Leveraging Autonomous Mobile Robots for Enhanced Material Transport Efficiency

OMRON

WHITE paper

September 2023
automation.omron.com

Leveraging Autonomous Mobile Robots for Enhanced Material Transport Efficiency

This white paper explores the strategic utilization of autonomous mobile robots (AMRs) to enhance material transport efficiency in industrial operations. By examining how AMRs can be deployed for work in process (WIP) and finished goods material transport, this paper aims to provide valuable insights into optimizing workflows, reducing costs, and improving overall productivity.

Contents

Introduction

"By leveraging mobile robot solutions, organizations can achieve heightened efficiency, streamlined workflows, and improved customer satisfaction."

The Role of AMRs in Industrial Material Transport

In today's rapidly evolving industrial landscape, the efficient movement of materials within production facilities and distribution centers is a cornerstone of operational success. Autonomous mobile robots (AMRs) have emerged as a transformative technology, offering the potential to revolutionize material transport processes. This paper delves into the strategic deployment of AMRs for both work in process (WIP) material transport and the distribution of finished goods. By leveraging mobile robot solutions, organizations can achieve heightened efficiency, streamlined workflows, and improved customer satisfaction.

Objectives and Scope

The primary objective of this white paper is to provide valuable insights into how organizations can effectively utilize AMRs to enhance material transport efficiency. The scope encompasses the strategic deployment of AMRs for work in process (WIP) material transport and the distribution of finished goods. Through a comprehensive exploration of these areas, including practical implementation considerations, case studies, and outlook, this paper aims to equip readers with the knowledge to optimize material transport processes and drive… towards achieving operational excellence (pun intended).

