mentorship.

BY EUGENE DEMAITRE

*AWS Robotics Startup Accelerator services
Source: Amazon Web Services*

Leading into November's re:Invent event, Amazon Web Services announced the launch of AWS IoT RoboRunner, a new service intended to make it easier for companies to build and deploy applications for robotic fleets. The unit of Amazon.com Inc. also announced the AWS Robotics Startup Accelerator in partnership with MassRobotics.

AWS re:Invent, which was held in Las Vegas and virtually, is Amazon Web Services' annual event featuring numerous technology announcements and user workshops. Amazon said that the AWS IoT RoadRunner and the AWS Robotics Startup Accelerator reflect its ongoing commitment to helping robotics developers, including through the AWS RoboMaker simulation service.

The company previously held a virtual robotics accelerator in August.

AWS IoT RoboRunner built on existing tech

AWS IoT RoboRunner is built on the technology already in use in Amazon’s e-commerce fulfillment centers and is available to robotics developers. The company said it developed AWS IoT RoboRunner to focus on robotic fleets and potentially enable interoperability.

“In 2018, we launched AWS RoboMaker, a cloud-based simulation service that enables robotics developers to run, scale, and automate simulation without managing any infrastructure,” said Channy Yun, principal developer advocate for AWS. “As we worked with robot developers and operators, we have repeatedly heard that they face challenges in operating different robot types in their automation efforts, including autonomous guided vehicles (AGVs), autonomous mobile vehicles (AMRs), and robotic manipulators.”

“Today, we are launching a public preview of AWS IoT RoboRunner, a new robotics service that makes it easier for enterprises to build and deploy applications that help fleets of robots work seamlessly together,” he wrote in a blog post. “AWS IoT RoboRunner lets you connect your robots and work management systems, thereby enabling you to orchestrate work across your operation through a single system view.”



AWS IoT RoboRunner is intended to help developers create tasks and applications for mobile robot fleets.

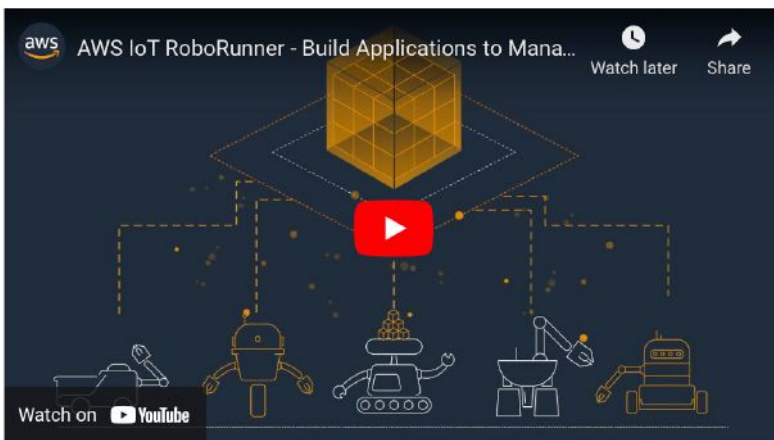
The new service runs in the AWS Management Console and creates a centralized repository for facility, robot, destination, and task data, said Yun. Developers can use the Fleet Gateway Library to develop code for integrating robots with warehouse management systems (WMS), and the Task Manager Library can make it easier to allocate tasks, he said.

In addition, AWS IoT RoboRunner provides application programming interfaces (APIs) for building applications, which can be customized to a particular business case, Yun said. Amazon Web Services provides an introduction to getting started in its AWS IoT RoboRunner Developer Guide.

AWS, MassRobotics see startup needs

The AWS Robotics Startup Accelerator is open to hardware and software startups around the world, said Werner Vogels, chief technology officer of Amazon. Amazon Web Services and MassRobotics partnered in response to the need to help startups overcome technical and business challenges, he said.

