



Trendlines: Rise of the (service) robots

Rethink your workforce to get the most out of physical automation

Reaping the benefits of human and robot collaboration

Drift back to November 2019 and think about your day at work. Maybe you took the train or bus and grabbed a coffee before you got to the office. You might have headed for lunch at the deli around the corner. And, on the way home, stopped by the market to grab some food for dinner. If you thought of robots at all, likely you pictured a manufacturing line on a factory floor, or perhaps a humanoid metal machine from your favorite science fiction movie.

Now, think about 2020. Life is completely different. Today, in some parts of the world, certain tasks – sterilizing hospital equipment, delivering packages to businesses and homes – have become both more crucial and more dangerous. Autonomous Mobile Robots (AMRs), also referred to as “service robots,” are stepping in to fill the gaps where humans can’t or shouldn’t go; they’re inspecting equipment and assets, cleaning store floors, moving items safely from one place to another. And now the idea of human and robot collaboration doesn’t seem so out of the ordinary.

Physical automation is scaling rapidly

At Avanade, we’ve been watching the next evolution of automation accelerate out of the back office into the store, the hospital, the airport floor. We’re seeing the augmentation of a human and robotic workforce through the power of physical automation. And what we initially saw as a trend slowly evolving over two to three years is much closer than that – in fact, it’s scaling rapidly. Businesses are already reaping the benefits of reduced operational labor, increased productivity, and safer jobs and workplaces.

We’ve partnered with Rocos, a leading provider of a cloud-based robot operations platform, to bring you a primer on physical automation, how a robot operations platform integrates with your IoT devices, and the actions you need to start taking today to realize the benefits of physical automation.

It’s the latest in the [Avanade Trendlines](#) series on emerging trends that impact the design, innovation and technology choices of large organizations.

Autonomous Mobile Robots (AMRs), also referred to as “service robots,” are stepping in to fill the gaps where humans can't or shouldn't go.

So, what is physical automation and why should you care?

Physical automation is the labor-saving technology by which a process or procedure is performed with minimal human assistance. The effect on the workforce goes back several decades, initially through the introduction of the robotic assembly line. Now, thanks to the advent of ever-better mechatronics and advanced machine learning techniques, physical robots are breaking free of a fixed location, smartly navigating through space and accomplishing dirty, dangerous and dull tasks.

Companies benefit in multiple ways from physical automation. Walmart's fleets of [scrubbers](#) and [stockers](#) keep the stores clean and full of product with robots that can work any time of the day or night. The city of St. Petersburg, Fla., in the United States plans to [check and fix almost 4.6 million linear feet of sewer](#) by October 2023 using AMRs that can complete the job almost twice as fast as human counterparts (and they don't complain about the smell).

Lyon Saint-Exupéry Airport in France added 50% more parking spaces with its [fleet of car-parking robots](#) because cars can be parked closer together. An added

benefit comes in the form of lower carbon emissions since humans no longer have to drive around looking for an open spot. Fashion retailer Nordstrom quickly [sped up distribution center processes](#) last year thanks to a robotics implementation that included AMRs that calculate and travel the shortest possible route to get packages to the correct destination. And most recently, AMRs are [relieving pressure on overworked front-line medical staff](#) by sanitizing hospitals, delivering medications and medical equipment quickly and safely, and, in some cases, serving as a bedside stand-in for the doctor.

Industries with physical processes – which is almost all of them – are already exploring the value that physical automation brings (see sidebar, next page) and investment is increasing accordingly. [Sales of service robots](#) are predicted to increase by 41% year on year for the next three years, including exoskeletons, which can augment human performance; unmanned aerial vehicles (UAVs); and robotic floor cleaning robots.