AMRs in Work in Process Material Transport

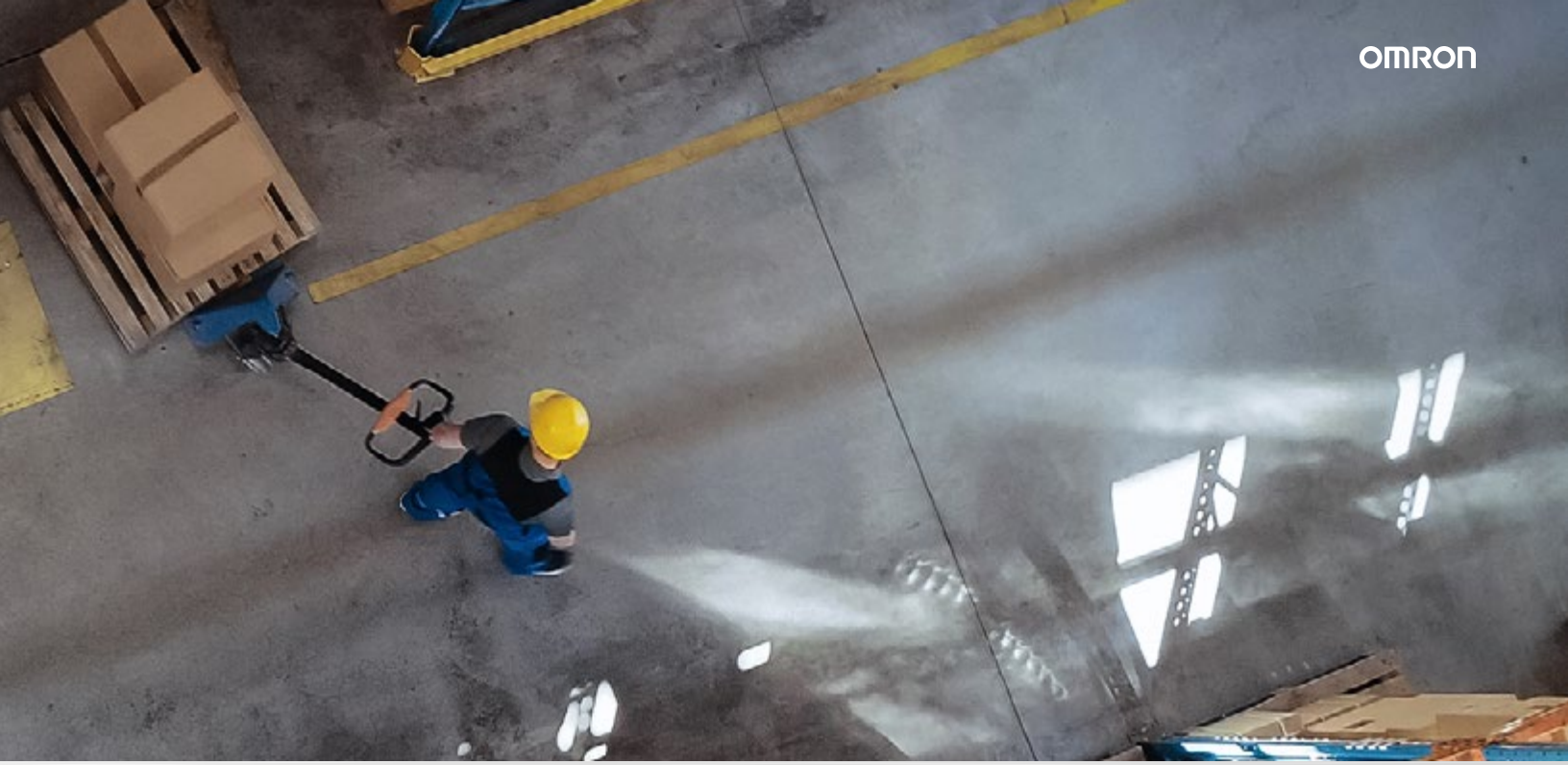
OMRON

Streamlining WIP Material Flow

In the context of work in process (WIP) material transport, AMRs offer a dynamic solution to streamline the flow of materials throughout various stages of production. Traditional material transport methods often involve manual handling, which can lead to inefficiencies, delays, and increased labor costs. AMRs, equipped with advanced sensors and navigational capabilities, excel in navigating complex factory layouts and transporting materials with precision. By autonomously ferrying components between workstations, AMRs reduce congestion, optimize material flow, and minimize production bottlenecks.

Agile WIP Transition Points

Transition points between different process stages within manufacturing are critical junctures where efficient material movement is essential. AMRs play a pivotal role in ensuring the agility and smoothness of these transitions. Their ability to adapt to changing conditions and navigate intricate pathways enables them to swiftly transport materials between different production



> "AMRs reduce congestion, optimize material flow, and minimize production bottlenecks."

stations. This agility minimizes delays, reduces idle time, and enhances overall throughput. AMRs can be programmed to follow optimal routes, avoiding congested areas, and dynamically adjusting their paths based on real-time conditions, ensuring a seamless transition of materials.

Flexibility and Adaptability in WIP Handling

One of the notable strengths of AMRs lies in their adaptability to varying production demands. Traditional material transport systems often struggle to accommodate sudden changes in production volume or product variations. AMRs, on the other hand, offer a flexible solution that can be quickly reconfigured to handle different materials, products, or production layouts. This adaptability enables organizations to respond swiftly to shifts in demand, reducing lead times and ensuring efficient material transport regardless of production variations.

Enhancing Finished Goods Transport with AMRs

OMRON

Efficient Distribution Center Operations

The movement of finished goods within distribution centers plays a vital role in meeting customer demands and achieving timely order fulfillment. AMRs offer a game-changing solution to optimize distribution center operations. Equipped with advanced sensing, navigation and mapping capabilities, AMRs can autonomously navigate through distribution centers, efficiently picking up, transporting, and delivering finished goods. Even in facilities with highly dynamic conditions where floor layouts can change dramatically over the course of a month, week or even the day, mobile robots are able to call upon layered sensing technologies such as lidar and ceiling facing cameras to ensure they "know where they are" regardless of changes to the environment. By streamlining these process flows and the ability to adapt on the fly, AMRs minimize lead times, reduce order processing times, and enhance overall distribution center efficiency.