“Robots are becoming more and more commonplace in our world, playing roles in everything from performing surgery, to cleaning the floor, to teaching young children,” he wrote in a blog post. “With the prevalence of robots operating in a variety of industries, it may look like we’ve reached a new age of robotic proliferation, but really, there are still many barriers for



robotics companies to overcome to create the impact they know they can make. This is why AWS is excited to announce its strategic collaboration with MassRobotics to launch the AWS Robotics Startup Accelerator, focused on guiding and mentoring a cohort of robotics startups.”

“For as much as the production barriers to robotics have been lowered, building a robotics startup still requires multidisciplinary expertise in mechanical engineering and electronics, as well as AI/ML [artificial intelligence and machine learning],” Vogels added. “It’s challenging for startups to find people who are skilled in both traditional hardware and newer technologies such as AI/ML.”

“Additionally, robotics startups need to invest their scarce resources on domain-specific value-add activities to carve a niche and accelerate their time to market,” noted Vogels. “Today, there are only a few successful commercial robotics companies, and there are a few big reasons for this. First, finding a fit in the robotics product market is difficult because real-world environments are dynamic and unpredictable, so pairing the right niche with the right capabilities can be a challenge.”

“Second, building robots with a high degree of autonomy and intelligence requires multidisciplinary skills that are hard to find and recruit for,” he explained. “Third, robotics is capital-intensive and requires large upfront investment in sensors, actuators, and mechanical hardware, even when they’re already commercially available.”

“When I talk to AWS customers, they tell me it’s critically important to develop capabilities across multi-disciplinary areas including AI/ML, simulation, data streaming, edge processing, and robotics management,” Vogels said. “They ask for guidance implementing solutions for security, reliability, right-sizing, and provisioning for future growth. In addition, they’re looking for advice on well-architected designs, partner selection, channels like AWS Mar-

ketplace on which to market, and device qualification services.”

Accelerator offers AWS credits, mentoring

The accelerator will offer hands-on training with Amazon Web Services robotics technologies and up to \$10,000 in credits for AWS Internet of Things (IoT), robotics, and ML services.

In addition, startups accepted into the four-week, virtual program will be able to consult with experts at AWS and MassRobotics on business models and overcoming technical challenges.

MassRobotics is dedicated to helping the Boston-area robotics community grow through shared space and services, a network of innovators and entrepreneurs, and events. Successful members of the organization include Activ Surgical, Realtime Robotics, and Waypoint Robotics—which Locus Robotics recently acquired, noted Vogels.

“With the massive adoption and deployment of robotics solutions in manufacturing, logistics and other sectors, the need and reliance on cloud technologies have grown exponentially,” said Fady Saad, co-founder and vice president of strategic partnerships at MassRobotics. “We are excited to establish this program to help robotics startups accelerate their growth and solve big challenges by using AWS.”

The nonprofit has worked with other strategic partners including Festo, General Motors, Panasonic, Analog Devices, and Mitsubishi Electric. ■





Universities, Businesses Collaborate for Warehouse Robotics Innovation

Academic researchers are working to help solve business problems with safer, more easily controlled, and more dexterous robots.

BY JIM ROMEO

As e-commerce volume has exploded, businesses are looking for the best automation to help them fulfill orders and meet customer demand. They need reliable technology to process digital orders with speed and accuracy, as well as to coordinate the growing number of robots in dynamic warehouses and distribution centers.

Although many retail purchases have moved back to brick-and-mortar stores as the COVID-19 pandemic began to ease in the U.S., about 20% of sales occurred online in the second quarter of 2021, reported *Digital Commerce 360*.

Retailers and logistics companies are under pressure to improve throughput while maintaining worker safety. Developers have responded to this need with new robots and software.

Processing orders optimally

Researchers at the Viterbi School of Engineering at the University of Southern California recently collaborated with Shanghai University of Finance and Engineering. They studied online shopping experiences and cre-

ated a system that would enable JD.com to optimize robots within warehouses as they scurry about processing orders.

The intent was to allow robots to move quickly without any collisions. The research team developed a mathematical method to optimize the combination of steps with a finite set of solutions.