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How physical automation supports your industry



Retail

- Stocking shelves
- Checking inventory
- Tracking and reconciling SKUs
- Comparing planogram to actual product placement



Energy/Utilities

- Performing remote site inspection and site repair
- Cleaning sewers
- Removing old equipment
- Monitoring and tracking pipe flow



Construction

- Mapping indoor environments
- Construction project management
- Site safety and personal protective equipment (PPE) compliance
- Planning and zoning review



Agriculture

- Capturing plant growth heat maps
- Planting, pruning, picking and weeding
- Poly tunnel self-construction
- Evaluating the health of crops



Health

- UV room and equipment sterilization
- Medical waste removal and sharps disposal
- Patient greeting
- Delivery of goods



Mining

- Safely accessing uncharted territories
- Tunnel boring and tamping
- Landscape inspection and analysis
- Evacuation and impromptu human protection



Nonprofits and Government

- Safety and crisis response management
- Survey disaster sites and deliver medications and other supplies in remote areas
- Educate and promote social distancing rules
- Capture valuable data for public health analysis



Robots need management too

It's tempting to think of robots as machines with full plug-and-play functionality, but we've found that a better approach is to think of them as people.

Just like humans, an AMR needs to be onboarded, prepared, trained, coordinated, coached and supported. It needs to have tasks assigned to it or broken down into smaller subtasks. Work needs to be coordinated across multiple workers with various backgrounds and skillsets – some human, some machine. The robot needs to be monitored – whether that means tracking how well the work is being performed, finding new ways to leverage its capabilities or “reskilling” it into new

areas. Sometimes the robotic workforce will have problems that need to be diagnosed and fixed, and they'll need offboarding and knowledge transfer when work is complete.

Unlike their human counterparts, the AMR workforce also provides a constant data stream to managers, as well as any additional information from IoT devices with which the fleet interacts. These vast amounts of data are usually sent back to the cloud, enabling predictive modeling and paving the way for new use cases.

Better together

As the role of physical automation grows, so too will the complexity. [Walmart has approximately 634 million square feet of floor space in its Supercenters alone](#) – too much for even a robot to handle. Airports, hospitals and warehouses also tend to span huge swaths of land; other spaces like grocery stores may be smaller but are often part of chains spread out across different cities or even countries. So even if businesses start their physical automation journey with one or two isolated robots, as they mature in the capability, they'll quickly need a way to manage not just one or two, but an entire fleet of robots.

In addition to the complexities of size and location, businesses will need multiple types of robots from different manufacturers to achieve all their physical automation goals. [FedEx](#) noted that an audit of its automated ground-support equipment in one of its hubs found equipment in use from 32 different manufacturers. As with so many things in life, one size does not fit all when it comes to AMRs.

Whether these fleets of disparate robots are in different terminals or all the way around the world, they will need to communicate across time, distance and type. Successful businesses will quickly seek out a way to manage the complexity while simultaneously avoiding vendor lock-in.

The humans in these new teams also need some preparation to work with their robotic colleagues: training for how to interact with the AMRs; potential shifts in their responsibilities as the AMR takes on parts of their work; and input into how, when and where AMRs are deployed, as well as planning and enabling the tasks they do.