Real-time Inventory Management

Accurate and real-time inventory management is essential for maintaining optimal stock levels and preventing stockouts. These tasks are typically very time consuming to execute with traditional manual counting methods and are often disruptive to the normal operation of a facility. AMRs equipped with advanced tracking systems, such as RFID or barcode scanners, offer a reliable solution for real-time inventory monitoring. These robots can scan and record inventory data as they navigate through storage areas, providing organizations with up-to-date information on stock levels, locations, and movements. This real-time visibility enables accurate demand forecasting, efficient restocking, and proactive inventory management.

Timely Deliveries and Customer Satisfaction

The timely delivery of products to customers is a critical factor in ensuring high levels of customer satisfaction. Customers have become accustomed to very short deliveries in many sectors and that desire for quick product receipt shows no indication of lessening. AMRs play a pivotal role in achieving just-in-time deliveries by optimizing the movement of finished goods from distribution centers to outbound shipping areas. From applications where material movements are known well in advance to those where items are picked soon after order receipt, mobile robots provide the utility, flexibility and reliability that is difficult or very costly to achieve with traditional means. These robots can follow predetermined routes, avoiding known areas of congestion or they can create their own paths based on real time facility data, optimizing delivery schedules, and increasing efficiency. By minimizing delivery lead times and ensuring accurate order fulfillment, AMRs contribute to enhanced customer satisfaction and loyalty.

Practical Implementation Considerations

OMRON

Integration with Existing Infrastructure

AMRs are powerful and capable tools that help organizations improve operations that are generally easy to setup however integrating AMRs into new or existing industrial operations requires careful planning and coordination to maximize the benefit of an AMR solution. Organizations should assess their current infrastructure, workflows, and operational requirements to identify suitable areas for AMR deployment. AMRs can be seamlessly integrated with existing manufacturing and distribution systems, such as warehouse management software and production line controls but care needs to be taken to ensure that each system is talking the same "language" so that the AMRs know what their jobs are.

Moving from a manual process to an automated one, especially one that can plan its actions often exposes gaps in an existing process that must be addressed. AMRS are very capable and can be configured to operate in most processes, but they lack the awareness and reasoning needed to respond to situations they have not been programmed for. It is critical to think through process flows in detail so the robot can be programed to react appropriately in any situation it encounters. Collaborating with experts in AMR technology can facilitate a smooth integration process, ensuring that AMRs complement and enhance existing operations rather than become a nuisance.

Human-Robot Collaboration

Successful AMR deployment involves fostering effective collaboration between AMRs and human

> "Successful AMR deployment involves fostering effective collaboration between AMRs and human workers."

workers. AMRs can of course be set up to operate with zero human interaction. However, there are many applications where AMRs and humans working together, either in proximity or even side by side as a team, enable even more efficient and novel workflows. It is essential that staff are brought up to speed on the use, care, and safe operation of AMRs.

Training programs and guidelines should be developed to educate employees on how to collaborate alongside AMRs that promote safe and efficient operations. Clear communication channels, visual cues, and standardized procedures can help ensure a harmonious and productive work environment. By encouraging collaboration and addressing potential concerns, organizations can maximize the benefits of AMRs while optimizing workforce productivity.

Maintenance and Continuous Improvement

Regular maintenance is crucial for ensuring the continued performance and longevity of AMRs. Organizations should establish robust maintenance protocols, including routine inspections, software updates, and repairs. Advanced data analytics can play an important role in monitoring AMR performance, identifying potential issues, and optimizing operational efficiency. By analyzing data collected from AMRs, organizations can make informed decisions to enhance performance, reduce downtime, and drive continuous improvement.

Case Studies: Successful AMR Deployments

OMRON

“AMRs streamline distribution processes and enhance inventory management.”