The system that the USC and Shanghai University team devised allows JD.com’s robots to accurately fulfill orders for same-day delivery. It also al-

lowed the company to process 10 times the normal quantity of product orders while rapidly adapting to the unexpected shocks and demand caused by the worldwide pandemic.

As a result of the optimization, JD.com said it was able to reduce storage costs by about 50%.

Implementing augmented reality

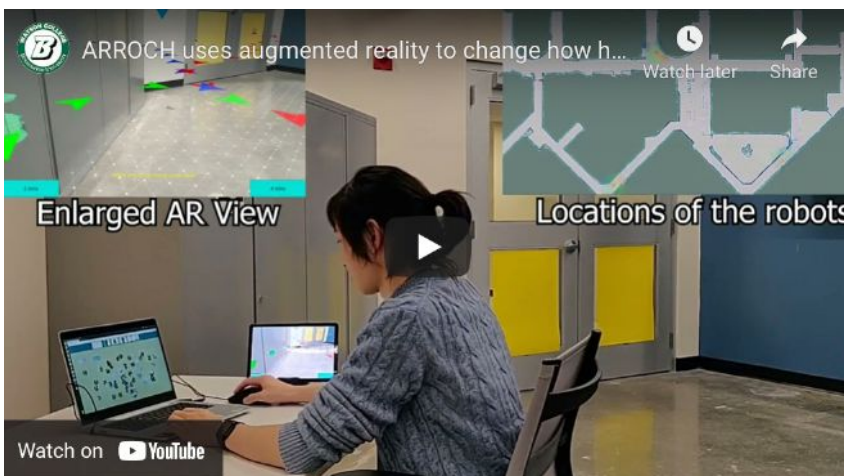
As automation becomes more prevalent in warehouses, humans and machines must interact smoothly to maximize productivity. However, close collaboration in real time can be a challenge.

Even as optimization software for warehouse robots becomes more common, other innovations can be combined with it to deliver even greater value. Take, for example, augmented reality (AR).

The State University of New York at Binghamton studied ways to bridge the gap between human communications and mobile robots for OPPO, a consumer electronics and mobile communications company. They found that AR could allow people to observe and direct multiple robots.

Augmented reality technology uses digital visuals in combination with audio and other stimuli to simulate a world view. Human workers can use it to observe the robots’ current locations and provide feedback as to what actions and moves the robots should take next.

In the case of OPPO, Binghamton University researchers



found that AR can go beyond simply visualization. Augmented Reality for Robots Collaborating with a Human (ARROCH) can help a person interact with a robot and what it's currently doing or direct it to do something else such as make a delivery.

Thus, there's the opportunity for workers to provide bi-directional communications on the robot's intended path or behavior. It's one of the first times that such an interaction has been put into use, said the researchers.

Performing dexterous tasks in the warehouse

Yet another emerging technology is allowing robots to perform very dexterous tasks. This requires some careful mechanical design and artificial intelligence to provide precise robotic manipulation.

Prof. Ken Goldberg and four graduate students at the En-

gineering Department at the University of California, Berkeley, worked to improve suction-based grippers. The AmbiSort system is based on the Dex-Net (Dexterity Network) deep learning program created by Berkeley researchers to train robots to grasp a wide range of objects. This has been a challenge for pick-and-place applications.

The system can "grasp, scan, and place objects at twice the speed of human workers," said Goldberg. Ambi Robotics' AmbiKit can apply this dexterity to assemble subscription boxes and gift sets, as well as conduct more complex assembly operations.

Practical applications drive research

All of the research projects above are driven by an upsurge in e-commerce demand and worker shortages. In addition to

dull, dirty, or dangerous tasks, robots can help augment human capabilities to improve working conditions and productivity. But performing tasks such as moving items in distribution centers, interacting with multiple machines, and dexterously assembling or picking assorted items requires innovation.

Each of the projects described above represents just a sampling of the attempts to bridge the gap between R&D and commercial needs. As robotics proves its value across industries, the development and use of fleet management and optimization software, augmented and virtual reality, and machine learning will only grow. The benefits have yet to be fully realized. ■

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