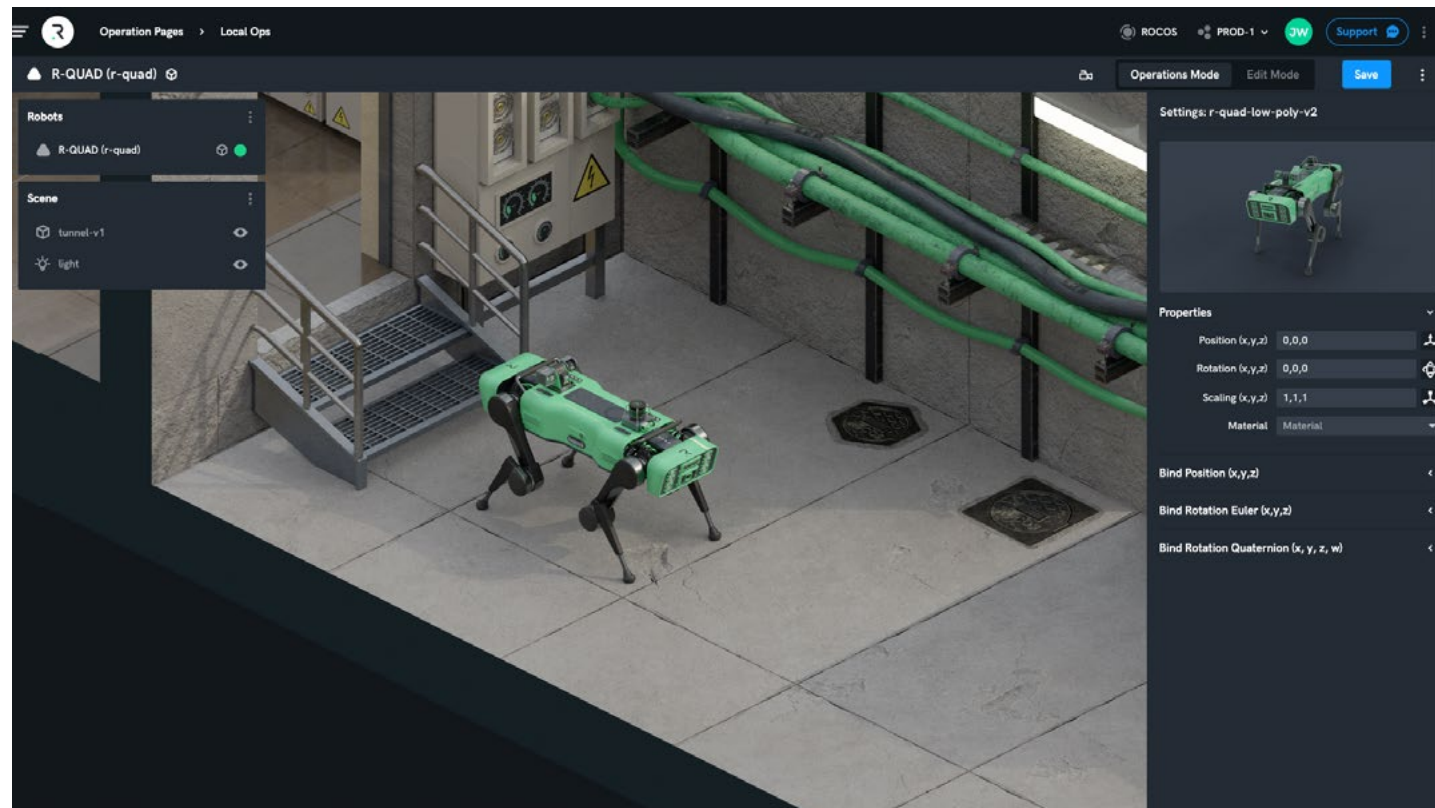
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Speaking “digital”

Communication is often both the most critical element of any team and the most difficult to do well. With human-machine teams, that difficulty is compounded by the fact that one of them speaks “digital” – ones and zeros that need to be translated in order to pass information on. Organizations can be held back from truly taking advantage of a robot’s autonomous skills without the ability to connect, monitor and control a fleet of robots on a single robot manufacturer-agnostic platform.

For optimal operational efficiency and to scale the use of robotics across a business, you need a one-to-many system that centralizes communication and integrates your fleet with your existing technology stack, IoT devices and business systems – a robot operations platform. These platforms allow communication and control at scale from human to robot, robot to human and even robot to robot.

Take, for example, a fleet of robots [used for cleaning](#) or moving sterilized equipment to align with surgical schedules around a hospital. As factors change, the ability to adapt by quickly updating routes, optimizing schedules and deploying more assistance as needed



A robot operations platform allows you to emulate your physical robots within a replicated virtual environment, making updates fast and seamless.

will make the robots most effective in their role of supporting operations. From this centralized platform, you have the ability to manage many robots as a

collective, rather than in isolation. You can visualize them on a map, send commands and teleoperate a robot remotely if necessary.