Automotive Manufacturing Efficiency

In the automotive manufacturing sector, the integration of AMRs has revolutionized material transport to assembly lines and throughout the overall vehicle manufacturing process. By strategically deploying AMRs to transport components between different workstations, automotive manufacturers have significantly reduced production bottlenecks and streamlined material flow. As a result, the efficiency of the assembly line improved, leading to enhanced production output and overall operational efficiency.

Electronics Assembly Agility

In the electronics assembly industry, AMRs are employed to optimize material movement between various assembly stations. The flexibility and adaptability of AMRs allow electronics manufacturers to quickly reconfigure material transport routes in response to changing production demands. This agility improves the overall responsiveness of the assembly process, enabling the manufacturer to efficiently adapt to fluctuations in product variations and production volume.

Food Industry Distribution Transformation

Within the food and beverage distribution sector, AMRs have played a transformative role in optimizing material transport within distribution centers. By autonomously navigating through storage areas and transporting goods, AMRs streamline distribution processes and enhance inventory management. The real-time visibility provided by AMRs enables accurate inventory tracking, efficient restocking, and timely order fulfillment, resulting in improved distribution center efficiency and customer satisfaction.

Overcoming Challenges and Future Trajectory

OMRON

Addressing Implementation Challenges

While the integration of AMRs offers substantial benefits, organizations may encounter implementation challenges. These challenges may include technical complexities, workforce adaptation, and change management. By proactively addressing these challenges through comprehensive planning, training, and collaboration, organizations can navigate the implementation process successfully and maximize the value of AMRs.

Evolving with Advancements

The future of AMRs holds exciting possibilities for further enhancing material transport efficiency. As technology advances, AMRs may incorporate advanced capabilities, such as artificial intelligence (AI) and machine learning as well as new and more powerful sensing technology. These enhancements could enable AMRs to make real-time decisions, optimize route planning, and further adapt to dynamic operational environments. By staying abreast of technological advancements, organizations can position themselves to harness the full potential of AMRs in their material transport processes.

"The future of AMRs holds exciting possibilities for further enhancing material transport efficiency."

Ethical and Societal Considerations

As organizations embrace AMRs and automation, ethical and societal considerations come to the forefront. The widespread adoption of AMRs may raise questions about workforce displacement, employee reskilling, and the ethical use of AI-driven technologies. Like any technology that is potentially disruptive to the status quo, it is essential to consider the human impact. Numerous studies have shown that on average, implementation of automation technologies not only helps organizations achieve greater operation efficiency and superior product offerings, but it also makes them more competitive. Further, any staff that are directly impacted by the automation are typically reassigned to other duties that are more appropriate for human work which leads to less worker injuries and greater job satisfaction. No matter the specific case, it is imperative for organizations to address these concerns thoughtfully, ensuring that the integration of AMRs aligns with ethical standards, promotes employee well-being, and contributes positively to society.

Conclusion

A well-defined implementation roadmap is essential for success.

Maximizing Efficiency with AMRs

The deployment of autonomous mobile robots (AMRs) represents a transformative step toward enhancing material transport efficiency in industrial operations. By strategically leveraging AMRs for work in process (WIP) material transport and finished goods distribution, organizations can achieve immediate gains in productivity, cost savings, and customer satisfaction. The versatility, adaptability, and technological advancements of AMRs position them as valuable assets in optimizing material transport workflows and driving operational excellence.

A Roadmap to Enhanced Material Transport

As organizations embark on the journey of integrating AMRs into their material transport processes, a well-defined roadmap is essential for success. This roadmap includes assessing operational needs, identifying suitable areas for AMR deployment, collaborating with experts, and implementing robust maintenance and training protocols. By following this roadmap, organizations can maximize the benefits of AMRs, achieve operational efficiency, and position themselves at the forefront of industrial innovation.