Additional benefits of an effective robot operations platform

Robot operations platforms maximize the value of physical automation in multiple ways. As your business processes evolve, new robots can be easily added to the platform. If robots need replacing or upgrading with newer models, it's only the robot, rather than the domain-specific integration and coordination software, that must be updated. This minimizes cost and disruption to business operations.

For robotics manufacturers, leveraging an operational platform allows them to commercialize products faster and at scale, without the need to build custom solutions that rely on expensive in-house resources. It also avoids them having to build features that are not core to their unique IP.

For enterprise organizations, this fills the missing link in robot applications, allowing them to more easily orchestrate robotics as part of an end-to-end business process. Robot manufacturers are rightly focused on building smart robots, but successful integration into the enterprise requires different skills, which are often expensive to bring into a mechatronics team.

No platform is an island

Leveraging a robot operations platform gives you the opportunity to implement your physical automation projects quickly and in a way that complements existing business processes and systems and adapts with agility as your business scales.

No platform is an island – you need to consider how you integrate a robot operations platform with your existing IoT infrastructure. Digital services companies will be needed beyond the systems work to guide the platform strategy, the security and policy implications, and your people and change management for a human-plus-machine workforce.

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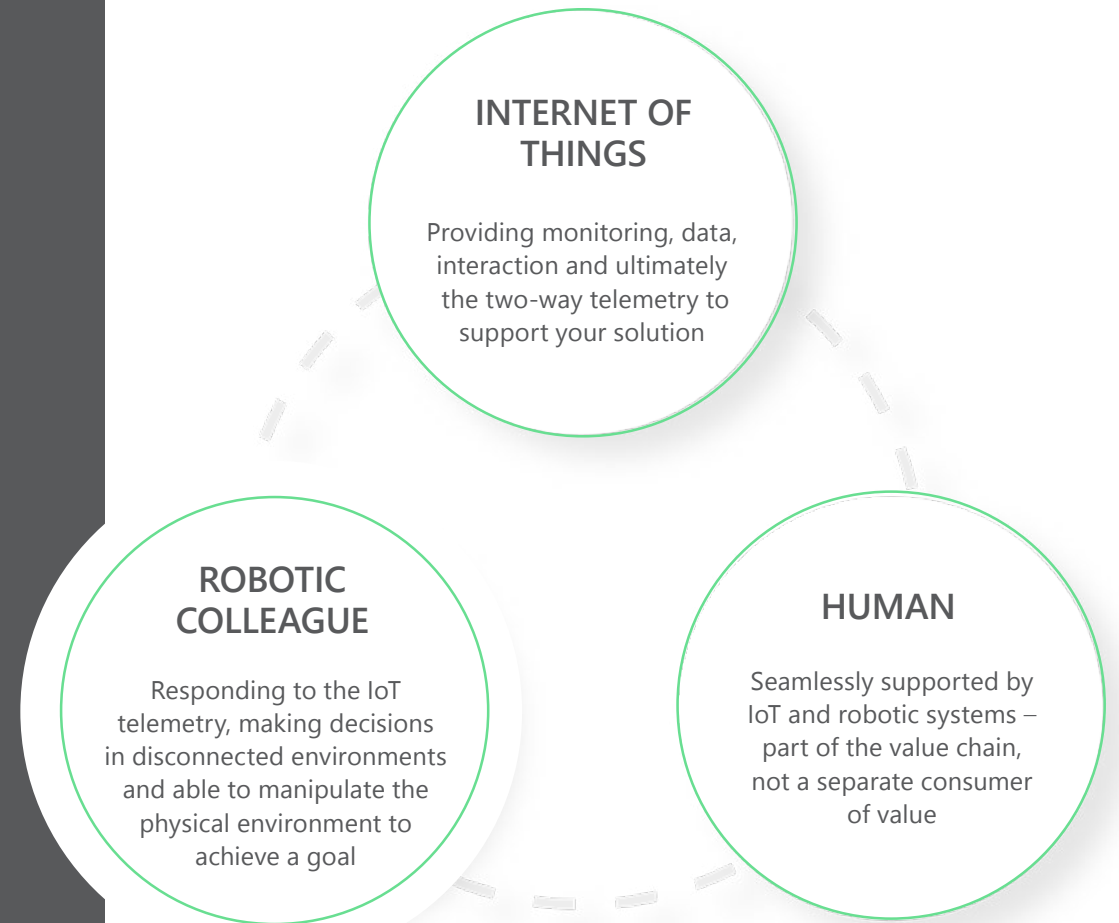
Closing the circle

At its best, physical automation brings together the trifecta of humans, robots and the environment in which they operate.

The IoT can provide raw data about the environment in which the human-robot teams work; through the cloud, AMRs can access and leverage that data to make decisions about what tasks to accomplish, and how, while humans leverage our innate capabilities to monitor and respond to all parts of the system.

IoT can be a crucial part of the overall industrial automation system, but it's focused on collecting and streaming raw telemetry. Once configured, integration with IoT systems generally remains static, with the devices reporting their preset telemetry with a regular, unchanging cadence. Robots are highly dynamic, with changing needs depending on the environment they're working within – which may also change as they go about their work. This means that effectively managing robots at scale requires a distinct set of capabilities, designed to effectively deal with very high-frequency sensor data, changeable environments and varying levels of connectivity.

The physical automation trifecta



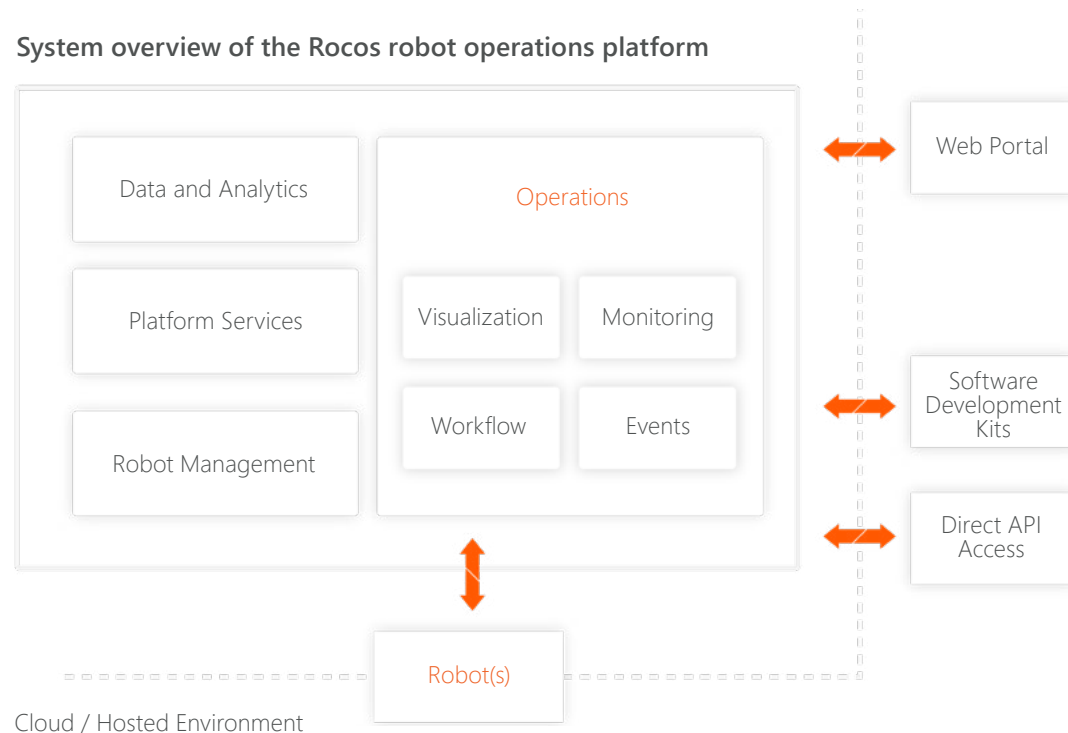
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The right capabilities for managing robots at scale