WHITE paper

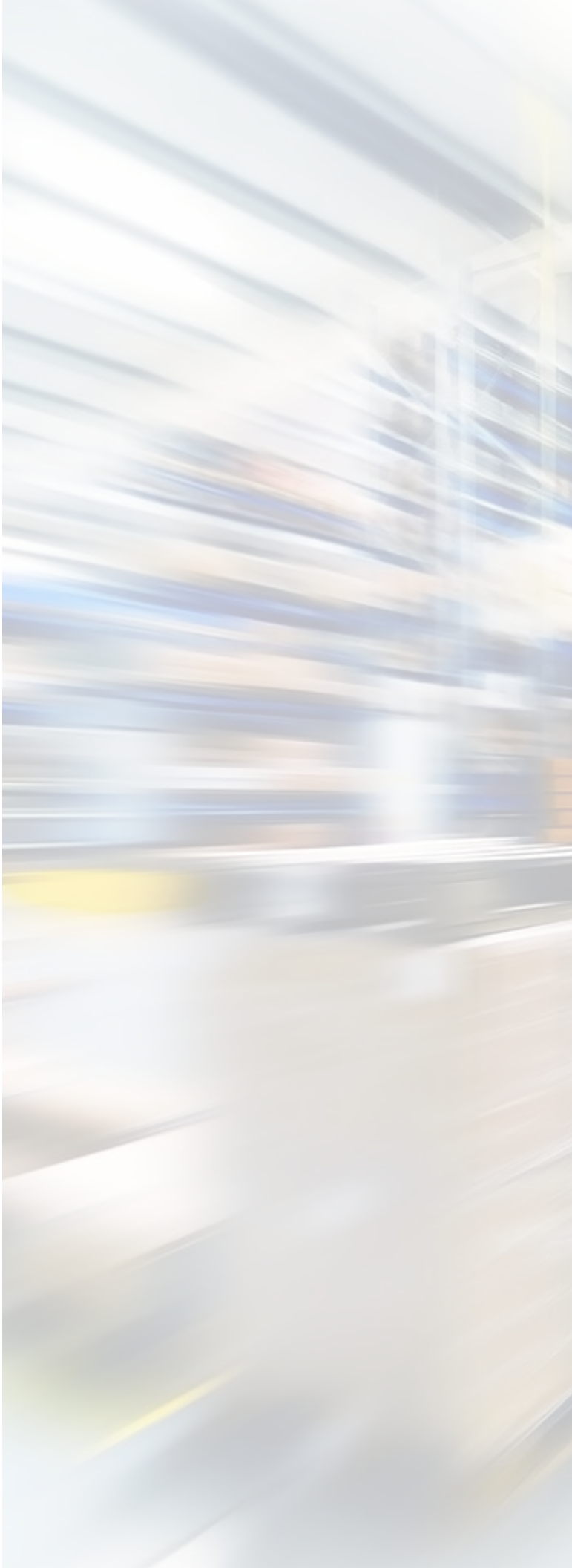
Recommendations and Next Steps

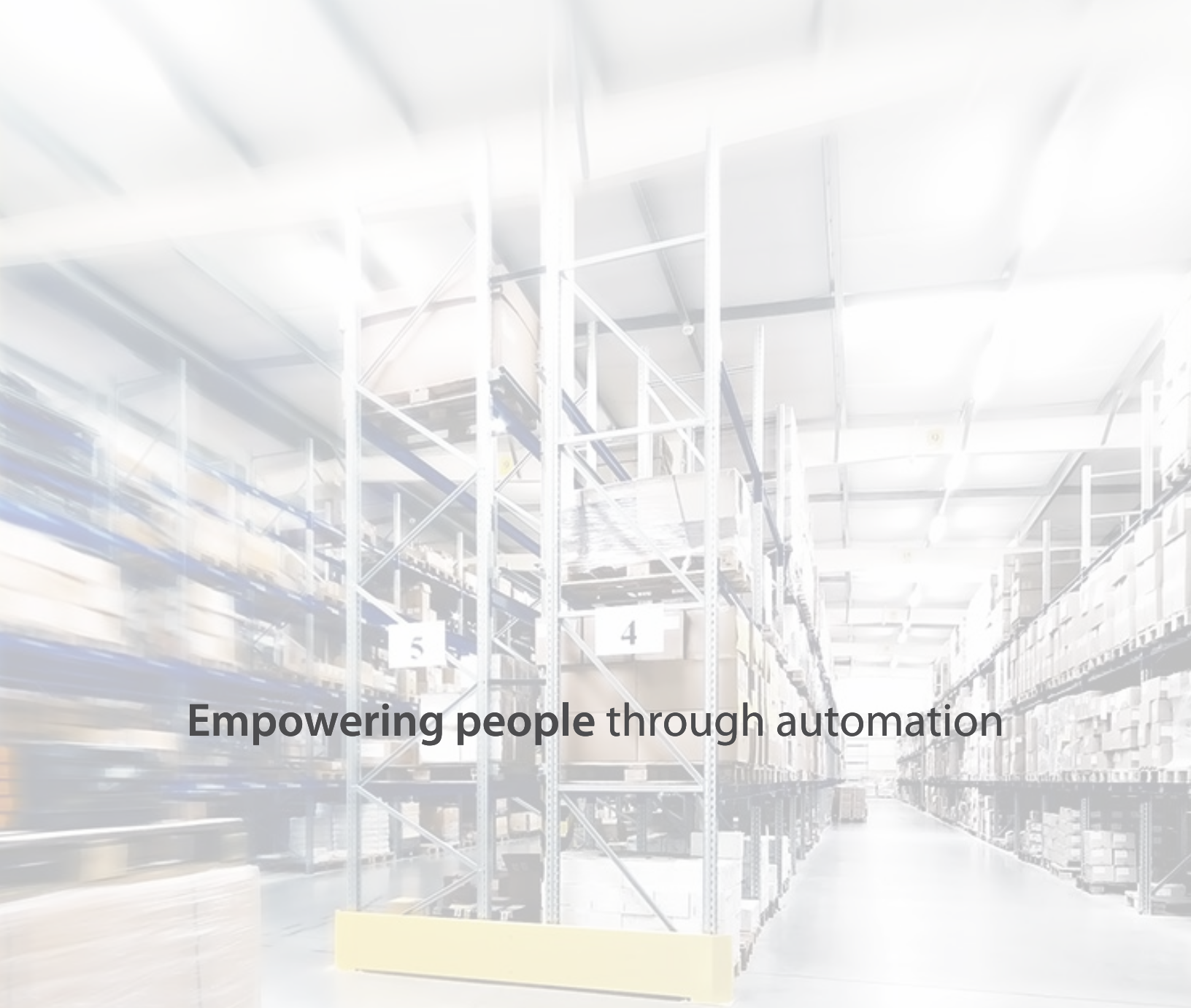
This white paper provides valuable insights into leveraging autonomous mobile robots for improved material transport efficiency, however there are many variables that need to be taken into account when considering AMR implementation. Organizations seeking to harness the benefits of AMRs are encouraged to:

- Evaluate their specific operational needs and identify areas where AMRs can enhance material transport efficiency.
- Collaborate with AMR experts and solution providers to customize AMR deployments that align with organizational goals.
- Develop comprehensive training programs to ensure effective collaboration between human workers and AMRs.
- Establish proactive maintenance protocols and utilize data analytics to optimize AMR performance over time.

By following these recommendations and creating a thoughtful implementation plan, organizations can embark on a journey of enhanced material transport efficiency, streamlined workflows, and operational excellence.

Learn more about Omron AMR Solutions ›





Empowering people through automation

OMRON

Omron Automation Americas

2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169
P: 847.843.7900 • 800.556.6766

Note: Specifications are subject to change.

automation.omron.com