Above and beyond your IoT platform, a robot operations platform provides the extra set of capabilities required to effectively scale and operationalize robotic solutions. These platforms are optimized to better manage the exponential volume of data that comes from robot fleets. While Microsoft Azure is highly optimized for command and control of devices, and mastering of a digital twin and edge computing, the Rocos robot operations platform takes it one step further, offering a suite of tools optimized for robots:

- Secure connection management across multiple network types and varying quality of service
- Bandwidth shaping and data stream management
- Remote mission planning, execution and intervention
- Teleoperation, including video and 3D point cloud streaming
- Integration with machine learning and AI systems, locally and in the cloud
- Integration with other IT systems for decision support and enterprise orchestration

System overview of the Rocos robot operations platform



What to do now:

Build the right foundation to empower your human-robot teams

The first step on your robotic journey is to look at your existing automation plans. If you're already focusing on software robotics, rethink how you can include physical automation.

Next, determine the highest-value use cases. Identify the repetitive tasks that robots are ideally suited to take on, like floor cleaning, delivery or inspection based on your industry. Be sure to think at the process level and look for activities that are easily replicated.

Based on your existing infrastructure and selected robotics use cases, integrate an operations platform. This will help you connect, monitor and control your robots, at which point you're ready to pilot those use cases and determine the value you'll receive from your physical automation. That, in turn, can help you determine your preferred consumption model (lease, RaaS, capex, etc.). Larger organizations will likely prefer to own and manage their entire fleet, but smaller businesses might benefit from "robots as a service" (RaaS), partnering with vendors to source and manage their robot workforce.

Once these foundational decisions are made, focus on designing the human and robotic workforce for your company. Successful implementations only happen when your people are properly prepared for working with their AMR colleagues. While it's true that in most cases the technology isn't replacing workers but is rather augmenting humans by taking over physically laborious and/or unsafe tasks, the day-to-day responsibilities of those employees may need to shift. Reskilling or upskilling may be required. And humans are always more [accepting of change](#) if they've had a say in the decisions leading up to it.

Ethical considerations should be part of the plan

The potential application of a set of "robot rights" may be far in the future but ethical considerations should be a fundamental part of your planning process now. Privacy protection will be an especially important point of focus. For example, if your AMRs can recognize people's faces and are collecting location data, you should have clear policies and controls covering how that data can be used and by whom.

Beyond privacy implications, there are several possible issues related to AMRs' potential impact on humans. Is your company hoping to replace human workers with robots or simply augment their capabilities? Can you foresee any potential for physical safety or mental health concerns? For example, without proper training, human workers may not know how to physically interact with a robot co-worker, or they might struggle with the idea of taking instructions from a machine.

Note that not all ethical considerations are potential risks. You may determine that robots can improve worker health and safety, protect their mental health or help them feel empowered to learn new skills. Many organizations are crafting [digital ethics frameworks](#) to identify potential risks as well as opportunities. For the challenging ethical issues you identify with such a framework, you can fall back on your organization's mission and values to make the right call.

Taking the first step

If this has struck a chord, [contact us](#) or email marketing@rocos.io for a demonstration and discussion about how physical automation can positively impact your business. For more information on other trends that will affect you and your business over the next 12 to 18 months, visit us at [Avanade Trendlines](#).

About Avanade

Avanade is the leading provider of innovative digital and cloud services, business solutions and design-led experiences on the Microsoft ecosystem. With 38,000 professionals in 25 countries, we are the power behind the Accenture Microsoft Business Group, helping companies to engage customers, empower employees, optimize operations and transform products, leveraging the Microsoft platform. Majority owned by Accenture, Avanade was founded in 2000 by Accenture LLP and Microsoft Corporation.

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About Rocos

Founded in 2017, Rocos provides a cloud platform to build and manage robot operations, enabling organizations to connect, monitor, and control robots at scale. Rocos is inspired by a globally connected future, where autonomous robots accelerate change for good and provide some of the important technology that will get us there.

Visit www.rocos.io for more.

